

## Market Access and fish farms' density in a sub-Saharan rural country side: a case study of the village of Gbotoÿe in the forested areas of Guinea.

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### 1 Introduction

The agro-environmental benefits of a fish-farm integrated into a farming system, mostly self-sufficient for supply of stocking fish and fish-food, are broadly admitted. But its contribution to rural household economy is sometimes qualified as insignificant, even non-profitable or even contemplative, sometimes it is only a self-sufficiency crop. In their review of African aquaculture, Brummett *et al.* (2007) identify the « local and regional marketing infrastructure for the sale of food fish produced » and the « lack of access to wealthier markets » as key constraints that are a main explanation of the failure of the promotion of a sustainable aquaculture integrated into farming systems across Africa. As a conclusion, they recommend promotion of small and medium-scale enterprises. More recently, Cai *et al.* (2012) point out that « However, the profitability of farming low-value species is usually low because of limited market potential ». So, the narrowness of the effective demand accessible to the rural fish producers would build up an impassable obstacle for the integrated fish farming development of the integrated fish farming. In these conditions, the economic benefits of this fish farming type at the level of the farming system would decrease as the number of rural fish farmers competing on the same fish market increases. Does the saturating of the so narrow local market doom the ability to densify the networking of the rural producers? This is an essential question in order to appreciate the potential contribution of this type of fish production to face the food security of the rural population in Sub-Saharan Africa. Although in Guinea, rural fish farming development schemes including the purpose of producing fish for the rural consumers have induced strong dynamics for about 15 years. Other choices targeted the quality of the integration of the fish production into the agricultural smallholding and the self-sufficiency for the supply of the fingerlings and for the fish-food. The strong development of this kind of fish farming in the region of N'Zérékoré for a decade justifies the support that the Government is providing to its promotion today. The village of Gbotoÿe is an interesting case study to answer this question. In May 2015, in this village of about 2000 inhabitants, 41 fish farming farms have been estimated to produce 11 t of fish, that means approximately 5,5 kg/inhabitant/y if all the fish is locally consumed. At the beginning of the years 2000, official estimations evaluate to 1kg the yearly fish consumption of a person living in forested Guinea. Although deepened studies show this figure was under-evaluated, the today global production seems significant before the local demand and shows a probably saturated market or becoming saturated.

### 2 Materials and Methods

Although economy and agricultural policies have focused on export crops, the rise of the food-producing sector for commercial purposes has supported strong dynamics of agricultural development (Chaléard and al. 2002 for Guinea and Chaléard 1994 for the Côte d'Ivoire). By mobilizing a geographic approach, this study seeks to explain how the fish farming sector slots into the village area and how this village area is itself connected to greater networks, particularly commercial ones. At this stage the connection of the village with N'zérékoré, a secondary town of 300 000 inhabitants (RGPH of 2014) is essential. This approach is completed by a description and an analysis of the fishfarming practices and of their evolution in order to point out how Gbotoÿe fish farmers adapt themselves to the market's opportunities and constraints. The systemic approach proposed by Cochet (2012), enables us to go over the fish-farm level in order to fit in those evolutions inside the global agricultural transformations all over the N'Zérékoré Region marked by a strong politics instability (Marchal and al 2002, Bangoura et al 2006). This study relies on a deep understanding of those farmers and of their agriculture smallholdings. Data are issued from field surveys dated ten years between them, at the beginning of 2000 up to 2013 – 2015. Three types of inquiries have been conducted : individual inquiries to understand the course of the individual development, inquiries on the fish-farming practices and their evolution, to analyse the integration of the fish farming unit inside the familial farming system and last, historical and group inquiries to record the evolutions of the village, global evolution of the fish farming sector and processors' perceptions.

### 3 Results - Discussion

Initially, the start in Gbotoÿe of the fish farming activities is boosted in 2002 by a scheme implemented by APDRA (Oswald, 2013). The evolution at the beginning is slow : in 2006, only 13 fish farmers have built up at least one pond. But Gbotoÿe's fish producers were able to quickly appropriate and adapt to the technical referential frame promoted. Even if no more schemes have directly operated inside the village since 2009, the number of fish producers is still increasing. In 2015, 10 new producers are building their ponds and soon should join the 41 that already produce, that means about one farming system among five has integrated a fish-farming system depending on our estimation. Most of the low-lands suitable for setting up a fish farm that is those in the upstream areas, are already converted (cf. Map). Up to 2009, fish production was orientated to the village fish market and self consumption. But since 2009, a growing share has been orientated towards the fish market of N'Zerekore. In this town, like elsewhere in this country, frozen or smoked fish is distributed and contributes to the main protein intake of the population. Frozen Fish is supplied from Conakry, and the capacity of the cold-storage warehouse has doubled from 153 tons in 2001 (Keita, 2001) to 298 tons in 2015 (according to the Direction préfectorale de la pêche et de l'aquaculture). A supply network for farmed fish has been set up, professional sale-women have gathered inside the Association des Vendeuses de Poissons de Pisciculture (AVPP). This evolution is not specific to Gbotoÿe, the network drains all the area and the sales-women go up to 50 km far to buy fish near ponds taking track-roads of poor quality. The complexity and adaptability of those fish selling chains give them their efficiency, similar to those described by Chaléard (1996) that enable the rise of the food-production for commercial purpose in West Africa.

Fish breeding cycles present a great heterogeneity. Fish stocking density and the duration of the fish cycle vary respectively from 0,1 to 2 fish/m<sup>2</sup> and from 3 to 12 month. That enables producers to produce the targeted size for fish depending on their purpose, the market and their cash-flow availability. Rather than increasing the size of the growth pond, farmers tend to multiply the number of serviceponds for reproduction, fingerling production or stocking in order to increase the number of harvests per year. Floating-rice cultivation inside ponds, planting when ponds are drained, fixes major dates of the agricultural calendar. The success of the integration of fishfarming explains for Simon *et al.* (2009), the contribution of the fish farming to the forested Guinea. Fish producers have also taken advantage of the evolution inside the palm oil processing chain. Relative price increase leads to the use of the light= mecanization, palm kernel crushers have spread off. Palm kernel cake, a by-product of this process, has been used to feed pigs. Pig farming quickly develops all over the area. In their great majority, fish producers have combined pig farming to their pond. In a second stage the way of planning ponds was revisited in order to better the valorisation of pig manure.

#### 4 Conclusions

In this case, the local fish market was not a constraint for the development of fish farming in Gbotoÿe, and more broadly among the Region of N'Zérékoré. In the first stage the local market of the village has allowed the setting up of an increasing efficiency by enforcing fishfarmers to cooperate with proximity services (like the supply of fish for stocking or the monitoring of pond building). Thanks to the technical referential frame which targets to give all the lever of the management to the producers, combined with the pragmatic and flexibility management of familial farming systems, the local fish market accompanied a true dynamic of intensification of the fish farming. In fact those fish producers consider fish as a commercial crop in this Region which quickly changes and endures major stresses, the fish farming evolution attests of a remarkable sustainability. In this agrarian system where perennial crops dominate, fish farming introduces an interesting diversification based on producing food for commercial purposes. Contributing to enabling those numerous producers in their family farming system to produce large amounts of fish is a realistic challenge, attested by the present study.

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