The Co-Management of Fresh Water Resources in the Okavango and Zambezi River Systems

Proceedings of a Consultative Workshop

Katima Mulilo
Caprivi Region
Republic of Namibia

14-16 November 2000

This publication was made possible through support provided by the US Agency for Development (USAID) Namibia Mission and the World Wildlife Fund (WWF) under the terms of the Co-operative Agreement No. 690-A-00-99-00227-00; the Norwegian Agency for Development Cooperation (NORAD) and the Food and Agricultural Organisation (FAO) of the United Nations. The views expressed in this document are the views of the editor or contributors and are not necessarily those of the sponsors.
Table of Contents

1. Background
2. Welcome
3. Official Opening
4. Overview of National Policies and Research Histories
5. Constraints and Challenges
6. Common Vision
7. Purpose
8. Objectives
9. Major Strategies
10. MNSCFF
11. Next Steps
12. Closing

Annexures

A List of Participants
B Botswana Country Paper
C Namibia Country Paper
D Zambia Country Paper
E Zimbabwe Country Paper
F Presentation by Prof. B van der Waal
G Presentation by Prof. P Skelton
H Katima Declaration
The Co-management of Fresh Water Resources in the Okavango and Zambezi River Systems

Proceedings of a Consultative Workshop
Katima Mulilo, Caprivi Region, Republic of Namibia
14-16 November 2000

1. Background
Representatives of various governmental and non-governmental institutions in Namibia, Botswana, South Africa, Zimbabwe, Zambia and Norway attended a two-day workshop in Katima Mulilo from 14-16 November 2000 with the view to:

- share information regarding fresh water fisheries and policies in their respective countries;
- obtain a common orientation towards the sustainable management and utilization of fish resources in the Okavango and Upper Zambezi River systems;
- identify possible solutions to address the most common and urgent issues related to co-management of these common resources; and
- identify the way ahead.

For more details regarding the participants, please refer to Annexure A.

2. Welcome
Dr. Burger Oelofsen, Director of Directorate of Resource Management in the Namibian Ministry of Fisheries and Marine Resources (MFMR) welcomed all participants to the meeting. He regretted that one of the major partners in the common resources, Angola, could unfortunately not be present.

3. Official Opening
The Honorable Governor of the Caprivi Region, Mr. Sibalatani, officially opened the workshop and welcomed the delegates to the region. He emphasized the fact that this is the first initiative of its kind within the SADC region that forms part of the proposed SADC Fisheries Protocol. The African States should take up the challenge of preserving and sustainably utilizing their natural resources. The countries in the Kavango and Caprivi regions should use this opportunity to develop and implement mechanisms for co-management of the common fish resources in the region.

4. Overview of the national policies and research history of each of the participating countries.
Representatives made presentations on their national policies and strategies with regard to fisheries in their respective countries. They also provided brief histories on fisheries
research being done in their countries. Detailed papers are being presented in Annexures B to E.

The following are some of the major statements and issues discussed during the presentation session:

- Clarity should be obtained about the role and impact of mesh size of nets on the fish stocks and whether restrictions are feasible or not.
- Community involvement in the conservation and sustainable utilization of the common resources is of paramount importance.
- The possible conflicts that may arise between the subsistence fisheries and the large-scale commercial fisheries should be investigated. Furthermore, the encouragement of the commercial fisheries against the possible negative effect it may have on the subsistence fisheries, must be addressed.
- The consequences of introducing exotic fish species into the river systems must be studied and weighed up against the importance of maintaining the natural environment.
- In Zambia, a decrease in the per capita fish consumption from 12 kg per annum to 8 kg per annum took place, mainly due to the increase in human population and the subsequent increase in demand for fish.
- In Zambia, sustainable production is estimated to be around 150 000 metric tons per annum, current demand is about 100 000 metric tons per year and the current production roughly 70 000 metric tons per annum.
- Fishermen in the Caprivi region are currently using a large variety of methods, although the majority makes use of gill-net gear.
- Although legislation is very important, participants expressed difficulties in law enforcement attempts.
- The co-management of the aquatic resources, involving communities at grassroots levels, is seen as a pre-requisite for proper law enforcement.
- Fisheries data collected in 1996 by Zambia within the Upper Zambezi section are available to all partners.
- The term “subsistence fishing” is unclear and needs to be better defined and understood.
- In Botswana, Community Based Natural Resource Management (CBNRM), including fisheries, is a new approach and in the final stages of preparation for implementation.
- In Namibia, three different types of fisheries are defined, based on the type of gear used as the criteria. When traditional and local gear are mainly used, it is considered to be subsistence. Rods and reels are mainly used in recreational fishing and gill nets used mainly for commercial and semi-commercial purposes. Even when surplus catches are sold, it should still be considered as subsistence activities.

In Botswana, conflicts exist among safari operators and local fishermen regarding access to resources and areas. The principle of sharing the resources and adequate compensation to local communities has been raised. Zimbabwe indicated that the difference between natural mortalities and fishing mortalities should be investigated. This will further contribute towards the debate on gear size and the need for restrictions on it.
• Fish habitats eg. stagnant pools, in ephemeral rivers should be carefully managed to prevent destruction of nests and fish. Some species of fish (such as catfish) bury itself in dry river beds.

5. Constraints and Challenges faced by individual countries.
Representatives from the participating countries presented some of the major constraints and challenges that the fresh water sector in their respective countries currently face. These are:

5.1. Namibia
• All perennial rivers in Namibia are shared with neighbouring countries, which make management difficult.
• Habitat degradation may have a profound effect on the fish resource and needs to be studied.
• The use of aquatic resources by the commercial fisheries versus the subsistence fisheries.
• Perceived conflict between the recreational and subsistence fishermen.
• Lack of implemented management of the fish resource.
• Different management policies or the absence of such policies
• Management of the fish resource to secure food supply.

• Implementation of legislation.
• Funding for regional co-operation.
• Manpower to conduct research in all river systems.
• The policy and legislative framework for inland fisheries is currently being attended to.

• With collaboration between concerned countries, there should actually be no constraints, only challenges.

5.2. Zambia
• The emphasis government put on so-called “minor” fisheries is currently very low.
• Inadequate skilled staff for research and management of fresh water fish resources.
• As part of the Agriculture Sector Investment Programme (ASIP), funds for fishing sector are controlled by the District Agricultural Coordinators and sometimes reallocated towards agricultural programmes.
• Fisheries legislation is outdated and should be revised. The process is currently ongoing, but very slow.
• The current policy towards Public Service Reform Programme (PSRP) where several Ministries are in the process of being restructured, leads to the retrenchment of certain key staff.
• The Upper – Zambesi River is not included in the new legislation.
• A challenge will be to harmonize the new government legislation with the traditional legislation of the Barotsi Royal Establishment.
• Information to support the co-management of the fisheries resources should be generated.
• Create an enabling environment for the co-management of the aquatic resources.
5.3. Botswana
- The Fisheries section is currently under the Department Animal Health and Production and can not compete for resources in the livestock industry.
- There are presently no specific fisheries related policy guidelines.
- Currently the recording of fish catch data is inadequate due to scattered fishermen, low literacy levels of fishermen, shortage of extension staff and difficult access to some remote fishing grounds.
- Current fisheries legislation lacks regulations for effective enforcement.
- Difficult to estimate sustainable harvesting levels.
- Conflicts between fishermen and some Safari Operators (Fishing Camps).
- Lack of marketing infra-structure to make fisheries more commercial.
- Drying up of natural fishable surface water.
- Under-developed aqua-culture industry.
- Lack of coordination, collaboration and consultation amongst partners in the Okavango Delta.
- Land Boards lease land to Safari Operators without consultation with fisheries, leading to conflict between small-scale fishermen and concessionaires for controlled hunting areas.

5.4. Zimbabwe
- Politicians should be convinced with hard data about the relative importance of the fresh water fishery sector in all countries. This might lead to greater commitment and financial support to the sector.
- Embark upon collaborative research on the shared resources, with special emphasis on the socio-economic aspects.
- Make maximum use of the existing SADC Fisheries Protocol in support of fresh water fisheries.
- Common infra-structure for use by all partners should be developed with the possible support from donors.

5.5 Presentation by Prof. Ben van der Waal
Prof. Van der Waal from the University of Venda in South Africa worked in the Caprivi region during the middle 1970’s and he shared his knowledge and experience with the workshop. His presentation is attached as part of Annexure F.

5.6 Presentation by Prof. Paul Skelton
Prof. Skelton is the Managing Director of the JBL Smith Institute in South Africa and he shared the knowledge and experience of this Institute with the participants. Some of the details of his presentation are captured in Annexure G.
6. Common Vision
In order to develop relevant objectives, strategies and plans, the workshop first elaborated a common vision that reads as follows:

*The aquatic resources of the Okavango and Zambesi River Systems continue to sustainably and significantly contribute towards the quality of life and food security of the inhabitants of the region, both present and future.*

7. Purpose.
In order to make a contribution towards the vision, a common purpose was elaborated:

*All stakeholders (government, non-government, private and community based) in the Okavango and Zambesi River Systems are effectively co-managing the shared aquatic resources in a sustainable manner.*

8. Objectives
To be able to achieve the purpose, the following broad objectives have been agreed upon:

**Objective 1**
*The aquatic system is better understood and the knowledge shared amongst all stakeholders.*

**Objective 2**
*A common policy and legal framework that is conducive to the co-management of aquatic resources is in place.*

**Objective 3**
*Appropriate structures and mechanisms for the co-management of aquatic resources are established and maintained.*

**Objective 4**
*Commitment and active participation of all stakeholders are secured and maintained.*

**Objective 5**
*The capacity of local communities to sustainably manage their aquatic resources is enhanced.*
9. **Major Strategies**  
The following strategies have been elaborated for each of the objectives:

**Objective 1:** The aquatic system is better understood and the knowledge shared amongst all stakeholders.

<table>
<thead>
<tr>
<th>No</th>
<th>Strategy</th>
<th>Responsible</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Review existing knowledge and identify biological and socio-economic</td>
<td>Joint Technical Team appointed by Stakeholders and coordinated by Dr. C. Hay</td>
<td>Draft: Oct 2001 Final: Jan</td>
</tr>
<tr>
<td></td>
<td>research gaps and compile overview status report.</td>
<td></td>
<td>2002</td>
</tr>
<tr>
<td>1.2</td>
<td>Develop and joint research programme to address shortcomings.</td>
<td>As in 1.1 and incorporating comments from all stakeholders</td>
<td>Draft: Dec 2001 Final: April</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2002</td>
</tr>
<tr>
<td>1.3</td>
<td>Create research structures to address identified research gaps.</td>
<td>Heads of regional freshwater research institutions coordinated by Dr. B. Oelofsen</td>
<td>August 2002</td>
</tr>
<tr>
<td>1.4</td>
<td>Mobilize necessary human and financial resources and implement research</td>
<td>As in 1.3 and coordinated by Dr. R. Gurure</td>
<td>Jan 2002 for a 10 yr period</td>
</tr>
<tr>
<td></td>
<td>programmes.</td>
<td></td>
<td>with reviews every 3 yrs</td>
</tr>
<tr>
<td>1.5</td>
<td>Disseminate information and management recommendations to all</td>
<td>All technical participants through coordinators</td>
<td>As soon as possible and</td>
</tr>
<tr>
<td></td>
<td>stakeholders.</td>
<td></td>
<td>then ongoing</td>
</tr>
<tr>
<td>1.6</td>
<td>Develop and use electronic newsletter in the mean time to keep up</td>
<td>Dr. C. Hay to initiate newsletter</td>
<td>As soon as possible</td>
</tr>
<tr>
<td></td>
<td>communication.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Remarks**

- In the longer term, the acquiring of e-mail facilities should be considered to optimize the use of the newsletter.
- Efforts should be made to disseminate scientific information in layman’s language to local communities.
Objective 2: Common policy and legal framework conducive to co-management of aquatic resources in place.

<table>
<thead>
<tr>
<th>No</th>
<th>Strategy</th>
<th>Responsible</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Conduct consultative meetings at regional and international levels on policy and aquatic resources legislation.</td>
<td>Standing Committee</td>
<td>July 2001</td>
</tr>
<tr>
<td>2.2</td>
<td>Review all existing policies and legislation with a view of harmonizing them.</td>
<td>Consultant under the coordination of Fisheries departments</td>
<td>Dec 2001</td>
</tr>
<tr>
<td>2.3</td>
<td>Develop a multi-lateral protocol on inland fisheries co-management framework.</td>
<td>Standing Committee</td>
<td>Dec 2001</td>
</tr>
<tr>
<td>2.4</td>
<td>Amend existing policies and legislation in accordance with the accepted protocol.</td>
<td>National Fisheries Departments / consultants and Office of the Attorney General</td>
<td>2002</td>
</tr>
<tr>
<td>2.5</td>
<td>Inform public on revised policies and legislation.</td>
<td>Ministries / Departments &amp; Regional Authorities</td>
<td>Two times in 2003</td>
</tr>
</tbody>
</table>

Remarks
- The time scale for these strategies seems to be a bit optimistic.
- Make contact with SADC Fisheries Sector Coordinating Unit in Malawi and refer to existing draft SADC Fisheries Protocol.

Objective 3: Appropriate structures and mechanisms for co-management of aquatic resources established and maintained.

<table>
<thead>
<tr>
<th>No</th>
<th>Strategy</th>
<th>Responsible</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Identify present and potential stakeholders (also Education Authorities)</td>
<td>National heads of Fisheries Institutions and coordinated by Dr. C.Hay</td>
<td>Aug 2001</td>
</tr>
<tr>
<td>3.2</td>
<td>Facilitate the formation of management structures at national, regional and local levels.</td>
<td>National heads of Fisheries Institutions and Regional Coordinators</td>
<td>2005</td>
</tr>
<tr>
<td>3.3</td>
<td>Build capacity with management structures through training, legal instruments, finance, etc.</td>
<td>As in 3.2</td>
<td>Jan 2006</td>
</tr>
<tr>
<td>3.4</td>
<td>Operationalise management structures and evaluate progress made.</td>
<td>As in 3.2</td>
<td>2005 and then every 3rd year</td>
</tr>
</tbody>
</table>
Objective 4: Commitment and active participation of all stakeholders secured and maintained.

<table>
<thead>
<tr>
<th>No</th>
<th>Strategy</th>
<th>Responsible</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Promote advocacy and awareness of co-management of aquatic resources.</td>
<td>NGOs, CBOs and Governments</td>
<td>Ongoing</td>
</tr>
<tr>
<td>4.2</td>
<td>Establish a Standing Committee on Inland Fisheries.</td>
<td>This Meeting</td>
<td>Now</td>
</tr>
<tr>
<td>4.3</td>
<td>Facilitate the development and coordination of fishers associations or</td>
<td>Standing Committee and the Departments of</td>
<td>Dec 2001</td>
</tr>
<tr>
<td></td>
<td>build on existing structures.</td>
<td>Fisheries</td>
<td></td>
</tr>
<tr>
<td>4.4</td>
<td>Establish cross-border linkages between existing as well as potential</td>
<td>Standing Committee and Fisheries Departments</td>
<td>April 2001 and</td>
</tr>
<tr>
<td></td>
<td>fishers associations.</td>
<td></td>
<td>ongoing</td>
</tr>
</tbody>
</table>

Remarks
- Angola should be contacted and included into the process from the beginning
- The process of implementation as well as the impact of the project should be monitored and assessed regularly.

Objective 5: The capacity of local communities to sustainably manage their aquatic resources is enhanced.

<table>
<thead>
<tr>
<th>No</th>
<th>Strategy</th>
<th>Responsible</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Launch public awareness programmes.</td>
<td>National heads of Fisheries Institutions</td>
<td>2001 and ongoing</td>
</tr>
<tr>
<td>5.2</td>
<td>Involve local communities in co-management.</td>
<td>National and regional fisheries authorities.</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>

Remarks
- The inclusion of fisheries related topics and themes into the school curricula is important but should be considered later on only.
10. The Multi-National Standing Committee on Freshwater Fisheries (MNSCFF)
In order to take this process further, the MNSCFF was established at the workshop and is consisting of the following members:

<table>
<thead>
<tr>
<th>Delegate members</th>
<th>Alternate members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Clinton Hay (Convenor) (Namibia)</td>
<td>Dr. Burger Oelofsen</td>
</tr>
<tr>
<td>Mrs. Emma Boys (Namibia)</td>
<td></td>
</tr>
<tr>
<td>Dr. Richard Gurure (Zimbabwe)</td>
<td>Mr. Vitalis Chadenga</td>
</tr>
<tr>
<td>Mr. Ben Chanda (Zambia)</td>
<td>Mr. Godfrey Milindi</td>
</tr>
<tr>
<td>Mr. Trevor Mmopelwa (Botswana)</td>
<td>Mr. Judge Manyemane</td>
</tr>
<tr>
<td>Angolan Representatives to be identified</td>
<td></td>
</tr>
</tbody>
</table>

Remarks
- Currently the Standing Committee consists mainly of scientists, and it should be balanced to include other disciplines at the first meeting.
- Other suggestions for a possible name include International Standing Committee on Fresh Water Fisheries (ISCOFF), Upper Zambezi Standing Committee on Fresh Water Fisheries (UZSCOFF) and the Standing Committee on Fresh Water Fisheries in the Zambezi Region (SCOFFFIZR) – courtesy Prof. Ben van der Waal.

11. Next Steps
The following important next steps have been identified:
- The moderator to finalize the proceedings of the workshop and Dr. C. Hay to make it available to all participants by 25th November 2000.
- The MNSCFF to meet under the chairmanship of Dr. C. Hay before the end of March 2001.
- The Katima Declaration has been signed by representatives of all SADC countries that were present at the workshop (See Annexure H).

12. Closing
Dr. Clinton Hay closed the workshop and thanked everybody for their presence, positive and active participation and wished them a safe journey home.

Workshop was moderated and the Proceedings compiled by:

Mr. Bertus Kruger
Desert Research Foundation of Namibia
P.O. Box 20232
Windhoek

Tel 061 229 855
Fax 061 230 172
e-mail: bertusk@drfn.org.na
Annexure A
## Annexure A

### List of Participants

<table>
<thead>
<tr>
<th>Surname</th>
<th>First name</th>
<th>Position</th>
<th>Institution and postal address</th>
<th>Tel &amp; fax no</th>
<th>E-mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oelofsen</td>
<td>Burger Wilhelm</td>
<td>Director Resource Management-MFMR</td>
<td>MFMR P/Bag 13355 Windhoek</td>
<td>264 61 2053114, 264 61 2250558</td>
<td><a href="mailto:boelofsen@mfmr.gov.na">boelofsen@mfmr.gov.na</a></td>
</tr>
<tr>
<td>Neusje</td>
<td>Tor Fredrik</td>
<td>Research Director</td>
<td>Norwegian Institute for Nature Research Tungasletta, no-7485 Trondheim, Norway</td>
<td>047 73801400, 047 73801401</td>
<td><a href="mailto:tor.nicus@ninatrd.ninaniku.no">tor.nicus@ninatrd.ninaniku.no</a></td>
</tr>
<tr>
<td>Van der Waal</td>
<td>Benjamin C.W</td>
<td>Professor, Department of Biological Sciences</td>
<td>University of Venda for Science, P/Bag X 5050, Thohoyandou 0750 RSA</td>
<td>015 962 8479, 015 962 8648</td>
<td><a href="mailto:bcw@univen.ac.za">bcw@univen.ac.za</a></td>
</tr>
<tr>
<td>Chandh</td>
<td>Ben</td>
<td>Chief Fisheries Research Officer</td>
<td>Fisheries Research Box 350100, Chilanga, Zambia</td>
<td>260-1-278597, 260-1-278418</td>
<td><a href="mailto:piscator@zamnet.zm">piscator@zamnet.zm</a></td>
</tr>
<tr>
<td>Milindi</td>
<td>Godfrey</td>
<td>Chief Fisheries Officer</td>
<td>Fisheries Extension Box 350100, Chilanga, Zambia</td>
<td>260-1-278173, 260-1-278418</td>
<td><a href="mailto:piscator@zamnet.zm">piscator@zamnet.zm</a></td>
</tr>
<tr>
<td>Nickanor</td>
<td>Nandehasho</td>
<td>Fisheries Research Technician</td>
<td>MFMR Hardap Freshwater Fish Research Institute P/Bag 2116, Mariental Namibia</td>
<td>264 63-242641, 264 63-242643</td>
<td><a href="mailto:harff@hotmail.com">harff@hotmail.com</a></td>
</tr>
<tr>
<td>Gurure</td>
<td>Richard</td>
<td>Chief Ecologist (A)</td>
<td>National Parks, Wildlife, Box CY 140, Harare, Zimbabwe</td>
<td>263-4-792786</td>
<td><a href="mailto:galsom@iafrica.com.zw">galsom@iafrica.com.zw</a></td>
</tr>
<tr>
<td>Surname</td>
<td>First name</td>
<td>Position</td>
<td>Institution and postal address</td>
<td>Tel &amp; fax no</td>
<td>E-mail</td>
</tr>
<tr>
<td>------------------</td>
<td>------------</td>
<td>---------------------------</td>
<td>-----------------------------------------</td>
<td>-------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Chadenga</td>
<td>Vitalis</td>
<td>Deputy Director</td>
<td>National Parks, Wildlife, Box CY 140, Harare, Zimbabwe</td>
<td>263-4-792786</td>
<td><a href="mailto:nlc@iafrica.com.zw">nlc@iafrica.com.zw</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>263-4-724914</td>
<td></td>
</tr>
<tr>
<td>Mmopelwa</td>
<td>Tevor. G</td>
<td>Principal Fisheries Officer</td>
<td>Fisheries Section, P/Bag 0032, Gaborone, Botswana</td>
<td>267 350502</td>
<td><a href="mailto:tmnopelwa@gov.bw">tmnopelwa@gov.bw</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>267 581383</td>
<td></td>
</tr>
<tr>
<td>Manyemane</td>
<td>Judge</td>
<td>Senior Technical Officer</td>
<td>Fisheries Section, P.O.Box 70, Maun, Botswana</td>
<td>267 660252</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>267 660315</td>
<td></td>
</tr>
<tr>
<td>Hay</td>
<td>Clinton. J</td>
<td>Chief Fisheries Biologist</td>
<td>MFMR-Hardap, P/Eag 2116, Mariental, Namibia</td>
<td>264 63 242642</td>
<td><a href="mailto:cjhay@mweb.com.na">cjhay@mweb.com.na</a></td>
</tr>
<tr>
<td>Kapirika</td>
<td>Servatius</td>
<td>Fisheries Biologist</td>
<td>MFMR-Hardap, P/Eag 2116, Mariental, Namibia</td>
<td>264 63 242642</td>
<td><a href="mailto:harfii@mweb.com.na">harfii@mweb.com.na</a></td>
</tr>
<tr>
<td>Skelton</td>
<td>Paul</td>
<td>Managing Director</td>
<td>JLB Smith Institute, P/Bag 10/5, Grahamstown, 6140 RSA</td>
<td>+27 46 6361002</td>
<td><a href="mailto:P.Skelton@ru.ac.za">P.Skelton@ru.ac.za</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+27 46 6222403</td>
<td></td>
</tr>
<tr>
<td>Purvis (final day only)</td>
<td>John</td>
<td>Fisheries Assistant</td>
<td>MAWRD, P/Bag 5005, Kaoma Mulilo</td>
<td>+ 264 6773015</td>
<td><a href="mailto:jpurvis@iafrica.com.na">jpurvis@iafrica.com.na</a></td>
</tr>
<tr>
<td>Boys</td>
<td>Emma S</td>
<td>Chief Policy Analyst</td>
<td>MFMR P/Bag 13355, Windhoek</td>
<td>264 61 2053128</td>
<td><a href="mailto:eboys@mfmr.gov.na">eboys@mfmr.gov.na</a></td>
</tr>
<tr>
<td>Kruger</td>
<td>Bertus</td>
<td>Moderator</td>
<td>Desert Research Foundation of Namibia</td>
<td>264 61 229855</td>
<td><a href="mailto:bertusk@drfn.org.na">bertusk@drfn.org.na</a></td>
</tr>
</tbody>
</table>
Annexure B
Annexure B:

POLICY AND LEGISLATION PERTAINING TO BOTSWANA FISHERIES

WORKSHOP ON CO-MANAGEMENT OF SHARED FRESHWATER FISHERIES

ZAMBEZI LODGE
KATIMA MULILO
CAPRIVI – NAMIBIA
14 – 16 NOVEMBER 2000

Trevor G. Mmopelwa
Private Bag 0032
Gaborone
Botswana

Tel: 350502/350668
FAX: 581383/303744
E-mail Tmmopelwa@gov.bw
Without a coastline but with limited inland water resources, Botswana is among the few Southern African States with small fisheries establishments. A large part of the country lies within the Kalahari desert. However fisheries potential is offered by the northwest region that is blessed with about 95% of the country’s perennial surface waters.

The Okavango and Chobe/Linyanti are the two systems that for many years have supported artisanal and sport fishing sectors. Commercial fishing did not take its present state until around 1982. But consecutive years of drought have had a negative impact on the performance of the fisheries sector in general. Lakes Liambezi (Chobe) and Ngami (Okavango) as well as the lower part of the delta including Boteti and Thamalakane outflow channels dried in the mid 1980’s.

1.1 Okavango

As a major permanent water source the Okavango experienced increased fishing pressure at the time when other productive fishing grounds dried. Incidentally the system had to sustain that pressure while it also received its lowest regimes of annual floods. It is not surprising therefore that the level of conflicts also rose amongst the various fishery resource user groups, notably safari operators and commercial fishermen.

The eradication of cattle due to lung disease in Ngamiland District (where the Okavango is) also contributed to the said pressure. Without beef, there was increased demand for alternative animal protein sources, including fish. Indeed the number of people seeking government assistance to start up new fishing ventures shot up between 1996 and 1997, coinciding with the cattle eradication exercise. Fishing has since improved with good floods of 1998/99 and 1999/2000 lessening the incidents of conflicts.

1.2 Chobe/Linyanti

Most part of the Chobe river (receiving back flow water from the Zambezi) lies within the Chobe National Park. Within a protected area (a park) fishing has been subjected to Wildlife management regulations that have seen changes over the years. Up until April 2000 sport fishing was permitted up to a maximum limit of ten fish per day before this privilege was stopped. Consideration is now being given to allowing subsistence fishing by “adjacent communities”. Guidelines towards that effect are in the process of being developed. All these changes are done with no consultation with the Fisheries Section.

The small length of the river east of the park to the point of the ferry does not offer good fishing because of the steep river banks and lack of stagnant lagoons.

With no fishing within the park, and either poor fishing from a fast flowing river or no fishing due to drought outside the park, most people are tempted to believe there are no fishers on the Botswana side of Chobe/Linyanti system. On the contrary Botswana fishers have been complaining bitterly about the wildlife regulations that deter them from fishing while no restrictions are imposed on the Namibian side.
West of the park fishing has been at the vagaries of nature. When lake Liambezi dried and the Chobe river reduced to a few cut off pools (lagoons), the fishing cooperative established at a nearby village (Satau) had to find new fishing grounds. The remote Linyanti swamps were identified but proved too far for the fishing operations to be viable. For every trip, enough fuel supplies for the vehicle and boats, as well as food supplies to last for at least a month were required. But the catch had to be dried (smoked or salted) since it was not practicable to keep ice for that period. High maintenance costs for the vehicle as well as the need to have it on site to run the cooperative retail store meant that fishing trips could not be made regularly. So the operation was eventually abandoned. Due to reduced activity in the area the extension officer posted at Satau was transferred pending improvements on the flood and fishing situations.

1.3 Limpopo

The fishery on eastern Botswana is based on man-made reservoirs that almost all fall within the Limpopo system. There are five major dams that are owned by a state corporation (Water Utilities Corporation), primarily to supply water to urban centres. The dams are fed by ephemeral streams that are tributaries of the Limpopo river. Access to the Limpopo is limited by private farms that lie along the river forming the border with South Africa.

2 EVOLUTION OF THE FISHERIES POLICY

The process of developing a policy for the fisheries sector dates from just after independence. In 1977 the Ministry of Agriculture policy committee (all expatriates, one local) minuted this about the fisheries policy; “Field experience indicates that neither of the natural and impounded waters are suitable for large scale commercial production for sometime to come. However, the natural waters of the Okavango delta and related systems offer the best potential for gradualistic development, e.g. upgrading existing fisheries through a small but efficient fisheries administration. The eastern impoundments are faced with the basic problem of lack of interest from local villagers in producing, not eating native fish species”.

Nevertheless the meeting concluded to adopt the following:

i) Concentrate efforts on practicing fishermen in the eastern impoundments and Okavango area, e.g. artisanal, or part-time fishermen.

ii) Adopt a gradualistic extension approach, e.g. step-by-step to upgrade fishermen through problem identification and solving.

iii) Obtain sufficient information on biology and socio-economics of the resource in both natural and impounded waters.
As can be seen the policy thrust was that of improving local fishing skills as well as build an institutional capacity so as to utilize the available fish stocks. The overall aim being to provide high quality animal protein and employment to the lower income bracket, to which most fishermen belong. Subsequently the Ministry programme of activities with respect to fisheries included:

➢ Providing an extensive farmer training programme to upgrade local skills and technology, particularly with respect to modern fishing techniques and fish handling and processing. An average of 7 – 11 village based courses were undertaken annually.

➢ Removing constraints imposed by lack of investment capital by utilizing as much as possible available financial credit and subsidy schemes offered by both government and local donor agencies. Financial Assistance Policy (FAP) played a key role in this endeavour.

➢ Developing an efficient market infrastructure. Government purchased dried salted fish through drought relief to feed the under privileged in institutions like schools and clinics.

➢ Training, developing, and deploying technically competent staff to strengthen the Fisheries Section's extension capacity. A two-year in-service training programme was instituted to build up the current staff establishment.

➢ Promoting fish acceptance and consumption through cooking demonstrations at schools, clinics, agricultural shows and annual trade fairs.

In August 1988 the Ministry policy committee (all locals, one expatriate) reviewed progress in the fisheries sector and recommended that:

➢ A research project to provide baseline data on fish stocks and monitoring be implemented.

➢ Boat building and repair of engines including an outboard motor maintenance course be introduced at Vocational Training Centres.

➢ Aquaculture programme be initiated as part of Fisheries Section activities, the first step being the establishment of an Aquaculturist position within the section.

➢ Fish marketing in outlying areas be continued with dried salted fish as the most feasible product and ensure that prices for this product reflect current market prices. With respect to fresh fish marketing, that when
conditions permit cooling facilities be established in strategic locations.

- Legislation designed to protect this resource be developed and enacted when sufficient information becomes available.

These policy initiatives have been pursued to varying degrees of success:

- A research project on stock assessment was launched in September 1999 after several years of failure to secure funding. Government is funding the project.

- A fishing and boat building craft course was introduced at Maun Vocational Training Centre (now Maun Technical College).

- The top two senior posts in the section are occupied by personnel aquaculture training at masters level.

- Two freezer facilities were set up in the upper delta to promote fresh fish sales, although only one is currently operational.

- Plans to introduce regulations in accordance with the Fish Protection Act were deferred pending completion of a Community – Based Natural Resources Management (CBNRM) policy.

Following a comprehensive agricultural sector assessment review of 1988, the government came up with a new national policy on agricultural development. This 1991 policy was targeted at improving the sector's contribution to the economy in general, and the rural population, in particular. The government adopted a policy shift from food self-sufficiency to food security, to be achieved through the following policy objectives:

i) Improve food security at both household and national levels.

ii) Diversify the agricultural sector production base for more income opportunities

iii) Increase agricultural output and productivity

iv) Increase employment opportunities for the fast growing labour force.

v) Provide a secure and productive environment for those engaged in agriculture

vi) Conserve scarce agricultural and land resources for future generations

Much as we know fishery resources to fall under the general category of natural resources, they are also classified as agricultural resources in Botswana. The lack of a fisheries sector specific policy therefore means that the fisheries development programme is expected to operate within the broad policy framework for agriculture.

There clearly are issues unique to fisheries that the agricultural policy has some inadequacies in. In particular the subject of this workshop – “Co-management of shared
fisheries” is not covered at all. To this and we look forward to higher level fora such as
the SADC protocol on Fisheries and the FAO Code of Conduct for Responsible Fisheries
pertaining to Inland Fisheries. Article 8 of the SADC draft protocol on Fisheries and
articles 6.4, 7.1.3 – 7.1.6 and 10.3 of the FAO Technical Guidelines for Responsible
Fisheries are particularly relevant.

3. THE FISH PROTECTION ACT - 1975

The Act provides for the more effectual regulation, control, protection and
improvement of fish and fishing in Botswana.

Section 3 of the Act empowers the Minister (of Agriculture) to make regulations
that shall apply to specified areas in which fishing may be carried out. The
government and management of such areas may include:

(a) Improving and prescribing conditions for the regulation of fishing
(b) Registering all boats employed in fishing
(c) Determining the times and seasons of fishing
(d) Issuing of licenses and certificates of registration to all fishers
(e) Prescribing license and registration fees to be paid
(f) Regulating the method of fishing and type of gear to be used.
(g) Regulating the bringing into Botswana of any live fish
(h) Regulating the transfer within Botswana of any live fish
(i) Regulating the sale of any fish

Section 4 makes it an offence for any person who uses or permits to be used any
explosive, poisonous or noxious substance for the purpose of killing, stunning or
disabling fish or in any way rendering fish more easily caught. However in the
interest of science or any reason deemed necessary, the Minister may exempt any
person from the provisions of section 4 or any regulations made under section 3.

Through Section 5 the Minister may under the said regulations fix penalties for the
breach or non-observance of any regulation or any order issued or by virtue of such
regulations as he may think fit. The penalties shall not exceed, in the case of first
conviction, a fine of P200.00 and imprisonment of three (3) months. In the case of a
second or subsequent conviction it shall not exceed a fine of P500.00 and imprisonment
for twelve (12) months. Where no penalty is fixed offenders shall be punishable to the
extent prescribed above.

Under section 6, authorized officers (a person authorized by the Minister for the purposes
of this Act) or police officers of and above the rank of Assistant Inspector are empowered
to:
(a) At all reasonable times enter into and upon any land or premises, or stop and enter any boat, for the purpose of preventing or detecting offences under the Act or any regulation made thereunder;

(b) Seize any –

(i) boat, explosive, poisonous or noxious substances, net, instrument, rod, line or any other appliance or article which he has reasonable cause to believe is being or has been used in contravention of the Act or any regulation made thereunder; or

(ii) fish which he has reasonable cause to believe was captured in contravention of the Act or regulation made thereunder; or

(c) Without warrant, arrest and search any person whom he may find committing, or whom he reasonably suspects of having committed an offence under the Act or regulation made thereunder.

It is an offence under section 7 for any person who willfully obstructs, hinders, assaults or resists an authorized officer or a police officer in the exercise of his powers under the Act or any regulation made under the Act. Such person shall be liable to a fine not exceeding P500.00 or to imprisonment for a term not exceeding twelve (12) months or both.

The last section of the Act (8) empowers the court to order any articles in respect of which an offence has been committed and any vehicle, or vessel which, with the consent or connivance of the owner thereof, was used in the commission of the offence, to be forfeited and to be destroyed, sold or otherwise disposed of. This is done when the offender is convicted.
TITLE:

POLICY AND LEGISLATION PERTAINING TO BOTSWANA FISHERIES

THREE PARTS:

➢ BACKGROUND

➢ POLICY EVOLUTION

➢ THE FISH PROTECTION ACT - 1975

1. BACKGROUND

➢ BOTSWANA WATER DEFICIENT - NO COASTLINE

➢ PRONE TO DROUGHT - (KALAHARI DESERT)

➢ FISHERIES POTENTIAL - NORTHWEST REGION

1.1 OKAVANGO

➢ FISHING PRESSURE SINCE 1980'S

➢ DROUGHT ⇒ CROWDING ⇒ CONFLICTS

➢ LAST TWO SEASONS - FLOODS FAIRLY GOOD

1.2 CHOBE/LINYANTI

➢ PERMANENT WATER PORTION WITHIN A NATIONAL PARK

➢ EAST - NOT SUITABLE FOR FISHING

➢ WEST - DRY (DROUGHT)
SPORT FISHING STOPPED
SUBSISTENCE FISHING – ADJACENT COMMUNITIES
DIFFERENCES IN POLICIES BETWEEN BOTSWANA AND NAMIBIA

1.2 LIMPOPO

EASTERN BORDER
ACCESS DIFFICULT – PRIVATE FARMS

2. EVOLUTION OF POLICY

1977 POLICY STATEMENT

Field experience indicates that neither of the natural and impounded waters are suitable for large-scale commercial production for sometime to come. However, the natural waters of the Okavango delta and related systems offer the best potential for gradualistic development, e.g. upgrading existing fisheries through a small but efficient fisheries administration. The eastern impoundments are faced with the basic problem of lack of interest from local villagers in producing, not eating native fish species”.

OBJECTIVES

- WORK WITH ACTIVE FISHERMEN
- UPGRADE SKILLS
- COLLECT BIOLOGICAL AND SOCIO-ECONOMIC DATA

STRATEGY

- FARMER TRAINING – 7-11 VILLAGE BASED COURSES PER YEAR
- INVESTMENT CAPITAL, FINANCE AND CREDIT (FAP, AE10, LG17/109 etc)
- FISH MARKET (DRIED SALTED FISH PURCHASED BY GOVT.)
• STAFF TRAINING (INTRODUCED 2-YEAR INSERVICE COURSE)
• PROMOTE FISH ACCEPTANCE

1988 POLICY COMMITTEE RECOMMENDED
• RESEARCH ON STATUS OF THE FISHERIES RESOURCE
• BOAT-BUILDING AND OUTBOARD MOTOR COURSE
• INTRODUCE AQUACULTURE – CREATE POST
• FISH MARKETING – DRIED AND FRESH
• LEGISLATION

1991 (NEW) AGRIC. POLICY

OBJECTIVES
• FOOD SECURITY
• EMPLOYMENT CREATION
• DIVERSIFICATION
• INCREASE OUTPUT AND PRODUCTIVITY
• CONSERVATION OF SCARCE RESOURCES

NO SECTOR SPECIFIC POLICY:
  0 OBJECTIVES RELEVANT
  0 BUT NOT NECESSARILY ADEQUATE
  0 SADC PROTOCOL HAS A CRUCIAL ROLE
  0 FAO CODE OF CONDUCT PROVIDES GUIDE
3. THE FISH PROTECTION ACT – 1975

SECTION 3

EMPOWERS MINISTER (OF AGRICULTURE) TO MAKE REGULATIONS FOR ANY AREA ON THE FOLLOWING:

- PRESCRIBE CONDITIONS FOR REGULATION OF FISHING
- REGISTRATION OF FISHING BOATS
- TIMES AND SEASONS OF FISHING
- ISSUANCE OF LINCENSES AND CERTIFICATES
- PRESCRIBE LICENCE FEES
- METHOD OF FISHING AND TYPE OF FISHING GEAR
- LIVE FISH IMPORTS INTO BOTSWANA
- LIVE FISH MOVEMENT WITHIN THE COUNTRY
- FISH SALES/MARKETING

SECTION 4

STIPULATES THAT:

- IT IS AN OFFENCE TO USE EXPLOSIVES, POISONS AND NOXIOUS SUBSTANCES
- PROVIDES FOR EXEMPTIONS FOR RESEARCH OR ANY REASON DEEMED NECESSARY

SECTION 5

Provides for minister to fix penalties:

- FIRST OFFENDER – P200 PLUS 3 MTHS INPRISONMENT
- SECOND OFFENDER – P500 PLUS 12 MTHS IN PRISON
SECTION 6

AUTHORIZED OFFICER PLUS POLICE OFFICER NOT BELOW ASSISTANT INSPECTOR EMPOWERED TO:

- SEARCH LAND, PREMISES OR BOATS
- SEIZE APPLIANCES AND EQUIPMENT USED IN CONTRAVENTION OF THE ACT
- SEIZE FISH BELIEVED TO HAVE BEEN CAUGHT ILLEGALLY
- WITHOUT WARRANT ARREST AND SEARCH SUSPECTS

SECTION 7

MAKES IT AN OFFENCE TO WILLFULLY OBSTRUCT WORK OF AN AUTHORISED OFFICER:

- FINE OF UP TO P500 OR UP TO 12 MTHS IN PRISON

SECTION 8

EMPOWERS COURT TO DISPOSE OF (SELL OR DESTROY) ARTICLES, EQUIPT., VESSELS OR VEHICLES USED IN BREACH OF THE ACT, ONLY AFTER SUSPECT HAS BEEN CONVICTED.
A HISTORICAL ACCOUNT OF FISHERIES RESEARCH IN THE OKAVANGO AND CHOBEB/LINYANTI SYSTEMS (BOTSWANA)

WORKSHOP ON CO-MANAGEMENT OF SHARED FRESHWATER FISHERIES

14-16 NOVEMBER 2000
ZAMBEZI LODGE
KATIMA MULILO
CAPRIVI – NAMIBIA

TREVOR G. MMOPELWA
FISHERIES SECTION
P/BAG 0032
GABORONE

TEL: 350502/350668
FAX: 581383/303744
E-mail – Tmmopelwa@gov.bw

1. Background

A notable characteristic of Botswana fisheries is a strong bias towards extension and fairly weak research establishment. Ten years of devotion to fisheries extension by one of the first expatriate officers (Cross 1967-77) to head fisheries in Botswana founded a fishery that produced a dried salted product. Bowley (1978) continued the good efforts of Cross, but did an even better job of promoting dried salted fish through extensive cooking demonstrations. The involvement of both staff and fishermen into utilizing fish and thus realizing its value set the pace for focusing on fish exploitation with little consideration for research and conservation.

The limited research activities that have taken place so far have been dominated by foreign experts and biologists with funding sourced from external donor agencies. This has had an obvious weakness of lack of consistency in following up research topics.

The apparent lack of commitment by government to fund fisheries research also contributed to the current poor status of knowledge of the resource base. The view that fisheries research and development should be left to external consultants had a negative impact on the development of local capacity to undertake fisheries research. It took the government 32 years after independence to make a definite decision to directly fund fisheries research activities.
Following is a chronological sequence of how fisheries research developed in Botswana. Because the Okavango and Chobe/Linyanti systems offer the best fisheries potential in the country they have inadvertently been the centers of fisheries research.


The foundation to fisheries research in the Okavango was laid out in the pre-independence period by Maar. Although his interest was on taxonomic studies and species composition of resident fish species in the delta Maar gave an estimate of standing stock of 10,000 tons for the delta. This figure has been widely quoted as the basis for developing the Okavango fishery. The funding from OXFAM was also used to build the current office facilities in Maun. *(The 1963 report referred to here could not be located).*

3. Fox

Working with a set of gillnets with a range of mesh sizes and a seine net (60m x 4m x 15mm), Fox established that there are 70 – 80 species recorded from the Okavango Delta. But compared to other freshwater ecosystems subject to seasonal flooding the Okavango was found to be less productive than other sub-tropical and tropical floodplain ecosystems. Estimates of standing stock for small unenriched lagoons in the southern delta were between 100 and 200kg/ha. The highest estimate of 700kg/ha recorded came from a small lagoon on the periphery of the delta populated by livestock. Fox attributed the low productivity to the following:

- **Nutrient deficient water** - The poor growth of algae and phytoplankton are an indication of low nutrient load. Also the dense growth of aquatic vegetation (reeds and papyrus mats) has a filtering effect as the water flows downstream. In such vegetated areas light penetration is poor and therefore respiration exceeds photosynthesis leading to substantial oxygen demand. Such areas support low numbers of fish.

- **Delayed flood cycle, coinciding with low temperatures**: After the rains, the flood takes six months to reach southern regions of the delta. So in much of the delta, the flood arrives during the coldest part of the year. Breeding seems more temperature dependent than rising floods. Low temperatures affect the efficiency with which fish can utilize food, and it is thus a disadvantage that a large part of the delta receives floods during the cold months, after the best season for fish growth.

- **Predator imbalance**; Piscivorous fish occupy a fairly large proportion of the biomass, however this could be due to the selectivity of gear (gillnets) used.
4. Gilmore

One of the expatriate officers who had two opportunities to work in Botswana (Katisi pers. comm.) first as a peace corp under Cross in early 1970’s and secondly as an officer heading fisheries development in the country (1977 – 1979). Much of his investigatory work was follow up activities to Maar’s efforts. As a Fisheries Officer, Gilmore emphasized the need for development of a policy and strategy to serve as guidelines for and administration vested with the role of initiator.


The greatest ever intensive work on the ecology of the fishes of the Okavango was undertaken by Merron on his PhD studies with the JLB Smith Institute of Ichthyology (South Africa). It is understood this was a response to a request by the Botswana Fisheries Section to gather biological data on commercially important species. The information was to be used as the basis for recommending ways to increase the local harvest of fish while conserving the long term integrity of this important resource.

In his approach Merron set out a major objective as to establish the response of the fishes to the annual flood cycle and to identify the key factors of the flood that determine the nature of fish communities.

He divided the Okavango into four ecological zones (ecotones); riverine floodplain; perennial swamp; seasonal swamp and drainage rivers. Due to logistical difficulties in accessing some sampling sites, a quarterly sampling programme was followed using a wide selection of fishing gear including rotenone.

A few of the major findings and recommendations from Merron’s three-year intensive work were:

- A higher species diversity was recorded in the riverine floodplain and perennial swamp than elsewhere.

- The catch per unit of effort (CPUE) was more constant in the riverine floodplain and perennial swamp than in the other two zones where it fluctuated widely.

- In contrast to most other African floodplains, the arrival of the annual flood in the Okavango coincides with the dry winter months. Both the flood cycle and increased water temperature greatly influence the breeding cycles of species studied.

- Some species have adopted reproductive strategies to survive the changing environmental conditions as a result of cyclicity of the flood. African pike, *Hepsetus odoe*, for example construct a foam nest for guarding the young and provide an oxygen rich environment.
The most interesting seasonal change in diet in relation to the annual flood was demonstrated by the African catfish, *Clarius gariepinus* that congregates and hunt in packs, commonly referred to as the barbel run.

Previous yield estimates of 10,000 tons per annum based on the delta surface area of 15,000km² were inflated. The surface area of the productive perennial water is approximately 1000km² and this should give a new yield estimate of 5000 tons per annum, using Welcomme’s formula.

There was a potential to increase the commercial fishery, but it must be realized that there are other exploiters of the fish resource, namely recreational fishery and artisanal fishery.

The prolific catfish *Schilbe mystus* was very much underexploited although it represented a considerably large biomass. Fishermen could be encouraged to target this species and reduce fishing pressure on larger species. Small mesh gillnets (50-63mm) could be used as they could not catch juvenile cichlids in open waters where the silver catfish was abundant.


As lake Liambazi dried a great many people, including the fishing cooperative at Satau, who depended heavily on fishing were at risk of losing regular protein supply and income. The Fisheries Section had to identify potential fishery sites along the Chobe/Linyanti permanent swamp. A five-day test fishing was therefore conducted at Zibadianja and Matsaudi lagoons.

A fleet of gillnets ranging in mesh size from 25mm to 125mm were used. Three commercially important species, *Schilbe mystus*, *Clarias spp.* and cichlids accounted for 74.75% of the catch, in numerical terms.

7. Bills, 1996 (JLB Smith Institute)

With the increase in the number of incidents of conflicts between safari operators and commercial fishermen, the Okavango Wildlife Society (OWLS) requested the JLB Smith Institute of Ichthyology (JLBS) to conduct an assessment of the fishery of the panhandle region. This followed complaints directed at OWLS that fish stocks in the Okavango were in the decline.

The Kalahari Conservation Society (KCS), a locally based conservation NGO, coordinated the project. NORAD provided funding for the project.

Three sites (Guma lagoon, Ngarange and Samochima) were sampled for 7 days each using a graded series of gillnets (50mm, 70mm, 90mm, 110mm and 130mm). Mesh panels were 10m long and 2m deep. The number of panels for each mesh size were 3 x 50mm, 2 x 70mm, 3 x 90mm, 1 x 110mm and 1 x 130mm. Data from this study was to
be compared to results obtained by Merron.

Questionnaire surveys were conducted on commercial fishermen at Ngarange and Samochima, to find responses to 45 questions. Four (all the visited) tourist lodge owners were interviewed, and one hook and line fisherman was interviewed at Samochima. The questionnaire and interviews were meant to achieve an item of the Terms of Reference i.e. “determine the opinions regarding fish stocks in the panhandle and degree of fishing activities…”

The one-month study concluded that:

- Results from the sampling and commercial fishermen’s catches did not indicate overfishing. There was no significant difference between mean sizes of certain fish species to those collected by Merron (1983-86). If there was overfishing the average size would have declined since Merron’s collections.

- Tourists’ claims that the number and size of fish caught have declined could not be substantiated for lack of historical records either at fishing lodges or within the Fisheries Section.

- The Fisheries Section and fishing camps need to initiate standardized record keeping of catch data immediately.

- Training and upliftment of skills of the section staff should be given the highest priority.

- Some commercial fishermen thought that there has been a decline in fish biomass but attribute this to low water levels.

- With instances where single fishermen own up to 100 nets there was certainly the potential for overfishing in the Okavango panhandle.

8. University of the Orange Free State – (Okavango Fish Parasite Project)

The University of Orange Free State was awarded a four-year research permit to conduct research on fish parasites and diseases. The aim of the project was to establish what parasites and pathogens were present in the Okavango system, how changes such as extraction of water and pollution would influence the balance between fish and parasites. The Debswana Diamond company provided part of the funding of up to P450, 000.

The 1998 fieldwork collected samples from several habitat types including Xaro camp, Guma lagoon, Pepere lagoon and Film camp. Work was undertaken during winter months (June to August) when floods were receding in the panhandle.

The fishes in these floodplain pools were severely infested with different parasites.
Specimens representing 52 species from the Okavango were collected. From those 25 parasite groups were identified which could represent an estimated 80 different species. Two new parasites that have never been found before were discovered.

Snail vectors of Bilharzia were encountered at different places. Some of the snails were found to be infested with Schistosoma parasite responsible for human bilharzia.

9. Fish Stock Assessment Project

At the request of Botswana government the Norwegian Institute for Nature Research (NINA) undertook a feasibility study for the fish stock assessment programme in Okavango in 1993, through NORAD funding. The outcome of this study was never carried forward. A follow up study was undertaken in 1996 by Jeppe Kolding of the University of Bergen (Norway). He recommended that basic and applied research be segregated and the latter be the main task of the Fisheries Section while basic research be left for academic institutions. This recommendation gave signs of a much leaner project focusing on stock assessment which NORAD developed interest to fund its implementation. Unfortunately, following a stakeholder workshop that was part of the preparatory process for the project, NORAD announced that due to OECD classification of Botswana, a policy decision has been taken that NORAD support to Botswana was to be phased out. This implied that the impending project could not get financial assistance from NORAD.

Subsequently the government decided to finance the project herself as part of the eighth national development programme. This was the first time ever that government had provided development funds for a fisheries project. The project was launched in September 1999 and will last for 3 years.

The approach of data collection in this project is very much similar to work undertaken at Bangweulu swamps (Zambia). Thus in parallel with the sampling programme undertaken by the section staff, twenty fishermen were engaged to supply data from the commercial fishery. Fortunately, Dr. Kolding who designed the methodology of fishermen's participation in data collection was contracted to supervise the project as a visiting consultant. Two trips are to be made to Botswana annually.

9.1 Sampling By Fisheries Personnel

Initially three sampling sites were identified at Seronga, Ngarange and Shakawe. Over a three-month period all three stations were sampled simultaneously by station-based teams to cater for fish migration. The teams collected data using multi-mesh experimental gillnets (50, 75, 100, 115, 125mm) on species, individual fish length and weight, mesh size from where the fish was caught, and gonadal stages of selected fish species. Simultaneous sampling was only possible when we had additional manpower from Maun Technical College. Twelve students were on attachment with the Section for field exposure.
As of March 2000, with input from the consultant's first visit, the sampling stations were reduced to two i.e. Ngarange and Seronga, and resorted to a single four-man mobile team due to manpower constraints. The team collects ten-day samples at each site monthly.

9.2 Data Collection By Fishermen

Of the twenty fishers selected to participate in the project, ten record data from their commercial gillnet (acquired from FAP) catches. The other ten use multi-mesh experimental gillnets exactly the same as those used by the fisheries research team. Records by fishers are kept simple and limited to species, individual fish length (not weight) and mesh size only. Each fisher has been issued with a measuring ruler, pencil and recording exercise book. New books are issued whenever old ones are filled. Fishermen using their own gear are paid a monthly incentive fee of P50. Those issued with multi-mesh research nets are allowed to utilise the catch for their household needs as a reward.

9.3 Project Resources

As there is no vehicle specifically allocated or purchased for the project, a vehicle was loaned from the government central transport department to get the project started. This is a 1994 vehicle that sometimes spends two months under maintenance, and thus disrupting sampling schedules. A project memo intended to provide the necessary transport initially budgeted for was submitted to the ministry planning unit in January this year.

Initially funds for incentive fees were paid from a member of staff's (Mr.Mosepele) thesis funding provided by the University of Bergen (his field work coincided with the commencement of the project). There was a bit of a problem identifying how the fishermen would be paid when the fund was exhausted. This was ultimately resolved with advice from government finance administrators.

Assigning four staff members to work full-time on the project means diverting manpower resources from their normal and regular duties. But the regular extension duties have to be carried out, and some staff rationalization and reorganization had to be done to maintain our output. This is however strenuous and now believe the authorities have to let rationale prevail. We were supposed to recruit more field assistants, only to be told to accept staff cuts from Tsetse Control Division. Without holding anything negative about the quality of Tsetse staff, I am certain that the division will not part with the best of its personnel. Maun Technical College is producing young Batswana who acquire the necessary fisheries skills through a two-year fisheries course and are more than suited for our mandate, and there is therefore no justification why we should settle for the second best.

10. AquaRAP – 2000

Conservation International (an international NGO), Botswana branch organized an
Aquatic Rapid Assessment Programme (AquaRAP) for the Okavango in June 2000. The goal of AquaRAP is to survey the biodiversity of freshwater aquatic systems. This was the first AquaRAP in Africa and specific objectives were as follows:

- Highlight biodiversity and uniqueness of the Okavango Delta.
- Collect and disseminate data on the changes in the aquatic systems of the delta over the past 12 years.
- Foster support among local communities, tourism operators, tourists and scientists by developing monitoring kits

About five groups of experts representing taxonomic fields of:

- Fish
- Invertebrates
- Limnology – Water Chemistry
- Aquatic birds and
- Aquatic plants

were formed with internal and local scientists participation. The Fisheries Section stock assessment team joined the Fish group for the one month expedition.

Sampling by the fish team began on 4th June and continued to 24th June. Sampling methods used were gillnets (two graded fleet of the following mesh sizes in mm: [net 1; 1, 21, 27, 36, 56, 73, 96, 118, 130]; [net 2; 50, 75, 100, 115, 125]; 30m and 3m long seine nets, a cast net (3m diameter); a D-frame dipnet; angling; electric fishing; and examining local fishermen’s catches and buying relevant specimens from them.

Four sampling areas were chosen; Shakawe, Guma lagoon, Xakanaxa and Oddball’s Camp.

- 64 – 66 species (some unidentified) were collected. The highest species diversity was at Shakawe where more than 54 species were recorded. Guma had the lowest diversity (36) due in part to the absence of riverine habitants. Oxygen levels were particularly low at Guma.

- One undescribed species of Aplocheilichthys was collected at several sites at Xakanaxa.

- Although the variety of habitats was lower at Oddball’s camp resulting in lower species count, noteworthy was the presence of six Serranochromis species occurring in the delta in a single gillnet catch. What was surprising, though, was the small size of fish compared to those at Shakawe. This was clearly not due to fishing pressure, as Oddball’s camp has no commercial fishing activities.
The team concluded that the current conflict between commercial fishermen and angling tourist lodge operators were not a result of overfishing. The issues at stake were more social, economic and environmental, so any decisions on management of fishing activities should take all aspects into consideration.

REFERENCES


TITLE

A HISTORICAL ACCOUNT OF FISHERIES RESEARCH IN THE OKAVANGO AND CHOBE/LINYANTI SYSTEMS (BOTSWANA)

TOPICS:

➢ BACKGROUND

➢ RESEARCH INITIATIVES
  • MAAR
  • FOX
  • GILMORE
  • MERRON

3 NENGU

• BILLS

• UNIVERSITY OF ORANGE FREE STATE

4 FISH STOCK ASSESSMENT BY GOVT.

• AQUARAP 2000
  BACKGROUND

➢ BIAS TOWARDS EXTENSION

➢ WEAK RESEARCH ESTABLISHMENT

➢ TRACED TO THE FOUNDING OF FISHERIES
  • NO FISHERMEN
  • PEOPLE DID NOT EAT FISH

➢ RESEARCH DOMINATED BY FOREIGN EXPERTS

➢ GOVT. RELUCTANCE TO FUND FISHERIES

➢ WEAK INSTITUTIONAL CAPACITY

MAAR (1965)
PRE-INDEPENDENCE RESEARCH WORK
ESTIMATED 10,000 TONS FOR OKAVANGO
BUILT CURRENT OFFICES (NOW DILAPIDATED)

FOX (1996)
OKAVANGO LESS PRODUCTIVE
NUTRIENT DEFICIENT WATER
DELAYED FLOOD CYCLE
PREDATOR IMBALANCE

GILMORE (LATE 60'S/EARLY 70'S & LATE 70'S)
FIRST AS PEACE CORP
AS GOVT. OFFICER EMPHASIZED NEED FOR POLICY

MERRON (1983-86)
MOST INTENSIVE RESEARCH WORK EVER IN DELTA
GVT. NEEDED INFO. FOR MANAGEMENT PURPOSES
EMPHASIZED ROLE OF SEASONAL FLOODS

FOUR ECOLOGICAL ZONES:
- RIVERINE FLOODPLAIN
- PERENNIAL SWAMP
- SEASONAL SWAMP
- DRAINAGE RIVERS

HIGHER SPECIES DIVERSITY AND CONSISTENT CPUE IN RIVERINE FLOODPLAIN AND PERENNIAL SWAMP

ADAPTIVE SURVIVAL REPRODUCTIVE STRATEGIES – PIKE
➢ SEASONAL CHANGE OF DIET - CATFISH PACK HUNTING
➢ YIELD LOWER THAN PREVIOUS (MAAR'S) ESTIMATES – 5000 TONS
➢ POTENTIAL TO INCREASE COMERCIAL FISHERY EXISTED
   ➢ SILVER/BUTTER CATFISH UNDEREXPLOITED

NENGU (1988)
➢ TO HELP CHOBE FISHERS IDENTIFY PRODUCTIVE GROUNDS
   FOLLOWING DRYING OF LAKE LIAMBEZI
➢ CLARIUS, SCHILBE AND CICHLIDS DOMINATED CATCHES
➢ NO MAJOR CONCLUSIONS (5-DAY TEST FISHING)

BILLS (1996)
➢ COMPLAINTS OF DECLINE IN FISH CATCHES FROM TOURIST
   SPORT FISHERS.
   ➢ JLB SMITH CONTRACTED – PRIVATE INITIATIVE
   ➢ MERRON'S DATA USED AS REFERENCE POINT
   ➢ ONE MONTH STUDY – 3 SITES, 7 DAYS EACH
➢ QUESTIONNAIRE FOR FISHERMEN AND LODGE OWNERS
   ➢ RESULTS SHOWED NO OVERFISHING
➢ NOTED POOR RECORDS (FROM GOVT. AND LODGES)
➢ POTENTIAL TO OVERFISH EXISTED – CAME ACROSS 100 NETS
   OWNED BY A SINGLE FISHERMAN

UNIVERSITY OF ORANGE FREE STATE
(OKAVANGO FISH PARASITE PROJECT)

➢ TO DETERMINE OCCURRENCE OF FISH PARASITES AND DISEASES AND WHAT INFLUENCED THEM

➢ COLLECTIONS MADE IN WINTER

➢ FISH SEVERELY INFESTED

➢ FROM 52 FISH SPECIES, 25 PARASITE GROUPS THAT COULD REPRESENT 80 DIFFERENT SPECIES

➢ SNAIL VECTORS OF BILHARZIA WITH SCHISTOSOMA ENCOUNTERED

FISH STOCK ASSESSMENT PROJECT (1999)

➢ FIRST EVER FUNDING FROM GOVERNMENT

➢ LAUNCHED SEPTEMBER 1999 (TO LAST 3 YEARS)

➢ APPROACH: LENGTH-BASED STOCK ASSESSMENT

  ▪ TO DERIVE GROWTH AND MORTALITY

➢ SIGNIFICANT AMOUNT OF DATA NEEDED

  ▪ RESEARCH TEAM (STAFF)
  ▪ FISHERMEN

RESEARCH TEAM

  ▪ INITIALLY 3 BASE STATIONS (SHAKAWE, NGARANGE & SERONGA)

  ▪ SAMPLED SIMULTANEOUSLY (MIGRATION)

  ▪ LATER REDUCED TO 2 SAMPLING SITES

  ▪ MOBILE TEAM OF 4 PEOPLE

  ▪ 20 DAYS AT EACH SITE PER MONTH

  ▪ USE MULTIMESH GILLNETS (5 MESH PANELS)
• RECORD DATE, TIME AND METHOD OF FISHING, SPECIES, LENGTH, WEIGHT, MESH SIZE, AND GONAD STAGE

FISHERMEN

• 20 SELECTED FROM SAMOCHIMA, SHAKAWE, NGARANGE AND SERONGA

• 10 USE OWN GEAR -PAID P50. PER MONTH

• 10 USE MULTI-MESH GILLNETS- UTILISE CATCH

• ALL RECORD DATE, TIME AND METHOD OF FISHING, SPECIES, MESH SIZE AND LENGTH.

• DATA ENTERED USING PASGEAR (SOFTWARE PROGRAMME).

CONSTRAINTS

• TRANSPORT

• STAFF

• INCENTIVE FEES?

• EVERYTHING SECOND HAND (VEHICLE, COMPUTER, AND STAFF).

AQUARAP – 2000

➢ ORGANISED BY CONSERVATION INTERNATIONAL (BOTSWANA BRANCH)

➢ OBJECTIVES:

• HIGHLIGHT BIODIVERSITY AND UNIQUENESS OF DELTA

• OBSERVE CHANGES OVER 12 YEAR PERIOD

➢ FIVE GROUPS OF EXPERTS INCLUDING ONE ON FISH

➢ SAMPLED 3 WEEKS IN JUNE – FOUR SITES CHOSEN
> COLLECTED 64-66 FISH SPECIES

> ONE UNDESCRIBED SPECIES OF *APLOCHEILICHTHYS* AT XAKANAXA

> SMALL SIZE OF PREDATORY CICHLIDS (*SERRANOCROMIS*) FROM SOUTHERN DELTA?? (NO COMMERCIAL FISHING ZONE)

> CURRENT CONFLICTS NOT A RESULT OF OVERFISHING AS ALLEGED.

> NEED TO ADDRESS SOCIO-ECONOMIC AND ENVIRONMENTAL ASPECTS, AS THESE ARE THE REAL ISSUES.
CONSTRAINTS TO FISHERIES
DEVELOPMENT IN BOTSWANA

PREPARED BY
J.M. MANYEMANE
SENIOR TECHNICAL OFFICER
MAUN, BOTSWANA

FISHERIES SECTION
The Fisheries Unit, vested with the powers to ensure sound management of the fishery resources, is placed under the Ministry of Agriculture. It is a unit within the Division of Animal Production in the department of Animal Health and Production, and as such, it is competing for the same resources with the strong livestock units.

POLICY
The Fisheries Sector does not have any policy guidelines that are specific to it. It operates on the broad policy guidelines of the Ministry of Agriculture, which are:-

- Improving food security at both household and national level.
- Diversifying agricultural base for more income opportunities.
- Increasing agricultural output and productivity.
- Increasing employment opportunities for the fast growing labour force.
- Providing a secure and productive environment for those engaged in agriculture.
- Conserve scarce agricultural and land resources for future generations.

STATISTICS
A fisheries data collection system is an important part of any fisheries department. The system provides information on fish stocks and fishing industry and hence, assists in achieving an effective management of the resource. However, Botswana is still faced with a problem of inadequate recording of fish catch data as done by the fisher folks who are engaged in fishing. As a result, the level of fish exploitation is not known. Other factors that contribute to inadequate recording of fish catch data are:- scattered and migratory nature of fishermen, the low literacy level of fishermen, shortage of extension staff and the difficulty in accessing some of the fishing grounds.
Due to inadequate recording of fish catch data and lack of information on fish stocks, Botswana is still not able to estimate the level of sustainable harvesting.

**LEGISLATION**

Fisheries legislation exists in the form of a Fisheries Act enacted in 1975 and has never been revised. The legislation has never been enforced due to lack of data to form the basis for management plans. For the management of any resource, it is of vital importance to have control measures clearly stated in the legislation.

Currently, fishing in Botswana is done on an “open door policy” (in exception of some areas such as Wildlife National Parks and dams whereby fishing permits have to issued). Anyone wishing to fish can do so at anytime. As a result, it is very difficult for the Fisheries Unit to impose control measures such as number and mesh sizes of nets to be used, allowable number of fishermen, licenses for sport fishers and control of spawning grounds.

**CONFLICTS BETWEEN FISHERMEN AND FISHING CAMPS**

The tourist industry is booming in the Okavango Delta and a number of fishing camps have been established for angling/sport fishing. Due to lack of legislation to control fishing activities, there are at present some conflicts between subsistence/commercial fishery and the tourist industry. Both parties claim that the other party is catching too much fish or that their activity is not environmentally friendly or is detrimental to the interest of the other. It is difficult to determine the true state of affairs, but certainly the conflicts will intensify as the population grows and the tourist industry and commercial fishing expand.

This could however be resolved by ensuring that the area of operation of subsistence/commercial fishermen does not overlap with that of the tourist industry. Thus, a policy to this effect has to be developed and implemented.

**SUBSISTENCE AND COMMERCIAL FISHING**

The current fishing practice is at a subsistence or small scale commercial level. Lack of marketing infrastructure, specially for fresh fish is a major negative factor. For the fishermen to market their catch in towns where the demand for fresh fish is high, cooling and freezing facilities are required. This has proven to be an expensive venture to the fishermen.

Currently, there is one freezer point that is operational in the upper Okavango and has slightly improved the market of fresh/frozen fish. However, a certain number of individual fishermen have been assisted with freezer facilities.

**WATER SITUATION**

Water is another major constraint in Botswana. The drying out of lakes such as Ngami and Liambezi, Thamalakane and Boteti rivers has had a significant reduction in the size of fishable natural surface water. Hence the concentration of fishing activities in the
Okavango Delta pan handle which has also increased the conflicts between the Safari Operators and subsistence/Small Scale Commercial Fishermen.

AQUACULTURE
Fish farming is not yet developed in Botswana. The only form of aquaculture that exits is that of dam fishery and small ponds constructed by some Junior Community Secondary Schools. Requests for private dam stocking and from the Junior Community Secondary Schools are met from seining some of the existing dam with established fish populations.

The main bottlenecks toward the development of this industry is the lack of hatchery facilities, lack of adequately trained manpower within the Fisheries Section and Small allocation of resources to the sector.

INSTITUTIONAL COLLABORATION
Okavango Delta is a shared resource involving various government departments, non-governmental organisations and community.

Collaboration and consultation amongst these parties is lacking. Each party is working independently of others, resulting in duplication of efforts regarding the use of the delta.

CONCLUSION
For a long term fisheries management plan to be developed for sustainable utilization of the fish resource, an intensive research on the Okavango fish stock should be embarked upon. The baseline biological and ecological data obtained will facilitate the formulation of a better fisheries management strategy. To this effect, the fisheries section has commenced a three year fish stock assessment programme in the Okavango Delta panhandle.

References:-
Proceedings of the Conference on Wetlands Management in Botswana
Annexure C
Annexure C

Namibia Country Paper
Ministry Of Fisheries And Marine Resources

E S Boys
Prepared by: Policy and Planning Division
Directorate: Policy, Planning and Economics
1. **Introduction:**

The Namibian constitution (article 95) states that “the state shall actively promote and maintain the welfare of the people by adopting---policies aimed at---maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilisation of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future”

This principle is in line with the Rio convention on biological diversity which elaborates the dependence of many traditional communities on these biological resources and therefore, the need to share in the benefits arising from the biodiversity equitably.
As a member of the world's major fishing nations, the Namibian government took up the challenge and introduced two main national policies namely, the “White Paper Towards The, Responsible Development of the Fisheries Sector (1991)” and the second White Paper Entitled “Responsible Management of the Inland Fisheries in Namibia (1995)”. These main policies are today the major instruments that are directing the development and management of marine, inland as well as aquaculture fishery sectors and resources. Some of the policies outlined in these documents (“Responsible Development of the Fisheries Sector, 1991”) have further been translated into legislation and regulations to facilitate the implementation of the policy directives that are aimed at ensuring sustainable utilization of these resources as outlined. However, for the purpose of this paper, though, I will mainly concentrate on the policy and legal issues pertaining to the inland fisheries in Namibia.

Additional policies and legal instruments are being elaborated on to comprehensively cover the fishery resources in the country, while at the same time strengthening the existing mechanisms that are employed in different local authority areas at present to achieve the efficiency and effectiveness required. These efforts are a response in realization of the research findings which indicated;

The richness of the Namibian fresh water fish fauna,

♦ That at least 100,000 people derive their daily livelihood from these resources,
♦ The need for its conservation,
♦ That cost effective management and utilization measures, involving the traditional, regional and local authorities, are needed for long term and optimal benefit from these resources to Namibians.
2. Policy Framework Governing The Inland Fishery Sector In Namibia:

"White Paper on Responsible Development of Inland Fisheries, 1995".

During the definition/development of inland fisheries policy, the draft policy document was widely circulated and debated by major stakeholders. Consultations and extensive discussions took place at several workshops held during the process of elaborating the policy framework. The policies stipulated in this document are promoting sustainable and optimal protection and management of the inland fish fauna, including its utilisation.

Secondly, the inland fisheries policy also emphasizes the importance of the involvement of communities in inland fisheries management. In accordance with this requirement, the minister is to consult with the regional, local, traditional authorities concerned. For this reason, the policy document was widely distributed and debated extensively.

In addition, consideration was given to local traditions and the role of the traditional and local leaders in regulating fishing and fishing practices in different areas of Namibia and more so, to the riparian communities. Comments and suggestions of the major stakeholders are therefore, fully integrated into the policy document.
2.1. Major Features of The Inland Fisheries General Policy:

- To protect and conserve aquatic ecosystems and allow the utilization of inland fisheries resources sustainably and at optimal levels;
- To ensure long term food security more especially to the riparian communities;
- To prevent harmful impact on traditional fishers dependant on inland fish resources for food security from uncontrolled commercialisation of these resources, both directly by commercial fishing and through tourism activities;
- Promote cooperation with the neighbouring countries for the management of the shared water course systems and inland fisheries resources therein;
2.2. Inland Fisheries Bill and Regulations:

In order to facilitate the smooth implementation of the policy directives, the government is working on both the Inland fisheries Act and Regulations at the moment. While the Act is to provide the officially induced legal basis for the coordinated management of the Inland Fisheries sector, the Regulations will ensure the enforcement of the policy directives and control.

The Act will provide for the conservation of aquatic systems and the sustainable development of Inland fisheries resources. The Act will also spell out detailed restrictions and allowances provided for to ensure satisfactory management and growth of this sector.

2.2.1. THE FEATURES OF THE ACT AND THE REGULATIONS:

A. FEATURES OF THE REGULATIONS:

- Closed season
- Proclamation of closed areas and breeding sanctuaries
- Licensing systems
- Bag limits
- Mesh size restrictions
- Enforcing the protection of certain species, its breeding stocks and fry,
- Regulating the fishing effort, through gear restrictions
B. FEATURES OF THE ACT:

• to ensure the sustainable and optimal utilization of the fresh water resources,
• to ensure that the objectives in (a) are based on sound ecological knowledge and principles,
• to in communal resources, favour utilization by subsistence households and fishers rather than the commercialization of the resources
• to ensure that the responsibility for the management of communal resource is vested at local level rather than with central Government through a “top down” system,
• to ensure that Local subsistence fishers are consulted about the extent the communal resources can be used for competitive and recreational angling by tourist,
• to regulate the exploitation of fish in government owned dams,
• to strive towards a holistic approach in the management of the fish, the rivers and floodplain environments,
• to regulate sport fishing in inland waters, and
• to ensure ensure coordination and cooperation between countries in the region, sharing inland water bodies and rivers with Namibia.
3. **Aquaculture Policy, Bill and Regulations:**

The policy of the government is to treat the aquaculture and mariculture matters separately from the general fisheries matters. In accordance with this expressed view, the ministry of fisheries and marine resources undertook to define a separate policy directives and legal framework for this industry in the fishing sector.

Hence, the aquaculture policy, bill and regulations are being defined separate from inland fisheries and it concentrates mainly on fish farming and ranching. The proposed policy directives for aquaculture are aimed at facilitating the aquaculture development for the social and economic benefit of all Namibians; while at the same time it will ensure responsible and sustainable management of this industry.

Draft aquaculture bill was drawn up to facilitate the implementation of the policy, but is currently going through major revision to take account of major institutional and related factors to ensure that the document is comprehensive once completed. After both the policy and the draft bill are concluded, work on the regulations will resume.
• Women be fully involved in the aquaculture development process,

• Aquatic farming communities, voluntary aquaculture producer organizations and individual aquatic farmers are to be encouraged to develop responsible aquaculture at the farm level,

• Aquaculture ventures be self-sustainable, and

• Land based, equitable and balanced participation of Namibians in this industry be encouraged.
Namibia – Research history

C.J. Hay
Ministry of Fisheries and Marine Resources, Private Bag 2116, Mariental, Namibia.

ABSTRACT
Freshwater fish play an important socio-economic role especially in the Omusati, Oshana, Otjikoto, Oshangwena, Okavango and Caprivi Regions in Namibia. The protection of this limited resource is of the utmost importance to secure the future food availability within these regions.

The newly adopted Inland Fisheries Policy is the first step towards the responsible management of this very important resource. An overview of the policy will be discussed.

Since independence, research has especially been directed towards the rivers where fish form part of the daily diet of the local inhabitants. Fish ecological studies were conducted to recommend management actions directed towards the sustainable utilization of the fish resource.

INTRODUCTION
The importance of inland fisheries as a source of animal protein cannot be over-emphasised in Namibia. More than 100,000 people are directly or indirectly dependent on this valuable resource. The people in the Omusati, Oshana, Otjikoto and Oshangwena regions utilise the fish resource from the oshanas during the flood season. The fishing in these regions is seasonal except for the Etaka oshana that is a perennial where fishing continues throughout the year.

The fishing along the Okavango, Zambezi and Chobe Rivers are intense with peak fishing periods during the low water seasons when the fish are concentrated in high densities. The annual migration of several fish species in the Zambezi River also stimulates intense fishing. The fishing in the Okavango is mainly for subsistence whereas the fishing in the Zambezi and certain parts of the Chobe also has a commercial aspect. Fish caught in the Chobe near Kasane are sold in Botswana to subsidise the daily food needs for the people. A commercial fish market is present in Katima Mulilo receiving fish mainly from the fisherfolk near Lisikili and the Zambezi River. Fish are also exported to Rundu and Oshakati.

Recreational fishing, especially in the Caprivi, also contributes to a significant inflow of revenue to the region and to the alleviation of unemployment.

RESEARCH HISTORY
A monitoring program for the Lower Orange, Kunene, Okavango, Zambezi, Chobe and Kwando Rivers is in place to establish a baseline from which tendencies within the fish populations can be identified and analysed. During these surveys, biological and
environmental parameters are recorded for future comparisons. Several types of gear are used to prevent selective sampling. These gears include gill nets, seine nets, dip nets, electro shocker, hook and line, rotenone and traditional gears.

The results of these surveys are analysed to give recommended management actions for legislation. This is done separately for all the perennial rivers. The degree of human impact on the fish resources varies between the perennial rivers and also within the rivers. The river systems all have different characteristics and will be treated differently in the legislation. Three different fisheries were identified in especially the Zambezi River. These are subsistence fishery, commercial fishery and recreational fishery.

The following research has been conducted at the Freshwater Fish Institute in the later years:

- Fish ecological studies on:
  - Lower Orange River (since 1995)
  - Kunene River (since 1990)
  - Okavango River (since 1989)
  - Zambezi/Chobe/ Kwando Rivers (since 1993)

- Radio telemetry projects:
  - Hardap Dam
  - Okavango River
  - Zambezi River

- Project on “Mitigating malaria in Namibia by biological control of mosquitoes”
- Projects on the protection of endangered fresh water fish species
- Projects on fresh water prawns and crayfish
- Socio-economic studies on the importance of fresh water fish in the Okavango and Caprivi
- Studies on the subsistence fishery on the Okavango and Zambezi Rivers
- Data collection program project with the Impalila community
- Migration, habitat utilization and behaviour studies on selected fish species.
The Okavango River
The Okavango River has been surveyed annually since 1989 from Nkurenkuru in the west to the Mahango Game Reserve in the east.

The Okavango River with the four zones (according to Hocutt et al. 1994) and the seven main sampling localities.

A table with the ten most important species in each of the fisheries: local fisheries, gill net catches and the other experimental gear used is listed. The importance of the species between these fisheries differs indicating the selectiveness of the fishing gear.

The Mahango Game Reserve was used as a control to compare the areas where no fishing is allowed with those areas exposed to intense fishing by the local people. The small mesh size gill nets showed very little difference between the different localities or zones. The large mesh size gill nets however had a much higher cpue within the protected areas. Literature does indicate that large individuals are replaced by smaller individuals due to fishing pressure. The effect of fishing activities is further emphasised when the cpue is compared with the human population density. The cpue is significantly inversely correlated with human population densities. Hence fishing have had a definite effect on the fish resource in the Okavango River.

The following management actions are recommended:
Management actions for immediate implementation

- All traditional gear may be allowed
- Gill nets and angling equipment should be the only modern gear allowed.
- All mesh sizes – to prevent selective fishing
- Gill nets should be registered
- Only people resident in Okavango should be allowed to register nets in Okavango
- A maximum of two gill nets - total length of 50m
- No gill net should be set in such a way to close off more than 50% of a waterbody
- The dragging of any fishing device should be prohibited
- No activities or gears should be allowed which may potentially pollute the environment
- No explosives, poison or electrical devices should be allowed
- No artificial light during any fishing activities should be allowed
- The recreational fishery should be licensed
- A bag limit of not more than 10 fish per day should be set
- All catches should be recorded on a form to be provided
- All motor powered boats used for fishing should be registered and licensed
- Organisers of angling competition must seek permission from the Ministry

Management actions for future considerations

- Establishment of fish sanctuaries addition to the Mahango Game Park should be considered
- Closed fishing seasons could be implemented to protect fish populations
- Defined areas for specific activities, such as fishing safaris, should be considered
- Initiation of a community data collection program to increase the fish database should be considered
- Continuous international collaboration with neighbouring countries should be given a high priority

Future research programs

- Long term monitoring program should continue
- Data from the subsistence fishery should be collected on a regular basis
- Knowledge of fish behaviour and migration is limited. Studies should be conducted on these aspects
- The socio-economic role of fish in the region should be subject to ongoing studies
- Collaboration with neighbouring countries is essential if the fish resource is to be managed properly
- Where possible, comparable data sets from neighbouring countries should be included in future analysis
A detailed report on the Okavango River fish surveys was published in 2000.

The Zambezi River
Fish survey data from the Zambezi River have been collected annually since 1997 and will be published during 2001.

Radio telemetry projects have been initiated in the Zambezi River. The main objectives of these projects are to investigate the seasonal movements, migration and habitat utilisation of important fish species as well as the effects of variations in water level on migration and habitat utilisation.

A fishing competition that was held in September in the Zambezi River was monitored. A total of 538 fish were recorded with a total mass of 1018kg. The most common species in number was the nembwe and in weight the sharptooth catfish. A total of nine cichlids were recorded, all large individuals. The largest individual fish was a catfish weighing 9.7kg. This was followed by a tigerfish of 7.5kg.

In addition, studies on the effect of the local fisheries are being planned.

CHALLENGES

1. All perennial rivers in Namibia are shared with neighbouring countries, which make management difficult.
2. Habitat degradation will have a profound effect on the fish resource and needs to be studied.
3. Commercial fishery versus subsistence fishery.
4. Perceived conflict between the recreational and subsistence fishermen.
5. Lack of management of the fish resource.
6. Different management policies in neighbouring countries. (unknown)
7. Management of the fish resource to secure food supply.

CONSTRAINTS

1. Funding for regional co-operation.
2. Manpower to conduct research in all river systems.

With collaboration between countries, there should actually be no constraints.
Mean CPUE in weight per setting with 95% confidence limits in the four different river zones of the Okavango River for gill nets with mesh sizes 22-28 mm (top) and 35-150 mm (bottom). Setting = 12 hours of fishing with one standard gill net (area = 50 m²).
List of the ten most important species in each of the three fisheries: local fisheries, survey gill net and other survey gears, from 1992 to 1999. The species are ranked in accordance with their importance in the different types of fisheries. 1 is the most important species either by IRI or by number (No).

<table>
<thead>
<tr>
<th>Species</th>
<th>Local fisheries No</th>
<th>Gill net IRI</th>
<th>Gill net No</th>
<th>Other gear IRI</th>
<th>Other gear No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudocrenilabrus philander</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barbus thamalakensis</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hippopotamyus discorhynchus</td>
<td>3</td>
<td>10</td>
<td>5</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Pharyngochromis acuticeps</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Micrelates acutifrons</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marcusenius macrocephalus</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schilbe intermedius</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Hemigrammocharax machadoi</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tilapia sparmanni</td>
<td>9</td>
<td>8</td>
<td>5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Tilapia randalli</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Hydrocynus vitulus</td>
<td>3</td>
<td></td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synodontis nigrimaculatus</td>
<td>4</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bycinus lateralis</td>
<td>5</td>
<td>3</td>
<td>9</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Clarias gariepinus</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hepsetus odoe</td>
<td>7</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barbus poechei</td>
<td>9</td>
<td>9</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Serranochromis macrocephalus</td>
<td>10</td>
<td></td>
<td></td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Barbus paludinosus</td>
<td></td>
<td></td>
<td>6</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Labeo cylindrical</td>
<td></td>
<td></td>
<td></td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Aplocheilichthys johnstoni</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petrocephalus catostoma</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Index of relative importance (IRI) of the ten most important species in the Zambezi River (caught in all gears) 1997-1999

<table>
<thead>
<tr>
<th>Species</th>
<th>No.</th>
<th>%</th>
<th>Kg</th>
<th>%</th>
<th>Freq</th>
<th>%</th>
<th>IRI</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brycinus lateralis</td>
<td>12456</td>
<td>34.5</td>
<td>141,643</td>
<td>25.4</td>
<td>210</td>
<td>23.6</td>
<td>1415</td>
<td>43.5</td>
</tr>
<tr>
<td>Schilbe intermedius</td>
<td>2477</td>
<td>6.9</td>
<td>96,368</td>
<td>17.3</td>
<td>267</td>
<td>30.0</td>
<td>725</td>
<td>22.3</td>
</tr>
<tr>
<td>Hydrocynus vitulus</td>
<td>857</td>
<td>2.4</td>
<td>88,588</td>
<td>15.9</td>
<td>155</td>
<td>17.4</td>
<td>319</td>
<td>9.8</td>
</tr>
<tr>
<td>Synodontis spp.</td>
<td>3011</td>
<td>8.3</td>
<td>15,097</td>
<td>2.7</td>
<td>99</td>
<td>11.1</td>
<td>123</td>
<td>3.6</td>
</tr>
<tr>
<td>Petrocephalus catostoma</td>
<td>3234</td>
<td>9.0</td>
<td>29,204</td>
<td>5.2</td>
<td>64</td>
<td>7.2</td>
<td>102</td>
<td>3.1</td>
</tr>
<tr>
<td>Tilapia sparmanni</td>
<td>1714</td>
<td>4.7</td>
<td>10,559</td>
<td>1.9</td>
<td>125</td>
<td>14.1</td>
<td>93</td>
<td>2.9</td>
</tr>
<tr>
<td>Barbus poechei</td>
<td>1133</td>
<td>3.1</td>
<td>9,783</td>
<td>1.8</td>
<td>148</td>
<td>16.6</td>
<td>81</td>
<td>2.5</td>
</tr>
<tr>
<td>Pharyngochromis acuticeps</td>
<td>888</td>
<td>2.4</td>
<td>7,950</td>
<td>1.4</td>
<td>156</td>
<td>17.5</td>
<td>67</td>
<td>2.1</td>
</tr>
<tr>
<td>Marcusenius macrocephalus</td>
<td>941</td>
<td>2.6</td>
<td>19,776</td>
<td>3.5</td>
<td>91</td>
<td>10.2</td>
<td>63</td>
<td>1.9</td>
</tr>
<tr>
<td>Hepsetus odoe</td>
<td>150</td>
<td>0.4</td>
<td>24,212</td>
<td>4.3</td>
<td>84</td>
<td>9.4</td>
<td>45</td>
<td>1.4</td>
</tr>
</tbody>
</table>
### Catches in the angling competition in Zambezi 14-16 September 2000

#### Number of fish

<table>
<thead>
<tr>
<th>Species</th>
<th>Date</th>
<th>Total</th>
<th>No of fish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharptooth catfish</td>
<td>Clarias gariepinus</td>
<td>99</td>
<td></td>
</tr>
<tr>
<td>Tigerfish</td>
<td>Hydrocyclus vittatus</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Threespot tilapia</td>
<td>Oreochromis andersonii</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Greenhead tilapia</td>
<td>Oreochromis macrochir</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Pink happy</td>
<td>Sargochromis codringtonii</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Green happy</td>
<td>Sargochromis giardi</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Humpback largemouth</td>
<td>Serranochromis altus</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Thinface largemouth</td>
<td>Serranochromis angusticeps</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Nembwe</td>
<td>Serranochromis robustus</td>
<td>179</td>
<td></td>
</tr>
<tr>
<td>Brownspot largemouth</td>
<td>Serranochromis thumbergi</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Redbreast tilapia</td>
<td>Tilapia rendalli</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>Spotted squeaker</td>
<td>Synodontis nigromaculatus</td>
<td>71</td>
<td></td>
</tr>
<tr>
<td>Squeakers</td>
<td>Synodontis spp</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>538</strong></td>
</tr>
</tbody>
</table>

### Catches in the angling competition in the Zambezi 14-16 September 2000

#### Weight of fish (kg)

<table>
<thead>
<tr>
<th>Species</th>
<th>Date</th>
<th>Total</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharptooth catfish</td>
<td>Clarias gariepinus</td>
<td>463.2</td>
<td></td>
</tr>
<tr>
<td>Tigerfish</td>
<td>Hydrocyclus vittatus</td>
<td>39.2</td>
<td></td>
</tr>
<tr>
<td>Threespot tilapia</td>
<td>Oreochromis andersonii</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>Greenhead tilapia</td>
<td>Oreochromis macrochir</td>
<td>7.4</td>
<td></td>
</tr>
<tr>
<td>Pink happy</td>
<td>Sargochromis codringtonii</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>Green happy</td>
<td>Sargochromis giardi</td>
<td>28.3</td>
<td></td>
</tr>
<tr>
<td>Humpback largemouth</td>
<td>Serranochromis altus</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>Thinface largemouth</td>
<td>Serranochromis angusticeps</td>
<td>312.2</td>
<td></td>
</tr>
<tr>
<td>Nembwe</td>
<td>Serranochromis robustus</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Brownspot largemouth</td>
<td>Serranochromis thumbergi</td>
<td>24.4</td>
<td></td>
</tr>
<tr>
<td>Redbreast tilapia</td>
<td>Tilapia rendalli</td>
<td>11.8</td>
<td></td>
</tr>
<tr>
<td>Spotted squeaker</td>
<td>Synodontis nigromaculatus</td>
<td>4.6</td>
<td></td>
</tr>
<tr>
<td>Squeakers</td>
<td>Synodontis spp</td>
<td>1018</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Mean weight (kg) of the various species caught in the angling competition in the Zambezi, 14-16 September 2000. Only species represented by more than ten individuals have been included.

<table>
<thead>
<tr>
<th>Species</th>
<th>Mean weight (kg)</th>
<th>Max. weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharptooth catfish</td>
<td>$Clarias gaiepinus$</td>
<td>4.68</td>
</tr>
<tr>
<td>Tigerfish</td>
<td>$Hydrocynus vittatus$</td>
<td>3.40</td>
</tr>
<tr>
<td>Threespot tilapia</td>
<td>$Oreochromis andersonii$</td>
<td>1.15</td>
</tr>
<tr>
<td>Greenhead tilapia</td>
<td>$Oreochromis macrochir$</td>
<td>0.57</td>
</tr>
<tr>
<td>Green happy</td>
<td>$Sarcochromis giardi$</td>
<td>1.07</td>
</tr>
<tr>
<td>Humphrey largemouth</td>
<td>$Serranochromis altus$</td>
<td>1.42</td>
</tr>
<tr>
<td>Nembwe</td>
<td>$Serranochromis robustus$</td>
<td>1.74</td>
</tr>
<tr>
<td>Redbreast tilapia</td>
<td>$Tilapia rendalli$</td>
<td>0.79</td>
</tr>
<tr>
<td>Spotted squeaker</td>
<td>$Synodontis nigromaculatus$</td>
<td>0.17</td>
</tr>
<tr>
<td>Squeakers</td>
<td>$Synodontis spp.$</td>
<td>0.14</td>
</tr>
</tbody>
</table>
Annexure D
Annexure D

PREAMBLE
Zambia is endowed with many lakes, swamps, rivers and flood plains and streams. The country has the potential to increase fish production from its water bodies. This could, inevitably, increase its contribution to the national economy through the generation of income and employment opportunities. The fisheries sector contributes over 1.8 percent to the Gross Domestic Product (GDP) which represents approximately 55 percent of the country's total protein requirements.

The Fisheries policy has formulated objectives that will create an enabling environment for aquaculture and capture fisheries. It will provide regulations and undertake research and information programmes that will support private sector activities. The proposed policy framework will create incentives for greater participation by the private sector in boat building, fish hatchery services and fish feed production, fishing gear, manufacturing, fish collection, storage, marketing, marine engineering and recreational.

The Fisheries Policy proposes ten objectives with their strategies.

MISSION STATEMENT

The mission of the Fisheries Service is to increase fish production and promote sustainable utilisation of fisheries resource by:

1. development of ways to exploit fish and other valuable aquatic organisms in all public water bodies;
2. regulation of fishing effort in proportion to the fish resources available in all fishery areas;
3. promoting the development of aquaculture;
4. strengthening capacity building and infrastructure development;

1.0 Introduction
The Fisheries Service wishes to ensure that both the natural and culture fisheries make maximum contribution to the national economy through improvement of nutrition, generation of income and creation of employment, particularly in rural areas. Currently, some of the fish stocks in the lakes and rivers have been over-fished while others are virgin and are at the verge of being exploited. On the other hand, fish farming is not yet fully developed.
2.0 Situation Analysis
The demand for fish is presently estimated at 90,000-100,000 tonnes annually which is higher than the current supply of 70,000 metric tonnes. Fish supply has been affected by inadequate knowledge of the sizes of fish stocks in various water bodies leading to over-fishing in some places and under-fishing in others. Other factors affecting supply are inadequate fishing gear material, inappropriate fishing technology used by fishermen, lack of investment and credit facilities to artisanal fishers. Therefore, fishers are unable to purchase new or replace old fishing gears. Thus, resorting to using illegal fishing methods and techniques.

In capture fisheries, inadequate knowledge in fish stock sizes has been compounded by shortage of personnel in fish stock assessment, limnology and fishing gear technology to provide appropriate fishery management services.

The development of large-scale aquaculture at commercial level has been affected by the shortage of quality fish seed. The situation has been compounded by shortage of trained personnel in aquaculture technology.

3.0 Rationale/Background
The Fisheries Policy is designed to enhance fisheries growth based on rational and sustainable management practices. In the past, the policy for the sector placed greater emphasis on job creation particularly for the unskilled workers without taking into consideration the fisheries capacity to withstand the fishing pressure.

It also provided for the development of commercial fishing in designated commercial fishery areas only. Now the trend is to develop with controlled access to all the fisheries in public water bodies and the development of Aquaculture.

The old Fisheries Policy also provided for Central Control of Fisheries Management. Now the trend is to decentralise by creating Fisheries boards and involve the private sector, non-governmental organisations (NGOs) traditional institutions, local rural communities and private individuals in the management and development of the Fisheries Sector.

The total catch has increased over the years, the capita consumption has decreased from 12kg to 8 kg due to increased population. To reverse the trend, there is need to increase fish production both from capture and culture fisheries.
4.0 Policy Objectives and Strategies
The Policy objectives and strategies for Fisheries Development are:

(i) To increase the country's total fish production.
Strategies
a) development of ways to exploit fish and other valuable aquatic organisms in all the public water bodies;
b) utilization of fisheries research data for planning, management and development;
c) regulation of fishing pressure in proportion to resources available in all fishery areas;
d) collaboration with neighbouring states in management of shared fish stocks and;
e) promotion of aquaculture development.

(ii) To improve fisheries resource management control mechanism.
Strategies
a) promoting controlled access to both artisanal and industrial fisheries;
b) promote improvement and harmonisation of fisheries statistics to ensure that the information is reliable and useful in formulating management guidelines;
c) update, review and harmonize the fisheries legislation with neighbouring states and establishment a common code for surveillance and enforcement of fisheries management regulations;
d) promote the use of appropriate fishing technology;
e) encourage the strengthening of extension services;
f) promote supply of appropriate fishing gears to fishers through the provision of incentives to suppliers;
g) encourage development of protocols to facilitate joint management of fisheries resources in shared water bodies;
h) collaborate with other relevant sectors in monitoring, removing and minimizing factors contributing to environmental degradation and fish resource depletion;
i) promote environmentally sound and economically viable exploitation methods for all fish stocks, and in particular for confirmed under-utilized fish stocks in the public water bodies;
j) identify and promote the protection of endangered or vulnerable fish species through regional harmonized regulatory mechanisms inclusion Conversion on International Trade in Endangered Species of Flora and Fauna (CITES) guidelines.

(iii) To establish programmes of applied research that will form the basis for fisheries planning, management and development.
Strategies
a) identify priority needs for fisheries research in consultation with stakeholders;
b) promote cooperation between research institutions within the country and neighbouring states;
c) develop short, medium, and long-term research plans for the country;
d) maintain and regularly update the database on fisheries research centres and;
e) strengthen institutional and scientific research capacity for effective implementation of research programmes.

iv) To promote conservation, sustainable utilisation and marketing of fisheries resources.

Strategies
a) develop and promote the use of improved technologies in the post-harvest, handling and processing of fish so as to improve the shelf life of fish and fishery products for local and international consumption;
b) promote development and trade in ornamental fish;
c) promote development of recreational fishing;
d) discourage the introduction of exotic species especially in aquaculture;
e) to increase fish conservation awareness and ensure that methods used in fishing are those that conserve fish stocks;
f) promoting private enterprise development in fisheries and;
f) promote fish marketing and distribution in collaboration with private sector and industry and the tread sector;

v) To improve the economic status and condition among small-scale fishers, fish farmers, processors, traders and boat builders.

Strategies
a) facilitate investment in Capture fisheries and Aquaculture in provision of tax rebates on fishing, processing, storage machinery and distribution equipment such as fish hatchery equipment, fish feed processing mills and wet laboratory equipment;
b) facilitation of provision of loans and credit to fishers, processors, traders and fish-farmers;

vi) To promote the development of aquaculture.

Strategies
a) establish and develop an appropriate legal and administrative framework which facilitates the development of aquaculture;
b) promote research to identify better performing fish species for aquaculture development;
c) promote the integration of aquaculture into other farming production systems among the rural communities;
d) promote the utilisation of small water bodies, dams and reservoirs for aquaculture;
e) promote where appropriate the inclusion of aquaculture in water supply and irrigation development programmes;
f) initiate the establishment of code of conduct for aquaculture to provide guidelines to address issues such as introduction of exotic species, water abstraction, spread of diseases, and effluent control;
g) establish effective procedures specific to aquaculture to undertake appropriate environmental assessment and monitoring with the aim of minimizing adverse ecological changes and related economic changes and social consequences
resulting from water extraction, land use, discharge of effluent, use of drugs and chemicals and other aquaculture activities;

h) promote extension of viable aquaculture technologies appropriate for small-scale and large-scale farming operations;

i) encourage the dissemination of information on improved aquaculture practices between experts;

j) devising appropriate technologies and methodologies in aquaculture and involving the private sector, Non Governmental Organisations (NGOs) and community-based organisations (CBO)

vii) To create a framework for local community participation in the fisheries development.

Strategies
a) encourage the involvement of local communities in the policy formulation and implementation;

b) update and review the legislation to provide for empowerment and participation of fishing communities and other stakeholders;

c) sensitise decision-makers on the importance of involving communities in the development of the fishery sector;

d) promote the establishment of the fisheries advisory and management boards and committees;

f) promote participation of women in community fisheries management

viii) To design training and educational programmes.

Strategies
a) assess regularly fisheries training needs based on specific requirement of human resources;

b) co-ordinate the development of curricula in training and educational institutions;

c) encourage the development of relevant vocational fisheries training programmes for fishers and;

d) strengthen capacity building in fisheries training institutions.

ix) To improve availability, accessibility and exchange of fisheries information.

Strategies
a) establish a fisheries resources database aimed at providing information for improved fisheries management;

b) facilitate production and dissemination of information designed to meet the needs of target user groups;

b) strengthening institutional capacity and infrastructure in relation to fisheries information management;

d) facilitate information exchange through documentation services and establishment of stakeholder networks;

e) promote awareness of fisheries information sources and services available within the country;

f) maintain and regularly update of fisheries database on aquaculture and fisheries;
(x) To incorporate gender perspectives in fisheries development.

Strategies
a) promote gender sensitization training for staff involved in administration and policy making;
b) encourage admission of women in fisheries institutions;
c) encourage gender equity at all levels of fisheries development and;
d) encourage participation of women at all levels of decision making in the fisheries sector.

(xi) To protect all aquatic life from environmental degradation.

Strategies
a) maintain and update all fish species in all water systems;
b) monitor and review environmental protection measures applied in all public water systems;
c) develop water quality monitoring systems;
d) ensure environmental impact assessment is carried out and taken into consideration in all fisheries projects;
e) promote conservation of biodiversity programmes;
f) promote the harmonisation of legislation prohibiting introduction or translocation of exotic species between water systems unless sound scientific evidence guarantees safety of genetic integrity of the aquatic ecosystems and;
g) promote the establishment of protocols and their implementing institutions in accordance with SADC Treaty (1994), for the management of watersheds in the catchment areas of riparian states;

(xii) To strengthen cross-sectoral collaboration.

Strategies
a) conduct planning meetings with sectors that have common interest in natural resources management;
b) conduct joint meetings with forestry and wildlife in areas of training, information and natural resources management and;
c) collaborate with water and crop production sectors to promote where possible appropriate the inclusion of aquaculture in water supply and irrigation development programme;

5.0 Legal Framework
The Fisheries Act is being reviewed with a view of taking into consideration the following:

(i) the need to regulate and manage fish farming;
(ii) the need to decentralise fisheries management through community involvement;
(iii) increasing need for co-operation with neighbouring states in the management and development of shared fisheries and;
(iv) the need to increase protection of aquatic fauna and flora, and biodiversity from environmental degradation.
6.0 Institutional Framework
The government through the Fisheries Research and Fisheries Extension units of the Ministry of Agriculture, Food & Fisheries has a mandatory responsibility to implement fisheries and aquaculture development programmes throughout the country. In order to perform these various functions, the Fisheries Service will collaborate with donors and the private sector who directly or indirectly support the fish industry.

**Fisheries Legislation**
The Fisheries Act is being reviewed and updated in order to facilitate involvement of stakeholders such as the riparian (surrounding) communities in Fisheries Management.

- **State of the problem**
  There was need to address the problems if inappropriate Fisheries Legislation, that is, centrally controlled and to update the Principal Fisheries Act so as to bring it in line with recent developments. The current Fisheries Act is not appropriate for facilitating Fisheries Development in a free and liberalised economy. The stakeholders are free to invent and participate in the development of the fisheries.

- **Rationale and Background Information**
The Fisheries Act currently used for the management of Fisheries came into existence as far back as November 1974. Since that time, a number of development and changes in the sector have taken place requiring appropriate changes in Fisheries legislation. It also provided for the development of commercial fishing in designated commercial fishery areas only. Now the trend is to develop with controlled access to all the fisheries in public water bodies and the development of Aquaculture.

- From 1992 to 1994, the Ministry of Agriculture, Food and Fisheries was involved in the preparation of the Agricultural Sector Investment Programme (ASIP). There is a Fisheries Sub-Programme under ASIP which put in place new policies and strategies required for the development of the fisheries sector in Zambia. In order to facilitate implementation of new Fishery policies and strategies, it is important to make corresponding legislation.

- The Draft Fisheries Bill has been prepared taking in full account the following changes and developments within the Fisheries Sector at both local and international levels;
  (a) The need to include Aquaculture in Fisheries Legislation in the Act;
  (b) The desire to decentralise some Fishery Management responsibilities from Central Government to local communities, in Fishery areas;
  (c) The need to involve rural communities, non-governmental organisations (NGOs), traditional institutions and even private individuals in Fisheries Management;
(d) To increase the impact of Fisheries Management and Conservation programmes even in remote Fishery areas of the country; and

(e) The need to develop framework in which funds generated from Fisheries resources are used for the direct benefit of fishery areas.

- Since 1980, the Department of Fisheries has been intensively promoting Aquaculture. This has been done with a view of supplementing fish production from Capture Fisheries since catches from natural water bodies are limited. The general public has responded favourably to the call to go into fish farming. Aquaculture is currently one of the fastest growing activities in rural economy. As fish farming expands, there is need to have regulations, dealing specifically with problems related to Aquaculture. The Draft Fisheries Bill has been prepared in such a way that there are provisions for formulating and enforcing regulations relating to Aquaculture. This is important in order to protect the Natural Fisheries from Aquacultural activities and to prevent the spread of fish diseases in fish farms.

- Some of the failures of present fisheries management systems arise from the fact that the present Fisheries Act in highly centralised, placing all the responsibilities for Fisheries management and development in the Ministry. Experience has however, demonstrated that the co-operation of riparian communities, traditional institutions and other stakeholders is very important for the conservation and management of Fisheries areas. The Draft Fisheries Bill has several provisions and arrangements for sharing Fishery management responsibilities and activities with riparian communities.

- Zambia shares most of her Fisheries resources with neighbouring countries. Over 40% of Zambia’s total catch come from shared water bodies such as Lake Kariba, Lake Mweru-Luapula, Lake Tanganyika and the Upper Zambezi Fishery (Sesheke District). It is therefore important to collaborate with neighbouring countries including international organisation in Fisheries management and development. The Draft Fisheries Bill also has provisions for facilitating co-operation and collaboration with neighbouring countries in the enforcement of Fisheries regulations.

- In recent years countries at both regional and international levels have made resolutions and agreements regarding wise exploitation of shared natural resources including Fisheries. Among the resolutions and Zambia include the following;

  (a) the resolution of the United Nations on Environment and Development (UNCED) which took place in Rio de Janeiro in 1992;

  (b) The code of conduct for responsible Fisheries adopted by FAO conference in 1995 in which Zambia participated;

  (c) The protocol on shared water ecosystems in the Southern in the Southern African Development Community (SADC Region) in 1985; and

- Impact
  Fish constitute an important source of animal protein in Zambian diet. Approximately 55% of animal protein produced in Zambia come from fish. The fisheries sector provides direct and indirect employment to over 300,000 households in the country. Sustainable management of the Fisheries Sector is therefore required for economic growth and development.

REFERENCES


1.0 BACKGROUND

The history of fisheries research in the region of the Zambia/Namibia transboundary waters of the Zambezi River is discussed here in the light of the available information and data on the Upper Zambezi fishery in western Zambia – formerly the Barotse floodplain fishery. The Upper Zambezi River arises in Mwinilunga in northwestern Zambia; flows south through Zambia’s Western Province to Sesheke. It then turns east towards Mosi-O-Tunya Falls on Zambia’s Southern border with Zimbabwe. Near Lukulu, the river and its major northern tributaries, the Kabompo and the Lungwebungu empty onto the vast, flat Barotse floodplain.

The Barotse floodplain is covers approximately 15,000 km². During the height of the wet season (March – April) the plains are capable of holding 17 billion cubic meters of water. The area receives an average of about 826 mm of rainfall per year and most of it falls between November and March.

Soils of the area comprise primarily of ancient Kalahari sands mixed to varying degrees with recent alluvial deposits. The floodplain soils are much richer than the nutrient-poor sand soils of the surrounding forested terrain. Therefore, farming activities are concentrated on the floodplain during periods of low water both before and after the floods. The floodplain is sparsely forested and is dominated by semi-aquatic grasses, and herbaceous swamp and aquatic vegetation. Many aquatic habitats exist on the floodplain during the low water fishing season (June –December). Some of these habitats include fast-flowing Main River channel, slow-flowing canals and side channels, still backwaters and lagoons of various depths and sizes.

1.1 The Zambia/Namibia Transboundary Waters of the Zambezi River

The Zambia/Namibia transboundary waters of the Zambezi River lie below the Barotse floodplain approximately between Katima Mulilo in the north and Mambova in the southeast. The approximate distance of the around 100 km. After emerging from the Barotse floodplain, the Zambezi River passes over a series of rapids from Senanga to
Sesheke after which it meanders along the Zambia/Namibia border forming numerous ox-bow lakes towards Mambova. There are also numerous lagoons among them the Chinga set of lagoons. From Chinga lagoon the Zambezi River forms an extensive Chobe swamp complex south of the river in Namibia's Capriv strip. This swamp complex which is situated above the Victoria Falls is believed to trap nutrients, leading to a decreased nutrient status of the river below it (Losse 1998). The Chobe swamp complex is probably Namibia's largest freshwater fishery in the Capriv strip. On the Zambian side, the Zambezi River has three major tributaries and these are Loanja, Luanzamba and Ngweze Rivers that drain in the Zambezi River. No information is available on the inflows from Namibian side.

Fish in this area constitutes the single most important source of animal protein for the people living along the Zambezi river and around the floodplain.

2.0 STATUS OF THE FISHERY

The Zambia/Namibia transboundary waters of the Zambezi River are part of stratum V of the larger Upper Zambezi fishery. The estimated annual fish yield from 1993 to 1996 is shown in Table 1. The average fish yield is approximately 1,500 metric tonnes. The Frame Survey (FS) conducted in 1996 showed that there are 160 full-time fishers in this area using a total of 294 fishing crafts; 97% of which are dugout canoes. Only 9 banana boats were recorded. There were about 2,584-gill nets and 130 seine nets. The numbers of seine nets represent about 16% of the total seine nets used in the entire Upper Zambezi fishery while nearly 20% of the gillnets are 50-mm and below (Chitembure 1998). Other fishing gears such as traps spears and hooks are also used. Hook and line is another much more important fishing gear than traps and spears.

No seasonality in the fishing pattern has been observed in the Zambia/Namibia transboundary waters. Most fishermen are traditional fishermen and derive their entire livelihood from fishing. Results of the frame survey carried in 1996 show that all fishermen are permanent residents and no temporary fishing camps exist.
Table 1. Annual Fish yield (metric tonnes) from Zambia/Namibia Transboundary Waters of the Zambezi River. These figures represent yield from Stratum V of the Upper Zambezi fishery.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>YIELD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>4226</td>
</tr>
<tr>
<td>1994</td>
<td>1035</td>
</tr>
<tr>
<td>1995</td>
<td>754</td>
</tr>
<tr>
<td>1996</td>
<td>911</td>
</tr>
</tbody>
</table>

Source: Chitembure, 1996

3.0 FISH FAUNA

There is no information on the status of the fish stocks in the Zambia/Namibia transboundary waters of the Zambezi River. No fisheries research studies have been carried out in these waters yet. However, information from the Catch Assessment Surveys (CAS) carried out in the area, show that a number of commercially important fish species have been recorded.

Some important fish species from this area include Cichlids (Oreochromis macrochir, T. rendalli, Serranochromis angusticeps, S. robustus, S. macrocephalus). Others are Clarids (Clarias gariepinus, Clarias ngamensis), Mormyrids (Marcusenius macrolepidotus), Characids (Hydrocynus vitattus) and many others.

The voracious predator Tiger fish, Hydrocynus vitattus is commonly caught in the actual Zambezi River and has formed an important fish species for sport fishing especially by Anglers from Namibia and Botswana. The evolved sport fishing in this area needs to be developed to boost tourism for the benefit of Zambia and Namibia.
3.0 History of Fisheries Research in the Area

There has been no fisheries research work done on the Zambia/Namibia transboundary waters of the Zambezi River. However, some earlier biological work has been done on the Barotse floodplain upstream the Zambezi River.

The most comprehensive study of the Upper Zambezi floodplain ecology and fishery was performed by Mr. D.W. Kelley, FAO Fishery Biologist from the United States, between February 1966 to January 1967 (Rep. FAO/UNDP (TA) 2554). Kelley's project involved a preliminary survey of the fish species exploited by fishermen at several locations on the floodplain. He investigated the following parameters:

- Size distribution;
- Length/weight relationships;
- Feeding habits of exploited species;
- The selectivity of gillnets;
- Selectivity of weirs (locally called 'maalelo' dam method of fishing).

In 1967, Kelley concluded that fish stocks on the floodplain were not over-exploited, and that new and more efficient method of fishing should be explored in order to increase the catch.

He doubted whether or not weir fishing, which catches many immature individuals of the larger commercial species, was harmful to the fishery at the levels existing at that time. He called for initiations of a statistical survey of catch assessment. Catch assessment was implemented by the Department of Fisheries a few years later and has continued on an annual or near annual basis ever since. Kelley also called for further research on the biology of the commercial fish species and research into the basic ecological factors controlling populations of fishes.

More research works were conducted by Dr. Bell-Cross of the Zambia Fisheries Department who carried out a survey of the Upper Zambezi fish fauna during the 1960's and early 1970's which resulted in improved species lists and distribution records for the region. Other FAO/UNDP Fishery Biologists such as D. Duerre, A. Vomoer and G. Weiss were attached to Fisheries Survey Unit of the Department of Wildlife, Fisheries
and National Parks during the Upper Zambezi fisheries survey. They successfully worked on the Central Barotse Flood plain for periods of approximately one year.

The Department of Fisheries did not carry out any comprehensive biological fisheries research after Dr. Bell-Cross conducted the fish surveys in the Upper Zambezi in the 1960s and 1970s.

In 1989, Dr. Kirk O. Winemiller from the US and a team of officers from the Zambian Department of Fisheries at Mongu Fisheries Station carried out a study in the “Observations of the State of the Upper Zambezi Floodplain Fishery – 1989.” Their study focussed on the following:

- Species identification for the floodplain fishes;
- Assessment of the distribution of fish species in the region of the floodplain;
- Determination of the population size structure during peak fishing season;
- Determination of the habitat affinities of fish species according to size classes and season;
- Identification of the feeding interrelationships of the fishes;
- Obtaining data on reproductive output for important commercial fish species;
- Making observations of the local fishing practices to determine possible effects on selected fish species

Unfortunately, a final report has not been deposited with the Research Headquarters at Chilanga, Zambia and the results of this study are not yet known.

The Department of Fisheries from Chilanga has intermittently carried out Frame Surveys for the Upper Zambezi Fishery (of which the Zambia/Namibia transboundary waters of the Zambezi River form Stratum V). The latest FS was carried out in 1996. The purpose of the FS was to establish the inventory of fishing materials such as numbers of fishermen, boats, nets, etc.

More recently, efforts to carry out a joint Fish Survey of the Upper Zambezi Fishery with the JLB Institute of Ichthyology in Grahamstown, South Africa has not materialized
mainly because of logistical difficulties. These efforts are still being pursued with Dr. Paul Skelton and Mr. Roger Bills of the same Institute.

4.0 Future Fisheries Research Plans
The following work are planned for the Upper Zambezi:

- Carry out a Frame Survey;
- Assess the status of the Upper Zambezi fishery;
- Investigate the effects of fishing practices on commercial fish species;
- Initiate a fisheries co-management research of the Upper Zambezi fishery

REFERENCES


Zambia constraints and challenges

Constraints
1. The transboundary waters of the Zambezi River (Zambia/Namibia) are considered a minor fishery in terms of fish yield and the inventories of the fishing material existing in the fishery.

2. Inadequate skilled personnel to carry out fisheries research and management e.g. There is no one with a relevant degree in fisheries related discipline. Two officers have Diplomas in Fisheries but cannot cover all areas.

3. Under the current Agriculture Sector Investment Programme (ASIP), funding meant for fisheries activities is controlled by District Agricultural Coordinators (DACO) who do not consider fisheries as a priority and prefer to spend funds on activities related to Agronomy.

4. Recently, the fisheries legislation is being revised to include aspects of Fisheries co-management and agriculture development. The process is slow and is impacting negatively on the implementation of Fisheries co-management.

5. The government policy on the Public Sector Reform Programme (PSRP) in which many Ministries have been restructured has led to redundancies and retrenchments. Therefore, the much-needed personnel critical experienced in research and management have been lost.

Challenges
1. Perhaps the greatest challenge facing the DOF is to harmonize the traditional management systems existing in the Barotse flood plain and the fisheries co-management.

2. Given the constraints as above, how can information be generated that can be used to support the implementation of fisheries co-management in the upper Zambezi fishery?

3. Creation of enabling environment for the implementation of fisheries co-management.
Annexure E

Zimbabwean Policies, Legislation, Research History, Constraints and Challenges
POLICIES & REGULATIONS FOR FISHERIES-1

- Introduction of exotic species in dams to enhance fish stocks
- Limits on gear types that can be used for fishing eg. Seine, gill & lift nets.
- Limits on gear sizes (mesh sizes & net lengths) - control of effort
- Limits to fishing areas eg. No fishing in rivers or shallow areas, seasons?
POLICIES & REGULATIONS FOR FISHERIES-2

- Fisheries development process:
- National dams assessed by NP researchers before commercial fishing is established.-tender procedures followed to select operators
- Small water bodies (10 000) controlled by RDC assisted by Agritex, Permits by NP
- Private dams NP issues simple permits
POLICIES & REGULATIONS
FOR FISHERIES-3

- Policies facilitate multi-use activities eg. Aquaculture, fisheries, tourism, angling etc.
- EIA policies on certain activities such as cage culture, tourism etc.
- Regulations on the movement of live fish.
- Control the entry/exit of fish (trade) thru. COMESA, WTO, EU etc.
- Indigenisation policy.
- Co-management SAFA, DIFAs
Research Activities

- Socio-economic studies in conjunction with CASS
- Biological studies:
  - Hydro-acoustic stock assessment studies on kapenta (*Limnothrissa miodon*) on L. Kariba
  - Inshore fishery potential
  - Food resource base for fish (phyto-, zooplankton, macrophyte studies) on L. Kariba
Research Activities

- Monitoring the fishery resource - ongoing program
- Statistical analysis of commercial catch data.
- Monitoring impact of cage culture projects eg. Kapenta, H. vittatus, tilapias
Research Activities

- Impact of land-based activities on fisheries e.g. tsetse control, agriculture, mining etc.
- Aquaculture diet development research - cost-effective diets for trout & tilapias
- Study of the status of threatened species e.g. killifish, lungfish, etc. commercially
- Weed control research projects e.g. Use of biological agents, use of chemicals.
Constraints

- Limited resources e.g. equipment, computers
- Microscopes, water testing kits
- High staff turnover
- Operational structure is not appropriate for research. Stations vs Disciplines
- Individualism - failure to work as teams
The Challenges

• Establish effective research teams.
• Formulate collaborative research projects with local, regional & inter. Institutions to reduce duplication.
• Publish research results in recognised journals.
• Focus and prioritise research agenda.
The Challenges—cont'd

- Conduct high quality and sound research.
- Undertake a skills needs analysis.
- Create linkages and networks among researchers and other institutions.
The Challenges cont’d

- Lack of research program.
- Lack of skills in certain disciplines eg. Genetics, diseases.
- Inadequate library systems.
- Inadequate laboratory facilities and equipment.
Annexure F
Annexure F

Presentation by Professor Ben van der Waal
FIGURE 1: Map of Caprivi and the neighboring regions.

FIGURE 2: Water levels of rivers and Lake Liambezi from 1973 to 1975.

Reeds

Wind direction

Silt deposition

Turbulence

Erosion
FIGURE 1: Map of Caprivi showing fishing regions.

FIGURE 2: Water levels of rivers and Lake Lumbazi from 1973 to 1975
Figure 3. Net efficiency of commercial fishery compared with fluctuations in numbers of active fishermen and lake level.

Figure 4. Morpho-edaphic indices and catches in kg ha⁻¹.
## Fish Harvest from Lake Liambezi 1973 to 1976

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Number of Fishermen</th>
<th>Tonnage Caught Ton Per Year</th>
<th>Harvest Kg per ha (Open Water)</th>
<th>Harvest Kg per ha (Total Lake)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973-74</td>
<td>92</td>
<td>636,9</td>
<td>63,7</td>
<td>21</td>
</tr>
<tr>
<td>1974-75</td>
<td>57</td>
<td>297,2</td>
<td>29,9</td>
<td>9</td>
</tr>
<tr>
<td>1975-76</td>
<td>30</td>
<td>115,3</td>
<td>11,5</td>
<td>4</td>
</tr>
<tr>
<td>Average</td>
<td>59</td>
<td>343,8</td>
<td>34,5</td>
<td>11,5</td>
</tr>
</tbody>
</table>

## Calculated Standing Crop of Fish in Lake Liambezi, Using Various Methods, 1975

<table>
<thead>
<tr>
<th>Method</th>
<th>Standing Crop (kg per ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotenone</td>
<td>156,6</td>
</tr>
<tr>
<td>Explosive</td>
<td>132,1</td>
</tr>
<tr>
<td>25mm Mesh Beach Seine</td>
<td>91,8</td>
</tr>
<tr>
<td>50mm Mesh Beach Seine</td>
<td>73,9</td>
</tr>
</tbody>
</table>
Change in average mass (g) and average mass (kg) caught per day during three years at Lake Liambezi

Change in fish catch composition in Lake Liambezi over three years
Average mass per fish species caught per night with commercial gillnets and a graded fleet of experimental gillnets.
Figure 3: Catch per unit effort (number of fish) for a fleet of experimental gill nets in Caprivi in 1975.

Figure 4: Catch per unit effort (kg of fish) for a fleet of experimental gill nets in Caprivi in 1975.
# Data on Fishing Activities in Caprivi in 1980

<table>
<thead>
<tr>
<th></th>
<th>Kwan Do</th>
<th>Linyanti</th>
<th>Liambesi</th>
<th>Chobe</th>
<th>Zambezi</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fisher Men</strong></td>
<td>50</td>
<td>137</td>
<td>47</td>
<td>111</td>
<td>340</td>
<td>685</td>
</tr>
<tr>
<td><strong>Gill Nets</strong></td>
<td>95</td>
<td>330</td>
<td>257</td>
<td>447</td>
<td>797</td>
<td>1926</td>
</tr>
<tr>
<td><strong>Nets/Fisher</strong></td>
<td>1.9</td>
<td>2.4</td>
<td>5.8</td>
<td>4.0</td>
<td>2.3</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>% Self Made</strong></td>
<td>94</td>
<td>82</td>
<td>26</td>
<td>94</td>
<td>34</td>
<td>49</td>
</tr>
<tr>
<td><strong>Annual Harvest Tons</strong></td>
<td>5.3</td>
<td>38.7</td>
<td>74.4</td>
<td>153.9</td>
<td>500.2</td>
<td>773</td>
</tr>
<tr>
<td><strong>% of Catch Sold</strong></td>
<td>0</td>
<td>18</td>
<td>89</td>
<td>48</td>
<td>17</td>
<td>34</td>
</tr>
<tr>
<td><strong>% Traditional Gear</strong></td>
<td>44</td>
<td>70</td>
<td>85</td>
<td>73</td>
<td>78</td>
<td>70</td>
</tr>
</tbody>
</table>
Range in area covered by Salvinia mats in Lake Llamebezi
Annexure G
# Annexure G

Presentation by Prof. Paul Skelton

<table>
<thead>
<tr>
<th>PHASE</th>
<th>YEAR</th>
<th>PLACE</th>
<th>NATURE &amp; OUTCOME</th>
<th>AGENT &amp; REPORT</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1979/1980 May-June</td>
<td>Moremi</td>
<td>Basic survey; Multidisciplinary Fishery potential id. Socio-economics</td>
<td>Rhodes University MN Bruton</td>
</tr>
<tr>
<td></td>
<td>Lake Ngami</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>1982 December</td>
<td>Lake Ngami</td>
<td>Research drying out phase; Transect drainage river to sump lake</td>
<td>JLBSI MN Bruton PH Skelton Inv. Rep #6</td>
</tr>
<tr>
<td>I</td>
<td>1983 February</td>
<td>Okavango Panhandle (N'xamaser)</td>
<td>Investigate pattern of diversity Transect mainstream to mojap pools</td>
<td>JLBSI MN Bruton GS Merron PH Skelton Inv. Rep #7</td>
</tr>
<tr>
<td>I</td>
<td>1983 October-November</td>
<td>Okavango Lower Delta, drainage rivers</td>
<td>Transects Collections Establish fishery contacts &amp; identify priorities</td>
<td>JLBSI GS Merron Inv Rep #8</td>
</tr>
<tr>
<td>I</td>
<td>1984 March</td>
<td>Okavango, Lower Delta, Moremi, drainage rivers</td>
<td>Resurvey transects Biomass estimates Fisheries potential Synopsis</td>
<td>JLBSI GS Merron MN Bruton PH Skelton In Rep #10,11</td>
</tr>
<tr>
<td>I</td>
<td>1984 October</td>
<td>Okavango, Moremi, Lower Delta, drainage rivers, Lake Ngami</td>
<td>Resurvey transects Mark &amp; recapture Fisheries</td>
<td>JLBSI GS Merron Multidisciplinary team Inv Rep #15</td>
</tr>
<tr>
<td>PHASE</td>
<td>YEAR</td>
<td>PLACE</td>
<td>NATURE &amp; OUTCOME</td>
<td>AGENT &amp; REPORT</td>
</tr>
<tr>
<td>-------</td>
<td>--------</td>
<td>---------------------</td>
<td>----------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>lb</td>
<td>1984</td>
<td>Rundu – Popa Falls</td>
<td>Baseline survey</td>
<td>JLBSI</td>
</tr>
<tr>
<td></td>
<td>February-March</td>
<td>Amatako Dam</td>
<td>Diurnal/Nocturnal dynamics</td>
<td>PH Skelton</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Von Bach Dam</td>
<td>Habitat preferences</td>
<td>GS Merron</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>55 species</td>
<td>DWA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>High water</td>
<td>S Bethune</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Inv Rep II 9</td>
</tr>
<tr>
<td>lb</td>
<td>1984</td>
<td>Rundu – Popa Falls</td>
<td>Baseline survey</td>
<td>JLBSI</td>
</tr>
<tr>
<td></td>
<td>October</td>
<td></td>
<td>Diurnal/nocturnal dynamics</td>
<td>PH Skelton</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Habitat preferences</td>
<td>GS Merron</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Low water</td>
<td>DWA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S Bethune</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Inv Rep II 14</td>
</tr>
<tr>
<td>lb</td>
<td>1986</td>
<td>Rundu – Popa Falls</td>
<td>Baseline survey</td>
<td>JLBSI</td>
</tr>
<tr>
<td></td>
<td>July</td>
<td></td>
<td>Diurnal/nocturnal dynamics</td>
<td>PH Skelton</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Habitat preferences</td>
<td>GS Merron</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mid-cycle</td>
<td>DWA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S Bethune</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Inv Rep II 24</td>
</tr>
<tr>
<td>PHASE</td>
<td>YEAR</td>
<td>PLACE</td>
<td>NATURE &amp; OUTCOME</td>
<td>AGENT &amp; REPORT</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------</td>
<td>-------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------</td>
</tr>
<tr>
<td>II</td>
<td>1985</td>
<td>Okavango Delta</td>
<td>6 major study sites&lt;br&gt;latitudinal and longitudinal transects&lt;br&gt;multiple gear&lt;br&gt;Chobe Fishing competition&lt;br&gt;• Day/night comparisons&lt;br&gt;• Schilbe – 60mm net&lt;br&gt;• Longlines&lt;br&gt;• Catfish run recognized&lt;br&gt;• Fisheries training recommended</td>
<td>JLBSI&lt;br&gt;GS Merron&lt;br&gt;Debswana Station Maun&lt;br&gt;Seronga Fisheries Camp&lt;br&gt;Inv Rep # 17</td>
</tr>
<tr>
<td>II</td>
<td>1985</td>
<td>Panhandle – Seronga</td>
<td>Low water transects&lt;br&gt;Multidisciplinary investigations&lt;br&gt;Catfish run; cichlid breeding&lt;br&gt;Pike nesting&lt;br&gt;Transect limnology</td>
<td>JLBSI&lt;br&gt;GS Merron&lt;br&gt;MN Bruton et al.</td>
</tr>
<tr>
<td>PHASE</td>
<td>YEAR</td>
<td>PLACE</td>
<td>NATURE &amp; OUTCOME</td>
<td>AGENT &amp; REPORT</td>
</tr>
<tr>
<td>-------</td>
<td>--------------</td>
<td>----------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>III</td>
<td>1986</td>
<td>Drainage rivers/Lower Delta</td>
<td>Tsetse Fly spraying programme July/August – fish kill Investigation Programme proposal Physiological and toxicology of cocktails</td>
<td>JLBRSI</td>
</tr>
<tr>
<td></td>
<td>July-December</td>
<td></td>
<td></td>
<td>GS Merron</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MN Bruton</td>
</tr>
<tr>
<td>III</td>
<td>1989-1991</td>
<td>Lower Delta; drainage rivers Guma Lagoon</td>
<td>WWF project 3914 Monitor Environmental effects of spraying programme Assist TFCU formulae management plan • Fish communities Biology &amp; ecology • Toxicology tests • Histopathology • Insecticide residues</td>
<td>JLBRSI</td>
</tr>
<tr>
<td></td>
<td>July-July</td>
<td></td>
<td></td>
<td>GS Merron</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MN Bruton</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Inv Rep # 31</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Controversial reports and outcomes • Conflict with ODI appointed Chief TFCO</td>
</tr>
<tr>
<td>PHASE</td>
<td>YEAR</td>
<td>PLACE</td>
<td>NATURE &amp; OUTCOME</td>
<td>AGENT &amp; REPORT</td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
<td>-------</td>
<td>------------------</td>
<td>----------------</td>
</tr>
</tbody>
</table>
| IV    | 1996 | Panhandle | Recreation/subsistence Fisheries conflict investigation | JLBSI  
R I Bills |
| IV    | 1998 | Panhandle Shakawe | Training course for fisheries officers | JLBSI  
R Bills  
PH Skelton |
| IV    | 1999 | Namibia – Kavango, Caprivi | Consultancy 
Advice to Ministry of Marine Fisheries | GMB  
U Schmidt  
PH Skelton |
JLB SMITH INSTITUTE OF ICHTHYOLOGY

Okavango – Zambezi programmes

ACHIEVEMENTS

Zambezi-Okavango River and Delta (1975)-1979 - 2000

- Fish taxonomy and biodiversity
- Distribution and biogeography
- Biology and ecology
- System seasonal dynamics
- Conservation biology
- Fisheries stock assessments
- Fisheries Management
- Training and Education
- Public Awareness of Science
- Heritage Resource collections & database
- Environmental Impact Assessment
  - Interbasin transfers
  - Ecotoxicology
CONSERVATION INTERNATIONAL AQUARAP
EXPEDITION JUNE 2000

- International multidisciplinary team > 20
- DWA and Fisheries Unit (MOA)

Aims
- brief overview of existing biodiversity and integrity of main ecological systems
- Compare with available information and evaluate changes
- Highlight and publicise biodiversity and unique features to promote conservation
- Provide sound management and research recommendations
- Identify conservation priorities
- Provide on-site training for students
- Develop long-term monitoring programme that will involve local communities and tourist camps

Studies on
- Fishes
- Macro-crustaceans
- Aquatic insects
- Aquatic plants
- Plankton & limnology including water chemistry & hydrology

Four focal areas
- Panhandle
- Upper Delta (Guma)
- North-eastern Moremi (Xakanaxa)
- South-western Chiefs Island (Boro)
JLB SMITH INSTITUTE OF ICHTHYOLOGY
OKAVANGO RIVER AND DELTA RESEARCH PUBLICATIONS

Scientific Publications


Popular articles

BRUTON, M.; MERRON, G.S. The Okavango Delta - give credit where credit is due. African Wildlife (Linden); Vol.39(2) pp 59-63, 1985 Reprint No.: 1995/0349


MERRON, G.S. FISH FROM THE SKY. Labyrinth No.36 pp 4-5, 1987

MERRON, G.S. KCS FUNDS OKAVANGO BARBEL STUDY. Kalahari Conservation Society Newsletter No.13 pp 9-12, 1986

MERRON, G.S. FISH FROM THE SKY. Kalahari Conservation Society Newsletter; Vol.MARCH(19) p 10, 1988

MERRON, G.S. NETTING RESULTS. MARUNG MAGAZINE; Vol.6(2) pp 9-13, 1988 Reprint No.: 1989/0383

MERRON, G. 1995. Fish and water plants in the Okavango. Marung (Botswana) 11 (79), 16-17, 1995

MERRON, G. Okavango water - to use of not to use? African Wildlife (Linden); Vol.47(5) pp 222-224, 1993; ISSN 0002-0273 Reprint No.: 1993/0713

MERRON, G. Fish and water plants. Marung (Botswana); Vol.11(79) pp 16-17, 1993 Reprint No.: 1994/0104

MERRON, G. A Synopsis of Presentations and discussions on the fish and fishery in the Okavango Delta, Botswana. Botswana Notes and Records (Gaborone); Vol.25 pp 133-140, 1993 Reprint No.: 1994/0105

MERRON, G. The annual Okavango catfish run. Phoenix (Albany Museum) (Grahamstown); Vol.6(3) p 13, 1993; ISSN 1011-8136
MERRON, G. Tsetse fly control and fishes in the Okavango delta. Okavango Wildlife Society Newsletter No.3 pp 14-17, 1992

MERRON, G. Control of the tsetse fly. Maurung (Gaborone); Vol.10(66) pp 30-33, 1992; Reprint No.: 1992/887

MERRON, G. Tsetse fly control and fishes in the Okavango Delta. Ichthos Newsletter No.34 pp 4-5, 1992; ISSN 1011-7490

MERRON, G.S. Tsetse fly control and the environmental implications for fish in the Okavango Delta, Botswana. Botswana Notes and Records (Gaborone); Vol.24 pp 49-56, 1992 Reprint No.: 1993/0534

MERRON, G. Conservation is the wise use of natural resources for the betterment of mankind. Marung (Botswana) No.1 pp 15-18, 1992 Reprint No.: 1993/0232


MERRON, G.S. Thamalakane - The River of Change. Marung (Botswana); Vol. 8(41) pp 79-81, 1990 Reprint No.: 1993/0351

MERRON, G.S. OKAVANGO SWAMPS - A LAST WORD. Tight Lines/Stywe Lyne (Silverton); Vol.JUNE pp 9-11, 1990; ISSN 0040-7399

MERRON, G.S. THE ANNUAL OKAVANGO CATFISH RUN. Tight Lines/Stywe Lyne (Silverton); Vol.I(APR) pp 16-17, 1989; ISSN 0040-7399


MERRON, G.S. BOTSWANA'S FIRST FISH FARM. Ichthos Newsletter No.18 p 15, 1988; ISSN 1011-7490

Scientific Reports


BRUTON,M.N. 1979c Preliminary report on the fishes of Lake Ngami. J.L.B. Smith Inst. of Ichthyol


MERRON, G.S. 1986. Results from October survey. JLB Smith Institute of Ichthyology Investigational Report (Grahamstown) No.18 pp 2-17, 1986


MERRON, G.S.; BRUTON, M.N. REPORT ON THE OCTOBER-NOVEMBER 1983 EXPEDITION TO THE OKAVANGO DELTA BOTSWANA. JLB Smith Institute of Ichthyology Investigational Report (Grahamstown) No.8 pp 1-20, 1984


Other Publications


Annexure H
• the aquatic system is better understood and the knowledge be shared amongst all stakeholders;
• a common policy and legal framework that is conducive to the co-management of the aquatic resources be put in place;
• appropriate structures and mechanisms for the co-management of the aquatic resources be established and maintained;
• commitment and active participation of all stakeholders be secured and maintained; and
• the capacity of local communities to sustainably manage their aquatic resources be enhanced.

Done and signed at Katima Mulilo, Caprivi Region, Republic of Namibia on this 16th day of November 2000.

[Signatures]
Trevor G. Minopelwa
Republic of Botswana

Judge Manyemane
Republic of Botswana

Chiton Bay
Republic of Namibia

Emma S. Boys
Republic of Namibia

Burger Oelofsen
Republic of Namibia

Ben Chanda
Republic of Zambia

Godfrey Mwendi
Republic of Zambia

Richard Gurure
Republic of Zimbabwe

Vitalis Chadeza
Republic of Zimbabwe

Servatius Kapirika
Republic Namibia

Nandehasho Nickanor
Republic Namibia
Annexure H

The Katima Declaration
Katima Mulilo
Republic of Namibia
16th November 2000

We, the fresh water fish scientists and officials from:

The Republic of Botswana
The Republic of Namibia
The Republic of Zambia
The Republic of Zimbabwe

acknowledge the important role of inland fisheries in the social and economic wellbeing and livelihoods of the people of the region, in the supply of food, and alleviation of poverty;

are convinced of the necessity for the sustainable co-management of the inland aquatic resources in the region for the benefit of all its inhabitants, both present and future;

recognize the unique trans-boundary character of the aquatic resources and ecosystems of the region;

are conscious that this declaration has important linkages to the SADC Fresh Water Fisheries Coordination Unit and its protocols;

declare ourselves willing to cooperate as far as possible and within the policy and legislative frameworks of the involved countries, to put joint strategies and plans into action for the sustainable utilization of the shared aquatic resources and to the benefit of all the inhabitants of the region, both present and future;

accept the common vision that the aquatic resources of the Okavango and Zambesi River Systems should continue to sustainably and significantly contribute towards the quality of life and food security of the inhabitants of the region, both present and future;

accept the common purpose that all stakeholders (government, non-governmental, private and community based) in the Okavango and Zambesi River Systems are effectively co-managing the shared aquatic resources in a sustainable manner;

accept as objectives, in order to jointly achieve the common purpose and contribute towards the common vision, that: