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Research Article

Diagnosis of fish farming and acclimation of the common carp (*Cyprinus carpio*) in the bimodal humid forest zone of Sud Cameroon

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ABSTRACT

To improve the ecological resilience of local aquatic ecosystems by diversifying fish resources, a study was carried out from March to May 2024 in the bimodal humid forest zone of South Cameroon. For this purpose, a survey of fish farmers was carried out to collect viable data on the fish species farmed in the area and their ecological features. The specificity of the common carp motivated its choice for this study. Therefore, 110 *Cyprinus carpio* fingerlings, weighing 4.4 ± 0.2 g and with an average total length of 6.03 ± 0.1 cm, were purchased from the CIG AIO (Groupement d'Initiative Commune Aquaculture Intégrée de l'Ouest) farm in Batié (West Cameroon) and conveyed to South Cameroon using a polyethylene oxygen bag. After acclimation, fingerlings were randomly distributed in triplicate in the Fastangs and Hapas fish tanks at densities of 18 individuals/m^3. Fish growth and water physicochemical quality variables were monitored weekly throughout the experiment. The Hapas recorded significantly (p < 0.05) higher conductivity values (127.6 ± 6.4 µS/cm). The survival rate was 95.5 % in Fastank and 95.0 % in Hapas. The highest values of average daily weight gain 0.39±0.22 g/d, and specific growth rate (14.33±2.144 %/d) were observed in Hapas, with the lowest in Fastank. Regardless of the infrastructure, the condition factor (K) was greater than 1, indicating fish overweight. The common carp has demonstrated good acclimation in the study area. We therefore recommend that its inclusion in pisciculture in the bimodal humid forest zone of Cameroon is a necessity.

Keywords: *Acclimation, Common Carp, Hapa, Fastank, Fish Farming, Humid Forest Zone*

RÉSUMÉ

En vue dresser un état des lieux de la pisciculture, d'améliorer la résilience écologique des écosystèmes aquatiques locaux du fait de la diversification des ressources piscifaune susceptibles de s'adapter aux conditions environnementales changeantes, une étude a été menée de mars à mai 2024 dans la zone forestière bimodale du Sud Cameroun. L'enquête auprès des pisciculteurs a constitué une étape clé de cette recherche permettant de collecter des données viables sur les espèces de poissons élevées dans la zone et leurs caractéristiques écologiques. Ce recensement s'est fait auprès de 20 fermes, choisis en raison de la volonté des pisciculteurs et de sa stabilité dans la production piscicole. L'enquête a relevé que la carpe n'est pas une espèce d'élevage courante dans la zone forestière bimodale contrairement aux silures et tilapias. La spécificité de la carpe a motivé notre décision de la placer au cœur de nos investigations dans le cadre de cette étude. De ce fait, 110 alevins de *Cyprinus carpio* de poids 4,4±02 g et de longueur totale moyenne 6,03±01cm ont été achetés à la ferme du GIC AIO (Groupement d'Initiative Commune Aquaculture Intégrée de l'Ouest) de Batié et transportés vers la région du Sud Cameroun dans un sac à oxygène en polyéthylène. A l'arrivée, les sacs à oxygène ont été mis en contact direct avec l'eau du milieu d'élevage pendant 40 minutes à des fins de stabulation. Ensuite, les alevins ont été répartis dans les Fastank et Hapas de manière aléatoire en triplicat à des densités de 18 individus/m^3. Les résultats relatifs à l'effet du type d'infrastructure sur les

paramètres physico-chimiques ont montré que les valeurs de conductivité les plus élevées (127,588 ± 6,400µS/cm) significativement (p<0,05) ont été observées en Happa. Le taux de survie a été de 95, 53% en Fastank et de 95% en Hapa. Les valeurs les plus élevées de gain de poids moyen journalier (0,39±0,22 g/j) et de taux de croissance spécifique (14,33±2,144 %/j) ont été observés en Hapa et les plus faibles en Fastank. Quel que soit l'infrastructure, le facteur de condition K a été supérieur à 1 signe d'embonpoint des poissons. Pour donner suite à cette recherche, nous recommandons vivement et indépendamment du type d'infrastructure de production l'inclusion de la carpe commune dans les stratégies d'élevage piscicole dans la zone forestière bimodale, en complément des silures et des tilapias.

Mots clés: Acclimatation, Carpe commune, Hapa, Fastank, Pisciculture, Zone forestière.

1. INTRODUCTION

The exponential increase in the world population brings about an explosion in the consumption of aquaculture products (FAO2022a). Aquaculture has undeniably confirmed its crucial role for global food security, due to the production capacities that have filled the gap between supply and demand for aquatic food products in recent decades (Peteri 2021). Among fishery products, fish and other aquaculture products are an important source of animal protein, and are also unique and extremely diversified suppliers of essential omega-3 fatty acids and essential nutrients (FAO 2022b). As compared to other sources of food, fish meal is a nutritionally dense and economically impactful food source (NOAA 2022). The State of World Fisheries and Aquaculture (SOFIA) in its 2024 edition reported that the global fisheries and aquaculture production in 2022 amounted to 223.2 million tonnes, a 4.4 % rise from the year 2020 (FAO 2025a).

In Cameroon, annual fish production is estimated at 170,000 tonnes for an estimated annual demand of nearly 500,000 tonnes/year (FAO 2025c). To compensate for this shortage, the Cameroonian State imported nearly 234,572 tonnes of fish in 2023, creating a trade balance deficit and, as a result, the outflow of foreign currency (NIS, 2023). The causes of the low expansion of fish farming are notably marked by the high cost of balanced exogenous feed used in pisciculture (Fonjweng 2018), the incomplete availability of fish fry, and insufficient research on species adapted to the Cameroonian climate (Kenfack et al. 2019). Fish farming in Cameroon is limited to a few species, including the Nile tilapia (*Oreochromis niloticus*), African catfish (*Clarias gariepinus*), Kanga (*Heterotis niloticus*), and common carp (*Cyprinus carpio*). The most suitable farming systems in the world are polycultures of *Oreochromis niloticus* and *Clarias gariepinus* in association sometimes with *Heterotis niloticus*, *Parachanna obscura,* and/or *Cyprinus carpio* (Kenfack *et al*. 2019; Djim-Adjim-Ngana 2022). The common carp (*Cyprinus carpio*: Cyprinidae) was introduced in Cameroon in 1962 to diversify fish production and improve the country's food security. It was chosen for its hardiness, ease of breeding, and rapid growth (Njock 2000, Ndoye 2003).

According to François et Ndjonjip (2020), the annual global production of carp was estimated at more than 3 million tonnes, making it a crucial species. Indeed, the common carp is one of the main aquaculture species in the world (Penman *et al*. 2005). Understanding its breeding is therefore an essential requirement for efficient and sustainable production. Most of the production of common carp in Cameroon comes from the West and North-West regions due to its ease of adaptation to climatic conditions (FAO 2025b). However, the South region of Cameroon is home to a dense hydrographic network, with several hydroelectric power plants, including the Memve'ele power plant and the Mekin power plant. Hence, it is crucial to understand the environmental and technical factors that influence the growth and monitoring of common carp in farms in the South region of Cameroon.

This study aimed at characterising fish farming and the naturalisation of the common carp, *C. carpio,* in the bimodal humid forest zone of South Cameroon. More specifically, this study: (a) surveyed fish farming in the Ebolowa municipality and (b) evaluated the effect of the type of infrastructure on water physicochemical parameters and the survival and growth parameters of common carp (*C. carpio*) in captivity. The outcome of this work is the diversification of aquaculture products intended for the consumer's table.

2. MATERIAL AND METHODS

2.1. Period, area and site of the study

The study took place from March 18 to May 29, 2024, in Ebolowa Si, located in Ebolowa II Subdivision, Mvila Division, South region of Cameroon (Figure 1). It is in the heart of the Equatorial Forest between 2°30' and 2°54

North latitude and between 11°09' and 11°45' East longitude with a minimum elevation of 570m and a maximum of 620m (AZ-Nations, 2025). The climate of the Ebolowa II municipality is a humid tropical climate, of the equatorial type, with 4 well-marked seasons (two dry seasons from February-April, then from November to January; two rainy seasons from May-June, then from July-October). The temperature varies from 24 to 26°C, and the average annual precipitation is 865.8mm.

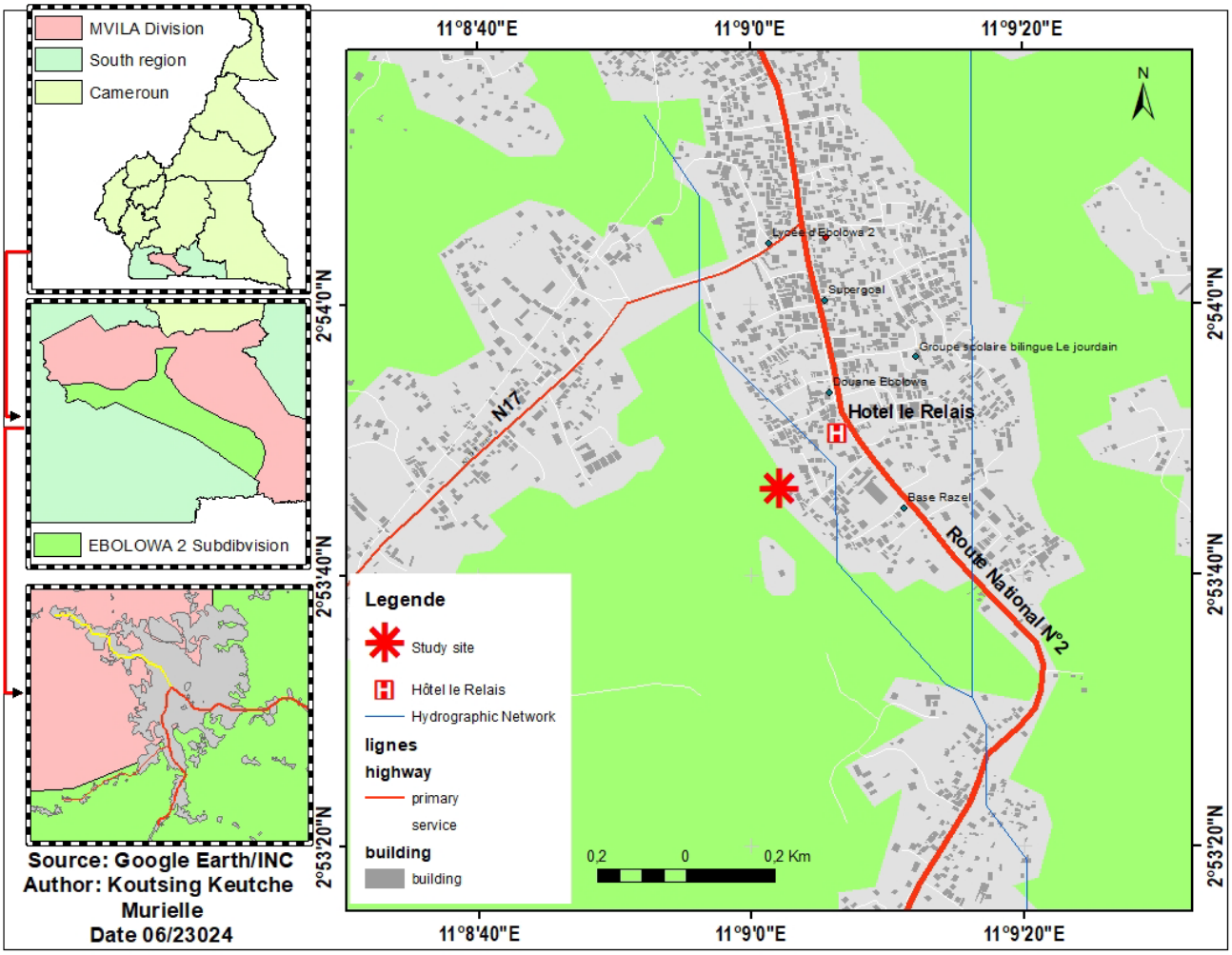

Figure 1: Location of the study area and site

2.2. Social and technical characterisation of fish farming in the Ebolowa Municipality

Initially, the documentation provided by the Ministry of Livestock, Fisheries, and Animal Industries (MINEPIA) allowed us to establish a reliable database for the identification of eligible fish farmers. Then, the snowball method helped to identify other producers (Wilhelm 2014). To achieve this objective, a questionnaire was administered to fish farmers. Using a convenience sampling strategy, twenty (20) farms distributed throughout the city of Ebolowa were selected for the survey. Informed consent was obtained from all the participants. Direct observations and interviews were also carried out to complete the research. The information collected for this purpose mainly concerned: the gender and age of the producer, the profession, the species of fish produced, and the production purpose.

2.3. Assessment of the impact of the type of infrastructure on the production parameters of common carp

2.3.1. Collection, transport, and acclimation of fingerlings

A batch of 110 common carp fingerlings with an average weight of 4.4±02 g and a length of 6.03±01 cm was purchased from the CIG AIO fish farm in Batié, in the West region of Cameroon, and transported in a polyethylene oxygen bag to the South region of Cameroon. Upon arrival, the oxygen bags containing the fingerlings were placed in contact with the water of the experimental ponds for 40 minutes for acclimation (Figure 2a). Then, these fingerlings were randomly distributed in the different infrastructures (Figure 2b) and in triplicate at a

rate of 18 fingerlings per production unit (03 Hapas and 03 Fastank of dimensions 1m×1m×1m; 0.2mm mesh size).

a) Hapa

Hapa refers to a small cage-like rectangular enclosure nets established within a pond that is suited to keeping brooders, hatchlings, and juveniles (IITA 2022).

b) Fastank

Fastank is a temporary holding structure for broodstock or larger fish, typically made from bamboo, wood, or netting, and placed directly in ponds.

2.3.2. Evaluation of the influence of the type of infrastructure on the physicochemical parameters of the common carp

Water physicochemical parameters were determined weekly throughout the study period. Thus, temperature, pH, conductivity, and salinity were measured using a multiparameter kit (5 in 1) of the DANOPLUS™ brand, and dissolved oxygen using a colorimetric test of the JBL™ brand (Figure 2c).

Figure 2: Test protocol: a-Acclimation of carps; b-Production infrastructure (hapas and fastanks) and c-Measurement of the physicochemical characteristics of the water in hapas and fastanks

2.3.3. Evaluation of the effect of the type of infrastructure on survival and growth parameters

Dead fish were thoroughly isolated in the different production units throughout the test. Based on the fish stocking densities and the number of losses, the survival rate was calculated per production infrastructure. The metric and weight characteristics of the fish were measured at each control fishing and a weekly frequency, respectively, using millimetre paper and a sensitive POCKET SCALE™ brand balance with a precision of 10^{-1}g (Fig. 3).

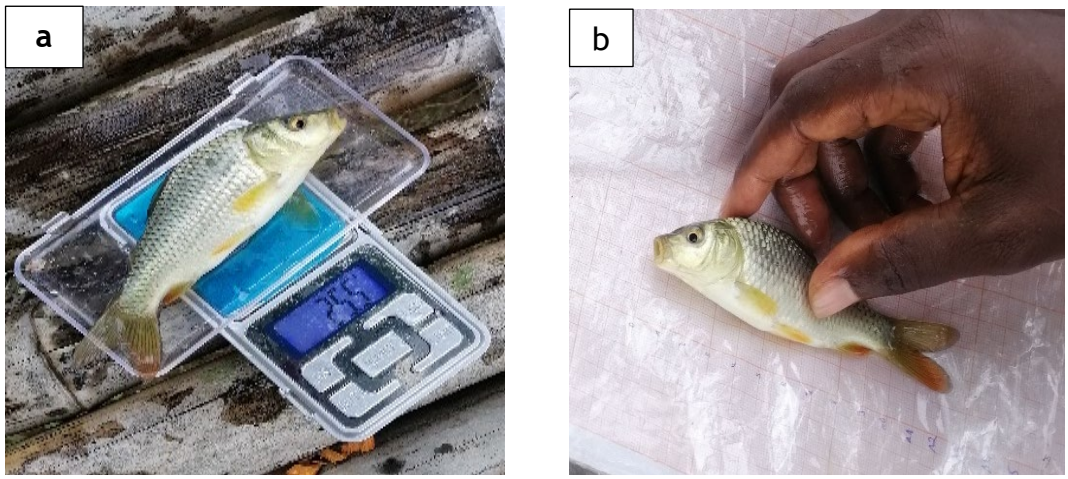

Figure 3: Growth control: a - Weight assessment; b - Length measurement

To assess the impact of the type of infrastructure on carp production, the following metrics were studied: survival rate, growth parameters (average weight gain, average daily gain, and specific growth rate), as earlier recommended (Agbokousse *et al*. 2016)

a) Survival rate

The survival rate (SR) is the percentage of the number of fish at the end of the experiment to the stocking density.

$$\text{Survival Rate} = \frac{\text{Number of surviving individuals}}{\text{Initial number of individuals}} \text{X } 100$$

b) Growth parameters

Average weight gain (AWG):

$$\text{Average Weight Gain (g)} = \text{Final Average Weight (g)} - \text{Initial Average Weight (g)}$$

Average daily gain (ADG):

$$\text{Average Daily Gain} = \frac{\text{Final average weigh} - \text{Initial average weigh}}{\text{Duration of the test (days)}}$$

Specific growth rate (SGR): The specific growth rate evaluates the weight gained per fish per day.

$$\text{SGR (\%/d)} = \frac{[(\ln(\text{final average weight}) - \ln(\text{initial average weight})]) \text{ X } 100}{\text{Duration of the test (days)}}$$

Condition coefficient (K in %): K is defined by the ratio between the weight and the size of the fish:

$$\text{K} = \frac{\text{Total weight of the fish (g)}}{\text{Total length of the fish (cm)}^3} \text{ X } 100$$

2.4. Data processing and analysis

The Microsoft Excel 2016 software was utilised to key data, make quantitative calculations, and generate graphs after the analysis of the survey sheet. To compare the means of the survival and growth parameters according to the type of infrastructure, the Student's test (t) was used. When there was a significant difference, the Duncan test at the 5% significance level was used to separate the means. These analyses were carried out using SPSS software version 26.0.

3. RESULTS

3.1. Social and technical characterisation of fish farming in the Ebolowa Municipality

3.1.1. Sex and age structure of the actors

Out of 20 fish farms investigated in the Ebolowa municipality, aquaculture activities are mainly carried out by men, with a participation rate of 80%. The analysis of the age distribution reveals that the age categories of [30 - 40] years and over 60 years old represent the highest proportion of actors, with 30% of the workforce. On the other hand, the age group [20-30] years was significantly underrepresented, with a percentage of only 5% (Figure 4a and 4b).

3.1.2. Production objectives and alternative activities to fish farmers

The study of the distribution of fish farmers according to the production objectives, as illustrated in Figure 4c, revealed a clear hierarchy, with production for marketing at the top, followed by production for marketing and self-consumption, and finally production for self-consumption.

Besides, a significant proportion of 40% of the actors were professional fish farmers, followed by civil servants as their alternative activity. Breeders of animals other than fish and retirees occupied a marginal place, representing only 15% of the labour force (Fig. 4d).

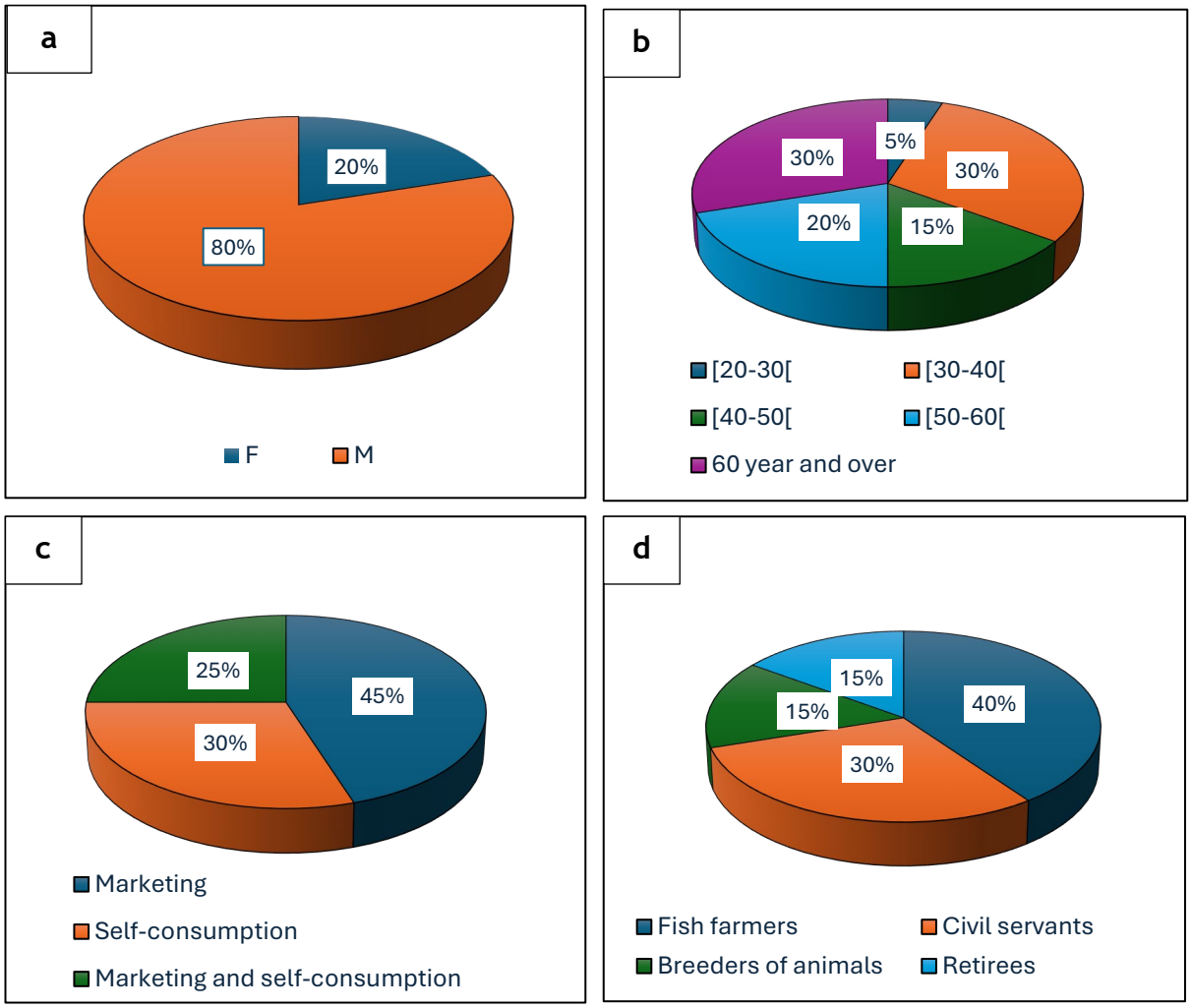

Figure 4: Distribution of fish farmers according to gender (a), age (b), occupation (c), and main occupation of respondents (d)

3.1.3. Main species farmed

The distribution of fish farmers according to the farmed species, as illustrated in Figure 5, showed that three (03) major species are produced in the bimodal humid forest zone of South Cameroon. Of these species, *Clarias* sp.(catfish) is the most widely farmed species, with 100% of fish farmers farming them, while tilapia and kanga are raised by 45% and 30% of fish farmers, respectively. Generally, catfish farming in this area is carried out in association with tilapia, either exclusively or in combination with tilapia and kanga.

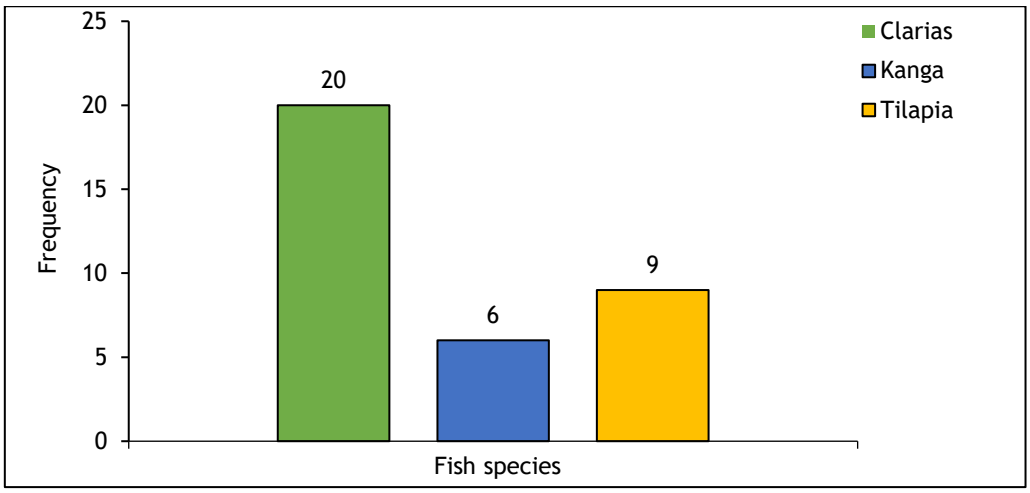

Figure 5: Distribution of fish farmers according to the species produced

3.2. Effect of the type of infrastructure on the physicochemical parameters of water

Apart from the electrical conductivity of water, all the physicochemical characteristics of water were not significantly affected by the type of infrastructure. The significantly higher electrical conductivity values were observed in Hapas compared to Fastank. The highest but not significant values of temperature, pH, and dissolved oxygen were also recorded in Hapas. The highest salinity values are observed in Fastang (Table 1).

Table 1: Influence of the type of infrastructure on the physicochemical characteristics of water

Physicochemical characteristics of water	Types of infrastructure		p-value
	Hapa	Fastank	
T (°C)	27.67 ± 0.50[a]	25.37 ± 0.43[a]	0.72
pH	7.59 ± 0.26[a]	7.38 ± 0.20[a]	0.35
Conductivity (µs/cm)	127.59 ± 6.40[a]	121.90 ± 28.28[b]	**0.008***
Dissolved Oxygen (mg/L)	4.79 ± 0.30[a]	4.19 ± 0.36[a]	0.60
Salinity (ppm)	61.56 ± 3.83[a]	64.62 ± 9.95[a]	0.09

a, b; values assigned the same letter on the same line do not differ significantly ($p \geq 0.05$)

3.3. Effects of infrastructure type on survival and growth parameters of *C. carpio*

The influence of infrastructure type on survival and growth parameters of common carp (*C. carpio*) is illustrated in Figures 6 and 7 and summarised in Table 2.

Table 2: Effect of infrastructure type on survival and growth parameters of *C. carpio*

Survival and growth parameters	Types of infrastructure		p-value	
	Hapa	Fastank		Standard benchmark
Survival Rate (SR) (%)	57.75 ± 1.50[a]	57.54 ± 1.00[a]	0.44	>85%
Weight (g)	19.00 ± 8.64[a]	12.77 ± 5.40[a]	0.36	1 – 30 g
Total Standard Length (TSL) (cm)	8.15 ± 1.36[a]	7.23 ± 1.12[a]	0.51	10-30
Total Length (TL) (cm)	10.33 ± 1.82[a]	9.03 ± 1.20[a]	0.19	10 -25 cm (1 year)
Average Daily Gain (ADG) (g)	0.39 ± 0.22[a]	0.24 ± 0.16[a]	0.51	0.1 – 0.3 (indoor)
Specific Growth Rate (SGR) (%/day)	14.33 ± 2.144[a]	7.397 ± 4.78[a]	0.37	1 - 2.5
Condition coefficient (K)	1.58 ± 0.08[a]	1.78 ± 0.44[a]	0.07	1.5 - 2

a, b: Means assigned the same letter on the same line do not differ significantly at the 5% threshold in different infrastructures according to growth parameters.

No significant difference was observed between the growth parameters regardless of the type of infrastructure. However, except for the condition factor (K), whose highest value was recorded in Fastank, all other growth parameters presented the highest values in Hapas.

3.3.1. Influence of the type of infrastructure on the survival of *C. carpio*

The effect of the type of infrastructure on the survival of *C. carpio* is illustrated in Figure 6 and summarised in Table 2. No significant differences ($p < 0.05$) were observed between the survival rate in Hapas (57.75 ± 1.50%) and that in Fastank (57.54 ± 1.00%). However, the highest values (95.53%) were recorded in Fastank. The survival rate in both facilities is in the standard benchmark for the common carp (>85%).

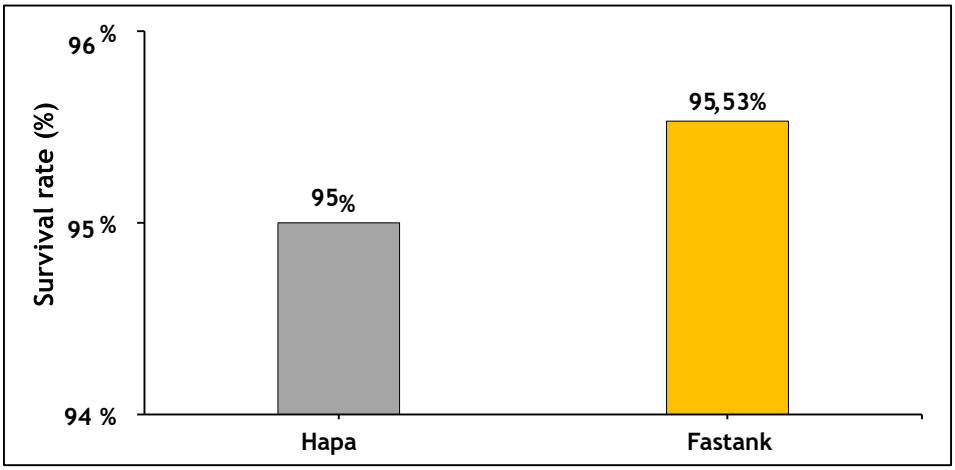

Figure 6: Effect of the type of infrastructure on the survival rate of *C. carpio*

3.3.2. Effect of the type of infrastructure on the evolution of the live weight of *C. carpio*

The weekly evolution of the growth parameters according to the type of infrastructure is illustrated in Figure 7. The curve of the evolution of the average weight presented the same profile, the same shape, and the same trend regardless of the type of infrastructure (Fig. 7a). The weight increased from the beginning to the end of the trial. However, the highest but non-significant values were observed in Hapa.

3.3.3. Effect of the type of infrastructure on the average weight gain and the specific growth rate of *C. carpio*

The evolution of the weight gain and the specific growth rate according to the type of infrastructure (Fig. 7b) and (Fig. 7d) were opposite throughout the trial period. Indeed, during the first week, the weight gain and the specific growth rate decreased considerably in the Hapas, unlike the Fastank. On the 7th day, the weight gain and the specific growth rate decreased drastically until the end of the test in the Fastank, while they increased considerably in the Hapas. On the 7th day, the highest values are nevertheless observed in Fastank.

3.3.4. Effect of the type of infrastructure on the average daily gain of *C. carpio*

The effect of the type of infrastructure on the average daily gain of *C. carpio* fry is illustrated in Figure 7c. The evolution curve has a sawtooth shape. However, the highest value is observed on the 21st day in Hapas (0.60g/d) compared to the 14th day in Fastank. Table 2 reveals no significant difference ($p \geq 0.05$) in average daily gain in the two infrastructures.

3.3.5. Effect of the type of infrastructure on the condition factor K on *C. carpio*

The influence of the type of infrastructure on the condition factor K of *C. carpio* is illustrated in Figure 7e. The evolution curve has a regular shape in Hapas, but rather a sawtooth in Fastanks. Apart from the beginning of the trial, where the condition factor K was higher in Hapas, the highest values were observed in Fastanks throughout the trial period. In addition, the highest values are recorded on the 14th day in Fastank. Nevertheless, these values remained higher than 1 regardless of the type of infrastructure utilised.

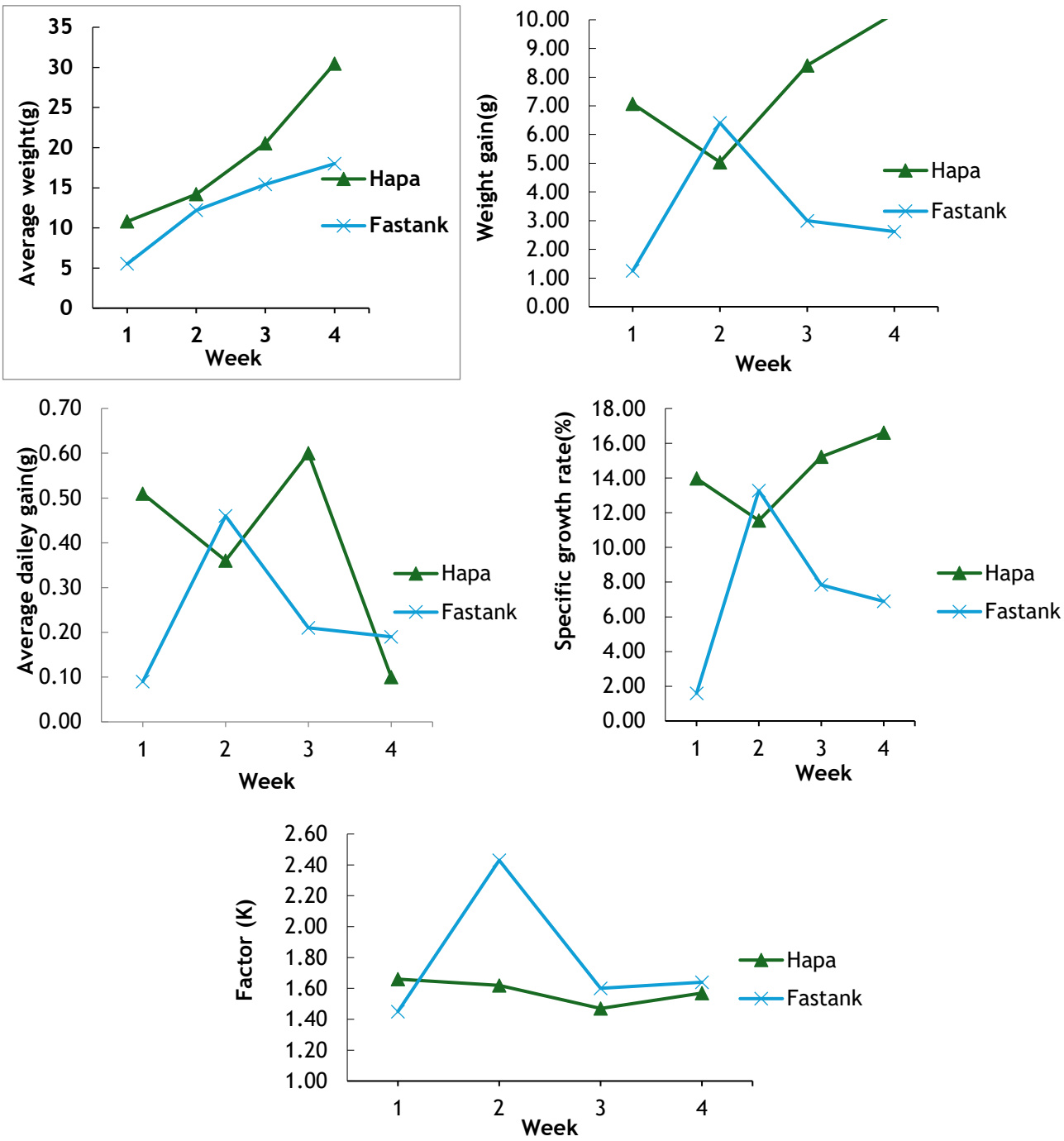

Figure 7: Effect of infrastructure type on growth parameters of *Cyprinus carpio*

4. DISCUSSION

4.1. Social characterisation and techniques of fish farming in the city of Ebolowa

Men are largely in the majority in the pisciculture sector in the city of Ebolowa, with a proportion of 80% compared to 20% for women. These results are in line with those of Bomba (2016), who worked on the characterisation of fish farms in the Mfoundi Division, where fish farmers were 90% men, as well as the results found by Yao *et al*. (2017) in Côte d'Ivoire, i.e., 94% men. The low representation of women shows that they do not engage in the activity. This situation could be explained by the fact that pond fish farming requires considerable physical effort for the construction of ponds and their maintenance, a condition that does not encourage women to devote themselves to it. In addition, the social restrictions faced by women, including difficult access to land, lack of capital, poor management skills, and lack of credit opportunities (Ngueguim *et al*. 2020), may be factors in the low involvement of women in the fish farming sector. The results obtained on the age group reveal that 30% of fish farmers are in the [30-40] age group, on the one hand, and in the category

over 60 years old, on the other hand. These observations share similarities with those of Pouomogne & Pemsl (2008) in the Noun Division (West Region of Cameroon), where 80% of fish farmers were between 30 and 50 years old. This can be explained by the fact that most producers have a certain level of income. On the other hand, this work is dissimilar to that of Tiogué *et al*. (2020), who worked on the socioeconomic and technical characteristics of fish farms in the Mbam and Inoubou Division (Centre Region of Cameroon), where 40% of fish farmers were between 50 and 60 years old.

Most fish farmers in the city of Ebolowa (40%) are professional fish farmers. These results are like those of Kpenavoun *et al*. (2017), who report that in Benin, fish farming is the main activity (32.5%) of the population. On the other hand, they diverge from those of Tiogué *et al*. (2020) in the Mbam and Inoubou Division, where fish farmers are mainly farmers (37.50%). This can be justified by the fact that fish farming nowadays in the city of Ebolowa is considered an income-generating activity, allowing the actors to provide for their needs and those of their families.

The results on the distribution of fish farmers according to the species raised showed that three main fish species, namely catfish, tilapia, and kanga, are produced in the bimodal forest zone, South Cameroon. This observation is contradictory to that reported by Kifufu (2019), according to which the crucial species raised in the territory of Bagata in the DR Congo are Tilapia (*Oreochromis niloticus*) and African catfish (*Clarias gariepinus*), and Kouamé *et al*. (2021), who revealed that *O. niloticus* and *Heterobranchus longifilis* are more predominant in the studied population of the PORO ponds in the North of Côte d'Ivoire. Of these species listed in the bimodal forest zone of South Cameroon, the catfish is the most represented, with an occurrence percentage of 100% of the actors' numbers. These results are like those of Tiogué *et al*. (2020), which reveal that the most produced species in the Mbam and Inoubou Division remains catfish (36.14%). Furthermore, they are dissimilar to those of Bomba (2016) and those of Ngandi (2009), where the most produced species in the Mfoundi Division is Tilapia (32.74%). This is probably due to the preference of the population of Ebolowa for the consumption of catfish. The main objective of fish production in the city of Ebolowa is marketing. These results diverge from those obtained by Tiogué *et al*. (2020) and Bomba (2016), who showed that self-consumption is the main production objective in the Centre Region of Cameroon. This may be motivated by the strong demand in the local market and the existence of a well-developed marketing infrastructure, such as markets, warehouses, and distribution networks.

4.2. Influence of the type of infrastructure on the physicochemical characteristics of water

The highest values of electrical conductivity of water are recorded in Hapas cages. To the current state of our knowledge, no research has yet been done to evaluate the comparative effect of fish farming in Hapa and in Fastank on the physicochemical parameters of water. However, these characteristics of water condition life in aquatic environments. The highest values of electrical conductivity thus observed in Hapa would be justified by the exchanges of ions between the soil and the water, as well as the leaching of minerals following precipitation, Fastank being above-ground production units.

4.3. Effects of the type of infrastructure on the survival and growth parameters of *C. carpio*

The survival rate of *C. carpio* was higher (95.53%) in Fastank as compared to Hapa (95%). These results correspond to the FAO recommendation (2007), stipulating that a minimum survival rate of 70% is recommended in fish farming. The results obtained are higher than those of Marchand *et al*. (2020), who obtained survival rates of 40% and 50% respectively, in ponds and in carp pre-fattening tanks. These results are lower than those of Staykov *et al*. (2015), who had a survival rate of 100% during their work on the feeding of common carp (*C. carpio*). Given that no predation by fish-eating birds was observed during the trial, the possible causes of the high survival rates regardless of the type of infrastructure could be explained by the stability of the physicochemical parameters of the water and a diet adapted to the needs of the fish.

The results from the evolution of the live weight of *C. carpio* reveal that the different live weights increased with the age of the fish, regardless of the infrastructure. The highest live weight value was recorded in the fish in Hapas. Feed consumption increased significantly in both infrastructures. This consumption was directly correlated with the live weights of the fish. These results correspond to those of Tagning *et al*. (2021), who showed that an improvement in feed consumption of batches subjected to the effect of the phyto-additive *Allium sativum* also increases the live weight in post-juveniles of *C. gariepinus*. This improvement in food consumption could be explained by the fact that the fish were already acclimated to their new environment.

The evolution curve of the influence of the type of infrastructure on the average weight gain in *C. carpio* showed that it is higher in Hapas. These results diverge from those obtained by Marchand *et al.* (2020), where the carp in the tank would have gained more weight than those in the pond. This difference can be explained by the fact that in Hapa, the fingerlings have plankton at their disposal, which would boost their weight gain, while in the Fastank, they just benefit from the exogenous food provided.

The results from the effect of the type of infrastructure on the average daily gain of *C. carpio* fingerlings show that the highest value is observed in Hapas (0.60g/d). These results are higher than those obtained by Gandaho (2007), i.e., 0.19 g/d on the incorporation of Moringa leaves in *Clarias gariepinus* juveniles. But lower than those obtained by Daddy (2021) (2.98 and 2.88g/d respectively using two types of feed in the diet of *C. carpio*. The difference observed compared to the latter author can be attributed to the lower quality of the feed used in our study, as well as the limited duration of the experiment.

The specific growth rate was higher in Hapas (17%/d) compared to Fastank (14%/d). These results are higher than those obtained by Montchowui et al. (2012), i.e., 2.80%/d in carp in tanks; also, higher than those of Mihai (2015), who obtained a specific growth rate of 4.04%/d by evaluating the effect of the quality of complementary feed on the growth performance of C. *carpio*. This difference in results could be justified by a difference in temperature between the breeding environments because, according to Ollier Angélique (2017), warm temperatures (25 to 32°C) accelerate the metabolism and stimulate the growth of carp.

The condition factor K was greater than 1, notably 1.58 in Hapa and 1.78 in Fastank, a sign of fish plumpness. These results are lower than those of Daddy (2021), who recorded a condition factor k of 1.99 when working on royal carp (*C. carpio*). These values are higher than those reported by Ekoué (2013), i.e., 0.6 and 0.74 with *C. gariepinus*. This superiority would be linked to the specific difference. At the same time, the breeding environment was designed to meet the specific needs of common carp, thus promoting their growth and development.

CONCLUSION

At the end of this work on the description of fish farming and acclimation of common carp (*Cyprinus carpio*) in the bimodal humid forest zone of South Cameroon, it can be concluded that fish farmers have similar profiles, with a predominance of a specific gender and two age ranges. Among the three species of fish recorded, only one, the catfish, is universally present among all stakeholders. As for the alternative activity, most fish farmers are professional fish farmers whose production objectives are geared towards marketing. Apart from electrical conductivity, the highest values of which were observed in Fastanks, all other physicochemical characteristics of the water did not vary significantly across the types of infrastructure. The highest survival rate was observed in Fastanks with no significant difference. Growth parameters did not vary significantly in the two infrastructures, although the highest values were recorded in Hapas. Just as catfish are produced in the bimodal forest zone of South Cameroon, the common carp should be introduced into the breeding environments of this zone to proliferate the species and vary the products present on the consumers' tables.

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