Institutional histories, seasonal floodplains (mares), and livelihood impacts of fish stocking in the Inner Niger River Delta of Mali.

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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.

Abstract

The seasonally flooded depressions in the Inner Niger Delta (known as *mares*) represent a critical fishery resource for the inhabitants of the village of Komio, and at present, access is open to all residents. A proposal to build stocked fish enclosures in the main village *mare* presents potential benefits and risks. On one hand, overall productivity in the *mare* could be significantly increased, providing important sources of protein and cash during the annual drought period, when few livelihood activities can be performed and when village livelihoods are at their most vulnerable. Enhanced productivity in *mares* may also decrease local household pressures for seasonal labor migration. On the other hand, a resulting increase in the value of these *mares* may encourage elite capture of project benefits or rent-seeking by certain village leaders of the landowning Marka ethnic group. As Bozo and Somono fishers appear most dependent on fishing income, clarification of access rights and *mare* fishery impacts on livelihoods is of particular concern to avoid negative externalities created by the pen aquaculture pilot program. Additionally, it may help us understand the potential for free-riding and theft that would undermine the project.

This research employs a triangulation between documentary, qualitative and quantitative data collections. To situate our assessment of *mare* stocking impacts, we review the literature describing the historical institutional context for *mare* and river fisheries access. Using qualitative interviews and focus group discussions, we provide evidence of how local institutional and leadership capacity for equitable common property resource management have evolved since the introduction of irrigated farming systems (known as *Périmètres Irrigués Villageois* or PIVs) in the 1990s. From household survey data we describe the livelihood strategies of the different ethnic groups' in this community, and the specific roles that *mares* play in them. We conclude with a discussion of probable benefits for different stakeholder groups, and offer suggestions for avoiding problems of elite capture and free-ridership.

Introduction

The Inner Niger River Delta in Mali encompasses a 30,000 km^2 area bordering the Sahara Desert that undergoes an annual cycle of flooding and drought (Kone 1985, Dicko et al 2003). The flooding (during Sept-Oct) provides fish with an immense, nutrient-rich spawning ground, and this bounty is then captured by fishers during the season of declining water levels (Nov-Mar) (Welcomme 1986, Lae 1992). In some areas, natural flood plain reservoirs (known as *mares*) prolong local communities access to these valuable resources well into the drought period (Apr-June), providing them with protein and income, as well as social/cultural networking opportunities during the season when most households face significant shortages (USAID 2008). Prior to the droughts in 1973 and 1978, fishing of the *mares* was an important part of local livelihoods in Komio village (in *Commune Rurale* Borondougou, Mopti *Cercle*, Mopti Region), and according to local sources, provided the basis for some families' entire livelihoods. Since the droughts caused siltation of the primary channel connecting Komio's *mares* with the river, the duration and extent of flooding in these *mares* has been limited, and associated annual fish production is presently estimated at 5400 kg (Dienepo, unpublished data).

An experimental fish pen culture pilot project was established in a small portion of the largest *mare* ("*Mama Pondu*") at Komio in 2009, to provide the village with a means for increasing fish production in the *mare*. However, based on the WorldFish Center's experience with conflicts due to elite capture with aquaculture projects in Asia (Toufique and Gregory 2008), a rigorous assessment of local institutions, livelihoods, and resource access rights regimes was undertaken in order to ensure that the project would not result in negative externalities nor create conflicts between different *mare* resource users. In the village of Komio, given that the *mares* belong to landowners of the agricultural Marka ethnic group, particular concerns was

to avoid negative impacts on the Bozo and Somono fisherfolk living in Komio.

Mali's several river basins include over 200 major *mares* where pen culture has the potential to be scaled up, increasing household resilience during the season when livelihoods are at their most vulnerable. The main concentrations of *mares* are found in the Inner Niger River Delta (spanning parts of Segou, Mopti and Tombouctou Regions), the Seri basin (Mopti Region), Gourma basin (spanning Gao and Tombouctou Regions) and the Sourou basin (starting in Mopti Regoin and extending into Burkina Faso) (Dicko et al 2003).

Methods

This research was conducted as part of a Consultative Group for International Agricultural Research (CGIAR) Challenge Programme for Water and Food project entitled: "Community based fish culture in irrigation systems and seasonal floodplains". In addition to an extensive literature review, a series of four research field visits were conducted to Komio village during May 2008-October 2009.

The first two visits investigated local livelihood strategies, terrestrial and aquatic resource access rights, and institutional contexts through qualitative interviews and participatory rapid appraisal group discussions (see Joffre and LaJaunie 2008, Russell and Coulibaly 2009). Subsequently, a household survey investigating demographics, livelihoods and periods of vulnerability was conducted in Komio village. Households were selected using a stratified random sampling with 15 households selected at random from each of the Marka, Somono and Bozo ethnic groups, in addition to all 7 Fulani households present. Finally, based on an analysis of the household survey data, the last research visit involved conducting focus group discussions with male and female member groups from each ethnicity. These groups discussed: *mare* resource uses, the roles of institutions for governing access

and resolving conflicts between mare resource users, and means by which conflicts associated with construction of fish enclosures could be avoided or addressed.

Results

Institutional history of mare access

Transitory Bozo fishers and water spirits

The first known users of this landscape were Bozo fishers who migrated and fished throughout this region for centuries prior to the establishment by the Marka of Komio village; however, their presence was probably a transient one. Notwithstanding their growing Islamization, the Bozo maintained their animistic traditions honoring the water spirits or genies (known as *nyenne* or *jegu*) that were known to inhabit the waters, and who were regarded as the true owners of these waters (Moorehead 1997, Fay 1989). Responsibilities for maintenance of this relationship fell to the senior male of the Bozo family that established the initial pact with the genie of a specific water body (the "water master")[1].

Although specific regulations varied, they generally included the setting of fishing seasons, and conducting ceremonial sacrifices to the water spirit (Kassibo 2004, Cotula and Cisse 2007, Moorehead 1997, Beeler 2006, Fay 1989). Fishing seasons were associated with seasonal changes in river water levels. During the flood season (when fish are dispersed, and territorial limits are hard to define) access to water bodies was granted freely to all in exchange for a symbolic token of respect (known as the "*prix de kola*"). However during low water levels (when fishing territories were easily defined and when fish were forced into the main watercourses and isolated *mares*), visiting fishers were expected to pay a third of their catch to the

[1] Known as "*maitre des eaux*" (water master) or "*chef des eaux*" (water chief).

water master (a payment known as "*manga jii")* (Moorehead 1987, see also Lavigne Delville 2003, Kone 1985, Fay 1989).

River and *mare* ownership sold to Fulani Empire allies

Traditional institutions and livelihoods underwent significant change following the establishment of the Fulani "*Fulbe barn*" Empire by Cheikh Amadou (1818-1864). The newfound stability and security encouraged permanent settlement of the land by displaced peoples, and the new rulers codified all access to natural resources through a system of laws referred to as the *Diina* (Kone 1985, Moorehead 1997, Fay 1989a, Sarch and Allison 2000). The Marka are an traditionally agricultural ethnic group who are known to have maintained good relations and close economic interdependencies with the Bozo (Fay 1989). According to local oral accounts, the Marka Timota clan was the first to establish a permanent settlement at Komio, having purchased the territorial rights from the Fulani Tukalor Empire (1864-93)[2] (referred to locally as "*fouta toro*" in reference to their capital city). The village territory was subdivided between four Timota siblings and continues to be headed by their descendent family heads. Subsequently, Somono, Bozo, and Rimaibe groups gained permission from the Marka to establish Kouana, Kamaga, and Kanguila villages respectively within the Komio's village territory

The establishment of the Fulani Empires gave prominence to the Somono, a new ethnic group and caste of river boatmen and fishers[3] who served as a naval force for the Fulani Empire, and who established settlements along the banks of the Niger River at one day (boat travel) intervals (Moorehead 1997). Throughout much of the delta, Somono settlers purchased the water

[2] The Fulani Tukalor Empire overthrew the Fulbe Barn Empire in 1864.
[3] This is a caste that was created during the Mali empire (1250-1450), initially primarily made up of Bozo fisherfolk, but later included ethnic Bobo, Bambara, and Dogon captives and developed into a navy (Moorehead 1997).

master rights from the Tukalor Empire.[4] The river along Komio village falls within the river territory known as "*Korondaga batigi*" and covers roughly 25km of the Niger River (see Appendix A). This territory was initially purchased by a single Somono water master. but has since been managed collaboratively by his three descendent families who live in different villages along the shoreline.

Ownership of all *mare* fisheries on the other hand remained with the Marka families who owned the land on which the *mares* are found. It seems most likely that the Marka left the traditional Bozo water master, "*Baba Aougal*", a purely spiritual role of maintaining the relations with the water spirits (not an uncommon arrangement in some parts of the delta, referred to by a new title, *namu-tuu)* (Kone 1985, Moorehead 1997).[5]

Institutions governing mare fishery access today

Today the *Baba Aougal* is responsible for setting the closed season ("*mise en défens*") which occurs once the *mare* becomes separated from the river (usually during February-March). He also sets the dates for collective fishing in the four main *mares*, and at times may be called upon to organize fishing in the river reserves. As discussed by Joffre and Lajaunie (2008), the closed season collective fishing events for the four main *mares* are interspersed by 1-2 weeks over the course of the dry season (April-July), with the deepest *mare* (known as "*Mama Pondu*") being fished in May. The primary fish species captured during the collective fishing events include some that migrate back to the river (*Citharinus sp., Siluranodon sp., Auchenoglanis sp.,*

[4] In fact, Somono leaders today claim that the river fishing territories and the relationships with the local water spirits were first established by the Somono water masters themselves rather than any Bozo predecessor. There is no means for conclusively confirming or rejecting this version of history, but it is unlikely given the much longer history of the Bozo in throughout the delta (Moorehead 1987).

[5] As above, local Marka leaders claim that rather than taking away the traditional Bozo water master territorial claims over mares, that they invited the senior Bozo lineage to take up this role due to its extensive animistic knowledge which was believed to protect people from crocodiles, hippopotami, and drowning.

Schilbe, Tilapia and *Bagrus bajad*) and others that remain in the deeper *mares* throughout the dry season (*Clarias, Hydrocynus brevis, Lates, Distichodus, Hemichromis fasciatus* and *Brienomyrus niger*)(Bénech et al 1994).

Aside from the imposition of a closed season, access to Komio's *mares* is open to residents and non-residents alike, and neither the Marka land owners nor *Baba Aougal* limit who may participate in *mare* fishing, either individually or during the collective fishing event. Additionally, unlike *mare* water masters in other communities or the Somono water masters of the local river fishing reserves, neither land owners nor the *Baba Aougal* charge non-residents a fee (*manga jii*) for participation in Komio's *mare* collective fishing events (Russell and Coulibaly 2009). The *Baba Aougal* is also a Muslim clergyman and is consequently reluctant to discuss any animistic traditions involved in his role as water priest, however, within the community he is still widely assumed to have spiritual powers derived from animistic traditions (Joffre and Lajaunie 2008).

The only fishery access rights that are enforced by the Marka land owners relate to the three main channels that connect the large *mares* to each other and to the Niger River itself. Ownership of fishing channels is exercised during the months of November to February, when the declining water levels (a season referred to as the "*décrue* ") make the channels strategic fishing locations as fish leave the *mares* for the Niger River. Such enforcement of private channel fishing rights is common throughout the Inner Niger River Delta (Fay 1989), and in Komio channel fishing is the exclusive right of a few Bozo families, in exchange for which they pay *manga jii* to the respective Marka landowners.

Common property institutions associated with irrigated farming

According to community members, the Sahelian droughts of 1973 and 1978 devastated livelihoods in Komio, forcing most families to sell their productive capital, and resulting in an exodus of Komio villagers to work

the cities. As part of a program intended to stabilize rural livelihoods, the government's Office du Riz – Mopti (ORM) established a rural irrigated rice farming scheme in Komio (known as "*Périmètres Irrigués Villageois"* or PIV) in 1986 on land owned by the village chief of Komio.

All families from Komio, Kouana, Kangela and Kamaka villages were allocated plots within the PIV and the high and assured productivity of PIV versus floodplain rice culture encouraged many families to return to their villages.[6] Unfortunately, the chief of Komio and local politicians in charge of the PIV misappropriated the proceeds, resulting in deterioration of the irrigation pump. After the pump broke in 1997, Komio underwent another exodus and the neighboring communities established their own independent PIVs. In 1996, the community (under leadership of one of the Marka elders, removed the chief from his office, and asked his brother, living in Bamako, to take up the chieftaincy. The new chief was able to convince ORM to supply them with two more pumps in 2002, allowing this PIV to once again produce two rice crops per year. The Chairperson of the PIV committee is the chief's senior advisor, Mr. Manfing Timota.

In this region of Mali, women do not traditionally practice rice farming. However, a group of120 women who already collaborated in collective production of onions, decided to attempt rice farming and were able to lobby an NGO[7] to donate an irrigation pump on 2001. Following a series of unfortunate mechanical difficulties, the men's PIV Association donated one of its older pumps to the women's association. Currently, both the women's and men's PIV collect membership dues that are invested in a very popular community development loan fund. This fund provides residents

[6] Joffre and Lajaunie (2008) report productivity of inundated rice cultivation in the Komio's floodplain to be anywhere between 500-1000kg of rice per hectare depending on the access in each family to labor and the productive capital needed (plows, oxen). In contrast, PIV culture is reported by this community to achieve between 7700-9600 kg/ha for each harvest due to the intensified rice farming practices used, the collective application of fertilizer, and the guaranteed access to water.

[7] "Organisation pour la Gestion de l'Environnement au Sahel" (OGS)

with investment capital, and the interest paid on the loans funds the maintenance of the pumps and other community development activities.

Roles of mare fishing in supporting livelihoods

There are four main ethnic groups living in Komio village: Marka, Somono, Bozo, and Fulani. Although many of these families have lived and intermarried with each other over the course of several generations, significant differences remain in terms of their livelihood strategies. As descendents of the original settling farmers, average Marka ownership of livestock and plows, and both floodplain and PIV plot cultivation are among the highest in the village. However, the Somono own almost as much livestock and cultivate almost as much as much land as the Marka, as well as owning modest amounts of fishing capital. The Bozo have the greatest ownership of fishing capital with modest farming activities, while the Fulani concentrate their livelihoods almost entirely on livestock herding.

There are also differences in household demographics and prioritization of education. Bozo have the largest average family size (7.3 members), and twice as many teenagers in their households (1.9) as an average Marka or Somono family (0.9). Differences between Marka, Somono and Bozo household numbers of children (age 5-9) and infants (1-4) are small. Fulani and Somono share the smallest household size average of 5.7 members. Somono households report the largest proportion of educated adults (~8%) and youths/children (~34%), whereas the Fulani report the lowest of each (0% and ~8%, respectively). Marka and Bozo households report similar low proportions of educated adults (~4%), but Marka households report more educated children (~24%) than the Bozo (~15%).

Table 1. Household productive capital and demographics by ethnicity

	Marka	***Somono***	***Bozo***	***Fulani***

Agricultural Capital				
Medium Livestock (sheep, goats)	2.8	1.5	1.3	8
Large Livestock (cattle, oxen, donkeys)	3.9	6.4	1.9	1.2
Plow	1.5	1.3	0.9	0.2
Floodplain cultivation (ha)	5.4	4.9	3	0.8
PIV plot cultivation (ha)	0.3	0.3	0.2	0
Fishing Capital				
Pirogues	0	0.6	0.9	0
Gillnet (yds)	13.8	96.3	307.8	0
Hooks	0	66.7	1333.3	0
Cast net	0.5	0.4	0.9	0
Traps	0.1	0	2.7	0
Demographics				
Adults (>15)	3.3	2.5	3.1	2.8
Young teens (10-15)	0.9	0.9	1.8	1.2
Children (5-9)	1.5	1.1	1.3	0.8
Infants (0-4)	1.1	1.2	1.2	0.8
Household size	6.9	5.7	7.3	5.7
Adults (primary sch./adult lit.)	4	7.9	4.3	0
Young teens/children (primary sch.)	24.3	34.5	15.2	8.3

The three most important livelihood activities (limited to those activities cited by at least 10% of each ethnicity) for each season are shown in Table 2. The sale of cereals (primarily millet and rice) produced in the floodplain, and river fishing are among the top three sources of income for the Marka, Somono and Bozo during both the declining waters (*Decrue*) and flood (*Hautes Eaux*) seasons. During the dry season (*Etiage*), fishing in the *mares* and river are the dominant sources of income for these three ethnic groups. During the period of rising water levels (*Crue*), rice production from the PIVs is the most important source of income. Among the Fulani, the primary sources of income throughout the years are sheep raising, livestock herding, and work as *marabouts*[8] and clerics. During the high water season

[8] Officially this term denotes a Muslim saint and holy man (see Brett 1980), however in sub-Saharan West African *marabout* frequently refers to (usually) a man of Muslim (but possibly of Christian or animistic faiths) who mediates and arbitrates in conflicts and sells amulets in exchange for gifts or money. His influence is based on knowledge of Holy scripture and supernatural powers that are attributed to him.

cereal production in the floodplan is most important, and the Fulani do not participate in fishing or PIV-agriculture at all.

Table 2. Top three sources of income by season and ethnicity

		Decrue (Declining waters)	Etiage (Drought)	Crue (Rising waters)	Hautes Eaux (Flood waters)
Marka	**1st**	Cereals (40%)	Mare fishing (43.3%)	Rice-PIV (40%)	Cereals (33.3%)
	2nd	River fishing (16.7%)	River fishing (23.3%)	River fishing (10%)	River fishing (16.7%)
	3rd	Commerce (13.3%)			Rice-PIV (10%)
Somono	**1st**	Cereals (40%)	Mare fishing (33.3%)	Rice-PIV (36.7%)	Cereals (36.7%)
	2nd	River fishing (33.3%)	River fishing (33.3%)	Veg-PIV (10%)	Rice-PIV (13.3%)
	3rd			Poultry (10%)	River fishing (10%)
Bozo	**1st**	River fishing (26.7%)	River fishing (26.7%)	Rice-PIV (46.7%)	River fishing (23.3%)
	2nd	Channel fishing (20%)	Mare fishing (16.7%)	River fishing (23.3%)	Cereals (23.3%)
	3rd	Cereals (20%)		Poultry (10%)	Poultry (13.3%)
Fulani	**1st**	Sheep (25)	Sheep (25)	Sheep (16.7)	Cereals (33.3)
	2nd	Herder (16.7)	Herder (16.7)	Herder (16.7)	Sheep (16.7)
	3rd	Cleric (16.7)	Marabout (16.7)	Marabout (16.7)	Herder (16.7)
	3rd	Marabout (16.7)			Marabout (16.7)

Reflecting its ranking by Marka, Somono, and Bozo households as one of the top two sources of income during the dry season, a majority of the households (93% of Marka and Somono, 67% of the Bozo) interviewed indicate their participation in the collective fishing of the local *mares*. This is somewhat alarming as the mean individual catch estimated by Dienepo (unpublished data) during the collective mare fishing event of 2008 was around 7.2kg (for those who participated in both days of fishing). While not discussed in length here, these events also have significant social value for community members, providing them with opportunities to meet and network with non-resident visitors. A small proportion of respondents from all three ethnic groups also indicate the *mare* fishery to be among the

top two sources of income during all other seasons of the year. Daily catches by these gillnet fishers were estimated by Dienepo (unpublished data) at roughly 1.1kg per person, and overall, individual fishing were estimated to harvest roughly 64% of the total fish produced in the *mare*. Almost all households in this community send some (or all) family members to pursue livelihood activities in other villages, towns, (and even countries) as part of their collective livelihood strategies. For all ethnic groups, the season with the greatest amount of out-migration is the dry season (Etiage), which is also the period when there is least need for labor at home (see Table 3). The Bozo, who have the largest average household sizes, send the largest average number (2.3) of family members away, closely followed by the Marka (2.1), Somono (1.9), and the Fulani (1.5). However, when calculated as a proportion of the total workforce available (adults + young teenagers), the Somono send the largest proportion of their able-bodied family members away during each season of the year (and up to ~57% during the Etiage).

The importance of *mare* fishing is highlighted by the fact that over 70% of all Marka, Somono, and Bozo leaving the village during the dry season for the purpose of income generation do so (for most exclusively) in order to participate in the fishing of *mares* belonging to other villages. Again, in terms of the amount of adult and young teenage labor available to each household, the Somono invest the greatest amount in *mare* fishing away from home (41%), followed by the Marka (39%), and Bozo (33%).

Table 3. Seasonal labor migration and mare migration by ethnicity

		Labor migration				Etiage mare migration
	Ethnicity	**Decrue**	**Etiage**	**Crue**	**H. Eaux**	
# Individuals	**Marka**	0.6	2.1	0.6	0.4	1.7
	Somono	0.7	1.9	0.7	0.5	1.4
	Bozo	0.7	2.3	0.4	0.5	1.6
	Fulani	0.2	1.5	0.3	0.2	0.0

% Adults + young teens	**Marka**	14.1	48.4	14.1	9.4	39
	Somono	21.6	56.9	21.6	15.7	41
	Bozo	15.1	46.6	8.2	9.6	33
	Fulani	4.2	37.5	8.3	4.2	0

Household vulnerability correlations with *mare* and river fishing

In addition to measurements of assets and productive capital, the household vulnerability assessment was based on reported shortages of a number of resources: water, pasture, labor, staple foods, and protein (Figure 1). For all ethnic groups, the periods of greatest shortage in all its forms occurs either during the *Etiage* or *Crue* seasons. It should also be noted that significant percentages of the households in each ethnic group reported no shortages (shown as "none" in Figure 1) in some resources throughout the year. The percentage of such households is consistently highest among the Bozo. Alarmingly, however, very few households of any ethnic group indicated overall resource self-sufficiency (an absence of shortage) in terms of staple foods or protein.

Figure 1. % Households reporting seasonal shortages in Komio Village

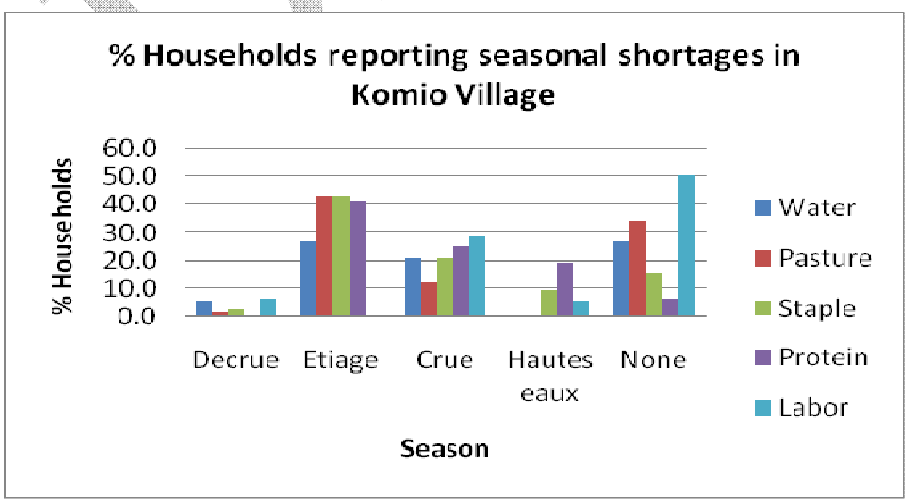
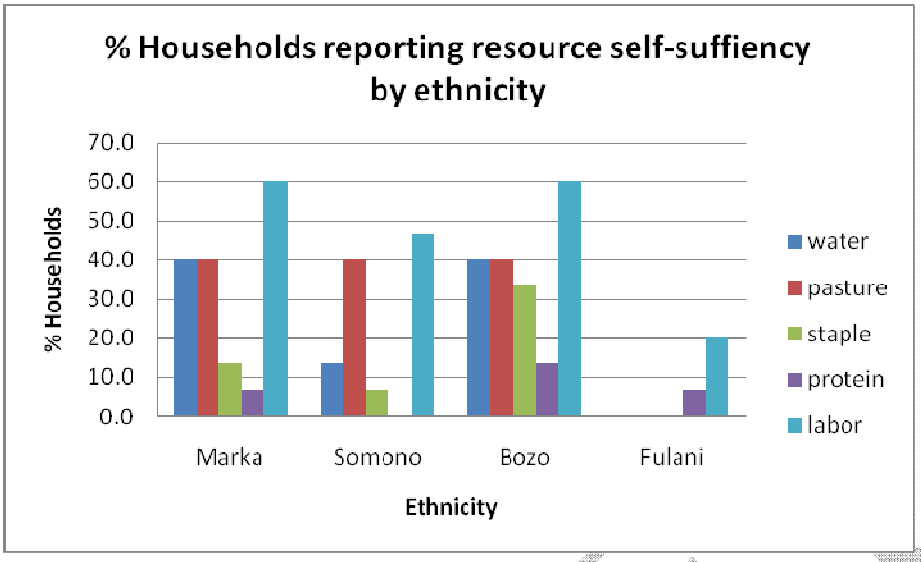


Figure 2. % Households reporting resource adequacy by ethnicity



In marked contrast with the strong correlations that link other livelihood activities such as, asset ownership, family demographics and vulnerability (an analysis that falls outside of the present discussion), the importance of *mare* fishing appears to be only very weakly correlated (if at all) with other variables studied. This suggests a relatively homogenous level of importance of collective *mare* fishing across socio-economic levels within each ethnicity (the Fulani excepted). The validity of these measurements is confirmed by significant correlations between income from river fishing and other livelihood activities, household assets, and demographics. While each individual livelihood activity is undoubtedly more critical for household resilience among poorer households than for wealthier ones, in contrast with the importance of river fishing as a refuge for the poorer Somono households, *mare* fishing does not appear to play any particularly critical livelihood role for poorer Bozo, Somono, or Marka households.

Mares – providing a variety of goods and services

In addition to their values as fisheries, *mares* provide the community of Komio with a wide range of benefits: drinking water, water for bathing,

cultivation of vegetables and cereals, livestock pasture, raw materials for brick making and roofing, collection of edible and medicinal plants, and hunting. Aside from fishing, the most important resource uses in *Mama Pondu mare* are livestock pasture, gathering of wild edible plants, and water for drinking and bathing (for people working in their fields nearby). The most intensive periods of *mare* resource use: *Decrue* and *Etiage*, coincide with the periods of greatest interest for a fisheries stocking intervention.

Key informant interviews and focus group discussions with all ethnic and gendered groups indicate an almost complete absence of conflicts between different *mare* resource users. The exception involves that of Fulani cattle grazing on cereal crops surrounding the *mare*, and even these conflicts are described as being resolved amicably at an inter-personal level rather than needing to involve any higher authority. Aside from participation in collective fishing, residents from neighboring villages make little use of the *mare* resources due to the presence of other wetlands or *mares* closer to their villages.

Discussion

Mare resources play a particularly important role for most Komio households during the periods of declining waters (*decrue*) and drought (*etiage*). However, while the Bozo own more fishing gears on average than the Somono and Marka, their fishing effort appears more focused on river fisheries, whereas the Marka and Somono rank fishing income from *mares* highest. Among the Marka and Somono, there are also weak (but consistent) correlations between the importance of *mare* fishing and other signs of wealth accumulation. The *etiage* is also the period when households send large numbers of people away from the village to bring in further income and diminish pressure on the household food supplies. Consequently, the

potential for improving the productivity of the *mares* through stocking of enclosures is greeted with enthousiasm in this community.

Although there are some questions surrounding origins and development of water master institutions in the *mares* of Komio Village, this does not appear to be a point of conflict between Bozo and Marka within the community. Aside from *manga jii* paid for channel fishing rights, the absence of rent-seeking by landowners associated with other fishing activities in the *mares* probably helps to limit conflict or envy. This is supported by extensive focus group discussions that indicated minimal conflict between existing users of the *mare* resources, and no predictions of negative externalities associated with construction of fish enclosures.

Following painful lessons learned through leadership corruption in the past, it appears that Komio's current leadership institutions enjoy high levels of trust through their equitable and transparent management of PIVs and the highly popular community development fund, as well as their support of the women's PIV. Nevertheless, the accumulation of influential roles by the chief's principal advisor, (i.e., PIV chairperson, head of clan that owns "*Mama Pondu*" *mare*, ouster of the former chief, representative to the *commune rurale* assembly) does raise inevitable concerns regarding the corruptibility of power in the future. Therefore, the project has taken steps to ensure transparency in harvesting of enclosures and division of the proceeds.

The primary risk to the project, as identified by stakeholder focus groups and our analysis, concerns the potential for theft of fish from the enclosures. This is of particular relevance as the *mares* become a valuable resource during the drought months when much of the country faces food shortages (USAID 2008). Given their expertise in fishing, the primary suspects might be expected to come from the Bozo and Somono populations.

However, our livelihoods analysis indicates that the Somono overall have the some of the most diversified livelihoods that combine investments in both fishing, farming, and livestock ownership, and (encouragingly) have much higher education levels than other ethnic groups. Additionally, while Bozo livelihoods are largely limited to fishing, their ethnic group has the largest proportion of households reporting no periods of shortage at all. This corresponds to patterns found by others showing Bozo fishery-focused livelihoods to be generally more resilient in the face of food shortages than other ethnic/livelihood strategy groups (Wampfler 2004). Nevertheless, some risk for free-ridership and theft remains from poorer Bozo and Somono households, and particularly for thos Bozo who receive little benefit from the community development fund and participate less in collective fishing (and other uses of) of the *mares*.

Encouragingly, most ethnic focus groups (including the Bozo and Somono) and the village leaders themselves identified the danger of theft and need for guarding of enclosures. Additionally, it will be important for the leadership to actively engage with the Bozo and the poorer Somono households to ensure that they perceive a benefit from the community development fund. Public harvesting of the enclosures and transparent accounting of the proceeds will also help ensure that no one feels cheated or marginalized by the program. Finally, although the Fulani present a minimal risk in terms of sustainability of the enclosures, from a social justice point of view, it should be noted that they have heretofore not been invited to participate in the collective fishing events, and may wish to participate if given the opportunity.

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Appendix A. Map of Komio Village and Korondaga River Fishing Territories