

## **Gross Anatomical Assessment of *Clarias Gariepinus*: An Ecotoxicological Study of Commercial Fish Farm in Ogbogoro, Rivers State, Nigeria**

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### **Original Research Article**

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**Abstract:** The study is an ecotoxicological evaluation of commercial fish farm in Ogbogoro (OGB), Rivers State Nigeria using anatomical/macro morphological assessment of *Clarias gariepinus*, and African Aquaculture Centre (ARAC) as a the reference site. The sampling involved harvesting of table-sized fish: twenty fishes from OGB and ten fishes from ARAC. The gross anatomy (fish necropsy) involved the determination of Fish Biometry (Condition factor, CF and Organosomatic Indices, OSI) and Health assessment index (HAI). Showed that: fishes from OGB were less healthy based on the CF; OGB were less Healthier based on OSI; OGB fishes were less Healthier based on HAI when compared to fishes from ARAC. It was concluded from the study that the fishes from Ogbogoro fish farm had certain level of pollution though considered to be moderate at the time of the study.

**Keywords:** Anatomical, Ecotoxicology, macro-morphology, HAI, CF, OSI.

### **INTRODUCTION**

The proliferation of indigenous fish farms in Nigeria is on the increase, it poses the question as to whether there are baselines being followed to enable the farmers produce good quality fishes for consumption. The fact remains that the health of these farms will directly impact on the consumers and in turn the nation. It has being maintained that fishes are truly products of their environment, unlike land dwelling animals, fish metabolism and biological functions are directly linked to the physical and chemical properties of the medium that surrounds them, water [1].

### **Aim**

This study was done to assess the gross anatomical features of the fishes to ascertain their level of health in Ogbogoro and ARAC fish farms. It is worthy of note that this species of fish that is sold and consumed more, grows at a very high rate.

### **Significance of study**

This study would provide baseline data for food consumption regulatory agencies or environmental pollution control agency as a precursor for Fish Consumption Advice or Environmental Alert. It will also provide commercial fish farmer scientific evidence of the pollution status of their fish ponds.

### **SCOPE OF STUDY**

Organosomatic Index, Health Assessment Index and Condition Index

### **Experimental Area (Ogbogoro commercial fish pond)**

Ogbogoro is a community, located in Obior Akpor Local Government Area of Rivers state. It is bounded by, Choba, Rumuekini, Emohua and Diobu. The geographical coordinates are, 4° 50' 48" North, 6° 55' 50" East in DMS- Degrees Minutes Seconds or 4.8451°N, 6.9290°E, [in decimal degrees] (maplandia.com, 2017)

The pond is sited in a swampy area which is prone to flood during the mid-raining season. It is located far from residential building. Aside the fishing section in the establishment, there are sections for piggery and poultry farming, although no animals were in them as of the time of my harvest of fishes for my experiment. The pond is divided into units according to fig. 2.2. Each of this units has nothing less than 200 fishes in them. The fishes in each unit vary in size/age ranging from, hatchling, fingerling, nursery, table size.

### **Water regulation**

According to koi food, the ideal regime for water changes is 10% per week or 20% per two weeks or 50% every six weeks. The percentage of water changed depends on the level of haze or cloudy appearance seen on the water, which is sign of high organics, (aquamed.com, 2000). 75% - 80% water must be changed at least twice per year. In Ogbogoro, the pond water is changed every two weeks, completely, although varies depending on the level of pollution of the water.

### **Feeding**

Commercial fish feeds are concentrated, and if too much is eaten, it will pass through the fish only partly digested and then pollute the water. If feeding as a supplement to natural foods in the pond, two or three times a week will be ample (www.aquapic.com). If excess food goes uneaten, it should be netted out to avoid pollution and feed less the next time. Ogbogoro commercial fish pond, feed their fishes during the day with fish feeds like coppens.

### **REFERENCE AREA (ARAC)**

African Regional Aquaculture Centre (ARAC) was chosen as the control site. It is situated at the training centre, Omuihuechi, Aluu in Ikwere Local Government Area of Rivers State. Most of the activities in the centre includes research, training, and development of sustainable aquaculture options, in sub Saharan African. It covers an area of 81 hectares of land.

It's a centre of excellence that focuses on multidisciplinary approach to user-driven aqua cultural research, development and training in sub-Saharan Africa geared towards sustainable fish production in the region.

### **STUDY SPECIES**

African catfish (*Clarias gariepinus*) is one of the most important primary treatment for tropical cultured fish due to high growth rate, high stocking-density capacities, and high resistance to poor water quality and oxygen and considered as a model for Eco toxicological studies.

### **Natural Distribution**

They are found throughout Africa and the Middle East, and live in freshwater lakes, rivers, and swamps, as well as human-made habitats, such as oxidation ponds or even urban sewage systems. The African sharp tooth catfish was introduced all over the world in the early 1980s for aquaculture purposes, so is found in countries far outside its natural habitat, such as Brazil, Vietnam, Indonesia, and India.

### **Habitat**

It is a nocturnal fish like many catfish. It feeds on living, as well as dead, animal matter. Because of its wide mouth, it is able to swallow relatively large prey whole. It has been known to take large water birds such as the common moorhen. It is also able to crawl on dry ground to escape drying pools. Further, it is able to survive in shallow mud for long periods of time, between rainy seasons. African catfish sometimes produce loud croaking sounds, not unlike the voice of the crow [2].

### **Natural spawning**

Spawning mostly takes place at night in the shallow, inundated areas of the rivers, lakes and streams. Courtship is preceded by highly aggressive encounters between males. Courtship and mating takes place in shallow waters between isolated pairs of males and females. The male lies in a U-shape curved around the head of the female, held for several seconds. A batch of malt and eggs is released followed by a vigorous swish of the female's tail to distribute the eggs over a wide area. The pair usually rests after mating (from seconds up to several minutes) and then resume mating.

Parental care for ensuring the survival of the catfish offspring is absent except by the careful choice of a suitable site. Development of eggs and larvae is rapid, and the larvae are capable of swimming within 48–72 hours after fertilization [2].

## **MATERIALS AND METHODS**

### **Phases of Study**

There are two phases of the study- phase one and two

#### **Phase One (Preliminary Study)**

The experimental site was inspected and vital information gotten as questions were asked. Such questions included: the number of fishes contained in the pond, type and frequency of fish feed used, treatment administered to fish in poor health condition, mode and frequency of changing the water content of the pond. These questions were asked in order to obtain necessary information about the experimental site.

A sample fish was harvested and taken to the African Regional Aquaculture Centre for identification by a taxonomist.

#### **Phase Two (Sampling of Fish)**

According to Institute of Veterinary Research and Food Security, Tirana, Albania, The European standards for fish sampling in lakes determined the sampling protocols and methodology developed in the course of fish and fishery monitoring for Prespa lakes.

The sampling procedure was based on stratified random sampling.

#### Control Sample

Control fishes were harvested from ARAC, this was done by first collecting some water content of the pond into a plastic container which would contain the fishes from the control site to the laboratory. The essence was so that the original aquatic habitat of the fishes will remain the same after harvesting as it was before. Failure to do this would have led to alteration of the fish habitat by that distorting the internal morphology of the fishes. Thereafter, the remaining water content of the pond was drained, then with the aid of a seine; ten table-sized cat fishes were harvested and put into the plastic container in which there was exactly the same water content of the pond.

#### Experimental Sample

Experimental fishes were harvested following similar procedure used for the control. Twenty table-sized cat fishes were harvested from the pond

#### Gross Anatomical Assessment

This involved the assessment of condition factor, organosomatic index and health assessment index.

#### Condition Factor

$$\text{Fulton's CF; } K = \frac{W}{L^3}$$

Where,

K is Fulton's condition factor, W is the weight of the fish and L is the length of the fish.

Fulton's condition factor is widely used in fisheries and general fish biology studies. This factor is calculated from the relationship between the weight of a fish and its length with intention of describing the condition of individual fishes [3].

$$CF = (W \times 100 / L^3).$$

#### Organosomatic index

This is the calculation of the organ mass as a proportion of the total body mass. It is represented by

the formula:  $OSI = (\text{Organ weight} / \text{Total tissue weight} \times 100)$ . This is a tool for measuring the organ maturity of animals [4].

#### Health Assessment Index

According to Adams *et al.*, [5], the health assessment index (HAI) is an extension and refinement of a previously published field necropsy system. The HAI is a quantitative index that allows statistical comparisons of fish health among data sets. Index variables are assigned numerical values based on the severity or damage incurred by an organ or tissue from environmental stressors. This approach has been used to evaluate the general health status of fish population in a wide range of reservoir types. The ability of the HAI to accurately characterize the health of fish in this system was evaluated by comparing this index to other types of fish health measures made at the same time as the HAI. In all cases, the HAI demonstrated the same pattern of fish health status between sites as did each of the other more sophisticated health assessment methods. The HAI has proven to be a simple and inexpensive means of rapidly assessing general fish health in field situations.

#### CALCULATION

Summation of organ weight divided by the total number of fish:

$$HAI = \sum \frac{WO}{nf}$$

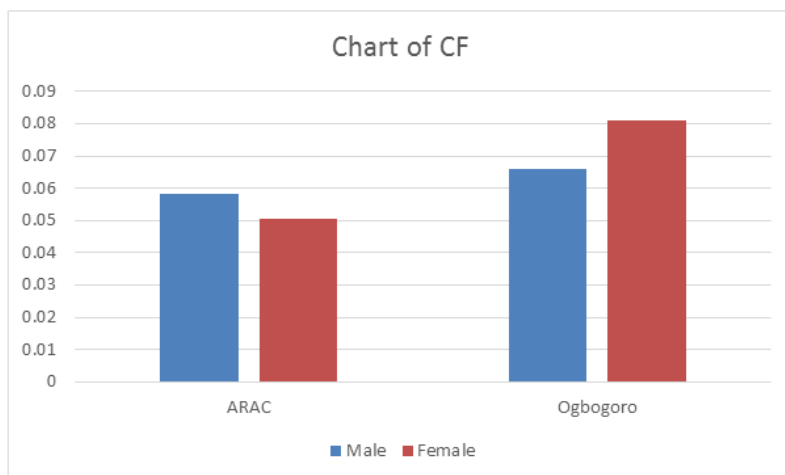
#### Sacrificing the Samples

The process was done following the guidelines given by the American Veterinary Medical Association. The fishes were sacrificed through cervical dislocation method (severing the spinal cord anterior to the dorsal fin) and surgically opened on the ventral side of the fish for excision of the organs.

#### RESULTS AND DISCUSSION

The results of the study were presented in both graphs and tables.

Condition Factor (CF)



**Fig-1: The mean value of Condition Factor**

The analysis done indicates that there was no statistical significant difference in both groups for the

males but there was significant difference for the females.

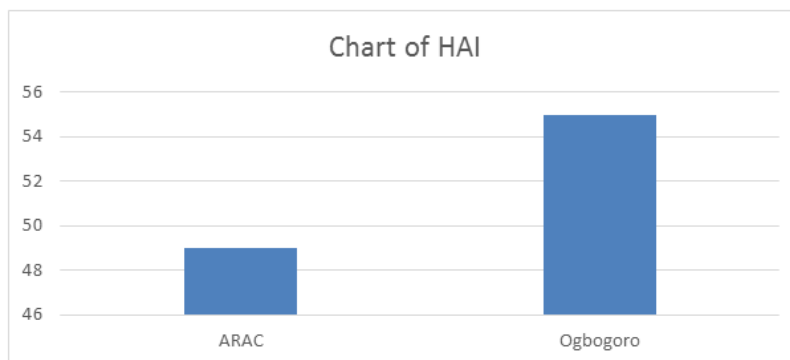
**Table-1: The statistical analysis of Condition Factor for both sexes**

	Males				Females			
	Mean	STD	t	Sign	Mean	STD	t	Sign
Experimental	0.065	0.0062	2.068	0.006	0.080	0.009	6.225	0.001
Control	0.058	0.0075			0.050	0.005		
P-value	0.05							

#### Health Assessment Index (HAI)

Health assessment index was performed on fishes harvested from Ogbogoro and compared with those from ARAC to investigate for internal

abnormalities within the visceral cavity. Fish organs examined includes: skin, fins, eyes, gills, parasites, liver and kidney. All abnormalities were recorded and fish HAI score were given on the pathological variable.



**Fig-2: The mean value of HAI**

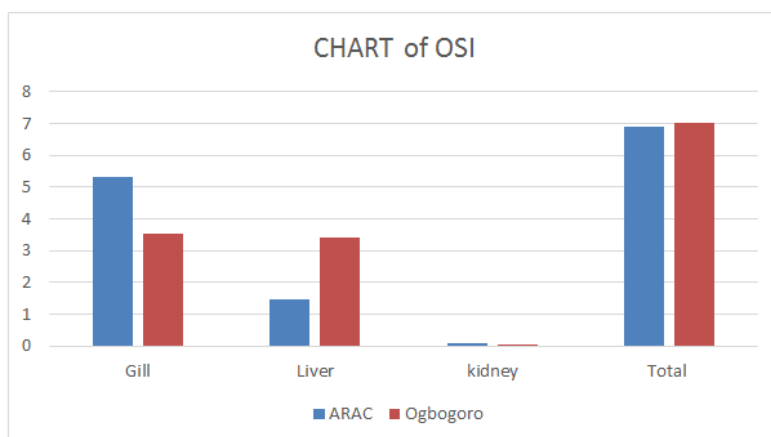
The analysis showed no significant statistical difference between the two groups.

**Table-2: The statistical analysis of HAI**

Groups	N	Mean	Standard Deviation	F	Significance
Experimental	20	55.02	25.02	0.494	0.488
Control	10	49.00	13.70		

### Organosomatic Index (Osi)

The weight of the organs (gill, liver and kidney) obtained from the study:



**Fig-3: The mean value of Organosomatic index**

The analysis of the study indicated that there is a significant statistical difference between the two groups.

**Table-3: The statistical analysis of OSI (Gill)**

Groups	N	Mean	Standard Deviation	F	Significance
Experimental	20	3.543	0.663	55.406	0.001
Control	10	5.301	0.477		

The analysis of the study indicated that there is a significant statistical difference between the two groups.

**Table-4: The statistical analysis of OSI (Kidney)**

Groups	N	Mean	Standard Deviation	F	Significance
Experimental	20	0.053	0.025	30.980	0.001
Control	10	0.109	0.027		

The analysis of the study indicated that there is a significant statistical difference between the two groups.

**Table-5: The statistical analysis of OSI (Liver)**

Groups	N	Mean	Standard Deviation	F	Significance
Experimental	20	3.392	0.715	69.528	0.001
Control	10	1.475	0.126		

## DISCUSSION

### Condition Factor

CF was calculated using the Fulton formula. There was no significant difference between the CF of the experimental group and that of the control. From the result of the study, it therefore suggests that the fishes in the experimental site and that of the reference site were both in good conditions. By implication, no difference between both categories which means that fishes from sites can be consumed without fear of contaminations going by the result for condition factors. These results agree with the results obtained by previous authors.

### Health Assessment Index

HAI was calculated using the Adam's formula [5]. There was no significant difference between the

HAI of the experimental group and the reference site. This again buttresses the fact that fishes from both sites were in good health as no statistical significant difference was observed. It goes on to mean that fishes from these sites can be eaten without fear of poisoning or contraindications. These results agree with the results obtained by previous authors.

### Organosomatic Index

OSI was calculated by multiplying the weight of the fish organ by 100 and dividing by fish weight. Contrarily, there was a statistical significant difference between the experimental and reference sites. It therefore implies that the vital organs had certain degree of distortions that were observed to a reasonable extent. It suggests that the fishes from the experimental site were contaminated but the level of distortion is not yet

lethal as condition factor and health assessment index still indicate that the fishes were normal. It also means that the environment of the experimental site should be improved and owners of these farms should adhere strictly to the rules and baseline regulations in fish farming to totally eliminate the contaminations. These results agree with the results obtained by previous authors.

## CONCLUSION

In conclusion, it suggests that the fishes from Ogbogoro commercial fish farms were moderately contaminated and the level of distortion is not yet lethal as condition factor and health assessment index still indicate that the fishes were normal.

## RECOMMENDATION

We write to recommend that further studies should be done on nutrient composition, types and production of fish feed.

## ETHICAL APPROVAL

Ethical clearance was obtained from the University of Port Harcourt Research Ethics Committee before commencement of the study.

## ACKNOWLEDGMENTS

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**CONFLICT OF INTEREST:** We write to declare that there is no conflict of interest

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