Contextual analysis in two villages of the Niger River Inner Delta

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The Community-based Fish Culture in Seasonal Floodplains and Irrigation Systems (CBFC) project is a five year research project supported by the Challenge Program on Water and Food (CPWF), with the aim of increasing productivity of seasonally occurring water bodies through aquaculture. The project has been implemented in Bangladesh, Cambodia, China, Mali and Vietnam, where technical and institutional options for community based aquaculture have been tested. The project began in 2005 and was completed in March 2010.

This working paper represents work-in-progress. It forms part of a series of documents presenting research findings from the project. The reader is advised that it has not been subjected to academic quality control, nor edited for errors of fact or interpretation.

Summary

The objective of the study was to improve our knowledge of mare management and the livelihoods of two villages of the Niger Inner Delta, Severi and Komio. We wanted to understand mare access and fishery management and to highlight the different stakeholders involved in mare management as well as the different rules regulating access to the various mare resources. We implemented a series of Focus Group Discussion with the different socio-economic groups of the villages (fisherfolk, farmer-fishers, and herders) and a series of semi-structured interviews with key informants and stakeholders involved in mare management took place in July 2008.

The study shows that mare resources are diverse not only as fisheries, but also as grazing lands. Resource users are numerous and varied according to the seasons, with herders using the mare as grazing land in the dry season, from December/January to June/July and later fisherfolk and villagers fishing in the mare when the water level is low enough from March to July.

Access to the mare is regulated by different stakeholders, with the Jowro conducting herds into the mare during the transhumance period and paying for the right to do so. The land masters, village chief and village council, together with the water priest (*Baba Aougal* or Father of Fishery) are involved in defining the mare calendar for fishery. They decide the period of "*mise en défens*" (restricted access to the mare) and the period of collective fishing when everyone can fish in the mare using low intensity fishing tools. They also decide the beginning of "depletion fishing", done by fisherfolk using intensive fishing tools (cast nets, seines, etc.).

Between the two study sites, the mares are not managed similarly, due to historical background, difference in mare productivity and the importance of mares to livelihood strategies. In Komio, the mares are not directly connected to the river by channels, limiting the water level and the productivity of the mare. The land masters are also village chiefs and part of the village council limiting conflicts with mare management. No fee is paid to have access to the mare after collective fishing, due to lower resources. In terms of livelihood options, fisher-farmers are the majority in the village and have access to irrigated rice areas and upland areas for cereal production as well as the river for fishing, thus diversifying their livelihood options.

In Severi, diversification of livelihood strategies is much more limited, with only flooded rice production and access to mares, channels and floodplains for fishing. Stakeholders involved in mare management are from different families and have a different concept of ownership with regards to the mare. This difference creates alternative rules for mare access, with several types of fees paid to the land masters by fisherfolk to have access to the mare. In addition, grazing land resources are much more important in Severi than in Komio, with several conflicts reported between herders and farmers.

Fishery resources in mares are important during the collective fishing periods which last for several months (March to July). Villagers may be invited to several collective fishings inside and outside their village territory. Even if collective fishing yields are low (mostly under 10 kg/day), the resource is important for their livelihood, providing household for home consumption for farmer-fishers during a period when gathering natural products is one of the main activity of households. In the case of

fisherfolk, the mare fishery is even more important and can represent 40 to 75% of the catch during the end of the dry season.

With the objective of developing a community-based fish culture in the mare, the results of this study show that mares are an important resource for villagers, especially when livelihood options are not diversified. In additions, the analysis showed that several stakeholders have to be involved in any development project which wants to modify mare use and management.

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I- Introduction

The Niger River's inland delta is one of Mali's most remarkable hydrographic features. This vast 40,000 km^2 flooding area stands nestled in the semi-arid Sahel, stretching more than 350 km from Ke-Massina to Tombouctou. It hosts a very dense network of distributaries fed by the Niger and Bani Rivers. This inland delta comprises a series of mares (pothole) and plains that flood every year. The flooded area spans 7,000 to 20,000 km2 (depending on the year) (Marie et al 2007).

Fishery in the inland delta is one of the most important economic activities, with the bulk of Mali's production coming from this area (80%), and an annual production of 40,000 to 120,000 t per year, depending on the flooded area, representing 3% of Mali's GDP. According to Breuil (1996), fisheries accounted for 1% of the country exportation in term of value in 1995/96. The main exportation countries are Ivory Coast, Burkina Faso and Guinea.

The population involved in fishing is difficult to estimate, with several types of fisherfolk, from full time fisherfolk, migrating along the river to part time fishers who have undertaken fishery activity at the village level, mainly in mares[1] and channels during drops in water levels and the low water period.

The "fishery campaign" takes place from November to May/June (the following year). This period corresponds to the peak period of fish landing in Mopti. 70% of the catches are made of fish 0+ (within their first year) and 75% of the catch takes place during the 5 first months of the "fishery campaign" (Morand 2000).

The productivity of the flooded area is estimated to be around 60 kg of fish per hectare, with production surges as much as 100 kg/ha. Aquaculture is not well-developed even though the intensity of fishery has increased and several years of drought have affected productivity. Aquaculture in Africa represented only 0.15% of the world production in 2002, even with a suitable natural environment, specifically in western Africa with a rich inland rivers and estuaries. Africa uses less than 5% of its potential for

[1] A mare is a permanent or seasonal water body located n the flood plain used for grazing land and fishery resource. The area of these water bodies can vary from several hectares to more than 100 hectares. The mares can be connected to river by channels or fed with water when the plain is flooded.

aquaculture (Kapetsky 1994). Miller (2006) summarized the different constraints for aquaculture development in the Sahel, with institutional and human capacity limitation existing in all countries (Table 1).

Table 1: Constraints to aquaculture development in the Sahel (from Miller 2006)

Type of Constraint	*Details*
Environmental	o Harsh climatic conditions (heat, high evaporation, wide temperature swings) o Water shortages
Social/Cultural	o Extension efforts have lacked the participatory approach and lack of involvement o the beneficiaries in decision making o Lack of public awareness o Difficulties in finding labor in some rural areas (e.g. Senegal)
Institutional	o Overemphasis on infrastructure (fish stations) o Lack of reliable statistics and general information on fish production o Poorly trained field and senior technicians, o Lack of involvement of universities and research institutions o Lack of coordination between and within countries o Lack of an established framework or strategy for advancement
Financial	o Insufficient financial resources o Lack of clear demonstration of economic viability
Technical	o Inputs for fingerlings and fish feed components limited, costly or unavailable o Theft and predation of fish o Lack of good pond construction and management

In the case of Niger Inner Delta, many studies have been conducted to assess the importance of fisheries, the biological aspects of fish migrations and productivity of the delta (Lae 1992, Lae et al 1994a, 1994b, 1994c) as well as anthropological approach to understand organization of fisheries and customary rules for fishery management (Fay 1989, Fay 1994, Quensiere 1994). Knowledge on fishery resources and stakeholders involved in exploitation and management is available and well described. At contrary study on aquaculture development in the Niger Inner Delta is less documented. Even if ecological potential for aquaculture development is high, few experiments or development projects have been conducted in the region, mainly in integrated rice-fish done by the French Association of Volunteers for Progress (AFVP) in the late 1980's, FAO/PNUD project for integration f aquaculture in large irrigated perimeters (1987-1992) or later FAO Special Programme for Food Security (SPFS) (1996-2002).

In most o the cases aquaculture was developed in an integrated way, associated with agriculture in irrigation scheme or in small scale seasonal ponds. None of these projects tried to use the potential of the flood plain for aquaculture production.

The productivity of the flood plain and specifically of the mare could be increased by the development of aquaculture techniques in seasonal water bodies. Recently the WorldFish Center established a new approach in Bangladesh and Viet Nam, where fish is cultured communally during the flood season and the same land is cultivated with rice during the dry season individually. The results of initial trials show an additional 10 percent lower cost of rice production and a net return from fish production of 400 US$/ha in the Ganges and Meghna floodplains (Bangladesh), 340 US$/ha in the Red River Delta (Viet Nam), and 220 US$/ha in the Mekong Delta (Viet Nam). Significantly, these benefits were obtained with no reduction in the wild fish catch, composed mainly of small indigenous species. The returns from the sale of the produced fish were distributed among the group members according to a sharing arrangement that was pre-negotiated among group members at the beginning of the season. Gains to the landless were in form of cash income, which was significant as they did not have any alternative income generating opportunities (WorldFish 2002).

In Africa, the potential for application of community-based fish culture is greatest in seasonal floodplains and in irrigation schemes. In West African floodplains, 470 000 hectares are used to grow deepwater rice (Catling, 1992) which could be used for concurrent deepwater rice and fish culture. Additionally, the social and economic conditions under which these technologies can be implemented need to be understood. Although the studies in Viet Nam and Bangladesh demonstrated the feasibility of the community based fish culture systems, much more work is needed to understand the social and economic viability of these approaches under different socio-cultural and institutional environments, and to design appropriate institutional arrangements for different social settings.

In the aim to understand the feasibility and the adoption of community based fish culture in Africa, the Inner Niger Delta in Mali was included as study site in the Challenge Program Water for Food 35 "*Community-Based Fish Culture in Irrigation*

Systems and Seasonal Floodplains"[2]. The WorldFish Center is the lead research institute for the project. In Mali, Africa Rice Center (WARDA) is a partner and the Institut d'Economie Rurale (IER) is the local collaborator.

The underlying assumption of the project is that seasonal water bodies (over-flooded crop fields) and canals/reservoirs in irrigation schemes can be communally managed by stakeholders under equitable and sustainable sharing arrangements. Originally, the aims of the project are to provide technical and institutional options for farmers and local community to integrate fish and other aquatic resources into irrigation systems and seasonal floodplains. Beside the technical aspects of increasing productivity of floodplain by stocking fish in enclosure, the project as a research project as several specific objectives:

- To develop a methodology for measuring water productivity at the landscape level and to assess the contribution of aquatic resources to water productivity in irrigation systems and floodplains;
- To develop appropriate technical and institutional options for increasing water productivity at basin level through integration of community-based fish production into existing floodplain and irrigation systems;
- To develop a participatory diagnostic and stakeholder-involving diffusion approach for community-based fish culture in shared water bodies;
- To enhance human resource capacity of national partners for supporting community based fish culture in shared water bodies.

In Niger Inner Delta, potential for aquaculture during the flood season is high but its development remains constrained by several factors such as availability of fingerlings, low technical skills and knowledge. In addition, the development of collective aquaculture in a common pool resource area might be impeded by the social context.

[2] CP n°10: Project number 35 as approved and funded by the CGIAR Challenge Program on Water and Food, which has sites in Bangladesh (Ganges Delta), Mali (Niger Inner Delta), Cambodia and Vietnam (Mekong Delta).

Several studies show that natural resource management is under customary law and formal institutions overlap these laws (Fay 1989, Fay 1994), thus multiplying the stakeholders involved in natural resource management. In addition, the diverse ways in which the water bodies are used, including agriculture, livestock and fishery may impede the development of community based aquaculture in floodplain. Using seasonal or permanent water bodies such as mares raised some questions about potential constraints and risks.

- What will be the impact on resource management and access to resources if mare's productivity is improved and access rules are modified?
- Does the development of aquaculture will modified the access to fishery for local people or exclude some part of the population and create conflicts among the different resources users?
- Mares are used both by local villagers, fisherfolk but also by herders as grazing lands. Does the multiple use and users of he mare impede the development of community-based aquaculture in the mares?

Therefore, more information was needed to understand the constraint and potentialities of the development of such kind of collective aquaculture in the Mali's context.

This report aims to provide accurate and updated information on natural resource management and specifically fishery resource management in villages of the Niger inner Delta in Mali. Two sites were investigated: one in the village of Severi (Latitude:14°45'20.92 N; Longitude: 4°11'35.87 W) in the commune of Dialoube and a second village, Komio (Latitude 14°45'25.24; Longitude: 4°4'50.13 W), in the commune of Diambakourou (Figure 1), both communes are within Mopti Cercle.

The first village (Severi) was chosen for its large resource in term of fishery, with a main "mare" fish collectively. Compare to the second village (Komio), Severi is more dependent on mare fishery, with less access to other fishing ground and no irrigation scheme for rice production. At the opposite, Komio was selected for the diversity of resources (river, mare, irrigation scheme), a lower dependence on mare's resources an also for its previous collaboration in development projects (irrigation scheme). The

diversity of situation will allow us to compare both villages in term of livelihood strategies and mare's resource management.

The initial objectives of this study were to obtain an overview of natural resource management at the village level, highlighting key stakeholders and possible conflicts over the development of a community based aquaculture. In addition, we wanted to have a better understanding of local population livelihood and specifically the importance of fishery. This report presents the results of the survey of the two sites separately and the last part of the report presents a comparative analysis of both sites.

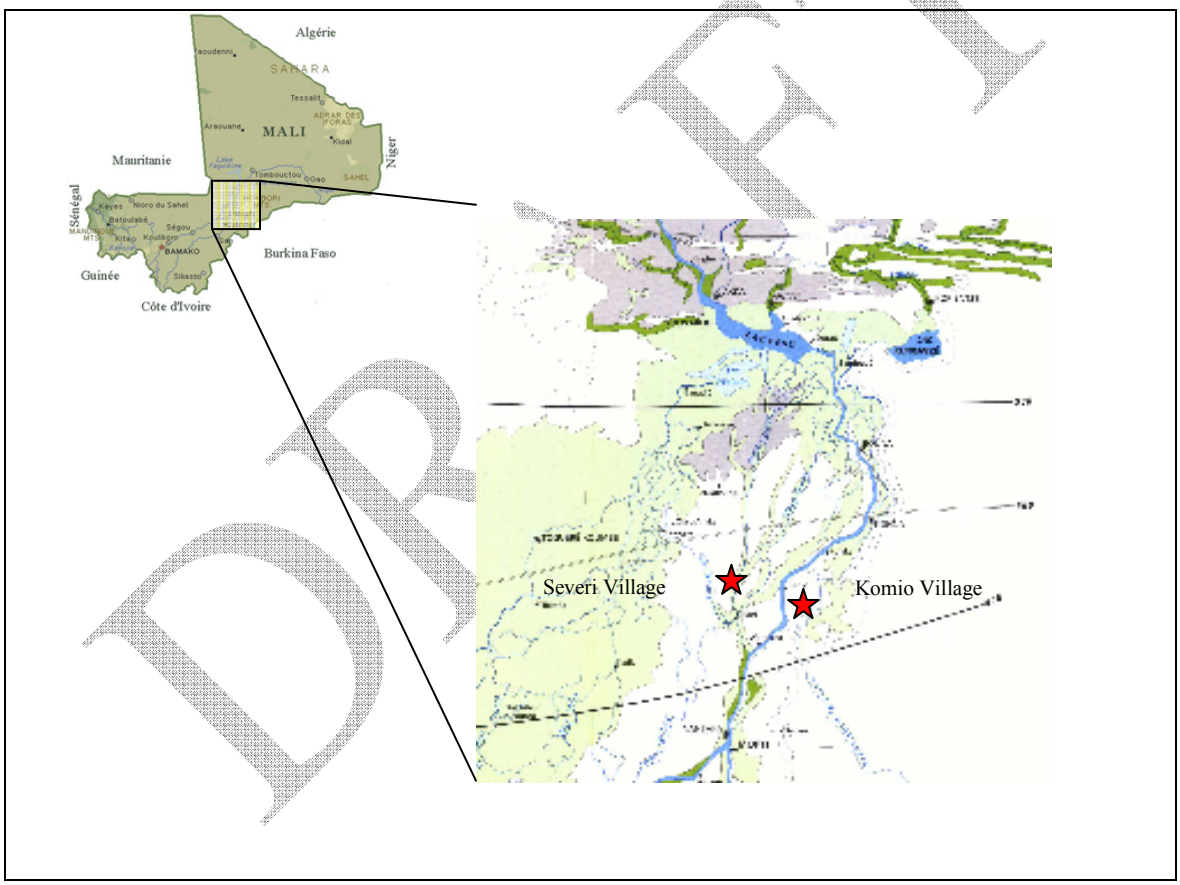

Figure 1: Study sites location

II- Methodology

To achieve our goals, we implemented a survey based on semi-structured interviews and Focus Group Discussions with the different stakeholder groups and institutional representatives at the village level.

After a meeting with IER staff and the village chief, we highlighted the different economic groups, based on their livelihood activities as fisherfolk, farmer-fishers and herders[3]. A series of Participatory Rural Appraisal (PRA) exercises was implemented with each group to fill in the gaps with regard to livelihood strategies such as mapping, seasonal calendar, wealth ranking and income ranking. Wealth ranking and poverty indicators identification was implemented during Focus Group Discussion with the different socio-economic group. Discussion group was composed by three to six villagers. We also implemented Focus Group Discussion with women groups in Severi.
The objective of these exercises was to estimate the importance of fishery for the different socio-economic groups of the village in terms of food procurement and income. We wanted to estimate the role of the mare in the different livelihood strategies and to understand the different uses of the mare according to seasonal variation. Moreover the rights and rules to access the mare were also investigated during Focus Group Discussion.

To understand access to natural resources in general, we implemented a series of semi-structured interviews with traditional and customary representatives such as the *water master*, the *land master*, and the *village chief*.
In Severi, the survey was done in two steps with the first series of interviews conducted from July 14th through July 18th, followed by a second series of interviews with women groups and focus group interviews within two fisherfolk permanent settlements located near the village conducted from July 28th through July 30th. In Komio Village, the survey took place from July 21st to July 25th, with two survey teams.

[3] In this study, fisherfolk include households involved only in fishing activity, they are from Bozo or Somono ethnic groups. Farmer – fisher are mainly involved in rice farming, they can fish during the flood season and participate to collective fishing. They are usually from Marka or Rhimaibe ethnic groups. Fisher –Farmers are mainly involved in fishing activity but also cultivate some rice land (bozo ethnic group). Herders are usually less represented in the villages. They are from Peuhl, Mabo or Diogorame ethnic groups and some of them can be involved in rice culture and collective fishing, but the main activity of the households is livestock production.

Natural resources of each village were outlined during a sketch mapping exercise with a group of villagers in each survey site. Maps were built on Mapinfo 7.8 using Google Earth satellite pictures and from information collected during Focus Group Discussion.

Specific attention was paid to the rules and management of the Vorkuma and Mama mares in Severi and Komio villages respectively, where the project has focused on developing community-based fishery trials. Mare management was one of the topics brought up during Focus Group Discussions and the survey team was present during the collective fishing in July at Vorkuma mare in Severi.

III- SEVERI VILLAGE

III.1- Natural Environment

Severi is located along one branch of the Niger River (Figure 2), called the *Mayo Dembe*. The territory of Severi is located on both sides of the river, with the main portion located on the western side. Agriculture in the village is based mainly on rice production. Rice land is located around the mare in flooded areas. Some households also cultivate rice on the plain. Uplands along the river bank and within the plain are also used to cultivate beans and corn. River banks and low land are used in the dry season, when the water level drops, for vegetable (mainly onion and pumpkin) production. Compared to other areas of the Niger Delta like Komio along the Niger River, Severi is located in the locally named "*bourgu area*", for its grazing land production. The area is flooded during the peak flood period and provides a rich grazing land for herd when the water level declines. Corn, millet or bean productions are not well developed in the village due to the lack of area protected from the flood (locally called "upland areas").

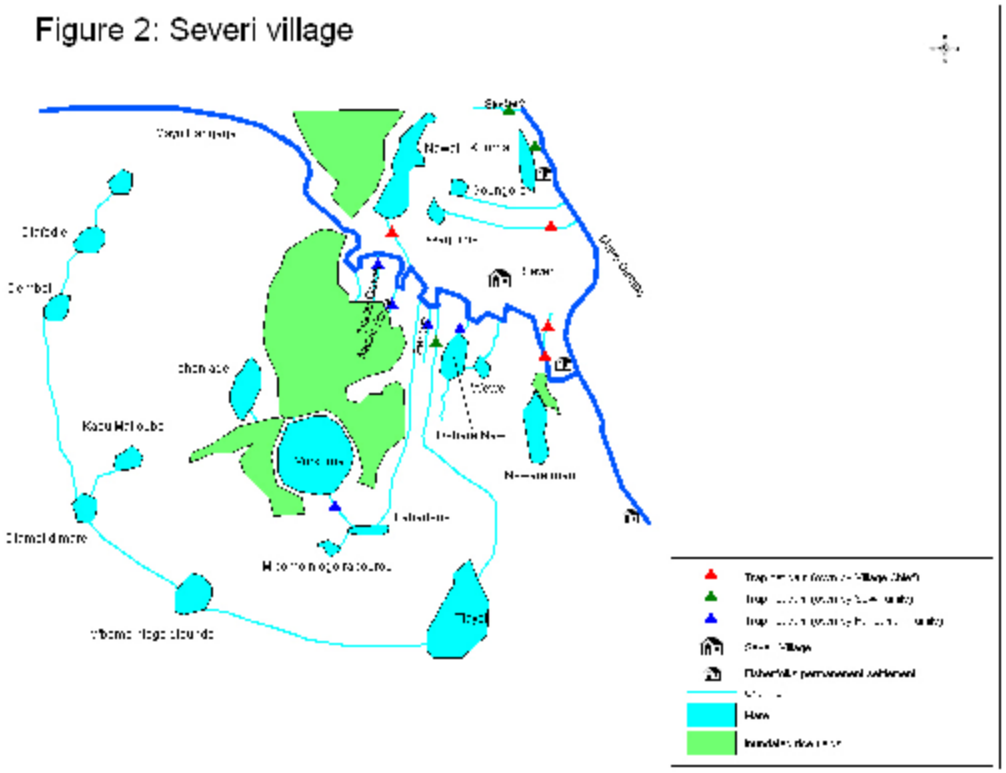

Figure 2: Severi Village

For herders, the main resource of the village is the "*bourgu*" (*Echinochloa stagnina*) found in this area as well as other grazing lands within the mare. In Severi, the area is considered a productive area for grazing even though since the 70's the *bourgu* has been replaced by *Vosya spp.* Unlike the Debo Lake area, people in Severi do not plant "*bourgu*" to increase grazing land's mare productivity (Zwarts et al 2005).

Fishing activity takes place in the different environments, depending on the water level. We can divide the fishing grounds used by villagers into four different types:

- Mare, permanent or non-permanent water body collectively fished;
- Channel and *Mayel* connecting the mare to the river branch;
- Flood plain;
- River fished by fisherfolk only;

For local populations, the year is divided according to the water level. We can distinguish four main periods (Table 2):

- Flood or rising water level period in July/August: when water levels rise in the river and channels;
- Peak flood period in September/October: when the plain is flooded;
- Declining water level: November to January/February: when the water level decreases in the plain;
- Low Water period from February/March to June

Table 2: Seasonality of plain water level

Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
level		Low Water				Rising water		Peak flood		Declining Water	
Flooded Plain		Dry Plain						Flooded Plain			

Within the territory of Severi, 17 mares are listed (Figure 2). These water bodies can be permanent or seasonal. They are connected to the *Mayo Dembe* by a channel called *Mayel Kakagna* as well as other secondary channels. The water level and the duration of the water body vary according to the mare altitude and the flood level. Some mares, not connected to the river and located in uplands area are almost dry in March/April and others located in low land may have a minimum of 60 cm of water in July.

The area of the different mares is not known, however, the area of the main mare (Vorkuma) was estimated by IER agents to be 105 ha. Three other mares are of major importance for fishing activities (Nawal, M'bomo niogo dioundo and M'bomo niogo rabourou).

III.2- Population

Severi is composed of 78 households[4], divided into 5 ethnic groups (Table 3). The Rhimaibe is the main ethnic group represented in the village. Mabo, Peuhls, Bozo and Diogorame are underrepresented, with only a few households. The village is mainly composed of farmer-fishers.

[4] In this study, household refers to the local term "marmite" which includes nuclear family and extended family living within the same compound

Table 3: Ethnics composition of Severi village

Ethnic group	*Households*	*Percentage*	*Livelihood*
Rhimaibe	53	67.95%	Farmer - fishers
Mabo	10	12.82%	Herder – farmers
Peuhl	8	10.26	Herder – farmers
Bozo	5	6.41%	Fisher - farmers
Diogorame	2	2.56%	Herder – farmers

Within the territory of Severi, three permanent settlements of fisherfolk (Bozo ethnic group) are present along the *Mayo Dembe*. The two settlements visited were composed of 50 and 34 households respectively. One of the settlements has been a permanent fixture for the last five generations. Before this, fisherfolk came only during the period where the water level dropped, from January to June. They originated from Numbozo, located 120 km south of Mopti, during the Peuhl Empire in the 19th century. The other settlement (located downstream along the *Mayo Dembe,* also composed of Bozo ethnic group) claimed to have been here before the arrival of the Rhimaibe. The livelihood of all the households of these settlements is based only on fisheries, with migration fishing to Dabo Lake. The settlement is now permanent since several generations according to fishermen even if seasonally migration of young members take place during the fishing season. They are considered to be professional fishers by the people of Severi. On the administrative point of view, fishermen are under the department of Eaux et Foret for issues relative to fishing techniques and under Dialoube Commune's administration.

III.3- Wealth Ranking, Seasonal Calendar and livelihood strategies

During focus group discussions with the different socio-economic groups, we implemented a wealth ranking[5] for each. For each group we present the different livelihood strategies explained during discussions, with a seasonal calendar of their activities.

[5] Wealth ranking exercise was done during the Focus Group Discussion for each socio-economic group (farmer-fisher, fisher-farmer and herders). Wealth categories were defined during these discussion as well as relative representation of each group.

II.3.1- Fisher-farmer

For fisher - farmer, the wealth categories are determined by the level of fishing equipment (nets, hooks, boats, etc.) and two categories were distinguished:

- The better-off own a boat, at least 40 boxes of hooks, upwards of 100 trap nets and more than 1,000 yards of gill net.
- The poor category does not own a boat, owns 10 to 20 hook boxes, around 30 trap nets and 150 to 200 yards of gill nets.

In Severi, the 8 fisherfolk households (all from Bozo ethnic group) consider themselves in the poor category, even though 3 of them own a boat. Better-off fisherfolk can be found in both permanent settlements outside of the village.

The main fishing period is from November to January, when the water level drops, and presents higher yields. During this fishing period, all the family members fish twice a day and all fishing tools are used (Table 4). Hook lines are operated by old people whereas gill nets are used by adults and teenagers (older than 10 years old). In cases where there is a lack of manpower, women can help. All the catch is smoked (women are in charge of the processing), stocked and sold in Mopti. A part of the revenue is used to reimburse debts.

Table 4: Seasonal Calendar of Fisherfolk in Severi (according to different water level)

Water Level	*Water level drop*	*Low water*	*Before Flood*	*Rising water*	*Peak flood*
Fishing Area	Plain /Channel/ River/Mare	Mare/River	Mare/Channel	Plain/Channel	Plain/Channel
Fishing Tool	Hook line (P, C, R) Gill net (P, M) Trap net (C)	Hook line (R) Gill net (M) Trap net (C)	Gill net (M) Trap net (C)	Gill net (P) Trap net (C)	Gill net (P) Hook line (P) Trap net (C, P)
Fishing intensity	++	+	+	-	-
Yield (kg/day)	+++ (10 – 100)	+ (4-40)	+ (4-40)	- (2-10)	- (2-10)

Note: P: Plain, C: Channel, R: River, M: Mare.

During the low water period, mares can be fished before the "*mise en défens*" (when fishing in the mare is not allowed) when the mare is still connected to the river, but the main production comes from the river. At that time, the yield is lower and less fishing tools are used due to lower fishing area availability. However, fishing activity takes place everyday, with the same amount of manpower. A part of the catch is sold in order to buy cereal grain.

Before the flood, after the collective fishing period, fisher - farmer fish in the mare with seines and cast nets during the "depletion fishing"[6]. They also operate trap nets in channels with the authorization of the land master.

During the rising water level and peak flood period, fishing activity takes place on the plain with gill nets and trap nets in the channels. The yield is low and the intensity of tool use is also lower. During the peak flood period, fishing is mainly done on the plain, with gill nets. However, due to high market prices, a part of the fish harvest is destined to be sold to purchase cereal grain for the family.

Fisherfolk livelihood is dependent on fishing, which is linked to their investment capacity for fishing tools (hooks, nets, boats, etc).This investment is made through loans from fishing tool retailers. Most of the households are in debt to fishing tool retailers and

[6] Depletion fishing is the translation of the local term indicating the use of intensive fishing tool in the mare after collective fishing. This fishing technique is undertaken by fisherfolk and farmer - fisher

have to sell their catch to them, but at lower prices. In fact, households are indebted anywhere between 10,000 and upwards of 25,000 CFA (21 - 54 USD) per household.

Fisherfolk have also been involved in agricultural activities such as rice farming (with 0.5 to 3 ha per households) for several generations up to the present. However, they do not have access to the more fertile rice-suitable land around the mares and have to rent cattle from other farmers in order to plow their fields.

Access to the mares for fishing appears to be important for these households. During the low water period, the fish catch is lower than the previous period in the river and channel, thus making the mare fishing more important. In addition, there are less fishing grounds due to the seasonal drop in water level. Therefore, fishing in mares is especially important at this time for fisher-farmer. Like fisherfolk from the permanent settlement, fisher-farmers from the village have access to different mares in several villages (including Severi) and during this period, fishing in the mares can represent 40 to 60% of the household revenue.

After the water level drops, young adults (20-25 years old) migrate to the city as labor or get involved in small businesses. This seasonal migration allows for investment in fishing tools after the peak flood period and can be a way to avoid the credit system with retailers. In the village, fisher-farmers are not involved in migration for fishing like those from the permanent settlement due to a lack of investment capacity in boats and fishing tools.

III.3.2- Herders

Herders consider themselves the wealthiest households of the village (20 households involved in livestock, but only 5 can be considered as real herders with large herd). Family members are usually involved in other activities, such as small business or agriculture. They also cultivate large areas (more than 5 ha of rice) for home consumption. They use the mare mainly for the *"bourgoutière"* and secondly for collective fishing, but are not involved in other fishing activities. They rent out theirs

cows to the farmers for plowing rice fields in exchange for labor associated with land preparation in their fields.

Four families own large herds of 300 to more than 500 heads (cattle). The herds arrive in the delta in December/January and leave in June/July according to the water level. The Jowro[7] defines the grazing area and the transhumance path. The herds do not necessarily graze in Severi territory and this depends on the Jowro they are linked with. The younger cattle and dairy cows stay within Severi's territory during the flood and have free access to *"bourgoutière"*.

III.3.3- Farmer-fishers

The wealth ranking of this group (Rhimaibe ethnic group) depends on the plowing capacity and the number of family members migrating to the city.

- Better-off households (10% of the households) can cultivate up to 10ha, have sufficient manpower or are able to rent manpower and own cattle for plowing rice fields;
- Medium households (20%) can cultivate around 5 ha with manpower, own a little equipment and have means of production for land preparation;
- Poor households (70% of the households) cultivate a small area (1 ha), do not own cattle and have a lack of manpower.

The drought period in the 70's and 80's reduced capital substantially in the household and consequently the overall cultivation area due to a lack of plowing animals, necessary for tilling large sections of land for land preparation. With limited cultivation area, access to credit for re-investment is not possible.

[7] Jowro are responsible for the timing and pattern of the grazing regime as well as the management of pasture land. The Jowro role was present before the Dina and was reinforce during the Peuhl Empire, with the Jowro regulating seasonal movement of livestock in and out of the delta (Cotula and Cisse 2007).

We will present the different activities according to the season.

Rising water level period (July – August) and peak flood (September – October)

Farming activity is dictated by access to the different agro-ecological areas, household equipment and manpower. At the beginning of the rainy season (the peak period for farming activity), rice land around the mares is plowed, as well as the upland (not affected by the flood) for corn and bean production (Table 5). This culture can be found along the *Mayo Dembe* (on embankments) and in some elevated areas on the plain.

Table 5: Seasonal Calendar of Farmer-fishers in Severi

	Jan.	Feb.	Marc.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Rice												
Corn												
Bean												
Vegetables												
Col. Fishing												
Picking												
Gill net fish.												
Migration												
Difficult Period												

Rice production depends on rainfall and flood levels thus limiting yield to 1 ton/ha for inundated rice. In addition, the main limiting factors for rice production are manpower and cattle for land preparation. For instance, a family with 7 persons working in the field and 2 cattle for plowing can cultivate 5 ha of rice, 1 ha of corn and 0,5 ha of bean as well as less than 100 m^2 of onion.

After the period of collective fishing[8] in the mare by the different villagers, a household can fish 4 to 5 times in the mare during the designated "free access" period using two-handed nets and/or cover pot nets. Farmers with land near the mare usually go to the field with their fishing tools and try to catch the household's daily consumption. During this period as well as the collective fishing, there is no restricted access to the mare for villagers. However, when the mare production is low, the catch is not sufficient

[8] Collective fishing happens when there is the lifting of the "*mise en defens*" of the mare and villagers and outsiders are invited to fish the mare after a sacrificial ceremony.

and they have to purchase fish, from July through September. During this period the funds sent to the family by members working in cities is used only for the purchase of grain and they collect natural resources such as water lily roots and wild cereal grain for their livelihood. Water lily roots are picked from mid-June to mid-July when the water level rises. During the rising water level period, natural resources are limited and they can collect Tamarind leaves, wild grains and firewood only.

The most difficult period for households, according to women, is from July to October, before the corn and millet harvest, due to the absence of any kind of product to collect. Women hoard inherited gold jewelry. This gold is used only in cases of emergency to provide extra funds. Otherwise, there is a lack of vested money coming solely from cereal grain production with some households claiming that they have not sold enough grain to make any money for more than ten years due to low production.

Dry season – Water level drop (November to February)

Some better-off and medium households are able to invest in gill nets (10 to 100 yards) to fish during the peak flood period and the water level drop period on the plain. Fish caught are partially used for home-consumption and the surplus is sold.

During the harvest period of upland crops (sorghum, millet) in October-November, women migrate around the main production area to rent out their manpower. Their salary is paid with cereal grain. This was seen in three households and between two and three women[9] moved around to participate in this activity in October/November. It provides anywhere from 15 days to one month of cereal grain consumption for the household. During the same period, women who stay in the village work in fisherfolk settlements doing fish processing, for around three weeks to provide household consumption.

After the rice harvest, woman can rent out their labor as rice harvest processors with a salary of 450 CFA for every 3 rice baskets processed. Their involvement in fishery

[9] This cannot be consider as a large pattern, with 3 households involved in such pattern out of 10 households interviewed.

is limited to the processing of the catch and they are not involved in any fishing activity even during collective fishing.

Dry Season – Low water period (March to June)

Later in the dry season, families with sufficient labor capacity can plant vegetables such as onion and cabbage along the channel and in the low land, where the land is still wet. Manpower is required for manual irrigation and fencing the plot to protect the crops from small livestock.

On average, household production lasts for 3 months after the rice harvest (until April/May) and family needs depend on fish catch and non-farm activities of young adults migrating to the city or on other non-farm activities at the village level including collecting activities (women and children). Women are in charge of the different natural resource collections. During the dry season from March to May they collect "*bougniare*" (wild cereal) and the Zaban fruits (*Saba spp*) (June-July) to sell at the market as well as firewood. During the dry season, farmer-fishers have access to collective fishing. In cases of a substantial catch (10 kg for example) part of the fish may be sold, specifically high value species such as *Lates niloticus* (capitaine) or *Clarias spp.* During this period, collective fishing and later the designated "free access" period of the mare are of crucial importance for household livelihood. Agricultural activities are limited to early land preparation and fishing is the main activity for men who remain in the village.

Small livestock

Households own small livestock (sheep or goats) or cattle. The maximum for a household is 5 heads. All the livestock of the village is gathered everyday by a herder to graze within Severi's territory. The livestock is also fed with *bourgu* collected in the mare by teenagers and adults. *Bourgu* collection starts after rice harvest up to July.

Gender, ages and activities

For agricultural activities, children can start working after 10 years old and even earlier for collective fishing, with 6-7 year olds manning the nets. Women can help to prepare the land for rice cultivation and they are usually in charge of corn and bean fields. Women also weed rice fields and participate in the post harvest processing, whereas men are in charge of land preparation and harvest.

As for collecting activities, women and children are involved in providing household consumption and daily monetary needs. Firewood collection (250 CFA/bundle), water lily and Zaban fruits are the main source of revenue.

Role and importance of migration

For this socio-economic group, agriculture is the main activity, followed by fishery and non-farm and off-farm activity. All the households have young family members who go to cities or abroad (Chad, Senegal, Ivory Coast, as well as others) to help their family. For most of these households, the funds sent by the outsourced family members are crucial to household economy, especially during the flood period, when corn and rice production is not yet possible. A household may receive 25,000 to 50,000 CFA per year/per migrant.

Migration to the city seems to be a necessity, with all the households sending some of their young adults to the city to help the family during the flood period when resources are limited. It appears to be a necessity, more than a privilege to have this seasonal migration to the city. This economic migration is not new, with previous generations already involved in migration-based income in their earlier years. Sometimes, the families help the migrants in terms of travel and start-up investment in a new activity once they get to the city. In one poor household composed of 18 persons, 6 young adults migrated abroad. Those young adults, who move within the country, come back to the village during peak periods of agriculture activity to participate in land preparation and harvest.

III.3.4- Fisherfolk from the permanent settlement

Three permanent settlements can be found in Severi, all located along the *Mayo Dembe*. Their livelihood is based only on fisheries. This activity takes place within several fishing grounds according to water level and migration.

Fishing in the mare starts at the end of the collective fishing until the water level rises again, and the entire period does not exceed three months. This is called "*depletion fishing*". Fisherfolk use different techniques than fisher-farmers, including seines, cast nets and/or gill nets. The rest of the year, fisherfolk fish in the river and use trap nets in channels during the flood and the drop in water level. In October, most of the fisherfolk migrate to Debo Lake for two or three months. Fishery campaigns in the lake are considered extremely profitable and some households rent boats to migrate there. Young family members are usually migrating for these fishery campaigns and require equipments such as large "pinasse" (boat) with an engine and fishing gears.

During the rainy season (July –August), they fish with hook lines in the river and with gill nets in the mares and they operate trap nets along channels. Later, during the flood in September to November, they use fixed gill nets in the flood plain. When the water level drops, from November to January, they operate trap nets in channels and fish in the river with hook lines and active gill nets. This period is the most productive of the year. When the water level is at its lowest from February to June, fisherfolk continue to fish in the river with hook lines and gill nets and have access to the mare for collective fishing and later on for "*depletion fishing*". The most critical period is between the flood and the beginning of the flood period (July to September). During this time, the mare is considered an important resource by fisherfolk during the dry season when resources in the river are scarce and/or non-existent.

III.4- Access to land and natural resources

In Severi, natural resources and specific environments are used seasonally for agricultural, pastoral and/or fishing activities. The diversity by which these resources are used and the seasonal variation show a complex framework where different stakeholders use the same ecological area for different purposes. In addition, the ways in which these

resources are used are regulated and access rules are diversified and complex, involving several stakeholders. Table 6 illustrates the different uses of natural resources according to seasonal variation, users and rules.

Table 6: Natural resource use in Severi village

Ecological Area	*Use*	*Season*	*User*	*Rule/Rulers*
Mare	Grazing land	January to June	Herders	Jowro
	"Bourgu" collection	January to June	Villagers	Free access
	Collective fishing	March-July	Villagers + outsiders	Land masters and "Baba Aougal" (Father of Fishery)
	"*Depletion fishing*"	March – August	Fisherfolk	Village chief, land masters
	Fishery	March – August	Villagers	Free access
Upland	Rice culture	July to December	Farmer-fishers Herder-farmers	Land masters
	Corn and Bean culture	July - October	Farmer-fishers Herder-farmers	Land masters
Plain	Fishing (gill net)	September - November	Farmer-fishers Fisherfolk	Free access
Channels	Fishing (trap net)	All year	Fisherfolk	Land masters
River	Fishing	March to June	Fisherfolk	Water master (river)

Table 7: Natural resource use in Severi village
Note: villagers include all the different socio-economic group present in the village.

Table 6 presents the wide diversity of agro-ecological area used for several activities according to seasonal variation or water level. In addition, we can notice that several key persons are involved in regulating access to these different resources. At the local level, only customary laws and traditional rules regulate the use of the resources. Decentralized structures (Fishery Council) involved in fishery resource management were not present in the village as well as regulation concerning fishing permit[10].

[10] The law (N° 95-032; 20 March 1995) recognized customary law through the concept of right of use defined as people or community can use temporarily or definitively, water and its products in the aim of satisfying their needs individually or collectively (without any commercial transaction). The conditions of these rights are defined locally by local decentralized authorities (*Fishery Council*) in a document called "*Fishery Convention*". Fishery Council are composed by fisherfolk association representatives, administration representative but also customary chief and traditional stakeholders involved in fishery resource management. However in the study areas, the fishery council was not actively perceived as a stakeholders involved in mare or river resources management.

III.4.1- Stakeholders involved in natural resource management

Access to natural resources of the village can be understood only through the history of the village. This explains the land division between the three main lineages present in the village.

Originally, the ancestor of the village settled in this territory (before the 19th century), cleared the area and secured the land previously included in the Puti village territory. In fact, the Puti village which previously owned the land of Severi territory made a pact with this ancestor giving him the land and water. The water master, located in Wandiaka Village, who owned the water in the *Mayo Dembe* in front of the village, also gave the water to the village after an alliance during a conflict. The original ancestor of Severi became the owner of the land and the water. Later this lineage started to distribute the land around the mare for rice culture and became in charge of sacrificial rights dealing with the fishery. Grazing land access and all activities related to livestock have been given to a different family, which became the Jowro family and is not living in the village anymore.

The original lineage disappeared due to the absence of male descendents and now three main families own the land, the channels and the mares. These three families are still clearly represented at the village level composing the three districts of the village; the main family (Hancamani), the village chief family (Kelly family) and the Sow family.

The Hancamani and Kelly families are all related with several connections through marriage. This can be seen all the way to the top of the family line as one of the daughters of the Father of Fishery (from the Hancamani family) is married to the village chief. It also appears that the Hancamani family plays an important role in the village, but its authority is not recognized by the Sow family which may create conflict for mare management.

According to different families, the perception of ownership of the mare is different. For some, the ownership of the land includes the ownership of the mare, whereas for others mare production is a collective ownership and fish production cannot be owned by a family or a person. In the case of Vorkuma mare, the villagers defined it

as the depression area surrounded by rice fields. The limit of the mare can be delimited by rice fields.

With his title, the village chief is automatically vested with the responsibility of one main mare called Nawal. This responsibility is transmitted from village chief to village chief. The chief owns the land where two other mares are located (Goungore, Waguidie). The Hancamani lineage owns the land where 12 other mares[11] are located. The two remaining mares[12] are owned by Samba Bilal Sow.

It appears that several stakeholders are involved in natural resource management, with three main families owning the land and having a different perception of the ownership of the mare. In addition, stakeholders such as the village chief, village council and "*Baba Aougal*" or the Father of Fishery, play a role not only in sacrificial aspects but also in the seasonal calendar of mare usage. The Jowro has a key role for the use of the mare by herders.

Village chief and village council

In Severi, the village chief decides on mare management together with the village council. The council is composed of different members of the main families and ethnic groups; however Bozo fisherfolk are not represented.

This council follows the advice of the owner of the land and the Baba Aougal for the decision of "*mise en défens*" and collective fishing.

The village chief is also involved in fishery management with two mares within his land and has rights on three channels. In addition, the village chief title is also tied to the management of one mare, called Nawal (one of the main mares).

The role of the village chief in mare management, therefore, is not clear and some allegations of mismanagement or a lack of management were claimed several times during the interviews.

In one case, a farmer affirmed that the village chief has not been using his authority, as he should, to control some fishery activities such as the development of trap

[11] Vorkuma, Labaderie, M'bomo niogo rabourou, M'bomo niogo dioundo, Djamel dimare, Koheniade, Kaou Matioube, Diafedie, Dembel, bogal, Wewe, Debare Nawo
[12] Kouma,Tiayel

net dams along the channels during the rising water level period. These activities are banned according to regulation of the Department of Eaux et forêts, which visit village mainly during the peak period to enforce the regulation of fishing gears.

Land masters

The three main families are considered land masters, and distribute land to the different households. For Vorkuma mare, the land around the mare is already distributed and most of this land belongs to relatives of the Hancamani family. According to several villagers and one land master, the mare cannot be owned by a family or a person. It's the property of the village even if the mare is within the territory of a land master. The land master family does own the channel connecting the mare to the *Mayel*.

Watchmen

Due to its value, mares are a key resource for the villagers and mares are protected against thieves during the "*mise en défens*". Watchmen for the different mares belong to the land master family. Usually within the family, the household which cultivates the largest land around a mare is responsible for monitoring the mare during the "*mise en défens*". The watchmen are also the first ones who indicate to the land master, the village council and the Father of Fishery when the water level is low enough to plan collective fishing.

Baba Aougal - Father of Fishery

The "Father of Fishery" (Baba Aougal) or water priest of the village is responsible for the relationship with the spirits of the mare and he is involved in the decision making for the "*mise en défens*" and collective fishing periods. His sacrificial ceremony before collective fishing ensures that fishing will be done without harm to the people. This specific skill is passed down from generation to generation to a single

person of Hancamani lineage. Surprisingly, the sacrificial aspects belong to the Rhimaibe ethnic group, role who usually belongs to Bozo ethnic group.

Jowro

The Jowro is the customary authority in charge of managing the grazing land (or "*bourgoutière*"). The Jowro in charge of the Severi territory has now settled in Dayebe Village (near Severi) after a conflict (some generations ago) with the Hancamani lineage several generations ago. The Jowro gives authorization to access the "*bourgoutière*" for migrating herds.

Administration – Eaux et forêts and Commune Council

The local administration such as Eaux et forêts or Fishery Council at the communal level do not have a real influence on natural resource management. Agents from Eaux et forêts department are mostly in charge of verifying fishing tools, fishing permit or the use of trap nets during the flood. Other institutional stakeholders do not have any influence on mare management according to mare users and other stakeholders.

III.4.2- Access to the mare and mare management

Access to the mare is varied according to the season and water level. The different usages of the mare, for fishery or grazing land are clearly separated in time by different rules involving several stakeholders. The different stakeholders involved in mare resources management are summarized in Figure 3

Water level Drop/Low Water

Mise en défens

After the rice harvest (January), when the plain is not flooded anymore, the mare is in "*mis en défens*[13]" until collective fishing begins. The "*mise en défens*" starts when the water outlet of the mare is dried up. The decision to begin and end the "*mise en défens*" belongs to the Baba Aougal, the land master and the village chief and village council. During this period, nobody has access to the mare for fishing; the mare watchman is the only one able to catch fish for his own consumption.

In cases where the customary laws of the "*mise en défens*" have not been followed, the village chief and other councilors decide on sanctions such as the confiscation of fishing tools. This council is also involved in mediation during conflicts between different mare users, or when there is a threat to the resource (e.g. predatory birds).

"Bourgoutière" management

Just after or sometimes before the rice harvest (December/January), cattle herds are moved back from pasture land in the North to graze in the "*bourgoutière*". The decision to open the delta to the herds is made during a meeting with the different Jowros of the area and administration representatives (Cerlce and Commune representatives as well as Eaux et Foret) in Mopti. Most herders have a long relationship with a Jowro and each herder is linked to a Jowro for transhumance within the Delta.

[13] The "*mise en défens*", translated as "put in prohibition" means that the access to the mare is strictly prohibited and no fishing activity can happen until the collective fishing.

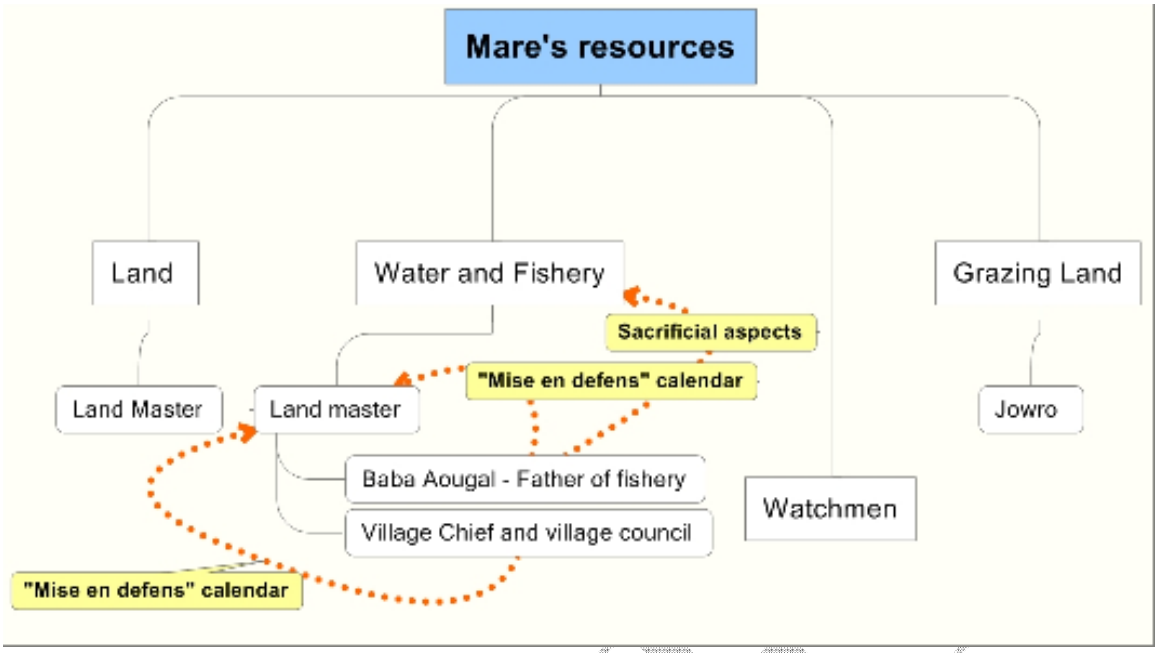

Figure 3: Stakeholders involved in mare's resources management

The herders pay a fee to the Jowro to use the "*bourgoutière*". For herders from the village, access to the "*bourgoutière"* can cost 10,000 CFA. If the herds want to have access to a "*bourgoutière*" in a different village the price can be upwards of 300,000 CFA.

The arrival of herds in the rice culture area can create conflicts between farmers and herders if cattle damage rice fields. They are the main conflicts reported by local villagers, especially if the herds are allowed to enter the Delta in December. In 2007, one farmer received compensation after the damage of his rice field by a herd. This does not seem to be an issue for the Vorkuma mare due to its high water levels which delay the herds return to the area until after the rice. During the dry season, between 20 and 50 herds graze around Vorkuma mare, with a herd being composed of 100 to 400 heads. Usually the Jowro stay around 20 days in this mare. At the end of September the *"bourgoutière"* are "*mise en défens*" until the water level declines. The productivity of the "*bourgoutière"* is estimated at 20 t/ha and represents the most productive grazing land in the delta (Marie et al 2007).

In Severi some herders follow a different Jowro (from Dialoube Commune), but their dairy cows are allowed to graze in the "*bourgoutière"* of Severi without paying any fee. Local villagers can use freely the "*bourgoutière*" and harvest *bourgu* for their own

livestock without paying any fee or asking permission from the Jowro. However, outsiders are not allowed to collect *bourgu*. In cases of infringement, the harvest is seized.

Collective Fishing

When the water level is low enough, the land master, the village chief and its council and the Baba Aougal decide the date for collective fishing. The date is transmitted to villagers. In Severi, collective fishing usually takes place during the dry season from March to July. Relatives and friends from other villages and communes are also invited to collective fishing in the main mares, where the resource is estimated to be enough to be shared with outsiders and in exchange villagers from Severi are also invited to collective fish in other territories. For example, one family was invited to collective fishing in 6 areas outside Severi. Another household was involved in collective fishing in 7 mares in Severi and 5 mares outside Severi, sometimes up to 30 km away.

The involvement in collective fishing of households also depends on rumors of a potential catch as well as rumors of illegal fishing during the former "*mise en défens*".

On the first day of collective fishing, access to the mare is free for all the inhabitants and even for outsiders. The Father of Fishery enters the mare and makes a sacrifice to the spirit of the mare. Then, the family of the owner of the mare enters the mare, followed by all other participants involved in collective fishing. Nothing except harpoons, two-handed nets, and cover pot nets are allowed. Collective fishing lasts between four and six days and its duration is determined by catch amounts. The village council and land master decide the official end of fishing in this manner. The collective fishing period could be anywhere from one day to one week, and is monitored according to the decreasing yield harvested with only the tools cited above.

The number of participants per household depends on the number of fishing tools available and only males and children (6-7 years old) participate. Only women from the Bozo ethnic group may join the collective fishing, whereas women from Rhimaibe ethnic group are not involved. The catches are extremely varied and range from nothing to 10 kg and even upwards of 50-60 kg.

Free Access

After the collective fishing the mare is considered "free" access. Three different forms of access are described by fisherfolk:

- Illegal access to the mare can happen during the "*mise en défens*" with the complicity of watchmen or the land owner. This is called "selling out of the mare". In 2004, this happened at Nawal mare and fisherfolk were allowed to fish for an access fee of 125,000 CFA;
- After collective fishing, when fish catches have declined, fisherfolk ask for permission to have access to the mare from land owners with a fee of 500 CFA per fisherfolk before the official "free access" period. This agreement allows fisherfolk exclusively to fish in the mare with intensive fishing tools such as gill nets, cast nets or seines. This practice was used in Nawal in 2008, but the Eaux et forêts Department interfered with this agreement and a tax was asked of the fisherfolk.
- During the free access period they have to pay a fee of 1000 CFA per fishing tool, regardless the type, to the land master and the watchman. In 2008, along the Nawal mare, 200 persons were using intensive fishing tools during a three day period, representing revenue of 200,000 CFA for the land master.

For several persons, the fee for accessing the mare is illegal and ownership of the mare is not recognized, due to the mare being recognized as common property.

Access to the mare for collective fishing and the free access period is gradual in the village. The first mare is opened in March and the last one (Vorkuma) is opened in July, which allows several periods of collective fishing for all the households of the village.

Water level rise and peak flood period

During the water level rise period and peak flood period, the mare is totally flooded and the limits of the mare are not clearly defined. The mare is not used, fish migrating to the floodplain outside of the mare and fishing activity takes place on the plains for fisher-farmers while the plain and river are fished by fisherfolk. Access to the mare is limited and the *"bourgoutière"* is "*mise en défens*" until the entrance of the Jowro.

Thus, the mare resource is only used during the dry season when the water level allows fishing activities and access to grazing land. During other season of the years, other fishing grounds are used by villagers, such as the plain, channels or river according to the water level and access rights.

III.4.3- Access to land

Land in Severi is owned by the three main families, which already distribute the main fertile rice land within their own lineage and to the different households. These families have still some land to distribute, which are located on the plain and consider as less fertile area. The rice land around the mare is the most productive land due to fertilization from cattle during the dry season. In one instance, 21 families who own rice plots around Vorkuma mare cultivated a total of 59 ha. The relatives of Hancamani lineage are over represented in this specific area.

During the peak flood period, access to fishing ground in the plain is more or less free. However, farmers who use a gill net to fish during this period claim that property rights can be used to set the gill net on their own rice plots.

In Severi, other land types such as non-flooded land or low land (for vegetables) are not abundant. Access to land for corn or bean production is limited due to the scarcity of land. On the contrary, the access to land for vegetable production seems to be restricted mainly by manpower and investment capacity for onion or cabbage production.

Apparently access to land has not been a large issue in Severi, with households owning large areas of rice land, but limited by their access to manpower and plowing capacity.

III.4.4- Access to the River and Channel

Eleven trap nets in channels are designed to form dams to intercept fish during their migration (Figure 2). The three families that own the channels connecting the mare to the *Mayel Kakagna* or the channels between mares and the village chief own the rights to fish in the Mayel using a technique called "*filet couloir recouvrant*" (damming devices, locally used in the Inner Delta). The ownership of these channels came from traditional and customary laws and is not contested by villagers or other fisherfolk.

During the raised water level and the declining water period, the different channels are fished by fisherfolk with the authorization of the family that owns the respective channel. The fishing techniques may involve a net or several trap nets. During rising water periods, fishing only lasts three days and produces a yield of 300 kg per channel whereas during the declining water period, channels are fished during a two month period with a yield exceeding 200 kg/day. The harvest can be divided 50/50 between owners and fisherfolk when the fisherfolk use the new techniques (e.g.: "*filet couloir relevant*"), but the main rule follows the *manga ji*[14] with 1/3 of the catch going to the channel owner, when just a trap net is used. According to several people in the village, dams operated during the rising water period are the main cause of the low yield in Vorkuma mare this year.

In the village, the *Mayo Dembe* is a fishing ground used only by resident fisher-farmer and fisherfolk from the different permanent settlements (Bozo ethnic group) (and not by farmer-fishers), thus representing only a small part of the population. For access to the *Mayo Dembe* during the declining water period within Severi territory, they do not have to ask permission to the water master of the river who is located in a different village (Wandiaka).

[14] *Manga ji* is the name of the tax to rent fishing grounds to the land master or water master according to customary law

III.5- Perception of Community-Based Fish Culture in the mare and recommendations

During Focus Group Discussions and semi-structured interviews, we asked for different stakeholders' point of view on the development of a Community-Based Fish Culture in the mare.

The different opinions and needs required to implement the project are presented in the following table:

Table 8: Opinion and needs required to develop enclosure in the mare

Opinion & Needs	Respondent
Involve all the village	Local authorities & villagers
Villagers can provide manpower for enclosure development	Village chief
Involve the fisherfolk from permanent settlement	Fisherfolk from permanent fisherfolk settlement
Increase enclosure watching to avoid thievery	Fisherfolk from permanent fisherfolk settlement + villagers
Involve the land master to avoid conflict	Herders
Settle enclosure in the open water- enclosure should not include vegetation to avoid conflict with Jowro and herders	Herders

One surprising aspect was that the villagers and local authorities were not aware at all of the project's technical aspects even though the monitoring surveys had been underway since February 2008. In addition, we wanted to inform the entire community during a meeting held in the village chief's household but the population did not come due to not being informed and possible conflicts with the village chief authority[15]. This last fact, in comparison with the other site (Komio Village) led us to believe that some conflicts involving the village chief might jeopardize the development of the project.

In fact, some information from the Focus Group Discussions, created suspicion on our part that the village chief has been involved in more than a few instances of mismanagement of the Nawal mare. In addition, the low yields observed during the collective fishing in Vorkuma mare this year was presented to us as mismanagement by

[15] It appears that the Village Chief was involved in some mare mismanagement (Nawal mare) and his authority is not recognized by other main families. However, conflicts were not clearly expressed by other villagers.

the watchmen and the land master family who had "sold out" their mare production during the "*mise en défens*".

These two facts combined with the various concepts of ownership with regard to the mare, highlighted the conflict and tensions that have been created around access to resources. Our study presents briefly the different stakeholders and resource users as well as the use of resources of the mare. In-depth study might present other sources of conflict and it appears important to check judicial records for any legal action that has been taken concerning the mare.

As a result of this study we can recommend the following actions for the project:

- *The project should be more independent from the village chief to avoid any misinterpretations from the villagers;*

Communication to the villagers should be clearer (through general meetings) and all households should be involved in the decision-making process. A general meeting (outside the influential area of the village chief) should be held in the village to present the different activities of the project.

- *Organizational aspect should be discussed with the entire community before any activity to avoid conflict later;*

Special focus should be taken on the following:

- Manpower allocation between households or families;
- Designation and role of watchmen;
- Involvement of fisherfolk that have formed permanent settlements;
- Repartition of the harvest.

- *Verify the legal status of the mare in judicial records;*

If the mare is part of a legal action between stakeholders (as many other mares in the Niger Inner Delta, Wetland International Pers. Com.) then the development of a Community Based Fishery might be impeded;

- *Technical aspects should be discussed with the villagers, however for the enclosure some points may be presented;*

For Vorkuma mare, the grow-out period is done from October to June/July, depending on the water level. The stocking period is dependent on the availability of fry and fingerlings. Villagers cannot afford fry and fingerlings and are not able to collect a sufficient number of fingerlings for the enclosure. Thus the project will have to purchase fingerlings from professional fisherfolk, due to the absence of real fry production in the Mopti region. The Projet of Compétitivité et Diversification Agricole (PCDA)[16] in Mopti can provide tilapia fry, however the quantity and the quality of these fingerlings is not known.

To avoid conflict with herders in the dry seasons, enclosures must be built only in open water, which limits the area to 20-30% of the total mare area (20 to 30 hectares maximum).

Due to the large number of potential beneficiaries from the project, the entire village being involved, the enclosures have to be sufficient enough to be used in community-based aquaculture programs and create cohesion for villagers.

Complementary feeding is not possible in this environment. Thus the stocking density will be limited by this factor. Local partners (IER) have recommended a stocking density between 2 and 5 ind/m^2, with the following species: *O. niloticus* and *Clarias spp*.

[16] This project's main objective is to enhance competitive, broad-based growth in the rural sector and help increase agricultural productivity and production in a sustainable manner in Mali. This project also aims to foster improvements in the performances of supply chains for a range of agricultural, livestock, fishery and gathering products, for which Mali has a strong comparative advantage. Through targeted investments, it will reinforce the competitiveness of agricultural products, both traditional products such as cotton and rice, but also non-traditional, such as fruits, horticulture products, oil seeds, Arabic gum, and cashews. The project was funded by the World Bank ($46.4 million) and implemented by governmental agencies.

III.6- Conclusions

This study shows several aspects of livelihood and resource use management in one village of the Inner Delta.

Fishing appears to be an important component of the livelihood strategies of both fisherfolk and fisher-farmers. Fishing activity is varied according to seasons with a peak period during the water level drop and the low water period. In Severi, the lack of upland and irrigated areas, reinforce the dependence on fishery for subsistence when compared to other villages along delta. This dependence on fishery is highlighted by the conflict concerning mare ownership and different concepts of mare property and usage rights.

Customary law shows that the entire population and even outsiders have access to fish production of the mare in cases where the mare is large enough to support this type of production. This aspect reinforces the potential for a community-based fishery. However, we have seen that several stakeholders are involved in mare management and that some of then claim ownership of the mare itself. In addition, for fishing, the mare productivity is coveted by several users, from fisherfolk using intensive fishing tools to villagers using low technical skills. Stakeholders involved in mare management have been tempted to gain some profit by selling mare production to fisherfolk, through several economic avenues.

All relations between the different stakeholders were not clearly analyzed due to a lack of time and the inherently complex situations involving customary law, historical background, genealogy and conflicts between families.

However, we have been able to highlight the main different stakeholders with regard to mare management, showing a complex network of persons interacting to manage not only fishery, but agricultural land and grazing lands. Thus, it appears necessary to involve all the different stakeholders if we want to develop a community-based fishery without any conflict (Table 8).

Table 9: Different stakeholders involved in mare management and use and their role in the mare management

Stakeholders	***Role***
Land master	Land distribution around the mare. Calendar definition for "*mise en defens*" + fishing fee for "depletion fishing" + fishing fee on channel – 3 different land master in the village
Baba Aougal – Father of fishery	Calendar definition for "*mise en defens*" and collective fishing + sacrificial ceremony – 1 Baba Aougal In the village
Village Chief	Calendar definition for "*mise en defens*" and collective fishing (+fishing fee for "depletion fishing" + fishing fee on channel as land master) _ 1 village chief in the village
Village Council	Calendar definition for "*mise en defens*" and collective fishing
Jowro	Management and access to grazing land
Local Farmer - Fisher	Users during collective fishing – almost the 78 households of the villages
Watchmen	Watch the mare during the "*mise en defens*"- 1 household per mare
Outsiders farmer - fishers	Users during collective fishing – invited to join the even (number not estimated)
Fisherfolk	Users during collective fishing, depletion fishing and channel fishing, (number no estimated)

One finding of this study was the absence of any formal institutions at the village level. A local fishery council at the commune level or even within the commune was not represented at the village level. The customary law, with the village chief as its representative was the only institution entitled to mitigate conflicts at the village level. The Department of Eaux et forêts has been the only one cited by fisherfolk for fishery regulation.

Even if the mare management appears to be complex, a community-based fishery could be developed on the basis of common property rights on the mare as a resource. This activity would depend on the development of a community-based organization involving the different stakeholders of mare management and a restricted or entire removal of the individual-based decision-making entity in place currently.

IV- Komio Village

IV.1- Natural environment and natural resources

Komio village is located in the commune of Diambakourou, within the Circle of Mopti. The territory can be divided into several agro-ecological areas according to water depth, duration of inundation and water management infrastructure.

- Within the river, several agro-ecological areas can be described according to the water level: the river bed (used during the low water period), water bodies separated from the river bed during the low water period called "reserves" and river banks.
- Three main types of agricultural land can be described, with flooded areas around the mares used for inundated rice, the uplands used for dry culture (millet and sorghum), and the embankment with irrigated areas for rice and vegetables.

Sixteen different mares are present in Komio. Five of these mares are considered major mares, where collective fishing may take place (Figure 4). According to the local population, the seasonal activities are dependent on the water level in the river and the duration of the flood period. The periods described are similar to the ones described by villagers in Severi (Table 2 in section III.1).

IV.2- Population and natural resources users

IV.2.1- The origin of the village

The origin of the village goes back before the Peuhl Empire of Cheickou Amadou. Ancestors of the Timota family (from the Marka ethnic group) were hunters

and settled in this area before an established village had been set up and started to cultivate the land. During the Dina Kingdom in the 18th century, land was given to three surrounding villages within Komio's territory, namely Kuana, Kamaka and Kanguila (Figure 4). Up to now, these villages have been dependent on the land masters of Komio village (descendants of Timota family) for access to land. These villages have the usufruct of the land but they cannot give or sell the land.

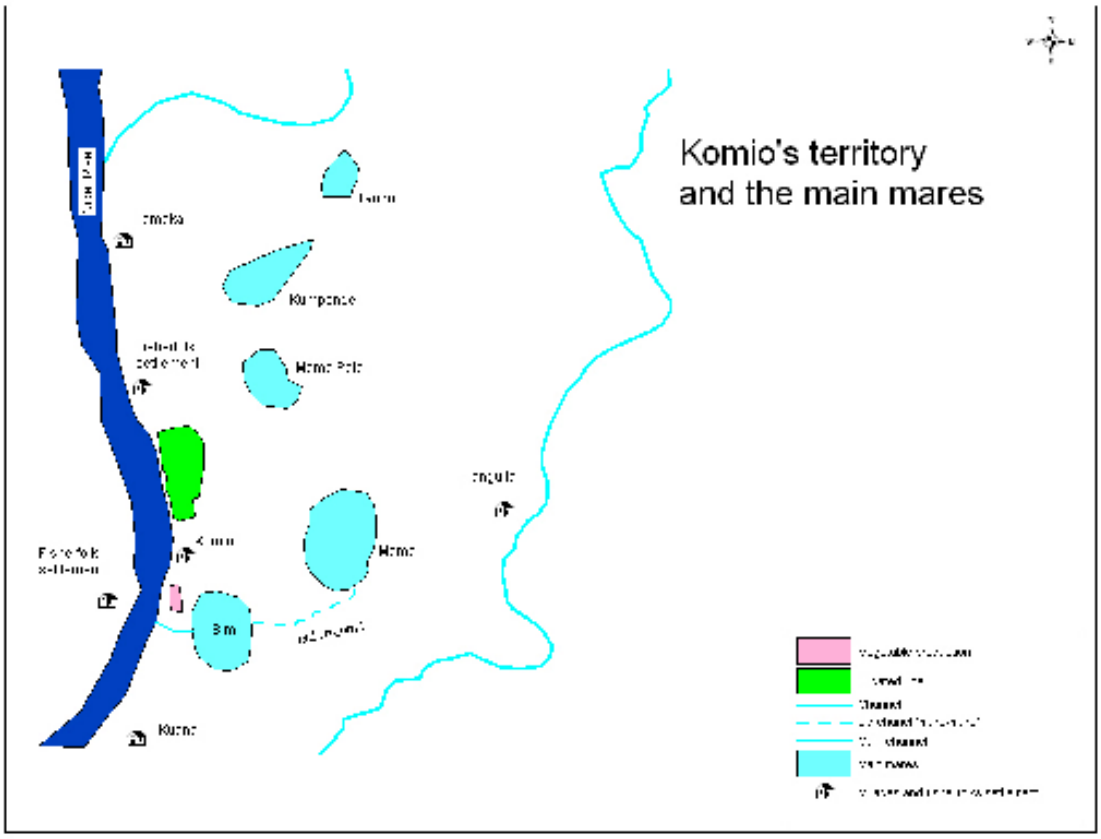

Figure 4: Komio Village

The ancestors of the Timota family, from the Marka ethnic group, were not involved in fishing activities. They gave the water of the river to the Somono family who settled in the village. The Somono manage the resources of the river up to the entrance of channels. The entire flood plain, channels and mare resources are owned by Markas. The Bozo ethnic group is only involved in the sacrificial aspects of the mare and the "*Baba Aougal*" (Father of Fishery or water priest) comes from this ethnic group.

With the drought period in the seventies and eighties, fish yield dropped considerably and Somono families progressively abandoned fishing and modified their livelihood strategies towards agriculture. Now only 4 households from this ethnic group are considered fisherfolk.

Bozo ethnic group are present in the village and outside the village in the three permanent settlements. The number of households in the settlements is not clearly defined but this settlement grows seasonally, with the arrival of migrant fishers from October through January.

In 1986, the government developed the first irrigation scheme, within the Operation Rice Mopti.(ORM). Between 1996 and 2002, the water pump was broken and the irrigation perimeter was not working until the supply of two new pump by the ORM in 2002..The irrigated area of 40 ha has been divided into plots of 0.13 ha and 170 households have access to these plots (93% of the households in the village), providing two rice crops per year (750 kg/plot/crop).

IV.2.2- Ethnic groups, activities and wealth ranking

In Komio the three main ethnic groups are the Marka, Somono and Bozo (Table 9).

Table 10: Ethnic group repartition and livelihood activities in Komio village

Ethnic Group	*Households*	*Percentage*	*Activity*
Marka	90	53%	Farmer-fishers (Herders)
Somono	65	38%	Farmer-fishers (Fisherfolk)
Bozo	15	9%	Fisherfolk

Fisherfolk

Fisherfolk are divided into three wealth groups (rich, medium and poor) according to their fishing tools. The wealth ranking includes both Bozo and Somono ethnic groups even though Bozo is the main ethnic group in the fisherfolk category. Only four Somono

families are considered as fisherfolk in the village as well as 10 to 15 families from Bozo ethnic group both located in the permanent settlement and the village. Fisherfolk explained that they dedicate themselves to fishery only when the water level is in decline.

Table 11:Wealth Ranking of Fisherfolk

	Rich (24%)	*Medium (36%)*	*Poor (40%)*
Boats	2	2	0
Cast net	4	3	0
Gill and active gill net	6	3	0
Trap net	<20	>15	>7
Seine	<1	1	0
Hook	<3	2	1

A difference can be seen between Somono and Bozo fisherfolk. Somonos fish mostly in the river, using seines, gill nets and hooks whereas Bozos fish in the river, flood plain and mares using cast nets, trap nets and active gill nets in the river and gill nets in the mare.

Bozos also dam up the channels with trap nets during the rising and declining water level periods. Almost all fisherfolk households are in debt for their fishing tools. Bozo and Somono fisherfolk also cultivate a plot in the irrigated rice area thus providing a part of their grain needs. Only some households with sufficient investment capacity migrate on the river up to the Debo Lake during the declining water level period and most of the Somono households shifted from fisherfolk to farmer –fisher, being more involved in rice cultivation than fishing.

Farmer-fishers

The Farmer-fisher category includes both Marka and Somono ethnic groups. The wealth ranking depends on plowing materials, livestock and fishing tools. Somonos are more involved in fishing activities with more boats, gill nets and cast nets than the Markas. However their fishing activity is not as substantial when compared to fisherfolk. None of these households migrate for fishing.

Table 12: Farmer-fisher wealth ranking

	Better-off (19%)	*Medium (33%)*	*Poor (48%)*
Plowing animals	<8	1-2	0
Plough	3	1	0
Rice area	12 ha	>10 ha	1-2
Millet area	6-10 ha	3-8 ha	0-2
Boats	1-2	0	0
Fishing tools	++	+	-
Activity	Renting in manpower	Variable	Renting out Manpower
Dependence to others	-	mutual aid	highly dependant

Better-off farmers have access to large rice (more than 10 hectares) and other cereal grain fields and sometimes own several plots within the irrigated area. They can cultivate large areas due to their plowing capacity, with several cattle and plows. In addition, they rent labor to plow and weed their fields. Agricultural production provides enough grain for home consumption and 10 to 60% of the production is sold.

Their fishing activity is limited during declining and low water period when agricultural activities are less time consuming. They use more fishing tools than medium or poor categories, with gill nets (3 to 10) and cast nets operated on boats on the river. They also take part in collective fishing in the mare for home consumption.

The medium category are mostly dependent on agricultural activity owning enough plowing cattle to cultivate their land. Their fishing activity is mainly for self consumption, based on few fishing tools, with gill nets sometimes being fixed on rice fields during the declining water level period. Their cereal grain production is sometimes not sufficient, however they do not have to rent out their manpower and do not rely on gifts or charity. Within this category, most of the households have some members migrating to cities during the dry season to provide some additional funds to finance the next cropping season.

The poor category owns some land but lack investment and plowing capacity to cultivate it. For instance, their plots within the irrigated area are not fertilized (inorganic or organic fertilizers). Their fishing tools are reduced to two-handed nets and their

livelihood relies on renting out their manpower to better-off farmers. During land preparation, they work in the field of others and in exchange, their fields are plowed later.

Poor households from Somono and Bozo ethnic groups skilled in fishing activities can be hired for their manpower by migrant or resident fishers during declining and low water periods to operate boats or cast nets. Two third of the harvest is kept by the boat and net owners. During the most productive period in November-December, working as labor on fishing boats can provide enough fish to supplement family consumption and the surplus can be sold, whereas mare fishing during the dry season provides only self consumption for the households with low yield of 1 to 3 kg/outing with two-handed net.

Herders

There are five main herders in the village with the main one owning between 300 and 400 heads. They are also involved in agricultural activities (30% of their income), whereas livestock represents 70% and fishery is limited to collective fishing in the mares for household consumption. Within the village they are considered the wealthiest category and represent only a small proportion of the households.

IV.3- Natural resources management

Natural resource management is clearly divided by ethnic groups at the village level. For example, in the case of fishery resources, Markas are in charge of mare and channel management and Somonos in charge of river fishery management. Stakeholders involved in mare and river fishery resources are summarized in figure 5.

The land belongs to 4 different land masters, all part of the Timota lineage. The village chief (Mamadou Timota) is part of this 4 land masters, but the most influential land master is Mafi Timota (owning the largest area and president of the irrigation perimeter association). These four land masters (Mamadou, Mafi, Nafi and Doudou Timota) own the 16 mares within the Komio territory. However, the ownership of the

different mares appears to be an issue between the different land masters. In this village, land masters are also mare owners, a much different concept from mare ownership rights in some cases observed in Severi village, where the mare's fish production was considerer collective property by one of the land masters.

IV.3.1- Access to land, grazing land

In Komio, *"bourgoutière"* are really neither present nor productive. *Bourgu* has been progressively replaced by *Vossia cuspidata*, a less productive plant according to herders. Thus grazing land is not really attractive and the Jowro and around 30 herds of cattle are only content to pass through Komio with a maximum settlement of seven days. Herds arrive in Komio just after the millet harvest in November/December and start to move out of the delta in June.

Some conflicts appear between rice/millet farmers and herders because farmers are expanding their rice fields to the herd transhumance corridors. According to the villagers, those disputes are solved at the village level, with the village chief and are never brought before the court.

Grazing land in Komio can be divided into the *"bourgoutière"* around the mare (under the authority of the Jowro) and the pasture land privately owned which corresponds to the fallow fields. For the second category, access is paid for according to the number of heads. For the first category, the fee depends on the location of the *"bourgoutière"*, with free access for villagers. Outside Komio, the access fee to *"bourgoutière"* depends on use exclusivity. For a *"bourgoutière"* shared by 10 herds, the fee can be 20,000 CFA per herd, whereas for a *"bourgoutière"*shared only by 3 herds, the fee can be as high as 75,000 CFA per herd.

Cultivated land is still available in Komio both for rice and upland crops (millet and sorghum). Four villages share the space with priority going to Komio villagers. Land access is normally free and only requires the authorization of the land master. However, it appears that land masters in Komio are in conflict with farmers from Kangula Village.

They are actually asking 2,500 CFA per households for access to cultivated land due to "their disrespectful" attitude towards the land masters[17]. Even if this information is anecdotal, it shows that land masters have still an important power on the livelihood of the villagers. For example, a farmer explained that he has to cultivate the entire area allocated to his households if he does not want to loose it.

Access to the irrigated area also depends on the village chief and the president of the village organization, which are both land masters in Komio, thus holding land distribution rights. Irrigated plots of 0.13 ha require a fee of 190 kg of paddy rice for dry season crop and 120 to 140 kg for the wet season crop.

IV.3.2- Fishing dams and Manga ji

During the declining water level period, Bozo fisherfolk operate trap net dams in channels connecting the mare to the river. The authorization to install that kind of dam belongs to the land master. Some Bozo families have the privilege of operating such barriers. This privilege is transmitted generation to generation until the land master decides to reacquire the land. The land master receives the "*manga ji"*, with 1/3 of the catch. Usually the fisherfolk give the catch of one day every three days. During the rising water period, these barriers are not allowed by formal law. However, some cases of trap net barriers were reported (Figure

IV.3.3- Collective Fishing and the "*Baba Aougal*"

The mare are "*mise en défens*" when the water level is declining and the mare is disconnected from the river. During this period, there is no specific person in charge of watching the mare. However, some cases of hook fishing were reported in the main mare. In cases of illegal fishing, the infringer is summoned to the village council to receive a warning.

[17] This information was not verified and the origin of the conflict is not known.

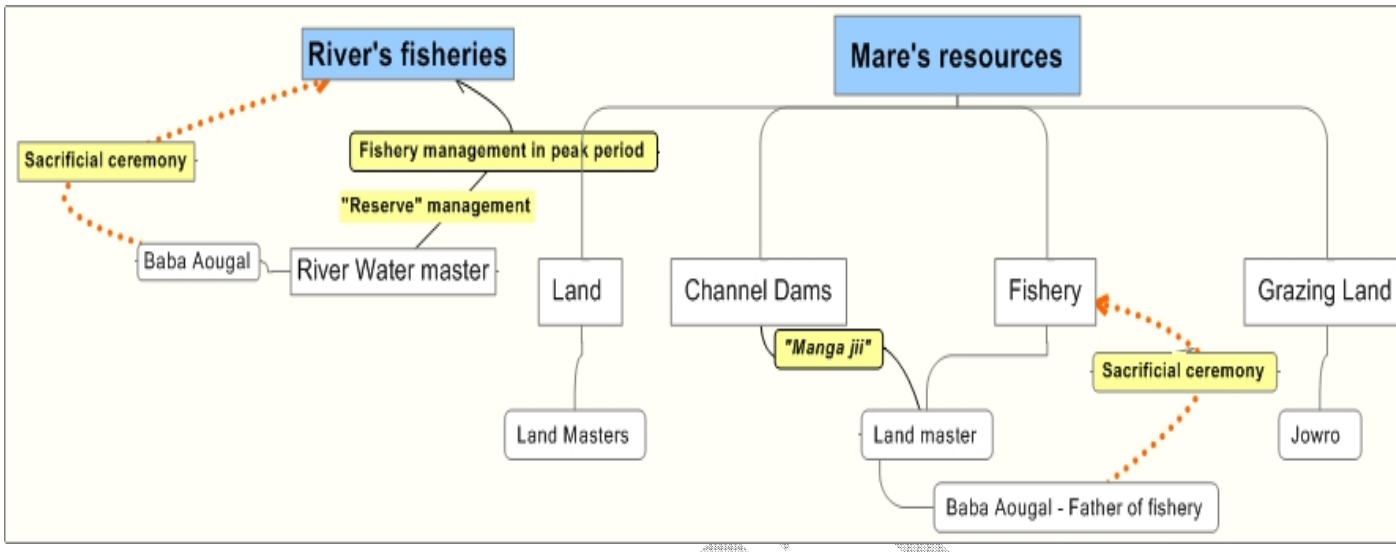

Figure 5: Stakeholders involved in mares and river resources management

The calendar of collective fishing usually follows customary rule. The day of collective fishing of the "Mama Pala" mare occurs the Thursday after the last collective fishing in the river's reserve. However, this customary calendar can vary with the water level of the mare which dictates the date of collective fishing.

For collective fishing in Komio's mares, there is no formal invitation to other villages. Only for the four main mares (Simi, Mama Pala, Mama Kumpende, Tando) are the seven neighboring villages informed. The other 12 mares are too small to necessitate formal management with a "*mise en défens*[18]" and a formal opening of collective fishing. The sacrificial powers belong to a "*Baba Aougal*" (water priest) from the Bozo ethnic groups. Markas decided to give the Bozos sacrificial powers because of their special link with fish and water. However the actual "*Baba Aougal*" is a representative of the Islamic clergy (muezzin) and thus does not, at least publicly, recognize his role in the animistic sacrifices before the collective fishing. He still decides when the collective fishing should start and its title will be transmitted to his son.

[18]However some villagers claimed that only one mare was really "*mise en défens*". This kind of information was not verified, but more in depth study is needed to know the effectiveness of the "*mise en défens*".

The collective fishing of the mare is usually spread from April to June, according to the water level of the mare (the main mare, Mama, is fished in May). Every week or every two weeks a mare is fished collectively to spread the resources during the dry season. Access to the mare is free and during the first day, the fishing tools allowed are harpoons, two-handed nets and cover pot nets. Afterwards, fisherfolk use gill nets and hooks in the main mares during the one month period.

For collective fishing, the mare owner claims that he does not receive any compensation because of the low production of the mare. If the mare was more productive, then the owner could ask for a fee for fishing after the collective fishing.

The importance of the collective fishing outside the Komio territory is variable. Komio villagers generally participated in 3 to 5 other collective fishings outside their territory including Saya, Kaginie (2 mares), Sanse and Severi, according to distance and availability. For example this year (2008), 3 persons from Komio went to the collective fishing of Vorkuma mare in Severi Village. It has been three years since the Komio population has been invited to Severi collective fishing. Invitations for collective fishing on a mare outside a village territory is put out during the actual collective fishing occurring within or outside the village territory. Collective fishing appears to be an important event for the different communities to meet and exchange information.

IV.3.4- River and Water master

Fishing in the river requires the authorization of the water master who belongs to the Somono ethnic group. The water master and the *Baba Aougal* of the river are part of the Kanta lineage, originally the first Somonos that settled in Komio. The area controlled by the lineage starts 3 kilometers upstream and ends 15 to 20 km downstream. Within this portion of the Niger River, three "reserves" are managed by the water master.

Thus, resident fisherfolk and migrant fishers (100 migrant fisherfolk can be counted in Komio) have to ask for authorization from the water master to fish in the river during the declining water level period, which corresponds to the abundance period. The

water master has to regulate access to the different fishing grounds and solve conflicts between fisherfolk. Conflicts can arise between migrant fisherfolk when access or access orders to fishing grounds are not well established, particularly when active gill nets are used, which required a specific organization in order not to threaten the catch of others working in the area.

Otherwise during the rising water period no permission is needed to fish. The price of access was not determined, but for local fisherfolk it seems that the price is symbolic. The authorization is usually asked from a family for the entire fishing season.

In the river, the "reserves" (During the dry season, the Niger River dries up in many areas, leaving behind isolated pools in what were the deepest portions of the river) are "*mis en defens*" from January to March and watched by the young and teenagers from the Somono ethnic group. Three "reserves" are located within the Komio territory and during the collective fishing 50 to 100 boats of non-resident fisherfolk can be counted. The fee to participate in such collective fishing depends on the fishing tool used, varying from 2,500 to 5,000 CFA for cast net and 50% of the catch for the use of a seine. In addition, a Bozo fisherfolk from the permanent settlement claimed to have paid 1,500 to 2,500 per boat to have access to the reserve.

The fee collected in kind is divided equally between Somono families and the funds granted are kept by the water master to pay the different taxes of the Somono families.

IV.3.5- Eaux et forêts

During interviews and focus group discussions, the only formal institution regulating or managing fishery cited was the department of Eaux et forêts. This department was cited for their control on fishing permits and their control of fishing tools used during collective fishing.

No other institution has been mentioned during interviews, the Commune Fishing Council has only been named, but no further definition of its role or action has been made.

IV.5- Agriculture and fisheries role and importance in livelihood

IV.5.1- Fisheries

The fishing calendar can be divided into four main periods, with the declining water level period from November to February, the low water period from March to June, the rising water level period from July to August and the peak flood period in September and November.

Fisherfolk

Bozos and a few Somonos are considered fisherfolk with fishing being their main activity. Around 20 households are included in this category.

Bozo fisherfolk fish in the river, plains and mares. In one case observed, during the rising water level period, a household composed of 5 young adults and teenagers (above 14 years old) operated cast nets during the day (2 persons per cast net) with a yield of 5 to 10 kg/day. 2 other persons operated active gill nets during the night-time with an average yield of 10 kg/day. Older adults were in charge of repairing fishing tools.

Somonos on the contrary mainly fish in the river. They use different tools including seines, and beach seines.

Table 13: Fishing calendar for fisherfolk (Bozo and Somono)

	Low Water	*Rising water*	*Peak flood*	*Declining water*
Fishing Ground	River/Plain/Mare	River / Channel	Plain	Plain/River
Fishing tools	Gill net (R, M) Active gill net (R) Hook (R,M) Trap (R) Seine (R) Cast net (R)	Cast net (R)/Active gill net (R)/ Dam (C)	Traps (P)/ Gill net (P)	Hook (P,R) Gill net (P,R) Active gill net ® Trap (P,R,C)
Relative Yields (kg/day)	++ (10-20 kg)	++ (15-20 kg)	+ (0-20 kg)	+++ (10-80 kg)
Fishing intensity	++	+	+	+++ (migration)
Destination	20% self consumption 80 % sold	10% self consumption 90% sold	8% self consumption 92% sold	14% self consumption 86% sold (1/3 saving and 2/3credit)

Note: P: Floodplain; C: Channel; R: river; M: mare

During the peak flood period, Bozo fisherfolk mainly use trap nets in the floodplains. There is no specific regulation for trap net fishing areas and fisherfolk usually decide the location of trap nets according to their knowledge and habits. One household can operate 15 trap nets, usually fixed during afternoon and released the next morning by 2 persons. The average yield is around 20 kg/day. Households with more investment capacity can use gill nets on the plains.

The declining water level period is the most productive period, when all the household members are involved in fishing, using the maximum fishing intensity of the household. Fishing in the flood plains, channels and river occurs during three months from November to January. Somono fisherfolk claim to catch 10 to 80 kg/day with 3 persons involved in fishing using hooks, gill nets, and trap nets in the plains and river. During this period, there are two outings per day. This is also the period when young Somonos and Bozos migrate along the river to catch *Alestes spp* and *Hydrocynus spp*".
Two Bozo households claim to fish 20 to 30 kg per outing (with two outings a day). During the first month, they start to fish upstream, the second month they fish on Komio territory and the last month they enter the Debo Lake. Within a family, 75% of the active

fishermen migrate while the remaining 25% stay in the village to fish on other fishing grounds, such as the channel or plains.

This period is also the most lucrative for fisherfolk. During this period, fisherfolk may be able to pay back their debts, especially those incurred on their fishing tools. For example, a better-off fisherman explained that 40% of the catch is sold to reimburse his debts. Another household estimated the percentage of revenue dedicated to reimbursement at 20%.

Later, when the water level continues to drop, the river is the only fishing ground, with fishing in the reserve done in May. In the river bed, Somonos use seines, active gill nets and cast nets to catch the remaining fish. This period is less intense than the declining water level period with only one to two outings per day and an average yield of 10 to 20 kg/day for 3 persons. One household head claimed to collect 10 /kg per outing with 6 persons involved.

In addition, during this period, collective fishing occurs in the mares. Four to five mares collectively fish in Komio. Fisherfolk usually use gill nets in the mare after the collective fishing to increase their catch. During the low water period, 40% to 75% of the catch comes from the mare for Bozo fisherfolk. The importance of the mare resource is lower for Somonos, with more access to river fishing grounds using different fishing tools.

Farmer-fishers

For farmer-fishers, the fishing activity is secondary to their main livelihood, and provides only household consumption. The main fishing periods are during the declining water level period in the floodplains and the low water period in the mare for collective fishing.

Table 14: Fishing calendar for farmer-fisher

	Low water level	*Declining water level*
Fishing Ground	River /Mare	Plain/River
Fishing tools	Two hand net (R,M) Harpoon (M) Cone net (M) Gill net (M,R)	Gill Net (P,R) Cast net (R)
Relative Yields (kg/day)	+	++
Destination	Self consumption	Self consumption and processing

During declining water level period, better-off and medium household categories use gill nets in flooded rice fields, catching 2 to 30 kg/day or 20 to 45 kg/day with gill nets and cast nets in the river. They fish both in the plains and river according to their fishing tools and a part of the catch can be sold.

During the low water period, fishing activity takes place along the river, with two-handed nets operated by children and teenagers or cast nets on boats for better-off families. These households also participate in collective fishing in the "reserve". In addition, during this period, collective fishing takes place in the mare for family consumption. Some medium and better-off households use gill nets in the mare during collective fishing. However, most of the households use cover pot nets and two-handed nets during collective fishing and the average catch is close to 5-6 kg/day.

After collective fishing and the depletion of the village mares, the households have to purchase fish for their consumption from July to September. For better-off households, fishery in mares and in the river can represent 20 to 40% of the revenue period whereas for medium household category the fishery activity represents 0 to 10% of the revenue.

IV.5.2- Agriculture

The agricultural calendar in Komio varies according to rainfall and flood periods. However, having an irrigated area for rice production allows two rice crops per year and this provides a secure livelihood.

Table 15: Cropping calendar of Komio village

	Jan.	Feb.	Marc.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Inundated Rice												
Rice (flood control)												
Irrigated Rice												
Millet and Sorghum												
Vegetables												

All the households have access to inundated rice plots in flooded areas and sorghum and millet plots in the uplands. The area cultivated depends on their ability to plow and prepare the land before the flood. 93% of the households have access to the irrigated area, with at least a plot of 0.13 ha, which allows a production of 750 kg/plot/crop on average. Households created after the irrigated area (7% of the households) do not have access to this area due to a lack of plots.

The second rice crop in the irrigated area depends on the investment capacity of the households for the different inputs and the calendar. In cases of longer land preparation for inundated rice or upland crops, irrigated rice crop can be delayed or abandoned altogether.

Vegetable production is done within an irrigated area operated by women. The production period is usually during the dry season, with the production of tomato, onion, sweet potato and chilis within 0.13 ha plots. Women mostly take care of vegetable production within the irrigated area.

Some families, with the investment capacity and manpower, have access to the flood-controlled rice area managed by the Office du Riz. This area is located near the territory of Komio and the access to a plot requires payment of a fee after the harvest. The average rice yield is somehow similar to the yield in the inundated area, with 500 kg to 1 ton per hectare.

Upland crops, millet and sorghum is important for household consumption. Cultivated land varies from 1 to 2.5 ha with an average yield of around 1.1 ton/ha.

The manpower and the plowing capacity are the main constraints for agriculture. Within households, field activity like weeding or plowing start at 15 years old. Younger children usually watch plots during the maturing period to protect crops from birds.

Better-off and medium category households can hire manpower to plow their land and weed their rice and upland crop fields. For example a household with 17 ha of rice and an upland crop use 26 man-day for weeding (the salary is 1,500 CFA per person per day). Harvest is usually done with the family and a lineage labor force, with salary paid in kilograms of grain. Grain consumption is not always sufficient for households, and farmers that rely mostly on agriculture have to sell 30 % of the production to finance their next crop. For Farmer-fisher households of the better-off and medium category, agriculture activity including rice, millet, sorghum and vegetable provides 60 to 70 % of the household revenue.

IV.6- Incentive and regulation aspects of Community Based Fish Culture development

The main incentive for Community-Based Fish Culture for the local authorities (Village Chief and Village Council) is to improve the water management infrastructure through collective action. In fact, thirty to forty years ago, the main mares of the village were connected to the river by a channel (Figure 4). After the silting of the channel, the mares were irrigated only during the flood period and mare production was reduced.

In 2007, the villagers dug up the channel of one mare, the closest from the river, to increase the water level and the mare production. This experience modeled the example of the neighboring village of Sanse, with a canal dug and water management infrastructures (sluice gates) connected to a rice production area, and motivated the local authority to make a similar canal connecting the mare. For local authorities and villagers, the development of a Community-Based Fish Culture may induce other development projects for water management infrastructures.

Another incentive for aquaculture development was a previous project using integrated rice-fish culture in the irrigated area. The production results were interesting, but few farmers adopted the technique because security problems impede the development of such activity.

During the survey, a general meeting with 43 representatives of the different families was done to present the project and its objectives. During this presentation IER staff presented our involvement in terms of technical assistance for enclosure development and fish stocking[19]. In front of a public audience, the local authority presented the commitment of the community as follows:

- Watching the enclosure and guarding it against thieves. No specific person was designated but the village council will decide which group of persons will be in charge of the watch;
- Manpower for any construction work and development of enclosure;
- Digging the mare in the enclosure to increase the water level and the duration of fish culture.

The villagers do not think it is possible to collect enough fingerlings during the stocking period for the first year of production without the IER's assistance. They also require assistance for enclosure construction from IER and WorldFish Center.

However farmers proposed to develop a rule for catch size during collective fishing to use fingerlings and small fish to stock in the different enclosure. This idea was developed by farmers claiming that before the drought period no small fish were caught during collective fishing to prevent the depletion of the stock for the next year. However, this idea will face a stocking problem, with collective fishing in April/May and the beginning of aquaculture in September. Fingerlings have to be kept during a 4 to 5 month period which might be difficult due to the low technical capacity of the village.

The distribution of the benefits from fish culture was an aspect of debate within the community. The local authorities presented the project as a project for the whole community (village) and different options for management were presented:

- distribution of the harvest between households;

[19] IER introduce the project as an experimental trial, to increase the productivity of the mare by stocking fingerlings in enclosure delimited by nets, during the "mise en defens". IER staff presented the project as small scale intervention but who can highlight the village situation and bring more NGO and other project to develop water management infrastructure. The technical aspects were presented as the development of enclosure with nets in the mare during the flood season and stocked with fingerlings to improve productivity of the mare. The area of the enclosure was not defined. The IER will provide materials to build the enclosure and fingerlings and villagers will provide the manpower.

- marketing of the harvest to collect funds for the village and providing a savings fund to use towards the village needs;
- 50% of the harvest should be divided between households and 50% should be sold to go towards the village saving fund.
- Sell the harvest to finance the digging of the channel between the mares and the river.

IV.7- Conclusion and Recommendations

Before, the implementation of the project, we recommend the following points:

- *Verify the legal status of the mare in judicial records;*

If the mare is part of a legal action between stakeholders (as many other mares in the Niger Inner Delta, Wetland International Pers.Com.) then the development of a Community-Based Fishery might be impeded;

- *The project should be more independent from the village chief and councilor to encourage independent access for the village population*

During our survey, we were limited to interviews within the village chief's house and all appointments were made through the village chief and its councilors. Some part of the population, not linked to the village chief, might be missing in the sample.

- *Organizational aspects should be discussed with the entire community before any activity to avoid conflict later*

Different ideas and points of view along the way with regard to the sharing of benefits were voiced during the general meeting. These different ideas should be discussed and the community should be helped in developing a Community-Based Organization to manage the fishery.

- *Technical aspects should be discussed with the villagers, however for the enclosure some points can already be presented*

For Mama mare, a grow-out period can be done from August/September to April, according to the water level. The stocking period is dependent on the availability of fry and fingerlings.

Villagers cannot afford fry and fingerlings and are not able to collect sufficient numbers of fingerlings for the enclosure. Thus the project will have to purchase fingerlings from fisherfolk, due to the absence of real fry production in the Mopti region. A project of the PCDA in Mopti can provide tilapia fry, however the quantity and the quality of these fingerlings is not known.

Even though the grazing land is limited in this area, to avoid conflict with herders in the dry season, enclosures should be built only in open water, which limits the area to 20-30% of the total mare area

Due the large number of beneficiaries of the project, with the entire village involved, the enclosure have to be sufficient to present the potential of community-based aquaculture and to gain the adhesion of villagers. Complementary feeding is not possible in this environment with a lack of techniques and no access to complementary feed. Thus the stocking density will be limited by this factor. Local partners (IER) were thinking about a stocking density between 2 to 5 ind/m2, with the following species: *O. niloticus* and *Clarias spp* and villagers also wanted to stock *Heterotis spp* and *O. ziili.*

In Komio Village, the mare does not represent a crucial resource when compared to Severi Village. Accessibility to the river for fishing and access to irrigated areas and upland crops provides more diverse livelihood options than in Severi. This devalued importance of the mare resource is represented by the difference in mare management with only a few mares "*mise en défens*" and only few outsiders invited to the collective fishing. However, mares represent a resource for poor and medium households through collective fishing during the low water period and a Community-Based Fish Culture may improve mare productivity and thus improve livelihood in the village.

V- Comparative analysis between Komio and Severi villages

In the conclusion of this report, we wanted to highlight similarities and differences between the two study sites. The goal of this contextual analysis was to have better understanding of the livelihoods of the different populations as well as of the rules and regulations of the mare's resource use. We will compare different aspects such as historical background, ethnic group compositions, management rules and give some estimations of the livelihood importance of the mare resources in both study sites.

V.1- History and Population

Komio and Severi are old villages, settled before the Peuhl Empire, that manage the natural resources within their territory. Severi gained their independence from Puti Village several generations ago and Komio was never under the influence of any other village. Komio Village also controls the access to land of three smaller villages located within its territory. In both cases, the land and water belongs to the original families of the villages. This characteristic is important when regarding mare management because management of the fishery resources of the mare belongs to village members.

The population of the village is composed of different ethnic groups. Only Bozo fisherfolk can be found in the two study sites, accounting for a small portion of population, respectively 9% and 6% of the household in Komio and Severi. However, in each study site we can count three fisherfolk permanent settlements composed of the Bozo ethnic group and involved in fishing in rivers, channels and mares.

Otherwise, the majority of the population is composed of the farmer–fisher ethnic group, the Rhimaibes (68%) in Severi and the Markas (53%) is Komio. In Komio, the second ethnic group in terms of importance (more than 30% of the households) is the Somonos, well known as fisherfolk. Most of the households belonging to this ethnic group depend mainly on agriculture activities even if they still own the rights to the river. In both

villages, Peuhl and other ethnic groups (Mabo, Diogorame) involved in livestock production are underrepresented and account for only a small part of the population even if they are usually the wealthiest households.

V.2- Natural resources uses and infrastructures development

Even though the villages are located within the Niger Inner Delta, we can observe several differences in the natural environment as well as infrastructure development. The similarities and differences are summarized in the following table.

Table 16: Komio and Severi natural environment resources and infrastructures

	Severi	*Komio*
Access to River	-	+
Access to River reserve	-	+
Access to Mare	+	+
Mare connected to river	+	-
Channels - Trap net dams	++ (12)	+(3)
Uplands availability	-	+
Irrigated rice area	-	+
Controlled submersion area	-	+
Flooded rice	+	+
Vegetable production	+	++
Gazing land	++	+

In terms of diversity of resources, Komio is more diverse, with access to upland areas for millet and sorghum production as well as irrigated and controlled submersion rice areas, whereas Severi is limited to flooded rice areas, with a limited upland area and farming activities dependent on flood level.

For fishing activities, Komio's population has access to the different river fishing grounds, used not only by fisherfolk but also by farmer-fishers. In addition, within Komio, three "reserves" can be exploited during the low water level period. In contrast, Severi's Bozo ethnic group fish in the river and other farmer–fishers do not use these resources. Fishing in the channels with trap net dams is done in both villages even though the number of channels is limited in Komio. Severi, on the other hand, has a dense network of channels connecting the different mares to the rivers and exploit them using trap net dams.

In both sites, the calendar for mare use is similar, with a period of "*mise en défens*" from January to the collective fishing (May to July). During this period, access to the mare is restricted for fishers and only herds use the mares for grazing. After collective fishing, the mare is used by fisherfolk for intensive fishing called "depletion fishing". During the rising water level, peak flood and declining water periods (from July to January), the mare is not used, fishing occurs in the river, the plains and in channels.

The number of mares is high in the two villages, with 17 and 16 mares in Severi and Komio respectively. However, in each village only 4 to 5 mares are used for collective fishing due to their importance and the potential wealth of resources. Other mares are considered of minor importance.

The mare's water regimes are different in the villages. In Severi, the main mares are connected to the river by channels, with a direct inflow, whereas in Komio the mares are fed only during the peak flood period. Thus, mares are dependent on flood levels. In addition, in Komio the mares are temporary, with a drought period between May and July. According to the local population, Komio is located on highlands, with mares yielding less in terms of fish as well as grazing land.

Herders also use the mare and a difference between the villages can be observed. Herd transhumance has not settled in Komio for a long period due to the low productivity of "*bourgoutière*" in the mare. In contrast, Severi is a cross roads for cattle herds, with 20 to 50 herds from several origins passing through the village territory.

It appears that the two villages, with a similar agro-environmental situation in terms of ecology and rainfall have nevertheless different natural resources and are not equal in infrastructure development and access to agricultural land. Komio presents more diverse agricultural options and river fishery is more developed, with river "reserves" also present. Severi is more dependent on mare and channel fishery. These differences will be reflected in the resource management and livelihood strategies of the two villages.

V.3- Mares and channels management

In both villages, there are several stakeholders involved in mare management. No formal institutions are significantly present in either area and regulation is done at the local level through customary rules enforced by representatives of each respective territory. . Stakeholders involved in mare management are similar in the two study sites, but the structures and the rules of management differ between the two sites.

For mare management and all fishery resources located in the floodplain, the water master is not involved in either village. In Komio, a water master (from the Somono ethnic group) is in charge of managing the river's resources only and in Severi there is no water master for the river (located in a neighboring village).

Table 17: Local stakeholders involved in mare's resource management

	Severi	*Komio*
Water Priest – Baba Aougal	Ceremony – calendar definition	Ceremony – calendar definition
Land master	Calendar definition + fishing fee for "depletion fishing" + fishing fee on channel trap net dams	Calendar definition + fishing fee on channel trap net dams
Jowro	Grazing land access	Grazing land access
Watchmen	Designed	not designed
Village Chief – village council	Calendar definition	-similar to land masters-

In both Severi and Komio, the Jowro and the water priest (*Baba Aougal*) have a similar role in mare management. The Jowro regulates the entrance of herds in the "*bourgoutière"* during the dry season (between January to June) and the water priest is involved in the sacrificial aspects of collective fishing and participating in defining the calendar for collective fishing and "*mise en défens"*. However, in Severi the water priest is part of the Rhimaibe ethnic group and belongs to a land master lineage, whereas in Komio the Markas gave this role to the Bozo ethnic group.

Watchmen are designated in Severi, with a household in charge of watching the mare during the "*mise en défens*". Usually, a household from the land master family with land surrounding the mare is designated by the land master for this duty. In Komio, the main mares are located near the village thus facilitating the watch of the mares during the "*mise en défens*" by the entire village. Therefore, no specific households are designated to watch the mares against thievery.

The role of the village chief and village council is different between the two villages. Both the village chief and council are involved in calendar definitions for Severi. This is not true for Komio, where the chief and council are not formally involved. However, the village chief and the main councilors are also the land masters. This situation implies that as land master, the village chiefs and the councilor are implicitly involved in the mare calendar definition in Komio. Therefore, in Komio, the control of land and the decision power of the village chief are held by the same family, limiting conflicts regarding resources management. In addition, it appears that access to the mare after the collective fishing, is free for fisherfolk due to the low remaining fish stock in the mare. An increase in resources will then modify management rules, with land masters claiming that a fee will be paid for mare access when fish resources are more plentiful.

In Severi, the land is divided up between three main families and the ownership of mare resources varies according to the families. Some claim that the ownership of the land includes the ownership of the fishery resources of the mare; others claim that fishery resources belong to the entire village community. This difference of conception induce different forms of management, with some land masters asking for a fee from fisherfolk for "depletion fishing" or even more controversial land masters who "sell out" the mare to fisherfolk before collective fishing.

For villagers, mares are important resource during the dry season and access is free and unlimited during collective fishing of the mare. Access to the mare is not restricted and all villagers have access to collective fishing. Usually a household participate in 4 to 7 collective fishings in Severi and 3 in Komio. In addition, they can be invited to collective fishing in other villages (3 to 5 on average). The participation in collective fishing depends on the potential resources, only large and productive mares are fished collectively. In Komio, the lower productivity of the mare (according to villagers) means land masters and village local authorities do not invite other villages, whereas in Severi, formal invitations to other villages and relatives are made. Usually, only the main mares of the villages are under the regulation of collective fishing, with a "*mise en défens*" during the dry season. Collective fishing happens anywhere from a few days to a week, depending on the abundance of resources in the mare and only active fishing tools

such as harpoons, cover pots and two-handed nets are allowed. In Komio, passive fishing tools (gill nets) are used after the first day of collective fishing.

Collective fishing in Severi appears to be an important event for information exchange. Mutual invitations are also a way to share the catch and to spread the resources during the dry season between villages, with collective fishing starting in April and finishing in July, with the first rains.

Another important fishery resource during the declining water period is the damming of channels connecting the mares to the river. There are 12 dams in Severi and only 3 in Komio due to the lower number of channels in the area. These dams are usually operated during the declining water period and for the last few years these dams have also been used during the rising water level period, thus limiting the migration of fish to the floodplain. In both villages, the use of trap net dams in channels follows the customary rule of *manga ji*, with 1/3 of the production given to the land master or owner of the channel and 2/3 of the catch kept by the fisherfolk. The land master gives the authorization for damming the channels and this authorization is transmitted generation after generation. Usually, fisherfolk from Bozo ethnic group are the ones operating these dams due to their specific skill.

Mare management and stakeholders are similar between the two study sites. However, we have seen that differences due to power sharing and mare productivity induce some slight differences in the fishery management of the mares in the villages.

V.4- Role of the mare's resources in livelihood

V.4.1- Farmer-fishers

For farmer-fishers, mare resources are limited to collective fishing during the dry season. Thus, the importance of the mare is limited in time and could be perceived as a resource of minor importance. However, participation in collective fishing is massive, with all village households and several members per household involved. The importance

of mare resources has to be understood in comparison with other fishery and agricultural resources.

In both villages access to inundated rice land is not limited and the main constraint for cultivated areas is material and access to cattle for plowing. Severi is much more limited in their agricultural activities with few upland areas and no millet or sorghum cultivation. This has been replaced by beans and corn instead. Severi's farmers do not have access to irrigated rice or submersion-controlled areas, thus limiting their cereal production to flooded rice culture. This difference in access to irrigation and upland areas explains the difference in the agriculture shared in better-off and medium households between Severi and Komio. In Severi, cereal production can cover the household's needs for a few weeks to three months for poor and better-off households respectively. In Severi, most of the household revenue comes from off-farm and non-farm activity, with seasonal and permanent migrations of household members to cities. In addition, in Severi women are involved in picking natural resources for household livelihood, mostly in the dry season and flood period.

Table 18: Relatives importance of fishery and agriculture for farmer-fisher in Severi and Komio

	Severi	*Komio*
Fishing ground	Mare : low water period (Plain : declining water level period)	Mare: low water period Plain : declining water level period River : declining water level period and low water period
Fishery importance in revenue per household category	Better-off: 0-10% Medium: 0-10% Poor : 0%	Better –off: 20-40% Medium : 0-10% Poor: 0%
Agriculture importance in revenue per household category	Better-off : 0-10% Medium and poor : 0%	Better-off and medium: 60-70% Poor:0%

Mare resources appear to be relatively more important in Severi than in Komio, representing the only fishing grounds in the area. Fishing tools used during collective fishing and after, when the mare is considered free access, are not intensive (harpoons, two-handed nets and cover pot nets). In Komio, gill nets are authorized on the second day of collective fishing and medium and better-off households use gill nets and cast nets in the river during the dry season. This difference in fishing tools partially explains the higher percentage of fishery in making up total household revenue.

In comparison, poor households only have access to mare resources during collective fishing in Severi, whereas poor households in Komio can fish with two-handed nets in the river during the low water period and during collective fishing.

The difference between the two locations is even more acute for better-off and medium households. In Komio, these households can use gill nets in the plains and river during declining water and low water periods, cast nets during collective fishing in river reserves and in the river and they participate in collective fishing. Thus, mare resources seem to be relatively less important for farmer-fishers in Komio.

V.4.2- Fisherfolk

For fisherfolk, the most important period of the year is during the drop in water level, when 80 to 100 kg/day can be caught in the river and channels. During this period, fishing intensity is at its highest and the wealthiest fisherfolk from Komio migrate along the river up to Debo Lake. In Severi, fisherfolk do not have sufficient equipment for migration. In both villages the wealth ranking criteria for fisherfolk was based only on fishing tools and boats.

For Bozo fisherfolk from Severi and Komio, mare resources[20] are economically important during the low water period and represents 40 to 60% and 40 to 75% of the catch in Severi and Komio respectively. For Somonos, mare resources are estimated to be less important with fishing activities occurring mainly in the river.

Fisherfolk are the only ones using intensive fishing tools in the mare. But access to mares in Severi seems to be more complex with specific fees paid to the land owner for exclusivity or the use of seine or cast nets. Therefore, mare resources are important for Bozo fisherfolk willing to pay a fee to have access to the resources, sometimes paying for exclusive access. This situation was found only in Severi, because of its more important fish resources being in the mares. Fisherfolk appear to be important stakeholders in mare use in Severi, more than in Komio where access to fish resources creates less conflict.

[20] The relative importance of the mare resources in the total catch and revenue of fisherfolk households includes collective fishing and the fishing period after the collective fishing of the mare, when mares are in free access.

V.4.3- Conclusion

We have seen that the two study sites present differences in terms of population, livelihood strategies and mare management. Ethnic groups, village history and relationships between land masters influence mare management. Access to different fishing grounds and diverse agricultural production can also have an influence on mare management. However, the differences highlighted in this report are preliminary and have to be studied more in depth.

In future studies it would be interesting to monitor for each socio-economic group and wealth group outlining the relative importance of the mare resources in household livelihood. It will be interesting to have an accurate estimation of the mare resource importance in livelihood of the different socio-economic groups during collective fishing and free access. Thus a monitoring of the catches per households is needed, including not only those from Vorkuma (Severi) and Mama (Komio) mares but also the different mares within and outside the village territory. To compare the two sites, differentiation in the type of catch from the river and in the mares is also needed. It might show an important difference between the two villages, with Komio farmer-fishers much more dependent on river resources than Severi. The access rules for the mare for fisherfolk during "depletion fishing" have to be understood more clearly, specifically in Komio, where no specific rules for fisherfolk access have been highlighted.

Understanding the different rules and the importance of mare resources in the different livelihood strategies of mare resource users are mandatory before any type of development action is taken on the mare. From this study, we have seen that mares are important resources and modifying access or management rule of the resources might create conflicts and jeopardize any development project if the local situation is not well characterized and understood.

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