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Socio-economic and zootechnical characteristics of fish farming in the Mwenga territory (South Kivu) in the Democratic Republic of Congo

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Abstract

Summary: During the Belgian colonial period (1950-1960), fish farming in the Democratic Republic of Congo (DRC) experienced a spectacular boom, producing nearly 1, 000 tonnes of marketable fish per year and 10, 000 tonnes of fry for 15, 000 fish farmers before the 1960s. After the country's independence, fish farming had declined sharply, with yields no more than 2.5 t ha⁻¹ per year in rural areas, or even a general abandonment almost across the entire DRC. This study was conducted from March 30 to December 30, 2023, using a survey questionnaire, interviews, direct observations, and documentation. Its main objective was to analyze the socio-economic and zootechnical characteristics of fish farming in the Bisitabyale Grouping in the Mwenga Territory, South Kivu Province, DRC. A total of 100 fish farmers were surveyed, either at their fish farms or within their households. After data collection, the data were processed using Excel and transferred to Statistical Package for the Social Sciences (SPSS) software for descriptive analysis. The results reveal that fish farming is exclusively practiced by men, with one-third of the farmers aged between 29 and 39, the majority of whom are married. Most of them have only a primary school education. A large majority of fish farmers (65%) are agricultural workers; 96% of fish farmers raise fish for economic reasons; 93% have not received any training in fish farming techniques; 72% own reservoir ponds. None of the farmers feed their fish or fertilize their ponds. All practice extensive farming and use a mixed stocking method. All fish farmers obtain their fingerlings from others. Finally, the majority face a lack of government support services and/or training in fish farming techniques.

Keywords: Extensive system, dam ponds, fish farming, fry, fertilizers, Mwenga territory

1. Introduction

Fish farming is one of the most important tools for the food self-sufficiency policies long advocated (FIDA, 2016 cited in Dakwen *et al.*, 2020) [8]. Indeed, fish plays a significant role in the diets of populations. In sub-Saharan African countries, it represents nearly half of the animal protein consumed, a figure that even reaches 70% in some countries such as Sierra Leone (Ndabarushimana and Mutimanwa, 2021) [47]. Beyond its high protein content, fish is also a source of essential trace elements for nutritional balance and health (Vanga *et al.*, 2000; FAO, 2008; N'Guessan *et al.*, 2017) [59, 12, 46]. Its flesh contains little cholesterol but a lot of polyunsaturated fatty acids (Lusasi *et al.*, 2019) [34] whose preventive and protective role against cardiovascular diseases is well established.

Fish farming, a very ancient activity practiced in antiquity by the Egyptians and Romans, was only introduced to Central Africa, and primarily to the Congo (present-day DRC), in 1946 (Micha, 2013) [41]. Before the 1960s, the country had a total of 122, 000 fish ponds covering an area of 4, 000 hectares, belonging to 15, 000 fish farmers, and *Oreochromis niloticus* was the main cultivated species (Micha, 2013) [41]. Despite a flourishing past, the country's aquaculture sector is currently in decline. Its aquaculture production was estimated by the FAO at 3, 000 tonnes in 2006, with a yield of 0.45 tonnes per hectare per year; The yield, well below that expected given the country's enormous potential, is explained by a multitude of political, institutional, social, and economic constraints (CIFOR, 2018) [6], namely the lack of fingerlings

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and feed, the lack of mastery of modern fish production and farming techniques, the difficulties in accessing capital, the lack of integration of fish farming into a subsistence activity, the lack of operationalization of the National Aquaculture Service, and the lack of qualified personnel in state services (CIFOR, 2018; Lumonakiése, 2020; Micha, 2013; Lukondi *et al.*, 2018; Lusasi *et al.*, 2019)^[6, 33, 41, 32, 34].

Nevertheless, the DRC, a country rich in waterways, can develop fish farming to improve the nutritional status of its population, as well as provide employment and curb rural exodus. The choice of the Mwenga Territory is justified by the fact that it is one of the eight territories in the South Kivu Province where Belgian colonists, missionaries, and mining companies (Great Lakes Mining) had developed fish farming in the Kivu region, and where fish farming activities are intensive. Furthermore, the Mwenga Territory boasts enormous potential in terms of arable land and its dense hydrographic network, including the Elila and Ulundi rivers, which are among the most important tributaries of the Congo River in its eastern reaches.

2. Materials and methods

2.1. Study environment

The Basitabyale group is one of the 22 groups (Babongola,

Bagezi, Bangunga; Bamulinda, Banamukika, Balinzi, Banampute, Basimwenda, Banakyungu, Buuse, Bawandeme, Basikamagulu, Basikumbilwa, Basimbi, Bagunga, Banakabale, Basibugembe, Basikasa, Bakute, Bagezi, Balighi, and Babongola) that comprise the Wamuzimu chiefdom (Wassomukokya *et al.*, 2004)^[61] in the Mwenga Territory, South Kivu Province, Democratic Republic of Congo (Fig. 1). It is bordered to the north by the Basilubanda group and the Lugela River; to the south by the Basibugembe group and the Ilezi River; It is bordered to the east by the Bawanda Grouping, and to the west by the Gambwa Grouping and the Kabilunga River. The area is 4, 112 km² with a total population of 317, 423 (Wassomukokya *et al.*, 2004)^[61]. Its hydrography is dense, including the Elila River, a tributary of the Congo River, into which flow the Zalya, Lubyala, Zizi, Kibe, Nyamupe, and Lusungu rivers. It comprises the localities of Ngolole, Kilimba, Mukila, Nyabisanza, Milanga, Katobe, and Kagogo. Its terrain is mountainous and it is surrounded by mountains (Itambila, Katuke-Ilango, Kibingo, Lulegeza, Kishinga, Misuna, Mingamba, Ilumba, Kagogo, and Misebe). Temperature and rainfall data indicate that the Basitabyale Grouping enjoys a humid tropical climate with two seasons: a dry season and a wet season. Its soil is silty-clay-sandy, favorable to agriculture (Mushikwa, 2020)^[44].

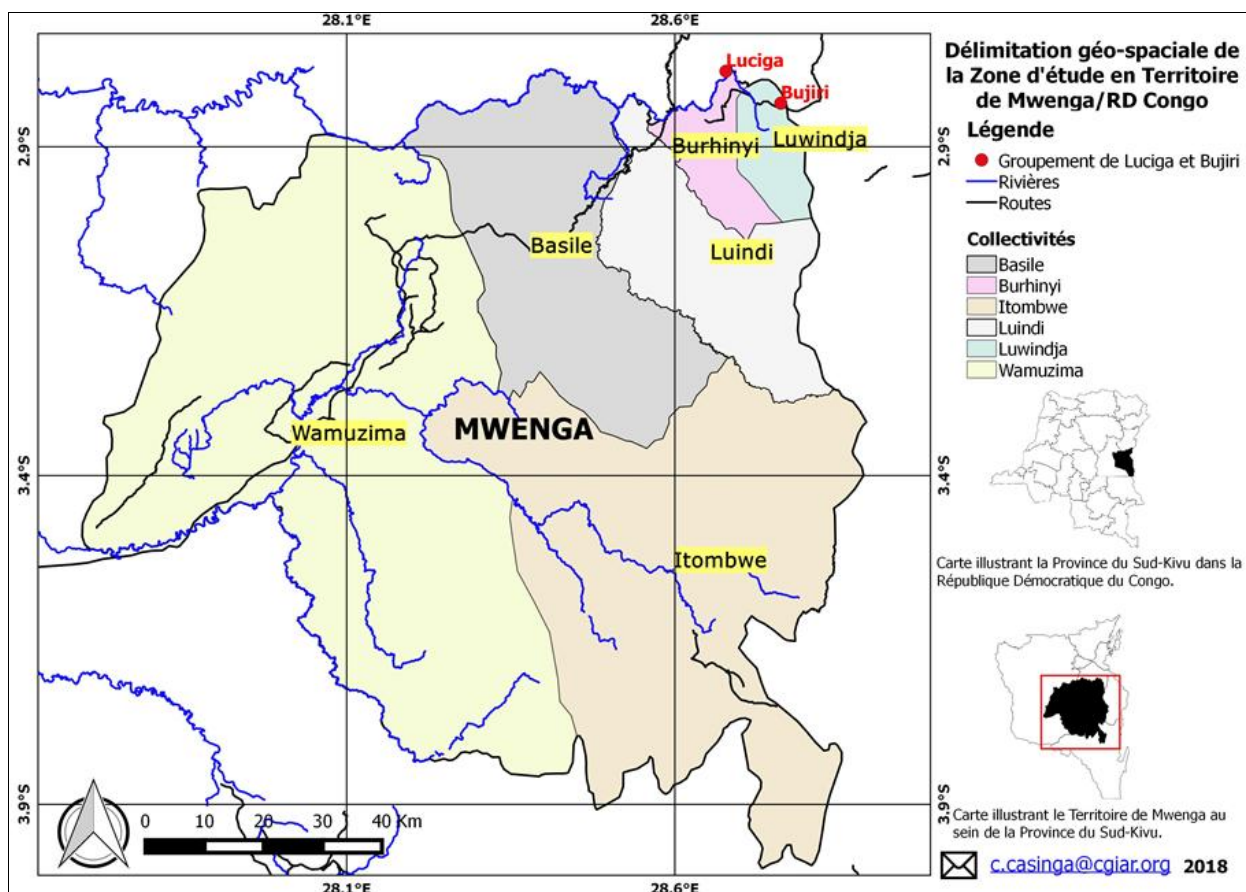


Fig 1: Map of the Mwenga Territory in the South Kivu province (source: De Saint Moulin L. & Kalombo) Tshibanda J.-L., 2005)

2.2 Data Collection, Processing and Analysis

The data for this study were collected using the following methods: (i) a literature review, (ii) direct field observations, and (iii) a survey questionnaire. The literature review allowed us to consult books, articles, reports, theses, and dissertations relevant to our topic. Direct field observations enabled us to understand the realities of fish farm operations. Finally, the survey questionnaire provided information on socio-economic

characteristics, the main sources of fingerling supply, farming systems, types of feed distributed, the main species raised, fertilization methods used, and fish production. The data for this study were collected either through visits to fish farms or at the household level. A total of 100 fish farmers were selected based on their ownership of fish ponds, as statistics on pond ownership were unavailable. During data collection, visits were conducted to the fish farmers, both at their fish

farms and at their homes. After data collection, the information was processed using Excel and transferred to SPSS software for descriptive analysis.

3. Results

3.1. Survey Results

The overall results concerning the socio-demographic

characteristics of fish farmers (Table 1) show that the dominant age group is between 29 and 39 years old, representing 32% of respondents, all of whom are men. Regarding the marital status and education level of the respondents, 86% are married, and the majority (53%) has a primary school education.

Table 1: Socio-demographic characteristics of fish farmers in the Basitabyale Grouping.

Variables	Features	Staff	Percentages (%)
Age ranges	18-28 years old	21	21
	29-39 years old	32	32
	40-50 years old	29	29
	50 years and older	18	18
Sexes	Male	100	100
	Female	0	0
Marital status	Single	9	9
	Married	86	86
	Widowed	0	0
	Divorced	5	5
Education levels	Illiterate	14	14
	Primary	53	53
	Secondary	25	25
	Superior	8	8
Household size	1-3 individuals	17	17
	4-6 individuals	40	40
	7-10 individuals	32	32
	More than 10 individuals	11	11
Main activity	Agriculture	56	56
	Breeding	15	15
	Mining	4	4
	Trade	7	7
	Fishing	2	2
	State agent	16	16
Reasons for practicing fish farming	Self-consumption	4	4
	Marketing	96	96
	Others	0	0

Source: Our investigations

Regarding household size and the respondents' main occupation, the results show that most fish farmers (40%) have households of four to six people and primarily engage in agriculture (56%). Furthermore, 96% of fish farmers raise fish for commercial purposes, while 4% raise fish for their own consumption.

Regarding the socio-economic characteristics of fish farmers, the results in Table 2 show that fish farming activities practiced in the Basitabyale Group contribute to some extent to food, housing, education and energy supply within the households of the fish farmers surveyed.

Table 2: Socio-economic characteristics of fish farmers in the Basitabyale Grouping.

Variables	Features	Staff	Percentages (%)
Children's education through fish farming	Yes	76	76
	No	24	24
Monthly payment of school fees through fish farming activities	< 50, 000 FC	20	20
	50, 000 - 100, 000 FC	24	24
	100, 000 - 250, 000 FC	28	28
	250, 000 FC and more	10	10
	None	18	18
Daily food consumption of the household	1 meal	2	2
	2 meals	96	96
	3 meals	2	2
Total		100	100
Expenditure from fish farming income allocated to daily feed	< 10, 000 FC	22	22
	10, 000 - 20, 000 FC	59	59
	20, 000 - 30, 000 FC	11	11
	30, 000 FC and more	8	8
Total		100	100
Housing status	Tenant	10	10
	Owner	83	83
	Family	7	7
Total		100	100

Types of housing	Sustainable materials	5	5
	Semi-durable	1	1
	Boards	69	69
	Earth	25	25
Energy sources used	Electric current	7	7
	Solar panel	76	76
	Generator set	0	0
	Oil lamp	0	0
	Flashlight	17	17

Source: Our investigations

Table 3: Characteristics of fish farms according to the types of ponds operated, feeding methods, fertilization, production and constraints in fish production.

Variables	Features	Staff	Percentages (%)
Years of experience in fish farming	≤ 3 years	38	38
	4-5 years	25	25
	6-10 years old	13	13
	10 years and older	24	24
Total			
Fish farming training	Yes	93	93
	No	7	7
Types of ponds put into operation	Dam ponds	72	72
	Diversion ponds	28	28
	Spring ponds	0	0
Food	Food distribution	0	0
	Non-distribution of food	100	100
Fertilization	Yes	0	0
	No	100	100
Fish production	< 1 basin	7	7
	2-4 basins	22	22
	5-10 basins	38	38
	11-20 basins	23	23
	21-30 basins	8	8
	31-50 basins	2	2
	More than 50 pools	0	0
Breeds of farmed fish	Local	82	82
	Hybrids	18	18
	Improved	0	0
Breeding cycle durations	≤ 6 months	15	15
	7-12 months	85	85
	12 months and older	0	0
Sources of fry supply	Other fish farmers	79	79
	Fry remaining after emptying	21	21
	Locally produced fry	0	0
	Harvesting from rivers and streams	0	0
Charging methods	Mixed mode	100	100
	Predatory use	0	0
	Separate age groups	0	0
	Monosexuals	0	0
Operating systems	Extensive	100	100
	Semi-intensive	0	0
	Intensive	0	0

Source: Our investigations

The results presented in the table above show that 38% of respondents have less than 3 years of experience in fish farming, 93% have not received any training in fish farming techniques, and 44% operate an average of 2 fish ponds. Regarding farm structures, 72% of fish farmers use reservoir ponds, and almost all (100%) do not feed their fish or fertilize their ponds. As for production, while some manage to produce up to 50 fish ponds per rearing cycle, a significant number of surveyed fish farmers (38%) produce only between 5 and 10 fish ponds per rearing cycle. The Tilapia, *Oreochromis Nile* is the most common species (82%), with a rearing cycle lasting between 7 and 12 months. The majority

of fish farmers (79%) obtain their fingerlings from other fish farmers. The mixed-age method (mixed classes) is the most widely used by all of these fish farmers (100%) during the initial stocking phase. The extensive system is the most common.

Finally, regarding the constraints of fish farming production (Fig. 2), the majority of fish farmers (52%) face a lack of support from government services or training in fish farming techniques. Furthermore, a quarter (24%) of fish farmers complains about fish theft from ponds and the lack of fingerling stations for supplying quality fry.

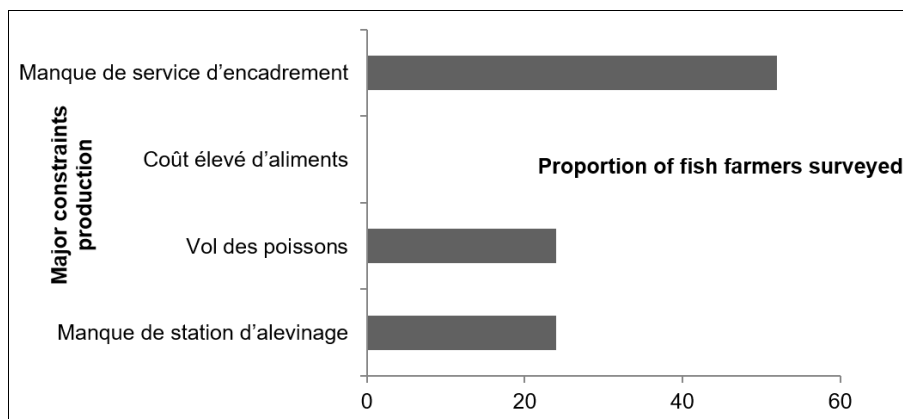


Fig 2: Major production constraints observed for fish farmers.

3.2 SWOT analysis of fish farming in the Basitabyale group: From our field observations, opinions received from respondents and other stakeholders. Local consultations revealed that fish farming in the

Basitabyale group faces many threats, even though there are many opportunities for the development of this activity in this area, as shown by the Strengths, Weaknesses, Opportunities and Treats (SWOT) analysis carried out (Table 5).

Table 4: SWOT analysis of fish farming in the Basitabyale group

SWOT Analysis	Strengths	Weaknesses
	Abundant aquatic biodiversity	Lack of regular support for the majority of fish farmers (70% receive neither monitoring nor technical visits)
	Existing feeding and fertilization practices (availability of agricultural by-products).	Lack of quality fry and food, and of suitable fish farming inputs to support sustainable aquaculture development.
	Economic potential with semi-intensive practices (30%).	Low yield due to traditional practices and a lack of financial and technical resources to innovate fish production.
	Presence of competent technicians to supervise certain fish farming activities.	Difficulties in accessing inputs, quality fingerlings and consumer markets due to the poor condition of the roads.
	Willingness of some fish farmers to invest in modern infrastructure.	Significant financial limitations prevent many fish farmers from modernizing their practices.
	Opportunities	Threats
	Hydrological potential: availability of land and water resources for the expansion of ponds.	Climate change: degradation of water quality affecting productivity. Pollution observed from artisanal mining.
	Growing demand for fish due to a rapidly increasing population.	Unofficial taxes reported by 80% of fish farmers increasing production costs.
	Increased awareness by NGOs and government programs on the benefits of fish farming.	Competition with other activities (mining, agriculture).
	Proximity to certain major urban areas offering a market for commercialization.	Weak institutional support and an inadequate legislative framework.
	Administrative structures those are conducive to the safety and formalization of fish farming activities. Existence of agricultural and pastoral activities that could allow for the development of integrated fish farming	Deforestation and increased pollution endangering hydrological resources.

Source: Our investigations

4. Discussion

This study revealed that the majority of fish farmers, 32%, are between 29 and 39 years old. This can be explained by the fact that young people are interested in fish farming. According to Nji and Daouda (1990) [49], age is a very important factor in the work required to successfully carry out fish farming activities. Furthermore, Olowesegun *et al.* (2004) maintain that young people have greater physical strength. However, our results differ from those of Kifufu (2019) [25] in Bagata Territory, Akilimali *et al.* (2020) in South Kivu Province in the DRC, and Hirigoyen *et al.* (1997) in Cameroon. The majority of fish farmers in our study area are exclusively male (100%). The predominance of men can be explained by the retrograde Lega custom, which prohibits certain activities for women. Our results corroborate those of Lokinda *et al.* (2018) [32] in the Yangambi Biosphere Reserve in Tshopo Province and are similar to those of Akilimali *et al.* (2020) in the rural highland and lowland areas of South Kivu

(DRC); Hirrgoyen *et al.* (1997) in Cameroon; Tiogue *et al.* (2020) in the Mbam and Inoubou Department (Cameroon); Micha *et al.* (2022) [40] in the Central Congo Province (DRC); Yao *et al.* (2017) in Ivory Coast and Lumonakiess (2020) [33] in the Mosia Grouping, Kwilu - Kimbata Sector in Kwilu Province, DRC. In these regions, men dominate fish farming activities. Therefore, Tomedi *et al.* (2010) had pointed out that the majority of men involved in fish farming activities are explained by the fact that they own land and practice fish farming. Moreover, Brumett *et al.* (2010) had already stated that fish production involves risks of uncertainty that lead to this activity being reserved for men. Furthermore, Marcela (2005) [36] emphasized that one of the inequalities affecting rural women is the lack of real or formal access to land and property, and that in other cultures, inheritance rights are patrilineal (UNAIDS, 2004). Regarding education levels, 59% of fish farmers have completed primary school. This situation can be explained by

early marriages and the participation of young people in artisanal mining activities in the nearby mines of Kamituga, Lugushwa, and Misisi. The majority of fish farmers are married. The predominance of married individuals can be explained by the fact that many young people marry at a young age. Our results corroborate those of Kifufu (2019)^[25] in the Bagata Territory of the DRC; Nihoreye *et al.* (2016)^[48] in the South Kivu Province of the DRC; Kamundu (2012)^[21] in the Masisi Territory of the DRC; Tiogue *et al.* (2020); Akilimali *et al.* (2020); and Lumonakiese (2020)^[33], where married individuals dominate fish farming activities.

The results related to vocational training show that 93% of fish farmers have not received any training in fish farming techniques. This situation can be explained by the fact that state services, including those from the Ministry of Agriculture, Fisheries and Livestock (National Aquaculture Service), are not very active, there is a lack of support for aquaculture development projects, and fish farmers are not organized into agro-pastoral organizations or cooperatives. Our results corroborate those of Kifufu (2019)^[25] in the Bagata territory (DRC); and Menga *et al.* (2023)^[39] in the city of Brazzaville and its surroundings, which indicate that the majority of fish farmers have not received any training in fish farming techniques. In contrast, in Malawi, Zizi *et al.* (2011) showed that on fish farms, production was high and incomes were high for fish farmers, who were among the most educated. Dam ponds are the structures most commonly used by the majority of fish farmers in our study area (72%). The expansion of dam ponds as the primary aquaculture structure can be explained by the fact that the pond was the first structure developed after the introduction of fish farming at the Kipopo fish hatchery in Haut-Katanga (Upper Katanga Region) in DRC, around 1948, and on the African continent (Lazard, 1990)^[29]. These assertions were confirmed by Grubert and Mathieu (1959)^[16]. In FAO analyses (2012), the fishpond, the oldest aquaculture structure, remains the system used today, contributing 75 to 80% to aquaculture production in inland waters worldwide. Its success is attributable to its high level of versatility and strong capacity for intensification and intensification. Furthermore, Kaningini *et al.* (2002)^[22] had already highlighted the expansion of dammed ponds in the Mwenga Territory. On the other hand, in Ivory Coast (Koumi *et al.*, 2017)^[27] they had identified earthen ponds, floating cages, enclosures, and hapas as the most used structures.

The results related to fish feeding reveal that 100% of fish farmers do not provide any feed to their fish. This situation is attributed to a lack of production units for quality fish feed and a lack of training in fish farming techniques. Yet, feed is a crucial element in fish production. Ignorance or a lack of information leads fish farmers to resort to natural feeding methods. These fish farmers reportedly feed their fish with readily available and inexpensive agricultural by-products (palm kernel meal, rice bran, green leaves, oil mill residues, etc.). It was in this context that Lessent (1977)^[30] observed that significant quantities of agricultural and agri-food by-products are often unusable in many countries and could be used to feed tilapia. This situation is similar to that observed by Lumonakiese (2019) in the Mosia Grouping in the DRC; Nihoreye *et al.* (2016)^[48] in the territories of Mwenga, Shabunda, Kalehe, and the Ruzizi Plain in South Kivu, DRC. However, Our results differ from those of (Hirigoyen *et al.*, 1997; Tiogue *et al.*, 2020; Pébanganan *et al.*, 2020) in Cameroon; (Amian *et al.*, 2017; Koumi *et al.*, 2017; Vincke,

1985)^[2, 27, 60] in Ivory Coast and (BFN, 2007 in Zizi *et al.*, 2017) in Liberia, where the fish are fed either animal or plant-based agri-food by-products. These observations have also been noted in Asia (Sergeloos, 2014)^[54]. According to our analysis, fish feed should never limit fish production in our study area, where agriculture is practiced and many fish farmers confirmed agriculture as their main activity, thus ensuring the availability and accessibility of agricultural by-products. A large majority of fish farmers (79%) obtain fingerlings from other fish farmers. This situation can be explained by the absence of fish hatcheries and a lack of training in fish farming techniques in our study area. Our results differ from those of Sembaito (2016) in Tshopo Province (DRC), Lusasi *et al.* (2022)^[35] in Kinshasa (DRC) and Bazir (1994)^[64] in Vietnam, who reported that in these areas fish farmers obtained fingerlings either from the Congo River, the Tshopo River and Lake Dau Tieng and Tri An (Vietnam). According to our analysis, fish farmers obtain fingerlings directly from the Elila and Ulundi rivers to replenish their stock. These strategies were used by fish farmers in Thailand and Indonesia (Lazard, 1974)^[28]. Obtaining fingerlings from other fish farmers leads to the degeneration of their stock. The majority of fish farmers (82%) raise *Oreochromis niloticus* of the local race. The proliferation of this culture is justified by the fact that Tilapia was the first species farmed since the introduction of fish farming in Africa, mainly at the Kipopo fish farm in Zaire (DRC). Our results agree with those of Morissens *et al.* (1986) in the ponds of the Godomey region in southern Benin; Coulibaly *et al.* (2025)^[7] in the Sinfran Department in the Centre-West of Ivory Coast; Mikolasek and Lazard (2001)^[42] in Ghana and Lokinda *et al.* (2018)^[32] in the Yangambi biosphere in the Tshopo Province; Gourène *et al.* (2007)^[15]; Kifufu (2017), FAO (2016); Micha *et al.* (2013)^[41]; Hirigoyen *et al.* (1997); Akilimali *et al.* (2020) in the agro-ecological zones of high and low altitudes in the South Kivu Province of the DRC. These observations were reported by Arrignon (1980) at the Landja fish farm in the Central African Republic; N'Dri *et al.* (2016) in the Gontougo region of Côte d'Ivoire; and Bignoli and Darwall (2012) in North Africa. The Tilapia, *Oreochromis niloticus* is considered the main species in fish farming (Lusasi *et al.*, 2022)^[35]. It also represents a strictly African original distribution encompassing the Nile Basin (Egypt, Uganda, Ethiopia, etc.), the Chad, Niger, Volta, Senegal, and Jordan River basins, as well as the lakes of the East African Graben as far as Lake Tanganyika and the rivers of West and East Africa (Trewavas, 1983; El-Sayad, 2006; Deines *et al.*, 2016; FAO, 2025)^[57, 11]. According to FAO (2018), *Oreochromis niloticus* is a profitable fish and is easily marketed in urban areas. Furthermore, Bard (2000)^[4] had already reported the success of *T. niloticus* in Brazil, the rest of tropical America, California, Paraguay, Taiwan, mainland China, Thailand, and tropical Asia. The majority of fish farmers use the mixed-age-class or mixed-age-class method when stocking their ponds. This practice, which is still widely used in our study area, is justified by the fact that it was first developed at the Kipopo station in Haut-Katanga with *Tilapia macrochir* and *T. rendalli* species. Moreover, Lessent (1977)^[30] emphasized that Tilapia fish farming in Katanga, using the mixed-age-class method, developed in connection with the mining industry. The great advantage of this method is its simplicity. However, this practice is currently abandoned and is now only used with fry of known age (Kestemont *et al.* 1989)^[24]. To

avoid genetic drift, Smitherman and Tave (1982)^[55] proposed a minimum effective broodstock population of 390 to 500 individuals, or 195 to 250 pairs. In this context, Hephher and Pruginin (1982)^[17] rightly emphasize that the age of the fish is an important factor and that recently enclosed fry (of known age) should be used, rather than small fish suffering from dwarfism and reproducing prematurely. Demangel *et al.* (2019)^[10] maintain that fish farmers must have knowledge of production methods, hatcheries, and adherence to sanitary standards to ensure they receive healthy and uncontaminated fry. In fact, this method has serious drawbacks, mainly in equatorial regions, where tilapia production is continuous, resulting in a high percentage of small, unmarked fish in the meat, eliminating any possibility of selection for restocking (Lessent, 1977)^[30], and often leading to dwarfism in most rural farms (Kombozi and Bolomo, 2005)^[26]. The extensive system is the most common in our study area. The continued use of this system is thought to stem from the legacy of fish farming through Belgian colonists, missionaries, and mining companies (Great Lakes Mines, Kivu Mining Company). These results corroborate those of Acho (2014) in the Goh, Upper Sassandra, Marahoué, and Nawa regions of Ivory Coast; Koumi *et al.* (2017)^[27] in Côte d'Ivoire; and N'Dri *et al.* (2021)^[45] and Kifufu (2019)^[25]. The expansion of this low-productivity extensive system has been reported in the majority of Sub-Saharan African countries (cited by Kestemont *et al.* 1989)^[24].

The majority of fish farmers (52%) in our study area face a lack of state support services and insufficient professional training in fish farming techniques. This situation is attributed to insufficient technical support from the National Aquaculture Service, the Congolese government's aquaculture policy, and the cessation of financial and technical support from donors (Peace Corps, FAO, ACTED, PNUD, FHI, AMI, etc.). These same observations have been made generally in the DRC for over a decade (Lumonakiese, 2020; Kifufu, 2019; Lusasi *et al.*, 2019; CIFOR, 2018; Sembaito, 2016; Kabongo, 2014)^[33, 25, 34, 6, 20]. This same situation has also been observed in many other countries, including the Sahel region (Miller, 2010)^[43], southern Benin (Azonhè *et al.*, 2019)^[3], and Ivory Coast. According to Lazard (1985), cases of theft had already been reported in Africa in the early 1960s and was one of the main causes of fish farming failures. Furthermore, Mikolasek and Lazard (2001)^[42] reported cases of theft in Nigeria, Ghana, Zimbabwe, Malawi, and Zambia around the year 2000.

5. Conclusion

This study provided us with in-depth knowledge of fish farming practices in the Basitabyale group in the Mwenga Territory. Fish farming is practiced there in a traditional, family-run, extensive system, without the use of fertilizers or the distribution of aquaculture feed. The Tilapia, *Oreochromis Nil* is the most prevalent species, regardless of the overall fish biodiversity in the region. The mixed-age or mixed-class farming method, which is unproductive and unprofitable, is still widely practiced. Fish farming is carried out by fish farmers for socio-economic reasons. These farmers do not adhere to zootechnical standards. This has been particularly evident in the stocking of ponds, which fails to consider their surface area or water volume. Fish farmers possess a limited understanding of basic fish farming techniques. Fish farming in the Basitabyale Grouping in general, and in the Mwenga Territory in particular, struggles to develop in its current state

and cannot offer a significant improvement in the living conditions of the local population. Our study thus highlights the priority needs: the resumption of funding and technical support from donors, the diversification of species and adoption of modern systems (floating cages, raceways integration of fish farming with livestock and agriculture), more state supervision, the opening of the Fisheries and Aquaculture sector in higher and university institutions, the rehabilitation of road infrastructure and the establishment of fry stations and fish feed production units.

6. Authors' contribution

- MUGANZA Musombwa Rigobert had conceived the research theme, prepared the survey questionnaire, collected, analyzed and interpreted the data and participated in writing the final version.
- ISUMBISHO Mwapu Pascal made the production of the final version possible.
- MASILYA Mulungula Pascal had contributed to the writing of this study.
- LUSASI Swana Willy oversaw the final version of this study.
- KONE Naminata made the realization of the final version possible.
- ATANGANA Kenfack JA participated in the writing of this article.
- BREHEMER Patrice had incorporated the map of the Mwenga territory and coordinated the final version of this study.
- CODJO Victor made the production of the final version possible.
- WIKONDI Jeanne actively participated in the completion of this study.
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