

Preliminary assessment of Lake Ntomba fisheries

C. Béné, R. Brummett, G. Bungubetshi and A. Gordon



commissioned by the
World Wide Fund for Nature - DRC

September 2007

Fish for All

WorldFish Center is a
FUTURE™
HARVEST
Center supported
by the CGIAR

For further information, contact
Dr. Christophe Béné
WorldFish Center
Africa and West Asia Programme
PO Box 1261 Maadi 11728
Cairo - Egypt
Tel: + 202 2736 4114 (ext. 109)
Fax: + 202 2736 4112

List of abbreviations

CARPE	: Central African Regional Program for the Environment (USAID)
CLIFS	: Congo Livelihood Improvement and Food Security Project
CF	: Congolese Franc
DRC	: Democratic Republic of Congo
FAO	: Food and Agriculture Organization of the United Nations
FY	: Fiscal (financial) year
IFAD	: International Fund for Agricultural Development
IRM	: Innovative Resource Management
LTL	: Lake Télé-Lake Ntomba Landscape
NGO	: Non-Governmental Organization
PACT	: Building Capacity Worldwide Network Global Organization
PO	: Professional Organisations
PRAPE	: Programme de Relance Agricole dans la Province de l'Equateur
RoC	: Republic of Congo
SIGPL	: Système Intégré de Gestion des Pêcheries Locales du fleuve Congo et du lac Ntomba
USAID	: US Agency for International Aid
WCS	: Wildlife Conservation Society
WWF	: World Wide Fund for Nature

Acknowledgments

This research was funded by the World Wide Fund for Nature – DRC Offices, and the WorldFish Center – Regional Offices for Africa and West Asia, under the Central African Regional Program for the Environment (USAID). We are also grateful to the WWF local staff for their logistic support during the field work and the fisherfolk of villages around Lake Ntomba for sharing their time and views.

Photo credit:

Photos 1 and 2: G. Bungubetshi - Photo 3: R. Brummett - Cover page: C Béné.

Content

EXECUTIVE SUMMARY	4
INTRODUCTION AND BACKGROUND.....	5
LAKE NTOMBA – PRELIMINARY INFORMATION.....	7
ISSUES, NARRATIVES AND HYPOTHESES	7
Bush meat versus fish.....	7
Decline of Lake Ntomba stock?	8
Mbandaka as a nodal fish market for the region	8
Past and present interventions in the landscape.....	9
METHODS	10
RESULTS.....	11
Livelihood strategies of the Lake Ntomba’s populations.....	11
Fishing activities: food security and income-generation.....	12
Fish marketing.....	12
Participatory assessment of the fisheries	14
Access to the Fishery & Conflict Resolution	15
Impact and effect of other interventions.....	16
CONCLUSIONS	17
Importance of fisheries in the livelihoods of the local population.....	17
Low productivity, marginal profit and consequence for future activities.....	17
Uncertainty regarding the resource status and the impact of the fishery	18
Relation bush-meat – fisheries: an urgent need for further investigation.....	18
The need to consider the landscape as part of a larger ‘picture’	18
Lessons from the previous projects: a lack of incentive, not a lack of capacity.....	19
The critical role of transportation	19
The market system, a key-element of the sector	19
PROPOSED ACTIONS UNDER CARPE II.....	20
REFERENCES.....	22
ANNEXES.....	23
Annex 1. Checklist of issues covered	23
Annex 2. General ethnographic information	24
Annex 3. Description of the fishery.....	25
Annex 4. Organization & external assistance to the fishing sector	29

Executive summary

In May 2007, a WorldFish team traveled to the Lake Télé-Lake Ntomba Landscape in the Democratic Republic of Congo to conduct a preliminary assessment of the Lake Ntomba fishery. Primary data were collected through rapid rural assessment techniques in seven villages. Three questionnaires were delivered simultaneously in each village, focusing on (a) the fishing activities and fish resources, (b) the farming and other non-farming activities, and (c) the overall socio-economic and institutional context of the villages. In addition, five markets were visited, four in Mbandaka and one in Kinshasa.

The information on the socio-economic and institutional context highlights the high geographical isolation of the area: absence of basic infrastructure (road, electricity) and minimum access to health services. Data indicate that at the village level, the population can be divided into 3 main groups: the full-time fishers, the fishing-farming households, and the full-time farmers. In total more than two third of the local population is involved in fish-related activities (either full-time or seasonal fishing, fish processing or trading). The large majority of the farming households engage in multi-culture systems, growing simultaneously several crops on the same plots. Little hunting activity seems to take place in the areas immediately surrounding the lake.

According to the fisherfolk interviewed, the core issue in the fishery is the lack of capitalization. Fishers lack individual capital to acquire or renew their fishing gear, while the processors lack capital to access processing inputs or to improve the quality of the product through technical innovation. Product quality and associated post-harvest losses are a major constraint. Losses in biomass due to over-smoking, under-salting, mould and insect infestation of the order of 30-40% are widely reported. Most fish destined for commercial markets are transported by pirogue or baleinière for sale in the main ports of the local towns and Kinshasa. Discussions also reveal that a number of legal and illegal taxes are imposed by different institutions along the fish marketing chain.

In the recent past, a series of field research, interventions and capacity-building activities has been implemented in the area by various NGOs. A large part of these programmes focused on the organisation of the local populations into fishing associations and local fishing management committees. Interviews revealed however that very few if any of these associations are still operational. Reasons for these failures are explored and discussed in the report.

Drawing upon these different findings, suggestions for future interventions are made. A first series of activities should focus on fish commercialisation, with the objective to increase the value of the fish products through improved marketing. Included should also be activities addressing the issue of (lack of) micro-finance systems. It is proposed that a second component should aim at establishing sustainable community-based monitoring systems in different pilot sites with the objective to monitor and assess the status and trend of the resource in relation to local fishing effort and the potential risk of overfishing. In parallel with these activities, it would be useful to investigate the bush-meat / fish relationship in a more comprehensive and rigorous manner. For this, a careful survey including quantitative household elements and qualitative investigation of key issues would be required to explore the exploitation, consumption and trade of these two products.

Introduction and background

The Lake Télé-Lake Ntomba Landscape (LTL) is situated at the heart of the Congo basin region. It extends over more than 126,000 km² at the border between the Republic of Congo (RoC) and the Democratic Republic of Congo (DRC) including the Lake Télé in RoC and the lakes Ntomba and Mai-Ndombé in DRC (**Map 1**).

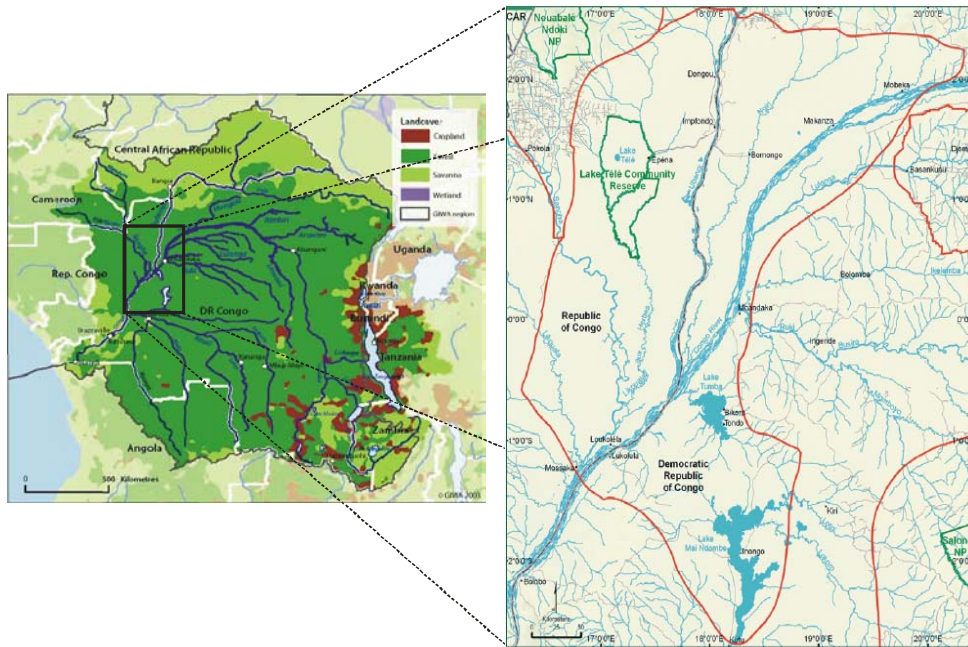
From a biodiversity point of view, in addition to large populations of primates and four main species of mammals, fish is particularly important in LTL with over 80 species identified in DRC and 50 in RoC components. This fish faunal diversity, however, is not solely an indicator of biodiversity, but is the foundation of the livelihoods of most communities. Studies for instance indicate that people in LTL rely on fish (91%) and bush-meat (7%) for most of their protein requirements and more than 85% of people obtain their living directly from natural resources (Poulsen and Clarke 2002, Luyinduladio 2004). Unfortunately, endemic poverty of the local population, limited government capacity to plan and manage natural resources, increasing commercialization, war and civil conflict, poor food security and few livelihood alternatives have led to the emergence of unsustainable exploitation of the natural resources in the landscape.

The LTL consortium, led by WCS and WWF and funded by the CARPE programme, has undertaken to address the issue of unsustainable use of natural resources and erosion of biodiversity. It articulates this need around 3 main threats, which are perceived as important: (i) habitat loss through commercial and artisanal logging; (ii) unsustainable subsistence and commercial hunting; and (iii) over-fishing and lack of management of fisheries. The WorldFish Center, as a partner of the consortium, will focus on the aquatic resources of the landscape and their use by the local populations. This essentially concerns the fishing activities that take place along the rivers and their tributaries (including the Congo River) and on lakes Ntomba and Mai-Ndombe in DRC.

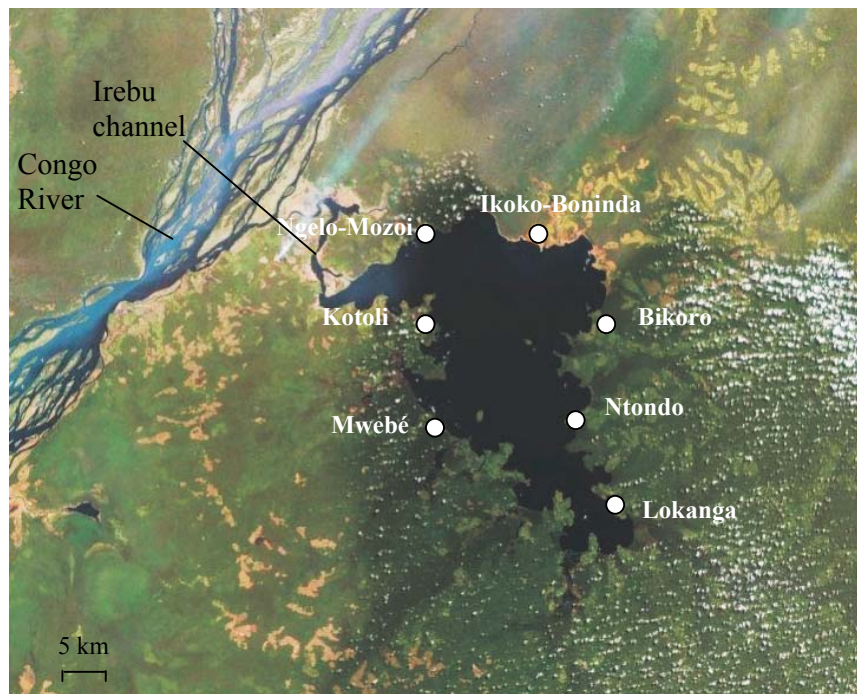
In May 2007, a WorldFish team comprising three researchers (Dr Randy Brummett – fisheries scientist, Dr Chris Béné – fisheries socio-economist and Guy Bungubetshi – natural resources management and fisheries post-harvest expert) traveled to the landscape with one staff member from the NGO PACT and one from the office of WWF-DRC. The logistical support was provided by WWF-DRC. The objective of this field visit was “*to conduct a preliminary assessment of Lake Ntomba to characterise and categorise fisheries and identify the main constraints and opportunities to improve management*”. The research was supported by a literature review by Maryline Revaud (Revaud 2007a) and planning and write-up inputs from the Regional Director for West and Central Africa, Dr. Ann Gordon.

The field visit reported here represents the first of three proposed preliminary analyses concerning fisheries in the landscape. The others will focus on Lac Mai-Ndombe and a stretch of the Congo River yet to be identified¹. The present document summarizes the main results of the team from its visit and, on the basis of this assessment, proposes activities and

¹ Ideally, the river stretch would be somewhere that generates more information of relevance to Lac Ntomba and Lac Mai-Ndombe, such as a point downstream of one or both these lakes, where more information on marketing can be collected. Additionally, if the three sites are completely separate, requiring completely separate access for field studies, the amount of detailed work that can be undertaken within the planned budgets would be limited.



Map 1. The Lake Télé-Lake Ntomba Landscape in Democratic Republic of Congo.
Source: GIWA and CARPE.



Map 2. Lake Ntomba and the seven villages surveyed (background map: Google Earth).

interventions for implementation in the remaining four years of the CARPE programme (Phase II) in the LTL².

² As such this report represents the full completion of the Lake Télé-Lake Ntomba Landscape CARPE II contracted output No.1 “Conduct preliminary assessment of Lac Tumba to characterize and categorize fisheries and identify main constraints and opportunities to improve management” for FY06, as well as the 25% completion of outputs No.2 “Conduct preliminary assessment of fish marketing system” and No.3 “Initiate

Lake Ntomba – preliminary information

Lake Ntomba is a shallow and flat-bottomed lake of 765 km², averaging less than 5 m depth with a maximum depth of approximately 10 m along the western shore. It is linked to the Congo River through the (Map 2). The terrain is heavily laterized. The water is dark, stained by tannins flushing in from the surrounding swamp forest. Also coming in from the watershed is a large amount of pulverized organic matter that washes up on the shore during high winds. Surface waters during our visit in May were rather warm, between 25-30 degrees within the upper 50 cm.

Thirty one villages are located on the shores or in the close proximities of the lake, with village population ranging from 500 to 11,000 (Inogwabini and Lingopa 2006). The overall population living around the lake is thought to be around 50,000 to 60,000 people. The Lake is divided between two administrative units, Motaka (in the South) and Bonginda (in the North) representing traditional divisions between tribes more involved in agriculture (Motaka) and fishing (Bonginda). Lake Ntomba was a high-priority fishery for the Government of DRC's 1987 national fishery development plan (Anon 1987). The objective of this plan was to increase fish supplies in local markets in the area up to 12 kg/per/yr from the 1983 estimate of 8.5 kg and if possible export to under-supplied markets in Kinshasa and Bas Congo. Under the plan, fishing communities were supposed to benefit from training, research and the provision of various services aimed primarily at the alleviation of gear shortages and improvements in fish processing, storage and marketing. At the last census in 1983, there were approximately 20,000 fishing families in the lake basin producing about 30,000 tonnes per year. The anticipated annual catch from the lake under the plan was 135,000 tons per year, a number that seems implausibly high, considering the high clarity of the water and apparent lack of primary productivity despite high temperate, light and organic matter loading. Moreover, based on the lake surface, Crul's relation³ predicts that the annual catch of Lake Ntomba should be around of 4020 t only.

Issues, narratives and hypotheses

A certain number of issues and/or assumptions, often articulated in the form of narratives or discourses, were identified from the literature review or from the formal and informal interviews that were conducted with the main actors involved in the management or use of the LTL resources.

Bush meat versus fish

One of the most predominant narratives found in the current literature that is of broad interest for us is the interaction that is assumed to exist between bush meat and fish. Broadly, the

development of pilot sites for implementation of decentralised fisheries management systems to address overfishing of lake resources by local population", in accordance with the revised Workplan Matrix for the Semi Annual Report (version 20 July 2007). The checklist of issues to be covered in this part of the work is provided in Annex 1. During pre-trip briefings in Kinshasa, Bila Inogwabini (leading the WWF DRC component of the landscape) indicated that his main areas of interest were: fishing methods, identification of stakeholder interests and fisheries management.

³ Based on data from 46 African lakes, Crul proposed the following predictive correlation between lake surface and catch: $Catch = 8.93 (\text{lake area, km}^2)^{0.92}$ ($R^2 = 0.93$) (Crul 1992).

assumption is that fish and bush meats are substitutes and that when one declines, people reallocate their effort to the other. The LTL Technical Document for instance states that:

“During the high water season when fishing becomes unproductive, many people rely on wildlife hunting for protein” (Anon 2006 p.15)

This narrative is obviously not specific to the LTL, nor to the Congo Basin. In fact articles have been published recently (for instance in the international journal *Science*) about this issue, based on West Africa and in particular Ghana (Brashares et al. 2004). Rarely, however, is the relationship between bush meat and fish explored thoroughly⁴, which may lead to too simplistic an interpretation and inappropriate intervention proposals. It is, for instance, crucial to distinguish the two fundamental functions that bush meat and fish play: cash-crop and food-crop, and to recognize that those operate at two different levels: the household and the market levels (Revaud 2007b). Moreover, when their potential as substitutes is explored, the role of each in markets/consumption and in livelihoods must be considered. Pending a better understanding of the different roles that both wild life and fish play in food security and the local economy, it is not possible to make any evidence-based proposal on how fish could contribute to a decline in hunting.

Decline of Lake Ntomba stock?

The second hypothesis which is abundantly reiterated in the literature is the claim that the resource of Lake Ntomba is declining:

“Initial analysis of the ongoing fish study, replicating FAO’s sampling methods, indicates that fishing has reduced Lac Ntomba fish stocks to 53% of 1984 levels with local extinction of some species since 1986” (Anon 2006, p.13)

If it was indeed the case that the resource has declined, it would still remain to be demonstrated that this is the result of the fishing pressure. Unfortunately there has been no rigorous assessment so far of the fishing effort in the landscape and how this effort relates to the resource level. Literature from other part of the Africa and the rest of the World tend to indicate that variations in lake, swamp and river fish stocks are more often the result of environmental changes than fishing pressure (Welcomme 1989, Junk et al. 1989, Kolding and van Zweiten 2006). In effect inland fish are extremely resilient to fishing pressure and it takes a great deal of effort to deplete a river or an open lake like Lake Ntomba. As will be discussed below, some caution is needed before concluding that fishing pressure by the local population is the cause of the still-to-be-demonstrated decline in the stock.

Mbandaka as a nodal fish market for the region

The third important hypothesis that influenced our visit planning was the view that Mbandaka –due to its strategic geographical location at the centre of the region and along the Congo river– is a ‘nodal market’ for fish products, attracting a large part of the fish caught in at least 3 landscapes in the vicinity: the Salonga landscape, the Maringa landscape and the LTL. The team had therefore structured the visit to spend some time in Mbandaka in order to visit some of the local markets, hoping to collect preliminary information about this economic

⁴ One recent exception is Wilkie et al. (2005).

dimension of the fishing activity⁵. The reality however did not confirm this hypothesis. Very little activity was observed in the various local markets that were visited in Mbandaka during the fieldwork. Two possible reasons can be advanced to explain this. The first one is that the visit took place in May, which is during the low season for fishing activity. Usually only few fish are caught and marketed during that period. If this is the case, the volume of transaction observed during this visit may not reflect the real importance of Mbandaka as a nodal market and this hypothesis still needs to be effectively assessed. Alternatively, the initial assumption may be wrong and the majority of the fish trade that takes place in the region is routed through other markets. This is what was reported by the fishers around the lake. In either case, this implies that a more thorough market analysis is necessary.

Past and present interventions in the landscape

As will be re-discussed below, the fact that the LTL has been –and is still– the object of several development interventions in the fishing sector is a critical element to bear in mind as these interventions have shaped the general environment within which the current programme will develop. Two of these interventions are of specific importance. First, the NGO Innovative Resource Management (IRM) implemented a series of field research, interventions and capacity-building activities essentially through two programmes: CLIFS (Congo Livelihood Improvement and Food Security Project) and SIGPL (Système Intégré de Gestion des Pêcheries Locales du fleuve Congo et du lac Ntomba). A large part of the activities⁶ of these programmes focused on the organisation of the local populations into fishing associations and local fishing management committees. The objective was to make these associations benefit from various capacity-building activities and training through workshops and technical supports in domains such as fish processing and financial micro-enterprise management. In return for these capacity-building activities, the members of the cooperatives were expected to adopt and enforce fishing regulations and sustainable uses of aquatic resources (CLIFS 2005).

The second main programme operating in the region is the current IFAD/Belgian-funded project PRAPE (Programme de Relance Agricole dans la Province de l'Equateur) initiated in 2005. To some extent, this programme presents some similarities with the IRM activities in the sense that a large part of its fisheries component⁷ has so far been in organizing the fisher communities into POs (Professional Organisations) at the local level. The members of these POs are then to benefit from capacity-building activities in financial management and from the creation of micro-finance institutions. Additionally, the interventions includes the distribution of fishing inputs (to start in June 2007, on credit) as well as construction of markets and storage facilities, along with landing facilities in Mbandaka (in one unique site), to improve fish commercialisation (Kalibu Mino Kahozi, head of the PRAPE fish component, pers. comm. May 2007).

⁵ See Methodology section below.

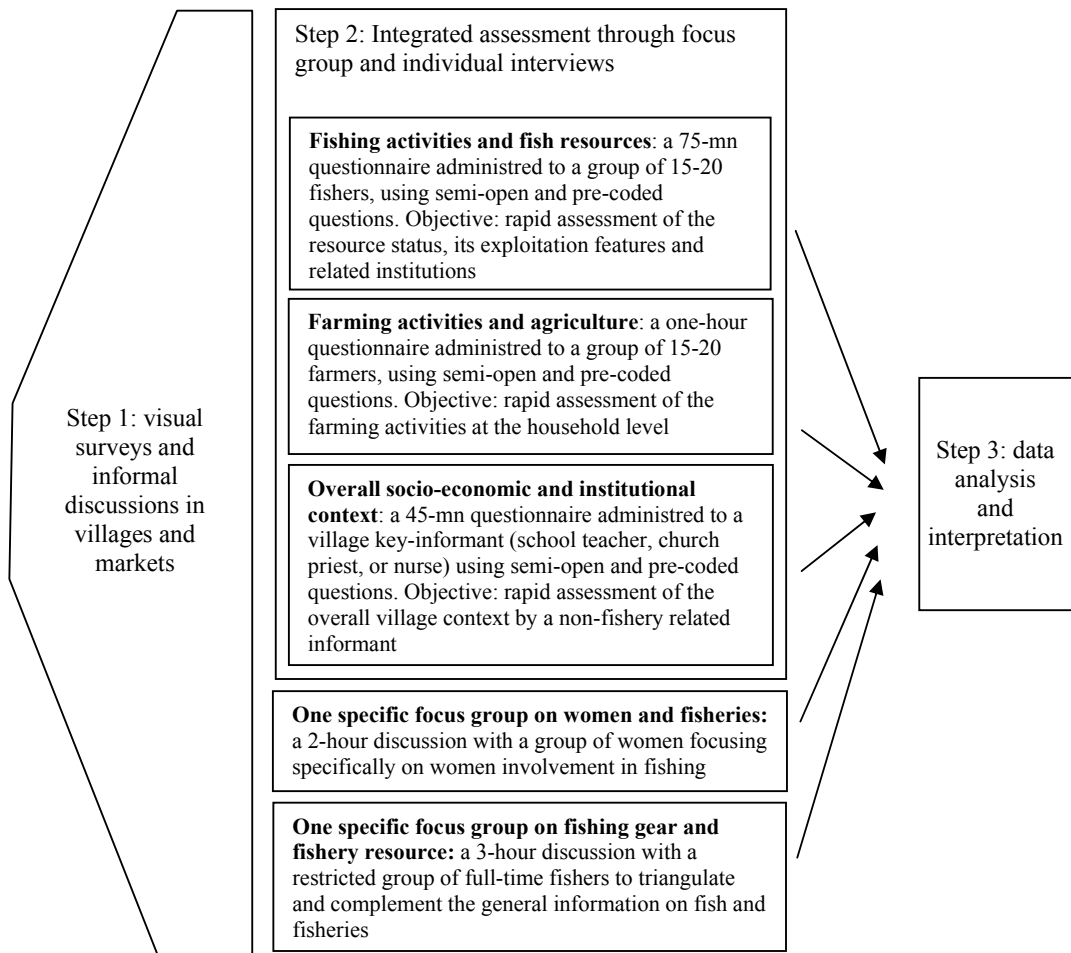
⁶ Prior to IRM's interventions, the Food and Agriculture Organization of the United Nations (FAO) came in shortly after the 1996-2001 wars to provide relief in the form of free fishing gear to some, but not all, villages. According to the fishers interviewed during this field visit, the number of nets distributed was insufficient but for those villages who received these nets this contribution helped sustain the population through some very difficult times.

⁷ In addition to the fisheries component, 2 other components are included in the PRAPE: one Agriculture component, and one Social component.

Methods

Primary data were collected through visual survey and informal discussion conducted in Kinshasa, Mbandaka and several villages around the lake. In addition, five markets were visited, four in Mbandaka and one in Kinshasa. The largest part of the information and data, however, was collected through a series of planned focus-groups and key-informant interviews conducted in seven villages located on the lake shoreline (see Map.2 above and Table A1 in Annex 2 for details). Three questionnaires were delivered simultaneously in each village, each covering different aspects of the livelihoods of the communities, namely: (a) the fishing activities and fish resources, (b) the farming and other non-farming activities, and (c) the overall socio-economic and institutional context of the villages around the lake. In addition, a meeting was organised in one village with a group of four women focusing specifically on women’s involvement in fishing, and another with a group of 6 ‘professional’ fishers to refine and triangulate the information obtained during the more general focus groups on fishing activities and fish resources.

Fig.1. Methodology used for the rapid appraisal of the farming-fishing communities of Lake Ntomba.



Results

Livelihood strategies of the Lake Ntomba's populations

The questionnaire on the socio-economic and institutional context indicates that the whole area suffers a severe absence of basic infrastructure (no electricity power in the entire area around the lake and minimum access to health services). In fact, due to the extremely bad condition of the only road connecting Bikoro to Mbandaka, the area has remained geographically and economically isolated. The road is now being renovated but the majority of the villages around the lake will remain isolated as they can be reached only by boat.

The local economy around the lake largely reflects this geographical isolation. The demand for farming labour has totally collapsed after all the large exploitation units (palm-oil, cacao, coffee, rubber plantations) which used to provide the main source of wage-labour shut down shortly after the Zairianisation in 1973. The cessation of these economic activities, coupled with the decline in supply of manufactured products and basic necessities due to the degradation of the road and fluvial network contributed to reduced trade, exacerbating further the isolation of the area. This combination of factors led the local economy to gradually revert to a trade system mainly based on barter, local exchange and agricultural subsistence.

In terms of livelihood strategies, the field study data indicate no major contradiction with other recent literature describing the rural communities living in the Equator Province (e.g. Colom 2006). The large majority of the farming households engage in multi-culture systems, growing simultaneously several crops on the same plots. Cassava and maize are the principal crops in the area. The other crops are sweet potatoes, groundnuts, plantains and leafy vegetables. Agricultural work is hard and very labour intensive, motivating people to work frequently in groups. This is a major difference with fishing which is essentially an individual activity –except for women (see below).

At the village level, the population can be divided into 3 main groups: the full-time fishers, the fishing-farming households, and the full-time farmers. Based on the estimates obtained from the interviews, the full-time fishers represent 44% of the local population, the full-time farmers 33%, and the fishing farmers 23%. In total this is therefore more than two third of the local population which is involved in fishing (either full-time or seasonal)⁸. The data indicate that for the totality of the farming and/or fishing population around the lake, the living conditions in the area are difficult. Productivity is very low in both farming and fishing activities and profits are marginal. As one woman in a focus group put it: “we work for nothing”.

A final important point in this overall description is that, unlike some other parts of the landscape or other regions in the basin, little hunting activity seems to take place in the areas immediately surrounding the lake, and virtually no participation in the bush-meat trade is reported by these communities⁹.

⁸ These figures diverge slightly from those obtained from the fishers groups (see Table 2 in subsequent section) where the data indicate an even higher percentage of households depending on fish and fish related activities.

⁹ See however comment in conclusion p.18

Fishing activities: food security and income-generation

Fishing is not practised all year round with the same intensity. The main fishing periods are the ‘short’ and ‘long’ dry seasons (respectively January to March, and July to September), although a few households also engage in fishing during the rainy season (October - December).

Fishing (like farming) involves both men and women. However, fishing activities tend to be strongly gender-specific: men engage individually in fishing, using mainly baited hooks and various types of nets that they operate from their boat, and traps on the lakeshore and tributaries around the lake, while women fish collectively using a traditional method called *écopage*¹⁰.

The principal objective of the women fishing is household food security, but some surplus is sold to neighbors or local markets. In contrast, most of the men’s catch is sold to generate cash-income. Recent data from another landscape (Salonga) indicates that on average fishing there generates more than 67% of the total household cash-income (Colom 2006).

Fish marketing

Most fish destined for commercial markets are transported by pirogue or *baleinière* (motorized freight boat, **Photo 1**) for sale in the main ports of Bikoro, Irebu, Ngombe, Lilanga (RoC) and Kinshasa where they are generally sold through one or more traders (**Photo 2**).



Photo 1 (above). A *baleinière* shipping freight on the Congo river.



Photo 2 (right). Women traders selling fish at the Bolodjua market (Mbandaka).

¹⁰ This technique consists in blocking the small tributaries and ponds bordering the lakeshore and the tributaries then ‘scooping’ them, using basket-traps called locally *eboko*.



Photo 3. A suzuki (bottom) and a pannier (top) of smoked fish destined for market



Valise of smoked mungusu (*Parachanna* sp)

Locally important are sales to households in Bikoro, to local villages that do not have their own lake access and to itinerant traders passing from village to village to collect fish for transfer to markets to the south. Occasionally, fish find their way to rather distant markets in Kikwit (Bandundu), Tshikapa (Kasai) or even Tembo on the Angolan frontier. None of the fishers mentioned selling into Mbandaka, citing the condition of the road and lack of vehicles as main reasons. Moreover, Lac Tumba is downstream of Mbandaka; as the main markets are to the south (i.e., downstream), fishers and traders are unlikely to expend time, effort and cost transporting fish upstream for any significant distance.

Product quality and associated post-harvest losses are a major constraint to improved revenues. Losses in biomass due to over-smoking, under-salting, mould and insect infestation of the order of 30-40% are widely reported. In addition, prices for low-quality products in the market are about 25% less than for well-smoked or well-salted fish. Substantial increases in revenue might thus be expected from improved processing.

Within the value chain, women play a major role in post-harvest processing (smoking and salting) and trading. The highest value product is salted tilapia, which are mostly transported to Kinshasa in sacks. In Bikoro the sale of fresh fish is much higher than in other villages around the lake. Selling prices were however difficult to specify as there is a wide range of units and sizes of parcel in which fish are transported and sold including: valise, basket, suzuki, sacks (**Photo 3**). Most important may be the differences in price obtained by fish sold in Bikoro versus Kinshasa¹¹.

¹¹ For instance, retail prices cited for a “valise” sold in Bikoro ranged between CF 2000 and 3000 depending upon size species and condition, while in Kinshasa the same unit would sell for CF 8000 – 11,000.

Costs of transport to Kinshasa can be considerable, the typical baleinière charging 10,000 CF per person and between 3,000 and 10,000 CF per cargo load depending upon size. When selling within the lake basin, fishers themselves do their own marketing. When fish are taken to Kinshasa, the typical practice is to employ a spouse, sibling or trusted friend to do the marketing. A number of legal and illegal taxes are imposed along the fish marketing chain (see **Box 1**).

Box 1. Legal and illegal fish taxes

In Bikoro, fish retailers operating in the local market are charged 50 CF per day by the market manager (Service des Affaires Economiques), while those taking a baleinière to Kinshasa pay approximately 500 CF/valise to the Service de l'Environnement. On land, en route to Kinshasa, a "ration des militaires" (the "soldiers' share") is reported to be charged at each roadblock in the amount of 100 to 1000 CF per person per stop. In Kinshasa, an illegal "unloading fee" of CF 2000 - 10,000 per unit (typically the valise) and up to CF 50,000 for a large suzuki is allegedly charged in addition to a variable, also illegal, fee paid to the port police of CF 100-1000 (sometimes reaching 5,000 CF), depending upon how much cargo the seller has and the skill of the trader in arguing his or her case.

Observations of the fish being sold in Mbandaka seem to indicate that, with the exception of the most vulnerable of the top carnivores (e.g., tigerfish), the stock in the Congo River itself is relatively healthy. Very large specimens of catfish and *Distichodus* are common, probably the result of few fishers having access to the larger and more robust gears needed to thoroughly exploit the fishery, leaving refugia from where larger, more fecund individuals can reproduce to ensure the sustainability of the harvest.

Participatory assessment of the fisheries

Table 1 summarises the main problems as perceived by the different groups of fishers interviewed during the field visit. According to these focus-groups the core issue is the lack of capitalization of the sector. Fishers lack individual capital to acquire or renew their fishing gear, while the processors lack capital to access processing inputs (e.g. salt) or to improve the quality of the product through technical innovation.

Table 1. Perceived problems in the commercial fishery of Lake Ntomba

Production Stage	Problems Mentioned by Fishers
Fishing gear & Equipment	Too expensive relative to income, refusal of traders to give gear on credit, irregular supply, "tracasserie" (hassle).
Fishing	Declining catches, bad weather, theft of fishing gear, limited access (due to lack of boat motors), floating plant mats interfere with gear placement, active gears damaging passive gears (lack of cooperation among fishers), hippos.
Preservation & storage	Lack and high cost of salt, poor smoking technology, general lack of technological expertise.
Marketing	Price and scarcity of transport, exposure of goods (and loss of quality) to weather and water during transport, too many middlemen, "tracasserie", lack of market knowledge (retail prices).

The groups also reported that catches have been steadily declining over the recent past and it was suggested that the neglect of traditional regulations (such as closed seasons or protection of spawning grounds) could partly explain this decline. In fact the interviews revealed that fishers had been sensitized to a large degree by the IRM's SIGPL programme and other similar initiatives by local conservation NGOs to the dangers of certain practices and fishing

methods¹² and claimed that these could be another possible reason for the observed decline in local catches.

Despite this awareness, many fishers admitted that they use these destructive gears frequently, explaining that poverty rendered them financially unable to eschew the short-term increases in individual catch generated by the use of destructive gears in favour of longer term increases in fish abundance and average size obtainable through enforced gear restrictions.

Also cited as possible causes of the alleged decline in the resource were an increase in the number of fishers, and two serious and seemingly destructive (of fish habitat) floods, followed by droughts in 1960 and 1972. “Climate change” perceived as a possible source of increased instability and irregularity in the traditional wet and dry seasons was also mentioned, as was a periodic release of hydrocarbon from unknown sources (spillage from some transport activity?) that fishers observed as having a negative effect on fishing. This latter phenomenon has also been reported from Lake Mai-Ndombe.

It is worth noting that from the rapid resource assessment data obtained during the field visit (see Table A4 in Annex 3) the relationship between maximum and typical sizes of fish in the catch seems to indicate that stocks of the most frequently harvested species are generally stable, contradicting –or at least downplaying– the local fishers’ claims that the fisheries resources are declining. Nevertheless, casual observation and the testimony of fishers suggest that some species, including top carnivores such as the once-common tigerfish (*Hydrocynus goliath*) have virtually disappeared from the ecosystem. If, in fact, the abundance of these top carnivores has drastically declined, one would expect a greater abundance of forage species (e.g., tilapias), with quite possibly an associated reduction in the value of the catch (as the market prices of lower trophic level fish are usually observed to be lower than those of species (predators) higher in the chain). This relationship between trophic level and revenues might be a relevant area for future research.

Access to the Fishery & Conflict Resolution

The fishery is generally open-access with few constraints, including across the Motaka/Bonginda administrative divide. In four villages, no limits at all were reported. In Ikoko-Bonginda and Kotoli, permission from the chief is required. In Ikoko-Bonginda, there is a small fee payable based on the catch. Only in Mwébé, is formal permission in writing required for outsiders to fish and a time limit set on the period for which the permission is valid; also a fee payable to the chief is mandatory. It may be worth noting that only in Mwébé was the chief treated with any special respect, appearing in his feathered head-dress and traditional fly whisk to supervise the administration of the questionnaire.

This open access is not the case in the affluent rivers, where traditional access is strictly enforced. In general the traditional limits of each villages fishing access rights are well-known among all communities and fishers, but are generally not respected and no effort is made to enforce them. Once fishers from outside have received the permission of the chief to fish in the villages traditional waters, this permission is recognized throughout the lake basin.

¹² Such as: damming of small streams; use of mosquito nets and Lifumba nets and use of “Lokala ya Bikoko” nets (lifumba is an active fishing gear which scrapes the substrate and allegedly disrupts feeding and reproductive behaviours).

There is no formal system for conflict resolution, including the intervention of the existing fishing associations (see below). In general, disputes that cannot be resolved amicably are taken to the chief of the village in whose traditional waters the infraction or dispute occurred. If this is not sufficient, the police are called in.

All villages reported consistent and serious declines in the fishery over recent years. This, however, seems to have created no new additional tensions among fishers, although thievery of fishing gears, especially nets, is reportedly high.

When asked why some fisher caught more fish than others, interviewees most often cited possession of more fishing gear and better technical mastery of fishing as reasons. In Ntondo, fishers mentioned black magic as a possible cause, while in Bikoro, some fishers were accused of using destructive fishing techniques and thus catching more fish than those who respected the “rules”. Nevertheless, there was no particular conflict mentioned as being in reaction to these differences.

Impact and effect of other interventions

As mentioned earlier, IRM has been very active in the Lake area in the past 5 years. In each of the 31 villages surrounding the lake, fishing associations have been created as part of the SIGPL activities with the objective that these associations would help develop the coordination capacities of these local fishing communities (Annex 4). Interviews with the fisher groups revealed however the relatively poor effectiveness of these associations. First, although present in all villages around the lake, the associations currently represent a very small minority of the fisher population (**Table 2**).

Table 2. Population and fishing association representation in 7 Lake Ntondo villages.

Village	Population*	Fishing Households*	Fishing Ass'n Members	Fishing Households in Ass'n
Ntondo	4300	75%	32	0.1%
Bikoro	12,000	50%	40	0.7%
Ikoko-Bonginda		80%	30	
Ngele-Monzoi	1800	90%	27	1.7%
Kotoli	450	85%	11	2.9%
Mwebé	3500	100%	20	0.6%
Lokanga	815	80%	49	7.5%
Total (average)		81%	29	2.6%

* estimated during the group interviews – does not distinguish between full-time and part-time fishers

Second, although in existence for more than 4 years (as of May 2007), interviews revealed that these fishing associations have generally failed to generate any tangible activities or to be able to establish any funding mechanisms.

The causes for this relatively poor outcome are probably complex. From discussion with the fishers, however, two main reasons came out clearly. One is the requirement that individual fishers, to be able to benefit from the project’s activities, should agree to use only non-destructive fishing techniques and fully comply with fishing regulations. This requirement

was perceived by many as too restrictive and constraining¹³ while, at the same time the benefits ensuing from their engagement were not tangible enough -often limited to capacity-building workshops. Two, the perception amongst the fishers that the amount of benefits and external support potentially gained from belonging to the association was to be broadly inversely proportional to the number of members of the association: thus the view that the smaller the number of members, the more benefits each of them would receive. The members therefore perceived a strong incentive to restrict access to the association to a limited number of fishers.

In reality, there are a limited number of practical options for intervention by external stakeholders. Without enforcement capacity, it is quite clear that direct management of the fishery is not an option. To restore the confidence of the fishers in the necessity of working in groups to better manage the fish resource, interventions with clear and tangible benefits accruing to the participants are needed. Reducing post harvest losses might be one such area where short-term gains could be made and could be linked to the collection of basic data on the catch per unit of effort for key species.

Ultimately, to assess the usefulness and potential cost-benefit ratios of various management approaches, comparison with catches among a range of fisheries is necessary. Coupled with a stock assessment (see below) a sociological comparison with, for example, the reportedly “better-managed” Lake Mai-Ndombe might yield research results that would be of not only local, but global interest within the fisheries management community.

Conclusions

Drawing upon the information summarised above, a series of conclusions can be proposed.

Importance of fisheries in the livelihoods of the local population

Evidence was generated through the questionnaires and rapid assessment that highlights the central role played by fishing activities in the livelihoods of the local population. Based on the data, it turns out that between two thirds and 80% of the population living on the shores of the lake is directly dependent on fishing and/or fishing-related activities (such as fish processing and fish trading). While the majority of the other household activities –agriculture and collection of non-timber forest products- are based on the subsistence economy and/or generate little cash-income, fishing and fish trading represent two of the main sources of daily cash-income for the local population. Fishing plays therefore a crucial role in the local economy, both at household- and community-level. As such, it offers a potentially important avenue for economic development that would help relieve pressure on forest resources.

Low productivity, marginal profit and consequence for future activities

The level of poverty of the population around the lake is very high and the geographical and economic isolation acute. Both farming and fishing activities are characterised by extremely low productivity. In addition, institutional and financial constraints (e.g. tracasseries and high input prices) erode further the potential margin of profit of the producers, hindering

¹³ The majority of the fishers could not afford to reduce fishing effort and give up some of their most efficient gear (which are usually the prohibited and/or most destructive ones).

investment and adoption of more efficient techniques. This creates a vicious cycle of low productivity \Rightarrow low profit \Rightarrow low investment \Rightarrow lower productivity, eventually forcing the local population to fall into a classic poverty trap. At present, these extremely low-income groups have very little, if any, flexibility at all, to reduce their fishing effort. In this context, trying to impose fishing regulations that would affect their already very fragile economic survival has little chance of success and would potentially run counter to the poverty reduction objective of CARPE.

Uncertainty regarding the resource status and the impact of the fishery

Contradictory information concerning the resource has been collected during this visit. The current scientific literature is too fragmented and incomplete to offer any solid basis for a rigorous resource assessment, but direct information collected through participatory exercises (fishers' perceptions) suggests a decline in the resource. In contrast, information deduced indirectly (though the comparison of fish average size versus maximum size) suggests that most the species exploited from Lake Ntomba and the surrounding water-bodies are stable.

Moreover, even if the resource were in decline, it has still to be demonstrated that this decline is due to the fishing pressure. As mentioned earlier, the general literature on inland fisheries, while recognising the risk of over-exploitation, also emphasises that in most cases, fluctuations in freshwater resources are the result of environmental changes essentially linked to water and flow conditions. In sum, very little solid information exists about the status of the Lake Ntomba's resources that could be used as the basis for a management regime. However, for the same reason, it might also be unwise to promote increased fishing effort by distributing new fishing gear (either free or even through carefully designed credit scheme), as currently proposed by some development programmes.

Relation bush-meat – fisheries: an urgent need for further investigation

The issue of bush-meat hunting and poaching is at the heart of the Congo Basin resource conservation. At the same time, a relation between bush-meat and fish is also widely postulated. The literature on this issue is however cluttered with wide generalization, oversimplifications and untested assumptions and hypotheses. If it is correct that bush-meat and fish are livelihood substitutes, this substitutability occurs in certain conditions which unfortunately are poorly understood. In the specific case of Lake Ntomba, while the local population claim stridently that they are not involved in hunting, the over-enthusiasm with which they insist in making this claim and other indirect information obtained 'off-the-record' suggest that the reality is more nuanced. Furthermore, even if there is apparently no professional poaching taking place around Lake Ntomba and the volume of bush-meat traded is less significant than in other parts of the landscape, a better understanding of the exact nature of the relationship between fish and bush-meat appears still essential to the design of appropriate and effective intervention strategies.

The need to consider the landscape as part of a larger 'picture'

The complete understanding of the various processes that drive the household economy within the LTL could only be achieved if one recognises that the origins of some of these processes are partially or totally outside the landscape. This is particularly the case for the fish trade which is for a large part driven by the evolution of market demand in Kinshasa. In a similar vein, it should also be recognised that we are not operating in a 'project-free' context.

The previous interventions implemented in the area have strongly affected the institutional landscape within which we will be operating. This induces some positive and negative effects that will need to be integrated into the planning of this current project.

Lessons from the previous projects: a lack of incentive, not a lack of capacity

The fishing associations established earlier have shown a relatively poor record in terms of completion of activities but also in terms of involvement (on average, less than 3% of enrolment rate). This failure is not related to a lack of institutional or organisational capacities, but to a lack of incentive. Fishers outside the association are reluctant to ‘tie up’ themselves to a collective institution since fishing on Lake Ntomba is essentially an individual activity for which little collective coordination is required¹⁴ (as opposed to farming activities)¹⁵. Second, these associations have been perceived as potential hindrance to free access to the resources, as, in the previous projects, membership was usually associated with constraints regarding the type of permitted fishing gear. Thirdly, the existing groups are suffering from meeting / planning ‘fatigue’ as most of the previous interventions focused on capacity building activities through participation in workshops) but very little concrete and tangible actions or direct benefits for the membership. Finally, those already in the associations have no incentive to increase the number of members as this may reduce further their individual benefits.

The need for such concrete interventions is great. Without such, it will be very difficult to realise any sustainable change in either the fish stocks or local livelihoods. The potentially large returns on investment to be gained through improved post-harvest processing and marketing might be one area where both local expertise and the existing group infrastructure could be used for a collective venture that would encourage cohesion within the community and enable more effective monitoring of the fish stocks.

The critical role of transportation

Unreliable road or fluvial transportation to regional markets (e.g. Mbandaka) and further ones (e.g. Basunkusu, Kinshasa), combined with the substantial illegal fees and tariffs imposed along the journey greatly affect local economic activities. In particular, these factors are key elements in the decision-making process regarding what activities and products take precedence over others in terms of income generation. While agricultural products can be produced in large quantities, many have a relatively low value per unit of volume. Faced with high transportation costs and risky journeys, people view fish as a better alternative than agricultural products because of its higher value per kilo/sac/basket.

The market system, a key-element of the sector

The information collected during the visit reported here has not confirmed Mbandaka’s status as a nodal market, but it is clear that an increasing quantity of fish coming from places like Lake Ntomba is marketed in different urban markets. This commercialisation trend is very likely to continue or even intensify in the near future. In fact – as is often the case for

¹⁴ For instance, no recurrent fishing conflict has been reported during the interviews (see Annex 3), although theft of fishing gear does occur.

¹⁵ In comparison, the farming associations are much more active. Our view is that the members of the fishing associations are not less capable or less educated than these farmers. They simply lack incentives.

fisheries - the demand (local, provincial, national) will soon become the major driving factor for the expansion of the sector (while supply was that driving factor when fishing was still mainly a subsistence activity). In these conditions, the market system (value chain) is a critical determinant of how added value –and thus revenues and benefits- can be created and how these benefits are distributed along the chain. At the present time, however, the market system is characterised by many deficiencies and constraints that largely restrict and distort its dynamics. Tracasseries (“hassle”), high transaction costs, asymmetrical information, are amongst the most obvious institutional issues, but technical and economic problems (prohibitive input prices, high post-harvest losses) also severely reduce the capacity of the different actors along the value chain to generate profits.

Proposed actions under CARPE II

Based on the above conclusions, suggestions are now made on activities and interventions for implementation by CARPE (Phase II). Pending the identification of additional funding, however, it will not be possible for WorldFish Center to work with the same level of intensity in all three areas of the landscape. Some prioritization will be needed following the completion of the three preliminary analyses (1st half of FY 08). The work plans made then will need to make provision for the detailed work undertaken in some parts of the zone to be transferred to other areas by partners, where appropriate.

We propose that interventions are structured within a 2-component approach. A first phase would focus on the commercialisation of fish, including activities related to the processing and trading of fish products. The objective of this component would be *to increase the value of the fish products through improved marketing*. The second component will then focus more specifically on the production side (fishing) –see below.

Several elements justify this 2-component strategy. First, as discussed in the conclusions above, fish has high per unit value relative to other (agricultural) traded products in the landscape. By developing activities that focus first on reducing the institutional, technical and financial constraints that affect fish marketing, the proposed interventions are intended to have immediate effects on beneficiary income and well-being (i.e., poverty reduction in the landscape).

This approach also draws upon the lessons learned from the previous interventions through the fieldwork, discussions with key informants and document reviews. In particular, we recognise that any initiative that erodes the livelihoods of low-income groups (e.g., the short-term impact of a harsher fisheries management regime) would very likely face strong opposition in the fishing community, thus jeopardizing its sustainability and the potential for other subsequent interventions.

The objective of the first component (proposed to run until end of FY10) is therefore to implement activities that affect different stages of the marketing process (including e.g., processing, transport, storage, micro-finance for wholesale and retail trade) thus “spreading” the benefits to a wider groups of stakeholders, both men and women, with the idea that different actors are involved at these various stages in the fishing sector. Included in this ‘package’ will also be activities addressing the issue of (lack of) effective micro-finance systems.

It is expected that the positive effects of these different interventions will lead to improvement in the livelihood and welfare of the local population, thus creating some 'space for manoeuvre' to initiate the second component of the programme. This second phase, which will be launched shortly after end of FY09 (i.e. overlapping the last year of the first component), will be aimed *at establishing a series of sustainable community-based monitoring systems* in different pilot sites to monitor and assess the status and trend of the resource in relation to local fishing effort and the potential risk of overfishing. The objective will be to generate through these monitoring systems operated by, and at, the community level the information necessary for a more comprehensive management plan. This will include data on fish capture, fishing techniques and the establishment of freshwater biodiversity indexes. With the cooperation of the fishing community, creel surveys and similar tools can be employed to assess basic trends in the key species. A more thorough study of fish stock structure would involve a two-step process of evaluating gear selectivity and then using regular sampling to determine the actual size and species composition of the fish fauna in the Lake. Although somewhat more time-consuming, the lake environment offers a much more conducive environment for such studies than do riverine locations and the data collected could be then used to implement more thorough stock assessments in other CARPE landscapes.

Based on this information we will then be in a position to address more sensitive issues such as control of fishing effort and use of destructive techniques.

In parallel with these activities, it would be useful to investigate the bush-meat / fish relationship in a more comprehensive and rigorous manner. For this, a careful survey including quantitative household elements and qualitative investigation of key issues would be required to explore the exploitation, consumption and trade of these two products. An interesting option would be to collect such data in the three landscapes of the CARPE programme within which WorldFish is working (LTL, Salonga, and Maringa-Lopori-Wamba). The expected outcome is an improved understanding of the interactions between fish and bush meat under different degrees of pressure on the wildlife and for different combinations of subsistence/commercialisation in the livelihoods of the local population, in order to be able to propose adequate policies tending to reduce the trade of bush-meat.

All these different interventions will be planned and implemented in collaboration with the other partners of the programme in LTL. In that respect, a particular effort will be paid to work in synergy with PACT which is also intending to intervene at the village level on livelihood issues intimately related to fishing (i.e. farming system production and agricultural product commercialisation).

In conclusion, the 2-component approach (completed by the bush-meat / fish relationship survey) reflects the need to consider adequately the livelihood context and economic incentives of the local population when addressing landscape natural resource management issues. A narrow focus on resource management, divorced from the factors that lead to over-exploitation (where it exists) is unlikely to succeed, particularly in contexts where community enforcement is the only realistic option. This reality explains why the WorldFish work-plan for year 2-5 of CARPE II has been broadened to include these market-related activities as well as management-focused activities proposed initially.

References

- Anon 1987. Plan National Directeur des Pêches. Kinshasa, République du Zaïre.
- Anon 2006. WCS technical application for the Democratic Republic of Congo Central Africa Regional Program for the Environment Landscape Program implementation 2006-2011, Wildlife Conservation Society, New-York, 30 p.
- Bungubetshi G. 2007. Compilation et revue des projets de développement récents en relation avec l'activité de la pêche dans la province de l'Equateur : analyse et leçons pour les interventions futures. [in French] Draft, WorldFish Center, Kinshasa, 79 p.
- Brashares J., Arcese P., Sam, M., Coppolillo P., Sinclair A. 2004. Bushmeat hunting, wildlife declines and fish supply in West Africa. *Sciences* 306, November, 1180-1183.
- CLIFS 2005, Annual report 2004, CLIFS, Innovative Resource Management Washington DC, Mars 2005.
- Colom, A., 2006. The socioeconomic aspects of natural resource use and management by local communities in the Salonga-Lukenie-Sankuru landscape: guidelines for conservation and livelihood improvement. Kinshasa, Democratic Republic of Congo: WWF, 250 p.
- Crul R.C.M., 1992. Modèles pour l'estimation des rendements potentiels en poisson des eaux intérieures africaines. Document occasionnel du CPCA No.16,CPCA/OP16, Rome, Food and Agriculture Organization.
- Inogwabini Bila-Isia and Zanga Lingopa 2006 Les inventaires des poissons dans le Lac Tumba, Congo et Ngiri – Paysage Lac Télé – Lac Tumba, Segment RDC. Rapport produit dans le cadre du Programme CARPE, Kinshasa DRC, 24 p.
- Junk, W.J., Bailey, P.B., and R.E. Sparks 1989. The flood pulse concept in river-floodplain systems. In Dodge, D.P. (ed.) *Proceedings of the International large River Symposium*. (pp. 515-532). *Can. Spec. Publ. Aquat. Sci.* 106.
- Kolding, J. and van Zweiten, P. (2006). Improving productivity in tropical lakes and reservoirs. Cairo Egypt: Challenge Programme on Food and Water - Aquatic Ecosystems and Fisheries, WorldFish Center, 139 p .
- Luyinduladio, N. 2004. "Etude de base du projet CLIFS - Rapport final". Kinshasa, DRC: Congo Livelihood Improvement and Food Security (CLIFS), US Agency for International Development.
- Poulsen, J. and Clarke C., 2002 Feasibility Study Report of the Lac Télé Community Reserve. Wildlife Conservation Society. 140 p.
- Revaud M. 2007a. Revue de la littérature existante sur le statut actuel de la pêche et de l'aquaculture en République Démocratique du Congo. [in French] Draft, WorldFish Center, Le Caire, Égypte, 60 p.
- Revaud M. 2007b. La viande de brousse et le poisson en Afrique- le potentiel rôle du poisson dans la substitution de la viande de brousse en matière de moyens d'existence et de consommation, Une revue de la littérature. [in French] Draft, WorldFish Center, Le Caire, Égypte, 44 p.
- Welcomme, R.L. 1989. Review of the present state of knowledge of fish stocks and fisheries of African Rivers. In Dodge, D.P. (ed.) *Proceedings of the International large River Symposium*. (pp. 515-532). *Can. Spec. Publ. Aquat. Sci.* 106.
- Wilkie, D. S., Starkey, M., Abernethy, K., Nstame-Effa, E., Telfer, P., and Godoy, R. 2005. "Role of Prices and Wealth in Consumer Demand for Bushmeat in Gabon, Central Africa." *Conservation Biology*, 19(1), 268-274.

Annexes

Annex 1. Checklist of issues covered

- the role and importance of fisheries in livelihoods in the landscape;
- fish species present;
- seasonality in the fishery or in the activities that impinge on it;
- fishing methods used for both commercial and subsistence activity;
- status and trends in the sustainability of the fish resources and key factors affecting this, including (where possible) identification of sources of instability or uncertainty;
- fish consumption patterns and the role (actual / potential) of fish products as a substitute for bush meat;
- identification of different stakeholders, directly or indirectly involved in capture fisheries (and related activities) and, to the extent possible, a brief characterization of each (gender, socio-economic status, subsistence or commercial activity, migrant or resident);
- the role of women in the fishery and related activities;
- opportunities, constraints and issues as perceived by those whose livelihood depends on the fishery, noting differing perspectives of different groups;
- any management regimes currently in place (formal, informal, operational or non-operational) and information on how effective they are (/were);
- sources of instability in the fishery and/or livelihoods relating to it;
- existing marketing patterns and processing and handling practices, with a preliminary indication of the relative importance of different end-markets and marketing chains, and key constraints to further development;
- service providers in the sector, including provision of critical inputs by the private sector (e.g., fishing gear, transport, credit, marketing services) and existence/capacity of public and non-governmental organizations that do/ could provide training, regulatory services, livelihoods development etc.;
- existing practices and potential for aquaculture in the landscape, and how this would relate to any key pressure points identified in the system;
- the institutions and policy context affecting the fishery and associated livelihoods, and;
- key areas of uncertainty in the findings (for instance, relating to recent changes that are difficult to assess or seasonality aspects that cannot be adequately assessed as part of this preliminary review).

Annex 2. General ethnographic information

Thirty one villages are located around Lake Ntomba amongst which, seven were surveyed during the assessment (**Table A.1**):

Table A.1. Villages surveyed and their estimated population

Village	Estimated Population
Ntondo	4300
Bikoro	12,000
Ikoko-Bonginda	na
Ngelo-Monzoi	1800
Kotoli	450
Mwebé	3500
Lokanga	815

There are approximately 22 tribes represented in the Lake Tumba fishery, most from Equateur Province:

- Ntomba and Batwa (indigenous Pygmies in the Lake Tumba Basin)
- Ekonda (indigenous Bantus on Lake Tumba, but not well-known for their fishing)
- Libinza, Banunu and Ngombé (well-known fishing tribes from Equateur Province; the Ngombé traditionally fish for *Clarias spp* in marginal swampy areas)
- M'pama, Bakundu, Mongo, Etonga, Bobangui, Ngbandi, Lingonda, Mongondo, Batende (Equatorial tribes but not a traditional fishing communities)
- Lokélé, Topoke, Mongando, (from the Kisangani region; the Lokélé and Mongando being especially well-known fishing tribes).
- Baluba (from Kasai)
- Bolia, Sengele and Bakongo (from Bandundu Province)

The major center for ethnic diversity is along the Eastern Bank of the lake, which has at least some limited access by road to the outside world. In the larger villages of Bikoro and N'tondo, 10 and 9 tribes, respectively, fish either full or part time. In the other villages sampled, an average of 5.4 tribes was reported, including Mwébé, where the most traditional control of access among sampled villages remains (see below).

Annex 3. Description of the Fishery

The fishery is highly sensitive to seasonality, with the two dry seasons being the main fishing periods, with less activity in-between seasons and very little fishing during the wet season. Virtually all of the commercial fishing occurs in the dry season when lake levels are about 2 m lower than in the wet season. The main types of fishing gear used in the lake and their seasonality and setting techniques are shown in **Table A.2**. Individual gear holdings and catch for fisheries association representatives are shown in **Table A.3**.

Table A.2. Main gears used in Lake Tumba and their seasonal use.

Gear	Type	Description	Season	Comments
Gill Net	Passive	80 or 160 cm deep suspended from wooden floats and anchored with poles on each end. Set lengths vary from 50 – 500 m. Checked 1-2 times daily.	Wet/ Dry	Most widely used gear, legal mesh >2”
Lifumba	Active	a heavily weighted, hand drawn purse seine worked on the bottom by a crew of up to 10 pers.	Dry	Considered a destructive gear
Filet Traînant	Active	similar to Lifumba, but worked on the surface	Dry	
Cast nets	Active	Circular net thrown from the beach or a canoe in shallow water	Wet/ Dry	3-5 m diameter, small-mesh
Motresse	Active	a beach seine (often of fine mesh) worked by up to 10 persons	Dry	Considered destructive
Canon	Passive	Long line of up to 1 km in length most often rigged with No. 14-16 hooks @ 1 m intervals. Live bait (fish) or worms are used as bait. Checked once a day and periodically moved as per the catch	Wet/ Dry	
Lokala Ya Bikoko	Passive	nets placed along the borders of the river, capturing fish as they make reproductive or feeding migrations into the flooded forest	Wet	Considered a destructive practice
Bienzu	Passive	Acadjas (brush parks) stacked in 5-6 m of water in the wet season, left for ± 1 year and harvested in the dry season.	Dry	Mostly in the lake’s north & south ends
Kopépa (Ecopage)	Active	Construction of dams on small streams or exploitation of “ponds” in the forest, which are bucketed out with “Eboko” baskets to capture the fish.	Dry	Women’s traditional fishery
Boyika	Active	“Ayika” plunge baskets worked in shallow water of rivers and the lake margins	Wet/ Dry	Women’s traditional fishery
Mempéyu	Active	“Ekaloli” scoop nets worked in shallow water for schools of small clupeids “mempeyu”	Dry	Women’s traditional fishery
Mohika	Active	Harpoons used in swamp forest and lake margins	Wet	For fish and crocodiles
Poison	Active	Reported used by Pygmies in swamp forest rivers	Dry	A number of natural fish poisons are used
Pio-Pio	Active	Hook and line fishing with a cane pole	Wet/ Dry	
Mongélé	Passive	The use of unbaited basket traps to capture fish channeled through natural or man-made corridors	Wet/ Dry	
Mobambo	Passive	Large baited hooks suspended from a float in deep water	Wet/ Dry	

Table A.3. Individual gear holdings and catch per 3 month fishing season for fishers association members in 7 Lake Ntomba villages.

Fisher	Number of Gears per Fisher					Catch per Season (3 months)			Unit	
	Nets (50 m segments)		hooks	traps	harpoons	pirogues	Good Fishing	Medium Fishing		Poor Fishing
N'tondo	≥ 2" mesh	< 2" mesh								
1	100				2	3	20	5-8	<2	valise
2	50					1	>20	3-5	0	valise
3	30					1	15-20	1-3	0-1	valise
4		40	200		5	3	18-20	9-10	0-2	valise
Bikoro										
1	40					1	5-6	*	*	suzuki
2	28				1	2	1-2	*	*	suzuki
3	40					1	4-5	*	*	bags of salted tilapia
4	35		200			1	1	*	*	suzuki
5			200			1	2	*	*	suzuki
Ikoko-Bonginda										
1	50	10	30		2	1	1-2	*	*	suzuki
2	40					1	1-2	*	*	suzuki
3	60					1	1-2	*	*	suzuki
4	120					2	6-7	5	0-1	mipiko (20 fish)
5	46					3	2-3	1-2	*	suzuki
N'gede-Monzoi										
1	20	1 cast net				1	10-12	6	1-3	valise
2			50			1	10 - 15	5	0-1	valise
3	20					1	8-10	4	0-1	valise
4	15			20		1	15-20	5	2-3	valise
5	22				1	1	10	3-5	0-1	valise
6	50				3	1	1-2 suzuki	4-6	2-3	valise
Kotoli										
1	57					2	2	1	1 valise	suzuki
2	56		200			1	1-2	1	*	suzuki
3			250				8-15	2-3	*	valise
4	40		250			1	1-2	*	*	suzuki
5	10					1	1-2	*	*	suzuki

M'webe								
1	40		1	4 valise	10-15	*		baskets @ 2-3 clarias
2	30	100	1	2-4	15-20	*		baskets @ 2-3 clarias
3	20	100	1	2	10-15	*		baskets @ 2-3 clarias
4	20		1	5	10-20	*		baskets @ 2-3 clarias
5	25		1	2 + 1 bag of salted fish (up to 1000 fish)	5 valise	*		baskets @ 2-3 clarias
Lukanga								
1	10	100		200	50-80	5-20		individual fish
2	20	200	1	1	*	*		valise
3		150		1-5	*	*		basket of 500 fish
4	36		1	50-60	5-15	*		valise
5		200	1	1200	1-15 (per day)	*		individual fish

* Fishing only for home consumption; virtually continuous, low-intensity fishing activities.

The species of most importance to the fishery are shown in **Table A.4**. The cichlidae, the M'pongo (*Labeo?*), *Chrysichthys sp.*, *Parachanna* and *Mormyrops anguilloides* and “ipiti” are the most targeted for the commercial market. Other species are regarded as by-catch and used mostly for home consumption.

Table A.4. Most frequently captured fishes in the Lake Tumba, by season.

Local Name (Lingala)	Latin Name	Season	Maximum Total Length Reported	Typical TL in Catch
Libundu	Cichlidae (<i>Tilapia</i> , <i>Tylochromis</i> , <i>Hemichromis</i>)	Dry	30 cm	20 cm
N'golo	<i>Clarias</i> spp.	Wet/Dry	40 cm	25 cm
M'pongo (carp)	<i>Labeo</i> sp. ?	Wet	60 cm	40 cm
Mangombe	<i>Chrysichthys</i> sp.	Wet/Dry	40 cm	30 cm
Mongusu	<i>Parachanna</i> sp.	Dry	50 cm	35 cm
Nzanda/Nyanda	<i>Mormyrops anguilloides</i> ?	Dry	80 cm	50 cm
Ipiti		Wet/Dry	70 cm	60 cm
Molongo		Wet/Dry		
M'wenzé		Wet/Dry		
Menka		Dry		
M'pende		Dry		
Minzulu (mpoka)		Wet		
Likoku	<i>Synodontis</i> sp.	Wet	20 cm	15 cm
Mokangangolé ¹⁶		Wet/Dry	80 cm	45 cm
Mempeyu	Lacustrine clupeid	Dry	15 cm	10 cm

Fishers report mid-April to mid-June and mid-October to mid-December as seasons where they encounter large numbers of juvenile fishes in the catch. Women reported that they capture large numbers of juveniles in their traditional fishing, which takes place largely in the flooded forest as water levels decline early in the dry season. Together, these data indicate that spawning is probably taking place in the early rainy season with juveniles taking advantage of flooded swamp forest to feed and grow rapidly to a size where they can resist predation in the main river channels during the dry season.

Commercial fishing pressure varies according to season, in the peak of the dry season fishers operate nearly every day, weather permitting. When fishing is mediocre, fishers work 3-4 days per week, while at the height of the rainy season, 0-2 days are fished. Non-commercial (family food security) fishing pressure is normally less in terms of fishing intensity, but is more or less continual in terms of days on the water.

Fisheries managed and exploited more or less exclusively by women employ a variety of baskets to trap fish in shallow water or as the swampforest drains over the course of the dry season (Table 2). The bulk of the catch is comprised of juveniles or small species. The principal objective of these fisheries is household food security, but some surpluses are sold to neighbors or local markets.

Women fishers tend to work in groups for reasons of work-sharing (most of these fisheries are highly labour intensive) and security (e.g., snakes, high risk of physical injury). Fishing is highly opportunistic, taking advantage of any natural spot where

¹⁶ This fish is not eaten by the local Bantu tribes, but either thrown back or given to Pygmies.

fish might accumulate or be attracted to shelter to capture small and juvenile fish, crabs, prawns (“messanya”, a *Macrobrachium* sp.) and snakes (not consumed by the women but taken home as a special food for men). Groups of up to 10 family women and/or friends fishing a couple of times per week throughout the year, increasing to 3-4 times per week during the dry season when the most widely practiced of these fisheries is the “Kopepa” (known more widely around the country as “écopage” (Table 1). Reported individual catch varies from 3-4 “éboko” baskets per woman per fishing day in the good seasons to less than one per day when fishing is poor. Despite working together, there is no equal sharing of the fish, each women keeping just what she catches.

“Ponds” represent an import variation on the typical swampforest “écopage”. Rather than block a stream, “pond écopage exploits pond-like depressions in the forest, some natural some built originally by “the ancestors”. These often began quite small but over the years, with repeated use and some modest excavation, have grown to sizes of up to some 100’s of square meters. When queried about the management of these “ponds” the women indicated that they were not, with theft cited as a principal disincentive.

Annex 4. Organization & External Assistance to the Fishing Sector

The fishing associations in each of the 30 villages surrounding the lake were developed by the non-governmental organization (NGO) Innovative Resources Management (IRM) to coordinate local develop activities. Although present in all villages around the lake, they represent a small minority of fishers (cf **Table 2 in main text**).

Although in existence for some 4 years as of May 2007, these fishing associations have generally failed to produce sustainable impacts. Although, IRM provided considerable training in sustainable resource management and support for group operations, the representatives of these groups told us that there had been no concrete activities or funding mechanisms identified for the groups. The reasons given for the small representation among fishing households were: 1) insistence by the group on the use of only “non-destructive” fishing techniques and, 2) the supposition by the group that any external support would be limited in amount, thus making the percentage larger for each member if the group is small. All fishers reported never having seen a government extension agent or having received any support from any government agency.