


# Socio-Economic and Zootechnical Characterization of Fish Farming in the Noun Division (West Region-Cameroon)

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## Abstract

The purpose of this study was to provide preliminary information on fish farming in Noun Division in order to contribute to the improvement of fish production and productivity. The Accelerated Participatory Research Method (APRM) and snowball approach were adopted. The data were analyzed using descriptive statistics and Principal Component Analysis (PCA). The study revealed that fish farming is practiced in all the subdivisions of Noun Division. This activity is dominated by men (94%), polygamists (86%), over 60 years of age (55%) and with a primary education level (75%). The fish raised are mainly intended for self-consumption (81%) and self-financing (92%) is the main source of financing for this type of farming. Production costs are unknown to 98% of the farmers. Almost all fish farmers practice the extensive farming system (96%) with family labor (74%) being the most used. The common practice in this type of farming is monoculture (63%) with *Oriochromis niloticus* (65%) in ponds and not fertilized (71%). Local feed is used by 90% of these farmers. Age, fish farming education, marketing location and source of funding are the main socio-economic characteristics most correlated with fish farm performance indicators. Age is negatively correlated with production quantity, while source of finance is not. The development of fish farming in Noun Division will therefore require the implementation of participatory strategies with the farmers that will allow the government to promote fish farming and strengthen the extension services for this activity.

**Keywords:** Fish farming; Characterization; Farming techniques; Noun division

## Introduction

Fishery products are considered as the main sources of animal protein in the world as they constitute 44% of total animal protein intake [1]. Fish also plays an essential role in the food security and well-being of the world's populations in general and Cameroon's in particular (Toppe et al., and FAO [1]). Indeed, 89% of fisheries production in Cameroon is for human consumption and the remaining 11% for non-food uses (mainly fish meal and fish oil production) (FAO, 2019). However, the increasing rise in the population of fishermen, the multiplication and sophistication of gear and catching methods have caused a decline in global fisheries production [2]. To address this shortfall, fish farming has been strongly developed in recent decades in African countries through programs such as the Project for the Development of Fish Farming in the Central and Eastern Regions of Cameroon (PDPCE) and the Extensive Family Fish Farming Systems in West and Central Africa (SyPiEx) project, set up to boost fish farming production. However, several constraints have been identified as impediments to fish farming in these countries, including institutional, financial, technical and organizational levels [3-6]. They negatively influence the practice of this activity [7], which leads to the reduction of production, resulting in low productivity and profitability of fish farms [8]. Thus, in an effort to define different strategies for improving fish farming productivity in Cameroon, many studies have focused on the socio-economic and technical

characterization of fish farms in different regions of Cameroon, such as the work of Tiogué TC [9] in Mbam and Inoubou, Bomba [10] in Mfoundi, Atangana et al. [11] in the East region, Oben et al. [12] in the North-West and South-West regions. In the Noun Division, on the other hand, very few studies are available on this subject. It is within this framework that a descriptive survey of fish farming in this Division was initiated, with the objective of contributing to the improvement of knowledge on aquaculture production through the evaluation of socio-economic and zootechnical parameters of fish farming.

## Materials and Methods

### Study area

The study took place from February to May 2021 in the Noun Division; West Region of Cameroon, located between longitudes 10°30 and 11°40 East and latitude 5° and 6° North. It has 9 subdivisions (Foumban, Koutaba, Foubot, Kouoptamo, Massangam, Malantouen, Njimom, Magba, Bangourain) and covers an area of 13892km<sup>2</sup>.

### Data collection

Data collection for this study followed the Accelerated Participatory Research Method (APRM) [13,14]. Focus groups were organized through focal persons such as village chiefs and heads of zootechnical and veterinary centers in the Subdivision, in order to ensure institutional anchoring. Herders were identified using a non-probability method known as “snowballing” [15]. In this method, the first farmers surveyed inform on other fish farmers and thus become additional informants. The sampling strategy used was exhaustive across the nine Sub-divisions in Noun divisions. The semi-structured surveys based on the survey forms made it possible to obtain reliable information on the identification and location of the farms, as well as their socio-economic and zootechnical characteristics. The identification of the breeding areas was done with the help of an agent from the divisional delegation of livestock breeding, fishing and animal industries. This survey was preceded by a pre-survey that allowed us to determine the sample size, target the farmers to be surveyed and validate the interview guide used during this work Fish.

### Data processing and analysis

The collected data were encoded in the Excel software version 2016. Descriptive statistics were used to determine the percentages of the different information collected in the field. Differential statistics were performed using SPSS software (Version 21.0).

**Table 1:** Distribution of fish farmers according to social characteristics.

Parameters	Characteristics	Pourcentage (%)
Sex	Female	6
	Male	94
Marital status	Monogamous	13
	Polygamous	86
	Widow or widower	1

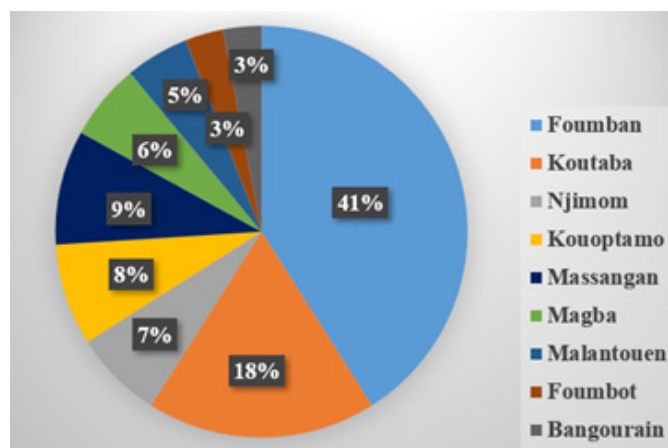
A. The Kolmogorov-smirnov and shapiro-wilk tests were used to test the normality of the variables of the socio-economic and zootechnical characteristics of the fish farmers.

B. Principal Component Analysis (PCA) was used to establish the correlation between the different variables in order to retain only the most explanatory variables of the characteristics of the producers.

## Result

### Distribution of fish farmers in noun division

Fish farming is currently practiced in all the subdivisions of the Noun division (Figure 1). The Foumban subdivision has the largest number of fish farmers (41%) followed by the Koutaba subdivision (18%), Massangam (9%), Kouoptamo (8%), Njimom (7%), Magba (6%) and Malantouen (5%). In addition, the Foubot subdivision and Bangourain (3%) appear to be the areas where fish farming is least practiced.



**Figure 1:** Distribution of fish farmers according to the different subdivisions.

### Social characterization of fish farming actors in noun division

Table 1 shows that fish farming in the Noun Division is mostly carried out by men (94%), married and polygamous (86%), over 60 years old (55%) with more than 15 years of experience in fish farming (41%), and most of them have a primary education (75%). Approximately 37% of the farmers take care of a number of children between 5 and 10. The main activity of these fish farmers remains agriculture (66%) while traders, active employees and retired employees represent respectively (17%), (14%) and (3%).

Age of fish farmers	20 to 30 years old	3
	30 to 40 years old	11
	40 to 50 years old	13
	50 to 60 years old	18
	Over 60 years old	55
Length of time in fish farming	Less than 1 year	17
	1 to 5 years	25
	5 to 10 years	11
	10 to 15 years	6
	More than 15 years	41
Number of children per farmer	1 à 5	18
	5 à 10	37
	10 à 15	24
	15 à 20	6
	More than 20 years	15
Main activities of fish farmers	Agriculture	66
	Active employees	14
	Retired employees	3
	Commerce	17

### Economic characterization of fish farming in non-division

This study shows that the fish produced are mainly intended for self-consumption (81%) (Table 2). The achievement of the production objectives is faced with low subsidies from the State, national and international partners (8%). In fact, self-financing (92%) represents the main source of financing for fish farmers. In

addition, only 12% of respondents are members of a formal farmer organization. Overall, these farmers acquire their land through inheritance (90%), producing less than one ton of fish (99%) per production cycle in this space. The farmers do not control their production costs (98%), which means that the selling price of the fish is generally not based on any criteria (81%). In addition, 81% of the fish farmers do not have a place to market the fish and therefore have no control over the selling price.

**Table 2:** Distribution of fish farmers according to economic characteristics.

Parameters	Characteristics	Pourcentage (%)
Production targets	Self-consumption	81
	Commercialization and self-consumption	19
	Savings	0
Sources of funding for fish farmers	Self-financing	92
	State subsidy	8
Farmers' organization	Yes	12
	No	88
Mode of land acquisition	Purchase	5
	Inheritance	90
	Donation	5
Quantity of fish produced per cycle	Less than 1ton	99
	More than one ton	1
Expenses for fish production	500000 to 1000000F	1
	More than 1500000F	1
	Don't know	98
Criterion for the selling price of fish	Weight	19
	None	81
Place of marketing	On the spot	19
	None	81

Selling price of fish	500 to 1000F	1
	1000 to 1500F	6
	1500 to 2500F	9
	More than 2500F	3
	None	81

### Technical characterization of fish farms in noun division

The distribution of fish farmers according to the type of labor shows that whatever the group, family labor (74%) is the most used in this farm (Table 3). In addition, 70% of the fish farmers have not received any technical training to run this farm and these fish farmers would like to receive training in the future to become professional and expand their farms. With regard to biosecurity, all of the respondents (100%) do not have foot baths and the presence of other animal species is noted in all farms. The majority of the interviewees do not practice a sanitary vacuum (97%) and all

the farmers (100%) do not analyze the quality of the water that feeds their structures. We noted that the majority of fish farmers practice the extensive farming system (96%), while the integrated and intensive systems represent the same proportions (2%). With regard to the type of integrated system, hen-fish and pigeon-fish represent the same proportion (1%). Fish farming facilities in this division are dominated by ponds (96%), followed by concrete tanks (2%) and combinations of ponds and concrete tanks (2%). In addition, the type of farming is dominated by monoculture (87%). Overall, these farms do not record their farm data in a farm register.

**Table 3:** Distribution of fish farmers according to farming techniques.

Parameters	Characteristics	Pourcentage (%)
Type of labor	Family workforce	70
	Employees	8
	Employee and family labor	22
Training in fish farming	Yes	30
	No	70
Desire for future training	Yes	70
	No	30
Presence of foot bath	Yes	0
	No	100
Presence of other animals on the farm	Yes	100
	No	0
	Yes	0
Physico-chemical analysis of the water	No	100
	Yes	3
Sanitary vacuum	No	97
	Intensive	2
Type of farming systems	Extensive	96
	Integrated	2
	Fish hens	1
Types of integrated systems	Pigeon-fish	1
	None	98
	Ponds	96
	Concrete ponds	2
	Concrete ponds and tubs	2
Type of breeding	Association	13
	Monoculture	87
Breeding register	Yes	0
	No	100

### Zootechnical characteristics of fish farming in Noun division

As shown in Table 4, Tilapia (*Oreochromis niloticus*) is the

main species raised by farmers in Noun division (65%), followed by catfish (*Clarias gariepinus*) (24%) and carp (*Cyprinus carpio*) (11%). The majority of the fry used for growth in these farms come

from the natural environment (60%). 98% of the fish farmers do not use synthetic or even natural hormones in the reproduction process on their farms. Fish feeding is based mainly on local feed (90%) with a feeding frequency of once a week (86%). In addition to fish, the respondents keep other animals on their farms. It can

be seen that the largest number of producers (77%) do not fertilize the ponds, while 23% do, and the most common fertilizer used is chicken droppings. 83% of the fish farmers raise their fish for a period of between 12 and 24 months.

**Table 4:** Distribution of fish farmers according to zootechnical characteristics.

Parameters	Caractéristiques	Pourcentage (%)
Fish species raised	Oreochromis niloticus	65
	Clarias gariepinus	24
	Cyprinus carpio	11
Origin of the 1st fry	Natural environment	60
Parameters	Reproduction	2
	State structures	30
	Other farms	8
Type of hormone used	Synthetic	2
	None	98
Fish feed	Local	90
	imported	10
Feeding frequency of the fish	1 time per week	86
	2 times a week	7
	3 times a week	7
Presence of other animals on the farm	Yes	100
	No	0
Fertilization of livestock structures	Yes	23
	No	77
Fertilizers used	Chicken droppings	19
	Manure	7
	Cow dung	2
	None	71
Duration of the production cycle	5 to 12 months	12
	12 to 24 months	83
	more than 24 months	5

### Correlations between Social characteristics and some production performance indicators

Table 5 of the correlations from the PCA shows that gender, age and training in fish farming are negatively and non-significantly correlated with fish mortality rate. Market weight, age, length

of time in farming and training in fish farming are positively correlated. The quantity of fish produced, age, number of children and training in fish farming are negatively correlated and only age is significant. The annual contribution of fish farming, age, marital status, and fish farming education are positively correlated while gender and main activity are not significantly different.

**Table 5:** Correlations between variables of producers' social characteristics and some performance indicators.

Variables	Sex	Ages	Mar_situa	Nber_chil	Mai_acti	Sen_fis_farm	Train_fis	MR	M	W_mark	Q_prod
Sex	1.000										
Ages	0.024	1.000									
Mar_situa	0.037	0.169	1.000								
Nber_chil	0.059	-0.040	0.246	1.000							
Mai_acti	0.028	0.088	-0.001	-0.127	1.000						
Sen_fis_farm	-0.007	0.399	0.067	0.053	0.015	1.000					

Train_fis	0.303	0.229	-0.139	-0.117	0.178	-0.008	1.000				
MR	-0.153	-0.155	0.018	0.095	0.063	0.024	-0.114	1.000			
M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.000		
W_mark	-0.085	0.259	-0.074	0.059	0.078	0.128	0.226	-0.057	0.00	1.000	
Q_prod	0.025	-0.266	0.022	-0.129	-0.069	-0.081	-0.157	0.061	0.00	-0.301	1.000

**Legend:** Mar\_situa: Marital Status; Nber\_chil: Number of Children; Mai\_acti: Main Activity; Sen\_fis\_farm: Seniority in Fish Farming; Train\_fis: Training in Fish Farming; MR: Mortality Rate; M: Disease; W\_mark: Weight of the Fish at the Time of Marketing; Q\_prod: Quantity of Fish Produced.

### Correlation of economic characteristics on some production performance indicators

Source of finance, selling price and criterion for selling price of fish are negatively correlated (Table 6) and have no significant difference for mortality rate Marketing weight, farmer organization, selling price, marketing location, criterion for selling price of fish, and expenditure on fish production are positively correlated, while source of finance is not. All have a significant difference.

The quantity of fish produced, the farmer organization, the place of marketing, the expenditure for the production of fish, and the criterion for the sale price are negatively correlated contrary to the source of financing. Only the production expense shows a significant correlation. For the farmer organization, the place of marketing, the expense for the production of fish, the selling price and the criterion for the selling price, there is a positively correlation, contrary to the source of financing. All these correlations are significant.

**Table 6:** Correlations between variables of economic characteristics of producers and some performance indicators.]

Variables	Sour_Fin	mod-ac_lan	FO	Price	Pla_mark	Exp_pro	Crit_sel_pri	MR	M	W_mark	Q_prod
Sour_Fin	1.00										
mod-ac_lan	0.12	1.00									
FP	-0.80	-0.10	1.00								
Price	-0.34	0.04	0.30	1.00							
Pla_mark	-0.59	0.08	0.51	0.78	1.00						
Exp_pro	-0.43	0.00	0.35	0.20	0.26	1.00					
Crit_sel_pri	-0.63	0.00	0.55	0.83	0.94	0.27	1.00				
MR	-0.13	0.09	0.07	-0.14	-0.03	-0.08	0.00	1.00			
M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00		
W_mark	-0.39	0.01	0.39	0.40	0.59	0.38	0.63	-0.06	0.00	1.00	
Q_prod	0.34	0.00	-0.27	-0.07	-0.20	-0.31	-0.21	0.06	0.00	-0.30	1.00

**Legend:** Sour\_Fin: Sources of Financing; mod ac\_lan : Mode of Acquisition of the Land; FP: Farmers' Organizations; Price: Selling Price; Pla\_mark: Place of Marketing; Exp\_pro: Expenditure for Production; Crit\_sel\_pri: Criterion for the Selling Price of the Fish; Tm: Mortality Rate; M: Disease; W\_mark : Weight of the Fish at the Time of Marketing; Q\_prod: Quantity of Fish Produced.

### Discussion

Fish farming is an activity practiced in all the districts of Noun division. It is not an important activity for children and adolescents, but rather is practiced by men, most of whom are polygamous and over 60 years old. The male gender appears to be the category of people most involved in this type of breeding. In fact, the low proportion of women at the head of fish farms can be explained by the configuration resulting from the origins of the people, traditions, as well as the status of women within African societies. This confirms the theory that in African societies, men are responsible for the management of fish farms and women, having very few property rights, generally accompany men in the various activities [16]. These results corroborate those obtained by Ntsama et al. [17] in the Central region and those of Okoror et al. [18] in Nigeria

and Benin who stipulated that fish farming is mainly practiced by men (93% and 81%). Fish farmers are multitasking in the Noun Department. Fish farming thus appears to be an alternative activity to agriculture or a subsistence activity for the majority of these fish farmers. This result is similar to those obtained by Oswald [19] and Tiogue et al. [9], who reported that fish farming is not the most important activity and that fish farmers mostly practice agriculture.

In this study area, the dominance of self-consumption in terms of the destination of production is consistent with the results of Bomba [10] in Mfoundi and those of Tiogue et al. [9] in Mbam and Inoubou. The status of the structures and the source of financing are in line with the results of Bomba [10], who stated that 80% of fish farmers in Mfoundi were private individuals and 97.5% of fish farming structures were set up with personal funds. The dominant

character of personal funds on the establishment of fish farming activity in this area would be dependent on the absence of banking structures capable of financing agropastoral activities, and when they exist, the access mechanisms remain cumbersome. Similar observations were made by Tiogue et al. [9] in the Mbam and Inoubou and by Kouamé et al. [20] in the Poro region. In addition, the majority of respondents are not members of a formal farmer organization of fish farmers. This result corroborates those of Toily [21] in the Abidjan and Agboville regions where most fish farmers are not organized into a cooperative.

Tilapia (*Oreochromis niloticus*) is the main species raised by farmers in the Noun department. This could be explained by the fact that this species adapts easily to local farming conditions and is highly valued by the population. The same analysis was made by N'dri et al [22] in the Poro region of northern Côte d'Ivoire. The noticed origin of fry from the natural environment could be explained by the fact that the quantity of juveniles produced in many fish farms in the country is insufficient to solve the problem of fry shortage. In addition, fish feeding is based mainly on local food. This situation is explained by the high price of imported feed, which increases the production cost of this farm. In addition, the choices of the type of feed to be used are influenced by the financial capacities of the promoters and the type of project promoted in the region [23]. Thus, the provision of quality inputs (fry and feed) at lower cost to fish farmers (in high concentration regions) will result in improved aquaculture production [24-28].

## Conclusion

At the end of this study, which aimed to characterize the socio-economic and zootechnical aspects of fish farming in Noun Department, it was found that this activity is carried out mainly by polygamous men with more than 15 years of experience in this sector. Nile tilapia (*Oreochromis niloticus*) is the main species produced by farmers in this area, followed by catfish (*Clarias gariepinus*) and carp (*Cyprinus carpio*). These species are mainly raised in monoculture, in ponds with a workforce generally of family type. The main type of feed used by fish farmers is local and 71% of them do not fertilize their ponds. In this locality, all of the respondents do not analyze the quality of the water that feeds their structures and do not have foot baths on their farms. Thus, a large proportion of fish farmers would like to receive training in order to become professionals in this field and to boost fish production. The development of fish farming in the department of Noun should involve raising awareness on the use of quality compound feeds, the adoption of adequate production techniques by fish farmers and the State should accompany the actors of this activity through multiple trainings.

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