

INTEGRATED CO-MANAGEMENT OF ZAMBEZI / CHOBE RIVER FISHERIES RESOURCES PROJECT

Project No.: WWF –9F0792
WWF-Norway –Norad – 5012 - GLO-08/449-29

Fish Ranching Programme in Caprivi Region

Part 1. Evaluation Report, February 2012

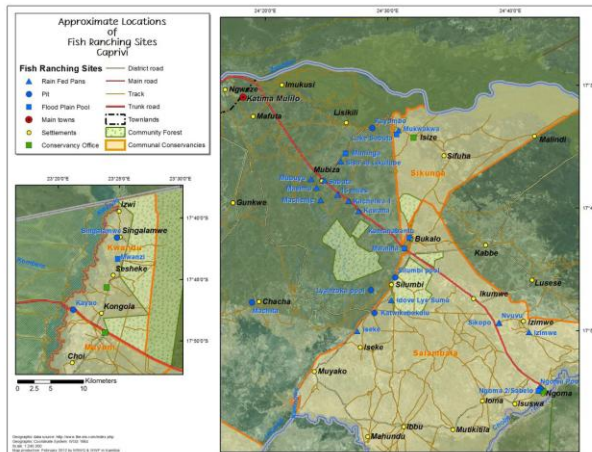
Part 2. Project Summary Reports, March 2011



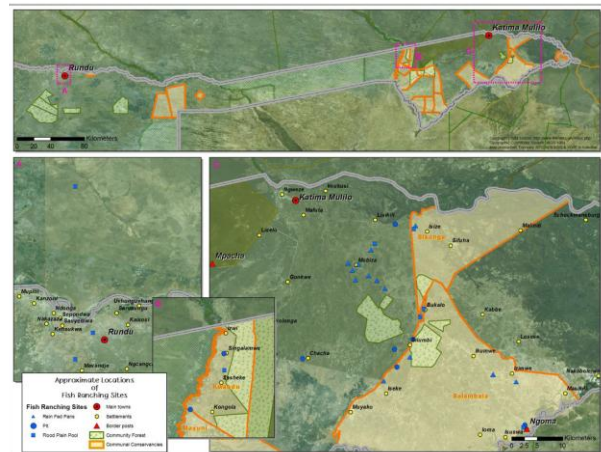
Iseke pool, a rain fed pan



Mr Ntema and Priscah Lilungwe at Iseke



Location of fish ranching sites in Caprivi



Location of fish ranching sites in Caprivi and Kavango

by: **Carol Murphy (Part 1)**

&

Priscah Lilungwe (Part 2)

Technical Report no. MFMR/NNF/WWF/Phase II/5



PREPARATION OF THIS DOCUMENT

The Integrated Co-Management of Zambezi / Chobe River Fisheries Resources Project provided technical support, particularly in the first phase of the project under the guidance of Dr B.C.W. de Waal, for the ICEMA - NNF Zambezi / Chobe Fish Ranching Project. Financial and technical support for the project ended in March 2011.

During the mid-term review of the Integrated Co-Management of Zambezi / Chobe River Fisheries Resources Project, it was recommended that an evaluation be made of the success of the fish ranching project, particularly to determine whether any of the stocked water bodies continued to yield fish under management of the local communities that were involved during the project. The first section of this document is the report on the evaluation that was commissioned.

This is followed by a brief summary final report on the project that was prepared by the project's leader, Ms Priscah Lilungwe.

The final section is a more general description on the project and its activities, also prepared by Ms Lilungwe.

EVALUATION OF THE FISH RANCHING PROGRAMME IN CAPRIVI REGION

1 FEBRUARY 2012

**Commissioned by the MFMR/NNF/WWF
Integrated Co-Management of the Zambezi/Chobe Fisheries Resources
Project**

Report by Carol Murphy, with field work assistance from Priscah Lilungwe



EXECUTIVE SUMMARY

The Caprivi Region is well supplied with natural pans and ponds and has numerous old “borrow pits” left from past road construction activities. This makes the Region suited to fish ranching that uses ponds stocked with fingerling to grow larger fish. Such ponds can be either ephemeral, where fish need to be stocked annually and harvested a few months later when the ponds start to dry out, or semi-permanent, where stocking can be less frequent provided naturally produced fingerlings are left in the ponds when harvesting of the larger fish takes place. From 2007, NGOs assisted local people to develop fish ranching activities at 30 sites in Caprivi. This is the only project of this nature in Namibia and has the distinct advantage over fish farming is that inputs are very low (mainly labour to clear ponds of unwanted plants and fish species, feeding with any garden or food waste and harvesting).

The existing fish ranching initiative is viable. Annual records from half of the existing ponds show that the commercial value of fish harvested would be about a quarter of a million Namibian Dollars, if the fish had been sold at the Katima Market. As most of the harvest from the fish ranching was consumed locally, this is an amount that people potentially saved in not having to buy food to eat. As Mr Tsukhani from Machita said, “If the fish ranching project continues, our sons will eat”.

An estimated sales figure from the actual fish sold at all the fish ranching sites in one year was about N\$ 40 000. Some of this fish sales income was reinvested in the fish ranching business through the purchase of fishing equipment (e.g. hooks were bought at Lyanzoka) or fish food (e.g. bran at Machita). Other income was invested in education. At Machita village, the fish pond committee opened a Nampost account with the N\$ 1 500 they earned from selling big fish and also fingerlings to a neighbour. Most of this fish ranching income (N\$ 1 000) was spent on school funds and uniforms for 22 orphans. The price for fish in Caprivi is high (N\$ 10/kg at source or N\$ 20/kg Katima Market) and market forces have the potential to provide the incentive for continued management of fish ranching at the community level.

Six of the existing ponds have permanent water, are not regularly flooded and have been fished post-project. Another 23 ponds are viable if managed for restocking after flooding or when the ponds dry out. Most of these sites are easily accessible from the main tar road or feeder gravel roads. Some of these sites have suitable sites for expansion of fish ranching activities in the vicinity.

The likelihood for future success is excellent if the fish ranching initiative is well managed with targeted outcomes. A key management feature is the supply of fingerlings early in the year (January/February) once rain fed pans fill up. Some equipment for restocking is still available (tanks) and some of the more successful ponds have been used to supply fingerlings to other ponds. Beneficiaries of the existing fish ranching initiative are willing to purchase fingerlings. Systematic monitoring and recording of stocking and harvesting is another crucial management feature.

Fish ranching is similar to game ranching in that wild animals are encouraged to live in their own environment with few inputs from outside. Far fewer resources are needed for a fish ranching initiative compared to fish farming (there is no water pumping or expensive feeding). However, in the event of resource limitations, priority can be given to a smaller number of pond sites than the existing total amount. To reduce time and travel costs, sites can be chosen in close geographic proximity to each other (refer to list in Appendix 4). Rundu sites should be serviced out of Rundu.

The existing fish ranching initiative was born out of a strong demand from Caprivian Conservancies to start keeping fish ponds. It is five years old and has survived despite multiple changes in funding and management. The consistent features have been the NNF implementer (P. Lilungwe) and the community members responsible for the fish pond management. These people are still available for future engagement.

Beneficiaries interviewed for this report were overwhelmingly positive about the project, including the project's continuation. An advantage of the fish ranching initiative to the MFMR is that it is a community development project with long-term benefits that addresses food security and livelihood improvement. Continuation of the programme within MFMR will improve public relations and act as a balance to the regulatory nature of other activities being addressed by MFMR.

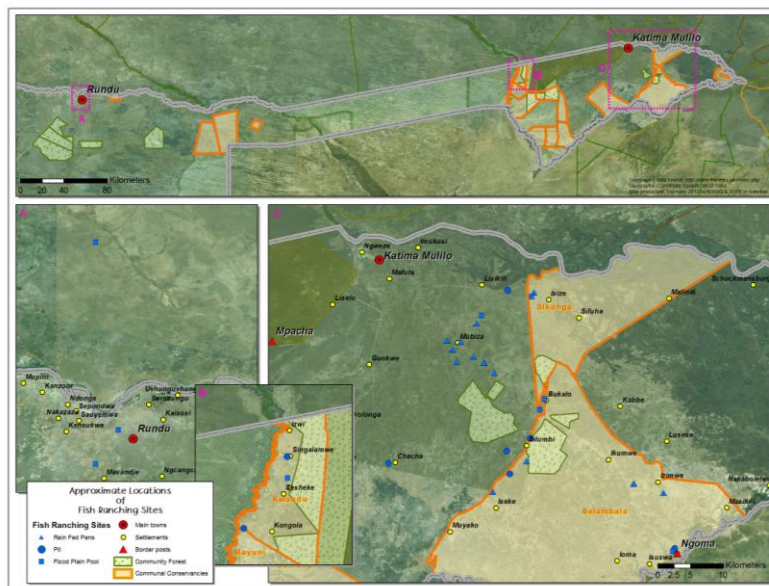


Figure 1. Location of fish ranching sites in Caprivi and Kavango Regions.

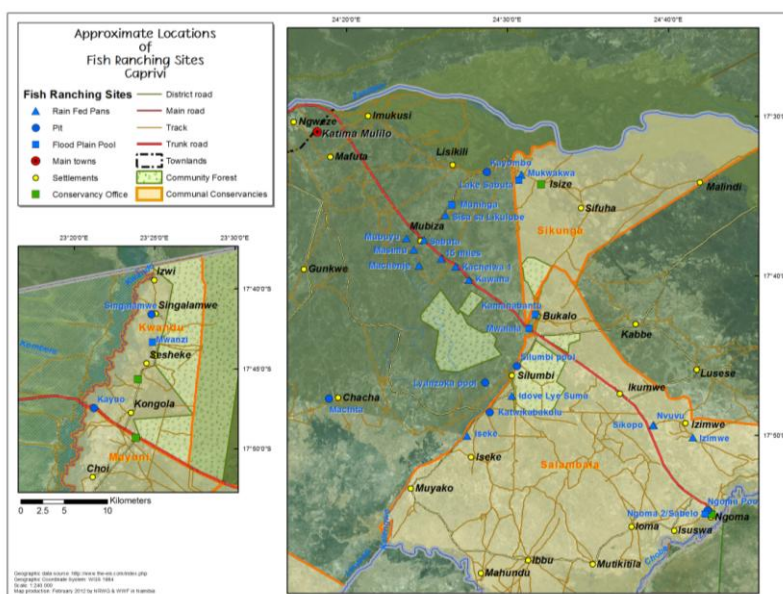


Figure 2. Location of fish ranching sites in Caprivi.

Abbreviations

NNF – Namibia Nature Foundation

CPP – Country Pilot Partnership

MFMR – Ministry of Fisheries and Marine Resources

WWF – World Wildlife Fund in Namibia

REASONS FOR EVALUATION

The MFMR/NNF/WWF Integrated Co-Management of the Zambezi/Chobe Fisheries Resources Project provided support to the Lead Fish Ranching Project, particularly in Phase 1. During Phase 2, the fish ranching was supported largely through the NNF CPP project. When the fish ranching project was discontinued at the end of the funding cycle, an option was for the activities to be continued by the MFMR as part of its core aquaculture activities. This did not happen. To determine the way forward for further potential fish ranching activities through the MFMR, it was deemed appropriate for an evaluation of the project's successes and/or failures.

The evaluation's main objective was to determine the viability of the existing fish ranching initiative and the likelihood of future success. Recommendations of the expansion of fish ranching activities into other areas outside the remit of the original project were also required. Appendix 1 gives the full terms of reference for the evaluation.

STUDY AREA

The map gives the locations of the 34 fish ranching sites¹. These sites are mainly in the Caprivi Region (31 sites), with 3 of the newer sites in the Kavango Region. Twenty-seven of the 31 sites in the Caprivi Region are between Katima and Ngoma and accessible off the main tar road. There is one site off the Linyanti Road (an old road "borrow pit" at Machita Village) and three sites in Kwandu Conservancy (along the Kwandu River floodplain).

IMPLEMENTATION OF ACTIVITIES AND METHODOLOGY

In December 2011, Ms Priscah Lilungwe (main project implementer) provided information about the fish ranching sites and project data, including some of the names and contact details of the key stakeholders. From this information, a matrix was drafted to describe aspects of each site as per the list of questions in the project's terms of reference². This matrix was used in the field to verify information with stakeholders and fill any data gaps. Interview material and matrix data were the main sources of information used in this report. Main features of the matrix are shown in Appendix 3. A ranking system was devised to classify each fish ranching site according to sustainability.

Although most sites were visited to get GPS points, those with the greatest likelihood of success were prioritised for closer inspection during the evaluation. This was done by ranking the 34 project sites in order of importance and locations in relation to each other. Sites in the Kavango Region were not visited. Ms Lilungwe helped access the sites and contact local people. In order for an

¹ During fieldwork, GPS points of 30 of 31 sites in Caprivi were obtained. Ministry staff obtained GPS points of Kavango sites. S. Thompson (WWF) produced the map. GPS points are in Appendix 5.

² Physical and socio-economic features of the matrix included pond type (excavated pit, natural pan or floodplain pool) and volume; number of beneficiary households; quality of water; whether there were undesirable fish species in the pond before the project and what method was used for removal; fish yields; whether harvest was for consumption and/or cash and any cash from fish sales.

independent review, the evaluation was conducted using an additional person as an interpreter (Mr Cisco Mwaka³).

ENVIRONMENTAL AND SOCIO-ECONOMIC ASPECTS OF THE SUSTAINABILITY RANKING SYSTEM

Water harvesting at fish ranching sites uses rainfall, with some sites fed by flood water. For this reason, the likelihood of water permanence was considered a major factor in the suitability of sites for fish ranching. Sites are either artificial rain fed pools (e.g. old road “borrow pits”), natural, rain fed clay pans in mopane forest or floodplain pools. The latter are filled by inundation or rainfall or both depending on local conditions. Rain fed pans may need regular restocking and were ranked as less sustainable than permanent pools that would be able to retain brood stock over the dry season. Likewise, floodplain pools can lose their fish stock if flooded before harvesting⁴. For this reason, floodplain pools were ranked as less sustainable than permanent pools. Whether rain fed pans were holding water at time of survey was used to further differentiate rain fed pans according to their water holding capacity. The pans holding water at the time of the survey were classified as more sustainable than those that were empty.

A key socio-economic feature of sustainability was whether the site had been fished post-project and therefore without external assistance. This was taken as an indication of community mobilisation and ownership.

Table 1 gives the categories (A, B or C) and criteria used to classify sustainability of fish sites.

TABLE 1: SUSTAINABILITY RANKING SYSTEM - CATEGORIES AND CRITERIA USED	
CATEGORY	CRITERIA
Sites are highly sustainable = A	Sites with permanent water (and no flooding) Retain sufficient brood stock without restocking Site fished post project Site over 2 years old
Sites are conditionally sustainable = B, if managed for flooding (B1) or restocking (B2 and B3) B2 = pans holding water at time of survey B3 = pans dry at time of survey.	Sites without permanent water or sites that are regularly flooded that require restocking Sites fished post project or strong community interest
Sites are not sustainable = C due to environmental or social reasons	Very shallow Community dispute

³ Mr Mwaka work previously in the general area for NNF as a community facilitator, mainly with conservation agriculture and chilli production.

⁴Management of flooding can include early harvesting pre-flood, or fencing the pool using traditional or wire fencing to retain the fish stock. Post flooding may require removal of undesirable fish species e.g. cat fish from the residual pools that are left behind on the floodplain.

RESULTS OF EVALUATION

5.1 Sustainability ranking of fish sites

Table 2 summarises the sustainability of 31 of the 34 fish ranching sites. Six sites are highly sustainable as they retain water and brood stock and have also been fished post-project. Twenty-three sites are conditionally sustainable if managed for flooding and/or restocking. Two sites are not sustainable due to environmental or social reasons. The three sites in Kavango Region were not included as they were not visited during the evaluation.

TABLE 2: SUSTAINABILITY RANKING OF 31 OF THE 34 FISH RANCHING SITES		
CATEGORY	CRITERIA	FISH RANCHING SITES
<p>Sites are highly sustainable = A <i>6 sites, four are large borrow pits and two are large floodplain pools.</i></p>	<ul style="list-style-type: none"> Sites with permanent water (and no regular flooding) Retain sufficient brood stock without restocking Fished post project 	<p>MACHITA SILUMBI POOL NGOMA POOL/KANDIANA MUNINGA SISA SA LIKULUBE LYANZOKA POOL</p>
<p>Sites are conditionally sustainable = B, if managed for flooding (B1) or restocking (B2 and B3) B2 = pans holding water at time of survey B3 = pans dry at time of survey <i>23 sites – 8 are floodplain pools and 15 are rain fed pans</i></p>	<ul style="list-style-type: none"> Sites without permanent water or regularly flooded Fished post project or strong community interest 	<p>B1 KAMABANTU MWALALA MUKWAKWA/MUCHENJE LAKE SABUTA KAYOMBO KAYUO MWANZI SINGALAMWE B2 MASIMU KACHELWA 1, 2 AND 3 IDOVE LYE SUMA KATWIKABAKULU ISEKE SABUTA IZIMWE B3 SIKOPO NVUVU KAWANA 15 MILES MUBUYU MUCHENJE</p>
<p>Sites are not sustainable = C due to environmental or social reasons</p>	<ul style="list-style-type: none"> Sites too shallow Land dispute 	<p>SABELO (filled in by soil) MARITZBURG (land dispute)</p>

5.2 Harvest data

Harvest figures for the first harvest season were available for half of the sites (17 out of 34). From these 17 sites, harvest numbers per site varied from 4 000 fish at Silumbi Pool (the largest fish ranching site) to 200 at Sabelo. The total amount of fish of all sizes caught at these 17 sites was just over 33 000 fish. At an estimate of 350g per fish⁵, this amounts to 11 550 kg. At N\$ 10 per kg, the commercial value if sold to a trader on site is estimated at N\$115 500⁶.

At all sites, the vast majority of fish was consumed by beneficiary households, with some sales. If the documented harvest for 17 of 34 sites was doubled to give an estimate of the total harvest from all 34 sites, this would be 66 000. If ten percent of this fish (6 600 fish) was sold for example, the total harvest consumed could be estimated at just under 60 000 fish or 21 000 kg of fish. This is valued at N\$ 210 000, using N\$ 10/kg of fish.

Fish was either sold at Katima Market (e.g. from Kawana at Mubisa) or locally. Sales figure amounts were confirmed by beneficiaries at 10 of the 22 sites visited during the evaluation. The total cash amount for the ten sites was N\$ 11 244⁷. This figure accounts for 10 of 34 sites or 30% of sites. If

5.3 Positive Livelihood impact of fish ranching project

By contributing to food security and poverty alleviation, the fish ranching project has had a positive impact on beneficiaries' livelihoods⁸. In addition, the training in fish management provided by the project is new and has improved local people's human capital. As Mr Sikopo remarked, "We didn't know that we can grow fish as we grow cabbages".

Most of the fish harvested from the fish ranching sites was consumed locally. "If the fish ranching project continues, our sons will eat" was a comment from Mr Tsukhani from Machita. Beneficiaries made savings in eating locally produced fish by not having to buy the equivalent food. If bought on the market, the estimated amount of fish consumed for all the sites in one season would have cost just less than a quarter of a million N\$.

At Ngoma Pool, N\$ 1000 was earned from the sales of the bigger fish harvested. This cash was distributed amongst six households, with each household earning N\$ 167. With this cash, people bought food. Although a modest sum, it compares favourably with previous, annual, cash distribution from Salambala Conservancy (disbursement of some of the trophy hunting income at the village level).

Some income from fish sales was reinvested in the fish ranching business through the purchase of fishing equipment (e.g. hooks were bought Lyanzoka) or fish food (e.g. bran at Machita).

Other income was invested in education. At Machita village, the fish pond committee opened a Nampost account with the N\$ 1 500 they earned from selling big fish and also fingerlings to a neighbour. Most of this fish ranching income (N\$ 1 000) was spent on school funds and uniforms for

⁵ Average figure for weight of fish provided by Denis Tweddle.

⁶ Bream is sold at double this price (that is, N\$ 20/kg) at Katima Market. So the value of the fish at the Market would be about N\$ 230 000.

⁷ Just over a quarter of this amount is for 3200 fingerlings bought by the project for stocking.

⁸ An estimate of the total number of beneficiaries at 34 sites is approximately 500 households or 2500 people (5 people per household). This estimate is taken from records of 24 of the 34 sites (70% of sites) which is 326 households or 1630 people.

22 orphans. As Mathew Tsukhani said, “we could not see the children running around in rags and do nothing”. Other fish ranching income was used to pay school fees⁹.

5.4 Strong community interest in fish ranching

Beneficiaries interviewed for this report were overwhelmingly positive about the project, including the project’s continuation. NNF staff members were thanked for being the first to teach people about fish farming. At the Ngoma Pool site Martin Matengu thanked the N3NF for their efforts, “We are very happy that NNF helped us a lot. We appreciate this help”. Even when harvests had been disappointing, there was still continued interest in getting the fish ranching right. Joseph Kayombo’s pond near Kalimbeza was flooded before he could harvest and he lost all his fish after spending a lot of cash on fish feed (bran mash from Katima). However, he expressed an interest in getting a chicken mesh fence to stop them being swept away in the floods.

Farmer innovation at protecting brood stock was shown by Mr Sikopo at Sikopo pond where he tried to keep fingerlings in a water tank when his pond dried out¹⁰. At the Sisasa Likulube site, a local farmer has dug ponds on higher ground to protect brood stock from being washed away in floods.

5.5 ASPECTS OF FISH RANCHING MANAGEMENT

5.5.1 Removal of undesirable fish species pre-project

The artificial ponds/ borrow pits and flood plain pools required removal of undesirable fish species prior to stocking¹¹. Netting and hooks were used.

5.5.2 Stocking

Total fingerlings stocked in 33 of the 34 sites was 34 000 fingerlings. Caprivi sites were stocked in 2008 and 2009. Sites on the Kwandu River and near Rundu were stocked in 2010. Stocking amounts varied from 200 to 3000 per site, depending on the size of the water body and available resources at time of stocking. A quarter of all sites were stocked to full capacity. In 2008 and 2009, the project bought 3200 fingerlings from three sites to stock other sites (and paid N\$1/fingerling).

All 16 of the beneficiaries interviewed (refer to Appendix 2) expressed a willingness to pay for fingerlings in the future (N\$1 per fingerling), with some requesting payment to be deferred till post-harvest.

5.5.3 Fish feeding

Stakeholders interviewed in the evaluation reported that they had fed the fish. Feed consisted of food leftovers, cattle manure and garden residue. MFMR supplied fish pellets in 2009 to some sites at no cost (e.g. Ngoma Pool). At Machita, cash earned from selling fish was used to purchase fish food (bran mash from Katima Mulilo).

5.5.4 Harvest methods

Harvesting took place using a drag net on loan from the project¹² or with hooks.

⁹PriscahLilungwe, pers comm.

¹⁰He did not succeed as he believed the water got too cold in winter.

¹¹ Removal was carried out at 12 of the 34 sites, often requiring multiple attempts at removal.

¹² Drag netting is an illegal practice hence the loan of the net for the specific purpose of harvesting in the ponds.

5.5.5 Future aspects of fish ranching

Future aspects of fish ranching management included fencing the ponds to avoid damage from cattle trampling, deepening ponds to increase productivity and expansion to neighbouring sites.

5.5.6 MFMR participation at the fish sites

Some of the sites reviewed in the evaluation had been visited by MFMR staff members in the past and supplied with fish pellets (e.g. Ngoma Pool and Mwana). NNF staff members also invited local fisheries staff member to accompany them on site visits. Three thousand fingerlings were taken by MFMR staff members to the Kalimbeza Fish Farm for safe keeping over the dry season.

Post-project, Machita fishing committee had contacted MFMR who visited as recently as November 2011. The Red Cross has also visited this site.

5.5.7 Expansion of fish ranching activities outside the original area

There is considerable opportunity to expand fish ranching activities. Road improvements over the last 10 years have left behind many borrow pits that retain water. During the evaluation, eight sites along the main Katima Mulilo-Ngoma tar road were identified in the vicinity of Sikuzwe. NNF staff members are contacted regularly for assistance from new areas e.g. at Namaluvi, a recently inundated area just outside Katima Mulilo on the Ngoma road.

Some of the existing ponds have suitable sites close by for expansion of fish ranching e.g. Silumbi and Machita.

CONCLUSION AND RECOMMENDATIONS

Five to seven years is a normal period needed to introduce and entrench a new technology or initiative whether it be fish ranching, farming or health practices. The Caprivi fish ranching project has completed a first pilot phase. It is a unique and valuable initiative suitable for household or village level production where it is an appropriate alternative to fish farming that requires a far higher level of input and expertise. The fish ranching sites that were identified and selected for stocking are still available for use and the community interest and commitment is still present.

6.1 Continuation of the fish ranching project

It is strongly recommended that the fish ranching programme should be formally continued, either through renewed project funding or as part of the MFMR's aquaculture efforts (see below).

6.2 Focus on a limited number of pond sites

The number of fish ranching sites serviced by a new project or MFMR should match the resources available. Appendix 4 can help in the selection of sites. Rundu sites should be serviced from Rundu. Preference should be given to the Caprivi sites between Katima and Ngoma rather than the Kwandu River sites, as the former are more established. The Machita site should also be prioritised.

6.3 Focus on a few key management activities, including stocking

Extension effort should focus on a few key activities. The main activity is sourcing and stocking with fingerlings. Some of the existing ponds can be used to source fingerlings.

6.4 Project records

Systematic recording and monitoring of stocking and harvesting is needed. For example, a spreadsheet system of recording date and number of fingerlings stocked and fish harvested/income

earned. The template in Appendix 4 could be used. Data capture needs to be regular and standardised.

6.5 Support by MFMR

If further project funding cannot be sourced, it is recommended that the fish ranching programme should be continued under the auspices of the MFMR as part of its “aquaculture” programme. The MFMR in Caprivi is providing some assistance already e.g. fisheries officials lent Silumbi fish committee a drag net to harvest in November 2011. This *ad hoc* assistance needs to be formalised. This report can assist in this process which should include drafting terms of reference for staff working on the fish ranching project.

6.5 Information about the future of the Caprivi Fish Ranching Project

For clarity at the community level, it would be desirable for the community fish pond committee members to be informed of the project’s future.

6.6 Facilitated process for handover

A facilitated handover of the project would be useful as some sites may be difficult to locate. The Integrated Co-Management of Zambezi/Chobe Fisheries Resource project may be in a position to assist with this facilitation.



Top left: Mr Ntema and Priscah Lilungwe, Iseke (pool rain fed pan)
Bottom left: Mr Tsukhani with Carol Murphy, Machita Pool (borrow pit)
Right: Mr Mwlima at Muinga Pool, Mubisa (floodplain pool)

APPENDIX 1: TERMS OF REFERENCE FOR THE EVALUATION

The consultant will:

- 1) Consult with the previous project leader, Ms Priscah Lilungwe, to determine the location of all pans and gravel pits stocked with fingerlings during the project.
- 2) Consult with Ms Lilungwe to determine the names and localities of all key stakeholders at each stocking site.
- 3) Develop a questionnaire for use with each group of stakeholders to determine the relative success or failure of the project and potential for long term success if MFMR re-engages with the programme.
- 4) Visit each project site, accompanied by a community engagement specialist/interpreter from IRDNC (through John Kamwi) or NNF (Tererai).
- 5) At each site, consult with the key stakeholders to answer the questions listed below (and others that the specialist may think relevant) and determine if the project had the potential for long-term, sustainable success.
- 6) Provide a brief, subjective description of the water body by answering the questions below.
- 7) Determine if there are any other pans or gravel pits in the vicinity of each existing site that might be suitable for stocking.
- 8) Produce a detailed report on the possibility of successfully developing a sustainable and economically viable fish ranching operation at each site, for submission to the MFMR Directorate of Aquaculture and Inland Fisheries.

QUESTIONS TO BE ANSWERED

This list is not exhaustive.

- 1) Did the community derive any benefits (either food security or economic) from the project?
- 2) If so, attempt to quantify by how much in kg or N\$.
- 3) Would the community like the programme to be resumed?
- 4) Has the community attempted to continue the programme through contact with MFMR?
- 5) Does the water body need restocking every year or can it be managed sustainably by leaving sufficient brood stock in the water body when harvesting to ensure successful breeding and thus natural replacement?
- 6) If stocking with fingerlings each year is considered necessary, is the community prepared to pay for the fingerlings from the MFMR at cost price?
- 7) What type of water body was the project site, e.g. rainwater fed pan, gravel pit, floodplain pool, etc.?
- 8) What is the size and approximate depth of the water body?
- 9) What is the water quality like? (subjective assessment, e.g. clear water pond; muddy pond; green, algae-filled pond; liquid cow manure, etc.?)
- 10) Is the water body completely isolated or is it connected to the floodplain waters, either annually or very infrequently at high floods?
- 11) Were there any fish naturally in the water body when it was first stocked by the project?
- 12) If so, what were they?
- 13) If so, what steps, if any, were taken to remove them before stocking?
- 14) What has happened to the fishes in the water bodies post-project? Are they being fished and if so, how? e.g. by organised community netting, fishing with hooks by children, fishing by women and children with mosquito nets for mbaala, etc.?

TIMING OF CONTRACT AND CONTRACT DETAILS

The consultant is expected to complete the evaluation within eight days in December 2011.

DAY 1. The consultant will spend the first day in consultation with Ms Priscah Lilungwe to determine the stocking site localities and the names and contact details of the key stakeholders at each site and to collect copies of all reports and project data. Mr Lilungwe will be contracted to provide all relevant information for the consultant, including reports and all data on stocking densities, harvest yields, earnings from fish sales, etc. These data will assist the consultant in evaluating the future potential for continued fish ranching activities.

DAYS 2 to 5. The consultant will visit each of the project sites and determine, through questionnaires and inspection of the sites, the likelihood of success of further interventions by the MFMR. The 34 reported project sites should be ranked in order of importance and locations in relation to each other for optimal planning of the programme. They should be ranked in order of priority, i.e. Ms Lilungwe's assessment of their success and/or potential. In case it is not possible to visit all sites in the allocated time period, this ranking should be used to determine priority sites for evaluation.

DAYS 6 to 8. The consultant will review the available reports and stocking/catch data for each site and draw conclusions on the viability or otherwise of future fish ranching activities. These will be combined into an evaluation report on the Lead Fish Ranching Programme that will serve to guide the MFMR in planning whether to continue the fish ranching programme and if so, whether to expand these activities into other areas outside the remit of the original project.

APPENDIX 2: NAMES AND LOCALITIES OF KEY STAKEHOLDERS INTERVIEWED AT SELECTED SITES

SITES	NAMES	PHONE NUMBER
No 1 Ngoma Pool/Kandiana	Mr Martin Mutengu	081 442 3629
No 2 Silumbi	Mr Obby Matomola (VDC chairperson) Helen (treasurer)	081 362 8229
No 10 Mwalala	Mrs Mwiya	081 320 7838
No 11 Iseke No 3 Lyanzoka No 24 Idove Lye Suma No 27 Katwikabakulu	Innocent Ntema	
No 12 Sikopo	Mr Sikopo	081 616 1054
No 14 and 15 Mukwakwa and Lake Sabuta	Mr Thomas Sabuta	081 229 7800
No 17 Muninga	Mr Mwlima	081 404 7567
No 18 Sabelo	Mr Harris Sililo	081 449 9615
No 19 Sabuta	Mr Sinvula Sabuta	
No 26 Machita	Mr Mathew Tsukhani Mr Geoffry Samunzala (neighbour who brought fingerlings)	081 647 5256 081 124 1480
No 28 Kayombo	Mr Joseph Kayombo	081 211 4758
No 29 to 31 Singalamwe, Kayuo and Mwanzi Singalamwe	Vasco Titus Lungwe	081 217 8883 081 753 6657
No 32 Shikanduko	Gosbert (MFWR)	081 284 2008
No 33 Mavanze	Buyer	081 343 1779
No 34 Kasote	Francis	081 405 1019

APPENDIX 3 – GROUPING OF PRIORITY FISH RANCHING SITES ACCORDING TO PROXIMITY		
AREA	SITES	ACCESS AND SPECIAL FEATURES
LINYANTI	MACHITA AND EXPANSIONS Neighbouring farmer bought fingerlings (Geoffry Samunzala)	Accessible off the Linyanti Road
SALAMBALA CONSERVANCY	NGOMA POOL and SABELO SIKOPO and NVUVU IZIMWE	Ngoma Sikopo and Nvuvu are close together off the main tar between Bukalo and Ngoma.
BUKALO TO MUYAKO	KAMABANTU MWALALA SILUMBI LYANZOKA ISEKE IDOVE LYE SUMA KATWIKKABAKULU	In the Bukalo Channel. Mwalala accessible off bridge area. Kamabantu behind Bukalo town and belongs to the Chief. Accessible off the Muyako road. Lyanzoka requires traversing the Bukalo Channel In mopane forest between Silumbi and Muyako
In or before SIKUNGA CONSERVANCY	KAYOMBO MUKWAKWA and expansions LAKE SABUTA and expansions	Just before Sikunga C, on the Kalimbeza road In flood plain off the Kamlimbeza Road.
MUBISA On tar road between Katima and Bukalo	MUNINGA SISA SA LIKULUBE MBUYU MASIMU MACHENJE SABUTA 15 MILES KAWANA KACHELWA 1,2 AND 3	Sites are next to each other, accessible off main tar road, but need 4x4 in wet season/flood. All close to main tar road.
KWANDU CONSERVANCY	SINGALAMWE MWANZI KAYUO	Kayuo is close to the bridge over the Kwandu River. Singalamwe accessible behind the school off main gravel road. Kayuo accessible off main gravel road.
KAVANGO	SHIKANDUKO MAVANZE KASOTE	All borrow pits easily accessible from main roads.

APPENDIX 4: MATRIX - FISH SITES

NO	NAME	TYPE	VOLUME (m3)	AREA	DATE STOCK	AMT STOCKED (fingerlings)	CONSUMPTION OR SALES	YIELD (fish)	CASH EARNED N\$	HHS
1	Ngoma Pool	Pit	270	Salambala C	2008 Oct	200	both	1684	1860	6
2	Silumbi pool	Pit	1500	Salambala C	2008 Oct	1000	both	4000	1145	15
3	Lyanzoka pool	Pit	1200	Sikanjabuka	2008 Oct	500	both	229	332	10
4	Kawana	pan	1000	Mubiza	2008 Feb	1000	both	2464	1004	20
5	Kachelwa 1	pan	560	Mubiza	2008 Feb	200	both	2872	1087	16
6	Kachelwa 2	pan	450	Mubiza	2008 Feb	200	consumption	150	0	16
7	Kachelwa 3	pan	225	Mubiza	2008 Feb	400	consumption	1200	0	16
8	15 miles	pan	600	Mubiza	2008 Feb	1000	both	3600	2049	5
9	Kamanabantu	pool	900	Bukalo	2008 June	1000	consumption	1700	0	0
10	Mwalala	pool	210	Bukalo	2008 June	1500	consumption	3355	0	0
11	Iseke	Pan	1000	Iseke area	2008 June	1000	consumption	2084	0	10
12	Sikopo	pan	1400	Salambala C	2008 July	200	consumption	1702	0	18
13	Izimwe	pan	250	Salambala C	No stocking	NA	NA	NA	0	0
14	Mukwakwa or Muchenje	pan	420	Sikunga C	2008 Sept	1700	consumption	Not known	0	10
15	Lake Sabula	pool	480	Sikunga C	2008 Sept	1800	consumption	900	0	0
16	Maritzburg	pool	1200	Salambala C	2009 Jan	1200	both	Not known	0	10
17	Muninga	pool	600	Mubiza	2009 Jan	1000	both	1400	1030	0
18	Sabelo	pool	480	Salambala C	2009 Jan	600	consumption	200	0	5
19	Sabuta	pan	100	Mubiza	2009 Jan	500	consumption	0	0	10
20	Machenje	pan	1200	Mubiza	2009 Jan	3000	both	0	0	0
21	Masimu	pan	600	Mubiza	2009 Jan	500	consumption	0	0	10
22	Sisasalikulube	pan	600	Mubiza	2009 Jan	1500	consumption	0	0	15

23	Mubuyu	pan	300	Mubiza	2009 Jan	1000	consumption	0	637	5
24	Idove Lye Suma	pan	600	Sikanjabuka	2009 Feb	800	consumption	0	0	8
25	Nvuvu	pan	1200	34 Miles	2009 Feb	1000	consumption	2000	600	16
26	Machita	pit	1200	Linyanti	2009 Feb	1000	both	3500	1500	15
27	Katwikabakulu	pit	480	Sikanjabuka	2009 Feb	600	both	0	0	10
28	Kayombo	Pit	540	Sikunga C	2009 Feb	2000		0	0	0
29	Singalamwe	Pit	600	Kwandu C	2010	1000		0	0	0
30	Kayuo	pit	600	kwandu C	2010	1000		0	0	0
31	Mwanzi	pool	600	Kwandu C	2010	500		0	0	0
32	Shikanduko	pool	600	Kavango	2010	1800		0	0	30
33	Mavanze	pool	300	Kavango	2010	1800		0	0	20
34	Kasote	pool	338	Kavango	2010	1500		0	0	30
	TOTALS		22603			34000		33040	11244	326

APPENDIX 5: GPS POINTS OF 34 FISH PONDS

NUMBER	NAME OF FISH POND	AREA	GPS S	GPS E	TYPE
1	Ngoma Pool	Salambala C	17.91144	24.70712	Pit
2	Silumbi pool	Salambala C	17.76083	24.50969	Pit
3	Lyanzoka pool	Sikanjabuka	17.77819	24.47689	Pit
4	Kawana	Mubisa	17.67114	24.46016	pan
5	Kachelwa 1	Mubisa	17.65738	24.44655	pan
6	Kachelwa 2	Mubisa	17.65738	24.44655	pan
7	Kachelwa 3	Mubisa	17.65738	24.44655	pan
8	15 miles	Mubisa	17.64885	24.43167	pan
9	Kamanabantu	Bukalo	17.7072	24.52917	pool
10	Mwalala	Bukalo	17.72179	24.52237	pool
11	Iseke	Iseke	17.83387	24.4581	Pan
12	Sikopo	Salambala C	17.82278	24.65138	pan
13	Izimwe	Izimwe	17.83527	24.69176	pan
14	Mukwakwa/Muchenje	Sikunga C	17.56099	24.51437	pan
15	Lake Sabuta	Sikunga C	17.567	24.51177	pool
16	Maritzburg	Salambala C			pool
17	Muninga	Mubisa	17.59301	24.44256	pool
18	Ngoma 2/Sabelo	Salambala C	17.91556	24.70483	pool
19	Sabuta	Mubisa	17.62923	24.41363	pan
20	Machenje	Mubisa	17.65598	24.40866	pan
21	Masimu	Mubisa	17.63945	24.40305	pan
22	Sisa sa Likulube	Mubisa	17.60346	24.43587	pan
23	Mubuyu	Mubisa	17.62746	24.3955	pan
24	Idove Lye Suma	Sikanjabuka	17.79181	24.50462	pan
25	Nvuvu	34 Miles	17.82302	24.6507	pan
26	Machita	Linyanti	17.79499	24.31499	pit
27	Katwikabakulu	Sikanjabuka	17.80927	24.48148	pit
28	Kayombo	Kalimbeza	17.55818	24.47852	Pit
29	Singalamwe	Kwandu C	17.69315	23.41342	pool
30	Kayuo	Kwandu C	17.79128	23.35381	pit
31	Mwanzi	Kwandu C	17.72232	23.41438	pool
32	Shikanduko	Kavango	17.92995	19.7718	pit
33	Mavanze	Kavango	17.97669	19.7408	pit
34	Kasote	Kavango		19.74057	pit

ICEMA - NNF ZAMBEZI / CHOBE FISH RANCHING PROJECT

PART 1

SUMMARY REPORT OF PROJECT ACHIEVEMENTS

ICEMA - NNF ZAMBEZI / CHOBE FISH RANCHING PROJECT

END OF PROJECT REPORT

Priscah Lilungwe – Project Co-ordinator

March 2011

The ICEMA – NNF Zambezi/Chobe Fish Ranching Project had the objective of establishing low input small scale fish farming in communities by stocking natural water bodies. Technical support and fingerlings purchased was some of the support provided by the NNF - ICEMA project in pilot sites in Caprivi and Kavango Regions. This aspect of the programme dove-tailed well with the Namibian government-lead initiative known as the Country Pilot Project Programme which is also supporting diversified livelihoods across the country. To date this program has been very successful as some of the sites are stocked with tilapia fingerlings already and growing well. The stocking of three types of tilapia species is recommended in this region because of biological factors such as environmental conditions, growth rates and breeding pertain. Specifically, these tilapia are: *Tilapia rendalli* [Redbreast], *Oreochromis andersonii* [Threespot], and *Oreochromis macrochir* [Greenhead]. Importantly, the program has been successful in reducing pressure on capture fisheries as well as improving the livelihood of the beneficiaries and communities living nearby the low input fish farms.

The majority of the fish farming projects implemented in Caprivi and Kavango Regions are those that require construction of manmade ponds to rear fish. Such systems are very expensive and require intensive management, therefore there are limits on reaching out to poor rural communities. The current programme, through the implementation of low input small scale fish farming by NNF-ICEMA, has been extremely well received by the communities who to date have appreciated the support and ease in managing and affording this option of fish farming.

A considerable amount of work has been undertaken including site identification for new or potential fish ponds; inspection and approval of these suitable sites; and subsequent follow up. All of these efforts were done in collaboration with the communities.

More than 50 sites across the Caprivi and Kavango Regions were selected, identified and inspected, with 34 of them approved and stocked with fingerlings. Opportunities for other sites in future to be included in this or future programmes are appropriate as support becomes available.

Two fish pond stockings took place in natural water bodies at Machita and Nvunvu in the Caprivi Region and eight more sites were still under improvement or final development stage in both Caprivi and Kavango Regions before final stocking was planned to take place in early 2011. As a critical component of the project, targeted training was to be undertaken before the end of March to facilitate capacity building.

Growth monitoring of the fish was conducted monthly in the stocked sites whereby 30 fish are gathered, measured, and weighed to monitor the growth, health status of fish. The results indicated

that fish were growing and very healthy despite limited fish food as a result of poor harvests. Unfortunately, most farmers lost their crops due to flooding and this has had a local impact on growth but not as much as expected. Fingerlings which were stocked in June/July 2010 at 3 cm to 10 cm became brood stocks and bred in Nvunvu and Machita. The samples showed there was a significant number of fingerlings in these ponds which is a good indicator for sustainability of the programme.

Nvunvu was expected to harvest about 500 fish, with small fish relocated to a nearby holding point as it is 'periodic' site. The site was planned to be restocked in early 2011 but the project then came to an end.

Machita is ready to provide fingerlings to other new farmers, with almost 5,000 fingerlings to be sold to other sites at a N\$1 per fingerling.

The low input fish farming programme is gaining momentum in the Caprivi and Kavango Regions, and as such the communities are realising the benefits. Numerous water bodies have been identified as floods recedes and these are under consideration for utilising as seasonal fish ponds in the future.

What we have Accomplished

- Five training sessions instructing farmers on various aspects of extensive fish farming management.
- Stocked over 40,000 fingerlings in different LFF sites.
- Initiated and improved site sampling to collect growth data from lead fish farmers.
- Identified alternative fish feed sources to use when there are no local harvest wastes available.
- Gained support and participation from the Communities.

Challenges

- Building farmers' capacity and ongoing commitment is limited due to limited projects funds hence the project is coming to an end as of March 2011.
- Due to a range of reasons, technical visits and opportunities to build extension capacity have been limited
- The conservancies and Communities around Kavango and Caprivi region are realizing how important the program is in improving their livelihood, a lot of request has been submitted and the project is not in a capacity to help due to lack of funds.

FISH RANCHING SITE DATABASE							
NUMBER	NAME OF FISH POND	AREA	Date stocked	Number of fingerlings stocked	Consumption or sale	Yield of fish	Cash earned
1	Ngoma Pool	Salambala C	2008 October	200	both	1684	1860
2	Silumbi pool	Salambala C	2008 October	1000	both	4000	1145
3	Lyanzoka pool	Sikanjabuka	2008 October	500	both	229	332
4	Kawana	Mubisa	2008 February	1000	both	2464	1004
5	Kachelwa 1	Mubisa	2008 February	200	both	2872	1087
6	Kachelwa 2	Mubisa	2008 February	200	consumption	150	0
7	Kachelwa 3	Mubisa	2008 February	400	consumption	1200	0
8	15 miles	Mubisa	2008 February	1000	both	3600	2046
9	Kamanabantu	Bukalo	2008 June	1000	consumption	1700	0
10	Mwalala	Bukalo	2008 June	1500	consumption	3355	0
11	Iseke	Iseke	2008 June	1000	consumption	2084	0
12	Sikopo	Salambala C	2008 July	200	consumption	1702	0
13	Izimwe	Izimwe	No stocking	N/A	N/A	N/A	0
14	Mukwakwa/Muchenje	Sikunga C	2008 September	1700	consumption	NOT KNOWN	0
15	Lake Sabuta	Sikunga C	2008 September	1800	consumption	900	0
16	Maritzburg		2009 January	1200	both	NOT KNOWN	0
17	Muninga	Mubisa	2009 January	1000	both	1400	1030
18	Ngoma 2/ Sabelo	Salambala C	2009 January	600	consumption	200	0
19	Sabuta	Mubisa	2009 January	500	consumption	0	0
20	Machenje	Mubisa	2009 January	3000	Both	0	0
21	Masimu	Mubisa	2009 January	500	consumption	0	0
22	Sisa sa Likulube	Mubisa	2009 January	1500	consumption	0	0
23	Mubuyu	Mubisa	2009 January	1000	consumption	0	637
24	Idove Lye Suma	Sikanjabuka	2009 February	800	consumption	0	0
25	Nvuvu	34 Miles	2009 February	1000	consumption	2000	600
26	Machita	Linyanti	2009 February	1000	both	3500	1500
27	Katwikabakulu	Sikanjabuka	2009 February	600	both	0	0
28	Kayombo	Kalimbeza	2009 February	2000		0	0
29	Singalamwe	Kwandu C	2010	1000		0	0
30	Kayuo	Kwandu C	2010	1000		0	0
31	Mwanzi	Kwandu C	2010	500		0	0
32	Shikanduko	Kavango	2010	1800		0	0
33	Mavanze	Kavango	2010	1800		0	0
34	Kasote	Kavango	2010	1500		0	0
TOTAL				34000		33040	11244

PART 2

GENERAL DESCRIPTION OF PROJECT ACTIVITIES

LOW INPUT FISH RANCHING IN CAPRIVI AND KAVANGO REGIONS

Priscah Lilungwe, NNF –Zambezi/Chobe Fisheries Project Co-ordinator- Fish Ranching Programme

Project Background

The low input fish farming concept was established in 2006 in Caprivi region by Dr B.C.W. van der Waal after the identification of more than 100 potential natural water bodies which could be used for fish farming activities. The low cost fish farming was then introduced to the region through the Community Empowerment and Enrichment Programme funded by European Union and Global Environmental Fund administered through the Namibia Nature Foundation. More than 50 sites were inspected and approved for stocking, of which 34 sites were stocked with fingerlings by the end of the project in March 2011, 30 sites in Caprivi and 4 sites in Kavango region. The remaining sites were not stocked due to the project's limited time frame and funds.

The overall objectives of the project were as follows:

1. Develop a suitable design and management regime for viable low input fish farming
2. Implement as many low input fish farms as possible in the regions
3. Develop appropriate technical fish production manuals in the local languages
4. Establish a training / extension system
5. Preparing other households to produce fish

The impact of the low input fish farming on resources:

1. Utilisation of previously unused natural water bodies
2. A decrease in destructive fishing practices and over fishing
3. Creation of alternate supplies of fish through small family managed fish ponds
4. An increase in availability/ consumption of competitively priced protein through improved production.

After the sites were identified, the communities were approached to introduce the low input fish farming concept, and to see if they were willing to take up the initiative. The communities responded very well; a high level of interest in aquaculture was already present in the area. Some of the communities had already started the introduction of catfish in the nearby natural water bodies. Most people tried the catfish farming, but it was not successful due to lack of knowledge to on what compatible species could be stocked and other biological factors. When the idea was accepted by the local Indunas and communities, sites were re- inspected and scanned for other predatory species. Water quality tests were carried out soon after the identification sites and site managers from the community were given tasks to improve the site production systems. In total, three pilot sites were selected in the eastern of the Caprivi region: Silumbi, Ngoma and Lyanzoka.

The pilot sites were successful and have been harvesting fish since 2007. Following the pilot sites another 30 sites were stocked in the same fashion. In response to the success of the initial low input fish farming programme the communities requested and obtained continued stocking of natural water bodies under CPP and ICEMA.

Production Systems for Low Input Fish Farmers

The availability of natural water bodies in the Caprivi and Kavango Region reduces the need for expensive constructed ponds, which require digging and lining.

There are two different types of natural water bodies available in the Caprivi and Kavango (rain or flood fed water bodies):

1. Permanent water bodies - hold water year round
2. Periodic water bodies - hold water for a minimum of six to eight months, then dry out.

Production in permanent water bodies can happen year round with two harvests per year, whereas harvesting in periodic sites can happen after six to eight months. If a consistent source of fingerlings can be maintained in the Caprivi Region, periodic sites can be a valuable source of protein and profits for community members.

Below are examples of these two types of natural water bodies found in the Caprivi Region.



Mubiza Site, a periodic site just 15 minutes from Katima Mulilo, was stocked with 1,000 fingerlings and harvested over 3,000 fish in six months. The community decided to use the fish for consumption, but if the fish were sold they would have made about NAD 30,000.

A permanent pond in the Bukalo area. This site has about 2 m of water all year round, which allows the farmers to harvest twice a year. Sometimes the fish go directly to the table, and at other times the fish are sold for NAD 5-10 each.

Species Recommended for Low Input Rearing.

Not all fish species are suitable for fish ranching, but there are specific types of species which are recommended for the stocking of natural water bodies in the Caprivi region.

Species scientific name	Species English name	Species local name (Silozi)	Description	Feeding behaviour
<i>Oreochromis andersonii</i>	Threespot	Njinji	Three midlateral spots	Surface feeder
<i>Oreochromis macrochir</i>	Green head	Muu	Greenish area on the head	Surface/ bottom feeder
<i>Tilapia rendalli</i>	Red breast	Mbufu	Reddish area on the chest	Bottom feeder
<i>Clarias gariepinus</i>	Sharptooth catfish	Ndombe	Catfish	Feeds on other fish/detritus



Oreochromis andersonii



Oreochromis macrochir



Tilapia rendalli

When stocking a natural water body, the natural environment should be maintained even during farming. The three tilapia species are stocked together in order to replicate a natural environment, as well as to maximise the use of food in the production system. *Clarias gariepinus* is stocked together with Tilapia species to control the high population in the ponds. Four to six catfish can be stocked, depends on the size of the pond and the number of fish in the ponds. *Clarias gariepinus* is

not, however, recommended for aquaculture in the region as it has a poor market value partly due to religious beliefs, and so forth by the consumers.



Clarias gariepinus harvested from Lyanzoka site before stocking of tilapia species. Catfish with prey item from stomach.

Stocking and Feeding of Low Input Fish

Stocking of fingerlings take place immediately after inspections and the agreement with the *Khuta (Indunas)* and the local communities. Approximately 1000 - 3000 fingerlings of 3-5 cm long are stocked in each pond. A few days after the date of stocking, fish are fed, using cheap or no cost feeds, such as food scraps, maize bran, vegetable garden residues (at least two times a day). The fertilisation of ponds is also done before or after stocking by adding dry-matter cattle or chicken manure to the pond water. This is done for the propagation of natural fish food such as plankton in the pond. Fertile pond water must look greenish; too much murky or turbid water can cause some unfavourable conditions to the fish which may affect the growth rate of the fish.

Site Sampling- Growth Monitoring

A sample of 30 fish is gathered from each site each month. Fish are weighed and measured for average length. This is done to monitor the growth rate of the fish as well as the health status of the fish under farming conditions.



Fingerlings from Sibulamunda site measuring 3-5 cm long. These can be sold to stock other project sites or kept longer to reach table size for consumption.



A six month fish in Silumbi (natural water body). This fish is an example of a good fish for consumption (hand size) or the fish could be left to grow a bit for sale.



An eight month fish from Silumbi (natural water body). This fish is a good example of a table size fish ideal for sale. The price for this fish could be approx. NAD 10.

These healthy specimens are an indication that the low input fish farming is successful without intensive infrastructure, fancy ponds, and expensive feeds.

Harvest Time

Monthly samples help a farmer to know when his fish is ready for harvesting. After rearing fish for a period of six to eight months the fish should reach table size (about the size of an adult man's hand). Depending on the farmers' needs, some farmers prefer harvesting small fish for personal

consumption and to sell big fish for income generation. During harvest, a large number of people will be at the site to assist farmers to harvest the fish, and fish will be sold and shared at the pond site.



Fisherman preparing the seine net for harvesting. The farmers are provided with training on proper use of nets and fish handling at harvest.



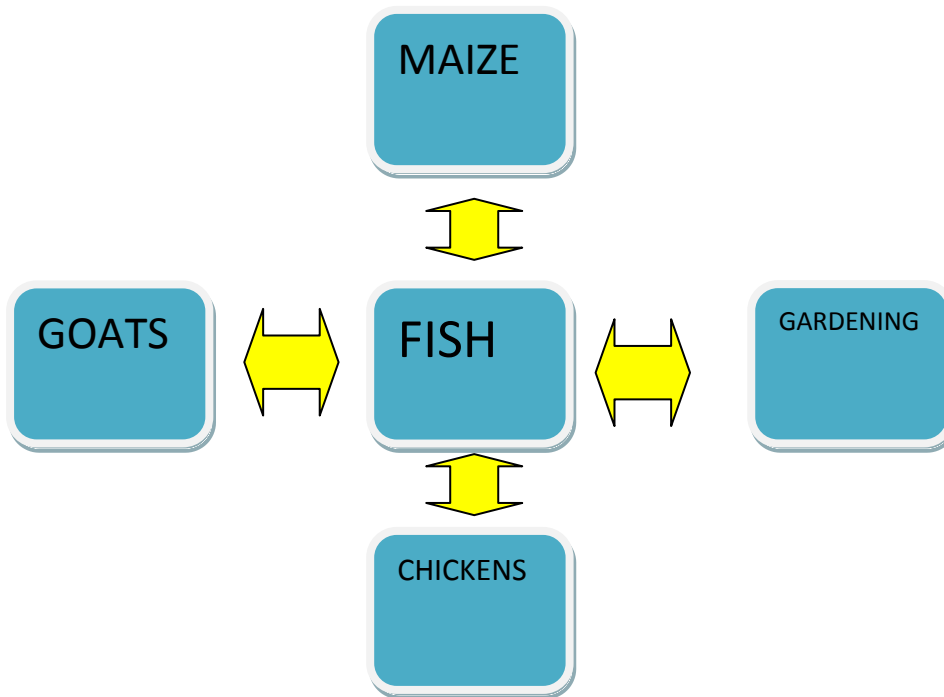
The day's catch ready for sale and for eating at the community members' tables.



Distribution and sharing of fish at the harvest site. The Induna is presiding over sorting. Sometimes conflicts arise during fish sharing, but the local authorities resolve conflicts between management and community members.

Integrated Fish Farming

The Low Input Concept complements the other programmes in the CPP/ICEMA programme. Chickens and Goats provide manure to the fish pond, while fish bones and pieces are good for poultry feeds. The garden provides residues while the fish pond water can be used to fertilise the garden and crops. Maize bran and maize can be used as a supplemental feed.



Other Current and Upcoming Initiatives to the Low Input Fish Farming Programme

- Restocking of depleted rivers and lakes
- Identification of natural water bodies as potential fish farming sites in Caprivi and Kavango
- Restocking of Lakes and Lagoons with depleted fish resources.
- Pen / Cage culture in lakes.
- Creation of fisheries reservoirs to enhance productivity- currently done by the Zambezi /Chobe Fisheries Project in Caprivi only. We have received several calls from Kavango region on this project hence the community are eager to learn how best they can conserve their fish.

EUS Challenge in Caprivi Region

Epizootic ulcerative syndrome or EUS is a disease caused by a mould which starts from the fish surface and gradually grows inside the fish. It was first reported in the 1970s in Japan and Australia. It is now in many countries around the world – in Asia, the United States of America and recently in 2006 in Africa – Namibia, Zambia and Botswana. EUS affects many kinds of fish, those living both in the rivers and in the estuaries, where the river meets the sea.

One of the most serious diseases affecting fish it causes high losses through mortalities, market rejection, public health concerns and reduced productivity. EUS threatens food security and peoples' physical health as fish is a major source of protein. The disease is also a potential threat to the environment and biodiversity, as more than 50 species of fish can be affected

EUS causes challenges for the low input fish farming programmes because to control the disease movement of fish must be restricted. It also reduces productivity in the existing supply of fingerlings, resulting in a limited supply of fingerlings to the Caprivi Region. The following information is provided to raise awareness of this disease. Following the information are some recommendations for the programme and the Caprivi Region as a whole.



Lake Liambezi is infected with EUS

What does EUS do to the Fish?

EUS causes ugly lesions in affected fish, lesions can range from small pinpoint red spots, localized raised areas on the body surface, scale loss, skin damage, up to holes in the skin showing the flesh. Lesions are observed most often in the lateral surface but can occur on any part of the body.



This photo is an example of *Clarias gariepinus* infected with EUS.

When does EUS Occur?

The fungus can attack the fish only in places where the fish skin is damaged, infection in fish occurs when spores of the fungi in the water or attached to other material reach the skin of the fish. The spores penetrate the skin and grow into the surrounding skin and deeply into the flesh, causing the lesions that can be seen in the affected fish.

Which Species are Susceptible or Affected?

More than 50 species of both farmed and wild fish, fresh water and estuarine species can be affected by EUS. These include, for example, barbs, bream, catfishes, cichlids, Churchill, eels, gobies, gouramies, Indian carps, (catla, mrigal, rohu), Japanese ayu, menhaden, mullets, perches, seabass, seabream, snakehead, and tilapias.

How does EUS spread? What factors cause the fish to get infected with EUS?

There are a number of factors that can lead to the spread of EUS. Movement of ships and boats, fish migrations and ocean currents are potential ways for the movement of the fungus. Movement of fish between areas is a proven way for spreading the disease. Some EUS outbreaks occur when there's heavy rainfall and flood events, drop in temperature, low alkalinity and salinity, and acidified run-off water from acid sulphate soil areas.

Is it safe to eat EUS fish?

Yes it is safe. The fungus does not pose any human health risk, however if the fish has very bad lesions, there may be some other organisms which may cause health problems. Therefore, it is always better to thoroughly cook fish showing lesions.

Can EUS be avoided or treated?

Control of EUS in rivers and lakes is impossible. Fish farmers whose farmed fish have been affected with EUS are encouraged to culture fish that cannot be affected by EUS, especially during EUS seasons. A number of simple practices can reduce the problems caused by EUS.

These are as follows:

- Always report to the authorities as soon as possible if you see lesions similar to the ones described in this report, which may indicate the potential presence of EUS.
- Always remove the fish affected by EUS and do not throw them back in the water.
- Dispose of infected fish properly by burying or burning them.
- In ponds, use lime or if possible increase the salinity of the water.
- Carefully observe the neighbouring ponds or canals for the presence of EUS affected fish and avoid water exchange if diseased fish are detected.
- Prevent exposure of fish ponds to any possible carries or vectors such as birds, or terrestrial animals or contaminated equipments, such as, fishing gears.
- Never move fish from infected places to places that may not be infected.
- Apply good farm hygiene, for example, hand washing between tanks/ponds, separation of nets/ tanks, stocks, regular and correct disinfection procedures.
- Apply good husbandry practices, good water quality management , proper handling of fish, regular monitoring of fish health and keep records of any observations or, stocking information, including movement records of fish in and out of aquaculture facility, etc.

What one can do in the event of a disease outbreak?

- Immediately report unusual lesions to the authorities (nearest fisheries or veterinarian authority) and ask for guidance concerning collection of samples
- Take note of simple observation such as:
Abnormal fish behaviour (e.g. fish swimming near the surface, sinking to the bottom, loss of balance, flashing, cork – screwing or air gasping (for non air – breathing) or
- Record any sign which deviates from normal behaviour; Date and time of observed signs; species type affected and estimate of mortalities; Pattern of mortality (small number of fish dying every day, large number of fish dying at one time, etc.), and any other unusual events in the area.

How Can We Reduce the Spread of EUS?

- Keep fish environment healthy
- Keep fish healthy
- Keep fish free of stress
- Prevent introduction of disease
- Practice good practice fish farming

Recommendations

EUS has brought a set back in Caprivi region by restricting the movement of fish to the rest of the region (south and west) of the region. The Zambezi/Chobe was reportedly affected with EUS fish disease, therefore, movement of fish to these areas is restricted. This contributes to shortage of fingerlings in the region. It is strongly recommended to establish a hatchery (breeding facility) for fingerlings production in the region to stock sites in the west – establishment of a mini-hatchery will help to produce fingerlings to stock sites in the west. Once EUS-free hatcheries are established in the region the problem of restricted movement of fish can be eliminated.

EUS Information Sources

FAO Informational Calendar, 2010. “What you need to know about epizootic ulcerative syndrome (EUS).”

van der Waal, B.C.W. & Nyambe, N., 2006. EUS Informational Pamphlet. Zambezi-Chobe Fisheries Project.

Sustainability and Challenges

During the project the sites were stocked once. In permanent water sites, once the production system is fully stocked, there is no need to re-stock again unless in case of occurrences such as floods or diseases. Fish will continue multiplying.

Low input fish farming is successful without intensive infrastructure, labour and cost-intensive ponds, and expensive feeds therefore farmers just have to be taught the principal of low input fish ranching.

The participation of the community in the project was high; and the interest of people towards the project is still high, showing potential sustainability of the project. With the end of funding for the project, farmers will have difficulty in obtaining assistance to continue production. Further project funding needs to be sought to resume support until a sustainable system is developed.