A TRANSBOUNDARY FISHERIES MANAGEMENT PLAN FOR THE OKAVANGO/KAVANGO/CUBANGO BASIN

July 2013

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Prepared by: Denis Tweddle & Clinton J. Hay

NNF/EU Community Conservation Fisheries in KAZA Project

on behalf of the Governments of Angola, Namibia and Botswana

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SAREP Southern Africa Regional Environmental Program

Supporting the sustainable management of the Okavango River Basin

OKACOM

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Acronyms

AECB	Association of Environmental Clubs of Botswana
BDF	Botswana Defence Force
CBNRM	Community Based Natural Resources Management
CBO	Community based organisation
CORB	Cubango-Okavango River Basin
DEA	Department of Environmental Affairs, Botswana
DoT	Department of Tourism, Botswana
DWMPC	Department of Water Management and Pollution Control, Botswana
DWNP	Department of Wildlife and National Parks, Botswana
EU	European Union
EUS	Epizootic Ulcerative Syndrome
FAO	Food and Agriculture Organisation of the United Nations
FPA	Fish Protection Area
GEF	Global Environmental Facility
INIP	Angola Ministry of Agriculture's National Institute of Fish Research
IRDNC	Integrated Rural Development and Nature Conservation
JPCC	Joint Permanent Commission of Cooperation between Botswana and Namibia,
KAZA	Kavango/Zambezi Transfrontier Conservation Area
KIFI	Kamutjonga Inland Fisheries Institute,
KOAR	Kavango Open Africa Route
MEWT	Ministry of Environment, Wildlife and Tourism
MFMR	Ministry of Fisheries and Marine Resources
MINAMB	Angolan Ministry of Environment's Institute of Biodiversity
MPA	Marine Protected Area
NBSAP	National Biodiversity Strategy and Action Plan, Angola
NGO	Non-Governmental Organisation
NINA	Norwegian Institute for Nature Research
NNF	Namibia Nature Foundation
NORAD	Norwegian Agency for Development Cooperation
OBSC	Okavango River Basin Steering Committee
ODMP	Okavango Delta Management Plan
OFA	Okavango Fishermen's Association.
OFMC	Okavango Fisheries Management Committee.
OIE	World Organisation for Animal Health
OKACOM	Permanent Okavango River Basin Water Commission
OKMCT	Okavango Kopano Mokoro Community Trust
OkBMC	Okavango Basin Management Committee
ORI	Okavango Research Institute, University of Botswana
SAIAB	South African Institute for Aquatic Biodiversity
SADC	Southern Africa Development Community
SAREP	Southern Africa Regional Environmental Program
TDA	Transboundary Diagnostic Analysis
UNAM	University of Namibia
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
VDC	Village Development Committee.
WHC	Water Utilities Corporation, Botswana
WWF	Worldwide Fund for Nature

Acknowledgements

This management plan was initiated by, and is the product of, a collaborative exercise between the government ministries responsible for fisheries management in Angola, Namibia and Botswana. The development of the management plan was supported by SAREP and managed and guided throughout by Dr Chris Brooks, supported during the development process by Michele Rolph. The following representatives of the three countries contributed to the development of the management plan through active participation during the planning workshops: **Namibia**; Christopher Munwela, Bargrey Kapelwa, Godfrey Sitengu, Victoria Mumba, Renier Burger, Gosbert Hamutenya, John Piri; **Botswana**; Kebonang Kebonang, Issac Batsile, Molothanyi Othomile, Phatsimo Lobelo; **Angola**; Francisco de Almeida, Inácio Rangel, Alberto Domingos, Francisco Mateus, Nelson Samuel, Justino Sequesseque, Gabriel Cambinda. The proposal for the transboundary management plan was developed during a training workshop for members of the three countries' fisheries departments at KIFI in April 2012 that was jointly held by SAREP and the MFMR/NNF/WWF Integrated Co-Management of the Zambezi / Chobe River Fisheries Resources Project. The latter project supported the contributions of the authors to that workshop. Following that project's completion, the follow-up NNF/EU Community Conservation Fisheries in KAZA Project continues to support the management plan. The February 2012 Windhoek workshop was attended by Tor Næsje and Odd Terje Sandlund of NINA in Norway, who are developing joint research programmes for the fish and fisheries of the region with the University of Namibia, now the employer of Dr Hay. These collaborative research programmes will support the aims of the management plan. The South African Institute for Aquatic Biodiversity (SAIAB) continues to support fish and fisheries research on the Okavango system and was represented in the current programme by Paul Skelton, who contributed to the February and May 2013 workshops. The river's ecotourism sector was represented at these workshops by Mark Paxton of Shamvura Camp, who provided constructive inputs to the process. The development of the plan benefited from reports written by, and discussions with, Tom Shipton and Peter Britz of the Rhodes University Department of Ichthyology and Fisheries Science, who recently assisted the Botswana Fisheries Division with proposals for the establishment of a fisheries management plan for Botswana's Okavango Delta.

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EXECUTIVE SUMMARY

The Transboundary Fisheries Management Plan for the Okavango Basin aims to establish a joint management system to ensure the conservation and sustainable use of the shared fish resources of the Cubango-Okavango River for the benefit of local communities. The plan is presented in two parts. Part A presents information used in the development of the management plan, while Part B details the activities to be carried out under the plan.

The outputs to be achieved from the implementation of the plan include;

1) Collaboration and communication strengthened on a technical level.
2) Standardised survey methodology adopted in the three countries.
3) Research teams and stations, monitoring activities, capacity building and fisheries training.
4) Government fisheries staff trained in use of equipment and research methodologies.
5) Database created for storage and analysis of resource information necessary for effective joint management purposes.
6) Data sharing protocol.
7) System for long-term ecological monitoring of fish stocks established.
8) Longitudinal profile of fish populations fully documented, from the riverine habitats in Angola to the seasonal swamps in the lower delta in Botswana.
9) Effects of seasonal flood level variations on the fish population dynamics and fish migration, behaviour and habitat utilization of the Cubango-Okavango River Basin determined.
10) Socio-economic importance of inland fish determined, in terms of catches and utilisation by the subsistence (and small scale commercial) fishers.
11) The role of possible different management measures for fisheries determined.
12) Co-management regime for Cubango-Okavango River fisheries proposed.
13) Development and harmonisation of policies and legislation.
14) Develop early warning system for the outbreak of disease and presence of alien/exotic fish species in the system.
15) Support required to implement the plan from the Nation States.
16) Budget to implement the plan.

The TOR for the study were:

1. Literature Review

(a) Frame survey reports from across the basin
(b) Fish biology and population ecology monitoring reports and scientific papers
(c) Relevant local, national and international regulations, policy and legislation

2. Stakeholder consultation

(a) International/transboundary organisations

(b) National Fisheries departments.
(c) Research institutes
(d) Community fisheries organisations

3. Development of Transboundary Fisheries Management Plan

(a) Report of survey defining current status of fish populations, fisheries activities and the implementation of various regulations, acts and policies within the basin
(b) Influence of adjacent basins. Collaborations, alignments and standardisation of monitoring activities and regulations
(c) Driving forces within the basin affecting fish populations, direct threats, conflicts and indirect impacts
(d) Management interventions;
    (a) Objectives
    (b) Policy harmonisation and law enforcement
    (c) Co-management models
    (d) Fish protection zones
    (e) Community awareness
    (f) Monitoring activities, frame surveys, biological surveys

The literature review added a fourth topic to those listed above, i.e. the important role of socio-economic and tourism studies. Scientific papers and reports on the Okavango fish and fisheries were examined to ascertain their relevance to the development of the Fisheries Management Plan. The first major research programme on the Okavango Delta, initiated in the 1980s by SAIAB, highlighted the importance of the annual floods in fish production. Prior to this major study there were only a few reports of limited scope. More recently, research on fish ecology and fisheries potential continued and has been expanded to include the social and economic aspects of fisheries and their development. Legislative and institutional frameworks are also covered in the review.

International and transboundary organisations involved in, or potentially involved in, the management plans are national fisheries departments, research institutes (ORI, KIFI, MINAMB and INIP), community fisheries organisations, OKACOM, OkBMC Biodiversity Working Group, KAZA, NNF, WWF in Namibia, IRDNC, Kavango Open Africa Route (KOAR) and SAREP.

For each country, the stakeholders are listed below:

Namibia

- Traditional Authorities. 5 TAs in Kavango.
- Conservancies, one on river but other two could be extended to include river.
- Schools, encouraged to form environmental groups.
- Fishery committees, but none yet established in Kavango.
- Kavango Regional Council.
- Subsistence fishers, some migrant fishers from Caprivi moving in.
- Ministry of Fish and Marine Resources;
- Ministry of Environment and Tourism;
- Ministry of Forestry & Agriculture;
- Regional and Town Councils;

- NamPol (Namibian Police);
- Immigration;
- Ministry of Health- spraying of insecticides along the river.

Botswana

- OFA-Okavango Fishermen's Association.
- OFMC-Okavango Fisheries Management Committee.
- AECB-Association of Environmental Clubs of Botswana; government-run.
- CBO-Community based organisations.
- VDC-Village Development Committee.
- The Tribal Authority is a government structure and not communities per se.
- Leadership from traditional authorities in villages.
- 5 community based concessions in the Okavango.

Also have CBOs, e.g. OKMCT, Poler's trust, Khwai. Each has management of trust and is primary stakeholder of fishery management in these areas. Outside of CBOs, SAREP has focused on VDCs (village development committees), each of which is a company with one share per village member. Currently, trusts are proposed in other areas, e.g. Lake Ngami.

- DWNP (Department of National Parks and Wildlife
- ORI (Okavango Research Institute, University of Botswana)
- DEA (Department of Environmental Affairs);
- DoT (Department of Tourism);
- WHC (Water Utilities Corporation);
- Tribal Administration;
- MEWT (Ministry of Environment, Wildlife and Tourism);
- DWMPC (Department of Water Management and Pollution Control;
- Vet services;
- Police;
- Immigration;
- Education;
- BDF (Botswana Defence Force).

Angola

7 fishery communities (Caiundo, Savate, Kaira, Kuangar, Calai, Dirico and Mucusso)

- IPA (Institute for Development of artisanal Fishery and Aquaculture
- INIP (National Institute for Fisheries Research)
- National Police (Immigration Service, and Boundary Guard)
- ACADIR (Association for Environmental Conservation and Integrated Rural Development)
- UNACA (National Union of Cooperative Associations for livestock and fisheries of Angola)
- DPHT (Provincial Department of Hotels and Tourism)
- UAN (Agostino Neto University)
- ISP (Higher Polytechnic Institute)
- SV (Veterinary Services)
- DPA (Provincial Department of Environment)

- Luiana (Luiana Organisation)
- Technocarro (Tourism)

Communities are organised with 30 members each, areas have Traditional Authorities, i.e. chiefs. A capacitating poverty relief programme run by the government gives communities 4 m boats, engines, gillnets and hooks. Savate and Calai have organized cooperation.

- Directorate of Fisheries and Agriculture in the provinces, with Department of Fisheries;
- Education;
- Health.

In the development of the Plan, the following aspects were covered in depth:

- Report of survey defining current status of fish populations, fisheries activities and the implementation of various regulations, acts and policies within the basin.
- Influence of adjacent basins.
- Collaborations, alignments and standardisation of monitoring activities and regulations.
- Driving forces within the basin affecting fish populations, direct threats, conflicts and indirect impacts.
- Management interventions.
- Policy harmonisation and law enforcement.
- Co-management models, with management plan guidelines for co-management.
- Fish protection zones.

A major component of the management plan is the outline proposal for monitoring activities, frame surveys and biological surveys, including:

- Compile fish species lists.
- Determine the status of the different fish species, especially commercially important species.
- Recommend measures to protect the species diversity.
- Use indices to assess environmental degradation, seasonal changes and exploitation of the fish population.
- Obtain ecological and biological data to study the life history of commercially important species.
- Determine the catch efficiency and species composition of different fishing gears.
- Document seasonal yields/catch rates from the subsistence and commercial fisheries for the system.
- Document catches from the tourism industry (recreational fishery).
- Obtain socio-economic data on the role played by fish in food security.
- Ensure research results are translated into management plans/actions.

Data to be collected and analysed fall into five categories, as follows:

1. <u>Fishery independent data</u>

a) Harmonisation and agreed scientific methodology between countries sharing a resource

b) Data sharing protocol

The goals for developing a common database are:

- Access for stakeholders to fish data from the entire river basin facilitated.
- Storage of fish data from the entire river basin over an extended period for the identification of trends to serve as a management tool.
- Development of a basin wide management approach facilitated.
- Quality and standardisation of data recorded evaluated and enhanced.
- Scientists from the three countries trained in data management and storage.
- Safe keeping of a database (digital and hard copies) guaranteed.
- Communication between scientists enhanced.

c) Long-term monitoring programmes
d) Joint research programmes
e) Joint steering committee (technical or advisory committee)
f) Training
g) Biological reference points
h) Station selection

2. Fishery dependent data
   a) Catch assessment surveys
   b) Frame surveys
   c) Local fish markets
3. Recreational fishery
4. Outbreak of disease and the presence of alien/exotic fish species in the system.
5. Joint Patrols (Namibia and Angola)

Outputs to be achieved from the implementation of the plan include:

- Sampling Strategy
- Recommended analysis
- Proposed sampling equipment to ensure standardised surveys
- Stations to be sampled
- Survey frequencies and timeframe
- Logistics for Surveys
- Setting up of steering committee
- Develop an early warning system for the outbreak of disease and the presence of alien/exotic fish species in the system
- Development of shared databases
- Joint Patrols (Namibia and Angola)

Remaining activities to be developed through the consultation process with an established steering committee.

- The support required to implement the plan from the Nation States
- The preparation of the budget to implement the Transboundary Management Plan
- The role of possible different management measures for fisheries determined, i.e. development and harmonisation of policies and legislation.

Appendices to this report include:

- The legislative and institutional framework for management of the Okavango Delta fisheries in Botswana (from Shipton, 2011).
- Submission by KOAR on tourism viewpoints on the management plan.
- Tabulation of legislation to be discussed in relation to harmonisation of policy and legislation during the implementation of the transboundary fisheries management plan.
- Arguments for and against the establishment of harmonised transboundary fishing closed seasons for the Okavango/Cubango River System.
- Logical Framework for the implementation of the management plan.
- Forms to be used in the surveys.

A TRANSBOUNDARY FISHERIES MANAGEMENT PLAN FOR THE OKAVANGO/KAVANGO/CUBANGO BASIN

Part A: Objectives, background information, and contents of the management plan

1. OBJECTIVES OF THE PLAN

The aim of the proposed Transboundary Fisheries Management Plan for the Okavango Basin is to establish a joint management system to ensure the conservation and sustainable use of the shared fish resources of the Cubango-Okavango River for the benefit of local communities. The Management Plan will therefore provide a foundation for the responsible co-management of shared fish stocks between Angola, Namibia and Botswana in the Cubango-Okavango River basin. In order to achieve this aim, information on the yield and harvesting patterns used by the subsistence and commercial fisheries, biological and biodiversity data of the fish populations and institutional linkages between scientists in Angola, Namibia and Botswana must be obtained. The Management Plan can contribute towards the national capacity of Angola, Namibia and Botswana to better conserve and manage the fisheries resources of the Cubango-Okavango River. It can also facilitate the greater participation of fishing communities in the management of the resources upon which they largely depend for food security and income generation, and the sustainable development of freshwater fisheries sector in all three countries. The Management Plan can further act as a catalyst for improving cooperation in management and development of the river with other riparian states that share the resources of the Okavango/Zambezi system, including, Zambia and Zimbabwe.

The outputs that should be achieved (with minor re-arrangement from original proposal) from the implementation of the plan include:

1. Collaboration and communication strengthened on a technical level.
2. Standardised survey methodology adopted in the three countries.
3. Research teams and stations, monitoring activities, capacity building and fisheries training.
4. Government fisheries staff trained in use of equipment and research methodologies.
5. Database created for storage and analysis of resource information necessary for effective joint management purposes.
6. Data sharing protocol.
7. System for long-term ecological monitoring of fish stocks established.
8. Longitudinal profile of fish populations fully documented, from the riverine habitats in Angola to the seasonal swamps in the lower delta in Botswana.
9. Effects of seasonal flood level variations on the fish population dynamics and fish migration, behaviour and habitat utilization of the Cubango-Okavango River Basin determined.
10. Socio-economic importance of inland fish determined, in terms of catches and utilisation by the subsistence (and small scale commercial) fishers.
11. The role of possible different management measures for fisheries determined.
12. Co-management regime for Cubango-Okavango River fisheries proposed.

13. Development and harmonisation of policies and legislation.
14. Develop early warning system for the outbreak of disease and presence of alien/exotic fish species in the system.
15. Support required to implement the plan from the Nation States.
16. Budget to implement the plan.

2. SCOPE OF MANAGEMENT PLAN

2.1. TOR for management plan

In this management plan, we address all outputs listed in the Background to the Project above, in the context of the required tasks provided in the Terms of Reference for this programme that are listed in the box below. All the proposed outputs are included in this management plan.

Kavango River Transboundary Fisheries Management Plan TOR

1. Literature Review
(a) Frame survey reports from across the basin
(b) Fish biology and population ecology monitoring reports and scientific papers
(c) Relevant local, national and international regulations, policy and legislation

2. Stakeholder consultation
(a) International/transboundary organisations
(b) National Fisheries departments.
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   (a) Report of survey defining current status of fish populations, fisheries activities and the implementation of various regulations, acts and policies within the basin
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   (d) Management interventions;
      (a) Objectives
      (b) Policy harmonisation and law enforcement
      (c) Co-management models
      (d) Fish protection zones
      (e) Community awareness
      (f) Monitoring activities, frame surveys, biological surveys

2.2. Consultation process

Following a fisheries meeting which took place in Maun towards the end of 2011, under the auspices of the Joint Permanent Commission of Cooperation (JPCC) between Botswana and Namibia, the Southern Africa Regional Environmental Program (SAREP) was asked to provide assistance to the JPCC in the form of training on fisheries identification surveys and the identification of fish diseases.

A training workshop was therefore organised, jointly hosted by SAREP and the MFMR/NNF/WWF Zambezi/Chobe Fisheries Project, at KIFI in April 2012. This initial training programme was entitled: **"Training/Workshop on Fish Identification, Pasgear, Monitoring and Diseases at KIFI (Namibia)".** This workshop was attended by the key research staff of the fisheries departments of the three countries. As part of this workshop, and based on earlier project proposals from the early 2000s, the participants developed the following proposal: **"Transboundary Fisheries Management Plan Proposal for the Cubango-Okavango River basin: Towards Responsible Shared Fisheries Management for the Cubango-Okavango River, Angola, Botswana and Namibia, May 2012 (Proposal for the development of the Management Plan)."** This document formed the basis for the current consultation process. With the support of SAREP, a regional fisheries meeting was convened in Windhoek that was attended by key fisheries personnel from all three countries to map the way forward to develop the full management plan as a consultative process. The workshop report was entitled: "**Developing a Transboundary Fisheries Management Plan: Proceedings of a regional fisheries meeting; attended by fisheries officers from Angola, Botswana and Namibia, Windhoek, Namibia; 23rd to the 26th July 2012".** The workshop was focussed to a large extent on close links being forged between the fisheries departments and researchers in the three countries for research and monitoring.

The discussions in the workshop were broad-ranging and emphasised the need to involve all stakeholders in outputs to be developed as proposals in the plan. Two consultants with decades of experience of inland fish and fisheries research and management in the region, Mr D. Tweddle and Dr C.J. Hay, were tasked with compiling the management plan and ensuring that all stakeholder groups would be fully represented when implementing the management plan.

Terms of reference were drawn up for the consultants to guide the development of the management plan. A scoping/inception report was prepared and circulated to key stakeholders in advance of a scoping workshop held in Windhoek in February 2013; reported in **"Developing a Transboundary Fisheries Management Plan, Proceedings of a regional fisheries meeting; attended by fisheries officers from Angola, Botswana and Namibia, 21st and 22nd February, 2013".** In addition to fisheries staff, this meeting was attended by Mr M. Paxton to represent the tourist lodge sector, Dr P.H. Skelton because of his knowledge of the fish fauna including the Angolan upper reaches, and Norwegian scientists who have, in the case of Dr T. Næsje in particular, extensive knowledge of the fisheries of the Namibian sector of the river.

For the scoping process, the consultants posed a series of questions that needed to be addressed during the workshop in order to inform the management plan. The results of those discussions were included in the proceedings. The key component of these proceedings is the list of stakeholders that will be involved in consultations during the implementation of the management plan. They are listed in the boxes below.

Namibia

- Traditional Authorities. 5 TAs in Kavango.
- Conservancies, one on river but other two could be extended to include river.
- Schools, encouraged to form environmental groups.
- Fishery committees, but none yet established in Kavango.
- Kavango Regional Council.
- Subsistence fishers, some migrant fishers from Caprivi moving in.
- Ministry of Fisheries and Marine Resources;
- Ministry of Environment and Tourism;
- Ministry of Forestry & Agriculture;
- Regional and town Councils;
- NamPol (Namibian Police);
- Immigration;
- Ministry of Health- spraying of insecticides along the river.

Botswana

- OFA-Okavango Fishermen's Association.
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Also have CBOs, e.g. OKMCT, Poler's trust, Khwai. Each has management of trust and is primary stakeholder of fishery management in these areas. Outside of CBOs, SAREP has focused on VDCs (village development committees), each of which is a company with one share per village member. Currently, trusts are proposed in other areas, e.g. Lake Ngami.

- KCS (Kalahari Conservation Society)
- BirdLife Botswana
- Basin Wide Forum in Angola, Botswana and Namibia
- DWNP;
- ORI;
- DEA (Department of Environmental Affairs);
- DoT (Department of Tourism);
- WHC (Water Utilities Corporation);
- Tribal Administration;
- MEWT (Ministry of Environment Wildlife and Tourism);
- DWMPC (Department of Waste Management and Pollution Control;
- Veterinary Services;
- Police;
- Immigration;
- Education;
- BDF (Botswana Defence Force).

Angola

There are 27 provincial associations of fishermen in Cuando-Cubango, with 768 registered fishermen in total and a fishermens' association with 20 members in Chitembo, Bie. All areas have traditional authorities, i.e. chiefs, known as 'Sobas', who are undisputed leaders and are key to state or NGO interventions in the villages.

7 fishery communities (Caiundo, Savate, Kaira, Kuangar, Calai, Dirico and Mucusso)

- IPA (Institute for Development of artisanal Fishery and Aquaculture
- INIP (National Institute for Fisheries Research)
- National Police (Immigration Service, and Boundary Guard)
- ACADIR (Association for Environmental Conservation and Integrated Rural Development)
- UNACA (National Union of Cooperative Associations for livestock and fisheries of Angola)
- DPHT (Provincial Department of Hotels and Tourism)
- UAN (Agostino Neto University)
- ISP (Higher Polytechnic Institute)
- SV (Veterinary Services)
- DPA (Provincial Department of Environment)
- Luiana (Luiana Organisation)
- Technocarro (Tourism)
- Provincial Office of Agriculture, Rural Development and Fisheries;
- DPA – Provincial Office of Environment and Conservation;
- UNACA – National Union of Agriculture;
- DRC – Development of Rural Agricultures and Fisheries (National ONG);
- Directorate of Fisheries and Agriculture in the provinces, with Departments of Fisheries;
- Education;
- Health.

Following the scoping process, the consultants developed a draft of this management plan, which was circulated to key stakeholders in advance of a final workshop to review the draft. This was held in Rundu, Namibia, on 7th May. Suggestions and comments from the participants of that workshop have now been incorporated into this final Management Plan document.

3. LITERATURE REVIEW

Literature was obtained covering the three topics listed in the TOR but adding a fourth topic, i.e. the important role of socio-economic and tourism studies:

(A) Frame survey reports from across the basin.
(B) Fish biology and population ecology monitoring reports and scientific papers.
(C) Socio-economic studies, including tourism.
(D) Relevant local, national and international regulations, policy and legislation.

As far as the authors are aware, the great majority of scientific papers and reports on the Okavango fish and fisheries have been examined to ascertain their relevance to the development of the Fisheries Management Plan. A full reference list is included here.

The first major research programme on the Okavango Delta was initiated in the 1980s with a PhD study by G. Merron of the JLB Smith Institute of Ichthyology (now SAIAB) that highlighted the importance of the annual floods in fish production (Merron, 1991, Merron & Bruton, 1988).

Prior to this major study there were only a few reports of limited scope (Dibbs, 1965; Hall, 1971; Maar, 1965; Fox, 1976; Gilmore, C., 1979a, b; Gilmore, K.S., 1976, 1979).

Merron and his JLB Smith Institute colleagues were the first scientists to emphasise the diverse nature of the riverine and floodplain fish fauna and highlight the possibility of expanding exploitation to the smaller species in the system, particularly the silver catfish, *Schilbe intermedius.* Numerous reports were produced during this research programme, covering fish ecology, species distribution, fisheries recommendations, potential impacts of the National Water Carrier on fish distribution, effects of tsetse fly spraying, etc. (Merron, 1987a,b, 1991; Merron & Bruton, 1984a,b, 1988, 1990, Merron *et al*., 1984a,b, 1985; Skelton & Merron, 1984, 1987; Skelton *et al*., 1985). In addition many scientific papers were published (Booth & Merron, 1996; Booth *et al*., 1995; Booth & McKinlay, 2001; Merron, 1992, 1993a, 1993b; Merron &,Bruton, 1995; Merron & Mann, 1995; Merron et al., 1990).

More recently, research on fish ecology and fisheries potential continued and has been expanded to include the social and economic aspects of fisheries and their development.

In Botswana, research was and is conducted by K. Mosepele and his colleagues in ORI and the Fisheries Section (Bokhutlo, 2011; Kgathi *et al*., 2005; Mmopelwa *et al*., 2005, 2009; Mosepele, 2000, 2001; Mosepele & Kolding, 2003; Mosepele & Mosepele, 2006; Mosepele & Nengu, 2003; Mosepele & Ngwenya, 2010; Mosepele *et al*., 2003, 2005a,b, 2006, 2009, In prep.; Nengu, 1995; Ngwenya & Mosepele, 2007, 2008; Ramberg et al., 2006; Siziba *et al*., 2011). The dynamic nature of floodplain fisheries has been repeatedly stressed in many of these publications. The concept of maximum sustainable yield is largely irrelevant in this floodplain fishery with its complex mosaic of habitats and areas of relative inaccessibility, where the main driver in fish production is the size of the flood pulse, but where fish availability and catchability is highest when discharge rates are at their lowest, through a 'concentration' effect (Mosepele *et al*., in prep.). The fish production/flood pulse relationship is common in numerous other African river fisheries (Welcomme, 1985, 1991) including other Zambezian floodplain fisheries (Tweddle *et al*., 1995). Other recent topics of fish-related studies have been genetic diversity and taxonomy (Kramer *et al*., 2003; 2007, 2011, 2012; Soekoe *et al*., 2009; Van der Bank & Smit, 2007; Van der Bank *et al*., 2009) and parasites (numerous papers by J. Van As and colleagues, e.g. Basson & Van As, 2002; Christison *et al*., 1998, 1999a, 1999b, 2001, 2005; Moravec & Van As, 2001, 2004; Reed *et al*., 2002; Smit *et al*., 2000, 2003, 2004)

Social and economic issues are of major importance in the Okavango fishery, with conflicting expectations of subsistence, commercial, and tourism angling interests, mainly in the Panhandle region of the river in Botswana (Nengu, 1995; Bills, 1996; Tweddle *et al*., 2003; Ramberg & van der Waal, 1997; Ngwenya & Mosepele, 2008; Mosepele & Ngwenya, 2010). These issues are covered thoroughly in the documentation for the draft management plan for the Okavango Delta in Botswana produced by Shipton (2011), particularly in the reports on stakeholder workshops. In all of

the published information on the perceived conflicts between different stakeholder groups, there has been a tendency to present the conflicting interests in terms of "either/or". Although the Biokavango programme succeeded in bringing stakeholders together to develop a Code of Conduct for responsible fishing in the delta, and initiating a pilot fishing-free zone (Biokavango Project, 2011a,b), there is considerable scope to investigate alternative scenarios for resource sharing that provide benefits for all stakeholders. The scope for Fish Protection Areas (FPAs), equivalent to the well-established concept of Marine Protected Areas (MPAs) should be considered rather than the widely discussed and controversial idea of separate zoning of recreational and commercial fishing areas that dominates the discussions in the documentation reviewed by the authors of this management plan (Bills, 1996; Tweddle *et al*., 2003; Setswalo, 2007; Shipton, 2011), although Shipton (2011, p. 39) recognises that if zoning of recreational fishing areas is to be successful it is essential that affected communities are empowered to benefit from the recreational fishery, e.g. in terms of employment opportunities.

In the Caprivi floodplain on the Zambezi River in Namibia, pilot FPAs identified and established by fishing communities are proving to have the potential to boost stocks for the benefit of the fishermen as well as earn revenue for the communities as a whole through income from angling tourism (Tweddle & Hay, 2011b). These pilot FPAs may form a model for the establishment of similar protected areas on the Okavango River. The establishment of FPAs is strongly encouraged elsewhere in the world e.g. Suski & Cooke (2007). Cooke *et al*. (2006) discussed compatibility between catch-and-release recreational angling and marine protected areas, and stated that "research in the field of catch-and-release is beginning to show that certain handling techniques can significantly reduce post-release mortality in fish. With appropriate regulation and angler education, catch-and-release could help enhance conservation and management goals associated with MPAs while maintaining public support and providing alternative tourism-based revenues for displaced fishers".

In Brazil, Lopes *et al*. (2011) reviewed the variety of systems of management, co-management, and reserves in the Amazon and also coastal fisheries, and discussed systems of management of natural resources as a whole, including use of "two categories of fisheries co-management in Brazil: Extractive and Sustainable Development Reserves". They stated that the inhabitants of coastal reserves can rely on ecotourism and jobs outside the reserves, which may reduce local fishing pressure. Such reviews of successes and failures of co-management elsewhere in the world should be used to inform such initiatives developed through the implementation of the current management plan.

There is also scope for integrating FPAs with other protected areas created for other conservation targets. In Namibia, Mahango National Park creates a no-fishing zone on the Kavango river at the Namibia-Botswana border. Between 1992 and 1999, experimental catch rates within the park were approximately five times higher than in heavily-exploited areas upstream (Hay *et al*., 2000). This park benefits fisheries on either side of the park and of the international border through improved recruitment from the park. In Botswana, a proposal has been made to establish the Phillipo Channel as a protected area for crocodiles during their breeding season (Okavango Crocodile Monitoring Programme, 2011). The proposal also highlights the importance of this channel for birdlife, particularly African Skimmer, Pels Fishing Owl and White Backed Night Heron. Establishment of the channel as a protected area would provide protection for 43% of crocodile breeding areas in the Panhandle, and would not interfere with transport through the main Okavango Channel. The channel is reportedly distant from the main commercial fishing concerns, and thus establishment of

the Phillipo Channel as a more comprehensive protected area for all aquatic fauna and flora is a realistic goal to be considered as a target in this management plan.

In Namibia, Hay (1995) conducted research on the Okavango River fisheries using mainly gillnets as the sampling method, and developed a database for the assessment of biotic integrity, while Hay e*t al*. (2000) made detailed recommendations on sustainable utilisation of the fishery, recommendations that are largely endorsed in the current (2003) Inland Fisheries Resources Act and associated regulations, and in the formulation of this management plan. New biological research results on the age and growth of the important commercial and recreational fishing species are also available (Peel, 2012; Peel *et al*., 2012) and have contributed to recommendations for modifications to the Inland Fisheries Resources Act and regulations (Tweddle & Hay, 2011a).

Frame survey reports are available for Botswana in 2005 (Bokhutlo *et al*., 2007) and Namibia in 2010 (Munwela, 2010), but no comprehensive frame survey has yet been conducted in Angola.

In Angola, biodiversity survey results are now available (Brooks, 2012; Bills *et al*., 2013). The biodiversity survey added several new species to the known Okavango fish fauna (Skelton, 2001, Tweddle *et al.,* 2003). In addition, recent name changes and recognition of other undescribed species in Namibia and Botswana are not yet reflected in the literature.

All government policy and legislation documents have been compiled for consultation in developing the Management Plan, and to review in terms of harmonisation of policies and regulations across the three countries, not only for fisheries but also for tourism (Government of Botswana, 1975. 1990, 2002, 2008, 2010a, 2010b; Government of Namibia, 2003a,b; ODMP, 2007). In addition, there are several contributions to planning and management processes by other organisations (Biokavango Project, 2011a,b; S.Thapelo Attorneys, 2008). A diagnostic analysis by Shipton (2011) of the legislative and institutional frameworks for the Okavango Delta in Botswana is discussed below. In Namibia, Kavango River fisheries are managed through the Inland Fisheries Resources Act of 2003 and associated regulations (Government of Namibia, 2003a,b). Recommendations for amendments are discussed below. In Angola, the inland fisheries are regulated through the "Regulamento Geral da Pesca, Decreto No 41/05 of 2005" under the Aquatic Biological Resources Act of 2004, i.e. "Lei dos Recursos Biologicos Aquaticos, (Nova Lei as Pescas), (Publicada no Diário da República No 81, I Série, Suplemento), Assembleia Nacional, Lei no 6-A/04".

Synopsis of issues arising from review of literature

Frame surveys

The main purpose of any fishery frame survey is to provide a comprehensive picture of the extent of a fishery, i.e. a detailed inventory of all the fishing craft and fishing gear. A frame survey should provide a complete description of the structure of any system to be sampled for collection of statistics. In fisheries, it may include the inventory of ports, landing places, number and type of fishing units (boats and gear), and a description of fishing and landing activity patterns. This information then provides the "frame" with which catch statistics collected from a sample of fishers can be used to estimate catches from the fishery as a whole by extrapolation (e.g. Bazigos, 1972; FAO, 1998). Typically, such frame surveys are also used to gather socio-economic data on the state

of the fishery and information on issues such as fish distribution routes, processing and marketing patterns, supply centres for goods and services, etc.

Namibia: The frame survey of the Kavango River in Namibia reported on by Munwela (2010) covered 28 villages and 1065 fishers, and according to C. Munwela (pers. comm.) covered the great majority of villages from which fishers operate. This report provides a very useful survey of communities along the Kavango River, their fishing activities, and their knowledge, or lack of it, about fishery regulations and management. It does not, however, fulfil the criteria for being a comprehensive frame survey that would allow a full statistical analysis to be derived from sample catch recording.

Botswana: The last frame survey conducted in Botswana took place in 2005 (Bokhutlo *et al*., 2007). Prior to that, a survey was carried out by the Fisheries Division in 1997 (Mosepele, 2001) across nearly all fishing households around the Okavango delta and estimated 3243 fishers. An attempt was also made to quantify the type of fishing equipment used to catch fish and how the use of such equipment varied with seasons.

The 2005 study was conducted in 16 villages in the Northwest District which are in the periphery of the delta within the newly proposed boundaries of the existing Okavango Delta Ramsar site. Villages covered were: Ditshipi/Daunara, Boro, Maun, Gumare/Tubu, Etsha villages, Ikoga, Sepopa, Nxamasere, Shakawe, Mohembo, Kauxwi, Xakao, Ngarange, Mogotlho, Seronga and Gunitsoga (These are the main fishing villages and they also comprise of small settlements).

The report emphasised flaws in data collection and therefore reported that data collected directly from fishers are of little help to the Fisheries Division.

The survey findings indicated that there was a total of 2703 fishers in the Okavango, the majority of whom (52%) were women. Only 3% (85 fishers) were commercial, with 97% purely subsistence. Of the 957 boats reported, 80% were dugout canoes (makoros) the rest being aluminium and fibreglass boats. A significant amount of the boats were used for transport rather than fishing, with 59% reported as being used for fishing. Knowledge of fishing regulations was reported to be very low throughout.

The Okavango Delta Management Plan (ODMP, 2008) is a 216 page document, which includes in its text the following (in text box) extremely limited information on fisheries, perhaps reflecting the very low priority still placed on fisheries by the Botswana Government. With such limited surveys, and the unrealistically low estimates of annual catch from the delta (~160 $t.yr^{-1}$), this is not surprising. With approximately 3000 fishers in the system, one might expect annual yields several times greater than estimated.

3.3.6 FISHERIES (from ODMP, 2008)

There is limited information on the Okavango fish stocks and this has resulted in uncertainties in the management of fish resources.

The overlap of commercial fishing and angling/ recreational activities on the same fishing grounds have often resulted in conflicts.

The only piece of fisheries legislation that exists is the Fish Protection Act of 1975, which is very outdated. The Okavango Delta fishery is still an open-access fishery with no regulatory mechanisms in place.

Fish biology and population ecology

The most comprehensive study on the biology and populations of the fishes of the Okavango system was the PhD study of Merron (1991), which resulted in the numerous reports and scientific papers listed in the introduction to this section. Merron's study included the reproductive and feeding biology of the important fisheries species, together with a comprehensive review of the overall floodplain ecology and the seasonal response of fish communities to the annual flood regime, including fish species distribution in relation to habitat. This study remains the definitive study on the ecology of the fishes of the Okavango Delta.

Follow-up studies have concentrated on fisheries stock assessment (Mosepele, 2000 and other papers listed above), based primarily on length-based assessments. Length-based stock assessment models were developed for use in fisheries where limited biological data are available on the species, but should not be considered as a substitute for detailed biological and ecological research, particularly age and growth studies.

In Namibia, a comprehensive sampling survey was conducted between 1992 and 1999 at selected sites along the length of the river (Hay *et al*., 1996, 1997, 2000; Hocutt *et al*., 1994). Species composition of catches of research nets, abundance indices, length frequencies, and biological parameters of the most important fisheries species were all determined. The report is particularly notable for the evidence it presents on the difference between catch rates in unfished and heavily exploited areas of the river.

A survey of the fisheries activities on the river was then conducted by Munwela (2010). This study also presented length frequency and cpue data for the commoner species in research nets.

More recently, the first reliable estimate of growth rates of the most important commercial cichlid species was conducted (Peel, 2012; Peel *et al*., 2012), using analysis of annual rings laid down on otoliths. The fish used in this study came largely from the downstream stretch of the river just above the Namibia/Botswana border, and can therefore be considered representative of fishes in the upstream part of the river in Botswana also, i.e. through the Panhandle section where the main commercial fishery operates.

The estimates of growth rate generated from the length-based stock assessment are unrealistic, particularly for the important threespot tilapia, *Oreochromis andersonii*, due to the limitations of assessment from research gillnets. For this species, for example, estimates of growth for *O. andersonii* in the first year ranged from 12 cm (Mosepele *et al*., 2006) to nearly 40 cm (Mosepele, 2000). The more realistic figure is in the range 15-20 cm (Peel, 2012) and length only approaches 40 cm after five years. With the new information on growth rates of the important commercial species, which differ from the estimates generated by the previous length-based assessments, it is important that the yield assessments are reviewed as part of the outputs stemming from this management plan.

The biology of the clariids in Botswana was studied by Bokhutlo (2011), who used otoliths to determine growth rates, determined the size at maturity, and concluded that the stock in Botswana was only lightly exploited.

Social and economic studies

In Botswana, Mosepele *et al*. (2006) reported on artisanal fishing in relation to food security in the delta, while Ngwenya & Mosepele (2008) reviewed the socio-economic status of subsistence fishing and Mosepele & Ngwenya (2010) reviewed the commercial fishery. The value to the local economy of the angling tourism industry has not, however, so far been accurately assessed despite the recommendations of Tweddle *et al*. (2003), which also addressed the need to understand the other components of the fishery.

The studies that have been conducted have revealed the vital importance of the fisheries for livelihoods of the communities along the river system.

The subsistence fishing study (Ngwenya & Mosepele, 2008) showed that fishing is a source of income for about 40% of the households sampled and contributes about 30% of the total median income. It is also noteworthy that the majority of subsistence fisher families in the Delta are single parent households headed by a female, which significantly highlights the vulnerability of the subsistence fisher households in the Delta. Cash earned from the sale of fish is mostly used for such daily necessities as food, toiletries and clothing.

The commercial fishery has varied in extent and in efficiency over the years with a most recent estimate of 85 commercial fishers (Bokhutlo *et al.,* 2007). Mosepele & Ngwenya (2010) provided a comprehensive review of the contribution of the fishery to local livelihoods. Unlike in Namibia, where Mahango National Park yields experimental catch rates five times greater than exploited areas (Hay *et al*., 2000) , the papers of Mosepele and his colleagues report no evidence of impact of fishing on the resources. Despite this, Mosepele & Ngwenya (2010) report intense resource user conflicts during the low water period. The conflicts that do exist are clearly not a result of overfishing, but of competition for the same resources in the same areas.

To date, no major study appears to have been made of the contribution of the tourism lodges to the local economy in the fishing areas, an observation also noted by Shipton (2011). Shipton gave an example from just one of the five fishing lodges in the Panhandle area. In 2010, receipts for accommodation for fishing tourists totalled approximately P2.4 million, with a further P680,000 earned from fishing boat hire fees. The establishment employs 35 people (with dependants, estimated at seven to ten per family head by Mosepele & Ngwenya (2010), this equates to ~250-350 people) with an annual wage bill in the region of P1 million. A study of fishing lodges in a similar recreational fishery on the Caprivi floodplain on the Upper Zambezi showed the considerable contribution fishing lodges made to the local economy in terms of employment (Sweeney *et al*., 2010).

Promotion of tourism is, however, not without problems. *Ad hoc* development of facilities and allocation of exclusive rights over use of natural resources to tourist companies without regulation through a comprehensive national policy can lead to problems (Mbaiwa, 2002) and conflicts with local communities. Mbaiwa (2002) criticised the way in which tourism has developed in the Okavango Delta area and highlighted several areas of concern, e.g. (1) management positions filled from outside while local community members are restricted to lowly-paid menial positions, and

unfair pay differentials between locals and outsiders when occupying similar posts; (2) inadequate control of external revenues and taxation; (3) unlawful exclusion of local community members from use of traditional natural resources, etc. It is also evident that, as in any industry and human endeavour, there is considerable variation in the quality of relationships between tourism lodges and local communities. While all these issues need to be addressed, they should not detract from the considerable potential of angling tourism to bring financial and infrastructural benefits to the local communities, whether directly through employment or indirectly through further investments in the local economy. Although admittedly based on wildlife tourism, Maun would not exist as a town in its present form without tourism investment, and similarly Kasane on the Chobe River is entirely focussed on tourism.

In Namibia, Munwela (2010) reported on the profile of people engaged in fishing activities. He noted that 60% of the fishers interviewed were female, with fishing being an obvious and convenient method of feeding their families. As in Botswana, therefore, subsistence fishing is a major contributor to local livelihoods. Recognising this, Namibian fisheries policy discourages commercialisation of the resources, following the recommendations of Hay *et al*. (2000). In the Kavango Region of Namibia, tourism is an important and growing source of employment for the local communities.

Literature on the Angolan Cubango fisheries is limited, and we are indebted to Francisco Almeida (pers. comm.) for information on the current status. The fishery is predominantly for subsistence using various kinds of fish traps together with small-meshed (37 & 40 mm) gillnets, hook & line and mosquito nets. Subsistence fishing is an important activity for women and children. There are some exceptions where government support is being provided in the form of nets and fishing vessels, documented under stakeholders later in this report. Fishermen depending entirely on fishing often spend long periods away from home when they follow fish migrations or concentrations. The region of the Cubango River and tributaries in Angola is home to 3,000 people.

Regulations, legislation and policy

Shipton (2011) reviewed the legislative and institutional frameworks for the Okavango Delta in Botswana and it is therefore unnecessary to elaborate on the issues here. Instead, it is included here (with adaptation and some abbreviation for consistency in presentation) as Appendix 1 to this management plan.

In Namibia, Kavango River fisheries are managed through the Inland Fisheries Resources Act of 2003 and associated regulations (Government of Namibia, 2003a,b). Recommendations on amendments to these regulations, aimed at empowering fishing communities to take a greater role in management in partnership with the MFMR, were put forward by Tweddle & Hay (2011a). These recommendations primarily include recognition of the important role conservancies can play in management. Their absence from the existing Act and regulations is a reflection of the rapid establishment and spread of conservancies empowered to manage their own natural resources throughout Namibia since the Act was promulgated. Wherever the Act recognises traditional authorities and regional councils, Tweddle & Hay (2011a) have recommended including recognition of conservancies. There is also a need to empower communities to establish bye-laws in partnership with MFMR, where fishery activities can legitimately be allowed that are not covered under existing regulations. A review of the Act and regulations is currently underway by MFMR.

In Angola, the inland fisheries are regulated through the Aquatic Biological Resources Act, i.e. "Regulamento Geral da Pesca, Decreto No 41/05". Relevant sections of the act are included in Appendix 3 of this management plan, where harmonisation of the acts and regulations in the three countries are reviewed.

4. STAKEHOLDER CONSULTATION

International/transboundary organisations

The Okavango River and its natural resources have attracted interest from numerous NGOs and other organisations in recent decades. Their contributions include:

IRDNC

In Namibia, the NGO Integrated Rural Development and Nature Conservation supports and provides training to conservancies in Namibia for natural resource management. It cooperates closely with NNF and WWF in fisheries management initiatives in Caprivi. IRDNC has a potential role in the management plan in Namibia to strengthen conservancies' participation in fisheries management.

Kavango Open Africa Route (KOAR)

KOAR has developed and is now engaged in promoting a Kavango tourism route as part of the southern African NGO Open Africa (www.openafrica.org), whose vision is "Open Africa offers travellers a network of authentic, life enriching journeys across Africa, while enabling livelihoods & enhancing conservation". The tourism operations are committed to the health of the river ecosystem and the well-being of the riparian communities. They are entirely open to assisting in any way possible with the sustainable management of this system. The tourism operators have long-term commitments and responsibilities, with a range of resources and expertise available to support the fisheries departments in implementation of agreed management interventions. A submission by KOAR on the tourism viewpoints is included as Appendix 2 to this document.

KAZA

The Kavango/Zambezi Transfrontier Conservation Area (KAZA) is a major transboundary natural resources management programme encompassing large areas of the Zambezi river system in addition to the Okavango River with governments as the major partners. The organisation is still very much in its initial development stage, and fisheries are assuming increasing importance in addition to the initial terrestrial mammal emphasis. KAZA is seen as potentially a major partner in any fisheries management programmes in the region.

NNF

The Namibia Nature Foundation led the Zambezi/Chobe Transboundary Fisheries project and the new EU-funded project for fisheries co-management in the region. This Okavango transboundary management plan development forms part of the close coordination that has developed between SAREP and NNF.

The EU project, short title “Community Conservation Fisheries in KAZA Project” has the potential to be a major partner in the implementation of this management plan. Partnered with ORI, the project’s aim is to “Strengthen community-based management of river and floodplain fisheries in Namibia, Zambia, and Botswana, contributing to environmental conservation and to improve socio-economic benefits and food security, especially for women, children and the rural poor through capacity building and the development of regional and international networking platforms.”

OKACOM

OKACOM was established in 1994 by Angola, Namibia and Botswana to promote a coordinated approach to the sustainable management of the Okavango river basin. The Okavango River Basin Steering Committee (OBSC) appointed by the commission in 1995, is the technical advisory body to the commission. From a fisheries perspective, the most important OKACOM programme is the Environmental Protection and Sustainable Management of the Okavango River Project. This is a GEF / UNDP / FAO funded initiative that has developed a Transboundary Diagnostic Analysis (TDA) and formulated Strategic Action Plans for the River System. From a fisheries management perspective, OKACOM provides a compelling vehicle with which to effectively address transboundary issues.

Basin-wide forum

OkBMC Biodiversity Working Group

This is an initiative to protect biodiversity in the Okavango through partnerships between tourism lodges, schools, government departments and other interested parties. OkBMC also helps in communication with communities adjacent to the river in Angola.

SAREP

The Southern Africa Regional Environmental Program (SAREP) is a five year project to advance regional integration through activities that increase capacity for managing shared natural resources, improve social welfare, and strengthen the health sector’s capacity to respond to HIV/AIDS, – primarily in the Cubango-Okavango River Basin (CORB) by providing support to the Permanent Okavango River Basin Water Commission (OKACOM). SAREP will support the initiatives of OKACOM to integrate improved water and sanitation services with strategies that address threats to ecosystem services and biodiversity within the CORB and to strengthen regional capacity to adapt and respond to effects of climate change. SAREP is responsible for the production of this Transboundary Fisheries Management Plan. SAREP is operating in each of the three basin countries in collaboration with its country-based NGO partners, i.e. Angola (ACADIR), Botswana (KCS) and Namibia (NNF and IRDNC).

WWF in Namibia

WWF has worked in close cooperation with NNF to support the fisheries co-management project activities in Caprivi.

National fisheries departments

The governmental organisations responsible for fisheries management in the three countries are now collaborating closely and strongly support the development of the Okavango Transboundary

Fisheries Management Plan. Harmonisation of regulations in all three countries is an important component of this management plan (Appendices 2 and 3).

Angola

Inland fisheries in Angola fall under the Directorate of Fisheries and Agriculture in each province, each of which has a Department of Fisheries.

The Angolan Ministry of Environment's Institute of Biodiversity (MINAMB) plays an active role in the fisheries. It has also worked with SAREP, having participated in the biodiversity survey in 2012. MINAMB is expected to be an active partner in the planning and implementation of the Management Plan.

Botswana

The government body in Botswana with responsibility for fisheries is the Fisheries Section of the Department of National Parks and Wildlife.

Namibia

The Ministry of Fisheries and Marine Resources is responsible for fisheries in Namibia. The Ministry has separate Directorates, with the Directorate of Operations and the Directorate of Aquaculture and Inland Fisheries being mainly responsible for inland fisheries development and management.

Research institutes

KIFI

The Kamutjonga Inland Fisheries Institute based just north of the Botswana border in Namibia is a MFMR facility that has the potential to be a major research institute for fish and fisheries research on the Kavango River in Namibia. It is envisaged that collaboration with ORI on fish and fisheries research and monitoring can greatly enhance the supporting role of both institutes.

INIP

The Ministry of Agriculture's National Institute of Fish Research (INIP) is a scientific institution of research and technological development contributing to marine and inland water research, including implementation, coordination and monitoring of applied research and experimental development marine fisheries, inland waters, lagoons and estuaries. It studies aquatic biological resources, their environment, proposing measures for the conservation and rational management of living aquatic resources and ecosystems to play an active role in the use and conservation of fisheries resources. INIP also participated with MINAMB in the biodiversity survey in 2012, and is expected to be an active partner in the planning and implementation of the Management Plan.

IPA

IPA is the Institute for Development of Artisanal Fisheries and Aquaculture, involved in management and development of artisanal fisheries and aquaculture.

ORI

The Okavango Research Institute based in Maun is an institute of the University of Botswana. It is a centre for the study and conservation of the Okavango Delta, established because this is one of the world's largest and most intact inland wetland ecosystems. ORI has played a major role in developing close relationships and partnerships between stakeholders in the Okavango Delta, particularly through the 5-year Okavango Wetland Biodiversity Conservation Project, known as the Biokavango project from 2006-2010. One of the Outputs from that project was "Biodiversity friendly management methods are inducted into fisheries production systems. Output 1: Biodiversity friendly management practices demonstrated for fisheries sector. Output 2: Biodiversity safeguards are incorporated into national aquaculture programmes". With its existing high profile in the area, and as a partner in the NNF/EU Community Conservation Fisheries in KAZA Project, ORI is a major stakeholder in the implementation of the management plan.

Community fisheries organisations

Botswana: In Botswana, there are two community organisations representing fishers' interests. The Okavango Fisheries Management Committee (OFMC) is a forum for government agencies to interact with fishers, whereas the Okavango Fishermen's Association (OFA) is an association for fishers from the commercial, subsistence and recreational fishing sectors. These organisations, together with relevant Traditional Authorities, listed in the box below need to participate fully in the development and implementation of the Management Plan.

Botswana

- OFA-Okavango Fishermen's Association.
- OFMC-Okavango Fisheries Management Committee.
- AECB-Association of Environmental Clubs of Botswana; government-run.
- CBO-Community based organisations.
- VDC-Village Development Committee.
- The Tribal Authority is a government structure and not communities per se.
- Leadership from traditional authorities in villages.
- 5 community based concessions in the Okavango.

Also have CBOs, e.g. OKMCT, Poler's trust, Khwai. Each has management of trust and is primary stakeholder of fishery management in these areas. Outside of CBOs, SAREP has focused on VDCs (village development committees), each of which is a company with one share per village member. Currently, trusts are proposed in other areas, e.g. Lake Ngami.

Namibia: Conservancies play an increasingly important role in natural resource management in Namibia. In Caprivi region, on the Zambezi River, Impalila and Sikunga Conservancies have established Fish Protection Areas (FPAs) a management concept that has tremendous potential in the Okavango system. The potential role of the three conservancies along the Kavango River needs to be investigated in the implementation of the Management Plan. Although two of these have

boundaries that do not reach the river, this can be reviewed. The Traditional Authorities and Regional Councils are also recognised as important stakeholders in Namibian fisheries.

Namibia

- Traditional Authorities. 5 TAs in Kavango.
- Conservancies, one on river but other two could be extended to include river.
- Schools, encouraged to form environmental groups.
- Fishery committees, but none yet established in Kavango.
- Kavango Regional Council.
- Subsistence fishers, some migrant fishers from Caprivi moving in.

Angola:

Angola

- Fishermen's association with 20 members in the Municipality of Chitembo, Bie Province.
- 27 provincial associations of fishermen in catchment, with 768 registered fishermen in total.
- All areas have traditional authorities, i.e. chiefs, known as 'Sobas', who are undisputed leaders and are key to state or NGO interventions in the villages.
- A poverty relief programme run by the government gives fishing communities 4 m boats, engines, gillnets and hooks.
- Savate and Calai have organized cooperation.

5. DEVELOPMENT OF TRANSBOUNDARY FISHERIES MANAGEMENT PLAN

5.1. Management interventions

i. Objectives

The main objective of management intervention is to *"contribute towards improving and maintaining the fish resources of the entire Okavango River Basin at a sustainable level thereby improving food security in the region"* and, in a broader context, to secure sustainable utilisation of the fish resources for the benefit of all stakeholders. This needs a much greater recognition of the role of tourism in the national economies. Several socio-economic studies have been made in Botswana but there is still no clear way forward for maximising the benefits of tourism to the local communities.

The major objective of the management plan should be to map the way forward to secure buy-in from all sectors for cooperation in management of the resources.

ii. Policy harmonisation and law enforcement

The process for achieving this is already underway through inter-governmental dialogue, supported by SAREP. A comparative table of regulations in the three countries has been compiled and is included as Appendix 3 to this document. Harmonisation issues to be resolved through the management plan include, but are not limited to the following, extracted from Appendix 3.

Prohibited gears. Light attraction, poisons, explosives, dragnets prohibited by all; block nets prohibited in Botswana (across lagoon entrances) and Namibia (more than halfway across watercourse); drifting nets prohibited in Namibia and Angola.

Alien species. Namibia and Angola need Minister permission, Botswana only Director. Latter needs modification to harmonise with others and provide better security at a higher level of government.

Closed seasons. This is a contentious issue. A separate table is provided in Appendix 4 noting the biological and political pros and cons of having a closed season.

Transboundary agreement on gillnets. Harmonisation is needed for Namibia and Angola for the length of their shared boundary. Harmonisation between Botswana and Namibia less important.

Fishing licence regulations. Transboundary agreement is needed for Namibia and Angola for the length of their shared boundary.

Fishing Councils. Botswana has two fishers' organisations that can potentially be incorporated into a fisheries council for the delta and panhandle. The Okavango Fisheries Management Committee (OFMC) is a forum for government agencies to interact with fishers and therefore plays a similar role to a formal fisheries council. The Okavango Fishermen's Association (OFA) is an association for fishers from the commercial, subsistence and recreational fishing sectors.

Protected areas. Namibian and Angolan acts are in agreement. Botswana act needs to be modified to include similar provision for reserves/protected areas.

Mesh size regulations. Agreement is needed for shared waters, but recognition is needed that different components of rivers, floodplains and the delta may need different regulations.

Law enforcement will also need to be coordinated between the three countries through agreements on collaboration established through this management plan.

5.2. Report of survey defining current status of fish populations, fisheries activities and the implementation of various regulations, acts and policies within the basin

The current knowledge of the status of fish populations is covered elsewhere in this document. In summary, Okavango Delta stocks are lightly exploited, with abundance most closely linked with variations in scale of the annual flood. Stocks in the Panhandle are exploited by tourist recreational anglers and commercial fishers, resulting in disagreements about the optimal use of the resources. The stocks remain healthy but with potential for localised depletion. In Namibia, Mahango National Park provides full protection for fish stocks, resulting in near pristine populations that a decade ago were reportedly five times greater than in more heavily exploited areas further upstream in Namibia, where exploitation rates have undoubtedly increased since. Exploitation rates in Angola are uncertain but increasing. The transboundary research and monitoring programmes proposed in this management plan will greatly improve knowledge of the stocks by comparing results in areas of varying exploitation rates throughout the system.

A report contributing towards the development of a management plan for the Okavango in Botswana was prepared by Shipton (2011). Key issues that were put forward for consideration in the development of a management plan for Botswana were: fisher organisations - the role of OFA/OFMC; institutional capacity for the DWNP Fisheries Division; trans-boundary cooperation; improved fisheries data; regulation review; compliance with fisheries and wildlife legislation; biological reference points; and CBNRM initiatives including promoting community based tourism opportunities. These issues became the focus for discussion in the scoping process for this

management plan, resulting in the development of this transboundary management plan, as many of the key issues are common to all three countries.

Policies to be promoted include: facilitating governance arrangements in communities wishing to set aside areas for recreational fishing. This concept needs to be extended to include Fish Protection Areas (FPAs) and earning of revenue from anglers for the communities. It needs very clear recognition of which communities actually own the fishing rights and how potential revenue should be handled. Consideration may be given to registration of fishers currently operating in potential FPAs and potential employment by communities as fish guards to protect any FPAs that may be established. We consider the much-discussed option of zonation in the Panhandle of commercial and tourism angling areas to be too simplistic and likely to result in disagreement, conflict, and flouting of rules. In contrast, we argue for the establishment of FPAs by communities to establish areas where fish are protected and where communities can earn revenue from anglers through payment of rod fees to communities to fish (practising catch and release) in the FPAs. The main long-term benefit to the communities is improved recruitment of fish to those adjacent areas that are open to fishing, but communities as a whole also benefit financially from the tourist rod fees.

5.3. Influence of adjacent basins. Collaborations, alignments and standardisation of monitoring activities and regulations

This project is just one component of increasingly integrated fisheries research and management activities throughout the region. KAZA is increasingly becoming a major partner in managing fisheries along with other transboundary natural resources.

The authors of this report are starting a new 4-year EU-funded project, following the completion of a 6-year, 2-phase project in Caprivi, Namibia funded by NORAD and administered by NNF/WWF/MFMR. The new EU project expands on lessons learned in community based management of the Caprivi Floodplain fisheries, and is extending the project's operational area to include the Okavango system. ORI is a partner in this new project, and all organisations operational in fisheries in the region are either full partners or associate institutions. The new project is coordinating activities in the Okavango region very closely with SAREP.

Standardisation of monitoring activities and harmonisation of legislation are discussed at length elsewhere in this management plan.

5.4. Driving forces within the basin affecting fish populations, direct threats, conflicts and indirect impacts

Direct threats to the Okavango fisheries include increasing, unsustainable commercialisation and widespread use of illegal, destructive fishing methods, in Namibia in particular, where influx of fishers from Caprivi with illegal gears is reported.

In Botswana, relations between the commercial, subsistence and tourism fisheries sectors have reportedly improved but some distrust remains, evident in the minutes of stakeholder meetings

published in Shipton (2011). The reported discussions show that many stakeholders share progressive viewpoints but others still do not understand the issues or the dynamics of fisheries. A different approach may yield dividends in securing much better cooperation between the sectors for the benefit of all stakeholders, a comprehensive list of whom is presented earlier in this document.

Irrigation schemes upriver that may flout agreed international protocols may impact on the downstream fisheries and other water-dependent sectors of the economy. These are issues that need to be addressed but are perhaps beyond the scope of this management planning process.

5.5. Co-management, lessons from elsewhere

Co-management is increasingly promoted in inland fisheries in Africa and elsewhere, with mixed results. In this southern African region, there are examples of both successes and failures, and here we present cases from Malawi. The most notable failure was, and still remains, the Lake Malombe fishery. In the 1980s, a change in fishing methods to target small cichlid species resulted in the demise of the important chambo (tilapia) fishery as a result of small-meshed nets (known as nkacha) destroying weedbeds and catching excessive numbers of juvenile chambo (Tweddle *et al*., 1995). The fishery for the small cichlids also went into decline, resulting in a fishery worth 10% of the earlier fishery. In response, a co-management system was proposed (Bell and Donda, 1993) and implemented (Hara, 2000, 2006a, 2006b, 2008). Beach village committees were established, composed of gear owners, crew members, processors, fish traders, active members of the village group, traditional leaders, and other co-management partners, e.g. NGOs such as CURE, Total Land Care, COMPASS and WESM (Njaya *et al*., 2012). Their duties included regulating admission of additional gear owners, patrolling their fishing areas, organising group members to discuss problems of the fishery, represent interests of its members at higher levels e.g. associations, data collection, and lobbying for policy reviews. In Malombe and the adjoining Upper Shire River, 31 such BVCs were established. The co-management arrangements have not, however, succeeded and the fishery has remained severely degraded. Hara (2008) attributes the co-management failure to problems of representation on beach village committees, and his criticisms, i.e. the abstract of his paper, are shown in the box below.

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Special Issue

Dilemmas of Democratic Decentralisation in Mangochi District, Malawi: Interest and Mistrust in Fisheries Management

Mafaniso Hara

Abstract

To establish 'participatory' fisheries management, in 1993 Malawi's Fisheries Department constituted elected Beach Village Committees (BVCs) with village headmen as ex-officio members. But, struggles between elected BVC members and traditional authorities (TAs) over benefits from fisheries undermined the authority of elected members. Legal ambiguity on who should make decisions facilitated the takeover by headmen. Further, the BVC was elected by the population as a whole, representing more than just the fishers, whom these committees were designed to control. This resulted in the sabotaging of the BVCs activities by the fishers. Under these conditions, representing the whole population undermined the effectiveness of the BVCs. In 1998, decentralisation reforms placed 'community inclusion' in fisheries management under Village Development Committees (VDCs), whose members would be appointed by elected District Assemblies (DAs). This reform is likely to unleash a struggle over BVC-VDC relations. But, different visions of decentralisation, shared mistrust of local democracy, higher level battles for authority among the government, politicians and TAs stalled the decentralisation process. Donors supporting these reforms were also mistrustful of representative local institutions. The institutions chosen and recognised by the government under donor pressure are the sites of political struggles in which representation, a sense of belonging and downward accountability are losing ground.

The major lesson to be learned, however, is that co-management of a natural resource can only succeed if there remains a resource to be managed, particularly in impoverished rural communities. The Lake Malombe chambo fishery can easily be restored, but not through co-management in its present form, which has sadly resulted in 20 years of lost opportunity for what was once a valuable fishery.

In contrast, Lake Chiuta has proved a co-management success story (Njaya *et al*., no date), although one might question the form of the co-management. The co-management initiative began when the lake was invaded by fishermen from Lake Malombe and from neighbouring Lake Chilwa, using the same destructive nkacha nets that destroyed the Lake Malombe fishery. The Chiuta fishers succeeded in establishing their own management system and removing the nkacha fishers, but only after reported fierce conflict. Lake Chiuta is a healthy lake with extensive weedbeds and yields a stable fish harvest for the local communities. Co-management on Lake Chiuta was successful for two reasons; a resource that had not yet been seriously overfished but could clearly be observed to be under attack; and, reportedly (discussions between D. Tweddle and fishers at Dinje Village, Lake Chiuta, in March 2013) a very strong local chief driving the programme. One might, however, question whether this is genuine co-management or another form of top-down management, but through a strong Chief and not central government. Donda (PDF on-line, no date or attribution), however, noted that village heads were excluded from BVCs on Chiuta but dominated those of Lake Malombe. Also Malombe BVCs were dominated by non-fishers (70%) but Chiuta BVCS were mainly fishers (80%). Njaya et al. (no date) stated that " Indications are that so long as the threat of nkacha fishers gaining access into the fishery exists, mobilisation of the fishers will remain strong. The fact the fishers initiated the organisation for management on their own remains the best foundation for sustainability of the arrangement."

There is general recognition that co-management systems are necessary in rural subsistence and artisanal fisheries, and these goals are being pursued in the countries bordering the Okavango and

Upper Zambezi River systems. In Zambia and Namibia these goals are clearly recognised in their inland fisheries legislation. For the Caprivi floodplain, in both Namibia and Zambia, fishing communities are actively encouraged and assisted to set up fisheries committees with the assistance of government, Traditional Authorities and NGOs (NNF and AWF).These committees are having varying success. Both successes and failures help to inform this management plan. Successes include Sikunga and Impalila Conservancies, A current failure in co-management was experienced in the Lisikili area adjacent to Sikunga Conservancy, where it proved difficult to establish a fully representative fishery committee because of disagreements and distrust in neighbouring communities. The Muyako village fisheries committee on Lake Liambezi, was highlighted as a success story (Tweddle *et al.*, 2011), then became a problem area with the fisheries committee not implementing agreements they had established, but now (in June 2013) the committee has re-established control through a system of registering canoes, prohibiting foreign fishers from fishing the lake, and closing the lake for two weeks to enable ghost nets to be removed.

Guidelines for co-management in Okavango/Cubango fisheries, based on the lessons learned elsewhere, are presented in Part B of this management plan.

5.6. Fish Protection Areas

The Caprivi Model

Two pilot Fish Protection Areas (FPAs) have been established in Caprivi. These are (1) the Kasaya Channel, that links the Zambezi River with the Chobe River, thereby creating Impalila Island, which forms the conservancy managing the FPA, and (2) the Sikunga Channel in Sikunga Conservancy. The establishment of these reserves followed a long consultation process in the fishing communities who were concerned about the deterioration in their fish stocks as a result of an enormous increase in fishing effort with destructive gears. With the assistance of the MFMR/NNF/WWF Zambezi/Chobe Fisheries Project, potential FPAs were identified and mapped, and two pilot sites with the greatest chance of success were established. Criteria for potential success were size, biological suitability, ability to control, ensuring that local fishers would not be disenfranchised, and potential for earning revenue from tourism primarily through fee-paying catch-and-release angling. A full background of the processes involved in setting up the FPAs was submitted to the Ministry (Tweddle & Hay, 2011b). Following their successful establishment, funds were obtained from the Millennium Challenge Account to equip the two conservancies for the first year of operation with boats, engines, publicity materials, start-up salaries for monitors, etc. The FPAs will subsequently become self-financing through tourism income.

In neighbouring Zambia, the African Wildlife Foundation in partnership with the Department of Fisheries is also working with fishing communities and with the Barotse Royal Establishment, establishing fishers' committees, and identifying and setting up FPAs in each of the committees' areas.

6. MONITORING ACTIVITIES, FRAME SURVEYS, BIOLOGICAL SURVEYS

6.1. Longitudinal profile of fish populations fully documented, from the riverine habitats in Angola to the seasonal swamps in the lower delta in Botswana.

Bills & Skelton (2013) have just produced the first report on the fishes of the upper tributaries of the Cubango/Okavango system, after a survey that yielded several new species and new records for the system. A new survey is underway. Further downstream, the fauna is fairly well-known (Skelton, 2001; Tweddle *et al.*, 2003) both locally and in a regional context (Tweddle *et al*. 2009), but nevertheless new species are still being found (Kramer *et al*., 2012; Tweddle, unpublished data) and other species brought out of synonomy (Kramer & Van der Bank, 2011).

In terms of fish assemblages and population abundances, the surveys proposed here will fully address any questions that might arise.

6.2. Introduction to fisheries monitoring surveys

To understand the dynamics of a floodplain river system, high quality, long-term data series with predetermined spatial and temporal intervals are needed. These surveys do put strain on the already stressed out resources from government which usually leads to diluted research and monitoring approaches where data are recorded in such a way that the most important questions asked by managers remain unanswered. Taking into account the importance of the fish resource from the Okavango River, especially for women, children and the rural poor communities, a collaborative, well planned approach should be put in place to ensure that this valuable resource is utilised sustainably for the benefit of these stakeholders.

Several shortcomings are noted when assessing the availability of data on the fish and the fisheries from the Okavango River. The intensity of data collection differs between the three countries due to different policy approaches, the availability of financial and manpower resources, infrastructure development and lack of experience of fisheries scientists. The first step would be to assess and to document the current status of available data, the data format and the spatial and temporal distribution of areas sampled in Angola, Botswana and Namibia. From these, research gaps could be identified and a research strategy jointly developed between fisheries scientists from the three countries.

The immediate objective once the research gaps have been identified would be to establish a long-term monitoring system synchronised between Angola, Botswana and Namibia for the development of a database recorded longitudinally along the entire Okavango River Basin with efficient flow of information between scientists and managers for assessing fish stocks and ecosystem functioning.

1. **Rationale for monitoring activities and data collection**

- Compile fish species lists.

- Determine the status of the different fish species, especially commercially important species.
- Recommend measures to protect the species diversity.
- Use indices to assess environmental degradation, seasonal changes and exploitation of the fish population.
- Obtain ecological and biological data to study the life history of commercially important species.
- Determine the catch efficiency and species composition of different fishing gears.
- Document seasonal yields/catch rates from the subsistence and commercial fisheries for the system.
- Document catches from the tourism industry (recreational fishery).
- Obtain socio-economic data on the role played by fish in food security.
- Ensure research results are translated into management plans/actions.

2. Fishery independent data

(a) Harmonisation and agreed scientific methodology between countries sharing a resource

Standardised survey methodology should be adopted in the three countries leading to the development of shared databases accessible to all three countries. The SADC Protocol on Fisheries states in Article 18 point no. 3 on Information Exchange that, "State Parties shall regularly consult on methodologies and approaches that will harmonise and enhance the reliability of data collection". The harmonisation of scientific methodologies between countries sharing a common fish resource has already been agreed upon by all SADC states and the mandate for this falls within the different departments in the different countries responsible for inland fisheries.

The knowledge base of the fish fauna in the catchment of the Cubango-Okavango River Basin in Angola is poor. An initial survey done in 2012 further emphasised the lack of any baseline data on the fish fauna from the catchment area (Brooks, 2012). Two outstanding key findings were made during the study, the total lack of certain groups from the Okavango Delta found in the catchment areas and the different fish assemblages between the Cubango River and the Cuito River and their tributaries. Close affinities were found between the Cubango catchment and the Okavango Delta, Kunene and Cuanza River fish fauna showing the level of speciation between these river basins. Each tributary has its own characteristic fish fauna, with possibly still some un-described species. The Department of Fisheries in Angola used to do surveys every May with thirty people assessing different fishery communities, but there are currently no surveys being conducted in the Cubango River in Angola. Angolan fisheries monitoring is still in its infancy but there are data for the Quanza River, where two surveys are completed each year by fishermen looking at the length, size and species of fish.

The Ministry of Fisheries and Marine Resources, Namibia started a monitoring programme in the Kavango River (the section bordering Angola) in 1992 and identified five stations that are annually monitored. These surveys are done during the high and low flood periods. A series of gill nets with 11 different mesh sizes (12-150mm mesh size, each mesh panel is 10m in length) are used to sample fish at each sampling station. A representative catch is collected at each station by using a variety of fishing gear as well as the sampling of all different habitat types at each station. The parameters recorded are gear type used, species, length, weight, sex and gonad stage. Very basic information

regarding the habitats is also noted. Data are then entered into Pasgear, a customised database. Some documentation is available giving baseline information for surveys done between 1994 and 2010.

The data collected by the ministry between 1994 and 2010 were divided into protected and non-protected areas. No definite change could be observed in the catches from the experimental gill nets either in the protected or non-protected areas between 1994 and 2010 although there seem to be a significant difference in catches between protected and non-protected areas. The population structure also differs between these two areas with larger fish (k-selected) sampled from the protected area (Munwela, 2011). Larger individuals are usually first targeted by the local fishing communities as these give the best return on investment, whether for selling or own consumption. This would be the first indication of fishing having an impact on the resource. More detailed statistical analysis is recommended with the available data to unconditionally state that no change in catches took place between 1994 and 2010.

The Department of Wildlife and National Parks (DWNP), Botswana conduct monthly surveys at four stations in the Panhandle (since 1999) and recently a further four stations in the Lower Delta including Lake Ngami, recently inundated after good rains fell in the catchment areas. A similar multifilament gill net set as used by Namibia, is deployed by the DWNP at these different stations. The parameters recorded are gear type used, species, length, weight and gonad stage. Data recorded are entered into Pasgear. Quarterly reports are produced, but it seems that very little of the information is incorporated into the management of the resource. The Okavango Research Institute (ORI) plays a supportive role in research whereby data recorded are forwarded to ORI for further analysis. The current sampling frequency put pressure on the department's resources and has manpower, logistic and financial implications and should be reviewed (Shipton, 2011).

Data collected by DWNP point to a decline in the CPUE of the experimental gill nets since 2006. The reason for this decline is unknown and could be related to the recent higher floods experienced in the delta. Higher water levels usually result in lower catches. However, it is crucial that these data be statistically analysed and integrated into future management actions.

(b) Data sharing protocol

The SADC Protocol on Fisheries states in Article 17 point no. 3 on Science and Technology that "State Parties agree that knowledge and data generated through joint regional fisheries research projects and programmes shall be shared by the participating State Parties". A protocol on data sharing should be developed outlining the technical aspects, the responsible institution/s for maintaining the database, the process in accessing data and quality control. It is proposed that a steering committee takes responsibility for the development of such a database. The database created should be for storage and analysis of resource information necessary for effective joint management purposes. The only means to effectively harmonise the research done on the Okavango River would be to develop a shared database with data recorded at a standardised and systematic approach. This database will form the foundation from which all recommendations for management purposes will be developed, reports and peer review papers published and capacity build throughout the region.

Currently several databases are available from the three countries with a range of variables recorded that are differently spatially and temporally dispersed. These however are not standardised and the

objectives for collecting these datasets differ between the countries, making these datasets inadequate to establish a shared database for studies relating to the entire river basin.

The goals for developing a common database are:

- Access for stakeholders to fish data from the entire river basin facilitated.
- Storage of fish data from the entire river basin over an extended period for the identification of trends to serve as a management tool.
- Development of a basin wide management approach facilitated.
- Quality and standardisation of data recorded evaluated and enhanced.
- Scientists from the three countries trained in data management and storage.
- Safe keeping of a database (digital and hard copies) guaranteed.
- Communication between scientists enhanced.

(c) Long-term monitoring programmes

Long-term monitoring programmes are necessary with good quality data analysed appropriately and translated into management policies. This is a long and tedious process and the monitoring programmes and research activities must be done statistically correct to ensure that data collected are relevant for management purposes. The main objective of a governmental institution should be the development of a long-term monitoring programme for the identification and evaluation of trends within fish populations. This will form the basis of any fisheries management plan. A system for long-term ecological monitoring of fish stocks should be developed jointly by Angola, Botswana and Namibia to ensure that all areas of mutual interest are incorporated.

(d) Joint research programmes

Apart from joint monitoring programmes, countries should further co-operate in establishing joint research programmes and projects with particular reference to shared resources and scientific problems of mutual interest. This will also include research programmes conducted by tertiary institutions or other organisations related to fisheries. Knowledge and data generated through joint regional fisheries research projects and programmes should be shared between the different countries. This will prevent duplication in research undertakings and as a further benefit costly facilities and equipment could be shared. This will create the opportunity to attach postgraduate students to these regional fisheries research projects enhancing capacity building within each government department, currently a major obstacle preventing high quality science produced from the region.

Countries should work towards the generation and application of best scientific advice as a basis for decision making on the sustainable use of the resource that shall be enhanced through:

- peer review including external evaluation of research by recognized centres of excellence;
- regional and international participation in national research seminars;
- collaboration with scientists from abroad on regional research projects;
- promoting publications of regional interest, including electronic journals; and promoting networks and professional associations.

(e) Joint steering committee (technical or advisory committee)

It is envisaged that a joint steering committee be established to facilitate and strengthen collaboration and communication on a technical level. This committee will have a role to play in the approval of research and monitoring programmes to be conducted and will be responsible for the timely execution of these programs. Furthermore, the committee needs to ensure that the collaboration, joint research and monitoring programs between the three countries continue after this project and that the process is sustainable considering future resources and infrastructure. The mandate of this committee should be clearly spelled out and the committee must be officially endorsed by the countries.

(f) Training

Government fisheries staff should be trained in the use of equipment and research methodologies. Staff should be encouraged to further their studies by enrolling at tertiary institutions specialising in fisheries. The research projects envisaged for this river system will allow staff the opportunity to register for postgraduate studies at these tertiary institutions.

It is further recommended that government scientists work closely with international scientists as a process of in service training. This will ensure that joint project reports and papers in peer reviewed journals are published, further strengthening capacity building.

Formal and informal workshops should be held where data recorded are jointly analysed by scientists from the three countries, outlining recommendations for management purposes.

(g) Biological reference points

The objective of a management plan is to maximise the socio-economic benefits for the local communities. This can only be done if a resource is managed in a biologically sustainable manner. The setting of biological reference points is a recognised method to measure whether the goals of the management objectives have been met. Floodplain systems are, however, very dynamic and the enormous natural fluctuations make the setting of biological reference points based on species population dynamics extremely difficult, if not totally irrelevant. Large parts of the Okavango River have been impacted by people through development projects although there are still pristine habitats along the system particularly in the tourism areas of the delta. Baseline data could therefore be used from near pristine environments against which to measure impacts of fishing and other activities in more heavily utilised areas. Biological reference points then need to be identified for each river section, if possible for different habitat types.

(h) Station selection

The rationale for selecting stations for monitoring purposes is to standardise data collection to facilitate the identification of trends within the fish population. Several aspects must be considered when selecting stations for future long-term monitoring programmes. Potential stations should include a variety of habitat types including areas of intense fishing activities. At least one area that could be considered low impact or even protected area such as a game park or conservancy should be selected. The station should be accessible throughout the year for monitoring purposes.

3. Fishery dependent data

Standardisation of data collection is also as important as for the fishery independent data.

a) Catch assessment surveys

A floodplain fishery is very dynamic and fishermen tend to adapt their fishing effort according to the fluctuations of the fish stocks. These catches consist of three different segments, namely catches mainly from the floodplains mostly done by women using traps, baskets or fine mesh nets. They target the smaller species (r-selected species) and are for own consumption with a small percentage sold locally. The more commercialised approach is the use of gillnets targeting larger fish, predominantly bream for the local or even the export market. The commercialised approach differs between the three countries, depending on the level of support they receive from government institutions, the availability of fish and whether the fishery is market driven. The third segment is the tourism sector where tigerfish and bream species are targeted. Catch and release is practised with very little impact on the resource. Documenting these changes in fishing effort and the catches from the fisheries are vital when studying floodplain fisheries. Governments do not usually have the manpower or financial resources to conduct these studies. The local communities should be trained to monitor catches from the subsistence and commercial fishery and lodges should be involved in documenting their client's catches. This is a very cost effective way of developing large databases over the long-term and the only way of estimating the annual harvest taken from the system. This initiative where communities are involved in research activities further strengthen their sense of ownership promoting more support from communities and other stakeholders towards a co-management approach.

In Botswana, it was found to be logistically difficult to collect catch returns from the commercial fishery in the delta and the quality of the data collected has also been questioned and the individual weights recorded were discarded as these were deemed unreliable. Data reported on do indicate that the catch rates from the fisher catches in the delta seem to have been stable between 1996 and 2002 and do not show any decline in the catch rates of the gillnet fishery in the delta.

No reliable data on the subsistence/commercial fishery is available from the Namibian section of the river. Logistically it is very difficult to record data from the local fishery from this section of the river as no landing sites are present and there are no formal fish markets in this river section. Each fisherman will catch fish from the river near his or her village, return to the village or would sell some of the catch along the road.

No surveys are being conducted in Angola in the Cubango River, but two surveys per annum are done by local fishermen in the Quanza River recording length, size and species sampled.

b) Frame surveys

Frame surveys will provide information on the demographics of the fishing community. Valuable data obtained are on the number and size of fishing gear used, number of boats/vessels, number of fishing days per fisherman, landing sites and spatial and temporal fishing activities. These will supplement the data recorded through the catch assessment surveys and will give an overview of the fishing effort. Very few frame surveys have been conducted throughout the system with one survey done in Namibia and two surveys in Botswana (the latest in 2005). Very little is known about the fishing effort from the catchment area. Data available are insufficient and are not standardised between the different countries and may be difficult to evaluate.

Frame surveys should be conducted systematically every 3 to 5 years and coordinated between the three countries. These data will be needed to estimate the annual harvest, fishing effort and fishing patterns of the subsistence and commercial fisheries.

c) Local fish markets

Local fish markets are a major driving force of fishing intensity, fishing effort and species selectivity in the region. Usually high valued cichlid species dominate local fish markets and these species are usually specifically targeted by the fishermen to ensure a profitable return on their investment. These are generally large individuals (k-selected species) with a longer generation period. These species are also more vulnerable to overfishing and are the first species to indicate any pressure on the resource. These species have a potential for the export market to neighbouring countries. Lesser valued species such as the smaller minnows and squeakers do play an important role and may be sold locally, mainly by women or used for own consumption.

Local fish markets should be monitored to assess fish prices and species preferences. Fish markets also relate to the state of the resource in the river system and can be used as an index to verify data recorded from the catch assessment surveys.

4. Recreational fishery

The tourism recreational fishery contributes immensely towards the economy of the region, conservation of the resource and job creation. This industry is important in generating revenue specifically benefiting the local communities where certain areas as agreed per community could be closed for any fishing except for those practising catch and release. In this way communities can still receive an income in the way of levies, making it possible to close certain areas for fishing. Funds could then be generated to employ local community members to enforce the closure of these areas. Data recording should therefore form part of the monitoring activities by involving the recreational anglers and lodges in the process.

5. Outbreak of disease and the presence of alien/exotic fish species in the system.

The Okavango River is a complex and dynamic river system providing a range of ecological services to the local communities as well as to national governments. The wide range of activities (development projects) spread along the river basin always pose a threat for the intentionally or unintentionally introduction of diseases, pathogens or alien species into the system. These introductions could impact on the fish resource as was seen with the discovery of Epizootic Ulcerative Syndrome (EUS) from the Zambezi and Chobe River Systems. Recently, EUS has also been recorded from the Okavango River basin. An early warning system should be put in place to monitor the spread of these introductions.

6. Joint Patrols (Namibia and Angola)

Conducting conventional patrols to effectively implement any legislation on a river that forms an international border is extremely difficult. The section of the Okavango River forming the border between Namibia and Angola is approximately 460 km in length, further complicating organisation of patrols to be undertaken along this stretch of river. Joint patrols between Namibian and Angolan authorities should be conducted, firstly to educate and inform the riverine communities and to ensure harmonised interpretation of legislation for the two authorities. These patrols should include the Police, Immigration and Fisheries Departments.

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A TRANSBOUNDARY FISHERIES MANAGEMENT PLAN FOR THE OKAVANGO/KAVANGO/CUBANGO BASIN

Part B: Components of the management plan, including Logical Framework

Management plan guidelines for co-management

Key: Learn from successes and failures elsewhere

Lessons:

- Co-management of natural resources can only succeed from the start where there are still resources worth protecting.
- If resources severely degraded, needs alternative approach to restore health of ecosystem services before embarking on co-management. Outside help may be needed.
- Environmental education essential at all levels from schoolchildren upwards; communities need to be fully informed of fisheries issues, very basic fish biology, regulations, etc.
- Set up fisheries committees for co-management only after very careful and detailed consultation with all stakeholders.
- Committees to be formed/elected by the communities themselves, but ensure all levels of community structure are represented on committees, with particular emphasis on fishers' representatives.
- If resource is shared by different communities, ensure all are fully represented on committee, or have central coordinating committee comprised of key members of separate village committees.
- Learn from already successful community based programmes through exchange visits between communities and other stakeholders.
- Fisheries departments' role is primarily education, supporting communities in decision-making, endorsing locally agreed bye-laws when appropriate, advising against inappropriate, unsustainable activities, etc.

Responsible organisations for implementation of co-management on the system:

- Government departments with fisheries responsibilities for the Cubango/Okavango Fisheries.
- Regional Councils
- Traditional Authorities

Contributing organisations for implementation of co-management systems:

- SAREP
- EU fisheries project
- ORI
- KAZA
- OKACOM
- INIP
- IPA

- MINAMB

Actions for implementation under management plan, by responsible and contributing organisations:

- Development of teaching materials.
- Cross-border dissemination of experiences, e.g. taking community members to other fishery areas to observe co-management in operation and share information on what systems work and why, etc.
- Identification of potential areas for co-management through stakeholder consultation and identification of potential for differing exploitation patterns of fisheries resources.
- Assistance in establishing fishers' committees and support through formative years.
- Support for locally-agreed bye-laws if appropriate scientifically and socially.

Proposal for establishing FPAs on the Cubango/Okavango system

Namibia

Different approaches are possible to set up FPAs along the Kavango River in Namibia. In terms of this transboundary management plan, we highlight two initial possibilities that can be investigated through the EU project and other potential programmes.

The first is related to the current proposal being prepared for recognition of Mahango National Park as a RAMSAR site. The planning for this is in initial stages, during which discussions are taking place about the potential for surrounding areas to be included in the programme. A possibility being explored is for the communities immediately to the north of the park to establish FPAs between Mahango and Divundu, where the tourist lodges that are the major contributors to the local economy can develop agreements with the communities for catch and release angling, following the Caprivi model.

The second possibility is for the three conservancies along or near the river to expand their natural resource management activities to the river, and establish FPAs in their areas of jurisdiction.

Botswana

In the literature review for this document, the Phillipo Channel has been highlighted as a key area for crocodile conservation, with the potential for it to be included as a protected area for other fauna and flora. This could include either some, or all, of the channel being established as a FPA. This management plan recommends that the potential of the Phillipo Channel should be thoroughly explored through a joint task force of key stakeholders, including, but not restricted to, the Department of Wildlife and National Parks (wildlife and fisheries divisions), Tourism, and Ministries with responsibilities for rural affairs. The mandate for this joint task force will be to determine the impacts that establishment of a protected area or areas will have on the communities, and the potential for deriving benefits for the communities from tourism in the channel. During the scoping workshop, it was suggested that different communities may have interests in the natural resources of the channel and therefore there is scope for conflict, hence the need for the task force to thoroughly investigate all potential issues.

The Phillipo Channel is one suggested potential site for an FPA, but there are numerous other smaller potential sites throughout the Panhandle and in the delta. The key criteria for setting up FPAs, as listed above, are size, biological suitability, ability to control, ensuring that local fishers would not be disenfranchised, and potential for earning revenue from tourism primarily through fee-paying catch-and-

release angling. Exploratory discussions with communities in the area are recommended in this management plan. The steering committee for the management plan should identify key partners to initiate this process.

Angola

At this stage in the management plan development, we are not in a position to make recommendations or suggestions, particularly as (a) tourism in the Cubango catchment area in Angola has not yet developed, and (b) we are uncertain about human population densities and fishing effort and thus cannot comment on the potential benefits of breeding sanctuaries. Instead, we concentrate on those parts of Botswana and Namibia that can benefit from FPAs and note that the successes and/or failures can serve as models for development of FPAs in Angola in future. Areas along the international border between Namibia and Angola may be identified as potential sites for FPAs stretching across the river, benefitting both Namibia and Angola.

Outputs that will be achieved from the implementation of the plan

Sampling Strategy

- The following templates are attached as Appendix 6.
    - Biological survey form
    - Habitat description form
    - Catch assessment survey form
    - Fisheries data bulk recording form
    - Fish market survey form
    - Recreational fishing survey form
    - Frame survey form
    - Water chemistry form

Recommended analysis to be done

- The following analysis should form the basis to work from:
    - Length at maturity for individual species (biological data);
    - Age and growth of commercially important species (biological data);
    - Breeding habitats (biological data);
    - Nursery habitats (biological data);
    - Length frequencies for individual species (biological, recreational, subsistence & commercial data);
    - Index of relative importance (biological, recreational, subsistence & commercial data);
    - Species diversity and composition (biological, recreational, subsistence & commercial data);
    - Sampling gear selectivity (biological, subsistence & commercial data);
    - Migration behaviour (biological data);
    - Habitat preferences (including water quality) (biological data);
    - Food preferences and food webs (biological data);
    - Abundance (biological, subsistence & commercial data);
    - Catch per unit effort (biological, subsistence & commercial data);
    - Population structure (biological, subsistence & commercial data).
- Historical data of life history parameters of commercially important species to be reviewed.
- Key species to be identified and age, growth and maturity at age and size determined using otoliths at selected areas throughout the river system.

- Life history information to be translated into management actions/plans.

Proposed sampling equipment to ensure standardised surveys

- Main sampling gear should be gill nets, supplemented by a wide range of sampling gear types to limit gear selectivity and to sample all habitat types.
    - Gill nets
        - Brown multi-filament nets with stretch mesh sizes ranging from 12 to 150 mm (i.e. 12, 16, 22, 28, 35, 45, 57, 73, 93, 118 and 150 mm).
        - Eleven (11) mesh panels randomly joined to form one set. Each mesh panel is 10 m in length and approximately 2 to 3m in depth.
        - Three to four sets are set per site, depending on the habitat types.
        - It is important to have a high effort (number of gill net sets) at each site to ensure a representative sample.
        - The nets (sets) are between 18:00 hrs in the evening and 06:00 hrs the next morning.
        - Gill nets are set at same locality if possible during each survey. Variable water level may cause sites to change with season.
        - The gill nets are used to survey open, deep-water habitats in main stream near the shore and deep backwater areas with some aquatic vegetation. Gill nets are set either in the middle of water-bodies or near marginal vegetation.
        - Gill nets play important role in identifying trends with time.
- Other gears are used at or close to gill net localities. These target small species and juveniles of long-lived species in shallow, vegetated and rocky habitats. Use of other gears are subject to type of habitats present at sites.

Proposed sampling equipment to ensure standardised surveys continued

- The following gears used to supplement gill net catches:
    - Rotenone
        - The piscicide rotenone used to survey habitats where other fishing methods are impractical or inefficient, including rocky rapids, dense aquatic vegetation, etc. Only be used by trained operatives due to dangers associated with using toxic chemicals.
    - Drag nets
        - A 10 to 30 meter seine net with a depth of 1.5-2.0 m, made from green anchovy net with stretched mesh of 12 mm. Operated in large open water bodies with very little water flow. Sample shallow habitats such as backwaters, bays and mainstream with sandy or muddy substrate. Occasionally used within aquatic vegetation.
    - D-net
        - Used in vegetated habitats and in shallow water with sandy substrates. Used in sandy habitats by removing top layer of sand.
    - Cast net

        - A 2 m cast (monofilament nylon twine) net with a 20 mm stretched mesh used to collect fish from deep-water habitats in backwaters and main stream. Slow, fast or deep flowing areas.
    - Electric fisher
        - Polish-made Samus backpack electric fishers useful for sampling a wide variety of habitats, particular rocky rapids and vegetation fringes of rivers. Used in conjunction with other gears, particularly D-nets, where the electric current is used to drive fish out of cover and into waiting net.
    - Traps
        - Conical-shaped traps are made from wire with 2 mm mesh size. Placed near the shore in shallow, strong water currents and within aquatic vegetation.
    - Rod & reel/long line
        - Angling with a rod and reel (including long lines) is an important tool to catch larger fish. Long lines target catfishes that may be under sampled using only gill nets.

Stations to be sampled

- Following stations recommended by countries to be surveyed:
    - Botswana:
        - Seronga
        - Ngalange
        - Guma
        - Samochima
    - Namibia (to continue at existing sites that they have been sampling):
        - Nkurenkuru
        - Musese
        - Rundu
        - Cuito
        - Kwetze
    - Angola to combine with Namibia until resources and human manpower improve:
        - Savate
        - Caiundo
        - Calai
- Stations should represent river section of that particular country and a wide variety of habitats in that area. If possible one protected area to be included to serve as potential reference point.
- Only two stations per country to be surveyed during this programme to reduce cost.
- More stations could be surveyed by individual countries after this program comes to an end, still forming part of the standardisation process.

Survey frequencies and timeframe

- Initially, as part of this program, two surveys should be conducted, one each during a high water (March/April) and a low water (September/October) period.
- Core survey team (consisting of 6 scientists, two from each country) to undertake these two surveys.
- Additional people will join survey when done in that particular country. Will facilitate capacity building within each country with a larger number of scientists being trained.
- The core team will move to next country and train further additional people. Each country to decide on number of additional people to be trained.

- Decision to be taken when surveys will take place. Earlier indication was between end of July and end of October 2013.
- Surveys will include biological, catch assessment, fish market and frame surveys done concurrently during the two survey periods.
- Frame survey will be carried out during first survey period and then only to be repeated every 3 to 5 years by each country separately.
- Biological surveys should continue (after the termination of programme) at each station as identified, conducted during high and low water period by each individual country using standardised research methodology as developed.
- The catch assessment surveys should be community based and local community members be trained in data collection. Should be collected on a bi-weekly basis.
- Namibia, where process is successful in Caprivi region, should assist in in-service training of community members. Visits to conservancies should be arranged for community members to witness the benefits accrue by these communities/conservancies.
- The major fish markets in each country should be surveyed bi-weekly.
- Owners/managers from fishing lodges must be identified to take part in data collection from their clients practising catch-and-release.
- A focal person from each country identified to liaise with fishing lodges to collect data forms to be processed.
- Sensitisation of communities before the surveys starts to establish trust and to gain support for these initiatives.

Logistics for Surveys

- The following points should be considered:
    - Fuel funds; stipend required to be used for vehicles;
    - Subsistence & Travel allowances;
    - Focal points to buy 4 nets per country. 'D' nets, electro-shocker;
    - PH, temperature and turbidity of water testing methods (provision of multi-meter);
    - Botswana committed to supply 2 boats, 2 vehicles, and camping gear;
    - Angola committed to supply 2 boats;
    - Namibia committed to supply 1 boat and 1 vehicle;
    - Additional funding needed for stationery.

Setting up of steering committee

- Responsibility to execute successful implementation of the programme.
- Consists of the following government officials from each country:
    - One person from management
    - Two scientists
- The committee can co-opt experts forming a sub-committee/working group to study a particular aspect.

- The following people were nominated as the focal person and will form part of the steering committee:
    - Mr. Isaac Batsile (Botswana)
    - Mr. Munwela (Namibia)
    - Mr. De Almeida (Angola)
- The chair and venue for meetings to rotate annually
- Meeting to be held at least once a year.
- Proposed Terms of Reference for the steering committee:
    - Development of a programme for joint surveys.
    - Responsible for the timely execution of monitoring surveys.
    - Responsible for establishment and maintenance of shared databases.
    - Development of a data protocol.
    - Responsible for producing research reports and efficient flow of results to management for integration into management policies/actions.
    - Identify research gaps to be addressed, either by fisheries departments or tertiary institutions.
    - Identify training needs and develop a training strategy to ensure future qualified and experienced scientists.
    - Ensure harmonisation of legislation and standardisation of research methodologies continue.
    - Responsible for efficient communication between all stakeholders.
    - Ensure that program becomes sustainable and fully supported by governments with necessary financial and manpower resources and infrastructure.
- The steering committee should report back to the fisheries departments from the three countries, to the JPCC (Namibia/Botswana) and to OKACOM.

Develop an early warning system for the outbreak of disease and the presence of alien/exotic fish species in the system

- The World Organisation for Animal Health (OIE) Regional Workshop on OIE standards held in Mozambique in 2008 recommended the following related to disease:

    - Promote dialogue between veterinary authorities and other competent authorities, as well as the private sector, to identify their respective roles and responsibilities with respect to aquatic animal health matters;
    - Review national legislative framework for allowing development of fisheries and aquaculture sector;
    - Prioritise aquatic animal diseases of concern and fast tracking implementation of surveillance programmes;
    - Enhance cross-border cooperation between competent authorities to control aquatic animal diseases; and
    - Coordinate and support establishment of regional aquatic animal health network for fisheries and aquaculture in southern Africa in with relevant bodies at national, regional and international level.
- Refer to the Aquatic Animal Health Code (2012) for more detail.
- The following steps are recommended to monitor alien species:

    - Tissue sampling for DNA bank should form part of monitoring process.

    - Digital photo of specimens.
    - Specimens preserved in 10% formaldehyde and send to SAIAB for identification purposes.

- Detailed reports on disease or alien species circulated to steering committee and other countries.

Development of shared databases

- Following shared databases to be developed:
    - Biological database;
    - Catch assessment database for subsistence and commercial fishery;
    - Recreational fishery database;
    - Frame survey database;
    - Fish market database;
    - Water chemistry database.
- Compilation of an inventory of all available data listing the following:
    - Data format (all databases);
    - Sampling frequency (sampling dates, all databases);
    - Sampling gear used (biological, catch assessment and water chemistry);
    - Localities sampled (GPS coordinates, all databases);
    - Variables recorded (all databases);
    - Total number of fish sampled (biological).
- Steering committee take responsibility for developing of database protocol
- Protocol should provide the following:
    - Guidelines for the usage and storage of the different databases;
    - Identify institution/s responsible for updating, data cleaning, storage and general maintenance for all databases, including hard copies of all recorded data.
- Protocol to be endorsed as an official document by all countries.
- The following software packages are recommended:
    - Pasgear 2
    - Microsoft Office Excel
    - Statistical Package for the Social Sciences (SPSS)
- The setup of these databases could initially be outsourced.

Joint Patrols (Namibia and Angola)

- The section of the river bordering Namibia and Angola should be regularly patrolled jointly by both countries.
- The frequency should be deliberated on between the two fisheries departments.
- Patrols should be done where possible in collaboration with Immigration and the Police.
- Patrol reports should be drafted and forwarded to the steering committee and to the two fisheries departments.
- Data should be entered into the shared database.

Remaining activities to be developed through the consultation process with an established steering committee

1. **The support required to implement the plan from the Nation States**
2. **The preparation of the budget to implement the Transboundary Management Plan**
3. **The role of possible different management measures for fisheries determined, i.e. development and harmonisation of policies and legislation.**

Appendix 3 provides a table of the issues to be considered by the steering committee in the harmonisation of policy and legislation, while Appendix 4 gives an overview of arguments for and against the establishment and harmonisation of closed season in the three countries.

APPENDIX 1. THE LEGISLATIVE AND INSTITUTIONAL FRAMEWORK FOR MANAGEMENT OF THE OKAVANGO DELTA FISHERIES IN BOTSWANA (FROM SHIPTON, 2011)

Shipton's (2011) review of Botswana's legislative and institutional framework is comprehensive and thus it is unnecessary to duplicate the work. It is therefore presented here with the author's permission. Several sections, particularly covering staffing of departments and descriptions of duties have been abbreviated. For details of this background information refer to the original document (Shipton, 2011).

Legislative Framework

While Botswana has developed an impressive array of legislative, policy and regulatory tools with which to manage the country's natural resources, the fisheries sector has to date received rather limited attention. Currently, fisheries is legislated under the outdated Fish Protection Act (Act 42 of 1975), and regulated under the Fish Protection Regulations (2008). To date, no fisheries policy has been developed, and thus the biological, economic and social objectives for the country's fish resources remain undefined. In this regard it is essential that a policy is formulated to guide the future development of regulations, governance structures and management planning processes. While permitting regulations have been in place since 1998, the fishery essentially remains an open access, common pool resource. In the absence of a set of clearly defined user rights, some stakeholders have been marginalised. Marginalisation has manifested itself as losses to property rights, the denial of access and the *de facto* privatisation of the resource, or as conflict. For example, in the southern part of the Delta, Mosepele (2006) cites the weak legal framework in the Wildlife Management Areas (WMAs) and the Controlled Hunting Areas (CHAs) as being problematic as the tourist operators claim exclusive rights to the fish resources within their concessions. The tour operators base their arguments for exclusive access to the resources on the tourism policy (Government of Botswana, 1990), which confers *de jure* rights within the concessions (DWNP, 2000), except in situations where citizens have *de facto* rights. In contrast, in the Panhandle, the lack of clearly defined user rights has led to conflict between the recreational fishers and the commercial gillnet fishers (Nengu, 1995; Bills, 1996; Ramberg & van der Waal, 1997) who view themselves as competing for the same resource, blaming one another for restricting access, and the depletion of the resources.

The following section provides a brief synoptic review of the most important legislation that relates to fisheries governance in the country.

The Fish Protection Act (Act 42 of 1975)

The Fish Protection Act (Act 42 of 1975) provides the overarching legislative framework within which fisheries operate and are managed in the country. Concomitant with many other countries' fisheries legislation, it is geared more towards control than development. The Act makes provision for the Minister to make regulations, and thus the Minister is empowered to set the fishing seasons, licensing and registration conditions, and fee structures, and regulate the trade of fish. Gear types can be controlled and the movement of fish into and within the country's borders regulated. In addition, exemptions to any of the regulations may be granted at the Minister's discretion. The Act

prohibits the use of poisonous or explosive substances in the fishery, and provides powers of entry, seizure and arrest.

In terms of compliance, the Act allows for fines not exceeding P500, or to imprisonment for a term not exceeding 12 months, or both. Setting upper limits on fine structures is problematic in as inflationary pressures over time tend to devalue their deterrent effect. The fish regulations of 2008 are restricted by these upper limits, and provide little deterrence to offenders.

The Fisheries Regulations (2008)

The Fisheries Regulations (2008) are the first set of regulations that have been developed to regulate the fisheries in Botswana. Prior to their promulgation, the fisheries were effectively unregulated. The regulations provide the licensing framework. Licences are required by the commercial gillnet fishers, recreational fishers, recreational fishing tournament operators, and gillnet importers and distributers. The artisanal fishers do not require licences. The drafting of regulations was the result of a consultative process between the fisher communities and amongst other conditions, provide for the prohibition of certain fishing practices (e.g. night fishing, seining, the use of mosquito nets), a closed season, restricting fish movements, and the collection of catch data. The regulations effectively maintain the fishery as an open access fishery. In terms of licensing, there are no restrictions on the number of entrants into the commercial or recreational fisheries, nor do the regulations explicitly allow for the control of effort.

Community Based Natural Resources Management (CBNRM) Policy

The CBNRM policy aims to actively engage communities in natural resource conservation by providing them with a framework that enables them to earn tangible benefits from sustainable natural resource management. The policy establishes the institutional, regulatory and participatory framework within which natural user rights can be devolved to communities, and provides guidance on CBNRM implementation. While fisheries are not explicitly mentioned in the policy, the policy provides useful insight into how communities could access and manage their local resources. In terms of fisheries management, the policy provides for Community Based Organisations (CBO) to be provided with rights to control access and enforce exclusion, and allows for 15 year community natural resource management leases to be granted to communities, with natural resource user rights being granted to communities within defined lease areas. While government would ultimately be responsible for regulating resource use and may set quotas on resource use, they have the responsibility of providing support to communities (e.g. mentoring and extension services). In terms of fisheries management, the policy fosters co-management, and would technically enable fisher communities to set up CBOs to manage the fish resources in a given area, be that for commercial, artisanal or recreational purposes.

The Draft Wildlife Policy

The draft wildlife policy is designed to provide the framework for conservation, sustainable resource use and the management of wildlife and biodiversity resources in the country. The policy focuses on generating development benefits for communities, and maintaining the country's biodiversity. In terms of the country's wildlife resources, the policy advocates for land uses and categories to be distinguished, defined and gazetted. In terms of the country's aquatic resources, these are identified

as: 1) *Important Fish Areas*: those being key habitats for fish that require protection and management; 2) *Transfrontier Conservation Areas*: for the management of natural resources that straddle international boundaries – this would include the wider Okavango River system; and 3) *Wetland ecosystems*: those areas with potential for aquatic species conservation, fishing, aquaculture and recreation. The policy complements the CBNRM policy in that it advocates the development of CBNRM systems and the co-management of resources, and the promotion of economic instruments for nature based tourism. The policy will be implemented through a participatory, decentralised institutional framework with some responsibilities being devolved to the private sector and communities.

Code of Conduct for responsible fishing in the Okavango Delta

The code of conduct was developed by the Okavango Fisheries Management Committee (Biokavango Project, 2011a). In many respects the development of the code was a landmark agreement that has reduced conflict between the commercial and recreational fishers, and provides a good example of co-management and conflict resolution. The code of conduct comprises 10 actions that have been collectively agreed upon to reduce conflicts between fisher groups. The code includes restrictions on fishing in the vicinity of the tourist lodges, no-wake zones, rights of way, prohibiting unsociable practices such as littering, camp fires and the use of alcohol on the water, marking nets, the submission of catch returns and compliance with the fisheries regulations of 2008. The code is not legally binding, and thus it is at present not possible to legally enforce the code.

Okavango Delta Management Plan (ODMP, 2008)

The Okavango Delta Management Plan has been developed to promote integrated resource management throughout the delta. The ultimate goal of the plan is the sustainable use of the Delta's natural resources, aligning interventions with national development goals as articulated through the District Development Plans and National Development Plans as well as Vision 2016. The plan was designed to align sector policies, legislation, and strategies such that the long-term ecological functioning of the Delta was ensured.

The plan takes a holistic approach to managing the Delta's natural resources; thus while some of the key operational objectives and issues identified in the plan address key fisheries issues, many others are cross-cutting in nature. It is important that this management plan takes into consideration the objectives of the OMDP and integrates them into the fisheries management planning process. In this regard, the three key fisheries issues, operational objectives, and proposed activities that are identified in the plan and the current outcomes relate to:

1. Need for improved baseline data on fish stocks in the system.

2. Manpower capacity of the fisheries division.

3. The problem of fisheries conflicts.

Other key operational objectives that were identified in the management plan that are not directly related to the Fisheries Division or fisheries *per se* but are cross-cutting in nature include:

1. The management of channel blockages to sustain communities' access to livelihood activities.

2. Traditional access rights to natural resources in concession areas.

3. Human/wildlife conflicts, reducing the conflict between fishers and crocodiles that currently damage their nets.

4. Building the capacity of communities for delivering management and promoting the sustainable use of natural resources.

Institutional Framework

National Institutions

Department of Wildlife and National Parks (DWNP)

The Fisheries Division of the Department of Wildlife and National Parks in the Ministry of Environment, Wildlife and Tourism is the government agency that is responsible for fisheries management in the country. The Division's head office is in Gaborone, with regional offices that have management responsibility for the Delta based in Maun and Shakawe.

Maun

The Maun office of the DWNP: Fisheries Division is a regional fisheries office that is responsible for the Districts in the North West of the country. The office has a staff complement of eight, comprising two wildlife biologists, three field assistants, and three senior wildlife scouts. (Modified from report of Shipton based on updated information). The Maun office is responsible for supervising the operations at the Shakawe office, collating the fisheries data that are collected from the fishers and the monthly fish resource monitoring programme.

Shakawe

The Shakawe office of the DWNP: Fisheries Division is the local fisheries office that is responsible for the Okavango District. The office has a staff complement of three based at Shakawe comprising a wildlife officer and two wildlife scouts. Gumare has one Senior Wildlife Warden and one field assistant, while Seronga has two field assistants. (Modified from report of Shipton based on updated information).

Staff deployment

Primary tasks undertaken by the departmental personnel include the permitting of fishers, compliance, extension, collecting and collating catch and effort data from the commercial fishers, and fisheries survey and extension work. Since the advent of the 2008 fishing regulations they have also had to assume responsibility for compliance activities in their respective areas. Shipton (in full report) reports a clear need to review the rationale behind deploying people in the field as both extension and compliance personnel.

Compliance operations

Currently, undertaking regular compliance operations is problematic for the Fisheries Division because of the poor condition of its boats and engines.

Fisheries monitoring

The DWNP is the responsible organ of state that is mandated to monitor the fisheries. Fisheries monitoring is currently undertaken at three levels, *viz*, catch returns, frame surveys and monthly fish

surveys. Creel surveys are supposed to be undertaken on a monthly basis; however, these are not being done due to logistical and staffing problems.

Catch returns

Monitoring catch returns is the primary mechanism with which the DWNP monitors the catch in the Delta. In this regard, the Second Schedule of the Fish Protection Regulations (2008) requires all commercial fishers to submit monthly catch records (recorded daily). The Eleventh Schedule that relates to the provision of a permit for a recreational competition also requires the submission of catch returns. A recreational lodge fishing permit issued under Schedule Eight does not require catch returns to be submitted. The reason that the recreational fishers / lodges do not have to submit catch returns appears to be an anomaly, and means that, with the exception of the recreational fishing competitions, the DWNP is not collecting any data from this fishery. Equally, as the subsistence fishers do not require licences, catch data from this fishery are also not being collected.

Frame Surveys

Frame surveys are used to provide an indication of the available effort in a fishery. Amongst others, the parameters that are usually surveyed and quantified would include the demographics and number of participants in the fishery, vessel and gear types, their use, and the spatial distribution of fishing effort, landing sites, and marketing and distribution networks. Over time they are useful in terms of monitoring changes in the fishery. The last frame survey of the delta fisheries was undertaken in 2005, and there is little long term information that characterises the number of fishers and fishing gears in use. The full report of Shipton recommends regular standardised frame surveys (e.g. annual, biennial, every five years) to enable the DWNP to accurately assess the levels of participation and effort in the fisheries. This would enable the Department to monitor changes in the fishery, and update their management regimes accordingly.

Monthly fish surveys

Since 1999, the DWNP has undertaken monthly fish surveys in the Upper Panhandle. Four sites have been gazetted for these surveys. In the lower part of the Delta, an additional four sites have been selected. Data collection requires the deployment of four fisheries officers / field assistants from Maun and another four from Shakawe. Multi-panel research gillnets (12 - 150mm mesh) that are designed to catch a range of species and size classes are deployed overnight for a period of up to 12 hrs. The data recorded include mesh size, CPUE, species, length / weight and gonad state. The data are recorded in PASGEAR, and sent to the Head Office in Gaborone. The capacity to use these data lies with the researchers at the Okavango Research Institute. Concomitant with all National Departments, DWNP has finite resources and the monthly survey requires the allocation of significant human and financial effort. Shipton's report noted that long-term monitoring data of this nature is useful in terms of characterising long-term changes in the fishery, but recommended a review of the monitoring frequency.

Other DWNP Agencies

Law Enforcement Unit (DWNP)

In addition to the compliance activities undertaken by the Fisheries Division, there is also a regional DWNP law enforcement unit that is designed to address compliance issues for all the DWNP. It would appear that the major focus of this unit is to address terrestrial compliance issues and thus,

while the unit may address fisheries compliance issues as and when they arise, they do not actively involve themselves in fisheries compliance operations, thus the responsibility for fisheries compliance falls to the Fisheries Division.

Research Division (DWNP)

The research division is mandated to undertake and coordinate research for the DWNP. The focus of the research division is largely on terrestrial issues and they have no fisheries research capacity. Effectively, therefore, the responsibility for research and monitoring of the fish stocks falls to the Fisheries Division.

Local Institutions in the Delta

The Okavango Research Institute, the University of Botswana

The Okavango Research Institute, formerly the Harry Oppenheimer Research Centre, based at the University of Botswana, Maun, has significant research capabilities that could potentially be co-opted by the Fisheries Division to assist them in managing their research needs. There is, however, no formal MoU or formal linkages between the two organisations.

Okavango Fisheries Management Committee (OFMC)

The Okavango Fisheries Management Committee was set up in 1998 to provide a forum to assist in the management of the fisheries resources in the delta and to reduce conflict between the various stakeholders. In the 2000s, interest in the committee waned and it was not until 2008 and with the support of the Biokavango project that the committee was reconvened. The committee is chaired by the DWNP- Fisheries Division with representation from the Department of Tourism, Department of Water Affairs, the Land Board, the Okavango Research Centre (ORC), and the Okavango Fishermen's Association (OFA), and representation from the fishing camps and tourist lodges. In 2010, the committee negotiated the Code of Conduct of Responsible Fishing in the Okavango Delta.

The committee meets on a quarterly basis.

Okavango Fishermen's Association (OFA)

The Okavango Fishermen's Association was formed in 1999 as a body to represent the interests of the commercial fishers. At inception it had over 150 members. In 2007, and with the assistance of the Biokavango project, the organisation's constitution was revised and the scope of the organisation expanded to include all stakeholders in the fishing industry. The revised constitution now mandates the OFA to act as an umbrella organisation for the various fisher groups (commercial, recreational and artisanal) in the Delta. The OFA is a legally registered entity with a constitution that elects office bearers on an annual basis. The stated objectives of the organisation are:

1. To provide a representative forum through which the collective voice of the concerns and problems of the members can be articulated to government and other concerned parties
2. To liaise with other institutions that are stakeholders of the fish resources of the Okavango Delta, and represent the users and the opinions of the members

3. To cooperate with the government in the management of the fish resources for the benefit of the members
4. To act as a medium through which disputes can be resolved amicably
5. To ensure that the fish resource is utilised sustainably by advising members to adhere to the fish protection regulations

While membership is open to all of the stakeholders, the major representation in the OFA comprises the commercial gillnet fishers, either as individuals or as fisher groups that are based at the village level. Evidently there is significantly less representation from either the recreational or subsistence fisher groups. Since 2007, funding and mentorship for the association has been provided by the Biokavango project, however with the closure of the fisheries component of the project in June 2010, funding has ceased. The association is now self-funding with contributions being made by the membership.

Fisher associations and trusts

Many fishers have organised themselves into fisher groups or trusts. These are geographically spread around the panhandle and are located in the larger fishing communities. The four main associations are the Boiteko Fish Resources Trust (Samochima), the Chechoara Fishing Project (Mohembo), the Itekeng Community Trust (Ngarange), and the Tubu Multi-purpose Cooperative (Tubu). Typically these associations were set up with FAP grants, assistance from NGOs and more recently some have received assistance from the Biokavango programme to upgrade their facilities. Typically, the facilities include buildings to house scaling tables, weighing equipment, storage space for the fishing gear, chest freezers or, in the case of the Boiteko Fish Resources Trust, a small freezer room. The associations and trusts comprise groups of 10-15 fishers who pay a levy (normally 10% of their catch value) to the group. The monies are used to operate the freezer facilities, to pay staff and for equipment repair and depreciation. The fisher associations have representation in the Okavango Fishing Association.

Artisanal fishers

The artisanal fishers are not well represented in the Okavango Fisheries Association and, to date, they have not formed an association or organisation that could be used to represent their interests. Thus despite their traditional exploitation of the fishing resources of the delta, their interests are not well represented on the Okavango Fisheries Management Committee (OFMC). In the absence of a formal representative body that can elucidate and represent their interests, it will be difficult to include this group of fishers into either co-management or other collective decision making management processes that the DWNP or the OFMC may recommend.

International institutions / Transboundary initiatives

The Okavango River Basin Water Commission (OKACOM)

OKACOM was established in 1994 by Angola, Namibia and Botswana to promote a coordinated approach to the sustainable management of the Okavango river basin. The commission comprises delegations from each of the three member states who are senior government ministerial officials. The organisation provides a forum for the commissioners to discuss and resolve transboundary

issues that affect the river basin. The organisation is based on the principles of equitable resource allocation, sustainable utilisation, sound environmental management and the sharing of benefits. The Okavango River Basin Steering Committee (OBSC) appointed by the commission in 1995, is the technical advisory body to the commission, and provides technical support to the various permanent or temporary subsidiary committees or task forces; currently these task forces include an institutional task force, a biodiversity taskforce and a hydrology taskforce. Finally, the OCAKOM Secretariat provides administrative and financial services to the organisation.

OKACOM operates a number of programmes in the Delta. From a fisheries perspective, the most important programme is the Environmental Protection and Sustainable Management of the Okavango River Project. This is a GEF/UNDP/FAO funded initiative that has developed a Transboundary Diagnostic Analysis (TDA) and formulated Strategic Action Plans for the River System. Since the original project funding cycle finished, the project is funded by the USAid SAREP programme – a US$23million programme –run through OKACOM. The programme is currently in the process of developing National Action Plans (NAPs) that will be informed by the Strategic Action Plans (SAPs). Despite the biological and socioeconomic value of the fisheries to the system, at present the Fisheries Division has no representation in the NAP development process. This is an oversight that if possible should be rectified.

From a fisheries management perspective, OKACOM provides a compelling vehicle with which to effectively address transboundary issues. While issues such as fish movements between the riparian countries, fish conservation and ensuring equitable access to the fish resources are obvious issues that need to be addressed, there are a number of more pressing issues that need to be addressed in the short term. Principally these comprise the introduction of fish disease to the system and the introduction of alien species – possibly for aquaculture purposes. The recent introduction of EUS to the system provides a graphic example of how fish introductions can have system-wide implications (Andrew *et al*., 2008). The introduction of alien species for aquaculture is also of serious concern. While Namibia and Botswana have decided to focus their aquaculture activities on indigenous species, it is reported that Angola has authorised the introduction of the Nile Tilapia (*Oreochromis niloticus*) for fish farming purposes in Central Angola. Due to its high growth rate and good production characteristics, *O. niloticus* is often the culture species of choice for many farmers. However, it is highly invasive and once in a system it almost always either outcompetes the indigenous *Oreochromines* or hybridises with them (Canonico *et al*., 2005; Tweddle & Wise, 2007). The results are significant losses to biodiversity and irreversible structural changes to the fish populations and the fisheries. Clearly, the introduction of an alien tilapia species into the Okavango river system in Angola will have very serious impactions for the downstream fisheries in Namibia and Botswana. Whether Angola has an explicit policy to allow the introduction of alien fish species into its catchments or it is simply allowing farmers to move these species between catchments needs to be assessed. In terms of the Okavango River System, at the very least, it would be appropriate to develop a harmonised policy on the introduction of alien species to the system.

Bilateral agreement between Namibia and Botswana

In terms of promoting bilateral ties between the two countries to promote cooperation in the fisheries sector, the 4th Session of the Namibia – Botswana joint commission of cooperation held in Walvis Bay in October 2008 mandated the Directorate of Aquaculture and Inland fisheries (Namibia)

and the DWNP: Fisheries Division (Botswana) to discuss issues of collaboration. Agenda items included:

1. Developing a Benefit programme for inland fisheries

2. The harmonisation of fisheries legislation and enforcement

3. ZACPLAN

4: Cooperation under the Zambezi Chobe River Basin Plan (The four corner project)

5. Data analysis and the standardisation of research methodology in shared river systems (e.g. combined frame surveys, livelihood studies etc.)

APPENDIX 2. SUBMISSION BY KAVANGO OPEN AFRICA ROUTE (KOAR) REGARDING TOURISM CONCERNS ABOUT FISHING ACTIVITIES IN THE OKAVANGO/CUBANGO RIVER SYSTEM

KOAR has been a constructive contributor to the planning workshops for this management plan. On being requested to give a tourism viewpoint on the proposals, the KOAR committee met and provided the following input.

These viewpoints are the input from KOAR as representative of the Tourism Sector in the Kavango Region.

1. **We regard the pricing of the fishing licenses for Recreational Fishermen to be fair and these should not be increased.**

2. **The procedures for obtaining these licenses at the moment are unrealistic and completely impractical.** Divundu operators have to travel into Rundu to obtain a license, a distance of over 400kms. Others get to their local Regional Council offices to obtain a permit only to find them unoccupied or licensing books unavailable. This whole procedure is detrimental to the Tourism sector's operation and leads to animosity. The following suggestions were made:

- It was suggested that blank permits be bought by the lodge concerned as a book or quantity, with the onus on the lodge to issue the permits as required for each guest.
- It was agreed that there should not be a flat fee levied based on the number of beds of a lodge. Not all lodges and tourism operators offer fishing activities for their guests.
- A fixed annual license fee per lodge covering, say, 4 permits. Additional permits are then issued as required with the accepted procedure.

3. **Non-Tourism boats on the river are regarded as detrimental to the entire Tourism sector unless regulated.** Private individuals either local or from neighbouring countries have no problem operating their boats on the river totally unregulated and with no respect or regard for the Tourism operations and the river communities. The following suggestions were made:

- Apart from the required Fisheries permits, all private boats should be heavily permitted with a fee more than those of the registered Tourism/Recreational Sector.
- All legitimate homesteads, registered Lodges/Camps and Campsites, communal washing points and properties which have river frontage with a clearly placed signboard indicating it as such, should be respected by passing boats which must be required to adhere to a "No Wake Zone" by going slowly. This situation works well in Botswana and therefore should also be the case in Namibia.

4. Serious thought must be given to the terminology used in the Fisheries Act with regard to "Subsistence", "Commercial" and "Recreational" fishermen as we see a serious overlap and misconception.

5. The use of nets should be completely banned on the Okavango River as it leads to illegal practices like Drag-netting and commercial operations and ultimately to over-fishing or over-exploitation of the fish stocks. Alternatively the net lengths should be limited to only 20 metres.

6. The Okavango River System cannot withstand or sustain any commercial fishing operations.

7. The Tourism sector is well aware that the cooperation of the Angolan authorities is absolutely essential to any successful forms of development, research or law enforcement on the Okavango River. However we are not able to assist or advise as this is clearly a Governmental decision process.

8. The Tourism sector completely supports the “Honorary Fisheries Inspector” concept and we would like to be considered as candidates when this process has been agreed upon.

9. The annual Crockango Fishing Competition is regarded as beneficial to the river and the Kavango Region in many ways. However it was felt that the regulations and rules governing this event and the participants are currently not adequate to prevent certain members from abusing the river, and having a negative impact on the local river communities and particularly many Tourism operations.

10. The legitimate Tourism operations on the Okavango River are committed to the health of the river ecosystem and the well-being of the river communities. We are therefore entirely open to assisting in any way possible with the sustainable management of this system. We are all established entities with long-term commitments and responsibilities, with a range of resources and expertise available.

APPENDIX 3. TABULATION OF LEGISLATION TO BE DISCUSSED IN RELATION TO HARMONISATION OF POLICY AND LEGISLATION DURING THE IMPLEMENTATION OF THE TRANSBOUNDARY FISHERIES MANAGEMENT PLAN, WITH NOTES ON FACTORS TO BE TAKEN INTO CONSIDERATION

	Botswana	Namibia	Angola
Fishing Gear Prohibited, Allowed, & Limited Note 1	Fish Regulations: 20. 1) No person shall catch fish by- a) setting nets across a lagoon entrance, or river channel; b) drive fishing; c) seining; or d) using a mosquito net. Article 4 of the Fish Protection Act prohibits the use of explosive, poisonous or noxious substances for the purpose of killing, stunning or disabling fish to render them more easily caught is prohibited.	Fisheries Act: 16. A person may not for the purpose of fishing use or have in his or her possession a net, unless the net - a)is a net of which the use is authorised by a fishing licence; b) is marked in the prescribed manner; and c) conforms to the prescribed requirements. 17. 1. A person may not use for fishing - a) any chemical, poison, poisonous plant or any noxious or other injurious substance; b) any explosive, firearm or electrical device; or c) any light at night to lure or attract fish. 2. A person who uses a net for fishing may not use the net - a)within 100 meters of a bridge, culvert or spillway when water is flowing through such structures; or b) in a manner that obstructs more than one half of the width of any watercourse where fishing is carried out. *Namibian Fisheries Act also has section for allowable fishing gears, i.e.* Fisheries Act: 11. Authorised means of fishing include a) a rod, reel, line and hook only; b) a net only; or c) both a rod, reel, line and hook and a net.	Decree Article 31 states that the following is prohibited: a)trawling in bays, estuaries and harbours; b) dragging on the ground; c) in pair trawling; d) use of dual net trawl; e) any drift gillnet; f) any fishing gear that adversely affects the sea or inland waters; g) light sources for attracting fish. Also prohibited is the use of any device that could obstruct or in any way reduce effectively the size of the mesh size so that it does not correspond to the authorized specification. Decree Article 37 section 2 states that when fishing or diving underwater the only materials that may be used are spears and slingshots or other fishing gear driven by the physical strength of the practitioner and these must appear on a list approved for the purpose by the Minister of Fisheries. Decree Article 33 allows the use of floating devices for concentration of schools. The Minister defines the conditions, installation and use of floating devices. Section 3 mandates that semi-industrial and industrial fishing operations must use a turtle excluder device on trawl fishing. Article 104 of the Aquatic Biological Resources Act prohibits a)the use of fishing explosive, toxics or electrocution to render a fish weak, stunned or killed; b) keeping on board a fishing vessel materials and substances that could be used in carrying out prohibited activities. Article 113 of the Aquatic Biological Resources Act prohibits the use of any kind of drift gillnet. Aquatic Biological Resources Act Articles 25, 26, 28 Regime Limits to Fishing Effort Where it is not possible to establish total allowable catches,

			spatial fisheries regime obeys the definition of fishing effort limits. The scheme limits fishing effort with the definition of criteria including, minimum dimensions of species and capture, sub-area and fishing areas, number of vessels authorized to fish in each zone, gear and fishing methods used and time spent fishing. Fixing the limits of effort must be based on the development plans of fisheries and the criteria contained therein, in particular the criteria of technical, scientific and socio-economic of each fishery or fishing zone.
Exotic Species Introduction Note 2	Fish Regulations: 21. 1) No person shall, without a permit from the Director, move fish from one water body to another water body.	Fisheries Act: 19. A person may not without written permission granted by the Minister - a) introduce or cause to be introduced into any inland water system, or transfer from one water system to another, any species of fish; b) import into Namibia any live fish; c) export from Namibia any live fish declared as an endangered species.	Article 201 of the Aquatic Biological Resources Act states that the Minister must approve, by executive order, the rules on the introduction and cultivation of exotic species.
Fishing at Night and use of light sources Also Note 1	Fish Regulations: 19. 1) No person shall catch fish at night except by the use of gill nets which have been set and left stationary in the water before or after the night.	17. 1. A person may not use for fishing - ..... c) any light at night to lure or attract fish.	The Aquatic Biological Resources Act Article 105 prevents the use of light sources for attracting fish
Open Season Note 3	Fish Regulations: 11. Open season is from March 1st through December 31st each year.		
Gill Net Length Note 4	Fish Regulations: 8. 1) No person shall catch fish with gill nets exceeding a total length of 150 metres	Inland Fisheries Resources Regulations: Inland Fisheries Resources Act, 2003. Restriction on number of gill nets to be registered. 13. A person is not allowed to register more than four gill nets.	
License Note 5	Fish Regulations: 15.1) No person shall undertake recreational fishing without a recreational fishing licence issued by the Director. 3) No person engaged in recreational fishing shall catch and keep more than five fish in one day. 4) A fishing camp shall be issued an annual fishing permit. 16. Any person participating in a recreational fishing competition must have a recreational fishing competition permit.	Fisheries Act: 11. A person may not engage in fishing in any inland water by means of any regulated fishing gear without a license.	Decree: Article 36 1) fishing or underwater commercial diving requires a licence and must be done under given framework 2) For tourism activities, fishing or diving need a special license.

Fishery Councils Note 6		Fisheries Act: 4. The Council consists of the Permanent Secretary and other persons as the Minister may appoint.	Decree: Article 13 The level of each province can be created Partners Fisheries Councils composed of fishing associations, local fishing communities and coastal communities as well as local non-governmental organizations whose main business focuses on fisheries or aquatic environment. Decree: Article 15 (Duties of the board of partners)The duties of the Board of Partners for Fisheries: a) Make recommendations on issues concerning the preparation of development plan fishing; b) Make recommendations on any existing or in preparation for the fishing industry; c) Make recommendations to the Ministry of Fisheries on measures of preservation and conservation of the species; d) Assist the Ministry of Fisheries in concrete measures and practices aimed at eliminating gear, methods and practices harmful to fish; e) Report violations of fisheries legislation and request the intervention of the competent authorities in their elimination; f) Assist the Ministry of Fisheries in the detection and control of unauthorized fishing unreported and unregulated fishing in Angolan waters.
Game Park or National Reserve Note 7	Fish Regulations: 3. The Fish Regulations shall not apply within a game reserve or national park.	Fisheries Act: 18. A fishing licence does not authorise the holder to fish in an area which has been declared as a game park or nature reserve or enter land owned or under the control of any board, institution or authority without permission from that party.	Aquatic Biological Resources Act: Rule 81, An aquatic national park is established by the Government on a joint proposal of the competent minister and minister in charge of environmental policy, as well as the ministries that oversee the water sector, in the case of inland waterways and maritime transport. It is meant to preserve the biological diversity and ecological integrity of one or more ecosystems, biotic communities, genetic resources and species, preserve landscapes of historic and aesthetic value as well as providing uses for scientific, educational, cultural, recreational and tourism. It park and prohibited to capture or extract a particular natural resource or to pursue economic activities that may disturb the natural environment. No exotic species may be introduced to the park and entering or transiting through the park is allowed only with specific permission.
Protected Species Note 8	Fish Protection Act: 3. The Minister may make regulations that provide for the more effective control, protection and improvement of fish, and the government	Fisheries Act: 21. 1) The Minister may declare any species of fish as an endangered species for the purpose of protecting or regenerating such species.	Decree: Article 21 prohibits the intentional fishing of rare or endangered species. In the presence of a fisheries management plan, the Minister of Fisheries, may approve additional lists of species depending on need and application

	and management of any specified area in which fishing may be carried on.		of the precautionary principle.
Shared Resources/International Agreements Note 9		The Fisheries Act requires the Minister, among other things to promote the co-operation with other countries for research, management and development of shared resources.	Decree: Article 28 (Shared Resources) When the State of Angola share with other states certain species must cooperate with these countries or through international organizations or regional in determining and implementing measures to conserve and manage these species in accordance with the rules and standards. Aquatic Biological Resources Act: Rule 87 (International Cooperation) 1. In the case of shared water resources and ecosystems, the government should ensure cooperation with other States, both bilaterally and multilaterally, for defining protection areas. 2nd. The state should cooperate with international organizations, in particular for the protection of the resources of the high seas.

Reserves Note 10		Fisheries Act: Fisheries reserves and limitation of licences 22. (1) The Minister, on his or her own initiative, or in response to an initiative of any regional council, local authority council or traditional authority, and in consultation with the regional council, local authority council or traditional authority concerned, may by notice in the Gazette declare any area of inland waters as a fisheries reserve if the Minister considers that special measures are necessary for reasons including, preservation of the aquatic environment and to protect fish resources and their environment. A person may not in a declared fisheries reserve engage in any activity for fishing or extraction of material. If the Minister is of the opinion that the sustainable utilization of fish is threatened, the Minister may by notice in the Gazette prohibit or limit the number of licences that may be issued in respect of any one or both the types of regulated fishing gear either in general or in respect of a particular area or for a specified period.	Aquatic Biological Resources Act: Rule 82 (Aquatic Nature Reserves) One. The aquatic nature reserves are protected areas whose objectives are the preservation of biodiversity, conservation, sustainable regeneration and renewal of aquatic biological resources, especially protected species under Section II of this chapter, the protection and rehabilitation of ecosystems and habitats, especially those degraded as well as providing uses for scientific, educational, cultural, recreational and tourism. 2nd. Nature reserves aquatic character may have full or partial, temporary or permanent, taking into account the need to protect and conserve resources. 3rd. In aquatic nature reserves with total character can only be exercised subsistence fishing, to the maximum amount, per fisherman per day, twenty kilograms, except it is a single specimen weighing more. 4th. In aquatic nature reserves with partial nature can be exercised subsistence fishing and fishing as may be specially authorized by the competent minister pursuant to define by regulation. 5th. The aquatic nature reserves are established by joint executive decree of the competent minister, the minister who oversees environmental policy as well as the minister in charge of the transport sector, in the case of reserves in the sea or the Minister that oversees the water resources sector, in the case of continental waters. 6th. The executive decree referred to in the preceding paragraph should set the rules of natural water reserves in accordance with their character and take into consideration the recommendations of the Integrated Management of Aquatic Biological Resources, the views of the government of the province where the reservation is located and the opinion Specialized Research Institute. 7th. The bays and estuaries of rivers are established as nature reserves, without prejudice to its refilling in terms of previous articles.
Mesh Size Note 11		Inland Fisheries Regulations. 18. (1) A gill net shall not be set within 100 metres of another net and the mesh size thereof shall not be less than - (c) 45 mm in the Kavango River	Aquatic Biological Resources Act: Article 97 (Dimension Mesh) The relevant Minister must establish the minimum mesh size of fishing gear, as well as standards for measuring these grids and the relevant restrictions. Article 114 of the Aquatic Biological Resources Act allows the competent minister to, by executive order, determine special restrictions as the mesh size, dimensions, exercise areas,

			guard the other arts and crafts for fishing with gillnets.
Monitoring Note 12		Under Section 30 (m) of the Act, the Minister may "provide for the making of surveys and gathering of information..."	Aquatic Biological Resources Act: Article 142 Objectives. One. The monitoring aims to collect information necessary for the planning of fisheries, aquaculture and related activities in order to ensure compliance with the provisions of this law and its regulations. 2nd. The information referred to above include, in particular: a) the number of fishing vessels by zone, type of vessel and fishing; b) the characteristics and selectivity of fishing gear; c) the means of technological support navigation or fishing and efficiency; d) seasonal changes in fishing effort and fishing; e) the location of fishing against other fleets; f) the historical evolution of catches and fishing effort by fishery; g) the composition of catches by fishery by size and other biological characteristics; h) the quantity, species composition and biological characteristics of the catch and discarded; i) the ability of fish processing establishments and their needs supply of fish; j) the environmental, economic and social planning measures, in particular as regards fishing effort; k) The offenses fishing practiced in certain periods, in some fisheries, fishing, fishing types and classes of boats.
Minister Note 13	(1) The Minister may make regulations which provide effective control, protection and improvement of fish for all or part of the following: (a) imposing and prescribing conditions for the regulation of fishing; (b) registering all boats employed in fishing; (c) determining the times and seasons at which the taking of any species of fish shall commence and cease; (d) the issuing of licences and certificates of registration to persons authorized to take any species of fish; (e) prescribing the fees to be paid for or in respect of any licence or registration	INLAND FISHERIES ACT: The Minister must formulate general policy with regard to the conservation and utilization of the Namibian Inland Fisheries taking into account relevant economic, social and environmental factors on the basis of the best scientific information available. When applying policy to a particular area, the Minister must consult with the regional council or any other authorities in that area. Numerous other provisions in the Act enable the Minister to act as necessary when intervention is necessary, e.g. provision for establishing activities that may be undertaken in a Fisheries Reserve gazetted under Section 22 of the Act	Aquatic Biological Resources Act: Article 97 (Dimension Mesh) The relevant Minister must establish the minimum mesh size of fishing gear, as well as standards for measuring these grids and the relevant restrictions. Article 114 of the Aquatic Biological Resources Act allows the competent minister to, by executive order, determine special restrictions as the mesh size, dimensions, exercise areas, guard the other arts and crafts for fishing with gillnets.

	issued or made; (f) providing for and regulating the description and form of nets to be used in fishing and the size of the meshes thereof, or the prohibiting of any special description of nets or meshes or any tackle, instrument or appliance whatsoever tending to impede the lawful taking of fish or being in any manner detrimental to the preservation or increase of fish; (g) prohibiting, restricting or regulating the bringing into Botswana of any live fish; (h) prohibiting, restricting or regulating the transfer within Botswana of any live fish; (i) prohibiting, restricting or regulating the sale of any fish. (2) Regulations made under subsection (1) may require acts or things to be performed or done to the satisfaction of an authorized officer and may empower such officer to issue orders requiring acts or things to be performed or done or prohibiting acts or things from being performed or done, and may prescribe periods or dates upon, within or before such acts or things are to be performed or done.		

Note 1. Light attraction, poisons, explosives, dragnets prohibited by all; block nets prohibited in Botswana (across lagoon entrances) and Namibia (more than halfway across watercourse); drifting nets prohibited in Namibia and Angola.

Note 2. Alien species: Namibia and Angola need Minister permission, Botswana only Director. Latter needs modification to harmonise with others and provide better security at a higher level of government.

Note 3. The closed season is a contentious issue. A separate table is provided below noting the pros and cons of having a closed season.

Note 4. Transboundary agreement on gillnets needed for Namibia and Angola for the length of their shared boundary. Harmonisation between Botswana and Namibia less important.

Note 5. Each country has its own fishing licence regulations. Transboundary agreements needed for Namibia and Angola for the length of their shared

boundary.

Note 6. This part covers coordinating bodies that may or may not be present in the three countries, and that may be used to help implement activities proposed under this transboundary fisheries management plan. Botswana has two fishers organisations, that can potentially be incorporated into a fisheries council for the delta and panhandle. The Okavango Fisheries Management Committee (OFMC) is a forum for government agencies to interact with fishers and therefore plays a similar role to a formal fisheries council. The Okavango Fishermen's Association (OFA) is an association for fishers from the commercial, subsistence and recreational fishing sectors.

Note 7. Policies between the three countries are fully harmonised already.

Note 8. Policies on protected species fully harmonised in the three countries.

Note 9. Namibian and Angolan acts are in agreement. Botswana act needs to be modified to include similar provision.

Note 10. Namibian and Angolan acts are in agreement. Botswana act needs to be modified to include similar provision for reserves/protected areas.

Note 11. Botswana regulations need to be checked. Namibian minimum mesh size regulation needs upward revision.

Note 12. Botswana and Namibian Acts do not explicitly recognise monitoring in regulations

Note 13. In all countries the Minister has wide powers to make regulations and to react promptly to changing circumstances in the fisheries.

APPENDIX 4. ARGUMENTS FOR AND AGAINST THE ESTABLISHMENT OF HARMONISED TRANSBOUNDARY FISHING CLOSED SEASONS FOR THE OKAVANGO/CUBANGO RIVER SYSTEM

ARGUMENTS FOR	ARGUMENTS AGAINST
BIOLOGICAL REASONS	
The majority of fish species breed early in the rains and will therefore be protected from fishing at this vulnerable time	While the majority of fish species breed during the rains, the main species targeted by the fishers, i.e. the large cichlid species such as the tilapias start to breed earlier. The closed season therefore starts too late in the year to protect the main target species, which begin to breed by September when the water is warming up but the river level is low.
Fishing pressure in Namibia is rapidly increasing, proved by experimental catch rates, therefore any reduction in effort will be useful in providing protection, and a closed season is one way of reducing overall effort.	In Botswana, it is argued that there is no overfishing overall because large areas of the system are inaccessible to fishers.
	Fishing by women and children with fine-meshed nets and traditional baskets for the small, highly prolific, pioneering floodplain species needs to be encouraged as the life cycle of these small fish species is adapted to the highly fluctuating floodplain environment. They grow rapidly and breed prolifically to take advantage of the annual flood to occupy new habitats. Because of this, there is no risk of overfishing. The time when these fish are exploitable is a time when rural communities often experience food shortages and should be encouraged to take advantage of this valuable food resource. This period, however, coincides with the closed season.

POLITICAL & CULTURAL REASONS	
Harmonisation of regulations between countries sharing a natural resource is highly desirable. Namibia shares fish resources with two countries that have closed seasons (Botswana on Kavango and Chobe Rivers, Zambia on Upper Zambezi). Having a closed season on one side of the border and not the other leads to conflicts between fishers, migration of fishers from one country to the other to exploit resources, and great difficulty in enforcement of regulations as fishers move from one side of the river to the other. (Declaration of a closed season in Namibia to harmonise with Botswana will then necessitate similar harmonisation with Angola, and therefore any such agreement will need to involve the three countries at once, and not just a bilateral agreement between Botswana and Namibia.)	The closed season deprives poorest in society of an important sustainable protein source at the most difficult time of year in terms of food availability.
Establishing a closed season in Namibia and Angola will need close consultation with stakeholders, providing an opportunity for raising awareness and understanding of management and conservation issues in the communities.	Establishing a closed season will deprive small-scale fish traders (largely female in this area) of income for the duration of the closed period. This can be balanced by ensuring all stakeholders are fully aware of the ban so that they can make alternative plans for income generation (saving earnings in the open season or trading in other commodities). If the closed season is successful in terms of stock conservation, overall earnings over the full year are likely to be greater.
The closed season coincides with the time when many fishers stop fishing anyway to concentrate on farming activities such as field preparation, weeding, and guarding crops against wildlife, birds, etc. At this time, therefore, having a closed season has least impact on fishers' livelihoods.	Each country has its own national interests to take into account in addition to its international obligations. Each country's decision makers must therefore make their own decisions for or against establishing a closed season for the fishery based on the arguments supplied.

APPENDIX 5. LOGICAL FRAMEWORK FOR IMPLEMENTATION OF THE TRANSBOUNDARY MANAGEMENT PLAN

This framework does not include time frames or expected quantities, as it is the function of the steering committee from the three countries to develop the programme of implementation.

	Intervention logic	Objectively verifiable indicators of achievement	Sources and means of verification	Assumptions
Overall objective	*Contributing towards improving and maintaining the fish resources of the entire Okavango River Basin at a sustainable level thereby improving food security in the region.*	*Catch statistics, research reports, scientific papers.* *Formal transboundary management and research agreements.* *Functioning steering committee.*	*Catch statistics and research/ monitoring results/reports show that fish resource is healthy and sustainably utilised.* *Committee minutes.*	*Government fisheries departments in agreement with all objectives.* *Governments taking ownership of this initiative.* *Funding secured from government departments and donor organisations (e.g. including SAREP and NNF/EU Community Conservation Fisheries in KAZA Project and its associated research projects).*
Specific objective	*A joint management system established to ensure the conservation and sustainable use of the shared fish resources of the Cubango-Okavango River system for the benefit of local communities*	*Fully established joint management system in place accepted by all stakeholders.*	*Management plan and fully functioning throughout the river basin.* *Minutes from joint meetings held between all stakeholders.* *Research and monitoring results published.*	*Joint management system a high priority for all countries.* *All stakeholders in agreement with all objectives.* *Buy-in from all communities and active participation in managing their resources.* *Funding for transboundary programmes secured.*
Expected results (1)	*Effective collaboration and communication established between all stakeholders, local, national and international.*	*Steering committee in place and fully functional.* *Stakeholders represented on steering committee.* *Tourism associations involvement.* *NGO involvement in programme activities (particularlySAREP and NNF).* *University involvement in capacity building (particularly ORI and UNAM)* *All stakeholders informed about all*	*Steering committee meeting minutes.* *ToR of steering committee.* *Minutes from meetings held between stakeholders (communities, departments, NGOs, tourism representatives, etc.).* *Project reports.*	*Willingness of stakeholders to attend meetings*

		activities.		
Expected results (2)	*Standardised research and monitoring in place and resultant shared databases in place.*	*Agreed standardised monitoring schedule.* *Joint monitoring surveys conducted.* *Regular surveys conducted independently by respective fisheries departments.* *Databases active.* *Reporting to JPCC on progress made.*	*Reports on joint surveys published.* *Databases with data entered available for accessing.* *Regular data entering by fisheries departments.* *Minutes available from JPCC meetings held on progress made.*	*Equipment available for surveys.* *Necessary funds and manpower available from all countries and donor organisations.* *Trained staff.*
Expected results (3)	*Harmonisation of fisheries legislation*	*Legislation between different fisheries and neighbouring countries harmonised with similar objectives.* *Joint patrols conducted.* *Reporting to JPCC on progress made.* *Fully implemented community based fisheries management systems in place.* *Communities fully involved in all decision-making and planning of fishery management activities.*	*Documentation available to indicate harmonised rules and regulations.* *Amendments to fisheries acts & regulations gazetted.* *JPCC documentation on progress made.* *Joint patrol reports available.* *Project reports.* *Fishers' committee minutes.*	*Input provided by fisheries departments regarding their legislation and management goals.* *Collaboration of all stakeholders.* *Willingness to harmonise legislation.*
Expected results (4)	*Integrated workplans developed and operational based on the proposed outputs of this management plan*	*Steering committee meeting at least annually.* *Management recommendations agreed based on results of research and monitoring programme.* *Fully integrated transboundary workplans agreed and implemented.* *Logical Framework populated with target dates and expected results.* *Fisheries management plans implemented based on results achieved from research and monitoring programmes.*	*Steering committee minutes.* *Detailed Logical Framework* *Detailed workplans for each country.* *Fisheries Management Plans adapted to local situations.*	
Expected results (5)	*Co-management programme established, and communities managing fisheries through*	*Management agreements between fisheries departments and communities.*	*Boundaries and rules and regulations of FPAs documented.* *Fisheries committee meeting*	*Agreement on objectives regarding co-management by all stakeholders.* *Common vision between*

	community fisheries committees in collaboration with fisheries departments	*By-laws included in legislation.* *Fish Protection Areas (FPAs) established (gazetted).* *Community fisheries committees established for each clearly defined fishery management area, meeting regularly and developing and implementing management plans in cooperation with fisheries departments.*	*report/minutes available.*	*stakeholders.*
Expected results (6)	*Capacity built in fisheries management, particularly at local community level but also at local government level and in fisheries departments at national level*	*Community members collecting fisheries data throughout study area.* *Fisheries scientists from the different fisheries departments conducting fisheries and scientific research throughout study area.* *Fisheries scientific staff doing post graduate studies.* *Fisheries officers working in collaboration with communities.* *Training workshops as required.*	*Data collected by community members available.* *Reports produced by fisheries scientists from the different fisheries departments.* *Workshop proceedings and reports.* *Fisheries departments' reports.* *Theses available.* *Papers published in international peer reviewed journals.*	*Fisheries staff (scientists and managers) available from the different fisheries departments.* *Community members appointed as fish monitors.*
1. Activities **1.1.** **1.2.** **1.3.** **1.4.**	*Effective collaboration and communication established between all stakeholders, local, national and international.* *Establish a transboundary steering committee to enhance communication links and facilitate information exchange.* *Fisheries departments and donors/NGOs agree on financial and logistical support for programme* *ToR agreed for steering committee.* *Meetings held with all stakeholders (individually and/or collectively depending on circumstances) for information sharing and dissemination, initially to explain*	*Steering committee in place and fully functional.* *Stakeholders represented on steering committee.* *Tourism associations involvement.* *NGO involvement in programme activities (particularlySAREP and NNF).* *University involvement in capacity building (particularly UB-ORI and UNAM)* *All stakeholders informed about all activities.*	*Steering committee meeting minutes.* *ToR of steering committee.* *Minutes from meetings held between stakeholders (communities, departments, NGOs, tourism representatives, etc.).* *Project reports.*	*Funding available for steering committee meetings from government departments and donor organisations.* *Members able to attend steering committee meetings.* *Steering committee meets as scheduled with agreed ToR.*

	programme, then at regular intervals to discuss plans, activities, and progress.			
2. Activities **2.1.** **2.2.** **2.3.** **2.4.** **2.5.**	*Standardised research and monitoring in place and resultant shared databases in place.* *Workshop held to discuss research and standardisation of research methods and monitoring process.* *Development of databases.* *Training workshops held in data analysis and paper and report writing.* *Facilitate research activities in the different countries.* *Training workshops held whenever required to accommodate new techniques, project interventions, etc.*	*Workshops held by all fisheries departments.* *Databases available.* *Database protocol developed.* *Workshops held for data analysis, training in report and paper writing, and finalisation of survey reports.* *Joint monitoring surveys done.*	*Workshop proceedings.* *Data sampling forms available.* *Entering of data sampled during surveys.* *Survey reports (results from data recorded) available.* *Joint papers published in peer review journals.*	*Funding secured from government departments, NNF/EU Community Conservation Fisheries in KAZA Project and its associated research projects.* *Stakeholders keep to scheduled programme.* *Agreement between fisheries departments on database protocol.* *Qualified scientists available.* *Common research objectives.* *Survey equipment available.*
3. Activities **3.1.** **3.2.** **3.3.** **3.4.** **3.5.**	*Harmonisation of fisheries legislation* *Workshop held through steering committee to review policy and fisheries legislation in each country and determine where harmonisation is feasible* *Report to JPCC on progress made.* *Communities advised of any proposed changes to legislation and the reasons for the changes.* *Amendments made to legislation and gazetted to harmonise legislation where agreed.* *Joint patrols conducted to sensitise*	*Workshop held between all stakeholders.* *JPCC meetings to discuss progress and recommendations.* *Amended legislation gazetted.*	*Workshop proceedings and recommendations made.* *JPCC meeting minutes on harmonisation of legislation.* *Amended legislation available and implemented.* *Joint patrol reports available.* .	*Agreement between countries on joint policies with regard to fisheries management goals,* *Willingness between countries to harmonise legislation.* *Boats and equipment available to do joint patrols.*

	fishers and thereafter to ensure compliance with rules.			
4. Activities **4.1.** **4.2.** **4.3.**	*Integrated workplans developed and operational based on the proposed outputs of this management plan* *Steering committee meets to develop joint programmes as listed in ToR of management plan and to populate logical framework with targets to be achieved (dates and numbers)* *Annual meetings (minimum requirement) of steering committee* *Detailed joint programmes for research and monitoring agreed and implemented between government fisheries departments*	*Steering committee meeting at least annually.* *Management recommendations agreed based on results of research and monitoring programme.* *Fully integrated transboundary workplans agreed and implemented including fully detailed Logical Framework.* *Fisheries Management Plans (local and transboundary).*	*Steering committee minutes.* *Logical Framework populated with target dates and expected results.* *Fisheries management plans implemented based on results achieved from research and monitoring programmes.*	*Agreement between countries on goals and workplans.* *Funding available for steering committee meetings from government departments and donor organisations.* *Members able to attend steering committee meetings.* *Steering committee meets as scheduled with agreed ToR.*
5. Activities **5.1.** **5.2.** **5.3.** **5.4.** **5.5.**	*Co-management programme established and communities managing fisheries in collaboration with fisheries departments.* *Fishing communities sensitised by fisheries departments.* *Workshops held between communities and fisheries departments to discuss co-management programmes.* *Discussions held for the establishment of potential FPAs.* *FPAs established by communities with assistance of fisheries departments and donor organisations (e.g. SAREP, NNF, and associated partners).* *Communities develop by-laws*	*Meetings held with all communities to sensitise them.* *Workshops held to discuss co-management and joint research programmes.* *Potential FPAs identified and approved by all stakeholders including traditional and regional authorities and government departments* *FPAs gazetted.* *By-laws appropriate to local conditions approved and gazetted.* *Community members involved in data collection.*	*Minutes and proceedings of meetings and workshop held.* *Boundaries of FPAs identified and rules and regulations drafted.* *FPAs gazetted.* *By-laws approved and gazetted.* *Data entered into database collected by community members.*	*All stakeholders in agreement regarding the community based approach.* *All in agreement with co-management programmes developed.* *All fishers abide by agreed local by-laws, FPAs and other co-management interventions.*

	suitable for local fishery conditions in partnership with fisheries departments			
5.6.	*Communities participating in monitoring and research activities.*			
6. Activities	*Capacity built in fisheries management, particularly at local community level but also at local government level and in fisheries departments at national level*	*Workshops held.* *Local community fisheries committees functioning effectively in collaboration with fisheries departments.* *Strengthened research and management capacity in the region, i.e. qualified scientists.* *Qualified scientists productively employed by fisheries departments and universities in the fisheries sector in the region.*	*Workshop proceedings.* *Scientific reports produced.* *Papers published.* *Staff with post-graduate degrees.* *Scientists employed productively in fisheries research and management in the region.*	*Willingness of fisheries department staff, postgraduate students, and community members to be trained.* *Post available in the region for staff and students trained through the programme.*
6.1.	*Workshops held for training purposes.*			
6.2.	*Communities informed and trained in community-based management techniques, including (but not limited to) committee functioning (roles of managers, secretaries, treasurers, etc.), basic fish biology in relation to fishing activities, etc.*			
6.3.	*Facilitate research activities in the different countries.*			
6.4.	*Postgraduate students identified and facilitated (funding from government, donor organisations and approved research projects to conduct research relevant to the aims of this management plan.*			
6.5.	*Scientists/students conduct data analysis, report writing publishing of papers in peer review journals.*			
6.6.	*Staffing levels of fisheries departments in each country increased and improved by integrating scientists trained through the implementation of the management plan.*			

APPENDIX 6. PROPOSED FORMS TO BE USED IN THE IMPLEMENTATION OF RESEARCH AND MONITORING ACTIVITIES UNDER THE MANAGEMENT PLAN

PASGEAR FIELD FORM

DATE...../...../.....(DD/MM/YY) GPS:.....S, ...E

STATION.....(full name) SITE ID.....

GEAR.....(A/B/C/) SETTING TYPE..... PASGEAR CODE.....

PANEL LENGTH(m) or SWEPT AREA(m^2)..... DURATION.....h

Species	Mesh	Number (Freq.)	Length (mm)	Weight (g)	Sex (MFX)	Gonad (1-5)		Species	Mesh	Number (Freq.)	Length (mm)	Weight (g)	Sex (MFX)	Gonad (1-5)

HABITAT DESCRIPTION

Page no.....

Date...../...../..... Station name..... Site ID.....

GPS

(a).....°S; .....°E (b) .....°S; .....°E

(c) .....°S; .....°E (d) .....°S; .....°E

Gear type..... Gear code (A,B,D,D etc.).....

Site description:

_____

_____

Habitat type: Mainstream ☐ Backwater ☐ Lake/Dam ☐ Side Channel ☐

Floodplain ☐ Rain Pool ☐ Rocks ☐ Isolated Pool ☐

Water depth (m)..... Water colour..... Flow rate.....

pH..... Water temp.....°C NH_4^+..... Oxygen.....

Aquatic plants.....

Bank vegetation.....

State of bank.....

External activities.....

Water sample Yes ☐ No ☐

FISH MARKET – DAILY TURNOVER

This form is to be completed for all fish entering the market on one day to determine weight of fish sold daily. Survey time 0730 hrs to 1600 hrs.

Date	Recorder	Weather

TIME	Type of fish 1 =Fresh 2 =Dried 3 =Mixed	Container type = cooler with ice = cooler with no ice = plastic bin with ice = plastic bin with no ice 5 = sack 6 =other describe	Origin of fish Village, fishing camp or general area	Where does the vendor live Village, fishing camp or general area	Transport used 1 =bakkie/truck 2 = private car 3 = taxi 4 = mokoro 5 = bicycle 6 = by foot	Weight of fish in kg. Subtract ice and box weight

FISH MARKET SURVEY -

Occupancy of market

Date	Recorder	Time

Fill in at each stall number whether it is occupied= X or not = O and selling fresh =1 fish or dried =2 fish or mixed = 3 fish. Survey time 1400-1500 hrs daily: Mon-Tues, Wed-Thurs, Tues-Wed, Thurs-Fri, Mon-Fri. In addition to two Saturdays and two Sundays each month.

1	2	3	4	5							

FISH MARKET SURVEY -
COMPOSITION OF FISH ON SALE

SELECTED VENDORS ARE ASKED TO ALLOW US TO MEASURE AND WEIGH THEIR FISH ON OFFER

Date	Time	Vendor name	Interviewer

Count of fish on table and in containers, for minimum five fresh fish vendors. Also complete if vendor sold out day one. Write stall no and sold out.

Stall no day one	**Fish species**	**Number on table**	**Number in container**		
Same vendor day two.	**Fish species**	**Number on table**	**Number in container**	**Reduction in price:** **From N$-To N$**	

Count of fish on table and in containers, for minimum five dry fish vendors

Stall no day one	**Fish species**	**Number on table**	**Number in container**		
Same vendor day two.	**Fish species**	**Number on table**	**Number in container**	**Reduction in price:** **From N$-To N$**	

Detailed measurement of sample of fish on table

Stall no	Species	Length [cm]	Weight [g]	Fresh or dried fish 1=Fresh 2=Dry	Price per fish	Is it fresh fish: To the market today (= 1) Left over from previous days (= 2)

VENDOR INTERVIEW

Three fresh fish and three dry fish every day.

Information on fish vendor

Date	Time		Interviewer

Name of vendor (if possible) and stall no:

Gender of vendor (female or male):

Have you been interviewed before (since 1 Oct 2010) or is this the first time:

First time:…….. Interviewed before: ……times

How long have you been selling fish? ……….years

Do you rent the market stall from owner or do you own the stall?

Own the stall…… Rent the stall……,. Price…….

How often are you selling fish at the Katima Fish market?

More than 4 days a week…… Between 2 and 4 days a week……..

Once a week…… Two times a month…….. Once a month…….

Less than once a month……

Where do you live:

Where do you get your fish, name of place?

How is the selling going?

Good……. Medium…….. Bad…….

Why is it good, medium, bad?.....

……

How important is fish sales to you?

Most important		**As important as piecework and farming**		**Not important**	

Why do you sell fish?

……

What is the vendor selling?

Fresh	Dried	Mixed/other

Can you give your reason for your choice?

……

What is best and worst times of year for selling fish?

SEASON	BEST	WORST	REASONS?
Litabula			
Muunda			
Mahila			
Mbumbi			

Do you prefer to sell a certain fish species/size of fish?

Species preferred:……

Size preferred:……

Reason for choice:……..

How do you travel from home to where you buy the fish?

Walking			
Private car		Cost to collect fish	
Taxi/combi		Cost to collect fish	
Other		Cost to collect fish	

How do you travel from home/where you buy the fish to the Katima market

Walking			
Private car		Cost to get to market	
Taxi/combi		Cost to get to market	
Other		Cost to get to market	

How many days or weeks does it take you to collect the fish you have brought to the market?

……..days or ……. weeks

What causes the biggest delays in getting to the market? Name in order of importance

Rank in order of importance most important: 1, second most important: 2

Getting enough fish		
Getting those fish species you want		
Getting the size of fish you want		
Getting the price of fish you want		
Preparing the fish		
Transport of fish		

How do you obtain the fish you have on sale?

Where?

Family member catches the fish		
Buy fish from fisherman on riverside		
Buy fish from fisherman at his village		
Travel to other village to buy fish		
Buy fish from trader		
Buy fish at market		
Other		

What is your marital status?

Married		Household head	
Single		Spouse	
Divorced		Daughter of household head	
Widowed		Responsible for maintenance of children	
Do you have children?		Other relative	

How much money did you spend to pay for this fish today?

Nothing		**Less than N$50**		**N$50 to 100**		**N$100 to 150**	
N$150 to 200		**N$200-250**		**More than N$250**			

How much profit will you make when all the fish are sold after all costs, transport and rent have been subtracted?

Nothing		**Less than N$20**		**N$20 to 50**		**N$50 to 100**	
N$100 to 150		**N$150-200**		**N$200 to 250**		**More than N$250**	

For fresh fish vendors only:

1) Was all fresh fish brought to the market today, if no how many days ago

   ……

2) What proportion of all the fish taken to the market for sale was left over from the previous days (including fish in the cooler boxes not on display):
   All…… Three quarter…… Half……. Quarter……. None……..

3) How many days does it take to sell all the fish brought to the market?
   ……. days

4) What fish is difficult to sell (f. ex. Small fish or some fish species)
   ……
   …….

5) What is the price for the fish of today and what is the reduction in price for old fish from previous days?
   ……
   ……..

May I ask some other personal questions?

Level of education: completed grade

3	4	5	6	7	8	9	10	11	12	Post school

What is your age

20-25	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	**51-55**	**56-60**	**61-65**	**66-70**	**more**

Thank you for your cooperation!

FISHERIES MONITORING DATA SHEET

Instructions: All fish measured or counted and weighed for a gillnet **PAGE NO.....**

Date	Time	Place	Recorder

Boat no.	Fishing gear used	Net length measured [m]	Mesh size Stretched (mm)	Fish species	Length (TL/FL) [mm]	Weight [kg]	Total number of specific species (if not measured)	Total weight (g) of the species group (if not measured)

FISHERIES DATA SHEET (BULK RECORDING)

Bulk recording for each canoe/fisherman **PAGE NO.....**

Date	Time	Place	Recorder

Fisherman or boat no.	Fishing gear used	Net length measured [m]	Mesh size Stretched (mm)	No. of large, medium, small coolers (or other write down)	Weight in kg of coolers (if possible)

FORM A: VILLAGE/FISHING CAMP CHARACTERISTICS

CONFIDENTIAL

Name of Recorder: _____ Date: _____Time:_____

Name of area: _____Name of Village/ camp: _____

Age of Village: ____. Population size: _____ Number of households: _____

GPS: **S**: _____**E**:_____

Village Headman: _____ Village Foreman: _____

Number of fishing boats by type:

1. Canoes ☐
2. Fiberglass/plastic boats ☐
3. Engine powered boats ☐
4. Other boats ☐ Total ☐

Number of fishers at camp/village by type:

5. Boat and net owners ☐
6. Net owners ☐
7. Boat owners ☐
8. Other fishers [traps, baskets] ☐ Total ☐

Is this village/camp it occupied permanently? Yes ☐ No ☐
How many months a year is the camp occupied? ☐ Months

If this camp is temporary, what is your home village? _____

What agricultural activity takes place here?

None ☐ Maize ☐ Millet ☐ Sorghum ☐ Vegetables ☐

Pumpkin ☐ Beans ☐ Cassava ☐ Sweet potato ☐

Others ☐ Describe_____

Where are these activities? Dry upland ☐ wet floodplain ☐

NOTES: *(such as condition of village, behavior of people interviewed)*

Fisheries Frame Survey

FORM B: FISHER CHARACTERISTICS

Recorder: _____ Date: _____ Village(s):_____

Fisher Code	Age	Gender	Citizen ship	Language group	Marital Status	Your position in household	How many dependants	Other sources of income of household	Which income is most important?	Years Fished	Years living In this village/ camp	How do you dispose of your fish?	What do you do apart from fishing?
meaning: 1= letter of river system Z, C, F, L, K 2-3=letter abbreviation of area 4=number of enumerator 5-6=number of fisherman			Country N = Namibia, B= Botswana Or O= other	1. Kwangali 2. Gcriku 3. Mbukushu 4. Rumanyo 5. Nyemba 6. Mbunda 7. Chokwe 8. Mbukushu 9. Other	1.Married 2.Single 3.Divorced 4.Widower 5. Other	1. Head 2.Son/daughter 3.Son/D in law 4.Brother/Sister 5. Grand child 6.Other relative 7. Domestic worker 8. Visitor 9. Other	Give number	1. Cattle 2. Crops 3. Govern-ment job 4. Remit tances 5. Pension 6. Grants 7 Shop/ trade 8. Piece work 9. Other	1. Fishing 2. Cattle 3. Crops 4. Govern-ment job 5. Remit tances 6. Pension 7. Grants 8.Shop/trade 9. piece work 10. Other	Give years	Give years	1. Family takes to market 2. Sell to people from village 3. Sell to vendors from Town. – [RU] 4. Keep fish for eating. 5. Dry fish for later use. 6. Other	1. All I do is to fish 2. I fish and farm 3. I have other business as well 4. I have other income/ grants/ salary

Fisheries Frame Survey

CONFIDENTIAL

FORM C: FISHING GEAR
Recorder: _____ Date: _____ Village(s):_____

Fisher code	*Boat type* **& number**		*Gear type, number and use*									
	Type	**Num-ber**	*Type*	**Num-ber**	**Mesh size, inches**		**Length of net mounted, m**		**Twine thick ness**	**Owner of gear?**	**Status in fishing emplo yment**	Number of years this type of gear is used?
1= river system 2-3 = area 4= recorder 5-6 = number of fisher	1: Canoe 2: Fiber/metal plank boat 3: Engine 4: Borrowed 5.:Other		1: Gill net 2: Drag net 3. , hook 4: Bashing 5. Traps, baskets 6. Others		Stretched mesh in inches or hook size		Length of net used to fish in m. Do not give length as bought or on label		2, 3, 4, 6, 9, 12 or other ply	1. No 2. Yes 3. Hired 3.Borro wed 4. Given	1. Self employ ed 2. Hired 3. For family 4. Helpin g	Give number

Fisheries Frame Survey

CONFIDENTIAL

Recorder: _____. Date: _____ Village(s):_____

FORM D: **FISHING ACTIVITY**

Fisher Code	**Best time to fish**	**Worst time to fish**	**Fulltime, Seasonal, Part-time or Occasional fisher?**	**Where do you fish?**	**Do you fish with a valid license?**	**Who do you ask to fish?**	**Do you pay for fishing?**	**Who shares the areas you fish in?**	**Are catches good?**
	1. summer **2.** flood **3.** winter **4.** spring		**1**. Fulltime = 6+m/y 2.Seasonal =one season/y 3.Part-time = do other jobs as well 4.Occasional = once/y or for sport 5.Other	**1**. Mulapos **2**. Channels **3**. Main channel **4**. Backwater **5**. Flood plain **6** Other **7**. All	**1=** No license 2= valid license **3**= non valid license	**1**. Induna **2**. Relati-ves **3**. Neigh-bours **4**. No one **5**. Govern-ment. **6**. Khuta **7**. Other	Yes or no Indicate amount if yes	**1**. Family **2**. Neigh-bours **3**. Lodges **4**. Friends **5**.Foreigners **6**. Every one **7**. No one	**1**. Yes **2**. Have declined **3**. Very low **4**. No **5**. Don't know **6**. Other

Fisheries Frame Survey

Recorder: _____ Date: _____ Village(s):_____

FORM E: PRESENT RESOURCE MANAGEMENT

Fisher Code	What type of fishing is banned here?	Who says it is banned?	What illegal fishing happens here?	By who?	What happens if they are caught?	Have there been conflicts here?	With who?	About What?	What do you know about fishery laws?
	1. Small meshes 2. Drag nets 3. Bash-ing 4. Lamp 5. Poison 6. Closed season 7. Other	1. Headman 2. Govt. 3. Traditional Authority 4. Fisher-men 5. Conser-vancy 6. All 7. Other	1. Small meshes 2. Drag nets 3. Bash-ing 4. Lamp 5. Poison 6. Closed season 7. None 8. Other	1. Fishers here. 2.Namib-ians 3. Other	1. Fine 2. Take nets 3. Arrest 4. Warn-ing 5. Noth-ing 6. Other	Yes or no	1. People here 2. Namibians 3. Wildlife 4.Other	1. Fish without asking 2. Using banned methods 3. Too many nets 4. Wildlife 5. Other	1. Nothing 2. Little 3. Wants to know more 4. Knows well

Fisheries Frame Survey

Recorder: _____ Date: _____ Village(s):_____

FORM F: FUTURE RESOURCE MANAGEMENT/KNOWLEDGE OF EUS

Fisher code	Should the fishery be regulated?	If yes, by who?	What should the regulations be used for?	What is the most important way of making sure there is enough fish for everyone?	Are you prepared to pay for a fishing license?	How should such money be used?	Do you know the fish disease known as EUS? Have you seen it?
	1= Yes 2= Don't know 3= No 4= Other	1. Traditional Authority 2. Government 3. Conservancy 4. Fisheries Committee 5. All 6. Other	1. Conserve fish 2. Keep outsiders out 3. Protect fish breeding 4. All 5. Other	1. Closed seasons 2. Ban dragnets 3. Ban small mesh nets 4. Fish reserves 5. Fishing licenses 6. Other	1. Yes 2. Don't know 3. No money 4. Never 5. Other	1. For fish guards 2. For Headman 3. For conservancy 4. For government 5. For people 6. Don't know 7. Other	1. Yes 2. Have seen it here. 3. Have seen it at …… 4. Have never seen it. 5. Have not even heard of it. 6. Other

RECREATIONAL FISHING ACTIVITY:

Fill in one form for every trip. *All* fish, small or large, released or landed, must be recorded. Decide *before* trip if you are going to record catches!

Date:..... Fishing started (time):..... Fishing ended (time):.....
Number of rods..... Group.....
Weather:..... Water temp.:..... Total km .....

Name of Establishment.....

	Species	Body length	Weight	Time caught	Location - where was the fish caught Name or GPS	Trolling, spinning, or worms	Released or landed	Comments
Example	Threespot	34.5 cm		17 hrs 45 min	Kalimbeza, Isl. View Lodge	Spinning	Released	Male
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
	13							
	14							

	15							
	16							
	17							
	18							
	19							
	20							
	21							
	22							

EXAMPLE OF WATER CHEMISTRY FORMS:

Lake Liambezi Limnology Monitoring Data Sheet

Date : DD / MM / YYYY **Record No.: _____**

Site :

Recorder Name : _____ **_____**

_____

Habitat Type : _____ **Wind Direction : _____** **Cloud Cover : _____**

Temp (◦C)	Conductity (ms/cm)	pH	DO (mg/L)	Do%	Secchi depth (m)	Bottom Depth (m)	Samples collected	Tick	Comments
							Phytoplankton		
							Nutrients		
							Zooplankton		
							Hardness & Alkalinity		

Habitat Type : _____ **Wind Direction : _____** **Cloud Cover : _____**

Temp (◦C)	Conductity (ms/cm)	pH	DO (mg/L)	Do%	Secchi depth (m)	Bottom Depth (m)	Samples collected	Tick	Comments
							Phytoplankton		
							Nutrients		
							Zooplankton		
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							Phytoplankton		
							Nutrients		
							Zooplankton		
							Hardness & Alkalinity		

ANNEXURE :

WIND DIRECTION CODES:

N - Northerly (Winds from the North)
NE - North Easterly (winds from the North East)
NW - North Westerly (winds from the North West)
S - Southerly (winds from the South)
SE - South Easterly (winds from the South East)
SW - South Westerly (winds from the South West)
E - Easterly (winds from the East)
W - Westerly (winds from the West)

CLOUD COVER CODES:

0 - Clear Sky (0 - 10 %)
1 - Partly Cloudy (10 - 50%)
2 - Overcast (50 - 100%)

STANDARD OPERATION PROCEDURES (SOP)

General and Weather data collection

Nutrient sampling and Preservation

Zooplankton sampling and Preservation

Phytoplankton sampling and Preservation