Biosecurity in fish farming: Implementation of the HACCP system at the Djissoumakö Fish Farming Centre - urban commune of Siguiri

Abstract

This study wascarried out from 10 January to 20 February 2022 in the urban and peri-urban area of Siguiri and aimed to learn about the application of biosecuritymeasures in some fish farms in Siguiri. To this end, 6 fish farms weresurveyed on the basis of a targeted sampling based on the criteria of accessibility, cooperation of fish farmers and the functional state of these farms, and 20 biosecurity variables weretakenintoaccount.

Of all the fish farms surveyed, only one (1) farmappliedbiosecuritymeasures, i.e. 15%, and the other five (5) saidtheyhad no knowledge of biosecurity, i.e. 85%.

In conclusion, the knowledge and application of biosecuritymeasurescouldundoubtedly help preventdiseases in fish farms, eventhoughthey are rare, and improve the productivity of fish farmers.

Keywords : Biosecurity, Fish farming and HACCP

INTRODUCTION

The consistent application of biosecuritymeasuresis essential to the success of any type of animal production. Biosecurity reduces the risk of disease introduction and the financiallossesresultingfrom infection. However, in severalsectors, the practice of biosecurity or its observance issporadic and variable, whether in cattle, pig, poultry or aquaculture farms (1).

However, failure to applybiosecuritymeasuresoftenresults in seriouslosses due to

- reducedgrowth and production of fish ;
- increasedfeedingcosts due to wastage of uneatenfeedcaused by poorappetite of the fish;
- increasedsensitivity to anyqualitydegradation;
- high fish mortality (2).

However, in the majority of fish farms in Africa, the main species of fish raised are from the tilapia and catfish group whoseresistance to certain infections isnowbeingquestioned, thesediseases can be spread naturallythrough the water, farmed fish infected by wild fish, vectors of an infectiousgene and evenhumans can be carriers of a genesuch as *Mycobacterium marinum*, responsible for tuberculosis in fish and alsoobserved in workers on fish farms (2).

Furthermore, fish farms in the Republic of Guinealack a real policy of biosecuritymeasurescompared to those in the sub-region. Thus, no study on the real practices of fish farmers in terms of hygieneseems to beavailable. This workis the first in a field of researchthatwill lead to the proposal of a guide of good biosecurity practices in the country's fish farms.

MATERIALS AND METHODS

MATERIALS

Brief presentation of the urban commune of Siguiri

The urban commune of Siguiri is the capital of the prefecture of the samename. It isbounded :

- to the east by the rural commune of Bankon.
- to the west by the rural commune of Kintinian;
- to the north by the rural commune of Doko;
- to the south by the rural commune of Kiniebakoura.

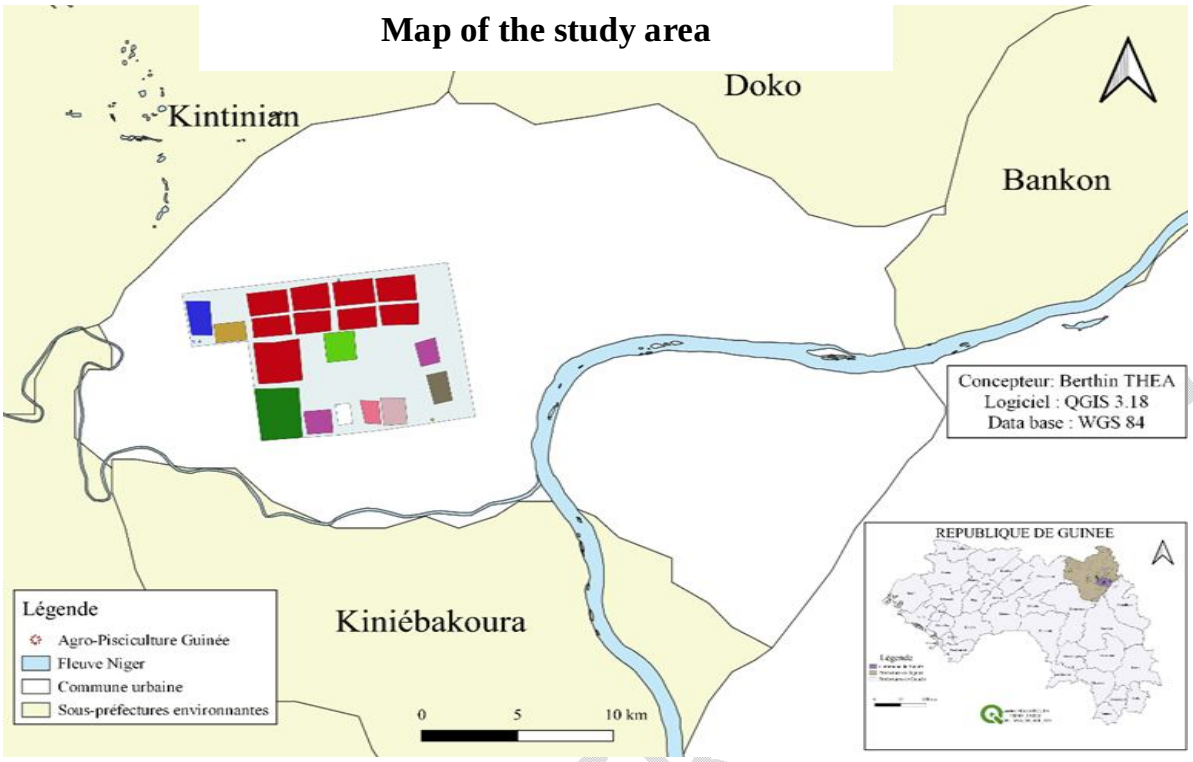

Figure 1: Map of the urban commune of Siguiri

METHODS

1. Identification and assessment of biosecuritymeasures on fish farms

- Selection and coding of surveyed fish farms

The selection of farms wasbased on the criteria of accessibility, cooperation of fish farmers and functionalstatus of the farms and all submitted farms werecodedusing the first twoletters of the farmname in upper case followed by the serial number of the surveyed farms.

- Questionnaire design and identification of biosecuritymeasures

The questionnaire wasdeveloped on the basis of the minimum biosecuritymeasures. Thesemeasurescovered 20 variables on whichour questions wereoriented, so the administration of the questions wasdone in the form of an interview.

After the interview, direct observation of certain variables allowed us to assess the quality of the answersobtained.

- Parameters of the biosafetymeasuresassessed

The variables of interestwere the recommendations of (3) regardingbiosecuritymeasuresapplied in aquaculture.

Table 1 : Biosecurity variables considered

Number	Variable	Codes
1	Types of farming structure	TSE
2	Physico-chemical analysis of water	APE
3	Workingclothes for staff	ERV
4	Workingclothes for staff	TTP
5	Protection of livestock structures	PSD
6	Knowledge of biosecuritymeasures	CMB
7	Farm Isolation	IF
8	Fish processing	TP
9	Knowledge of fish diseases	CPP
10	Disinfection of farm equipment before use	DMEAVU
11	Disposal of dead fish	DPM
12	Disinfection of farm equipment after use	DMEAPU
13	Visitor contact with water	CVE
14	Veterinaryvisit	VV
15	Presence of animals on the farm	PAF
16	Inter-farm exchange of livestock equipment	EMEF
17	Fish treatmentproducts	PTP
18	Quarantine of new fish	MQ
19	Frequency of water renewal	FRE
20	Visit	V

2. Mapping of surveyed fish farms

For the mapping of the surveyed fish farms in the study area, weused a GPS (Android). The operationconsisted of collecting GPS coordinates, namely longitude and altitude. Finally, the data wasused in QGIS3.18 software to beprocessed to produce the map.

Table 2 : Geographicalcoordinates and coding of surveyed fish farms

N°	Farm	Code	NAltitude	Longitude W
1	Agro Pisciculture Guinea	AP01	11°25.892	009°14.307’
2	Eco Farm Djoliba	EC02	11°43.718	009°01.955’
3	Cissé Farm	FC03	11°25.329	009°15.987’
4	Barry Farm	FB04	11°21.285	009°10.049’
5	Manden Mansa Farm	FM05	11°25.936	009°10.766’
6	Paracetamol Farm	FP06	11°26.396	009°08.348’

3. Elaboration of the HACCP system of the Djissoumakö Fish Farm

The implementation of the HACCP system of the Djissoumakö fish farming centre according to the ISO 22000 standard concerned the 5M whichis one of the methodsapplied in foodhygiene and safety and whichmakesit possible to check the possible sources of contamination of food.

4. Collection and processing of statistical data

In this study, the method of analysis usedis a descriptive one, sothree computer programs wereused for raw data entry, statistical analysis, map design and presentation of results.

- Sphinx iQ2 Version 7.4.0 wasused to developsurveysbased on biosecurity variables and to collect data;
- QGIS Version 3.18 wasused to design the thematic data (map) ;
- Microsoft Excel Office 2019 wasused to create the tables.

RESULTS

Table 3: Biosecurity features related to the management of fish farm staff and visitors

Biosecurity aspects	Modalities	Frequency (%)
Workingclothes for staff	No	88
	Yes	12
Workingclothes for staff	No	94
	Yes	6
Knowledge of biosecuritymeasures	No	94
	Yes	6
Visit	1-25/month	100
	0/month	0
Visitor contact with water	No	100
	Yes	0

Table 4 : Biosecurity features related to the management of rearing equipment on fish farms

Biosecurity aspects	Modalities	Frequency (%)
Types of farming structure	Basins	94
	Tanks	6
Physico-chemical analysis of water	No	88
	Yes	12
Protection of livestock structures	Protected	94
	Unprotected	6
Farm Isolation	Fenced	100
	Not fenced	0
Presence of animals on the farm	No	66,66
	Yes	33 ,34
Disinfection of farm equipment before use	No	88
	Yes	12
Disinfection of farm equipment after use	No	88
	Yes	12
Inter-farm exchange of livestock equipment	No	100
	Yes	0

Table 5 : Biosecurity features related to fish management

Biosecurity aspects	Modalities	Frequency (%)
Fish processing	No	94
	Yes	6
Knowledge of fish diseases	No	88
	Yes	12
Disposal of dead fish	Consumed	100
	Discarded	0
Veterinaryvisit	No	100
	Yes	0
Fish treatmentproducts	Oxytetracilin	45
	No-iodizedsalt	55
Quarantine of new fish	No	88
	Yes	12
Frequency of water renewal	Everytwoweek	94
	Everymonth	6

Table 6 : HACCP system of the Djissoumakö fish farmaccording to the ISO 2200 reference standard

5M		Highlights	Period of execution	Coordinators	Enforcers
Fish		Supply	Daily	Production Assistant	Fish Farmers
		Water renewal	Weekly	Production Assistant	Fish Farmers
		Monitoring of physico-chemical parameters	Weekly	Production Assistant	Fish Farmers
		Monitoring of biological parameters	Monthly	Production Manager	Production Assistant
		Sanitary monitoring	Monthly	Production Manager	Production Assistant
Environment	Hatcheries	Cleaning	Daily	Production Assistant	Fish Farmers
		Washing and disinfection	before and after reproduction	Production Manager	Fish Farm Workers and Assistant
	Shed	Cleaning	Weekly	Production Assistant	Fish Farmers
		Washing and disinfection	Monthly	Production Manager	Fish Farm Workers and Assistant
	Tanks	Washing	Weekly	Production Assistant	Fish Farm Workers and Assistant
		Washing and disinfection	Before loading and after total fishing	Production Assistant	Fish Farm Workers and Assistant
	Feed storage	Washing and disinfection	Weekly	Production Assistant	Fish Farm Workers and Assistant
	Waste water reception tank	Cultivation of water hyacinths (purification)	None	Technical team	Manager, Assistant and Workers

	Disinfection room	Washing and disinfection	Daily	Fish Farmers	Maintenance workers
	Toilets	Cleaningand disinfection	Daily	Fish Farmers	Maintenance workers
	Green areas	Cleaning	Weekly	Fish Farmers	Maintenance workers
	Wastewater drainage channels	Cleaning	Monthly	Production Assistant	Maintenance workers and fish farmworkers
Labour	Equipment	Mandatorywearing of uniforms, boots, gloves, aprons, safetywaistcoats and jackets	Eachactivity	Production Assistant	Technical team
	Visitcertificate	Medical check-up	Monthly	Administrators	Staff
	Medical follow-up	Knowing the state of health of the staff recruited	On hiring	Administrators	Recruited
Workingmaterials					
	Breeding equipment	Washing and disinfection of equipment	before and after reproduction	Production Assistant	Production Assistant
	Fishing equipment	Maintenance	after use	Production Assistant	Fish Farmers
	Biological monitoring equipment	Maintenance	after use	Production Assistant	Fish Farm Workers and Assistant
Workingmethod	Work rate	Avoid rough handling of fish	During control and total fisheries	Production Manager	Fish Farm Workers and Assistant

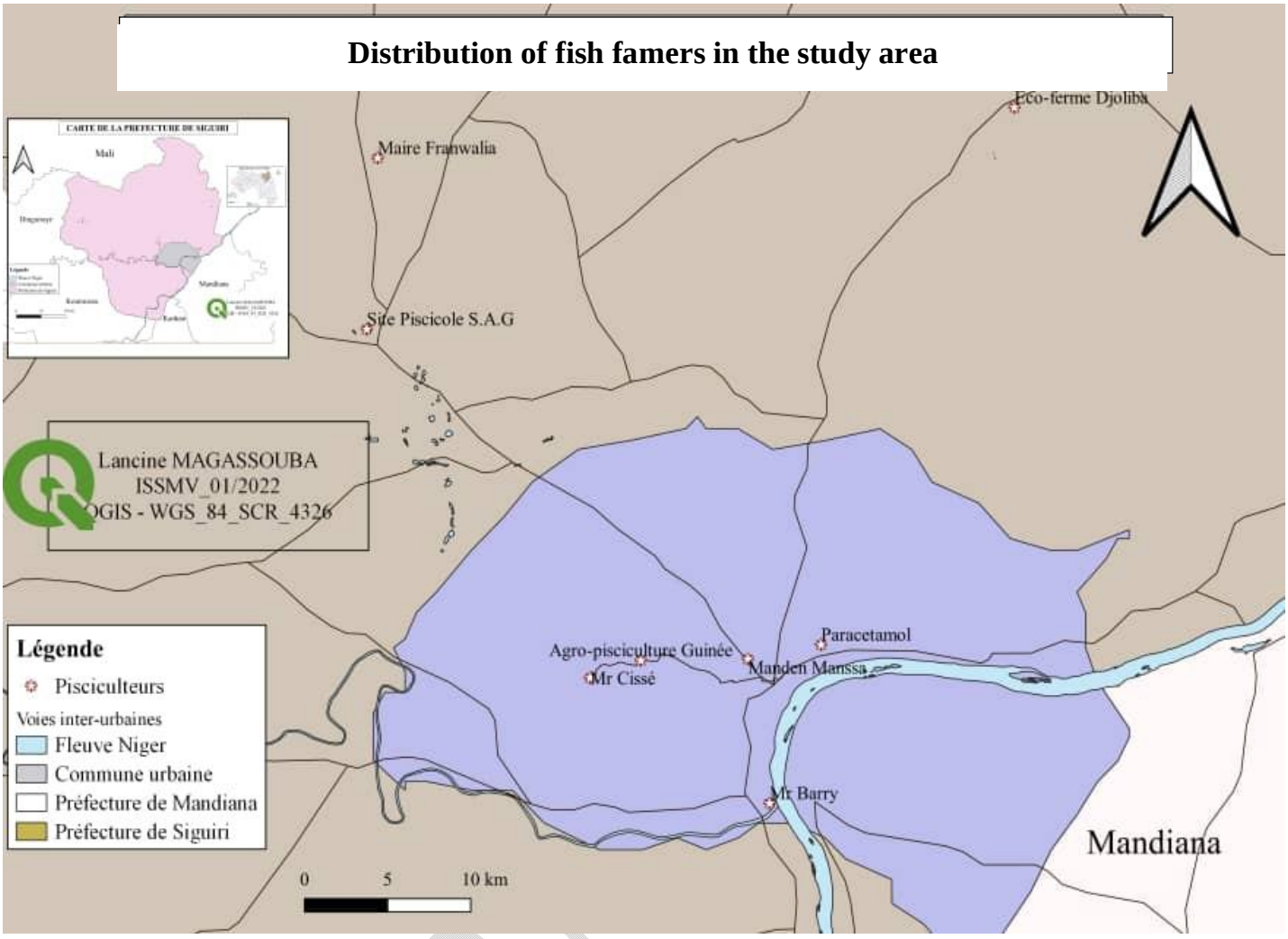

Fig 2: Identification map of surveyed fish farms

DISCUSSION

In terms of knowledge and practice of biosecuritymeasuresapplied on the different fish farms surveyed, ourresultsrevealthat more than 85% of the fish farms do not applybiosecuritymeasures and 15% applypreventivemeasures but in a discontinuousmanner. This would have hadconsequences for the health of fish and staff. Our surveysshowedthat 94% of the farms have fish ponds and 6% have tanks, 66.66% have other animal species on their farms, 88% have not disinfected the farming equipment and 100% of the farms have not allowedveterinaryvisits and 88% do not take physico-chemical parameters.Furthermore, ourresultsalsoindicatedthat 88% of the fish farms did not applyquarantine to new fish and 94% renewed the water once a month.

The analysis of the different values from the biosecurity practices shows that the majority of the fish farmers do not have anyknowledge on biosecurity and thosewhoapplypreventivemeasuresaccumulatefair practices that can expose their fish and staff to risks of infection or infestation. Looking at the values fromanother angle, wefindthat the fish farmers in the study area do not have anypreventivepolicies for their farms.

However, ourresults are similar to thoseobserved by (5) among aulacode farmers in the Sud-Comoé and Agnébyregions of Côte d'Ivoire, whostatedthat in most aulacode farms basic prophylacticmeasures are not applied by the farmers and that the neglect of preventive practices is due to the lack of qualifiedprofessional training of the farmers. The latter are also, for the most part, illiterate and would have learned the profession of animal husbandry on the job.

Our resultsrevealedthatmost of the fish farms surveyed have other animal speciesthat have access to the environment due to the absence of controlledaccess zones on the farms. This constitutes a failure of otherbiosecuritymeasures, regardless of theirlevel of implementation. The presence of other animal species can constitute a risk of introducinggerms, as highlighted by (4). Indeed, it has been shownthatsomeavianspecies can be carriers of germs and be sources of contamination for othersthat are more susceptible to thesegerms. This mixture of speciesthereforecreates an environmentfavourable to the emergence of variousaviandiseases

The implementation of the HACCP system at the Djissoumakö Fish Farm is a tool for the application of biosecuritymeasures and itshouldbenotedthat in the Siguiri prefecture fish farms are concentrated in urban and peri-urban areas.

CONCLUSION

The analysis of the biosecurity measures variables showed that in almost all the fish farms surveyed, biosecurity measures are not applied, which undoubtedly has consequences in terms of productivity. It appears that the fish farming stakeholders in the peri-urban and urban area of Siguiri do not have extensive information on the application of biosecurity measures in fish farming, however, the application of the HACCP system presented in this article could be considered as a good practice guide for biosecurity measures in fish farms and will allow for a profitable and environmentally friendly production.

COMPETING INTERESTS DISCLAIMER

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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