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TABLE OF CONTENTS

AQUACULTURE

3

Standardization of *Clarias gariepinus* fingerlings using age, weight and length estimations

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Abstract
A study was conducted to estimate the range of weight / length as well as age at which a *Clarias gariepinus* fish can be said to be a standard fingerling. Artificial breeding was conducted using male and female brooders weighing 2.7Kg and 2.3Kg respectively. Offspring were managed through eight weeks in both indoor (glass aquarium) and outdoor (concrete tanks) facilities. Data on weight and length were obtained and recorded weekly. Physico-chemical properties of the water were also monitored and recorded. The study revealed that the age at which a *Clarias gariepinus* fish can be said to be a standard fingerling is after six weeks while the range of weight and length recorded were from 4.00 - 6.5g and 6.50 - 10.00cm respectively. The study recommends that hatchery operators raise *Clarias gariepinus* for a minimum of six weeks before selling to fish farmers – to reduce mortalities recorded at the fish farms and its multiplier effects on existing and intending fish farmers

Keywords: *Clarias gariepinus*, Catfish, Fingerling, Standardization

Introduction
Fingerlings are baby fish of between 1 – 2 months old for most fish species and usually "finger" length in size. They are the "seeds" for stocking of fish ponds, reservoirs and depleted open water bodies. They form the bedrock of fish farming industry (Madu, 2016). The demand for fingerlings in Nigeria was estimated at over 4.3 billion annually and less than 56 million was being produced (F.D.F., 2007). The availability of reliable source of fingerlings, especially of *Clarias gariepinus* and its hybrids is one of the criteria for a successful fish farming enterprise (Madu, 2004, 2014). Because fingerlings can be ready for sale from 6 - 8 weeks after breeding, this expect of the fish farming value chain is regarded as the "fastest revenue yielding" and thus should be "standardized" to avoid the continuous exploitation of quacks and its multiplier effects.

The African Catfish is a species of catfish of the family Clariidae and its scientific name is *Clarias gariepinus* which was named by Burchell in 1822. The physical changes in terms of weight and length or age of fish from the point of hatching to adult fish can be sub-divided into the following stages - Larvae / Hatchlings, Fry, Post-fry, Fingerlings, Juveniles and Adult fish. According to Olaoseibikan (2011) and Madu (2016), these stages are described as follows:

Larvae / Hatchlings – newly hatched eggs, from day 1 – 3 usually with yolk sac.

Fry – are fish seeds aged 4 – 28 days. They do not have yolk sac and accept artificial food – live feeds.

Post-fry – are fishes of 4 – 5 weeks old, the intermediate between fry and fingerlings. They are ready to accept artificial feed. They are not stable thus this stage is considered critical.

Fingerlings – are fishes of 6 – 8 weeks old. They accept artificial feed and are more stable at this age. They are considered the "seeds" for stocking.

Juveniles – are fishes of 8 – 10 weeks old, very stable and accept most artificial feeds.

Adult fish – these are fishes of over 12 weeks old

Generally fingerling production which can also be referred to as fish breeding, induced breeding, seed multiplication, fish seed propagation or fish hatchery management, involves a series of breeding and feeding practices which can be grouped under the following three major sequential operations (FAO 1997; Madu, 1989; Wedemeyer, 2001)

This refers to the procurement, care and maintenance of the parent stock (brooders). The broodstock can be best sourced from either the wild / natural waters or established fish farms. The sexes of the broodstock should be identified and stocked separately. For the brooders to be healthy, they must be fed well. Catfish requirement is 35 – 40%. The water quality parameters must be checked daily.

Induced Spawning and Hatching of Eggs

Fish are usually stimulated to release their eggs under controlled and conditions manipulated by hatchery operators. The major method which is commonly used is the artificial hormone induced spawning / stripping and artificial fertilization method. This method allows the hatchery operator to control almost all aspects of the breeding process.

Nursery Management of Hatchlings up to Fingerling Stage

This is the most delicate aspect of fingerling production because the percentage survival of the hatchlings could be zero if not properly handled. The newly hatched fish (hatchlings or larvae) are very delicate and must be handled with ultimate care. Some of the important factors that must be considered during nursery management include – Adequate stocking density, adequate food and feeding schedule, good water quality management, sampling and sorting to remove jumpers and measures to control of predators.

Materials and methods

Experimental Site: The study was conducted at the Hatchery Complex of the National Institute for Freshwater Fisheries Research (NIFFR) and Federal College for Freshwater Fisheries Technology both in New Bussa, Niger State, Nigeria.

Collection and Management of Broodstocks: Male and female brooders weighing 2.70kg and 2.30kg respectively were sourced from Awuru river in Niger state. Both fishes were properly checked to make sure they were gravid and allowed to acclimatize in holding tanks for one week before using them for breeding. During this period, the brood fishes were fed very well twice daily with 40% crude protein feed. This is to ensure production of many offspring during breeding.

Inducement, Collection of Eggs and Milt: The female fish was induced by injection of ovaprim® hormone at a dosage of 0.5ml/Kg of fish body weight. This was done using 2mm needle at an angle of around 35 degrees below the line of the fish towards the anterior part. This method is intramuscular. The fish was then allowed for the latency period (9 – 12 hours). After the period of latency the female fish stripped for collection of eggs by gently pressing the stomach with the thumb from the pectoral fin towards the genital opening and green-brownish eggs were being collected in a bowl as they easily ooze out until the eggs stop coming out. The only way to collect the milt (sperm) was to kill the fish, thus the fish sacrificed and the two testes carefully removed and dried with filter paper. The cream-white part of the testes lobes containing ripe semen were put into saline water.

Fertilization, Incubation and Hatching: The testes from the male fish was cut using blades in the saline water and then mixed with the eggs for one minute using a clean feather to allow fertilization. Distilled water was then added and again stirred for another one minute to complete the fertilization. Thereafter, the water and excess milt were decanted. The fertilized eggs were spread in a single layer on the kakabans placed in the breeding tank to avoid suffocation. The incubation water was supplied from the borehole and allowed to stay overnight and properly aerated using electric aerator to provide enough oxygen. After 24 hours the healthy developing eggs (greenish in color) started hatching, the kakaban was removed and some of the eggs which did not hatch (white in color) were siphoned away.

Indoor Management of Larvae and Fry

The larvae (hatchlings) were not fed until they were seen to have absorbed their York sacks after three days. The fry were then fed three times daily with zooplanktons trawled from the hatchery complex combined with commercial Artemia® from the fourth day until two weeks. During this period, jumpers were sorted out, removed and replaced weekly to avoid cannibalism and malnutrition of other fishes. The water quality was monitored to ensure its kept within acceptable aquaculture range and the oxygen demand was supplied using constant aeration. The tanks were siphoned daily and water replaced to the required level. After two weeks the fishes were transferred to prepared outdoor tanks at a stocking density of 200 fish / m2. The tanks were covered with 2mm mesh net to evade predators.

Outdoor Management of Post-Fry and Fingerlings: The post-fry fishes were fed three times daily with commercial fish feed (Coppens®) of 0.8 – 1.2mm. With progressive growth, the feed size was increased to 1.5mm and later 2mm size of feed was used for the last week.

Data Collection: The data (weight and length) collection was done weekly using sensitize weighing scale and meter rule. The data collection is only for the majority uniform sized fishes since the few jumpers and minors were removed from the experimental tanks and replaced from the pool.

Results and Discussion

Water Quality Parameters: The results of the mean water quality parameters as were recorded for the experimental duration of eight weeks are presented in table 1.1.

Table 1.1: Mean water quality parameters of experimental tanks (8 weeks)

Parameters	Mean	Range	Ideal Ranges
PH	7.16	7.0 – 7.6	6.50 – 9.00
Water Temperature (°C)	28.20	28.00 – 30.90	25.00 – 33.00
Dissolved Oxygen (mg/L)	8.96	6.20 – 9.10	5.00 – 9.00
Conductivity (µS/cm)	160	90 – 320	150 – 500

Data are expressed as Means of daily readings for eight weeks

From the results in the above table, the water quality parameters were all within the optimum range for the culture of the experimental fish (*Clarias gariepinus*) fingerlings.

Weight – Length Estimation

Results of weight and length as recorded for the experimental duration of eight weeks are presented on table 1.2.

Table 1.2: Weight and Length range of experimental fishes for eight weeks

Duration [Week(s)]	Weight Range (Grams)	Length Range (Cm)
1	0.50 – 0.60	Approx. 1.00
2	1.10 – 1.20	1.70 – 2.00
3	1.65 – 1.80	3.80 – 4.00
4	2.20 – 2.50	5.00 – 5.30
5	2.60 – 3.00	5.50 – 5.70
6	3.50 – 4.00	6.00 – 6.50
7	4.20 – 4.50	6.50 – 7.00
8	5.00 – 6.50	8.00 – 10.00

Performance of Fish during Study

Visual observation during feeding and sampling times revealed that the fishes became more active after 3 days as they were seen swimming up vigorously in search of food. It was also noticed that the few mortality of the fishes recorded started at this time and this can be attributed to the inability of the few fishes to adapt to the supplementary feeding after yolk sac absorption. It was noticed that from the 6th week, the fishes were very much active and very stable and this could be an indication that they have gone out from the "lag-phase" of growth. (Madu, 2008)

Conclusion

From the estimation study, it can be concluded that *Clarias gariepinus* fingerlings are fishes not less than six weeks old and ranging from 4.00 – 6.50g weight and 6.50 – 10.00cm length.

Recommendation

Study should be repeated using different stocking densities and different (bigger) culture medium to evaluate changes in water parameters and growth rate; since most farmers are likely to breed with higher density and bigger culture medium with thousands of fry. It is also recommended that outreach and awareness campaign be initiated and intensified by major stakeholders; especially for hatchery operators, fingerlings/fish seed mongers, fish farmers / intending farmers on the ideal size of fish to be procured and the dangers or consequences of procuring fishes below or within lag-phase of growth.

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