

# CPWF Project Report

Participatory diagnosis and adaptive management of  
small-scale fisheries in the Niger River Basin

Project Number 72

Chris Béné, Amaga Kodio, Jacques Lemoalle, David Mills,  
Pierre Morand, Solomon Ovie, Famory Sinaba, and Ahmadu  
Tafida.

for submission to the



December 31, 2009

## **ACKNOWLEDGEMENTS**

This project was funded by the Challenge Programme on Water and Food. Matching funds were also provided by the following institutes: the WorldFish Center; the National Institute for FreshWater Fisheries Research (Nigeria), the Institut d’Economie Rurale (Mali), and the Institute pour la Recherche et le Développement (France).

In addition to the principal investigators listed as main authors, the following individuals have also participated to the project research and/or contributed to the redaction of this report (in alphabetic order): Neil Andrew (the WorldFish Center), Fatoumata Ba (IER), Richard Bwala (NIFFR), Seydou Coulibaly (IER), Tiemoko Coulibaly (IER), Amadou Kodio (IER), Godfrey Nwabeze (NIFFR) and Aminu Raji (Executive Director, NIFFR). Their respective contribution is fully acknowledged.



WorldFish Center



NIFFR



IER



IRD

### **Program Preface:**

The Challenge Program on Water and Food (CPWF) contributes to efforts of the international community to ensure global diversions of water to agriculture are maintained at the level of the year 2000. It is a multi-institutional research initiative that aims to increase the resilience of social and ecological systems through better water management for food production. Through its broad partnerships, it conducts research that leads to impact on the poor and to policy change.

The CPWF conducts action-oriented research in nine river basins in Africa, Asia and Latin America, focusing on crop water productivity, fisheries and aquatic ecosystems, community arrangements for sharing water, integrated river basin management, and institutions and policies for successful implementation of developments in the water-food-environment nexus.

### **Project Preface:**

“Participatory diagnosis and adaptive management of small-scale fisheries in the Niger River Basin”

In a broad sense, analysis of ‘resilience’ is about the capacity of systems to adapt to shocks, recognizing that disturbance and change are integral component of complex systems. More formally, resilience analysis proposes to focus on mechanisms and processes that help systems absorbing perturbations and shocks, and coping with uncertainty and risks. Defined in such a way, the concept of resilience thus appears particularly useful for the management of small-scale fisheries. However, while the resilience concept is appealing, particularly in the face of the failure of current management approaches, the danger is that it remains largely academic and theoretical, and not of a great help in effectively improving the way natural resources are managed on the ground. The challenge, therefore, lies in a pragmatic approach to operationalizing the concept of resilience and making its implementation on the ground practical and meaningful. In this project we propose a framework aimed at this objective and we test it in the specific context of small-scale fisheries in the Niger River Basin.

### **CPWF Project Report series:**

Each report in the CPWF Project Report series is reviewed by an independent research supervisor and the CPWF Secretariat, under the oversight of the Associate Director. The views expressed in these reports are those of the author(s) and do not necessarily reflect the official views of the CGIAR Challenge Program on Water and Food. Reports may be copied freely and cited with due acknowledgment. Before taking any action based on the information in this publication, readers are advised to seek expert professional, scientific and technical advice.

**Citation:** Béné, C., Kodio, A., Lemoalle, J., Mills, D., Morand, P., Ovie, S., Sinaba, F. and Tafida, A. 2009. Participatory diagnosis and adaptive management of small-scale fisheries in the Niger River Basin. *CPWF Project Number 72: CGIAR Challenge Program on Water and Food Project Report series*, [www.waterandfood.org](http://www.waterandfood.org).

**Fish and Gender:**

Reflecting our recognition of the central role played by women in many different aspects of small-scale fisheries in the world, only gender-sensitive words have been used in this report. In particular the word 'fisherman' which carries an inappropriate gender bias has been systematically replaced by gender-neutral terms such as 'fisher', 'fisherfolk' or 'fishing community'. Exceptions only hold for the particular term 'chief fisherman' or to refer to existing official names of organizations (e.g. "Rahama Tunga Mairuwa Fishermen Multi-purpose Co-operative Society").

**CONTENTS**

Acknowledgements .....	2
Contents .....	5
List of Tables .....	7
List of Figures .....	7
List of Illustrations .....	7
List of Maps .....	8
List of Boxes .....	8
List of Abbreviations and Acronyms .....	9
Research highlights.....	10
Executive summary.....	11
<b>Introduction .....</b>	<b>15</b>
<b>Project objectives .....</b>	<b>17</b>
<b>1. The PDAM framework: General presentation .....</b>	<b>17</b>
1.1. Introduction and background .....	17
1.2. The PDAM framework .....	18
1.2.1. Participatory diagnosis phase.....	18
1.2.2. Adaptive Management phase .....	18
1.3. The two pilot sites .....	20
1.3.1. Selection of the sites .....	20
1.3.2. Brief description of the two pilot sites.....	21
Batamani (Central Delta of Niger) .....	21
Tungan Mairuwa (shore of Lake Kainji) .....	22
<b>2. Adaptation of fishing communities to environmental changes in the Niger River basin</b>	<b>24</b>
2.1. Introduction .....	24
2.2. Hydro-climatic changes undergone by river-floodplain fishing communities .....	24
2.3. The example of the Central Delta of Niger .....	25
2.3.1. Hydrological and fisheries data on the Niger Inner Delta.....	26
2.3.2. Evidence of the high sensitivity of fish abundance and fish catches to hydroclimatic conditions	27
2.3.3. Adaptation of fishers to hydrological conditions and fish availability .....	29
2.3.4. Adaptation of fishers' intensity of farming to hydro-climatic conditions.....	30
2.3.5. Low flexibility of fisher traditional activities .....	32
2.3.6. Migration strategies .....	32
2.3.7. Possible scenario .....	33
2.3.8. New livelihood opportunities and policy options.....	34
<b>3. Identifying threats to the livelihoods of fish-dependent communities in the Niger River Basin .....</b>	<b>35</b>
3.1. The concept of resilience .....	35
3.2. Participatory Diagnosis.....	36
3.2.1. 360° integrated assessment .....	36
3.2.1. Dashboards .....	37
Results.....	37
3.2.2. Vulnerability analysis.....	43
Method .....	43
Analysis/results .....	43
Discussion .....	46
3.2.3. Dashboards at the community level .....	46
Results.....	46
<b>4. Implementing Adaptive Management .....</b>	<b>49</b>
4.1. General introduction .....	49
4.2. Management actions.....	50
4.2.1. Setting up the right conditions .....	50
4.2.2. Identification of Management-actions .....	51
4.2.3. Implementing the management actions .....	52
4.2.4. Preliminary perception of the community about the interventions.....	60
<b>General discussion and conclusion .....</b>	<b>61</b>
Implementing resilience management: lessons from CP72.....	61
Assessing the Participatory Diagnosis tool .....	61
Assessing the Adaptive Management phase .....	64
Panel expert's dashboards and resilience management.....	64

## Contents **CPWF Project Report**

Sustainability of the project’s management actions.....	65
Signs of change? .....	66
Assessing the concept of resilience.....	67
<b>Conclusion .....</b>	<b>68</b>
<b>Outcomes and impacts .....</b>	<b>69</b>
Description of the Project’s Main Impact Pathways .....	69
<b>International Public Goods.....</b>	<b>72</b>
New Insights .....	72
Tools and methodology .....	73
Datasets .....	73
Publications.....	74
<b>Partnership Achievements .....</b>	<b>74</b>
<b>Recommendations .....</b>	<b>76</b>
Scaling out and scaling up.....	76
Relevance of the vulnerability analysis beyond the two pilot cases.....	76
Universality of resilience interventions? .....	76
A need to tailor rural interventions.....	76
Back to subsidiarity principle.....	77
Water management .....	77
The need to include fishers in the process .....	77
Scope of interventions.....	77
When the community is too small .....	77
Providing alternatives to fishing increases resilience.....	78
‘If I can’t feed my family, I can’t fish sustainably’.....	78
Fishery interventions can play a crucial role in building resilience .....	78
A multi-sectoral approach is critical.....	78
<b>Publications.....</b>	<b>79</b>
Peer-reviewed Journals .....	79
Policy Briefs .....	79
Conference Proceedings.....	79
Research papers .....	79
Ph.D Thesis or dissertation.....	79
<b>Bibliography .....</b>	<b>80</b>
<b>Project participants .....</b>	<b>84</b>
<b>Appendix : Abstract of peer-reviewed publications .....</b>	<b>85</b>

**LIST OF TABLES**

- Table 1.1. Ranking of the seven Lake Kainji villages visited.
- Table 1.2. Criteria used to select the pilot site (Batamani) amongst the initial two preselected options.
- Table 2.1. Main dams established or planned in the Niger River basin.
- Table 2.2. Value of flood index of each year (1988-2004) and statistics of fish recorded in Mopti for the fishing campaigns  $t$ ,  $t+1$  which follows the corresponding floods  $t$ .
- Table 3.1. Dashboard resulting from the expert panel consultation for the Lake Kainji fishery (Nigeria)
- Table 3.2. Dashboard resulting from the expert panel consultation for the Central Delta of Niger fishery (Mali)
- Table 3.3. Dashboard resulting from the household consultation in Tungan Mairuwa
- Table 3.4. Dash board resulting from the household consultation in Batamani
- Table 4.1. Composition of the two representative committees in Batamani
- Table 4.2. Management-actions proposed by the Batamani community
- Table 4.3. Management-action proposed by Tungan Mairuwa community

**LIST OF FIGURES**

- Fig.2.1. Variations of annual rainfall in the Sahel region at centenary scale (standardized JJASO – mean Sahel rainfall, 1898-2004)
- Fig.2.2. Hydrological variations in Mopti (1988-2005) Continuous line: gauge level for each day (in cm). Red squares: annual flood index
- Fig.2.3. Response of the mean catch per fishing trip  $\times$  participant regarding flood index, for the two parts of the fishing campaigns
- Fig.2.4. Relationship between fish quantities recorded in Mopti and flood index
- Fig.2.5: Trends of some fishing efforts indicators
- Fig.2.6. Variations of the fishers' households' involvement in farming activities among the 3 areas surveyed
- Fig.3.1. The 360° integrated assessment map
- Fig.3.2. Assessing the conditions of the system against thresholds
- Fig.3.3. Vulnerability ladders of the two fishing communities surveyed. In black are indicated the sources of vulnerability related to the fish stock and/or fishing activities
- Fig.3.4. Comparative analysis of vulnerability between fishers and non-fishers in the Inner Delta of Niger River (Mali)
- Fig.3.5. Comparative analysis of household vulnerability between the top (richest) and bottom (poorest) quartiles for the Inner Delta (Mali) community

**LIST OF ILLUSTRATIONS**

- Photo 1.1. Change in the landscape of Batamani between flooding and dry seasons – Photo credit: P. Moran
- Photo 1.2. Débaré pond used for rice and fishing activities – Photo credit: C. Béné
- Photo 1.3. Shore of the Lake Kainji during low water level – Photo credit: D. Mills
- Photo 1.4. Castnet on the Lake Kainji – Photo credit: D. Mills
- Photo 1.5. The Council of Elders of Tunga Mairuwa – Photo credit: P. Moran
- Photos 4.1. Women of Tungan Mairuwa during the meetings introducing the microcredit intervention (Sept 2009) – Photo credit: C. Béné
- Photos 4.2. Women assembly during one of the sensitization meetings to health / water-borne disease in Batamani (Oct 2009). The nurse is standing on the right hand side – Photo credit: P. Sinaba
- Photos 4.3. The condition of severe deterioration of the Tungan Mairuwa primary school – Photo credit: C. Béné
- Photos 4.4. The condition of the school prior to the project intervention. Pupils sitting on the floor (or even outside) with no desk or other furniture – Photo credit: S. Ovie

## Contents **CPWF Project Report**

- Photos 4.5. The school teachers with the CP72 national coordinator Dr Ovie and the NIFFR director Dr Raji in front of the renovated school building (left). The new benches and desks supplied by CP72 (Sept 2009) (right) – Photo credit: A. Tafida
- Photos 4.6. Pupils and teachers enjoying a new and much more comfortable learning environment (Oct 2009) – Photo credit: S. Ovie
- Photos 4.7. Tungan Mairuwa teachers with the newly enrolled pupils – Photo credit: S. Ovie
- Photo 4.8. Children fetching drinking water in one of the 3 boreholes rehabilitated by the community with the support of CP72 Project in Tunga Mairuwa – Photo credit: S. Ovie
- Photo 4.9. CP72 partners visiting Tunga Mairuwa (Dec 2009) and been shown one of rehabilitated boreholes – Photo credit: P. Moran
- Photos 4.10. The new grain mill bought by the men multipurpose cooperative of Tunga Mairuwa created with the support of CP72 (Nov 2009) – Photo credit: D. Mills and P. Moran
- Photos 4.11. The two nurses (one male and one female) during their visit at Batamani – Photo credit: F. Sinaba
- Photos 4.12. The female nurse at Tungan Mairuwa – Photo credit: D. Mills and P. Moran
- Photos 4.13. Usman Naira (President of men multi-purpose cooperative, Tunga Mairuwa), Hure Mohammed (President of Tamako female multi-purpose cooperative) and Dr S.I. Ovie at Kontagora Microfinance Bank where the cooperatives opened two saving accounts in Oct 2009 – Photo credit: A. Tafida
- Photo 4.14. Dr Aminu Raji, Executive Director, NIFFR (extreme left), Dr S.I Ovie CP72 Project Coordinator, NIFFR (extreme right), Hamisu Hakimi, village head (second extreme left) and women loan beneficiaries as part of the CP72 micro-credit interventions at Tunga Mairuwa – Photo credit: A. Tafida
- Photo 4.15. The first group of Tunga Mairuwa men receiving loan from the micro-credit scheme (Oct 2009) – Photo credit: A. Tafida
- Photo 4.16. Hamisu Hakimi, village head (left) on behalf of NIFFR team, presenting a loan to a member, women cooperative Tunga Mairuwa as part of CP72 micro-credit intervention – Photo credit: A. Tafida
- Photos 4.17. The initial poor condition of the sluice gate controlling the entrance and exit of water in and out of the Débaré pond (Batamani community) before CP72 intervention – Photo credit: J. Lemoalle and C. Béné
- Photo 4.18. The gate of the Débaré after rehabilitation by the community – Photo credit: F: Sinaba

### **LIST OF MAPS**

- Map 1.1. The area of Batamani within the Central Delta of Niger (Mali).
- Map 1.2. The detail of the Batamani area including the main habitat cluster (Batamani villages and the 3 fishing camps –Batamani Daga, Gatal and Débaré)
- Map 1.3. The location of Tungan Mairuwa on the shore of Lake Kanji

### **LIST OF BOXES**

- Box 1.1. Selecting the pilot site in Nigeria.
- Box 5.1. Symptom or cause of poverty?

**LIST OF ABBREVIATIONS AND ACRONYMS**

ADF	Agence Française de Développement
AM	Adaptive Management
CBOs	Community-based Organizations
CDoN	Central Delta of Niger
CGIAR	Consultative Group International Agricultural Research
CP72	Challenge Programme Water for Food Project Number 72
CPUE	Catch Per Unit Effort
CPWF	Challenge Programme Water for Food
DFID	Department for International Development
DPAM	Participatory Diagnosis and Adaptive Management
DoF	Department of Fisheries
FAO	Food and Agriculture Organization
IER	Institut d'Economie Rurale, Mali
IRD	Institut de Recherche pour le Développement, France
NARES	National Agricultural Research Extension Stations
NGOs	Non Governmental Organizations
NIFFR	National Institute for Freshwater Fisheries, Nigeria
PADEPECHE	Projet d'Appui au Développement de la pêche continentale
PD	Participatory Diagnosis
PDAM	Participatory Diagnosis and Adaptive Management framework
PRO	Public Relation Officer
US\$	United States of America Dollar

## **RESEARCH HIGHLIGHTS**

Small-scale inland fisheries are notoriously difficult to assess and to manage, due to the complex (multi-species, multi-gear) and diffuse (informal, seasonal, unrecorded) nature of their operations. In addition, small-scale inland fisheries are increasingly affected by external factors which mainly lie outside the area of influence of the fishers themselves or of the agencies in charge of the resource management -such as impacts of upstream dams, pollution, irrigation schemes, or even, increasingly, change in hydro-climatic factors.

The central hypothesis of this research is that the concept of resilience, revisited from a socio-ecological and adaptive management perspective, can be applied to reduce the vulnerability of these fishing communities to external shocks, and lead to improved resource management. In order to test this hypothesis the project sought to operationalize the concept of 'resilience management' understood as "interventions aimed at increasing the capacity of the community to adapt to shocks and uncertainty".

Two fishing communities were selected in the Niger River Basin to test this approach: one in the Central Delta of Niger in Mali and one on the shores of the Lake Kaniji in Nigeria. In these two pilot communities, a range of participatory assessments were first implemented to identify the source of vulnerability. While providing a valuable self-assessment of the priorities for reducing vulnerability, these vulnerability ranking exercises also contained important insights into how poverty/vulnerability interventions in fishing communities should be conceived. In particular they challenge the conventional view that development interventions should primarily focus on the resource: although fish stock depletions/fluctuations were acknowledged and certainly affect their livelihood, the communities identified some more fundamental sources of vulnerability related to their basic needs, such as food insecurity, exposure to water-borne diseases and lack of access to cash and micro-credit facilities.

Based on these assessments, the communities identified a series of interventions (management-actions) aimed at addressing directly those sources of vulnerability. The decision making process leading to the identification of these interventions was facilitated by the creation of specific committees at the community level. Special attention was paid to the composition of these committees to ensure gender-equity and reduce the risk that the process is captured by the most powerful individuals/households in the communities.

The various management actions proposed by the communities were then implemented during the second phase of the project. These included interventions aimed at improving access to health services and medication supply, rehabilitation of boreholes and flood control infrastructures, improvement of school facilities, and creation of microcredit cooperatives.

Although it is too early to determine whether these interventions will effectively have impacts on the livelihoods of the communities and in particular reduce their vulnerability to future shocks, some preliminary signs indicate that the project activities have already triggered some positive changes in the attitude of some key actors. The analysis also suggests that the sustainability of the interventions is likely to continue after the project phases out.

Overall the concept of resilience appears therefore useful to reduce the vulnerability of fishing communities, although its usefulness was recognized to derive more from the project' ability to develop a pragmatic approach -leading in particular to a successful integrated participatory rural development planning- rather than from the highly theoretical debates which are currently proposed about resilience in the academic literature.

## **EXECUTIVE SUMMARY**

### **Background**

In Africa, small-scale inland fisheries are important to the livelihoods of the poor, contributing both income and food security for millions of households living in the vicinities of freshwater lakes, reservoirs, rivers and floodplains. These inland fisheries are however characterized by complex multi-species, multi-gear exploitation systems, and large numbers of fishers operating completely within an informal sector, making them extremely difficult to assess and manage.

Small-scale inland fisheries are also significantly affected by processes outside their control. In particular water storage infrastructures (dams and irrigation schemes) affect many inland fishery dynamics. The uncertainty induced by climate changes will in the future increase the unpredictability of these systems as well as the competition for water, therefore impacting severely on the capacity of the local fish-dependent populations to rely on those resources to sustain their livelihoods.

Faced with such constraints and multiple sources of uncertainties, conventional management has, by and large, failed to provide a basis for sustainable development of aquatic resources. This project, which has a strong 'action research' orientation, has been designed to initiate and guide major changes in the way small-scale fisheries in sub-Saharan Africa are assessed and managed. Its main goal is to strengthen the resilience of fishing communities through the field-testing and application of an innovative framework for participatory diagnosis and adaptive management (PDAM).

### **Objectives of the project**

The central hypothesis of this project is that the concept of resilience, revisited from a socio-ecological and adaptive management perspective, can reduce the vulnerability of fishing communities and lead to improved resource management and water productivity.

In order to test this hypothesis the project uses a Participatory Diagnosis and Adaptive Management (PDAM) framework, with the objective to strengthen livelihood and ecosystem resilience of small-scale fishing communities. The project aims at developing and testing this PDAM framework in two pilot sites: one in Mali in the Central Delta of Niger and one in Nigeria on the shore of the Lake Kainji.

### **Results – research findings**

In a first part of the research we examine the ways Sahelian floodplain fishers have adapted to the major environmental changes that have affected the region in the last 2 decades. For this we use existing secondary data from the Central Delta of Niger. The analysis shows that fishers are highly sensitive to change in hydro-climate conditions but that they are remarkably limited in terms of potential ways to mitigate the impacts of these changes. For those who have adopted a diversified livelihood and are also engaged in farming (fisher-farmers), a close analysis reveals that the high seasonality characterizing their various activities and in particular the specific period of these activities during the season does not allow much flexibility. For the other major groups of fishers –those who have adopted a more specialized strategy and migrate-, the situation is not necessarily better as the high density of the population in the delta reduces drastically the possibility to find any new migration routes.

In sum, although migration and diversification are often presented as strategies adopted by households or individuals to reduce their vulnerability, this analysis demonstrates that in the case of fish-dependent population in the Central Delta of Niger, these strategies

## Executive Summary **CPWF Project Report**

alone will not be sufficient to help the communities to face the increasing constraints associated with the coming changes in hydro-climate conditions.

The second part of our research focused on the design and field-test of the first component of the PDAM framework, the Participatory Diagnosis, in the two pilot sites. Our research shows how the two main tools developed as part of this Participatory Diagnosis (the 360° assessment map and the dashboard) were successfully applied by the communities and help them to identify the main threats impacting their livelihood. The PD was also used to identify key resilience indicators and associated entry points for interventions (management-actions).

The last part of the research (the Adaptive Management component) was aimed at guiding and supporting the two communities in implementing and monitoring the different management-actions that they had identified during their participatory self-assessment. These management actions included interventions to improve the community's access to health services and medication supply, improve access to drinking water by rehabilitating boreholes, renovate flood control infrastructures, improve school facilities, and create microcredit cooperatives.

### **Outcomes and impacts**

Although it is too early to assess formally the impact of these interventions, the team agreed that the project has been overall successful. The PDAM framework has been developed and implemented according to the initial project planning. The report demonstrates the great relevance of the PDAM framework to engage with local communities about their sources of vulnerability, and to lead these communities to identify, in a participatory and gender-sensitive manner, potential solutions to reduce these sources of vulnerability. The two communities already show some encouraging sign of changes –although these are still to be confirmed- and mechanisms have been put in place to ensure the self-sustainability of the interventions.

Overall the concept of resilience, which underlined the PDAM framework, was therefore assessed positively, although its usefulness was recognized to derive more from the project partners' initial effort to strip it down to a pragmatic conceptual tool -leading to integrated rural development interventions- rather than from the theoretical and sometimes esoteric debate of which it is the object in the academic literature.

### **International public goods**

By developing and field-testing a framework aimed at operationalizing the concept of resilience in the particularly challenging context of small-scale inland fisheries in sub-Saharan Africa, the project contributes to the current debate about the way to manage these fisheries. The project offers therefore useful lessons for practitioners and/or researchers interested in similar management issues in the same sector (small-scale fisheries) but also in other sectors (pastoralists, agro-forest-dependent communities) where populations are also particularly exposed to various sources of shocks and uncertainty.

Through these activities, the project initiated sustainable management actions and generated lessons about the processes of operationalizing resilience management. Some of these lessons are relevant for the future, in particular as environmental changes in the Sahelian region are likely to become more prominent over the coming decades due to climate change. These lessons were summarized in two scientific articles (Mills et al. 2009 and Moran et al. submitted) and three policy briefs.

**Recommendations**

- The livelihood of the Niger River populations strongly depends upon water management decisions which are taken at the national level and mostly take into account the most visible users (large irrigation perimeters, hydropower generation, and navigation). Although different fishing communities in the basin may have different needs regarding the hydrological cycle management, proper consultation mechanisms involving the fishing communities should be implemented.
- The approach to resilience-based interventions outlined in this project recognizes that poverty in fishing communities is not simply a resource issue; it is multi-sectoral and complex. As such, effective intervention requires an integrated approach from a diverse range of stakeholders. Given that the focus constituency is fishing communities, it is likely that fishery institutions will be heavily involved in initiating and executing such action. It is less likely however that fishery institutions would lead diagnosis and implementation processes, as there is a critical role in coordinating government departments and stakeholders across sectors that may be better facilitated by appropriately equipped external agencies e.g. Department of Rural Development.
- The resilience framework developed in this project focuses on the sources of vulnerability and constraints that impact the livelihoods of individual households at local level. As such it provides valuable insight into vulnerability dynamics at the micro, community-level. These sources of vulnerability are symptomatic, not only of the two pilot communities where these assessments took place, but more widely, of a large segment of the rural population living in the same regions. As such the conclusions of the vulnerability assessment can, and should, be transferred (scaled out) to other parts of the Sahelian region.
- The same way the vulnerability analysis contains some 'generic' results, the types of interventions that were identified by the communities to address their source of vulnerability present some 'generic' messages. In particular a substantial part of the management actions that were identified and implemented in the two communities are aimed at increasing (more or less directly) the degree of diversification of the households' livelihood. This is not surprising since diversification has been recognized for long as a powerful way to address uncertainty and risks, thus improving household resilience.
- Although food insecurity, lack of access to health services, education and credit are common issues across the rural areas in Mali and Nigeria, and the rest of the Sahelian belt region, the types of interventions designed to address these issues still need to be carefully tailored to, and reflect, the local specificities of the communities where they are implemented. For instance in the case of the two communities involved in this project, the way to address health issues varies substantially between the two communities as these are not characterized by the same geographical level of marginalization.
- One way to address this challenge –existence of generic rural development issues but need to address these in a locally adapted manner- is to support local interventions through policies that are developed, not at the national level but at a lower, 'intermediate', meso-level, such as district level. These meso-level policies are likely to reflect in a more appropriate manner the local conditions of the communities where the interventions that they support are taking place and still offer a policy environment that is generic enough to embrace the common nature of the main constraints.

## Executive Summary **CPWF Project Report**

- The two focus communities engaged in the project utilize fisheries resources that have no discrete boundaries at the scale of the community; that is, there are many other users-groups of the same water and fisheries resources. As a result issues such as control of water level, water quality degradation and catchment use are largely beyond their control. It follows that the ability of a community to implement interventions at the scale of the resource is limited; collective action at a much broader scale would be required for successful outcomes.
- The provision of alternative livelihoods acts in multiple ways to reduce vulnerability in fishing communities. Acknowledging that factors leading to uncertainty in the resource are, in many instances, largely beyond the control of the community, reducing direct dependence on the fishery resource is the best mechanism for increasing resilience. Additionally, redirecting livelihood effort away from the fishery through the provision of alternative opportunities will reduce pressure on the resource.
- The resilience-based approach to resource management recognizes that the provision of basic needs can play a significant role in promoting sustainable resource use. In the pilot sites in Nigeria and Mali the lack of provision of basic needs dominates the life of fishing community members. When immediate critical needs cannot be met, community focus on short-term survival will invariably take precedence over any consideration of long-term sustainability issues. Expecting any consideration of sustainability issues under such circumstances is unrealistic. By addressing basic needs through targeted interventions, the project aimed to reduce the dominance of pressing survival needs in daily life, thereby at least in part clearing the way for broader livelihood sustainability issues to be considered.
- Where fish-related interventions at the community scale can be identified these interventions may be particularly productive. Experience in other fisher/farmer communities suggests that the introduction of aquaculture technology may be well received and productive. Providing an alternative means of fish production has the added benefit of supporting multiple livelihoods such as fish processing and marketing that previously relied solely on the capture fishery.

## **INTRODUCTION**

There is a bewildering diversity of ever-changing fisheries in inland waters. This diversity is to be found in their ecology as well as the social and institutional settings they operate in. There is also considerable uncertainty in the processes that govern their ecological and economic dynamics. Part of this uncertainty is due to the poor quality or total absence of data and information, but perhaps the greater source of uncertainty lies in the ecological and social processes themselves (Allison and Ellis 2001). These factors combine to make small-scale fisheries extremely difficult to assess and manage.

There is broad consensus that inland fisheries in the developing world are failing to fulfill their potential as engines of social and economic development. The most common explanation for this shortfall has been 'failure of management', but the problems facing these fisheries are more profound and complex than that (Andrew and Evans 2009). Even in managed fisheries it is often the broader political, institutional and economic drivers of global and national economies that control their destiny. Competition with other resource users and the indifference and neglect of governments add further layers of vulnerability (Dugan 2005). In other fisheries, biophysical processes operating at large spatial scales such as water flows, pollution and climate variability may be the dominant influences (Jul-Larsen et al. 2003; Allan et al. 2005). Within the sector, uncritical application of generic command-and-control methods and a pre-occupation with the biophysical aspects of the problem have produced many failures and missed opportunities for inland fisheries to play a greater role in socio-economic development. In this context it is not surprising that inland fisheries are rarely considered in water-management decisions at either the national or basin level.

For the prospects of fisheries to improve, established theory, approaches, definitions of sustainability, and indicators of management performance have to be re-thought. The broader literature on the management of natural resources in the developing world is moving fast and on multiple fronts (e.g. Campbell et al. 2001, Folke et al. 2005). In particular, a consensus has now emerged across disciplines (ecology and social sciences) which emphasizes the necessity to build management around the concepts of resilience and adaptive management (Walker et al. 2002).

Resilience, defined as 'the capacity of a complex system to absorb shocks while still maintaining function, and to reorganize following disturbance' (Walker et al. 2004) and adaptive management (AM) – a structured process of "learning by doing" (Walters 1997) – are now widely recognized as the most appropriate concepts to accommodate the irreducible uncertainty that characterizes most natural resource-based systems (Carpenter et al. 2001, Folke et al. 2005, Walker et al. in press). In this new thinking, fisheries may be viewed as complex social-ecological systems, and the prime goal of fisheries management becomes to: (i) prevent the system from moving into undesirable configurations and (ii) nurture and preserve the elements that enable the system to renew and reorganize itself following external stresses and disturbance (Walker et al. 2004).

This new and innovative approach to fishery management seems particularly appropriate to inland fisheries in the developing world. Its development is extremely timely, as recent global assessments suggest that pressure on African fisheries will continue to intensify, and their resulting degradation will aggravate already acute poverty levels. As outlined above, these fisheries are vulnerable to numerous external processes that operate with seemingly irresistible power. They are politically weak and the social institutions needed for durable decision-making are often absent. Although many elements of a new way of managing inland fisheries exist, and have individually enjoyed partial success, they have not been synthesized into a coherent framework and tested in the real world. The challenge is therefore to develop and operationalize a new management framework that addresses these challenges. This research is particularly innovative and relevant to policy as increasingly, international institutions have come to

## Introduction **CPWF Project Report**

recognize not only the environmental value of small-scale fisheries, but also their social development value (e.g. World Bank 2004, NEPAD 2005, FAO 2006), yet managers have no access to tools and frameworks that integrate this understanding into practical management systems.

## **PROJECT OBJECTIVES**

The central hypothesis of this research is that the concept of resilience, revisited from a socio-ecological and adaptive management perspective, can reduce the vulnerability of fishing communities and lead to improved resource management and water productivity.

In order to test this hypothesis the objective of the project is to operationalize the concept of 'resilience management'. In this context, and in an attempt to emphasize the practical nature of this project as opposed to the highly academic nature of the current debate about the 'correct' definition of resilience, we voluntarily adopted a simple and loose definition of resilience -resilience is about how to adapt to change in an uncertain environment. 'Resilience management' is therefore about identifying policies, interventions and actions (at different levels) that strengthen the capacity of a system (in our case a fishery system) to adapt to the changes that affect it functions. The approach uses a Participatory Diagnosis and Adaptive Management (PDAM) framework, to strengthen livelihood and ecosystem resilience in the face of wide-ranging uncertainty. Drawing upon this PDAM framework, the project focuses on the specific challenges facing river fisheries in the Niger River system and especially how best to integrate these fisheries into water management processes. The project aimed at developing and testing the PDAM framework in two pilot sites in Mali and Nigeria in an approach which has clear links with action research philosophy (e.g. McNiff and Whitehead 2006).

1. The first specific objective of the project is to document through existing data and an historical perspective the capacity of fishing communities of the Central Delta of Niger to adapt to the hydro-climatic fluctuations of their environment;
2. The second objective is to operationalize the new PDAM framework and to conduct Participation Assessment exercises in the two pilot sites, with the aim to identify the current threats impacting the livelihoods of the fish-dependent communities;
3. The third objective is to draw upon the Participatory Assessment completed in the two pilot sites to identify potential entry points for adaptive management interventions; and to help the community to implement these interventions.

### **1. THE PDAM FRAMEWORK: GENERAL PRESENTATION**

#### **1.1. Introduction and background**

In many developing countries, small-scale inland fisheries are important to the livelihoods of the poor, contributing both income (through capture and post-harvest activities) and food security (Béné et al., 2007). This is particularly true for river fisheries, and especially so in Africa, which has important inland and de facto unregulated open access fisheries, on which millions of poor households depend. These inland fisheries are characterized by complex multi-species, multi-gear exploitation systems, and large numbers of fishers operating completely within the informal sector, making them extremely difficult to assess and manage, thus contributing to livelihood uncertainty and vulnerability.

Even more importantly in the context of water management, small-scale fisheries are significantly affected by processes outside their control. In particular, water allocation policy and investments (e.g. dams and irrigation schemes) are dominant factors driving many inland fishery dynamics. Further, the unpredictable institutional and policy environment typical of many countries in sub-Saharan Africa is a source of great uncertainty and potential threat. Finally, the uncertainty induced by climate changes will in the future increase the unpredictability of these systems as well as on the competition for water, therefore impacting severely on the capacity of the local populations to rely on those resources to sustain their livelihoods.

## Objectives **CPWF Project Report**

Faced with such constraints and multiple sources of uncertainties, conventional management has, by and large, failed to provide a basis for sustainable development of aquatic resources. The project, which has a strong 'action research' orientation, has been designed to initiate and guide major changes in the way small-scale fisheries in sub-Saharan Africa are assessed and managed. Its main goal is to strengthen the resilience of fishing communities through the field-testing and application of an innovative framework for participatory diagnosis and adaptive management (PDAM).

### **1.2. The PDAM framework**

The participatory diagnosis and adaptive management framework reflects current research and reflection undertaken at the WorldFish Center in collaboration with FAO on the way to improve the management of small-scale fisheries (Andrew et al., 2007; Garcia et al, 2008; Evans and Andrew 2009). Drawing upon these researches, the project team designed a two step framework, with two distinct phases:

- (i) A participatory diagnosis phase
- (ii) An adaptive management phase

#### **1.2.1. Participatory diagnosis phase**

The objective of the first step: the participatory diagnosis (PD) is to identify: (i) undesirable states of the system (biological, economic, social) which may jeopardize the viability of the fishery (the source of vulnerability); (ii) the mechanisms and options that will allow the system to stay away from these undesirable states; and (iii) a series of indicators of fishery management performance.

Conventional fisheries assessment emphasizes biological factors within the system (e.g. over-fishing, habitat destruction), but to a growing extent also social, cultural or economic fisheries-specific processes (e.g. over-capacity, knowledge systems, and integrity of traditional institutions). Increasing evidence suggests however that factors arising from the external environment related to water use and management at the basin or watershed level (e.g. changes in water allocation or water availability, increased urbanization, regional or global climate variation) are usually amongst the critical driving forces impacting on inland fisheries (Friend et al. 2009). Particular emphases are therefore placed in this PD on identifying threats and opportunities related to these external drivers. The diagnosis process is also placed in a broader development context with emphasis on poverty reduction. This approach is expected to lead to a very different assessment process and possibly different entry points for fishery management: these may still include some intra-sectoral (classical) dimensions, but will also integrate elements outside the domain of the fishery (e.g. water management allocation and planning), or even cross-sectoral issues (e.g. alternative livelihoods, improving literacy rates, access to health services, etc). A central tool in this evaluation exercise is the elaboration and use of 'resilience indicators' and community-based 'dashboards' which can reflect the dynamic state (regimes) of the fisheries and their limits of desirable states.

The structure and content of the PD exercises draw upon well established methodologies of participatory assessment (Pretty et al. 1995, Wadsworth 1998) and reflect important recent progress on action-research (e.g. Flyvbjerg 2001, McNiff and Whitehead 2006).

#### **1.2.2. Adaptive Management phase**

The adaptive management (AM) phase corresponds to the period when interventions (what will be called 'management actions' in subsequent sections of this document) are implemented. These interventions are expected to evolve over time, as the system itself changes and adapts to new constraints and opportunities, and as the stakeholders'

understanding about the system dynamics and its driving factors improve. This combination of structured learning and adjustment is the core of AM.

Details of management actions and the identity of the appropriate organizations, groups and institutions involved in their implementation vary among fisheries and their exact nature cannot be determined in advance. These elements have to be discussed and agreed by the stakeholders during the diagnosis phase. The discussion should also be used to identify the mechanisms of information feedback necessary to establish the learning cycle of the AM.

A critical element in the early stage of building consensus around the different options for management actions is the institutional settings in the community where the PDAM framework is implemented. In particular the 'strength' of the local institutions and their capacities determine to a large extent the level of sophistication of the management actions to be implemented. Experience has shown that the challenge of implanting policy or management initiatives in relation to natural resource use and management often lies in finding the adequate match between the various options for actions and the capacities of the institutions involved. Management plans which are too ambitious may not transform into durable and robust outcomes, simply because institutions are too 'weak' to support them. It is therefore the responsibility of the implementing team to ensure the adequacy and workability of management actions.

In the case of this project, 'seed-funds' of US\$20,000 per pilot site were disbursed to the local institutions associated to the project to finance the implementation of the management actions. Disbursement procedures for these seed-funds followed a lump-sum agreement framework, where the whole seed-fund was broken into several sub-amounts, associated to specific deliverables. This avoided burdensome financial monitoring and facilitated the rapid disbursement of the funds to the local institutions to cover the up-front costs of initializing management actions. The second advantage of this procedure is that the management actions were fully implemented by local institutions, thus avoiding the classical problem of project's phasing out. Several support visits to the pilot-sites by the CG and the ARI partners took place during the AM phase, complemented by monthly monitoring visits by the NARES partners.

Given the limited time-frame, it was not expected that the management actions achieved their ultimate objective (improved resilience of the fisheries to external factors) within the life of the project. Rather, the project initiated sustainable management actions and generated lessons about the processes of implementing AM. These lessons are the object of the section 3 of this report.

#### Box 1.1. Selecting the pilot site in Nigeria

Following a briefing by the project coordinator, the NIFFR team visited several fishing communities around the Kainji Lake between 29<sup>th</sup> April and 2<sup>nd</sup> May 2008. The aim of the visit was to identify a suitable community for setting the pilot project based on a list of predetermined criteria, including: accessibility, clearly defined boundary, homogeneity (religious, linguistic, ethnicity), existence of CBOs, population size, viable village institutional structure, receptiveness of the community and distance from NIFFR. Seven fishing communities were visited and a summary of the findings is shown in Table 1.1. While all the communities appeared qualified as pilot sites, the team selected Tungan Mairuwa based on the following considerations:

- (i) Household numbers fall into the medium range of 50 – 100 in the Kainji lake basin. It is considered that this is a manageable village size for the PDAM project
- (ii) Village structure is well defined and largely homogenous with strong social capital and respect for community leaders. This would facilitate community mobilization for project activities.
- (iii) A cooperative society (though weak) exists in the community. We would built on this available strength
- (iv) Women are actively involved in community activities such as fish processing, farming and petty trading.
- (v) Community has a well defined boundary and close to a Local Government Authority (LGA) headquarters.

## Objectives CPWF Project Report

- (vi) The people are receptive, warm and used to visits by international project groups.
- (vii) Tatabu was judged the next most suitable but the community is currently enrolling in a community project supported by DFID/FAO-SFLP and NIFFR.

### 1.3. The two pilot sites

#### 1.3.1. Selection of the sites

Two pilot sites were chosen in the Niger River basin to experiment this new approach, one in Mali in the Central Delta of Niger and one in Nigeria on the shore of the Lake Kainji. Box 1.1, Table 1.1 and Table 1.2 detail the process and criteria used to select these two pilot sites.

Table 1.1 Ranking of the seven Lake Kainji villages visited

Village name	AHHN	AHHS	MO	SO	ETMS	EFMS	VS	EC	WI	MEG	DIS	Probs.	Bdr.
Tungan D. Biri	27	17	Fishing	Farming	Yes	Yes	2	No	2	Hausa	40mins	1	2
Tungan Ibrahim	50	8	Fishing	Farming	Yes	Yes	3	No	2	Hausa	1hr	1	1
Tungan Mairuwa	100	12	Fishing	Farming	Yes	Yes	1	Yes	1	Hausa	2hrs	1	1
Bajibo	100	12	Fishing	Farming	Yes	Yes	2	No	2	Hausa	2hrs	1	2
Tungan Leda	60	12	Fishing	Farming	Yes	Yes	3	No	1	Hausa	2hrs	1	2
Tungan Dogo	10	15	Farming	Fishing	Yes	Yes	3	No	2	Hausa	2hrs	1	2
Tatabu	48	11	Fishing	Farming	Yes	Yes	1	Yes	1	Nupe	1hr20mins	1	1

Keys: AHHN = Approximate Household Number; AHHS = Average Household Size; MO = Main Occupation; SO = Secondary Occupation; WI = Women Involvement; ETMS = Existence of Traditional Management System; EFMS = Existence of Formal Management System; Vs = Village Structure; EC = Existence of Cooperative; MEG = Main Ethnic Group; Dis = Distance; Prob. = Problems; Bdr. = Boundary; Village Structure (VI) ----1 = Well structured Leadership, 2 = Relatively structured Leadership, 3 = Poorly Structured Leadership; Women involvement (WI) ----1 = Active involvement (Fish processing/marketing / petty trading / farming) 2 = Partial involvement, 3 = No involvement; Problems (Probs) ---- 1 = Multiple problems 2 = Few problems 3 = Single problem; Boundary (Bdr) .....1 = Well defined Boundary, 2 = Poorly Defined Boundary.

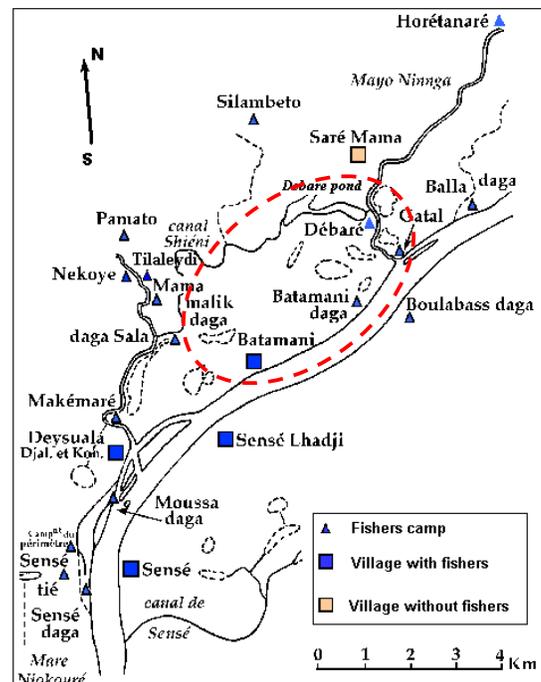
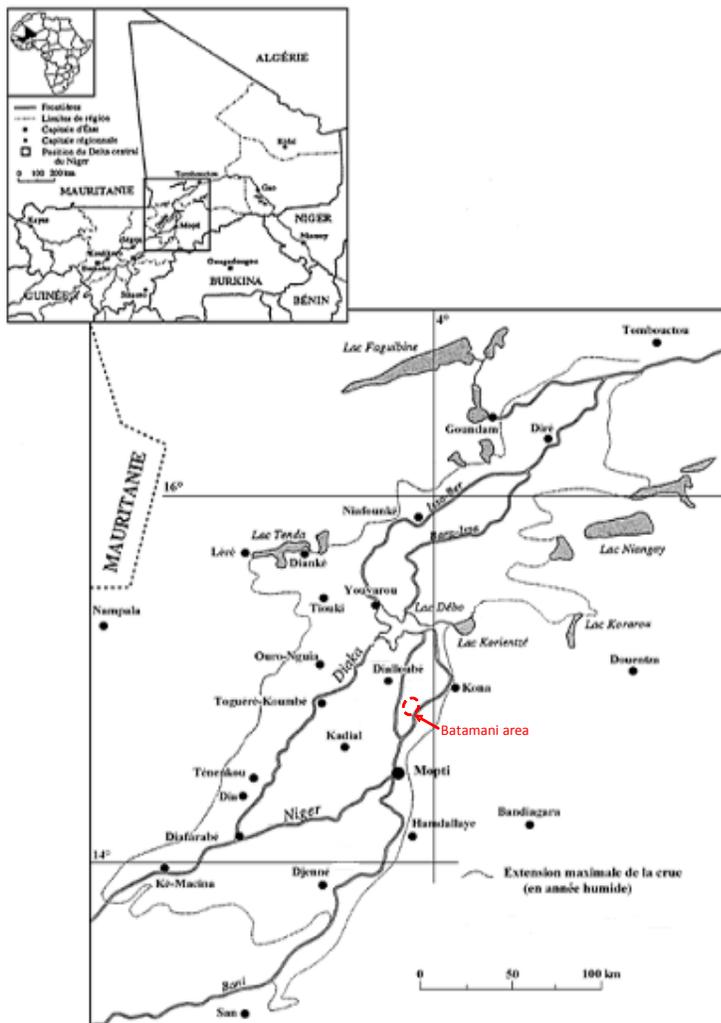
Table 1.2. Criteria used to select the pilot site (Batamani) amongst the initial two preselected options.

Characteristics	Selected sites	
	Batamani	Korientzé
Location	Upstream Niger river	Central lakes
Area (km <sup>2</sup> )	6 500	2 000
Waterbody type	Floodplain, pond, river	lake
Relative contribution to fish production	23 %	28 %
Distance to Mopti (km)	about 50 km	120 km
Access	Road, river	Road
Productive system	Fisheries	Fisheries
	Rice	Rice
	Irrigated farming	Irrigated farming
Fisher status	Mainly autochthonous	Migrants
Mobility	Resident	Migratory
Conflicts for the access to the resource	Low	High
Data	Large number of past studies (socio-economics, hydrological, etc.)	Little information

**1.3.2. Brief description of the two pilot sites**

**Batamani (Central Delta of Niger)**

The Batamani village is located on the left side of the Niger River 45 km downstream of the Mopti town (Map 1.1). It is composed by a poly-ethnic main habitation cluster (Batamani village) and three nearby fishing camps: Batamani daga, Gatal, and Débaré daga (Map 1.2). The majority of the population in the area is sedentary, but one of the fisher camps, (Batamani daga), is inhabited by “foreign” (i.e. migrant) fishers originating from other areas in the south of the Inner Niger Delta. Photos 1.1 illustrate the great changes that characterize the landscape during the annual flood cycle. At the peak of the flood period (October), nearly all the surface of the zone is inundated: the river bank (where the houses have been built up) remains the only part of land which is not flooded. During the low water level period (February to May), water remains only in the river bed.



Map 1.1. (left) The area of Batamani within the Central Delta of Niger (Mali)

Map 1.2. (right) The detail of the Batamani area including the main habitat cluster (Batamani villages and the 3 fishing camps –Batamani daga, Gatal and Débaré)

The political power in the area is held by the Peul who are mainly pastoralist, but the fishers Bozo who are the more numerous control waters and fish resources. Bozo fishers engage in fishing activities during the whole year using a rich set of different gear (gillnets, driftnets, longlines, castnets, traps, small seines). All Bozo people have rights to operate in the Niger River mainstream, but only the autochthonous “Batamani

## Objectives CPWF Project Report

originated" fishers are allowed to fish in the channels connecting the ponds to the rivers, the ponds themselves and the floodplains. These autochthonous households are also the only ones who have access rights to lands. They use these rights to practice farming activities during the rainfall/flood season, mainly consisting in extensive rice crop in the floodplains. One of the most productive sites of the Batamani territory is the Débaré pond (photo 1.2), a natural depression which is used for cultivating rice during the rainfall-flood season, and fishing during the receding season (December-February). The access to Débaré was so far restricted to the autochthonous population –leaving out the Bozo of Batamani daga.

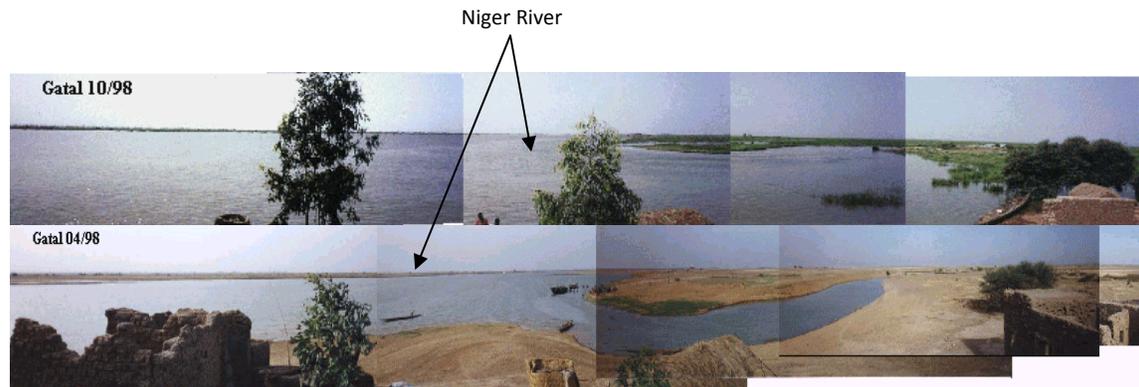


Photo 1.1. Change in the landscape of Batamani between flooding (top) and dry (bottom) seasons.



Photo 1.2. Débaré pond used for rice and fishing activities

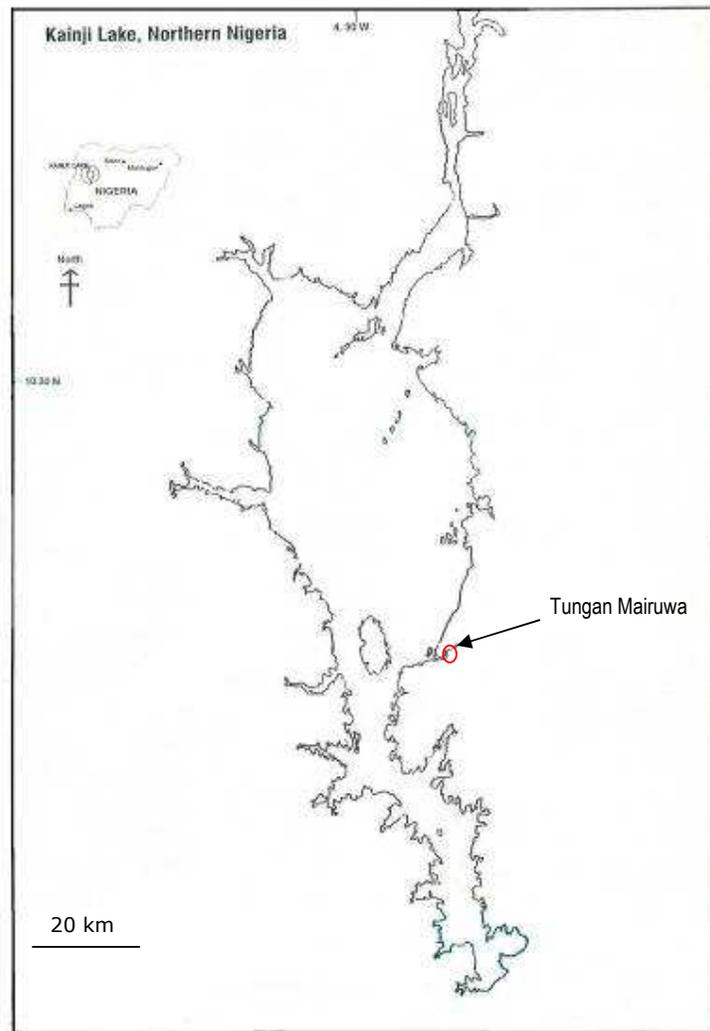
### Tungan Mairuwa (shore of Lake Kainji)

Tunga Mairuwa is located on the East coast of the Kainji Lake (Photo 1.3 and Map 1.3), in Ngaski Local Government Area of Kebbi State. The community comprised about 100 households with an average family size of 12 persons, comprising mainly of Hausa and Nupe ethnic groups. There are migrant non-indigenes from other parts of the country that have integrated very well with the local indigenous population. The people are predominantly Muslims although other faiths have freedom of worship. Fishing, the main occupation of the people, is operated on the lake using dugout canoes and various types of fishing gear (Photo 1.4.) and combined with farming and petty trading. There is a relatively strong village traditional Institution headed by the Village Head (Hakimi) and his Council of Elders (Photos 1.5). The community is characterized by a high level of

social cohesion and peace but lacks basic infrastructure such as access to electricity or running water.



Photo 1.3. Shore of the Lake Kainji during low water level



Map 1.3. The location of Tungan Mairuwa on the shore of Lake Kanji



Photo 1.4 (top) Castnet on the Lake Kainji. Photo 1.5 (bottom) the Council of Elders of Tunga Mairuwa

## 2. ADAPTATION OF FISHING COMMUNITIES TO ENVIRONMENTAL CHANGES IN THE NIGER RIVER BASIN

### 2.1. Introduction

This first main section of the report examines the ways African floodplain fishers have adapted to the major environmental changes that have affected the Sahelian region in the last 2 decades. While it looks at the past, the lessons that can be drawn in term of 'resilience management' are relevant for the future, in particular as environmental changes in the Sahelian region are likely to become more prominent over the coming decades due to climate change.

### 2.2. Hydro-climatic changes undergone by river-floodplain fishing communities

African inland fishers make use of two types of ecosystems: (i) lakes, which today are mainly man-made reservoirs, and (ii) large floodplain-rivers systems, where the fisheries are concentrated in the river stretches bordered by floodplains that support the natural productivity of fish resources (Welcomme, 1979, 1989).

The river-floodplain ecosystems of the Sahelian region have undergone two major hydrological changes in the past. The first phenomenon is an increase in interannual rainfall variation. Although climate modellers consider this increased variability as only one of several possible climate change scenarios for the region (Cook and Vizy, 2006), it must be recognized that the phenomenon has now been observed for fifteen years. After twenty years (1950-69) of high rainfall and 23 years of low rainfall (1970-93), the current period (1994-2009) is characterized by alternation between high/medium rainfall years and low rainfall years (Fig.2.1). These rainfall variations subsequently impact year-to-year variations in river discharge, as discharge depends primarily on rainfall on the upstream basin.

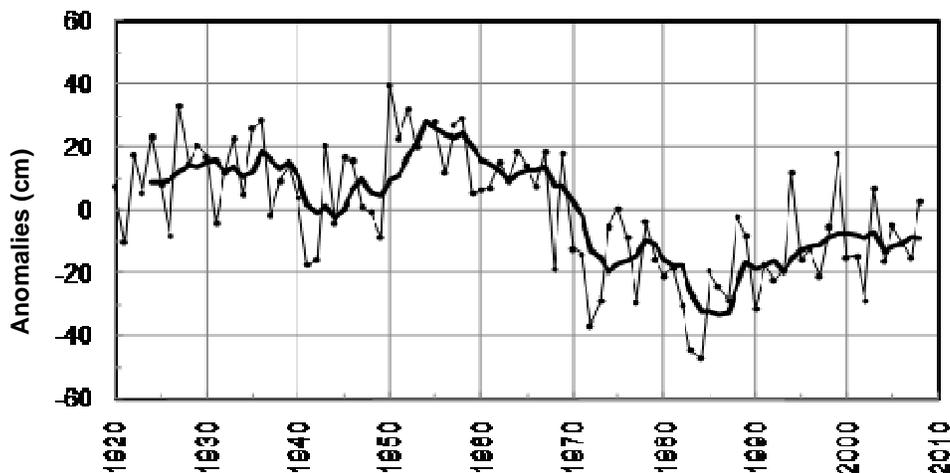


Fig.2.1. Anomalies of the annual rainfall in the Sahel region, with respect to 1900-2008 mean (data from JISAO website, 2009). Bold line is a 5 years moving average

The second phenomenon is due to human activity: the construction during the second half of the 20<sup>th</sup> century of an increasing number of dams and water abstractions on the upstream catchments of most large West African rivers. The main consequence is a strong decrease of the flood peaks in the downstream stretches of the rivers and a reduced inundation of the floodplain. Dam construction is continuing at a great pace, as it is a central pillar of African governments' current policies to adapt their economies, particularly the agricultural and energy sectors, to demographic growth and climate

change (FAO 2008).

Table 2.1. Main dams established or planned in the Niger River basin.

Country	River	Name of the dam	Year of construction (or starting year planned)	Type of dam	Lake reservoir area (if relevant), in km <sup>2</sup>
Guinea	Niandan	Fomi	2012	with reservoir	400-500
Mali	Sankarani	Selingue	1981	"	410
Mali	Niger mainstream	Markala	1947	sill + water abstraction	-
Mali	"	Taoussa	not yet defined	with reservoir	1500
Niger	"	Kandadji	2009	"	28
Nigeria	"	Kainji	1964	"	1270
Nigeria	"	Jebba	1984	"	270
Cameroun	Benue	Lagdo	1982	"	490

In the upper and middle basin of the Niger River, a certain number of large dams/reservoirs exist already (Table 2.1). More are planned at Fomi, in Guinea; Taoussa, near the end of the river's course in Mali; and Kandadji, just upstream of Niamey in Niger. The first dam will directly impact the Central Delta of Niger in Mali (CDoN), which is the main fishing area of the Niger Basin. Downstream, the floodplains of the Gao region, which is the third-largest fishing area in Mali, will completely disappear as soon as the Taoussa dam is built.

When the impact of dam construction is combined with years of very low rainfall –as occurred throughout the 1973-93 period (Fig.2.1) and occasionally (1997, 2002 and 2004) in the recent period– the result is a very sharp reduction in discharge in the downstream part of the river. This affects annual mean discharge, of course, but even more so the flood peak and the area of the inundated zones.

The question is whether fishers are able to adapt to such major changes in the hydrologic regime. To answer this question, we analyze the sensitivity of fishing outputs to hydrological variation, and then examine the main current characteristics of fishers' livelihood strategies, with the aim of understanding how these strategies do enhance fishing communities' resilience.

### 2.3. The example of the Central Delta of Niger

Since 1947 (year of completion of the Markala dam) and 1981 (completion of Selingue dam), the CDoN has been subject to the effects of human development policies. According to Laë (1992), these two "older" dams are responsible for an annual loss of about 5,000 tons for the CDoN. The new dam to be constructed at Fomi in Guinea (upper Niger Basin) will certainly reinforce the negative effects of the two existing dams on flood levels in the floodplain. In addition, the doubling of irrigated areas in the "Office of Niger" irrigated perimeter is expected to lead to an increase in the quantities of water abstracted by the Markala dam.

According to various studies (Zwarts et al., 2005; Marie et al., 2007), these infrastructures cause very significant decreases in the flood peak in the CDoN, within the range of 20-25 cm at the present time (Markala + Selingue effects) to 60-65 cm in the next future (when Fomi will be completed). As the relation of inundated area to flood peak water level is about 65-95 km<sup>2</sup> of area flooded per centimeter of water level, the loss of inundated area is estimated to range between 1300 and 2400 km<sup>2</sup> at present, and it will be of 3900 to 6200 km<sup>2</sup> in the next future. Given a median inter-annual maximum flooded area of about 15000 km<sup>2</sup>, it is clear that the cumulative impact of the

existing dams is already significant and will become even more drastic when the Fomi dam is operational. In addition to these big dams, the construction of several small dams and man-made sills are planned in the upstream part of Niger basin essentially in Guinea and Mali. Individually these small dams have limited impacts, but they accumulate with each other and add up to the effects of the bigger dams.

**2.3.1. Hydrological and fisheries data on the Niger Inner Delta**

The only hydrological data regularly collected within the DCoN are data on the daily water level recorded at the Mopti-Nantaka gauge (Direction Régionale de l'hydraulique Mali- DRH). The time series used here consists of 18 years of daily data, from 1988 to 2005 (Fig.2.2). Since the hydrological cycle is very regular, an "index of flood duration", defined as the number of days during which the gauge reading exceeds 4.50 m, can easily be derived for each year. This flood duration index serves as a proxy of the combination of the flood extent and duration in the floodplain. The maximum of flood peak curve (usually in October) shows very large interannual variation (from 5.10 m to 6.65 m), as does the flood duration index (48 to 129 days).

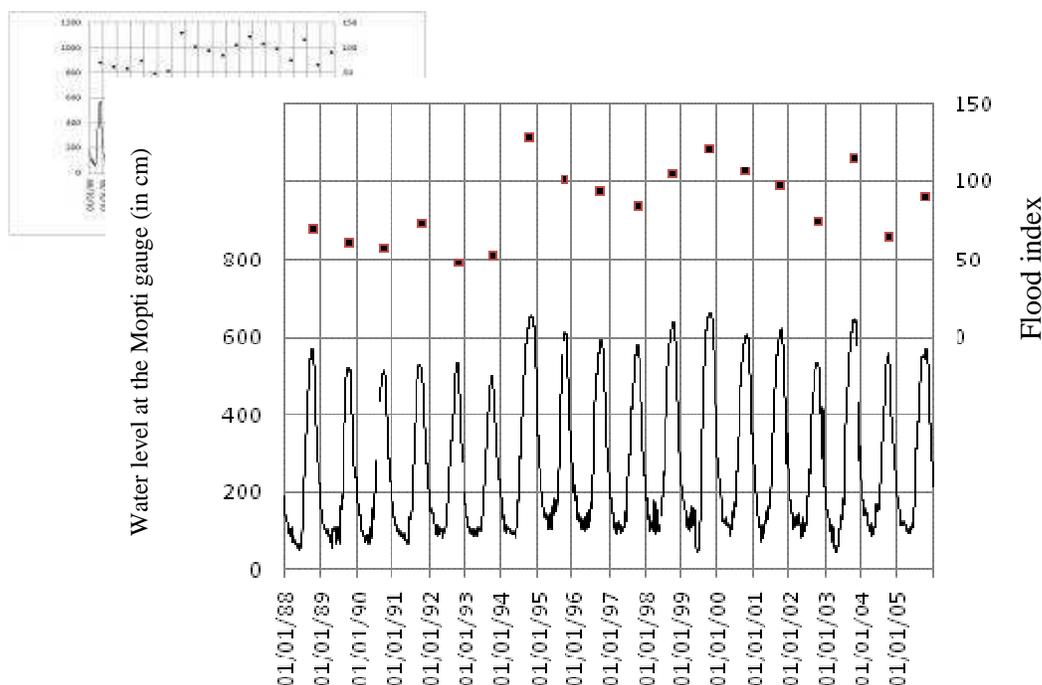


Fig.2.2. Hydrological variations in Mopti (1988-2005). Continuous line: gauge level for each day (in cm). Red squares: annual flood index.

As far as fishery is concerned, official statistics on the amount of fish brought to and marketed in Mopti (the main export centre for fish caught in the DCoN), have been recorded by the programme 'Opération Pêche de Mopti' for 1989-2000 and by the Direction Régionale des Pêches for the more recent years. The amounts recorded, which are estimated to represent 20% of the total catch in the CDON, are used by the Malian authorities and by various authors to estimate the total catch in the Delta, using a variety of extrapolation and adjustment factors. In this section, however, we used the raw Mopti statistics which are probably very tightly correlated with variations in the total catch in the CDON. Most of the fish are caught during a portion of the year, mainly from December to July, which corresponds to the receding stage and low-water period. Detailed examination of the statistics on fish marketed in Mopti shows that the fish catch reach their maximum in December-March and drop to a low level from August to October. The period from December to July is therefore usually called the 'campagne de pêche' ("fishing campaign"). When one aggregates the data from October of year *t* to

September of year  $t+1$ , one obtains yearly statistics that can then be correlated with the river flood index (Table 2.2).

Table 2.2. Value of flood index of each year (1988-2004) and statistics of fish recorded in Mopti for the fishing campaigns  $t, t+1$  which follows the corresponding floods  $t$ .

Years: $t, t+1$	Flood index at year $t$ (in days)	Fish landed recorded from October $t$ to September $t+1$ (in tons of equiv. fresh fish)
1988-89	70	10189
1989-90	61	10553
1990-91	57	9563
1991-92	73	7275
1992-93	48	6876
1993-94	53	6740
1994-95	129	15077
1995-96	101	19237
1996-97	94	13739
1997-98	84	15394
1998-99	105	15760
1999-00	121	20567
2000-01	107	16292
2001-02	97	19401
2002-03	74	9149
2003-04	116	15734
2004-05	65	7617

Data on fisher's activities were collected from early 1995 to late 2000 through a monitoring system called "Observatory of fishing in the Central Delta of Niger (IER website, 2009; Morand et al. 2002). This monitoring system was implemented in three areas of the CDoN: Batamani, Diakka-aval and Korientze. It included mainly two survey modules:

- A bimonthly census of the presence and movements of households, with record of their fishing activities during the previous week. This also includes information regarding their potential engagement in agricultural activities
- A sampling survey on fishing trips landing including fishing technique used and catch (species, weight). This survey module was carried out annually, in the form of two visits in each of the three zones: the first visit during the first half of the fishing campaign (from mid-November to early March) and the second during the second half of the campaign (from late March to early July).

### **2.3.2. Evidence of the high sensitivity of fish abundance and fish catches to hydroclimatic conditions**

First, the sensitivity of "catch per fishing trip" (a good proxy of fish abundance) to the intensity of the flood immediately preceding the fishing campaign was analyzed. A distinction was made between the catches landed during the first half of the fishing campaign (mid-November to mid-March) and those landed during the second half (mid-March to mid-July). This distinction allowed us to take into account one major factor of variation, namely the downward trend in the average catch per trip over the course of the fishing campaign (Kodio et al., 2002). Thus, we obtained two separate response curves describing the sensitivity of the "catch per trip" parameter to flood strength (Fig.2.3).

The upper curve (catch per trip observed during the first half of fishing campaign) shows that, between the worst campaign (1997-98, after the 1997 flood) and the best one

(1994-95, after the 1994 flood), the predicted mean catch per participant x trip varies by a factor of 3, from 8 kg to 24 kg.

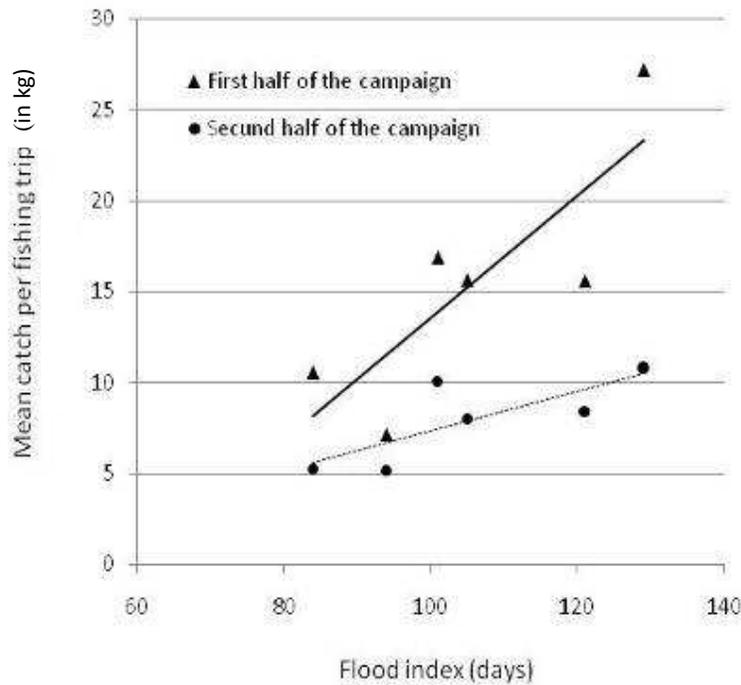


Fig.2.3. Response of the mean catch per fishing trip  $\times$  participant regarding flood index, for the two parts of the fishing campaigns.

The catch per trip observed during the second half of the fishing campaign, from mid-March to July is always lower than those of the first half. The slope of the line also indicates a sensitivity to flood strength: the mean catch predicted varied from 5.5 kg to 11 kg per participant  $\times$  trip depending on the strength of the flood preceding the campaign.

Another way to study the effect of flood strength on fish abundance is to consider the fish quantities recorded at Mopti throughout a full fishing campaign (i.e. from October of year  $t$  to September of year  $t+1$ ), compared to the flood duration index for the flood occurring in October of year  $t$ , just before the campaign (Fig.2.4).

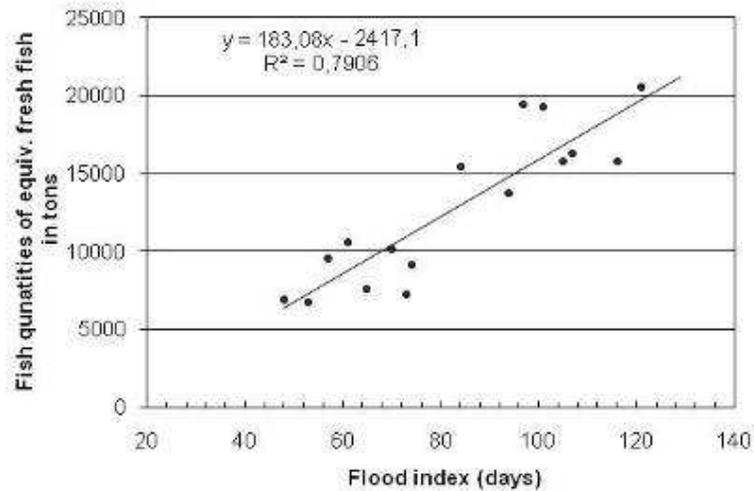


Fig.2.4. Relationship between fish quantities recorded in Mopti and flood index

The two variables are clearly correlated ( $r = 0.89$ ). Welcomme (1988) and Laë (1993) obtained similar results, but their data sets covered a different period and were strongly influenced by the monotonic downward trend in rainfall, discharge and catches in the region from the late 1960s to the early 1990s. The relationship between flood strength and fish catches is confirmed here for a more recent period, which enhances the reliability of the fish vs flood correlation.

All of the above results indicate that the sensitivity of fish resources to year-to-year flood variations is a major characteristic of the CDoN fisheries.

### 2.3.3. Adaptation of fishers to hydrological conditions and fish availability

In this section we consider whether fishers increase or decrease the intensity of their fishing activity depending on the abundance of fish. A first indication may be found by comparing the response curves in Fig.2.3 (catch per fishing trip vs. flood index) and Fig.2.4 (total catch vs. flood index). Fig.2.3 and 2.4 indicate that in years with weak floods, when catch yields are low, the fishing effort is at least equal to that of years of stronger floods offering much higher yields. This first observation suggests that fishers do not respond to declining yields by diminishing their fishing activity.

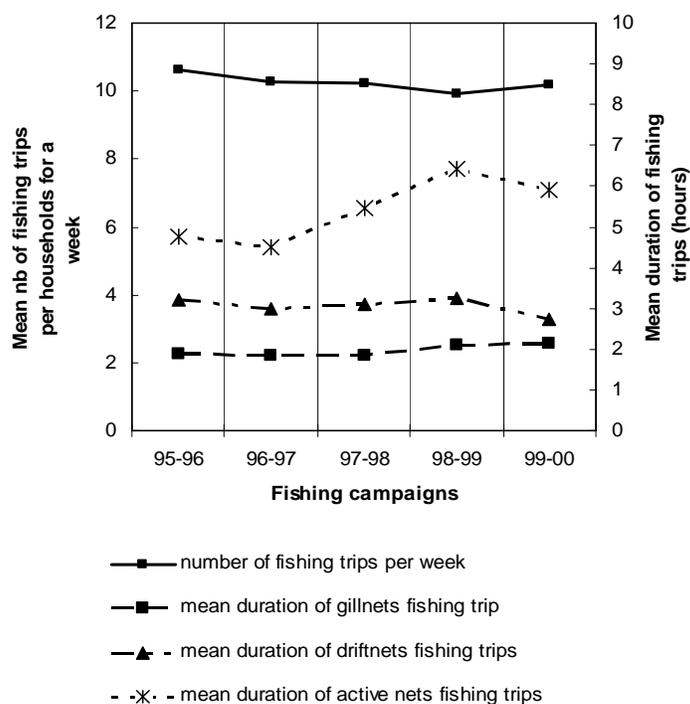


Fig.2.5: Trends of some fishing efforts indicators

This is confirmed by other indicators that relate more directly to the intensity of fishing activity. The overall frequency of fishing trips varies very little from one campaign to another: it is constantly high, at about ten trips per week, or 1.4 per day. The mean duration of fishing trips shows some weak and divergent trends (Fig.2.5). More than 50 % of all trips are passive “gillnet trips” (i.e. trips in a dugout canoe to set one or more stationary nets and land the catch), whose mean duration does not vary from year to year. The duration of trips with active nets having a high catch capacity (large seine net, familial seine net, castnet) seems to be increasing over the period considered (1995-2000), whereas driftnet trips are becoming slightly shorter. These trends are monotonic and very slow, and they seem to be correlated neither with the sharp interannual variations in hydrological conditions nor with changes in mean fish availability for the five considered fishing campaigns.

These results suggest that, at interannual scale, fishing activity always involves a relatively constant level of labor time, irrespective of the yields and the hydro-climatic conditions.

**2.3.4. Adaptation of fishers’ intensity of farming to hydro-climatic conditions**

Due to traditional land tenure systems, only fishers living in their own villages or in a settlement located on their village territory have access to land. We consider here the information regarding the “agricultural activity” collected as part of the bimonthly census of the monitoring system. The percentage of autochthonous fishing households responding that they do some farming is reported in Fig.2.6.

The data show that farming activity follows a regular annual pattern. At the seasonal peak of farming activity, in August and October, up to 45% (Korientze), 70% (Diakka-aval) or 95% (Batamani) of the households of autochthonous fishers are involved in farming activities (the aggregate ratio for the three areas is 78%). At this time of the year, between two fishing campaigns, the majority of the fishers are present in their

villages or areas of origin; hence, these results indicate that a high proportion of CDoN fishers engage in farming.

The interannual variations in the percentage of fisher households involved in farming are important, but some interesting observations emerge. It can be observed for instance that during the crop season of August-October 2000, just after the highly productive fishing campaign of 1999-2000 (associated with the relatively high flood level of 1999; see Table 2.2), the proportion of fishers working in the fields fell slightly. This may be attributed to the decision of some households to extend their 1999-2000 fishing campaign by several weeks. According to Fay (in Baumann et al. 1994), households that migrate seasonally have a tactical choice to make concerning the end of their fishing campaign and the return to their village of origin. To some extent, this choice determines the balance between fishing and farming, as there is much work to do in the fields beginning in June and July.

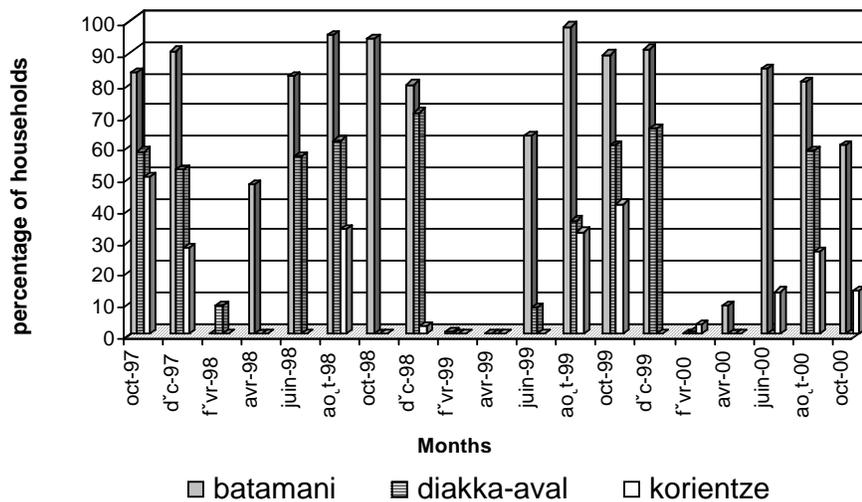


Fig.2.6. Variations of the fishers' households' involvement in farming activities among the 3 areas surveyed

These interannual variations in farming involvement are small, however, as they involve only 5 to 20% of the fisher's households present in their home village in August and October. When longer-term trends are considered, the information available indicates a certain stability, since the proportion of households engaging in farming activity observed in the three areas monitored over the 1997-2000 period is very similar to the rate of 81% observed on 1987 by Baumann et al. (1994) among CDoN fishers, during a period of severe drought.

The persistence with which a majority of fishers try to raise crops each year is remarkable in view of the wide interannual variations in hydro-climatic conditions (rainfall and hydrology) that strongly affect crop yields. For example, yields of rainfall/flood-fed "floating" rice, the main traditional crop, can be almost nil some years in some locations. Overall the total rice production of the CDoN floodplain ranges from 20.000 to 110.000 tons depending on the year (Zwarts et al., 2005).

It is thus observed that (i) farming as a secondary activity constitutes a strategy used by the majority of fishers' households and (ii) this strategy is put into practice every year even though the results are highly uncertain and highly variable from year to year.

### **2.3.5. Low flexibility of fisher traditional activities**

To understand why fishers' traditional activities (fishing and extensive rice farming) show little interannual flexibility, we shall consider the characteristics of the rice farming activity in detail, as well as its interaction with fishing.

The traditional farming activity of CDoN fishers consists mainly of rainfall/flood-fed rice farming. The main advantage of this type of crop system is that it is based on natural flooding and hence requires no particular infrastructure. But yields are highly sensitive to rainfall and hydrological conditions. First, because the yield of each plot depends on the local timing of the arrival of the rains and the subsequent flood (with some risk of mismatch); and secondly, because, on a larger scale, the potentially productive surface area depends on the overall flood level of the CDoN (see above).

In terms of labor, flood-fed rice farming is easily compatible with fishing, since the period of intensive labor in the fields (mainly May-June to early December) overlaps only slightly with the fishing campaign (end of November to July). Decisions on how to divide labor time between the two activities therefore do not raise major problems. In late May or early June, when the fishing campaign is drawing to a close and fish are becoming scarce, some fishers leave the camps early for their villages in order to plough the fields before the rains begin.

From the economic standpoint, the two activities display very different characteristics. Fishing requires large investments but may also bring in large cash income whereas rice farming when the harvest is good enough generates lower revenues (Kuper and Maïga, 2002). Rice farming is thus primarily a subsistence activity, and under no circumstances can it replace fishing, which brings in steady, substantial cash income for much of the year. Thus, fishing and traditional rice farming are complementary activities, which means that fishers cannot adopt a strategy of shifting completely from one to the other.

Moreover, there is no guarantee that poor fishing years should be good years for rainfall/flood-fed rice farming. The relationship between climate and rice yields is not as simple and clear as that between hydrology and fish catch, but such a relationship does exist (Zwarts et al., 2005). When the Sahelian region undergoes a series of low rainfall years, as it did during the prolonged drought of 1973-93, the output of both activities (rice and fish) is severely reduced.

### **2.3.6. Migration strategies**

Another strategy that needs to be considered when one tries to understand fishers' response to environmental changes concerns their migration and settlement strategies.

It should be recalled that fishers in the CDoN may settle either in their place of origin, i.e. in the village of their ancestors or its immediate surroundings (e.g. in small fishing camps), or in "foreign" territory, not necessarily far away, but whose resources (land and water) are under the authority of chiefs of other villages. Settling in camps on other villages' territories generally does not allow 'migrants' to access land for farming.

The majority of fishers' camps are called "temporary" because they are entirely empty from August to December, when migrant fishers return to their home villages for farming (Fig.2.6).

A substantial proportion (25%, according to IRD-INRZFH, 1988) of the CDoN fishers migrate seasonally so as to be close to the places where fish congregate.

There are also "migrant" fishers who have become sedentary. These spend the entire year in the camps, leading to what is called "permanent camps" -this is the case for instance of the migrant fishers living in Batamani Daga. They settled there more than 60

years ago. Despite permanently living in these camps, these fishers are generally still considered as allochthonous people by the autochthonous population, and do not enjoy access to land.

In order to investigate if innovation in seasonal migration patterns could be a way of response of the fishers to hydro-climatic variations, we used the bimonthly census of fisher households. At first, it appears that the three areas monitored reveal clear variations in the pattern of seasonal occupation. In Batamani area, the dominant group is made up of autochthonous fishers who spend the entire year in their home villages or in small camps on the village territory. The pattern of occupation in the Korientze region is the exact opposite, with only one village and a number of large migrant fishers' camps, most of which are occupied only a few months during the year for the fishing campaign. The pattern in the Diakka-aval area lies between these two extremes, with several villages in addition to many large temporary fishing camps.

In the two areas having many camps (Diakka-aval and Korientze), the pattern of occupation of the camps is very similar from one year to the next. The peak occupancy season in the camps is the same each year, both overall and in each camp. Although there may be a high interannual variation in the number of fishing households during the occupancy peaks, such quantitative year-to-year variations do not indicate marked changes in the migration paths of migrant fishers. Indeed, most of the households had "come to the same site last year" or "had come here in the past" (from responses in the survey data). This means that the seasonal migration paths of fishing households are highly stable, though not exactly the same every year.

In addition, the available data indicate that most of the settlements that are constantly occupied today were founded long ago, before 1968. Many temporary seasonal camps are also long-established sites: 70% of them (30 out of 43) existed before 1968. This shows that the number of settlements in the three areas studied has stabilized, which seems to indicate that the CDoN is saturated in terms of spatial occupation of favorable sites.

The relative stability of settlements and migratory patterns inside the CDoN is probably due mainly to the fact that this area has long been occupied and has reached saturation. It should be remembered that the CDoN is a floodplain area and that much of it is unsuitable for permanent human settlement. It is rare today for new permanent settlements to be founded, and while there is considerable seasonal migration, it follows rather strict patterns, as the camps are occupied each year at the same period by more or less the same households. As a result of the longstanding human occupation of the CDoN and its high population density today (about 20 rural inhabitants per km<sup>2</sup>, one-fourth of whom are fishers), any attempt to find a new place to settle entails high transaction costs. Within the CDoN, fishers thus have a choice between remaining in their home village and undertaking seasonal migration to fishing camps following the same path as in previous years. These migratory paths were marked out in the past by their elders, who negotiated and obtained the rights to settle and fish in favorable spots.

Fishers thus have little freedom of movement within the CDoN to help them cope with environmental changes. The only new opportunities are these offered by the new reservoirs. Indeed, it appears that man-made reservoirs, notably those in Mali, do represent a possible migration destination for fishers from the CDoN.

### **2.3.7. Possible scenario**

In theory, having multiple activities and migratory capacity could help fishers to cope with environmental changes. However, the observed low level of interannual variability in productive activities and the rigidity of spatial mobility within the CDoN indicate that, in fact, fishers in the CDoN are highly vulnerable to the modifications in flow induced by new dams or by climate change. Under these conditions, several scenarios are possible.

First, increased competition can be expected among fishers over the fish resource of the CDoN. This dynamic seems in fact already under way, as highly efficient fishing practices are increasingly observed. In the last ten years, prohibited practices have emerged, such as complete blockage of large channels with nets during the rising flood stage. The increased use of these predatory fishing techniques cannot be attributed solely to climate change. Population growth and the weakening of customary fishing rules probably play a role as well. Regardless of which factor is the main cause of this phenomenon, it clearly brings no benefit in the long-term in terms of average catch per household and will probably exacerbate social conflicts over the sharing of fish resources.

Second, with the downward trend in the area inundated by the floods, it can be expected that productive acreage for traditional rainfall/flood rice farming will gradually decline.

For these reasons, the economic and food situation of fishers' households may well deteriorate in the coming years, accentuating the poverty and vulnerability that already characterizes them today (Mills et al., 2009) and could return to the catastrophic level they reached in the years of severe drought (Baumann et al., 1994).

The end result will probably be the same as what happened in the 1980s: the departure of young fishers for other regions of West and Central Africa offering scope for their occupational skills (man-made reservoirs or estuaries). Fishers from the CDoN do well in these fishing areas in terms of putting their original skills to use, but as "foreigners" they also encounter new factors of vulnerability: lack of access to land, services and infrastructure, lack of civil and administrative rights.

### **2.3.8. New livelihood opportunities and policy options**

Are the scenarios of impoverishment and/or emigration of fishers presented above inevitable? Some innovations can be identified that could help the fishers of the CDoN to adapt to their changing environment and improve their prospects.

One of these innovations, which began to be used in the late 1980s (at the end of the long drought period) by some fishers living in villages, is to dig or deepen trenches in the river benches to promote the inundation of the floodplains (Chamard et al. 1997). This practice locally accelerates the flooding of rice plots, which can enhance their yield. When the floodwater recedes, the trenches can be blocked by fish traps or nets that provide an additional catch. However, since this practice is generally not accompanied by the construction of gates to retain water, it also accelerates the drainage of the floodplains in the receding stage, which is undesirable both for rice and fish. More recently, as from the late 1990s, some real innovations have emerged in the livelihood strategies of many fishers living in villages. Some of these involve auxiliary productive activities, such as small-scale livestock raising and market gardening along the river's edge (the latter activity being primarily pursued by women). Another innovation, which constitutes a more radical departure from the traditional lifestyle of some fishing village communities, is intensive irrigated rice farming during the off-season, from March to July, in paddies watered by motor-driven pumps that draw water from the river. This new form of rice farming, which is costly in terms of inputs but well supported by NGOs, makes rice production less subject to hydro-climatic contingencies and offers much better yields.

More generally, it should be emphasized that most possibilities for innovation in livelihood strategies are unavailable to fishers settled in camps, particularly those who live year-round in permanent camps, because they have no land use rights.

It can thus be seen that many fishers will be unable to adapt to hydroclimatic change through agricultural innovations. We should therefore expect further waves of emigration of CDoN fishers to other fisheries. The foremost destinations will undoubtedly be the

lakes formed by the dams slated for construction: Kandadji in Niger, Fomi in Guinea, and possibly Taoussa in later years. To ensure that the arrival of fishers from the CDoN as “foreign” migrants does not lead to the same problems encountered in the past in other places, multifaceted policy actions should be taken in support of their establishment as well as measures to mitigate possible negative impacts on their environment and livelihoods.

Only the adoption of such supporting policies will make it possible for the migration of river-floodplain fishers to man-made reservoirs to become a winning adaptation strategy, rather than simply a move towards greater vulnerability.

### **3. IDENTIFYING THREATS TO THE LIVELIHOODS OF FISH-DEPENDENT COMMUNITIES IN THE NIGER RIVER BASIN**

The previous section investigated the ways African floodplain fishers have tried (and only partially succeeded) to adapt to the changes affecting their direct environment. The stories of these fishers demonstrated in a particularly vivid way why the initial ambition of this project (operationalizing resilience management) appears perfectly relevant in the case of inland fisheries.

The section below presents the result of the first part of the project, that is, the design and implementation of the participatory diagnosis in these two pilot sites in Mali and Nigeria.

#### **3.1. The concept of resilience**

For the prospects of fisheries to improve, established theory, approaches, definitions of sustainability, and indicators of management performance have to be re-thought (Andrew et al. 2007). The last decade or so has seen fisheries research and management broaden considerably in the search for better ways of doing things. These developments have proposed new approaches, concepts and methods, such as the precautionary principle (FAO 1995), ecosystem approach (FAO 2003), sustainable livelihoods framework (Allison and Ellis 2001), participatory methods and co-management (Pomeroy and Riveira-Guieb 2006). More broadly, recent developments in socio-ecological theory have provided new concepts and approaches to move these issues forward (e.g., Folke et al. 2005). In particular, a consensus has now emerged across disciplines (ecology, social sciences), that emphasizes the necessity to build management around the concepts of resilience and adaptive management (Carpenter et al. 2001, Walker et al. 2002).

In a broad sense, analysis of ‘resilience’ is about the potential capacity of systems to adapt to shocks, recognizing that disturbance and change are integral component of complex systems. More formally, resilience analysis proposes to focus on mechanisms and processes that help systems absorbing perturbations and shocks, and coping with uncertainty and risks. Defined in such a way, the concept of resilience thus appears particularly useful for the management of small-scale fisheries. However, while resilience is appealing, particularly in the face of the failure of current management approaches, the danger is that it remains largely academic and theoretical, and not of a great help in effectively improving the way natural resources are managed on the ground. The challenge, therefore, lies in operationalizing the concept of resilience and making it practically and pragmatically meaningful when it comes to its implementation on the ground.

In practical terms the goal of resilience management is to ensure that the socio-ecological system under consideration will remain within the set of ecological and socially

## Objectives CPWF Project Report

desirable configurations (Carpenter et al. 2001). One needs therefore to identify indicators and thresholds that define these desired configurations. This is the role of the first component of the PDAM framework: the participatory diagnosis.

### 3.2. Participatory Diagnosis

#### 3.2.1. The 360° integrated assessment

The objective of this participatory diagnosis is to identify key threats and resilience indicators specific to a system (in the present case a fishery system). This participatory diagnostic can be implemented using various techniques. In our case, we use a 360° integrated assessment map (Fig.3.1).

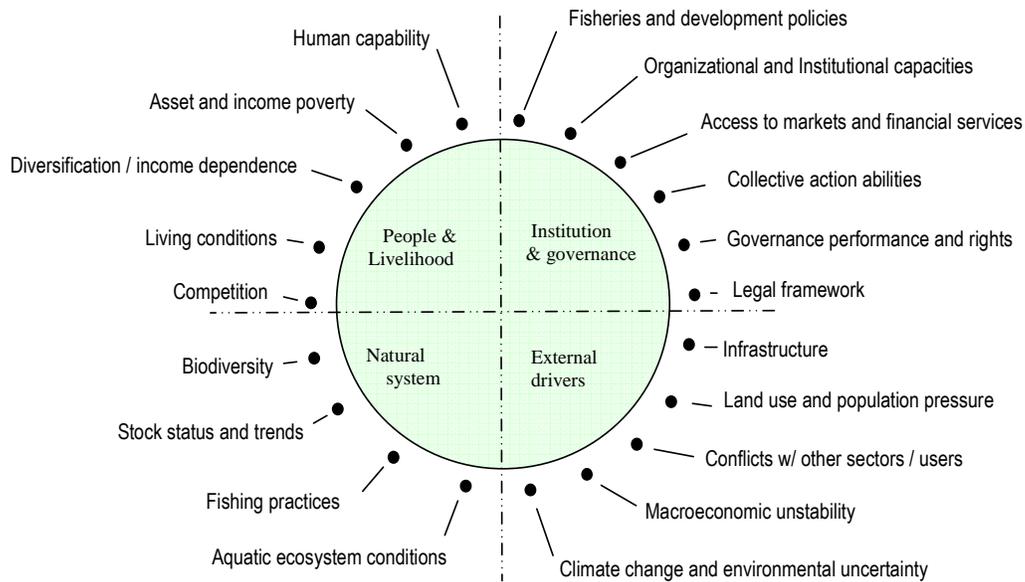


Fig.3.1. The 360° integrated assessment map

The idea of this integrated assessment tool is to scan in a systematic and comprehensive manner the system in order to gain a better appreciation of the true nature of drivers and processes that affect the dynamics of that system. Four domains are considered: (a) natural system, (b) livelihood and people, (c) institutions and governance, and (d) external drivers. In each of those 4 domains, resilience indicators are identified and conditions of the system assessed against those indicators, using a combination of quantitative variable and thresholds.

One example is used here to illustrate the process. In the case of the indicator "Asset and Income poverty" in the domain "People and Livelihood", stakeholders (say, the fishing households) are asked to assess their situation in terms of income by identifying two thresholds; one distinguishing what those households consider as a "desirable" situation from an "undesirable" one. Above, say, US\$4 per household per day, the fisherfolk consider that their situation is satisfactory ("desirable"), while below that same US\$4 threshold the situation is considered as unsatisfactory ("undesirable"). Finally, under a lower threshold of US\$2 per day the households regard the situation as a 'crisis'. Over time (season, life), the households income varies, passing above or below the thresholds (Fig.3.2). The objective of the resilience management is to ensure that household income remains in the "desirable" zone.

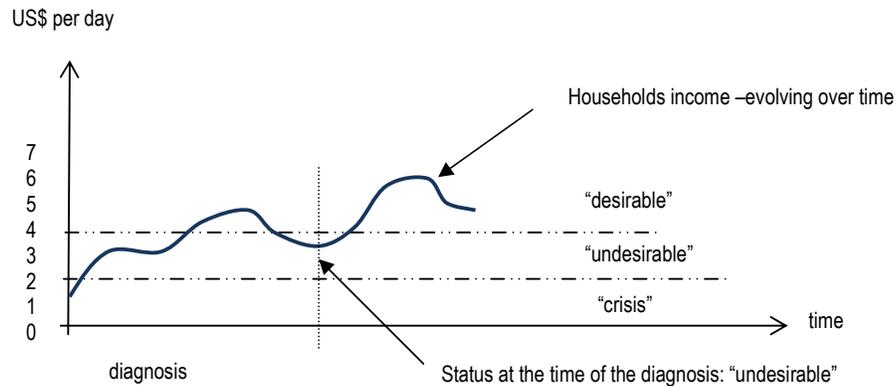


Fig.3.2. Assessing the conditions of the system against thresholds

### 3.2.1. Dashboards

Applying this approach to each of the indicators considered critical by the stakeholders, a dashboard can be constructed, which reflects, for each indicator, the perception of the stakeholders about the conditions of the system.

Different stakeholders can contribute to the evaluation of different indicators (or even domains) of the system. One may for instance request a panel of experts to assess the situation of the system for the 'external drivers' domain, while the local community may be asked to express their views about the 'people & livelihood' or the 'natural system' domains. In our case we asked two panels of experts to construct the dashboards of the two fisheries on which the pilot sites were relying: the Niger River fishery in the area of the Central Delta in Mali and the Lake Kainji fishery in Nigeria. The dashboards resulting from these two parallel consultations are presented in Tables 3.1 and 3.2.

### Results

The two dashboards present some similarities and some dissimilarity. In both fisheries the experts recognize biodiversity (measured by the number of species available in the ecosystem) as being one of the key resilience indicators for the natural system domain. Similarly the experts in both Nigeria and Mali affirm that income level and degree of livelihood diversification are critical elements of the resilience of households. Markets are seen as both an opportunity (in Lake Kainji fishery) and a threat (in Central Delta of Niger). In both cases, fishing pressure is seen as a threat. Some factors are more case-specific. For instance, for the Central Delta of Niger, the intensity of flood is another critical factor and can be seen as an external opportunity (when the flooding is important) or as a threat (when the flood is low). Unexpected water release from the dams upstream is also seen as a threat for the biological cycle as well as for the life of those who live on the banks of the river.

In essence, none of the indicators identified by the experts were fundamentally surprising. They do correspond to the 'generic', conventional indicators that we could have expected for these two types of systems (fishing communities operating in large reservoir and in river-floodplain system respectively). Perhaps more informative are the values of the different thresholds that were proposed by the local experts. These are specific to the two fisheries. In relation to these thresholds, the number of 'crises' that are reported by the experts to characterize the current situation of the Lake Kainji and Central Delta of Niger is extremely high: 11 indicators amongst the two fisheries (5 for Lake Kainji and 6 for the Central Delta of Niger) were estimated to be at the crisis level, with potentially additional ones if we consider the indicators for which no estimates were

## Objectives **CPWF Project Report**

indicated by the experts. This means that in both cases, a large number of the indicators that were considered as critical for the overall resilience of the systems need immediate actions.

Table 3.1. Dashboard resulting from the expert panel consultation for the Lake Kainji fishery (Nigeria)

Domain	Indicator	Justification	Variable	Threshold	Status	Partners
Natural System	Biodiversity	Maintaining a high and stable biodiversity is crucial to fisheries and fisheries dependent communities. The sustainability of the fisheries is dependent on maintaining the diversity of the natural resources.	Number of species available	- 150 sp. - 100-140 sp. - < 100 sp.	62 (crisis)	DoF, RIs, Communities
	Fish landing	Catch or fish yield in African Lakes increases with increase in the number of fishers up to a peak of 2 fishers /km <sup>2</sup> . Beyond this limit the catch is observed to fall drastically showing evidence of over fishing which ultimately leads to decreased income and livelihoods.	Annual production or landing	- 30 t/year - 15-29 t/year - > 15 t/year	10 t/year (crisis)	DoF, KLFMCU, Communities RI
	Fishing Practices	Fishing practice is important in sustainability of fishery resources as obnoxious fishery practices often lead to stock depletion while acceptable fishing practices (eg CCRF) engender sustainability.	Compliance with recommended fishing gears	- 50 -100% compliance - < 50% compliance	Less than 50% (crisis)	Community, KLFMCU, RI, DoF, LGA, FISON
External drivers	Infrastructure (Roads)	Access road is important for easy movement of fish and fish product to market	Percentage of road maintained annually	- 25% maintained annually	Less than 10% of the road maintained (crisis)	SG, LGA, Community
	Number of Fishers	Fisher number has relationship with fishing effort. Too high fisher number leads to increased effort and potential stock depletion and low income	No. of fisher/km <sup>2</sup>	- < 2 fisher/km <sup>2</sup> - > 2 fisher/km <sup>2</sup>	More than 4 fisher/km <sup>2</sup> (crisis)	DoF, RI, Community
	Fish Market	Fish markets are crucial to fish and fish product sales. In addition, they are a major source of income to non fishers such as fish mongers (Middle Men) and ancillary actors such as packagers fish carton fabricators, loaders, food sellers	Presence of fish market	- <5 km to market - 5-10 km to market - >10km to market	< 5 km (satisfactory)	LGA, Community, Fisher folks
People and livelihood	Dependence on fishery	Fishing still remains a viable economic activity contributing immensely to the fishers' income/livelihoods. Dependence on fishery provides a basis for determining the contribution of the sector to livelihood.	Percentage of fisher in the community	- 50-100% involvement - below 50% involvement	More than 50% (satisfactory)	DoF, RI, Community
	Livelihood diversification	Involvements in diversified livelihood portfolios provide alternative income opportunities from array of activities in	Involvement in other livelihood	- 50% involved in more than 1 activity.	Over 50% involved in	DoF, RI, LGA Community

## Objectives CPWF Project Report

		the event of declining fish stock. It also enable fishers to support fishery management	activities as safety net during lean periods from the fisheries.	- < 50% involved in one activity.	multiple activities	
	Sustainability of income overall	All-year round access to regular income is a reflection of community resilience and well-being.	Availability of regular income	- 50% with regular income. - < 50% with regular income.	Over 50% with regular but inadequate income	NACRDB, Community, MFI Private sector, DoF, RI
Institutions and Governance	Accountability of traditional institutions	Accountability of traditional institution is vital to providing a basis for measuring the confidence and cohesiveness of rural fishing communities.	Approval rating amongst community members	- 70% approval - < 70% approval	Greater than 70% (satisfactory)	Emirate council, CBOs, SG, RI, FISON
	Cooperative and CBOs	The existence of cooperative /CBOs is important as they serve as vehicles for achieving common goals when properly harnessed or managed.	Number and effectiveness of co-operative and CBOs in the community	- Increase in no. and effectiveness of cooperatives and CBOs	Low no. and weak co-operative/ CBO	Fisher folks, Community, SMC, RI, FISON
	Capacity of formal Institutions	Capacity of formal institutions is quite important as they have <i>de jure</i> responsibility for fisheries policy development and management. Weak formal institution is inimical to effective fisheries management and the delivery of expected benefits from the fisheries.	Budget allocation to the sector	- High - Medium - Low	Low budgetary allocation (crisis)	Legislature, FG, FMAWR, NPC, FMF

**Keys:** DoF = Department of Fisheries, RIs = Research Institutions, FMAWR = federal ministry of agriculture and water resources, FMF = Federal Ministry of Finance, SG = State Government, SMC = State Ministry of Commerce, NPC = National Planning Commission, FISON = Fisheries Society Of Nigeria, FG = Federal Government CBOs = Community Based Organizations, NACRDB = Nigerian Agricultural Cooperative and Rural Development Bank, KLFMCU = Kainji Lake Fisheries Management and Conservation Unit. LGA = Local Government Authority.

Table 3.2. Dashboard resulting from the expert panel consultation for the Central Delta of Niger fishery (Mali)

Domain	Indicator	Justification	Variable	Threshold	Current status	Partners
Natural system	Biodiversity	Biodiversity in the Central Delta of Niger is one of the central issues	Number of couples of fishing eagles nested per 10 km of river	- > 1 - 0,5-1 - <0,5	0.5-1, decreasing	DRP, DRCN, UICN, WETLANDS
	Catch species composition	Inform about the resource status	Number of species constituting 80% of the landing	- >14 - 10-14 - <10	13, worsening	DRP, OP
	Resource abundance	Inform about the system productivity	Mean capture per gillnet fishing trip on December to March	- > 32 kg - 18-32 kg - < 18 kg	28	DRP, WETLANDS, OP, AFARTct
	Hydro-climate change		Flood duration index	- >105 - 75-105 - <75	85	DRA, Météo, DRHE, ORM, DRPIA
External drivers	Fishing pressure	Inform about the anthropic impact on the stocks	Fish mean size in catches	- > 25 cm - 15 -25 cm - < 15 cm	16 - worsening	DRP, OP, WETLANDS
	Flood (water level)	Influence fish habitat	Flood level (are inundated in km <sup>2</sup> )	- >21000 km <sup>2</sup> : - 12000 - 21000 km <sup>2</sup> - < 12000 km <sup>2</sup>	10000 to 21000 km <sup>2</sup> –	DRP, DRCN, UICN, WETLANDS, DRHE, ORM
	Demand for fish and access to market	Increasing demand. Malian consumes more fish than meat	Annual fish consumption per capita	- >15 kg/cap/year - 10-15 kg/cap/year - <10 kg/cap/year	13 kg/cap/year	DRP, OP, AFARTct, PCDA, fish traders
	Dams and water control infrastructures	Fishers activities are strongly impacted by water flood infrastructures such as hydroelectric dams	Number of water release events from March to June (more than +10 cm at Mopti gauge)	- <3 - 3-6 - >6	3 to 6	DRP, ORM, OP, PADEPECHE
People and livelihoods	Income	Important factor for households wealth	Household income in fisher groups	- 2 US\$ per day - 1-2 US\$ per day - < 1 US\$ per day	300 \$/ household/ year (crisis)	DRP, UICN, WETLAND, OP, DRPSIAP
	Diversification of	Increasing importance of diversification as a	Number of activities other	-	Perception of	DRP, DRCN, OP,

## Objectives CPWF Project Report

	livelihood	key strategy to improve livelihood	than fishing ; Contribution of other activities to total income ; Percentage of non-fish dependent households		improvement (increasing diversification)	AFARtct, CAL, ORM, DRA, DRPIA
	Food security	Contribution of fish resources to food security	Number of meals per day	- 3 meals / day - 2 meals/ day - >2 meals / day	>2 meals / day (crisis)	DRP, PSSA, GRAT, OP, CAL
	Access to health services	Health determines labor force	Number of visits to health center	-		DRS, DRESDS
Institutions & Governance	Organizational capacity	Efficiency and effectiveness of CBOs in fishing communities	Number of activities planned and implemented ; Total number of operating socio-professional organizations	-	Bad but reversible	DRP, CRA, OP, CAL, DRA
	Conflicts	Multiplication of conflicts in the Central Delta of Niger	Nature and frequency of conflicts	-		DRP, DRCN, OP, AFARtct, CAL
	Participation of fishers in fisheries development policies	Representation of fishers at different levels of the fisheries development policies	Number of policies involving fishers	-	low (crisis)	DRP, OP, CAL, AFAR

**Keys :** DRP: Direction régionale de la pêche à Mopti ; DRCN : Direction régionale de la conservation de la nature à Mopti; ORM : Office Riz Mopti ; PCDA : Programme de compétitivité et de diversification agricole ; PADEPECHE : Projet d'Appui au Développement de la pêche continentale ; OP : Organisation de pêcheurs ; CAL : collectivité (maries) et autorités locales (préfets et sous- préfets, chefs coutumiers) ; AFAR : Action de Formation et d'Autopromotion Rurale ; GRAT : Groupe de Recherche et d'Application Technique; UICN : Union Mondiale pour la conservation de la nature ; WETLANDS International ; DRHE : Direction Régionale de l'Hydraulique et de l'Eau ; DRA : Direction Régionale de l'Agriculture ; DRPIA : Direction Régionale des Productions et Industries animales.

### 3.2.2. Vulnerability analysis

#### Method

The 360° integrated assessment map that was initially used to help constructing the dashboards was also used to design a household questionnaire aimed at exploring in a comprehensive and systematic manner the various sources of vulnerability affecting the livelihoods of the populations living in the areas of the two pilot sites.

For this vulnerability analysis, forty households in the Nigeria community and ninety in the Malian one were selected randomly. The two main adults (man and woman) of the households were interviewed separately in each household in order to ensure that the survey captured the gender-dimension of the household livelihood. Questions included information regarding the household general background (number of persons, ethnic group, age, etc.), income, assets, and livelihood strategies (on-farm and non-farm activities). Income referred to the household's income earned in cash plus payment in kind that could be valued at market prices. The cash-earning components of income included crop and vegetable sales, petty trade, remittance, and fish sales. A final section of the questionnaire focused more specifically on the various key threats and external drivers affecting those households' livelihoods. Based on this, individuals were then asked to rank what they perceived as being their main sources of vulnerability.

It was hypothesized that the sources and intensities of vulnerability affecting the different households would depend on, or at least reflect, the main economic activity of the households. Similarly, it was hypothesized that wealth would influence the household vulnerability structure, with the poorest households being exposed to different sources or intensity of vulnerability than the better-off households.

#### Analysis/results

Vulnerability ladders were computed by aggregating the individual households' responses and normalizing the scores (total = 1) as follows:

Let  $V_i$  be a source of vulnerability (e.g.  $V_i = \text{'food insecurity'}$ ),  $i = 1$  to  $n$ , where  $n =$  total number of sources of vulnerability identified by the households in the community (e.g.  $n = 16$  in the Nigerian community). Respondents were asked to identify the first five main sources of vulnerability for their individual household. For each source of vulnerability  $V_i$ , a vulnerability score  $k_{Vi}$  across the community was then computed as follows:

$$k_{Vi} = \sum_{j=1}^5 \alpha_j \times N_j$$

where  $N_j$  is the number of times (counts) the source of vulnerability  $V_i$  was mentioned by households in round  $j$ , ( $j = 1$  to  $5$ ), and  $\alpha_j$  is a weighting vector. In our case  $\alpha_j = (1; 0.95; 0.9; 0.75; 0.33)$ , which means that vulnerability sources identified as first main sources are weighted 1, 2<sup>nd</sup> sources were weighted 0.95, 3<sup>rd</sup> source: 0.9, and so forth. The vulnerability scores were then normalized:

$$k_{Vi}^* = \frac{k_{Vi}}{\sum_{i=1}^n k_{Vi}}$$

## Objectives CPWF Project Report

so that  $\sum_{i=1}^n k_{Vi}^* = 1$  and direct comparisons between villages and between sub-samples were possible.

These vulnerability ladders present some important similarities between the two communities<sup>1</sup> (Fig.3.3). In particular, in both communities, food insecurity and health issues rank amongst the three most important sources of vulnerability. Lack of cash and poor access to capital was also identified as a major issue. This in itself is not surprising as poor access to (formal) micro-credit has been long recognized in rural development literature as one of the major constraints for poverty alleviation (IFAD 2001, World Bank 2002). Perhaps more surprising is that in the two communities, fishing activities and fish resources issues (highlighted in black in Fig.3.3) are given a relatively low ranking.

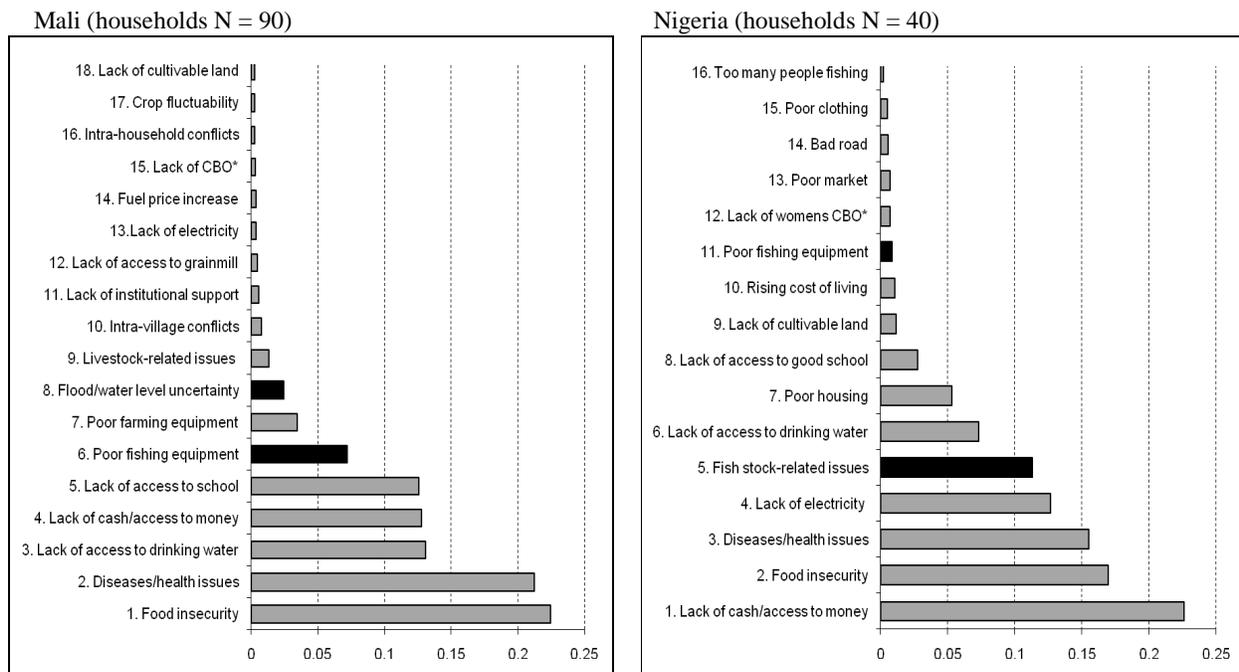


Fig.3.3. Vulnerability ladders of the two fishing communities surveyed. In black are indicated the sources of vulnerability related to the fish stock and/or fishing activities

Clearly it cannot be assumed that the sources of vulnerability identified in the survey are independent of each other. Indeed, it could be argued that the importance of fishing activity as a major source of cash-income and food transpires indirectly in the ladders through the presence of 'food insecurity' and 'lack of cash/access to money' at the top of the ranking. One may even argue that the 'disease/health issue' (which refers not only to a lack of access to health facilities but also to the household inability to pay for those services), is also related to that general lack of cash, thus possibly related to fishing activities and the poor resource status. An analysis of vulnerabilities in the Malian community disaggregated by main livelihood activities (fishers vs. non-fishers<sup>2</sup>) (Fig.3.4) suggests however that this assertion may be only partially correct. The vulnerability ladder indicates that the sources of household vulnerability remain essentially the same, irrespective of the households' main livelihood. In other words, 'food insecurity' and 'lack

<sup>1</sup> Those vulnerability ladders were computed by aggregating the individual households' answers and normalizing the scores (total = 1) so that direct comparisons between villages and between sub-samples are possible.

<sup>2</sup> 'Fishers' were defined as households who derive 75% or more of their total income from fish-related activities while 'non-fishers' are those who derive no cash-income from fishing (essentially farmers and herders).

of cash/access to money' may not be related to the fact that households are fishers, but rather represent overarching vulnerabilities that affect the community as a whole.

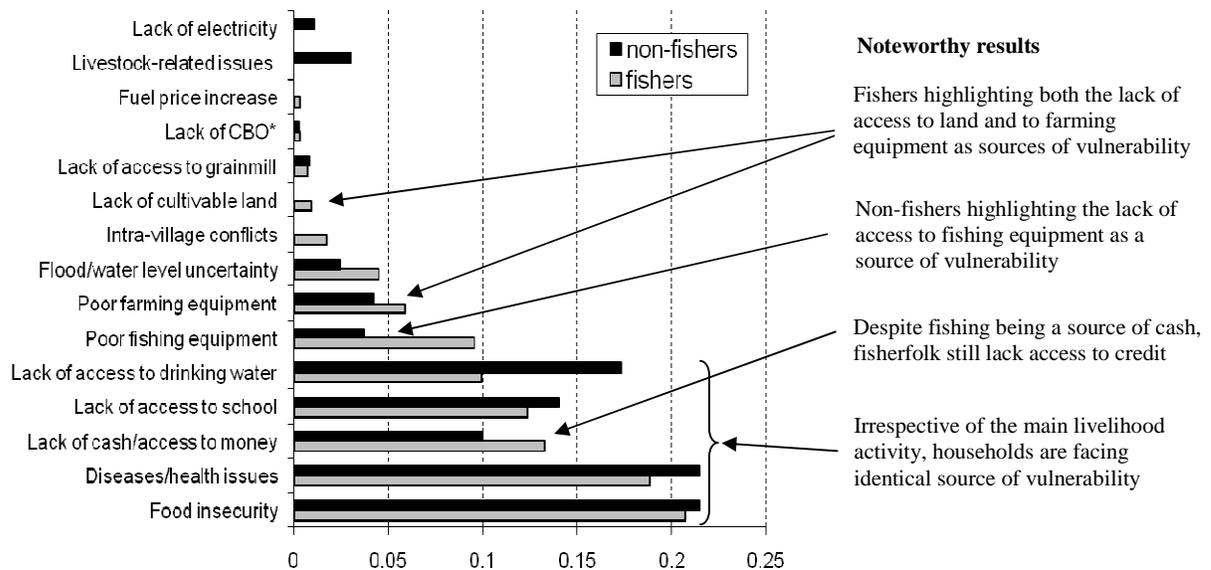


Fig.3.4. Comparative analysis of vulnerability between fishers and non-fishers in the Inner Delta of Niger River (Mali) (fishers N = 25; non-fishers N = 30)

The comparative analysis between fishers and non-fishers reveals other policy-relevant results (see Fig.3.4 annotations). First, the fact that scarcity of cultivable land is identified as a source of vulnerability, not by the non-fishers (farmers), but by the fishers, suggests that farming would be considered as a source of diversification by those fishers if they could access more land. This interest in farming is confirmed by the fact that 'poor farming equipment' is also perceived as a more severe constraint by fishers than by the non-fishing households. Less surprisingly, 'poor fishing equipment' affects fishers. The fact that non-fishers also identify this lack of fishing equipment as a source of vulnerability (see Fig.3.4) suggests however that non-fishers would also invest in fishing if they could access good equipment. Finally, the higher severity of the 'lack of cash/access to money' amongst fishers (compared to non-fishers), despite the well-recognised capacity of fishing to generate cash (e.g. Béné et al. 2009), is assumed to relate to the unwillingness of the local money lenders to provide credit to migratory fishers who are more difficult to track for repayment than the sedentary farmers.

Comparing vulnerability rankings among the bottom (poorest) and top (richest) quartiles at the Malian pilot site<sup>3</sup> (Fig.3.5) unsurprisingly shows that the poorest households are more severely affected by the lack of cash, food insecurity and health issues than the wealthier households. Also interesting (but not surprising) is that education is superseded by more critical 'life support' categories for the lowest income quartile. Aside from the ranking of education, the analysis reveals that households, independent of wealth, are facing the same sources of vulnerability.

<sup>3</sup> Similar results are observable in the Nigerian community.

## Objectives CPWF Project Report

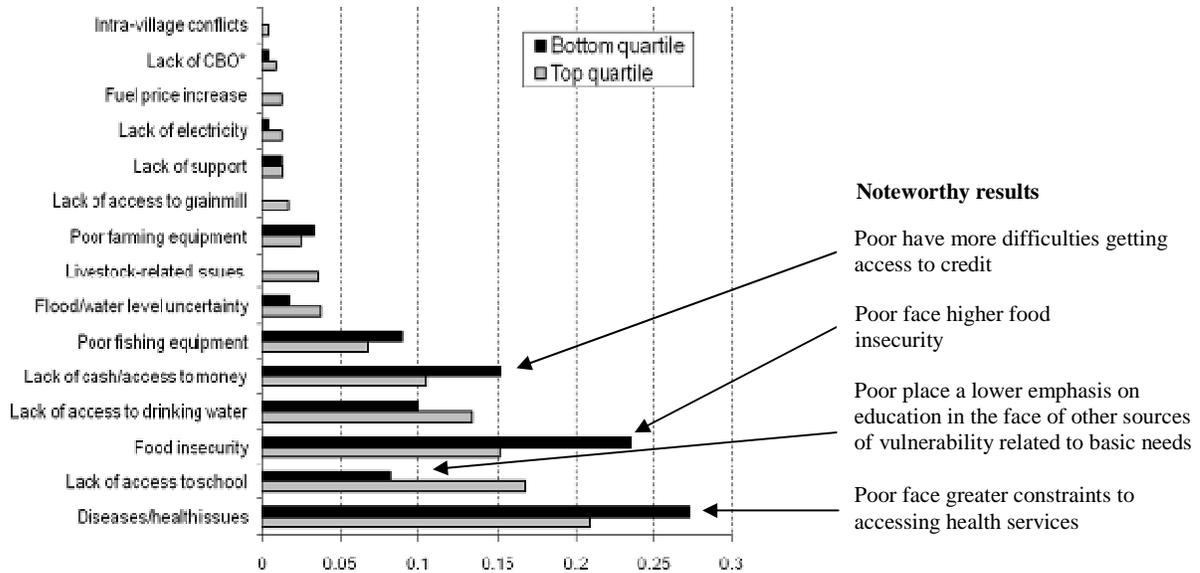


Fig.3.5. Comparative analysis of household vulnerability between the top (richest) and bottom (poorest) quartiles for the Inner Delta (Mali) community

### Discussion

While providing a valuable self-assessment of the priorities for reducing vulnerability in target communities, these vulnerability ranking exercises also contain important insights into how poverty/vulnerability interventions in fishing communities should be conceived; they certainly challenge the conventional view that efforts should primarily focus on the resource. Although fish resource depletions/fluctuations are acknowledged and certainly affect their livelihood, the communities identified some more fundamental sources of vulnerability related to their basic needs, such as food insecurity, exposure to water-borne diseases and lack of access to cash and micro-credit facilities.

The vulnerability rankings also convey important lessons for resource managers charged with implementing sustainable use systems under the constraints of minimal resourcing – a common condition among small-scale fisheries in developing countries. Under such constraints, private incentives for collective action among resource users are critical to ensure successful and equitable management outcomes (Olson 1965, Ostrom 1990, Thomson 1992, Vedel 2000). Incentives for individuals to invest in resource sustainability will increase as vulnerabilities ranked higher by the community are addressed, and as the risk of fishery decline comes to the fore. It follows that the most productive interventions to promote sustainable resource use may lie outside the ‘natural system’ domain; in this case within the ‘people and livelihoods’ (for water-borne diseases) and ‘institutions and governance’ (for access to micro-credit) domains.

### 3.2.3. Dashboards at the community level

As part of the process that led to the completion of vulnerability assessment, the community were asked to identify the different components of what would be the communities’ dash boards. Tables 3.3 and 3.4 show the results of these processes.

### Results

A series of remarks emerge from these dashboards. First the general content of the dashboards closely reflects the results of the vulnerability ladders. This was expected as the dashboards were constructed after the results of the vulnerability analysis had been presented to the communities during a feedback meeting.

Table 3.3. Dashboard resulting from the household consultation in Tungan Mairuwa (Lake Kainji, Nigeria)

Domains	Indicator	Threshold	Current Status
People and Livelihood	Food Insecurity	<ul style="list-style-type: none"> <li>- Food available for &gt;9 month</li> <li>- 3-9 month</li> <li>- &lt; 3 month</li> </ul>	Crisis
	Health/Sickness Frequency	<ul style="list-style-type: none"> <li>- Few members fall sick within a year</li> <li>- Sickness once for most members of the households</li> <li>- Sickness more than twice for most members of the household</li> </ul>	Most members fall sick more twice (Crisis)
Institution and Governance	Traditional Leadership	<ul style="list-style-type: none"> <li>- Consulting his subjects and accepting their views for decision making</li> <li>- Accepting all views without scrutinizing, and taking wrong decisions</li> <li>- Cheating on his subjects</li> </ul>	Acceptable
External Drivers	Access to Electricity	<ul style="list-style-type: none"> <li>- &gt; 50 functional generators</li> <li>- 10-50 functional generators</li> <li>- &lt;10 functional generators</li> </ul>	Only 3 functional generators (Crisis)
Natural System	Fish Pond Number	<ul style="list-style-type: none"> <li>- &gt;50 ponds</li> <li>- 10-50 ponds</li> <li>- &lt;10 ponds</li> </ul>	4 ponds (Crisis)

Table 3.4. Dash board resulting from the household consultation in Batamani (Central Delta of Niger, Mali)

Domain	Indicator	Variables	Threshold	Current status
People and livelihood	Food security	<ul style="list-style-type: none"> <li>- Number of household with enough food from July to October</li> </ul>	<ul style="list-style-type: none"> <li>- &gt; 80%</li> <li>- 50-80%</li> <li>- &lt;50%</li> </ul>	<10% (crisis)
		<ul style="list-style-type: none"> <li>- Percentage of women in the community who can afford prenatal consultation</li> </ul>	<ul style="list-style-type: none"> <li>-</li> <li>-</li> <li>-</li> </ul>	-
	Access to health	<ul style="list-style-type: none"> <li>- Rate of medical consultation in the community</li> </ul>	<ul style="list-style-type: none"> <li>- &gt; 80%</li> <li>- 50-80%</li> <li>- &lt;50%</li> </ul>	<10% (crisis)
		<ul style="list-style-type: none"> <li>- Rate of visits to formal health centers (hospital, pharmacies, CESCO* ...)</li> </ul>	<ul style="list-style-type: none"> <li>- &gt;70%</li> <li>- 50-70%</li> <li>- &lt;50%</li> </ul>	<3% (crisis)
Institution and governance	Conflict	<ul style="list-style-type: none"> <li>- Number of persons referring to inter-community conflicts</li> </ul>	<ul style="list-style-type: none"> <li>-</li> <li>-</li> <li>-</li> </ul>	-
		<ul style="list-style-type: none"> <li>- Number of cases on conflicts being deliberated in court</li> </ul>	<ul style="list-style-type: none"> <li>-</li> <li>-</li> <li>-</li> </ul>	-
External drivers	Access to micro-credit	<ul style="list-style-type: none"> <li>- Rate of individual who have had access to credit</li> </ul>	<ul style="list-style-type: none"> <li>- &gt;25%</li> <li>- 15-25%</li> <li>- &lt;15%</li> </ul>	<2% (crisis)
		<ul style="list-style-type: none"> <li>- Number of water release events during period of low water level</li> </ul>	<ul style="list-style-type: none"> <li>- 0</li> <li>- 1-3</li> <li>- &gt;3</li> </ul>	6 in low water season in 2008 (crisis)
Natural system	Flooding	<ul style="list-style-type: none"> <li>- Time required to catch 50 kg of fish</li> </ul>	<ul style="list-style-type: none"> <li>- &lt;1h</li> <li>- 1h-1 month</li> </ul>	1h-1 month
		<ul style="list-style-type: none"> <li>- Time during which one can use pirogue to transport firewood in the floodplain</li> </ul>	<ul style="list-style-type: none"> <li>- &gt;1 month</li> <li>- &gt; 2 months</li> <li>- 1-2 months</li> <li>- &lt; 1 month</li> </ul>	1-2 months
		<ul style="list-style-type: none"> <li>- Flooding time of the Débaré pond</li> </ul>	<ul style="list-style-type: none"> <li>- &gt; 2 months</li> <li>- 1-2 months</li> <li>- &lt; 1 month</li> </ul>	1-2 months
		<ul style="list-style-type: none"> <li>- Flooding time of the Débaré pond</li> </ul>	<ul style="list-style-type: none"> <li>- &gt; 2 months</li> <li>- 1-2 months</li> <li>- &lt; 1 month</li> </ul>	1-2 months

\* CESCO: centre de santé communautaire (Communal Health Center)

In particular food security and health were identified in both communities as the key resilience indicators of the livelihood of the people in line with the vulnerability analyses where they had been ranked as two of the three most important sources of vulnerability by the two communities' households. The variables which were proposed to monitor/evaluate these key resilience indicators however vary slightly between the two communities reflecting the local specific nature of the concept of food insecurity in these communities. In Tungan Mairuwa, the variables proposed by the community to monitor the level of food insecurity was the availability of food over the whole year while in Batamani the monitoring variable was the food availability during one particular period of the year (known as the 'soudure') from July to October. In both Tungan Mairuwa and Batamani the level of food insecurity currently experienced by the community was perceived to be 'in crisis' reflecting the relatively insecure situation of the two communities.

Similarly, the Tungan Mairuwa committee identified access to electricity as the main key resilience indicator for the external drivers -reflecting the community vulnerability analysis- and considered that the current level of access was 'in crisis', far below what could be considered as an acceptable situation. Worth noting is the fact that this access to electricity was not evaluated in terms of access to the public supply of power by the state but in terms of ownership of individual generators, recognizing that the central and/or local governments are not at the present time capable of supplying this service. In Batamani the key resilience indicator proposed by the community for external driver was the river flow control through the number of artificial water releases made from the upstream dam of Sélingué and Markala during the low water level season. Interestingly, with no water release event during the last low water level season the situation was considered as 'ideal'.

Finally the last domain considered was the natural system. In Tungan Mairuwa, the committee considered that the key indicator vis à vis this natural system should be the number of individual fish ponds operated by the community's households. We can assume that this choice reflects the attempt of the community to improve their capacity to respond to the variability and uncertainty characterizing the Kainji Lake fish resource and in particular to reduce the dependence of the household income to the fishing activity which was perceived as unreliable. Note also that the instrumental factor which played a key role in the identification of fish ponds as an option was the existence in the village of a small number of households who had already invested in the construction of fish ponds and were relatively successful in operating them. In contrast in Batamani the key resilience factor for the natural system was identified to be the flood of the Niger River itself. Three variables were 'associated' to this flood level: the time it takes to fish 50kg of fish (reflecting the fact that local populations in the Central Delta of Niger have recognized for long that the quantity of fish caught annually is positively correlated to the intensity of the flood -confirming the results highlighted in Fig.2.4); the time that people can use pirogue for the transport of firewood (the larger the flood, the longer the period during which they can use pirogue); and thirdly the time during which the Débaré pond remained flooded.

Also of interest is the comparison between the versions of the dashboards as constructed by the two communities at the local level and those that were constructed by the intersectoral expert panels for the Lake Kainji and the Central Delta of Niger (see Tables 3.1. and 3.2. for recall). The two dashboards (community' and experts') of the same area reveal numerous commonalities in terms of indicators. For illustration, diversification of livelihood (engagement in economic activities other than fishing) and food security were proposed by both the community of Batamani and the Central Delta of Niger intersectoral expert panel as key-indicator of the resilience of the population in the 'Livelihood and People' domain. For 'Institutions and Governance' both Lake Kainji experts and community of Tungan Mairuwa recognized that the accountability of the traditional leaders is critical - although of course the community did not use the term 'accountability' but more simply

“cheating on his subject” to express something quite close to accountability (or lack of it). The variables selected by the two communities to measure against thresholds are often very pragmatic (see for instance the “time it takes to catch 50kg of fish” as opposed to more ‘sophisticated’ variables for the experts), or reflecting a particular local-specific view of the issue considered (see e.g. the number of individual power generators to measure the access to electricity) but this is not necessary a generality. In some other cases the variable they choose is no ‘simpler’ or less ‘sophisticated’ than the one chosen by the experts, as illustrated by the case of the ‘access to health’ in Batamani, which was proposed to be monitored through the ‘percentage of women in the community who can afford prenatal consultation’ or the ‘rate of medical consultation in the community’ –not different from what experts have also chosen. This sensitivity to the importance of prenatal consultation may be the (positive) effect of active communication campaigns organized by the Malian government through radio and visits of extension service agents targeting pregnant women and population exposed to malaria risk.

Perhaps one of the rare (but noticeable) differences between the dashboards constructed by the communities and these constructed by the experts, is the absence in the communities’ dashboards of direct and explicit indicators related to the resource ‘health’ as part of ‘Natural System’ domain<sup>4</sup>. Similarly none of the two communities seem to consider change in biodiversity or even in the composition or size of the fish they catch as a relevant indicator of their livelihood resilience. One potential explanation for this is that none of the two communities have experienced strong decrease in the volume or change in the composition of their catch. In that case it seems logical that these variables do not appear as critical as other variables to them. The community dashboards reflect the constraints which are particularly felt, with direct impact. Not those with indirect impact.

## **4. IMPLEMENTING ADAPTIVE MANAGEMENT**

### **4.1. General introduction**

The previous section presented the first element of the PDAM framework –the participatory diagnosis–, the way this PD was used in each pilot site to identify in a participatory manner the current threats impacting the fish-dependent communities and how this led these communities to identify key resilience indicators and associated entry points for interventions. In the present section we document the way these interventions were implemented through the second phase of this project: the Adaptive Management phase.

In its modern form, adaptive management (Holling 1978; Walters 1986), a structured process of ‘learning by doing’ (Walters 1997), has been widely recognized as a powerful approach to accommodate the irreducible uncertainty that characterizes most natural resource-based systems and to improve management (Carpenter and Folke 2006; Folke et al. 2005).

Nevertheless, the approach has delivered on that promise in relatively few instances (see Walters 1997; Lee 1999; Anderies et al. 2005 for review). The reasons it has not enjoyed more success are many but include inadequate attention to the social institutions needed to enable management (Halbert 1993; Walker et al. 2004). The response to this shortcoming has been to broaden the ‘experimental’ base of the management regime to include the people that play an integral part in the system (Folke et al. 2002; Garaway and Arthur 2004). In this respect, it may be argued that management as practiced by fishers for centuries is adaptive (Johannes 1978; Kurien 1998). Nevertheless, as Rogers

---

<sup>4</sup> Some would argue that “the time to catch 50 kg” mentioned just above could be understood as an indicator of the resource ‘health’. In other circumstances, Yes, but in the specific case of Batamani this indicator was specifically use by the community as a indicator of the quality of the flood: “the larger the flood, the higher the future catch”, not as an indicator of the resource itself.

## Objectives **CPWF Project Report**

(1998) and Rogers and Biggs (1999) point out, in a modern institutional context, organizations that do not evolve to fully participate in the learning process will impede sustainable development.

Against this background, the project's adaptive management phase has been articulated in a way that draws upon the 'adaptive learning cycle' developed by Garaway and Arthur (2004) but with a much stronger problem-solving focus. While Garaway and Arthur's adaptive learning cycle deals essentially with improving stakeholder information (i.e. generating, sharing, and utilizing information between fishery stakeholders), the focus of the adaptive framework proposed here is about management-actions which enhance the resilience of the fishery system.

### **4.2. Management actions**

#### **4.2.1. Setting up the right conditions**

In each of the two pilot sites, the communities used the vulnerability analyses completed during the participatory diagnosis to identify a series of interventions aimed at addressing directly the main sources of vulnerability. This selection was facilitated by the creation of representative committees in each community. To ensure that the interests of women were appropriately accounted in the identification of the management actions, two committees were actually created conjointly in each community, one for men and one for women. Special attention was also paid to the composition of the executive bureau of these committees in order to reduce the risk that the process was biased towards the interests of the most powerful individuals/households in the communities (Box 4.1).

##### Box 4.1. Formation of committee and election of executive at Tungan Mairuwa

In accordance with the agreed project work plan, NIFFR team took a two day visit to Tungan Mairuwa between 18th and 19th Jan 2009. During the visit, two important issues were addressed. First, the community was organized and sensitized about the roles of community based organization and the need for them to always unite and work as a team. Thereafter, they were informed on the need to form two committees (Male and Female) in respect of the project and the need to elect executives and their responsibilities, which appeared to be clear to most of them. Before commencement of the election, two forms of elections were explained to the community members, viz: Democratic and appointment/consensus which they agreed to go by the latter. The following positions and their responsibilities were announced to the community members, and called for nomination:

- Chairman
- Vice Chairman
- Secretary General
- Treasurer/Financial Secretary
- Public Relation Officer (PRO)

Subsequently, the exercise commenced. Some members of the community nominated the Village Head as Chairman, which the Team members immediately advised against it, explaining that it will create fear of dominancy and possible manipulation to other members of the community, even though they have no problem with the leadership, which both the village head and the community members agreed. Thereafter, the exercise continued for both Men and Women. After nomination, the chairman and chairperson for both committees in their remarks thanked the community members for the confidence reposed on them and assured the members commitment to ensuring that the goal of forming the committee will be achieved. Generally, the community members promised to respect and cooperate with the leadership of the committees and to give them all necessary supports as they may require at all times. The meeting comes to an end at about 4.30 pm.

In Batamani where the community is made of a heterogeneous assemblage of several ethnic groups characterized by strong socio-economic and cultural differences (see section 1.3.2 above), the composition of the two committees was carefully adjusted to ensure the representation of all the different groups (Table 4.1).

Table 4.1 Composition of the two representative committees in Batamani.

	Man committee	Woman committee
Batamani village	6	7
Batamani daga	2	2
Débaré	2	1
Gatal	1	1
Tootal	11	11

#### 4.2.2. Identification of Management-actions

With the support of the NARES the committees were then tasked to lead the process of identifying potential management-actions with the rest of the population. Table 4.2 and 4.3 shows the lists of interventions as these were identified in Batamani and Tungan Mairuwa respectively. Some of the proposed activities were to be fully supported by the project through the project seed-fund, while others would be funded by two community micro-credit cooperative societies -one for men and one for women- which were also to be created as part of the management actions.

Table 4.2. Management-actions proposed by the Batamani community

Issues	Interventions	Objective	Comments
Lack of access to health services	Bi-monthly visits by nurse to ensure medical diagnosis and provision of medication. The project will engage with the local health authorities (on the behalf of the community) to request for this arrangement. Patients will still have to cover medication costs. In parallel, a series of information meetings by the nurse will be organized to sensitise/educate the community to issues related to health problem (including water-borne diseases). The project will cover the costs of those visits and meetings (travel + local remuneration). Ideally, the costs of the nurse's visits in the future should be covered by the two cooperatives (see below).	Improve access to health services and information	Issues related to health were identified as the second main source of vulnerability for Batamani community, after food insecurity. The regional health directorate in Mopti will support the initiative.
Education	The project will cover the cost of meetings between the community and the CAP (local institution in charge of education) to discuss the possibility of establishing an "école communautaire" (community-run school). The objective of those meetings will be to explore, sensitize, and evaluate the real willingness of the community to establish those écoles communautaires.	Initiate the creation of a école communautaire in Batamani	The CAP in Mopti will support the initiative
Natural resources	Infrastructure of the water control of Débaré pond. The project will cover the costs of material input for the rehabilitation of the infrastructure while the community will provide labour input.	The objective is to improve the period of water retaining in the pond to enhance the productivity (rice, fish)	The Regional office of the DoF in Mopti and the PADEPECH will support the initiative
Lack of access to cash and micro-credit	Creation of two micro-credit cooperative societies (one for men and one for women) Those cooperatives will then be used to finance initiatives such as those proposed already by the community <ul style="list-style-type: none"> <li>▪ Small poultry</li> <li>▪ Petty trade (including fish, but also rice trade)</li> <li>▪ Gardening (women)</li> </ul>	Improve access to micro-credit in order to boost the capacity of the community members to engage in new economic activities	Memorandum of understanding will be signed with a formal local bank

## Objectives **CPWF Project Report**

Table 4.3. Management-action proposed by Tungan Mairuwa community

Vulnerability factor.	Area of Intervention	Reasons	Probability of Success
Lack of money	Establishment of community microcredit cooperatives to finance individual initiatives such as <ul style="list-style-type: none"> <li>▪ purchase of water pump for irrigation</li> <li>▪ Establishment of backyard poultry</li> <li>▪ Establishment of homestead fish farming</li> <li>▪ Procurement of Medium ruminants (Women)</li> <li>▪ Procurement of sewing machine (women)</li> </ul>	Reduced fishing intensity and effort, enhance food security and alternative income sources	<ul style="list-style-type: none"> <li>▪ Availability of resources and skills.</li> </ul>
Disease and Health	<ul style="list-style-type: none"> <li>▪ Training one traditional birth attendant by Primary Health Care Unit of Ngaski LG.</li> <li>▪ Monthly Visit of Medical practitioner to the community.</li> <li>▪ Sinking of two borehole</li> </ul>	Reduced child and maternal mortality, to encourage community members to patronize orthodox medicine and reduce source of water-borne diseases.	<ul style="list-style-type: none"> <li>▪ Ready volunteers from the community.</li> <li>▪ Availability of resident doctors in Wara and New Bussa</li> <li>▪ Community receptiveness to Borehole</li> </ul>
School	<ul style="list-style-type: none"> <li>▪ Procurement of chairs/desks</li> <li>▪ Roofing of one block of classroom</li> </ul>	Conducive learning environment and encouragement of pupils	<ul style="list-style-type: none"> <li>▪ Existence of structure</li> </ul>

### 4.2.3. Implementing the management actions

The various management actions have now been put in place and implemented for 3 to 6 months at the time of writing this report (Dec 2009). It is certainly too early to expect any tangible impact of these interventions on the livelihood of the local population. A series of comments are however worth making.





Photos 4.1. (this page and previous page) Women of Tungan Mairuwa during the meetings introducing the microcredit intervention (Sept 2009)



Photos 4.2. Women assembly during one of the sensitization meetings to health / water-borne disease in Batamani (Oct 2009). The nurse is standing on the right hand side.

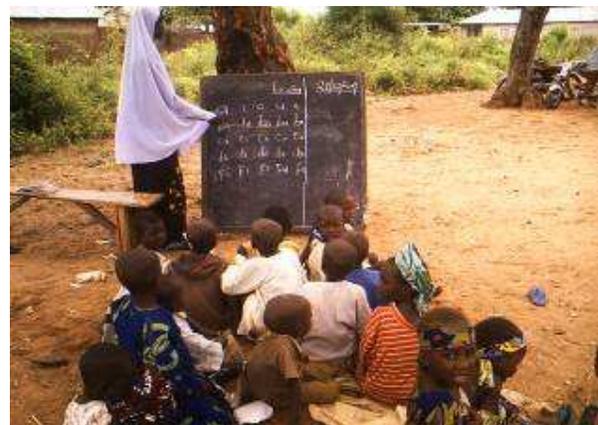
## Objectives CPWF Project Report

First the level of engagement of the different groups in the community has been remarkable so far, as evidenced by the continuous presence of women to the different meetings organized by the project (Photos 4.1 and 4.2).

In Tungan Mairuwa the rehabilitation of the school and the provision of benches and desks for the pupils had a huge effect on the day-to-day life of both children and teachers as attested by Photos 4.3 and 4.4 (before rehabilitation) and 4.5 and 4.6 (after).



Photos 4.3. The condition of severe deterioration of the Tungan Mairuwa primary school (March 2009)



Photos 4.4. The condition of the school prior to the project intervention. Pupils sitting on the floor (or even outside) with no desk or other furniture



Photos 4.5. (left) the school teachers with the CP72 national coordinator Dr Ovie and the NIFFR director Dr Raji in front of the renovated school building. (right) the new benches and desks supplied by CP72 (Sept 2009)



Photos 4.6. Pupils and teachers enjoying a new and much more comfortable learning environment (Oct 2009)

The rehabilitation of the school has even triggered some additional unexpected results. The rate of pupil enrollment increased by 66% -from 120 children prior to the project intervention to 200- after the school was rehabilitated (Photo 4.7).



Photos 4.7. Tungan Mairuwa teachers with the newly enrolled pupils

The other interventions were successfully completed under the supervision of the community committees (Photos 4.8 to 4.18). Only one intervention has not been completed. It concerns the project of establishing a community-run school in Batamani. The collaboration between the community and the local education institution in charge of supporting such an initiative (CAP) did not take off despite an initial meeting between the project partners and the CAP. The reasons for this failure are not totally elucidated, but it seems that the CAP local advisor was not convinced about the genuine interest of the community in such an initiative.

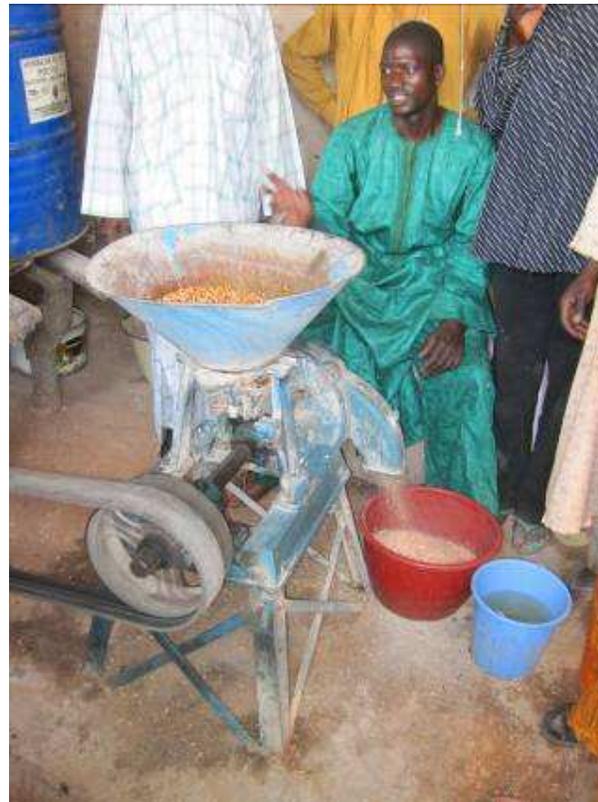
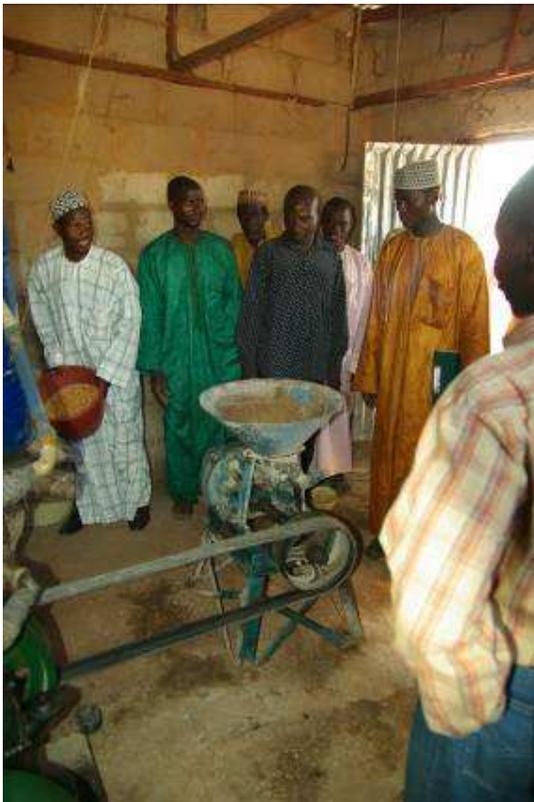
## Objectives CPWF Project Report



Photo 4.8 (top) Children fetching drinking water in one of the 3 boreholes rehabilitated by the community with the support of CP72 Project in Tunga Mairuwa



Photo 4.9 (right) CP72 partners visiting Tunga Mairuwa (Dec 2009) and been shown one of rehabilitated boreholes



Photos 4.10. The new grain mill bought by the men multipurpose cooperative of Tunga Mairuwa created with the support of CP72 (Nov 2009)



Photos 4.11. (top) The two nurses (one male and one female) during their visit at Batamani. After further consideration it appears that it was more cost effective for them to stay in the community instead of travelling back and forth from Mopti



Photos 4.12 (right). The female nurse at Tungan Mairuwa during one of her weekly visit



Photos 4.13. From left: Usman Naira (President of men multi-purpose cooperative, Tunga Mairuwa), Hure Mohammed (President of Tamako female multi-purpose cooperative) and Dr S.I Ovie (National Coordinator CP 72 Project, NIFFR) at Kontagora Microfinance Bank where the cooperatives opened two saving accounts in Oct 2009

## Objectives CPWF Project Report

Photo 4.14. Dr Aminu Raji, Executive Director, NIFFR (extreme left), Dr S.I Ovie CP72 Project Coordinator, NIFFR (extreme right), Hamisu Hakimi, village head (second extreme left) and women loan beneficiaries as part of the CP72 micro-credit interventions at Tunga Mairuwa

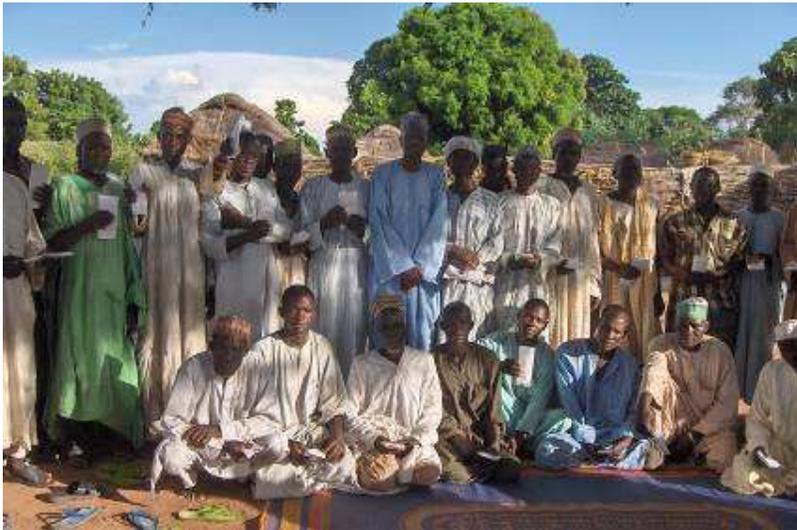


Photo 4.15. The first group of Tunga Mairuwa men receiving loan from the micro-credit scheme (Oct 2009)

Photo 4.16. Hamisu Hakimi, village head (left) on behalf of NIFFR team, presenting a loan to a member, women cooperative Tunga Mairuwa as part of CP 72 micro-credit intervention





Photos 4.17. The initial poor condition of the sluice gate controlling the entrance and exit of water in and out of the Débaré pond (Batamani community) before CP72 intervention



Photo 4.18. The gate of the Débaré after rehabilitation by the community

#### **4.2.4. Preliminary perception of the community about the interventions**

It is far too early to be able to assess formally the impact of the various interventions supported by the project. The CP72 partners were however able to collect the feelings of the population few weeks after the interventions were initiated. The following excerpts are some of the comments recorded during these discussions in Tungan Mairuwa.

##### **Hakimi Hamisu (Village Head)**

*"I am more than happy for what you (project) have done for me and my people. If it were possible to open my heart for you to see the joy in it, I would have done so. I thank you for the things you have brought to the community. May Allah bless you all."*

##### **Dahiru Usman (Secretary of Male Coop. Society)**

*"I am very glad especially for the revolving loan. I will invest it well to yield profit. I am happy for the school benches and desks as our children will no longer sit on the floor to learn. The oxen will remove the drudgery of hand labour for land preparation."*

##### **Hajia Hure (President of Women Coop. Society)**

*"I am happy the way the project recognize us as women and gave us our own cooperative society. The loan will help us a lot and we promise to invest well to reap profit from it to improve our living."*

##### **Zeyanu Ibrahim (Teacher Head)**

*"Never seen anything like this before in this or surrounding communities. The classroom seats will encourage more parents to send their children to the school. It will entice children to the school. I am very happy for all the assistance."*

##### **Jumai Saidu (Female teacher)**

*"This [referring to the benches] is very good for our children. They will not need to wash uniforms every day. It will help learning."*

##### **Hassan Sani (Arabic teacher)**

*"We are very happy about the classroom seats. We had contacted the education secretary but there has been no positive response. We thank this project for this kind gesture."*

## **GENERAL DISCUSSION AND CONCLUSION**

### **Implementing resilience management: lessons from CP72**

In a broad sense, resilience is about the capacity of systems to adapt to shocks, recognizing that disturbance and change are integral component of complex systems. Defined in such a way, the concept of resilience appears potentially useful for the management of small-scale fisheries and in particular small-scale inland fisheries as both their ecological and economic dynamics are characterized by high fluctuability, external shocks and considerable level of uncertainty (Evans and Andrew 2009).

However, while the concept of resilience is appealing, particularly in the face of the failure of current fisheries management approaches (Andrew et al. 2007), the danger is that it remains largely academic and theoretical, and not of a great help in effectively improving the way natural resources are managed on the ground. The challenge, therefore, lies in a pragmatic approach to operationalizing the concept of resilience and making its implementation on the ground practical and meaningful (Walter et al. in press). In this project we draw upon recent reflection about the management of small-scale fisheries carried out at WorldFish (Andrew et al. 2007, Andrew and Evans 2009) to propose a framework –the Participatory Diagnosis and Adaptive Management framework- and we tested it in the specific context of small-scale fisheries in the Niger River Basin. We propose in this discussion section to revisit in greater length some of the main results generated by the project.

During the wrap up meeting (New Bussa Nigeria, Dec 2009), the project team had little hesitation to conclude that the project has been overall a great success. The PDAM framework has been developed and implemented in the two pilot sites according to the initial project planning and the precedent sections demonstrated the great relevance of the framework to engage with local communities about their sources of vulnerability, uncertainty and shocks, and help them identifying in a participatory and gender-sensitive manner local solutions to reduce these source of vulnerability. Some of the initial concerns expressed by the team (in particular the critical step of disbursing a US\$20.000 seed-fund to the community while avoiding the so-frequent elite capture dynamics) have been addressed successfully. Despite this overall positive 'feeling', some areas of the project call for further comments.

#### ***Assessing the Participatory Diagnosis tool***

The Participatory Diagnosis was the first component of our general framework. A first legitimate question is to ask is whether or not the Participatory Diagnosis effectively led to the identification of "sources of vulnerability" as we claimed in earlier sections of this report, or whether (more broadly) it led to identification of some "symptoms of poverty, mixed with some form of vulnerability" -as one of the project partners put it during the wrap up meeting?

A great deal of thought and methodological effort has been put during the early stage of the project to ensure that the Participatory Diagnosis and in particular the 360° assessment map help stakeholders carrying a full, comprehensive and integrated assessment of their own situation. The underlying motivation for this was the recognition that too often participatory assessments implemented in fishing communities lead to a rather narrow, resource-centered evaluation. How many times when visiting fishing communities have we not received the following stereotyped answer: "what I need for my family is a new set of fishing net"? The PD was designed to help the individuals and the community to go beyond a classical narrow interpretation of poverty ("if I had a new net I could catch more fish and make more money"), to recognize that perhaps some of sources of poverty or vulnerability lie beyond the (decreasing or fluctuating) volume of catch and that other factors may also impact strongly on their livelihood, including some events

## Objectives CPWF Project Report

totally outside their area of direct influence, such as, e.g., the dam that was recently constructed 120 km upstream, on the other side of the border, in the neighboring country.

The results of the vulnerability ladder (section 3.2.2) demonstrate that the PD achieved its main objective. With the help of this tool, the local population completed a self-assessment process through which individuals (men and women) and communities were able to provide a clear and full 'picture' of the main issues affecting their lives. What is less clear, though, is whether these main issues are sources of vulnerability, causes or even symptoms of poverty (see Box 5.1).

### Box 5.1. Symptom or cause of poverty?

Food insecurity was systematically identified as a major issue in most households. But, is that 'food insecurity' a symptom of poverty or is that a cause? It is certainly a symptom in the sense that poverty (irrespective of how people understand and define it) is often associated with food insecurity. Poor are more likely to face food insecurity. Now, is food insecurity also a cause of poverty as well? Yes it is, as widely demonstrated in the development literature. Chronic food insecurity and under- or mal-nutrition leads to impairment of the ability to do sustained work, which usually results in lower productivity and wages, thus income poverty. Poor nutritional and food security also leads to higher risks of illness – leading eventually to a higher mortality rate. Finally there is also a risk of intergenerational transmission of poverty through food insecurity: there is evidence that poor nutrition is associated with poor school performance in school-age children. Because of hunger, children are listless or tired and inattentive, and cannot participate in learning activities, reducing therefore their chance to move up along the socio-economic ladder.

An important and still increasing literature is available on the concept of vulnerability. Without trying to review it here, it may be sufficient to highlight two distinct schools of thought about this concept. On one hand the economists would define vulnerability as the probability to fall under a given level of welfare in the future (irrespective of how this welfare is measured: income, nutrition intake, etc.). Broadly speaking they see vulnerability as the 'dynamic equivalent of poverty'. On the other hand, social science researchers drawing upon the literature on natural disaster literature, see vulnerability as the combination of several concepts, namely sensibility and exposure to risk and unexpected shocks, and capacity to adapt and react to these shocks. We did not attempt to include any of these precise definitions in the Participatory Diagnosis. In that sense our 'struggle' about whether the list of issues identified by the communities in the vulnerability ladders are 'sources of vulnerability' or 'sources of poverty' (or even 'symptom of poverty') is partially due to the broader definition of 'source of vulnerability' we adopted. Perhaps in our case, a more appropriate term (instead of source of vulnerability) would have been "constraints to household livelihood". Another reason for this 'conceptual confusion' is clearly that poverty and vulnerability are complex, multidimensional and inter-related issues (Prowse 2003). In fact, discussion in the specialized literature on how effectively measure and quantify poverty, vulnerability and what dimension of the former should actually be considered as component of the latter is still ongoing (Hoddinott and Quisumbing, 2003).

A second important comment about the PD tool is the fact that the large majority of the interventions which derive from it were non-fishery specific. While this project has been submitted to the CPWF as an 'aquatic ecosystem and fishery' project the fact that the large majority of the management actions that were identified were not addressing directly the fishery resource or the use of that resource may at first sight seem surprising. It should not be so however, especially when one recalls from the paragraph above that vulnerability (or 'constraints to household livelihoods') are multi-dimensional and cannot simply be reduced to issues related to resource use. In that sense the non-fishery-specific nature of the management-actions proposed by the communities is the confirmation of the success of the PD and in particular the evidence that the PD leads people to 'think outside the fishery box'.

Furthermore the project team felt strongly that one of the key policy messages of this situation (the predominance of non-fishery-specific interventions) is clear: one cannot claim to strengthen –or attempt to strengthen- the resilience of a fishery if the fishing communities that depend upon that fishery cannot send their children to school or are exposed to unacceptable levels of water-borne diseases. In other words, to the question of whether the project could have had larger impact on the two fishing communities included in the project by focusing only on fisheries-specific issues, the team felt that the answer is No, for several reasons.

First, as explained just above, our vulnerability analysis confirmed what has now been highlighted for several years, namely the fact that poverty in fishing community largely reflects “*the general lack of development of the rural areas within which [these] fishing communities live*” (Béné 2003, p.959), in particular the lack of access to infrastructure and public services.

This argument, which for its large part had so far been mainly rhetorical, begins to be backed up by empirical evidence. The DIFD-FAO Sustainable Fisheries Livelihood Programme (SFLP) implemented during the 2000’s in West Africa had for instance funded a series of interventions in fish-dependent communities that aimed at improving literacy, access to health, or access to micro-finance (FAO-SFLP 2006), contrasting drastically from the conventional FAO or World Bank interventions promoted in the 1970s and 1980s that consisted in the distribution of fishing nets and the funding of fishing port infrastructure. Those innovative SFLP interventions showed some significant positive impact on these communities and the concept was recently taken on by the Swedish Development Agency (SIDA) which founded a USD5 million programme across 6 countries in sub-Sahara Africa aimed at addressing health issues in fishing communities and in particular reducing the effect of the HIV/AIDs pandemic on fisherfolks. Those are evidence that non-fisheries-specific development interventions can be implemented and target specifically fishing communities. Our project reached a similar conclusion, with perhaps the additional innovation that the whole process and the choice of interventions have been led totally by the communities themselves.

These various arguments certainly justify the *presence* of non-fisheries-specific interventions. But they don’t explain the *absence* of fisheries-specific interventions. One could indeed argue that these two types of management-actions are not exclusive and could be combined. This point is correct, except that it does not account for another important constraint: the mismatch between the scale of the project intervention (the community) and the scale at which collective action can be effective for common pool resources (the water-body). In the case of the Lake Kainji or the Central Delta of Niger for instance, collective actions aimed at improving the resource status and/or the governance or the management of the resource would be effective only if they were to involve the communities of the entire Lake (in the case of Lake Kainji) or a substantial part of the delta communities (in the case of the Central delta of Niger). Indeed even if one isolated community (say Tungan Mairuwa) were to successfully improve the compliance of its fishers to some form of local management system, the potential positive impacts that this improved level of compliance would have on the resource (assuming that a single fishing community can have tangible effect) are likely to be either benefiting other communities which may chose to free ride –ripping off the fishers of Tungan Mairuwa from the benefits of their effort/investment- or even been annihilated by the non-compliance of the other communities operating along the Lake shore. In these conditions, it is not surprising that the two communities (Batamani in Mali and Tungan Mairuwa in Nigeria) did not propose any resource-specific interventions. Interestingly, in the case of Batamani, the only intervention that can be considered as a ‘resource-related’ intervention concerns the Débaré pond, which is entirely under the control of the community. In that case the community is sure to ‘redeem’ the fruits of its investment.

A last but critical argument as for why the project team strongly believes that addressing basic needs first (i.e. preceding the fisheries-specific management-actions) is appropriate

## Objectives **CPWF Project Report**

in the context of these small-scale fisheries in developing countries, is the increasing recognition amongst practitioners and scholars that perception of risks is an essential element influencing individual's behavior. As pointed out by Allison et al. (2006, pp.8-9), for "*fishing communities, resource degradation is not necessarily the most important cause of their 'poverty'. The risk of resource degradation or stock collapse is therefore not perceived as high by many fisherfolk as the exposure of their livelihood systems to the risks of ill health or death (particularly from Malaria, HIV/AIDS, waterborne diseases, and drowning and accidents), theft or loss of fishing gear or lack of secure access to alternative productive assets, such as land, or to basic human rights.*" In these conditions fisherfolk are not willing or ready to engage/invest in resource management until they perceive that these more important other sources of risks have been addressed. In that sense, addressing basic needs (such as food insecurity) is an end in itself (from a human development perspective) but also a means (as it is likely to improve the capacity and the willingness of individuals and community to address resource management issues).

### **Assessing the Adaptive Management phase**

The second element of the project that deserves some further comment is the Adaptive Management component implemented as part of the PDAM framework. The objective of this Adaptive Management was to identify potential entry points for addressing the sources of vulnerability identified by the community through the Participatory Diagnosis; and to help the community implementing these interventions.

One interrogation related to this adaptive management is whether the latter was effectively an *adaptive* process. The literature on systems highlights that for a system to be adaptive, various conditions need to be put in place. One critical element in this 'learning-by-doing' process is the existence of some feedback mechanisms allowing the system's current situation to be assessed against benchmarks and the information to be fed back to the 'control' (or decision making process) of the system. The benchmarks have been put in place in the two pilot communities through the resilience indicators of the dashboard, but the formal feedback mechanisms are yet to be fully established.

This absence of feedback mechanisms is only the consequence of the shortness of the project. The 24 months during which the project was funded were fully utilized (a) to ensure the successful implementation of the PD phase and (b) to put in place the necessary conditions for the two pilot communities to initiate the management actions they had identified. Even though the project has now ended, the two NARES are in a position to facilitate the establishment of the feedback process in the coming months through the completion of conjoint research activities implemented in the two pilot sites areas –see below. The feedback process will be formally established through feedback meetings organized by the NARES with the communities' committees. During these feedback meetings the committees will be asked to revisit the community dashboards and assess in particular the progresses made against each of the resilience indicators. The plan is to organize the first of these feedback meetings around mid-year in 2010 and to continue this process every 6 months.

Several other elements suggest that the management-actions initiated by the community will continue after the completion of the project. These are discussed in detail in a subsequent section. Before moving on this however, additional comments are presented below about the two experts' dashboards, and why these are thought to constitute important elements favoring the establishment of resilience management.

### **Panel expert's dashboards and resilience management**

Because dashboards allow the identification of indicators of any nature, they provide a powerful way to integrate the combinations of economic, environmental and social dynamics that characterize the realm of fisheries management. In this sense, they are

effective tools for multi-criteria assessment. The main merit of using dashboards, however, lies in their capacity to initiate and then strengthen the resilience management process, essentially through two mechanisms. First they help all the experts involved in the diagnosis process realizing that there is no one unique management target. This aspect is critical in the sense that it clearly demarks this approach from the perception that the large majority of practitioners and researchers still have about fisheries management. Under this innovative approach, management is not about looking for the unique, or 'fair' solution, it is about negotiating a set of acceptable configurations, and agreeing on interventions, incentives or constraints to ensure that the system stays within these negotiated accepted configurations (Andrew et al. 2007, Evans and Andrew 2009).

By so doing the dashboard also helps stakeholders to realize that the management process is bound to rely on trade-offs between ecological, social, and economic indicators of management performance. A vivid example of these trade-offs could be a situation where catching 'too many' fish is a short-term objective that might be 'acceptable' from a food security point of view. Indeed when small-scale fisheries are set within the reality of societies with great poverty, insecure food supplies, and/or variable fisheries resources, such levels of harvest may be necessary and unavoidable for a while as long as the overall system is not irreversibly affected.

Second, if run through a participatory process that involves a large range of stakeholders and/or experts, the dashboard exercise can easily create the preliminary conditions that facilitate the adoption, comprehension and acceptance of the concept of resilience management amongst stakeholder groups which are not necessarily familiar with this rather abstract concept. Because of the simplicity of the criteria ('undesirable' versus 'desirable' configurations) that capture in a simple and clear manner the configurations of the system and management objectives, the dashboard can facilitate communication and knowledge exchanges between the different groups of experts/stakeholders, thus making easier the negotiation process and setting the stage for rules and patterns of social interactions between stakeholders during the following adaptive learning process. In particular it can facilitate the identification of mechanisms and options that allow the fishery to stay away from undesirable states and the identification of resilience indicators which can then be used during the implementation of the adaptive management phase to monitor the 'health' and evolution of the system under a resilience management approach.

### **Sustainability of the project's management actions**

"Do we have reasons to believe that the community interventions that were initiated with the support of the project will continue after the end of the project?" This question was posed to the partners during the wrap up meeting in Dec 2009.

Globally their responses were all positive. Some of the reasons they brought forward to justify this optimism rely on tangible evidence. Others are more subjective, reflecting 'views' or 'feelings'. They are all detailed below.

One of the first and strongest reason for the partners to believe that 'things will not stop when the donor withdraws' is the nature of the micro-credit tri-partite contract that was signed between the micro-credit bank, the NARES and the representative of the community (the president of the newly created cooperative societies). In this tripartite agreement (which draws upon the growing experience of micro-credit schemes operated in a large number of developing countries), it is stated that:

- Micro-credit loan cannot be contracted without the signature/endorsement from the NARES. This contractual clause ensures that the interventions for which members of the cooperatives wish to obtain a loan, along with the identity of these beneficiaries, are in line with the original 'philosophy' of the project. The NARES is therefore the guarantee that the cooperative fund will not be mis-used in some inappropriate activities, or 'hijacked' by some particular individuals.

## Objectives CPWF Project Report

- New loans are not released by the Bank until the previous ones have been fully reimbursed. This condition creates an environment of 'community-fellow pressure' where the members of the community who have benefited from a loan in the past feel a moral obligation to reimburse it to allow other members to benefit from future loan opportunities. There is therefore a strong pressure and a close monitoring by the community itself on how each past beneficiary is doing with his/her investment and whether or not s/he repays his loan in time.
- A 10% interest rate is charged on each loan. One part (6%) is used to cover the Bank services fees, while the remaining 4% is paid to the cooperative's account, leading the initial fund to grow over time. This growing fund can be used to support a larger number of loans (or alternatively the same number of larger loans). But it can also be used to cover the repairing and maintenance costs of the initial collective interventions (boreholes, grainmills, sluice gate etc.) implemented in the two pilot communities.

Other factual elements comforted the partners' confidence that the communities will be able to continue implementing the management-actions. These include the fact that the two NARES are about to receive additional (non-CPWF) funds in 2010 that will permit them to continue engaging with the two communities. In Nigeria, NIFFR has requested federal funds from the Government to cover the continuous monitoring of the project interventions and the establishment of the feedback meetings. In Mali, the start of a project funded by the Agence Française de Développement (AFD) in 2010 in the area of Batamani will offer IER the opportunity to continue engaging with the community, monitor the project interventions, and establish the feedback meetings.

In addition to these tangible elements, other more subjective factors reinforced the positive impression about the potential for sustainability of the management actions. The high commitment of the whole communities –in particular the strong involvement of women- in the establishment of the various project activities was noticeable and interpreted as the evidence of the strong sense of ownership by the members of the communities for the project. In that respect the strong commitment shown by the *Hakimi* (traditional leader) in Nigeria and the *Chef de village* in Mali was certainly instrumental in the establishment of this positive dynamics.

### Signs of change?

We highlighted above that it was too early to observe the project's impacts on the livelihoods of the households in the two pilot communities. Some preliminary signs that the project activities have triggered some positive changes are however already palpable. One particularly noteworthy sign is the unexpected change in attitude that was observed in Batamani in relation to the rehabilitation of the Débaré sluice gate. As mentioned in the introduction (section 1.3.2) of this report, the access to land and to the Débaré pond was so far restricted to the autochthonous people living in Batamani village. In contrast the migrant fishers living in Batamani Daga were so far denied access to these resources. In this context the fact that the young men of Batamani Daga were authorized by the chief of village to participate and contribute to the rehabilitation work along with the people from Batamani village is viewed as the extremely promising sign that 'something has changed'. As pointed by the partners from IER and IRD who have a long experience in the area, although this event (the fact that the people of Daga were invited to contribute to the rehabilitation work does not, in itself, guarantee that they will effectively be entitled access to the Débaré pond), it is quite likely that this will happen. If it were to occur, this change would be a drastic improvement in the local institutions: since they arrived about 60 years ago these migrants have never been entitled to the access to these resources.

Another important change is potentially about to occur. This is the change in attitude shown by the micro-credit bank vis à vis the fishers of the Central Delta of Niger. Fishing communities (and in particular male fishers) in Mali have a relatively bad reputation with the banking institutions due to their poor past record in repaying loans. As a consequence

fishers in the Central Delta of Niger were no longer having access to these formal sources of credit<sup>5</sup>. If the project microcredit scheme is successful and the male fishers of Batamani start repaying their loans, this could 'break the negative reputation' dynamics and offers them an opportunity to strengthen their livelihood resilience.

Although it would be difficult to demonstrate it rigorously, the project team felt that part of these overall positive signs, and the underlying constructive 'spirit' that seems to emerge from the communities may have been facilitated, or encouraged, by (a) the systematic attention paid by the project to include all the different groups of the communities –in particular women- in the different components of the activities (from planning to implementation), and (b) a subtle balance found by the project between 'guidance' (by the partners) and strong 'ownership' (by the communities) to decide what to do and how to do it. These two components (inclusion of all groups and balance between guidance and ownership) reflect the awareness of the project partners to the importance paid to issues related to community participation, elite captures, gender, economic and institutional inequity, and their intimate knowledge of the two areas where the two pilot communities were selected.

### **Assessing the concept of resilience**

"Is the concept of resilience as implemented in this project a useful concept -in other words, could we have done the same thing without this concept?" The question is pertinent but the team did not reach a clear and consensual position on this point during the wrap up meeting. While it was rapidly agreed that the academic theoretical discussion about the concept of resilience as discussed *ad nauseum* in the literature was not necessarily useful –most of the partners admitted that they do not follow closely the current debates taking place in this literature-, they also acknowledge that the loose definition used in this project: "resilience is about adaptation to shock and uncertainty" was useful in helping them revising some of their own views about how to best manage a small-scale fisheries. In that sense the initial objective of the project "How to operationalize the concept of resilience" (understood in the sense: how to help fishing communities adapt to shock and uncertainty) was, to their view, much more relevant than many academic debate found in the literature such as, e.g. 'how to measure resilience'.

The question of whether the same activities and interventions could have been designed and implemented without making explicit reference to resilience is the point where partners had the most difficulties (and failed) to find a common view. Some pointed out that a concept such as 'vulnerability reduction' could have achieved the same results. As put by one of the partners: "I see resilience as a way to reduce vulnerability". This last comment is closely linked to the earlier discussion referring to the strong interrelation between poverty, vulnerability and resilience (see section 'Assessing the Participatory Diagnosis tools' p.58)<sup>6</sup>.

For other partners, however, the reference to resilience, and in particular the ambition of the project to investigate the capacities of a fishing community to reduce its vulnerability to all types of shocks in a unpredictable system (the "resilience of what to what" – Carpenter et al. 2001) is the central element that encouraged the team to adopt an integrated approach (formalized through the 360° map) and to help the communities to think beyond the conventional fisheries-specific interventions. In other words even taken in a broad and loose sense, the concept of resilience may have been the critical catalyst that helped the project team to realize that "developing the resilience of a fishing community" is much more than simply "supporting participatory fisheries management". If it is the case, then perhaps, Yes the concept of resilience is indeed useful.

<sup>5</sup> This issue was mentioned in Section 3.2.2.

<sup>6</sup> As one of the partners put it: "In sum vulnerability and resilience (in the way we used them) are the same thing –except that resilience convey a more positive picture."

## **Conclusion**

The central hypothesis of this research was that the concept of resilience, revisited from a socio-ecological and adaptive management perspective, can reduce the vulnerability of fishing communities and lead to improved resource management and water productivity.

In order to test this hypothesis the project developed a new framework –the Participatory Diagnosis and Adaptive Management PDAM framework- which was then tested in two pilot communities in the specially challenging environment of the Niger River Basin -one in the Central Delta of Niger in Mali and one of the shores of the Lake Kainji in Nigeria. In those two communities, the participatory diagnosis (PD) component of the framework was used to help the households to identify their main sources of vulnerability. Relying on the result of this diagnosis, the two communities were then helped to identify a series of management-actions that they would have to implement and monitor with the support of the project partners. This Adaptive Management (AM) component was successfully initiated during the second phase of the project. The management-actions included interventions aimed at improving access to health services and medication supply, rehabilitation of boreholes and flood control infrastructures, improvement of school facilities, and creation of microcredit cooperatives.

Although it is too early to assess formally the impact of the project, the team agreed that the project has been overall successful. The PDAM framework has been developed and implemented according to the initial project planning. The report demonstrated the great relevance of the PDAM framework to engage with local communities about their sources of vulnerability, and to lead these communities to identify, in a participatory and gender-sensitive manner, potential solutions to reduce these sources of vulnerability. The two communities already show some encouraging sign of changes –although these are still to be confirmed- and the self-sustainability of the interventions seems to be secured for the time being.

Overall the concept of resilience, which underlined the PDAM framework, was therefore assessed positively, although its usefulness was recognized to derive more from the project partners' initial effort to strip it down to a pragmatic conceptual tool -leading to integrated rural development interventions- rather than from the theoretical and sometimes esoteric debate of which it is the object in the academic realm.

## OUTCOMES AND IMPACTS

### Description of the Project's Main Impact Pathways

Actor or actors who have changed at least partly due to project activities	What is their change in practice? i.e., what are they now doing differently?	What are the changes in knowledge, attitude and skills that helped bring this change about?	What were the project strategies that contributed to the change? What research outputs were involved (if any)?	Please quantify the change(s) as far as possible
<b>Niger Central Delta</b>				
The whole village community	<p>Migrant households, formerly excluded, now involved in sharing the village resources, including land.</p> <p>Sharing approach and access to medicines, with self finance system.</p> <p>Two cooperatives (men and women) for microcredit have been setup</p> <p>Diversification of activities resulting from micro- credit</p> <p>Improved pond water management for fishery and agriculture</p>	<p>Whole village community involved in projects by the scientific team.</p> <p>Capacity building of community on health and medicine use.</p> <p>Input of initial funds in the bank by the project.</p> <p>New skill in project presentation</p> <p>Rehabilitation of the gate between pond and river with the aid of project funds</p>	<p>Project funding to repair the gate to manage pond inundation.</p> <p>Project funding of health personnel during short period.</p> <p>Lack of access to credit identified as major issue by villagers during village survey</p> <p>Capacity building by project</p> <p>Participatory identification of objectives</p>	<p>Expected migrant household in collective fishing and land use)</p> <p>Increased rate of consultation</p> <p>20 projects have received credit</p> <p>20 projects have received credit</p> <p>Increased the level of water in the pond</p>
Fishery Cooperative societies	Confidence between cooperatives and official authorities	Open discussions in an informal setting.	Organizing stakeholders seminars by the project	No possible quantification
IER Scientific Team	Data collection New techniques for data analysis	<p>Improving data collection</p> <p>Acquisition of new methods for data analysis</p> <p>Improved experience in publication writing</p> <p>Experience in project management and administration</p>	<p>Kick off meeting of project</p> <p>Data analysis in common with IRD colleagues during adhoc seminars</p> <p>Shared publication of papers in journals</p>	<p>Two questionnaires based on 360° tools</p> <p>One adhoc seminars with IER colleagues</p> <p>Two publications with project partners</p>
Official	Project management Relation with fisher	Experience in project	Participatory research through	No possible quantification

## Outcomes and Impacts CPWF Project Report

authorities	and stakeholders	management and participatory approach  Building good relation between official authorities and stakeholders	Scale out project advantages to stakeholders of new research results and its application to improve fish production from the lake  Scale up the recommendation gained in the project to decision makers	
<b>Lake Kainji</b>				
Whole village community	More regular community meetings  Formation of cooperative societies for both male and female  Increased access to community facilities  Increased visits by women for anti natal  Increased pupil attendance and enrolment	Improved knowledge of available health facilities	Investment of financial resources and time by project staff in ensuring participation  Intensive participatory research strategy	School enrollment grew from 120 to 200 within 5 months.  cooperative societies grew from informal (CBOs) to 2 formal registered cooperative societies  functioning boreholes grew from 0 to 3  community oxen grew from 0 to 4
Male and female cooperative societies	Registration of formal cooperative societies for both male and female with Kebbi state ministry of commerce, industries, cooperatives and tourism  More frequent meetings  Full accountability for use of resources and formal record-keeping	Better knowledge of equitable governance systems and accountability	Provision of equal seed fund for both male and female cooperatives  Capacity building on cooperative management and administration provided by NIFFR	Micro-credit beneficiaries = male- 29, female – 20 Meetings grew from very infrequent (informal CBOs) to twice per month (formal cooperatives)
Hakimi and other members of traditional council	Regular meetings of the traditional council  Oversees the facilitation of resilience interventions	Knowledge for better governance strategies  Knowledge of concepts of vulnerability and community resilience	Early involvement in participatory activities of the project	
NIFFR	Use of participatory methods for community data collection  New techniques for data analysis	Better understanding of resilience and vulnerability analysis  Improved capacity for the organization and management of rural based organizations	Frequent meeting with project partners  Regular assessment of resilience intervention in Tungan Mairuwa community	

## Outcomes and Impacts **CPWF Project Report**

Local education authority	Involvement in facilitating repairs and improvement of school facilities  Undertook and funded additional minor repairs of school facilities	Increased interest in school improvement	Early involvement of local education authority in diagnosis assessment ensured interest in project	
Health authority	consultation visits to the community to encourage use of available health facilities	Increased interest in health improvement of community members	Identifying a low cost opportunity of providing health services by employing a retired nurse  Remuneration of health worker for full participation	Visits by health worker increased from 0 to twice a month

*Of the changes listed above, which have the greatest potential to be adopted and have impact? What might the potential be on the ultimate beneficiaries?*

### **Niger Inner Delta**

In the village community:

- approach to health care,
- continued access to credit,
- migrants households have been included in collective activities.

### **Lake Kainji**

- revolving loan scheme that focuses on gender equity. The potential impact of this would include making community women less dependent on their male-folk and increase livelihood resilience in the face of uncertain environmental conditions
- Low cost approach to community health care that ensures regular visit of health worker, thus leading to reduction of maternal and child mortality including increased likelihood that community members would seek appropriate and timely medical care
- The process of participatory vulnerability analysis has proven particularly powerful in ensuring broad buy-in from the community, equitable outcomes from interventions, and ultimately we anticipate will dramatically increase the likelihood of sustainability of interventions.
- The gender-sensitive roll-out of interventions formulated through the participatory diagnosis has not only lead to additional and more diverse livelihood options for women in the community, but also to empowerment and increased participation in decision-making processes.

*What still needs to be done to achieve this potential? Are measures in place (e.g., a new project, on-going commitments) to achieve this potential? Please describe what will happen when the project ends.*

### **Niger Inner Delta**

The follow up of the new activities in the village is a necessity. This will be taken into account by IER in the setting up of its future research projects.

### **Lake Kainji**

Continues engagement of NIFFR project team would lead to sustainability of established institutions and interventions (e.g. the cooperative societies and collective resilience projects e.g. grain mill, bore holes and oxen for animal traction) in the community.

*Each row of the table above is an impact pathway describing how the project contributed to outcomes in a particular actor or actors.*

*Which of these impact pathways were unexpected (compared to expectations at the beginning of the project?)*

### **Niger Inner Delta**

Both the village community and the experts staff have agreed that the constraints on the livelihood of the village are highly diversified and not only dependent on fishery variables.

#### **Lake Kainji**

- Acceptance by the traditional authorities and male folk on the role of women in decision making and fund distribution
- Increased level of trust amongst community members due to the open process of choosing interventions and establishing the organizations and executives members

*Why were they unexpected? How was the project able to take advantage of them?*

### **Niger Inner Delta**

Most of the literature on fisheries development deals mostly with the biological component (fish stocks and regulation) and not with the social and economic environment.

#### **Lake Kainji**

- Due to Socio-cultural influences, women are not normally accepted in leadership and decision making roles
- high level of distrust was observed during early household survey conducted by the project team

*What would you do differently next time to better achieve outcomes (i.e. changes in stakeholder knowledge, attitudes, skills and practice)?*

### **Niger Inner Delta**

If we had to do again such a project we would add a follow up phase (two years) for monitoring and evaluation of the adaptive management capacity of the community and the effectiveness of the new recommended activities.

#### **Lake Kainji**

The short time scale of the project has limited the ability to measure resilience outcome for new interventions, ideally there should be inbuilt post project monitoring and evaluation activities for at least two years after interventions. NIFFR has shown commitment towards funding post project evaluation of the impact of the project through regular monitoring visits.

## **International Public Goods**

### **New Insights**

From a fisheries science perspective, one of the most important insights generated by this project is certainly the fact that once a real, comprehensive, assessment of fishing community vulnerability is conducted (using for instance the 360° assessment map tool and the dashboards), fisheries/resources issues are no longer systematically the main constraints identified by the communities, suggesting that resource issues (fluctuability, or even stock decline) may not be the only issues to deal with when one is interested in increasing the resilience of these fishing communities and their capacity to engage in resource management. Matters of reorganizing priorities to address the basic needs of the communities (such as access to health, drinking waters and education) and other institutional limits (e.g. access to credit) appear therefore as critical as addressing the more conventional resources management issues. Some of these lessons were summarized in an article published in the *Journal of International Development* (Mills et al. 2009).

Conjointly the capacities (or inabilities) of fishing communities to adapt to major hydro-climate and human-induced environmental changes have been described and analyzed in

detail in the specific case of the Delta Central of Niger. This work has also been submitted for publication (Moran et al. submitted).

### Tools and methodology

The main objective of this project was to develop and field-test an approach to operationalize the concept of resilience that would be suited to the complex ecological and social context of small-scale fisheries. For this, the project, which has a strong 'action research' orientation, used an interdisciplinary framework called Participatory Diagnosis and Adaptive Management PDAM framework that was developed at the early stages of the project (see Béné et al., 2008; Andrew and Evans, 2009; Evans and Andrew, 2009). Increasing evidence in the literature suggests that factors arising from the external environment related to water use and management at the basin or watershed level (e.g. changes in water allocation or water availability, increased urbanization, regional or global climate variation) are usually amongst the critical driving forces impacting on inland fisheries. Particular emphasis has therefore been placed on identifying threats and opportunities related to these external drivers. The diagnosis was also placed in a broader development context with emphasis on poverty reduction. This pathway led to a very different assessment process and different entry points for fishery management: these still included some intra-sectoral (classical) dimensions, but mainly integrated elements outside the domain of the fishery (e.g. water management allocation and planning), or even cross-sectoral issues (e.g. alternative livelihoods, improving literacy rates, access to health services, etc). A central tool in this evaluation exercise was the elaboration and use of 'resilience indicators' and community-based dashboards which can reflect the dynamic state (regimes) of the fisheries and their limits of desirable states.

### Datasets

The following series of data have been generated:

Type of data	Succinct description	Format	Contact
Socio-economics			
	Lake Kainji: socio-economic baseline data: 40 fishing household data including household assets index, fishing assets, and perception on source of vulnerability	Excel	Dr. Solomon Ovie: National Institute for Freshwater Fisheries Research (NIFFR) PMP 600 New Bussa Niger State Nigeria soloovie@yahoo.com or Chris Béné Policy, Economics and Social Science, The WorldFish Center P.O. Box 500, GPO, 10670 Penang, Malaysia e-mail: c.bene@cgiar.org
	Delta Central of Niger: socio-economic baseline data: 40 fishing household data including household assets index, fishing assets, and perception on source of vulnerability	Excel	Mr. Famory Sinaba Institute of Rural Economy (IER) P.O. BOX 205 Mopti Mali famorys@yahoo.fr or Chris Béné Policy, Economics and Social Science, The WorldFish Center P.O. Box 500, GPO, 10670 Penang, Malaysia e-mail: c.bene@cgiar.org

## **Publications**

See section publication below

## **Partnership Achievements**

### **IRD**

1- Partnership achievements in science:

- Scientific cooperation and exchange of ideas, project management procedures, scientific publications, workshops with project partners. Publication of joint papers.
- Scientific cooperation with Nigeria Institute for Freshwater Fisheries Research (Nigeria) and with Institut d'Economie Rurale (Mali) on fisheries and fishing communities has brought new knowledge to us on the two studied regions.

2- Partnership achievements in outcomes:

- The partnerships with project partners helped in successful conduct of project implementation and strengthened links with fishers communities both in Mali and Nigeria.

3- Partnership achievements in impacts:

- Possibility to scale up the results into recommendations to decision makers.

### **IER**

1- Partnership achievements in science

- The partnerships with the project African and foreign partners resulted in generation of new insights for ecology and socio-economics of fisheries, and possible increased cooperation in the future.

2- Partnership achievements in outcomes:

- The partnerships with project partners helped in successful conduct of project implementation and strengthened links with fishers communities both in Mali and Nigeria.

3- Partnership achievements in impacts:

- The partnership with the project team led to a more effective approach and project implementation, leading to better relationships with the fishing communities.
- Overall an improved skill in fisheries knowledge should make IER better recognized as a partner for future research and policy developments.

### **NIFFR**

- Partnership between scientists and fisherfolks community and sectors of the communities.
- Partnership with NGOs (e.g. Taimako Tungan Mairuwa Men fisherfolk cooperative society and Taimako Tungan Mairuwa women fisherfolk Cooperative Society, Nigeria.)
- Partnership with government fisheries Department ( Federal/State Department of fisheries).

1- Partnership achievements in science

- Partnership between different subject scientists enhanced multidisciplinary approach to different issues of project and decision making;
- Scientific cooperation and exchange of ideas, project management procedures, scientific publications, workshops with WorldFish Center.
- Ph.D. program to study Livelihood diversity and poverty assessment of fisher in Kainji Lake Basin, Nigeria.
- Ph.D. program to study Characterisation of fishers livelihoods and sustainable fisheries management practices in the Jebba/Kainji lake basin, Nigeria.

2- Partnership achievements in outcomes:

- Male and female cooperative societies established and operational
- Functional revolving loan scheme for male and female cooperative members
- Good teaching and learning condition for both teachers and pupils
- Access to health consultation and advice by the community members
- Access to portable water
- Reduced cost and access to ploughing oxen
- Enhanced processing of agricultural products for the women through the use of grain mill.
  
- Partnership between scientists and primary stakeholders harmonised strict scientific approaches and real human needs modifications. The partnership also increased incorporation of scientific attitude and approaches of primary stakeholders in their activities. Finally, this partnership enhanced traditional knowledge of the scientists in the fisheries activities of primary stakeholders which could improve on interpretation of results.

3- Partnership achievements in impacts:

- Partnership between projects and NGOs enabled the application of business principles to the activities of the primary stakeholders.

## **Recommendations**

A series of recommendations can be derived from the activities and results of the project. These have been grouped under 3 headings: scaling out and up, water management, and scope of intervention.

### ***Scaling out and scaling up***

One first domain where the project generated some relevant lessons for recommendations is related to the question of scale -scale of the interventions and scale of the policy aimed at supporting these interventions. One way to illustrate this is to pose the following question: at which level is the PDAM framework likely to be more impact-effective? For instance, can governments use the PDAM framework to guide their PRSP at the national level?

### **Relevance of the vulnerability analysis beyond the two pilot cases**

Through its methods, the PDAM focused on the sources of vulnerability and constraints that impact the livelihoods of individual households at local level. As such it provides valuable insight into vulnerability dynamics at the micro, community-level. The sources of vulnerability as they were identified through the PDAM framework are however symptomatic, not only of the two communities where these assessments took place, but more widely, of a large segment of the rural population living in the same regions. This is confirmed by other recent research. For instance the review of the literature available in other part of the Sahelian region (e.g. Burkina Faso) reveals that although quantitative difference still exists between fishing or rural villages across the region, important qualitative 'commonalities' in the nature of the constraints that impact these communities can be identified (Ducommun et al. 2005; Nwabeze, 2006; Lemoalle, 2009). In that sense, the conclusions of the vulnerability assessment can, and should, be transferred (scaled out) to other parts of the Sahelian region.

### **Universality of resilience interventions?**

The same way the result of the vulnerability analysis contains some 'generic' element that go beyond the pilot cases considered in the project, the types of interventions that were proposed to address these source of vulnerability present also some form of 'universalities'. A particularly illustrative example of this 'generic' nature of the interventions is the case of diversification. A substantial part of the management actions that were identified and implemented in the two communities are aimed at increasing (more or less directly) the degree of diversification of the households' livelihood. This is not surprising since diversification has been recognized for long as a powerful way to address uncertainty and risks, thus improving household resilience.

### **A need to tailor rural interventions**

At first sight the points made in the two previous paragraphs could be viewed as a strong argument for the elaboration of generic national policies (e.g. through PRSP). Indeed as recognized above the need for diversification but also the detrimental impact of food insecurity, lack of access to health services, education and credit on the long term capacities of local population to pull themselves out of poverty are common issues across the rural areas in both Mali, Nigeria and the rest of the Sahelian belt region. We strongly feel, however, that the types of interventions still need to be carefully tailored to, and reflect, the local specificities of the communities where they are implemented. For instance in the case of the two communities involved in this project, respondents in both communities recognized that health issues are amongst the most important sources of vulnerability for their family members. Yet the way to address this major constraint varies substantially between the two communities because Batamani is so remote that it

takes several hours to reach the first health center while Tungan Mairuwa is located only 5 km away from the local hospital.

### **Back to subsidiarity principle**

One way to address this challenge –existence of generic rural development issues but need to address these in a locally adapted manner- is to support local interventions through policies that are developed, not at the national level (which is clearly too disconnected from the local specificity) but at a lower, 'intermediate', meso level, such as district level. These meso-level policies are likely to reflect in a more appropriate manner the local conditions of the communities where the interventions that they support are taking place and still offer a policy environment that is generic enough to embrace the common nature of the main constraints affecting the livelihood of rural populations in these regions and create some economy of scale and synergy in the interventions.

### **Water management**

Amongst the inland fishery resource issues, the hydrological cycle is often a main concern. Although the inherent variability of the rainfall regime over the Niger basin is out of fishers' control, are there means of flow or water level management that could favor the fisheries?

### **The need to include fishers in the process**

The fishing communities around Lake Kainji benefit from a fairly reproducible hydrological cycle, but it is not the case for Batamani and the whole Central Delta of Niger. This appears clearly in the Batamani dashboard, where the water regime is subject to both the natural variability of the river flood and to the artificial water releases from the upstream dams of Sélingué and Markala: the key resilience indicator proposed by the community for external driver was the river flow. The community livelihood is thus dependent upon water management decisions which are taken at the national level and mostly take into account the most 'audible' users (large irrigation perimeters, hydropower generation, navigation). Although different fishing communities in a basin may have different needs regarding the hydrological cycle management, proper consultation mechanisms involving the fishing communities should be implemented.

### **Scope of interventions**

Critical to the success of resilience-building interventions is a realistic appraisal of the scale at which community-level actions can produce positive and significant impacts for focus communities. While reform of water use policy, catchment protection or sustainable resource management may be the ideal, the reality is that in the face of multiple requirements for water use, the needs of isolated fishing communities will rarely be considered (see point above). Is it then possible for interventions at the community level to build the resilience of fish-dependent communities to uncertainties beyond their control? What form would these interventions take?

### **When the community is too small**

The focus of this project was on resilience interventions at the level of fishing communities – how can communities become more resilient to uncertainties associated with relying on the fishery resource? It may come as a surprise then that many of the interventions did not take place within the fishery resource domain; rather they tended to relate to health, education and alternative livelihood options. This is a direct result of both the central role of the community-based participatory diagnosis process and recognition of the limits of scale at which community influence can lead to positive

outcomes. The two focus communities engaged in the project utilize fisheries resources that have no discrete boundaries at the scale of the community; that is, there are many other users-groups of the same water and fisheries resources, and as a result issues such as control of water level, water quality degradation and catchment use are largely beyond their control. It follows that the ability of a community to implement interventions at the scale of the resource is limited; collective action at a much broader scale would be required for successful outcomes. As an example, any restrictions on fishing practices or fishing effort within the individual communities may in fact be counter-productive. The positive effect of one among many users-groups decreasing resource exploitation will likely be minimal, and restrictions placed on focus communities would ensure that any benefits generated would flow to other resource users.

### **Providing alternatives to fishing increases resilience**

Rather than addressing fishery issues directly in project pilot-sites, they were mainly addressed indirectly through promoting livelihood diversification and provision of basic needs. The provision of alternative livelihoods acts in multiple ways to reduce vulnerability in fishing communities. Acknowledging that factors leading to uncertainty in the resource are, in many instances, largely beyond the control of the community, reducing direct dependence on the fishery resource is the best mechanism for increasing resilience. Additionally, redirecting livelihood effort away from the fishery through the provision of alternative opportunities will reduce pressure on the resource.

### **'If I can't feed my family, I can't fish sustainably'**

The resilience-based approach to resource management recognizes that the provision of basic needs can play a significant role in promoting sustainable resource use. In focus sites in Nigeria and Mali the lack of provision of basic needs dominates the life of fishing community members. When immediate critical needs cannot be met, community focus on short-term survival will invariably take precedence over any consideration of long-term sustainability issues. Expecting any consideration of sustainability issues under such circumstances is unrealistic. By addressing basic needs through targeted interventions, the project aimed to reduce the dominance of pressing survival needs in daily life, thereby at least in part clearing the way for broader livelihood sustainability issues to be considered.

### **Fishery interventions can play a crucial role in building resilience**

Despite the minimal fishery-related interventions at the two focus sites in this study, clearly livelihood constraints in fishing communities often relate to the state of the resource. Where fish-related interventions at the community scale can be identified these interventions may be particularly productive. For example, experience in fisher/farmer communities suggests that the introduction of aquaculture technology may be well received and productive. Providing an alternative means of fish production has the added benefit of supporting multiple livelihoods such as fish processing and marketing that previously relied solely on the capture fishery.

### **A multi-sectoral approach is critical**

The approach to resilience-based interventions outlined here recognizes that poverty in fishing communities is not simply a resource issue; it is multi-sectoral and complex. As such, effective intervention requires an integrated approach from a diverse range of stakeholders. Given that the focus constituency is fishing communities, it is likely that fishery institutions will be heavily involved in initiating and executing such action. It is less likely that fishery institutions would lead diagnosis and implementation processes, as there is a critical role in coordinating government departments and stakeholders across sectors that may be better facilitated by appropriately equipped external agencies e.g. Department of Rural Development.

## **Publications**

### **Peer-reviewed Journals**

Mills D., Béné C., Ovie O., Tafida A., Sinaba F., Kodio A., Russell A., Andrew N., Morand P., Lemoalle J., 2009 Vulnerability in African small-scale fishing communities. *Journal of International Development* 26: 1-6.

Morand P., Kodio A., Sinaba F., Andrew N., Lemoalle J. and Béné C. Will African floodplain fishermen be able to adapt to hydro-climatic change? A forward vulnerability analysis from the Niger Inner Delta case study. submitted

### **Policy Briefs**

Béné C. et al. 2010 Managing Resilience in West African small-scale fisheries, Policy Brief WorldFish Center Penang Malaysia, 5 p.

Lemoalle J. et al. 2010. Adaptation of floodplain fishing communities to hydro-climatic changes in the Niger River basin, Policy Brief WorldFish Center Penang Malaysia, 5 p.

Mills D. et al. 2010 Assessing vulnerability in African small-scale fishing communities, Policy Brief WorldFish Center Penang Malaysia, 5 p.

### **Conference Proceedings**

Béné C., N. Andrew, A. Russell, F. Sinaba, S. Ovie, P. Morand, and J. Lemoalle. 2008. Managing Resilience in West African small-scale fisheries. Paper presented at the Second International Forum on Water and Food (Addis Ababa 10-14 Nov 2008)

Béné C, Mills, D., Ovie S. and Sinaba F. Assessing Vulnerability in Small-Scale Fishing Communities. Submitted for presentation at the IIFET 2010 Conference, Montpellier France

Morand P., Kodio A., Sinaba F., Andrew N., Lemoalle J. and Béné C. Fishers adaptation to hydro-climatic change in the Central Delta of Niger. Submitted for presentation at the IIFET 2010 Conference, Montpellier France

### **Research papers**

Andrew, N.L. and Evans, L. 2009. Approaches and Frameworks for Management and Research in Small-scale Fisheries in the Developing World. The WorldFish Center Working Paper 1914. The WorldFish Center, Penang, Malaysia.

Evans, L. and Andrew, N.L. 2009. Diagnosis and the Management Constituency of Small-scale Fisheries. The WorldFish Center Working Paper 1941. The WorldFish Center, Penang, Malaysia.

Sinaba F., Kodio A.D., Kodio A., Béné C., Morand P., Lemoalle J., Russell A. 2009. Participatory Diagnosis and adaptive management of small-scale fisheries in the Niger River Basin: Case of Batamani in Mopti. IER Report Research, Bamako, Mali

### **Ph.D Thesis or dissertation**

Tafida, A. A. Livelihood diversity and poverty assessment of fishers in Kainji Lake basin, (in progress) defense scheduled in 2010

Nwabeze, G.O Characterization of artisanal fishers livelihood and sustainable fisheries management practices in Kainji/Jebba lake basin (in progress) defense scheduled in 2012.

## **BIBLIOGRAPHY**

- Anderies, J.M., Janssen, M.A. and Ostrom, E. 2005. A framework to analyze the robustness of social-ecological systems from an institutional perspective. *Ecology and Society* 9(18) Available at: <http://www.ecologyandsociety.org/vol9/iss1/art18>, accessed on 12 June 2007.
- Andrew, N.L. and Evans, L. 2009. Approaches and Frameworks for Management and Research in Small-scale Fisheries in the Developing World. The WorldFish Center Working Paper 1914. The WorldFish Center, Penang, Malaysia.
- Andrew, N., Béné, C., Hall, S., Allison, E. H., Heck, S. and Ratner, B. 2007. Diagnosis and management of small-scale fisheries in developing countries. *Fish and Fisheries* 8, 227-240.
- Allan, J. D., Abell, R., Hogan, Z., Revenga, C., Taylor, B. W., Welcomme, R. L. and Winemiller, K. 2005. Overfishing of inland waters. *BioScience* 55: 1041-1051.
- Allison, E. and Ellis, F. 2001. The livelihoods approach and management of small-scale fisheries. *Marine Policy* 25: 377-388.
- Allison, E.A., Horemans, B., & Béné, C. 2006. Vulnerability reduction and social inclusion: strategies for reducing poverty among small-scale fisherfolk. Paper presented at the Wetlands, Water and Livelihoods Workshops. Wetland International. January 30 - February 2, St. Lucia, South Africa.
- Baumann E., Fay Cl. and Kassibo B. 1994. Systèmes de production et d'activité : trois études régionales. pp. 305-405 in J. Quensièrre (ed.) La Pêche dans le Delta Central du Niger, IER-ORSTOM-Karthala, 495 p.
- Béné, C. 2003. When fishery rhymes with poverty, a first step beyond the old paradigm on poverty in small-scale fisheries. *World Development* 36(1): 945-975.
- Béné C., Macfadyen G., and Allison E.H. 2007. Increasing the contribution of small-scale fisheries to poverty alleviation and food security. FAO Fisheries Technical Paper. No.481. Rome, FAO, 125p.
- Béné C., N. Andrew, A. Russell, F. Sinaba, S. Ovie, P. Morand, and J. Lemoalle. 2008. Managing Resilience in West African small-scale fisheries. Paper presented at the Second International Forum on Water and Food (Addis Ababa 10-14 Nov 2008)
- Béné C, Steel E, Kambala Luadia B, and Gordon A. 2009. Fish as the "bank in the water" - Evidence from chronic-poor communities in Congo. *Food Policy* 34: 104-118.
- Campbell, B., Sayer, J. A., Frost, P., Vermeulen, P.S., Pérez M. R., Cunningham, A., and Prabhu, R. 2001. Assessing the performance of natural resource systems. *Conservation Ecology* 5, 22. [online] [URL:http://www.consecol.org/vol5/iss2/art22/](http://www.consecol.org/vol5/iss2/art22/)
- Carpenter, S.R. and Folke, C. 2006. Ecology for transformation. *Trends in Ecology and Evolution* 21: 309-315.
- Carpenter, S. R., B. H. Walker, J. M. Anderies, and N. Abel. 2001. From metaphor to measurement: resilience of what to what? *Ecosystems* 4:765-781.
- Chamard Ph., Courel M.F., Adésir-Shilling M., and Hamalla Diakité Ch. 1997. L'inondation des plaines du delta intérieur du Niger (Mali). Tentative de contrôle : la réalité et les risques. *Sécheresse* 8 (3): 151-156.
- Cook K.H. and Vizy E. 2006. Coupled Model Simulations of the West African Monsoon System: Twentieth- and Twenty-First-Century Simulations. *Journal of Climate* 19(15): 3681
- Dugan, P. 2005. Fish out of water: competing for water for Africa's Freshwater Ecosystems. In Thieme M. L., Abell R. A. and Olson D. M. Freshwater Ecoregions of Africa: A conservation assessment. pp.128-132. Washington, DC. Island Press.
- Evans, L. and Andrew, N.L. 2009. Diagnosis and the Management Constituency of Small-scale Fisheries. The WorldFish Center Working Paper 1941. The WorldFish Center, Penang, Malaysia.
- FAO 1995 Precautionary Approach to Fishing. Part 1. Guidelines on the Precautionary Approach to Capture Fisheries and Species Introductions. FAO Technical Paper No. 250/1, Rome: Food and Agriculture Organization, 52 p.
- FAO 2003. The Ecosystem Approach to fisheries. FAO Technical Guidelines for Responsible Fisheries No.4, Rome: Food and Agriculture Organization.

- FAO 2008. Conférence sur « L'eau pour l'agriculture et l'énergie en Afrique: les défis du changement climatique ». Syrte.
- FAO 2006. FAO Technical Guidelines for Responsible Fisheries: Increasing the Contribution of Small-Scale Fisheries to Poverty Alleviation and Food Security. Food and Agriculture Organization of the United Nations, Rome, 97 p.
- Folke, C., Carpenter, S., Elmqvist, T. et al. 2005. Resilience and sustainable development: Building adaptive capacity in a world of transformations. Scientific Background Paper on Resilience for the process of The World Summit on Sustainable Development on behalf of The Environmental Advisory Council to the Swedish Government, 33 p.
- Flyvbjerg, B. 2001. Making Social Science Matter. Cambridge: Cambridge University Press.
- Friend, R.M., Arthur, R.I. and Keskinen, M. 2009: *Songs of the doomed: the continuing neglect of fisheries in hydropower debate in the Mekong*. In Molle, F., Foran, T. and Kähkönen, M., (eds.), *Contested waterscapes in the Mekong region: hydropower, livelihoods and governance*. London: Eatherscan, 23-54.
- Garaway, C.J. and Arthur, R.I. 2004. Adaptive learning: a practical framework for the implementation of adaptive co-management – lessons from selected experiences in South and Southeast Asia. MRAG Ltd., London. 40 p.
- Garcia, S.J., Allison, E.H., Andrew, N.L., Bene, C., Bianchi, G., de Graaf, G., Kalikoski, G.J., Mahon, R. and Orensanz, J.M. 2008. Towards integrated assessment and advice in small-scale fisheries: principles and processes. FAO Fisheries and Aquaculture Technical Paper No. 515. Rome, FAO.
- Halbert, C.L. 1993. How adaptive is adaptive management? Implementing adaptive management in Washington state and British Columbia. *Reviews in Fisheries Science* 1, 261–283.
- Hoddinott, J. and Quisumbing, A. (2003) Methods for microeconomic risk and vulnerability assessments. Social Protection Discussion Paper No.324, Washington DC: World Bank, Social Protection Unit Human Development Network, 134 p.
- Holling, C.S. (ed.) 1978. Adaptive Environmental Assessment and Management. John Wiley and Sons Ltd, London, 377 pp.
- Johannes, R. E. 1978. Traditional marine conservation methods in Oceania and their demise. *Annual Review of Ecology and Systematics* 9: 349-364.
- Jul-Larsen, E., Kolding, J., Overa, R., Nielsen, J. R. and van Zwieten, P. 2003. Management, co-management or no management? Major dilemmas in Southern African freshwater fisheries. Food and Agriculture Organization FAO Fisheries Technical Paper 426/1, Rome: Food and Agriculture Organization.
- Kodio A., Morand P., Dienepo K. and Laë R. 2002. La dynamique de la pêche du delta intérieur du Niger revisitée à la lumière des données récentes. Implications en termes de gestion. In Orange D., Arfi R., Kuper M., Morand P. and Poncet Y. (eds.) *Gestion Intégrée des Ressources naturelles en Zone Inondable Tropicale*. pp. 431-453. Editions IRD Colloques et Séminaires.
- Kuper M. and Maïga H. (2002): Commercialisation du riz traditionnel dans le Delta intérieur du Niger (Mali). In Orange D., Arfi R., Kuper M., Morand P. and Poncet Y. (eds.) *Gestion Intégrée des Ressources naturelles en Zone Inondable Tropicale*. pp. 639-660. Editions IRD Colloques et Séminaires.
- Kurien, J. 1998. Traditional ecological knowledge and ecosystem sustainability: new meaning to Asian coastal proverbs. *Ecological Applications* 8: S2–S5.
- Laë R. 1992. Influence de l'hydrologie sur l'évolution des pêcheries du Delta central du Niger de 1966 à 1989. *Aquatic Living Resources* 5(2): 115-126.
- Laë R. 1993. Impact des barrages sur les pêcheries artisanales du Delta Central du Niger. *Agricultures* 1: 256-263
- Lee, K.N. 1999. Appraising adaptive management. *Conservation Ecology* 3, 3. Available at: <http://www.consecol.org/vol3/iss2/art3/>, accessed on 12 June 2007.
- McNiff, J. & Whitehead, J. 2006. All You Need To Know About Action Research; Sage, London

- Mills D., Béné C., Ovie S., Tafida A., Sinaba F., Kodio A., Russell A., Andrew N., Morand P. and Lemoalle J. 2009. Vulnerability in African small scale fishing communities. *Journal of International Development* 26:1-6
- Marie J., P. Morand and H. N'Djim (eds.) 2007. Avenir du Fleuve Niger. The Niger River's Future. Bilingue + CD-ROM. IRD Editions. Collection Expertise collégiale. Paris. 287 pp.
- Morand P., Kodio A. and Niaré T. 2002. Vers un observatoire de la pêche dans le Delta intérieur du Niger. Méthodes, résultats et enseignements d'un dispositif expérimental. In Orange D., Arfi R., Kuper M., Morand P. and Poncet Y. (eds.) Gestion Intégrée des Ressources naturelles en Zone Inondable Tropicale. pp. 685-716. Editions IRD Colloques et Séminaires.
- NEPAD 2005. The NEPAD Action Plan for the development of African Fisheries and Aquaculture. Document adopted during NEPAD-Fish-for-All Summit, 23 August 2005, Abuja Nigeria, 27 p.
- Pomeroy, R. and Rivera-Guieb, R. (eds.) 2005. *Fishery co-management: a practical handbook*. CABI/IDRC.
- Pretty, J., Guijt, I., Thompson, J., and Scoones, I. 1995. Participatory learning and action: A trainer's guide. International Institute for Environment and Development, London.
- Prowse, M. (2003) Toward a clearer understanding of 'vulnerability' in relation to chronic poverty. CPRC Working Paper No.24, Manchester: University of Manchester, Chronic Poverty Research Center, 41 p.
- Olson M. 1965. *The logic of collective action*. Cambridge, Mass.: Harvard University Press.
- Ostrom E. 1990. *Governing the Commons: the evolution of institutions for collective actions*. Cambridge: Cambridge University Press.
- Thomson J.T. 1992. A framework for analysing institutional incentive in community forestry. Community Forestry Note 10, Rome: Food and Agriculture Organization.
- Rogers, K. 1998. Managing science/management partnerships: a challenge of adaptive management. *Conservation Ecology* 2(2) Available at: <http://www.consecol.org/vol2/iss2/resp1/>, accessed on 12 June 2007.
- Rogers, K. and Biggs, H. 1999. Integrating indicators, endpoints and value systems in strategic management of the rivers of the Kruger National Park. *Freshwater Biology* 41: 439-451.
- Vedeld T. 2000. Village politics: heterogeneity, leadership and collective action. *Journal of Development Studies* 36(5): 105-134.
- Wadsworth, Y. 1998. What is Action Research? Action Research International November 1998 available on-line at <http://www.scu.edu.au/schools/sawd/ari/ari-wadsworth.html>
- Walker, B., Carpenter, C., Anderies, J., Abel, N., Cumming, G.S., Janssen, M., Label, L., Norberg, J., Peterson, G., and Pritchard, R. 2002. Resilience management in social-ecological systems: a working hypothesis for a participatory approach. *Conservation Ecology* 6 available on-line at <http://www.consecol.org/vol6/iss1/art14>
- Walker, B., Holling, C. S., Carpenter, S. R. & Kinzig, A. 2004. Resilience, adaptability and transformability in social-ecological systems. *Ecology and Society* 9(5) available on-line at <http://www.ecologyandsociety.org/vol9/iss2/art5>. [Viewed 10 Sept 2006]
- Walker B., Sayer J., Andrew N.L., and Campbell B. (in press). Enhanced Resilience as an Objective of Natural Resource Management in Developing Countries. *Crop Science*.
- Walters, C.J. 1986. *Adaptive Management of Renewable Resources*. Macmillan, New York, 374 pp.
- Walters, C. 1997. Challenges in adaptive management of riparian and coastal ecosystems. *Conservation Ecology* 1(2) Available from the Internet. URL: <http://www.consecol.org/vol1/iss2/art1/>
- Welcomme R.L. 1979. *Fisheries ecology of floodplain rivers*. London, New York. Longman, 317 pp.
- Welcomme R.L. 1986. The effects of the saelian drought on the fishery of the Central Delta of the Niger river. *Aquatic Fisheries Management* 17: 147-154.

- World Bank 2004. Saving Fish and Fishers: towards sustainable and equitable governance of the global fishing sector. Report No. 29090-GLB, Washington DC: World Bank, Agriculture and rural development Department, 93 p.
- Zwarts, L., van Beukering P., Kone B. and Wymenga E. (eds.) 2005. The Niger, a lifeline. Effective water management in the Upper Niger Basin. RIZA, Leylstad / Wetlands International, Sévaré / Institute for Environmental studies (IVM), Amsterdam / A&W ecological consultants, Veenwouden. Mali / the Netherlands. 304 p.

## **PROJECT PARTICIPANTS**

### **NARES**

*National Institute of Freshwater Fisheries Research (Nigeria)*

Principal Investigator: Dr Solomon Ovie

Dr Aminu Raji

Mr. Tafida Ahmadu

Mr Geoffrey Nwabeze

*Institut d'Economie Rurale (Mali)*

Principal Investigator: Dr. Famory Sinaba

Mr. Amaga Kodio

### **ARI**

*Institut de Recherche pour le Développement (France)*

Principal Investigators: Dr Jacques Lemoalle & Dr Pierre Morand

### **CG-center**

*WorldFish Center (Malaysia)*

Project Leader: Dr Chris Béné

Dr David Mills

Dr Neil Andrew

In addition the following persons have contributed to the project activities (in alphabetic order): Neil Andrew (WorldFish), Fatoumata Ba (IER), Richard Bwala (NIFFR), Seydou Coulibaly (IER), Tiemoko Coulibaly (IER), Amadou Kodio (IER), and Godfrey Nwabeze (NIFFR).

**APPENDIX : ABSTRACT OF PEER-REVIEWED PUBLICATIONS**

Mills D., Béné C, Ovie O., Tafida A., Sinaba F., Kodio A., Russell A., Andrew N., Morand P. Lemoalle J., 2009 Vulnerability in African small-scale fishing communities. *Journal of International Development* 26: 1-6

Fishing communities are often recognised as being amongst the poorest in developing countries, and interventions targeted at improving resource status seen as central in the fight against poverty. A series of field assessments focusing on vulnerability conducted in two communities in Mali and Nigeria revealed some counterintuitive results. Despite fishing being the primary livelihood, vulnerabilities relating directly to the state of the resource were ranked lower than those relating to basic human needs. Those results challenge the conventional view and suggest that non-sectoral interventions can have more effective impacts on the livelihood of those communities than interventions targeting the resources.

Morand P., Kodio A., Sinaba F., Andrew N., Lemoalle J. and Béné C. Will African floodplain fishers be able to adapt to hydroclimatic change? A forward vulnerability analysis from the Niger Inner Delta case study. submitted

In this paper, we examine the ways Sahelian floodplain fishers have adapted to the major environmental changes that have affected the region in the last 2 decades. For this we use data from the Central Delta of Niger. The analysis shows that fishers are highly sensitive to changes in the hydro-climate conditions of the delta but that they are remarkably limited in terms of potential way to mitigate the impacts of these changes. For the fish-dependent households who have adopted a diversified livelihood and are also engaged in farming (fisher-farmers), a close analysis reveals that the high seasonality characterizing their various activities and in particular the specific period of these activities during the season does not offer any flexibility. For the other major group of fishers –those who have adopted a more specialized strategy and migrate–, the situation is not necessary better as the high density of the population in the delta reduces drastically the possibility to find any new migration routes. In sum, although migration and diversification are often presented in the literature as strategies adopted by households or individuals to reduce their vulnerability, this analysis demonstrates that in the case of fish-dependent population in the Central Delta of Niger, these strategies alone will not be sufficient to help the communities to face the increasing constraints associated with the coming changes in hydro-climate conditions.