EFFECTS OF FEEDING LEVELS AND TEMPERATURE ON THE DEVELOPMENT OF THE GONADS IN THE AFRICAN CATFISH (Clarias Lazera): AN OVERVIEW

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Abstract

Clarias Lazera and other species of clarias are commercially important because they are highly priced, they are muscular, and available in moist water (fresh water) in Africa particularly in Nigeria fresh waters. The Gonads (Testis and ovary) of Clarias Sp are internal and usually longitudinal and originate as paired structures. Testis are suspended by lengthwise mesenteries (mesorchia). While the ovaries are suspended from high on the sides of the body cavity by a mesenteries (mesovaria). Maturation of the gonads of any species of fish including that of *clarias Lazera* needs a certain "amount" of temperature which can be quantified as hour-grades, or day-grades. Natural spawning in *clarias Lazera* takes place mostly at night. Other environmental factors necessary for gonadal maturation in *Clarias Lazera* include length of photoperiods, water depth; salinity (PH), dissolved oxygen etc. A well balanced compound diet containing all the essential nutrient requirements particularly the amino-acids; vitamins and minerals is a pre-requisite for proper gonadal development.

Introduction

Clarias Lazera (cuvier & valenciennes), and other species of clarrids such as clarias gariepinus inhabit inshore areas in tropical, sub tropical Africa, Eastern Turkey and the middle east. The inshore areas inhabited by these fish are only useful at night as during the day they migrate offshore into the deeper part of the water body. Their migration patters are the remarks of the Oreochromis, Sarotherodon etc (Bruton, 1979).

One of the most widely distributed cat fish family is the claridae, members of which are found throughout South East Asia, the Indian sub country. Africa and the near east (John, 1989).

John, Ryther & Mclarney (1972) also reports that clarrid catfish are distinguished by the possession of an accessory air breathing organ, which enables them to exist for hours at a time out of water or indefinitely in oxygen poor waters and even moist mud. Madu (1987) also reports that Clarias is one of the most extensively cultured species in Nigeria today because it is very hardy and has accessory air-breathing organs which enable it to tolerate low dissolved oxygen and other adverse aquatic conditions where most other cultivable species cannot survive. These good features coupled with its high growth rate and ability to feed on virtually anything makes it highly recommendable for farming in Nigeria.

The African catfish, *Clarias* Sp is one of the popular food fishes in Nigeria. Its only flesh is highly relished by most people in the country and it is therefore highly preferred for its good taste (Ayinla & Nwadukwe, 1988).

Anatomical Structure of *Clarias Lazera*

Clarias lazera has the pelvic fins midway between the tip of the snout and the root of the caudal fin, or slightly nearer to the body is 3.0 to 3.5 time as long as the head. The dorsal fin has 62-82 rays while the anal fin has 50-65 rays. The vomerine teeth are all granular, forming a band which is

1.3 to 2.5 times the width of the teeth on the premaxillary. There are 35 to 135 long gill rakers on the fist gill arch (Lagler et al 1977).

The colour of *Clarias lazera* varies considerably, but is usually blackish on the back and white or slightly yellowish on the belly, and the flanks are grayish olive. The fins are black, except for the ventralis and pectoralis which are almost grey or transparent. The barbells are generally black (Lagler et all 1977).

Reproduction in Clarias Lazera

Adult males of *Clarias lazera* can be distinguished from the females by the fact that they possess long, conical and "papilla", a projection from the vent containing the sexual opening, but this is not always exposed (Bone et al 1995).

Clarias lazera is an oviparous fish, the eggs are laid in layers and the eggs are characterized by size of the egg. Some eggs are small between 1.5 to 30mm in diameter. The eggs may be adhesive and deposited in strips sticken together throughout the incubation period or they may be attached singly to some substrates. After having been fertilized egg take sometime before hatching out. The duration of incubation varies according to the different species and according to the temperature of the water. The warmer the water the shorter the incubation time (Lagler et al 1977).

Courtship Behaviour of Clarias lazera

During courtship (Fig. 1) males fight to establish which catfish have he status to proceed with courtship. After a skirmish, the victor in a particular fight approaches a female and butts her lightly on (1) the body, (2) if the female is not receptive (3) it swims away. Receptive females swim towards the lake shore, followed by the male and enter an area of inundated grassland or sledges. Eventually the female stops as a result of light butting by the males on her abdomen, head and tail. Once they have stopped swimming, the female butts the male near the urogenital opening and the male but the female along the abdomen and around the head, and then adopts a U-shapped position around the females head unit the dorsal fin directed towards the female. After a few shuffling movements accompanied by continuous quivering; the pair suddenly becomes motionless (Bruton, 1979).

Feeding in Clarias Lazera

Clarias lazera have terminal mouth and four pairs of simple barbells. The nostrils are far apart, the anterior one is tubular and the posterior one is equipped with a long tentacle. The numerous small teeth of *clarias lazera* are arranged in bands on the jaws and also on the teeth of the mouth. The character of these bands of teeth is the most reliable means for determining that they feed on a wide variety of food, from weeds and plankton to insect larvae, snails, crustacean, worms and small fish (Bone et al 1995). *Clarias lazera* also has fine gill rakers with which they are able to filter plankston from the water.

Clarias lazera is a predatory catfish essentially omnivorous the predatory efficiency of the catfishes such as *clarias lazera* was estimated to be higher in shallow water at night despite the low number of cichlids (Bruton, 1979).

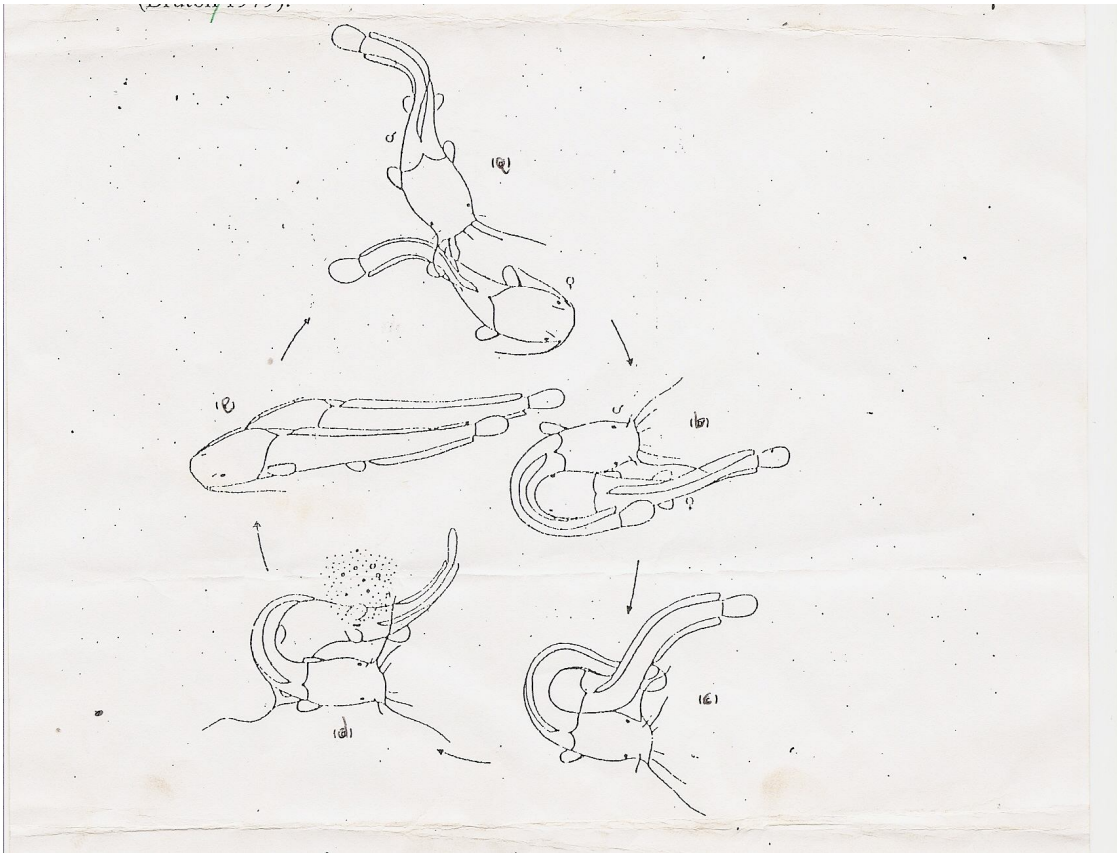

Fig. 1: Courtship Behaviour of Clarias Lazera
(a) Following (b) Amplexus (c) Sperm release
(d) Egg release (e) Resting

Effects of Temperature on the Growth of *Clarias Lazera*

Fish does not grow all the time. In the tropical region continuous growth may seem possible; but periodic events such as changes in light; nutrient; temperature, salinity and biological processes such as spawning or feeding can cause somatic growth checks.

Catfish such as *Clarias Lazera* are warm water fishes with a temperature range 16^0C-30^0C. The survival, growth and reproduction of a fish depend on the income of energy and nutrients generated by it feeding activities.

The temperature is linked with dissolved oxygen, the higher temperature, the lower the dissolved oxygen content. Sikoki (pers comm) and Oladosu (pers comm) says that the favourable temperature of clarias is between 25^0C to 30^0C, while maximum reproduction temperature is 23^0C (Onuoha, 1992).

Growth also varies with body temperature. This means that with higher temperature a fish will grow faster, however, after a certain temperature, which varies according to species, further rises result in a fall in the growth rate. This means that a country with seasonally changing water

temperature, when the water starts to warn allow the winter the growth rates start to accelerates and continue until a certain temperature is reached, after which further rises slow down the growth rate (Bruton, 1997).

Gonadal Development in Clarias Lazera

The gonads maturity of the female *Clarias lazera* indicated by the roundness of the abdomen can also be checked by counting the number of post viteologenic eggs of an egg sample from ovary. The diameter of the eggs can be measured with a binocular, using a micrometer or mini paper. This sample is representative for the eggs development of the ovary since there is no significant different between the maturity of different parts of the gonad (Bone et al 1995).

Sperma Togenesis in Clarias Lazera

In spermatogenesis, (Fig 2) primordiatgerm cells divide repeatedly by mitosis to form diploid spermatogonia. There then follows a brief period of growth, during which each spermatogorium increases in size to form a primary spermatocyte. This then divides meitotically, the first meotic division giving two secondary spermatocytes, and the second a group of four spermatids (Bone et al 1995).

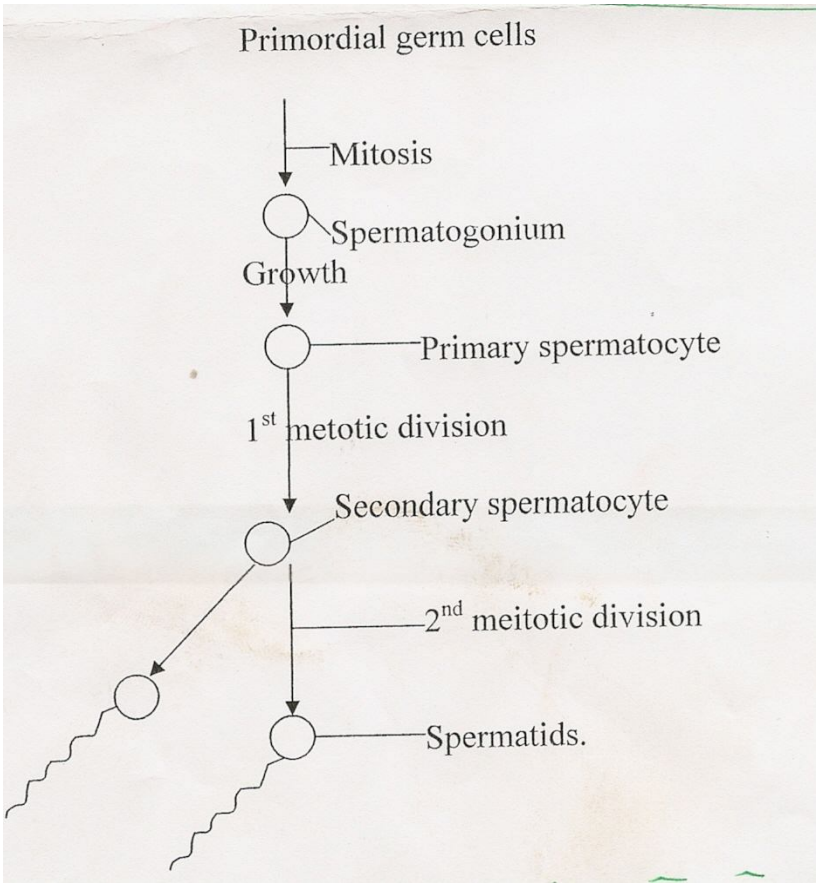

Fig 2. Diagramatic Representation of the Process of Spermatognesis in Males Clarias Lazera

Oogenesis in *Clarias Lazera*

Oogenesis (Fig 3) is basically similar to spermatogenesis, but different in detail. A primordial germ cells proliferate mitotically to form Oogonia; but only one of these grows into a primary Oocyte the other degenerate. The amount of growth that takes place at this stage is much larger than the spermatozoa. The primary oocyte now undergoes meiosis but the divisions are equal resulting in the products differing greatly in size. The first meiotic division produces a secondary oocyte and a very much smaller polar body which smaller polar body which may be seen adhering to it (Bone et al 1995).

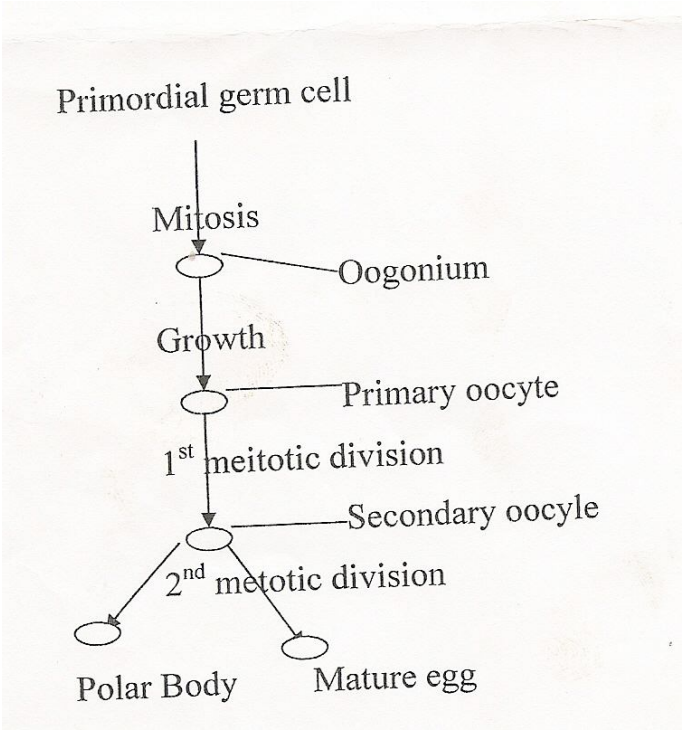

FIG 3: Diagramatic Representation of the Process of Oogenesis in Female *Clarias Lazera*

Feeding Levels and their Effect on the Development of the Gonads

Obviously, fish can only grow (or even live at all) if it has a supply of food of the right quantity and quantity. The ingested food is broken down by the digestive enzymes of the fish, which has been shown to be varied enough to digest most food materials and in deed are closely comparable to those of cattle; In the case of *clarias;*

The products of digestion are absorbed, through the gut, into the tissue or the fish, and Hickhing (1962), reports that the two most important uses to which the absorbed food stuff are put, are maintenance and growth. In any case, the storage of a surplus, as fat, will only occur when maintenance and growth are satisfied.

Feeding Levels and their Effects on the Development of Female Gonad (Ovary) and Male Gonad (Testis) of *Clarias Lazera*

Sexual maturation is a process, usually directed by external factors (temperature, photoperiod, water depth, salinity, PH etc). Proper health of the fish can be assumed by adequate feeding or the brood stock for a sufficient time before spawning occurs (Richter et al 1982).

Carotenoides muscles are present in maturing ovaries. They are mobilized from the concentrated in the ovaries. Deficiencies of vitamin A or carotenoides in the female *clarias lazara* will decrease the chances of survival or the eggs and larvae (Shehadeh, 1975).

During maturation of the gonads (ovary and testis), there is on accumulation of non saturated fatty acids in the ovaries and increase of level of protein and dry matter (Shehadh, 1975) also found that fat accumulation reached a peak in *clarias lazera* just before their gonads reached full development fat reserves probably provide readily utilizable energy for the rapid production or gonadal materials.

Temperature Variations and the Effects on the Development of the Gonads of Clarias Lazera

Maturation and the development of the gonads needs a certain "amount or temperature", which can be quantified as hour grades or day-grades, i.e the number of hours or days at a given temperature needed accomplish gonadal maturation. The optimum temperature of 25^0C with a minimum fluctuation is a pre-requisite for quantitatively and quantitatively adequate gonadal development year round (Richter et al 1982).

Temperature Variation and their Effect on the Development of the Male Gonad (Testis) and Female Gonad (Ovary of Clarias Lazera)

The has been interest on the direct relationship temperature and development of individual within a species e.g *clarias Sp*. Temperature tends to affect the efficiency with which food stored in the eggs of clarias sp is converted into body weight of the embryo.

The viability of the sperm cells is also affected by temperature; they live longer in lower temperature than in higher ones. The optimum temperature for rearing of catfish larvae and young fish is above 300C. Too low (&22^0C) and too high (>36^0C) temperature (Hogendoorn et al 1980).

Catfishes also prefer muddy water than brightness, water condition must also be optimal as regards to dissolved oxygen, PH etc. Stocking densities should be low, then avoid stress and disturbances, that may affects the fish and maturation of the gonads (Woynarovital et al 1981).

Recommendation

Proper water health management and good hygiene conditions either in the wild of fish farm are the most important factors for successful development, growth and survival of all fish species in general an in catfish in particular.

Over feeding of the fish species especially *clarias* must he avoided in the pond since this is believe to be main cause of disease out breaks at any stages of development.

Induced breeding is also very necessary for mass production of the fish seeds. Species of commercial importance which do not breed readily in locally available natural conditions can be obtained thing induced breeding.

Due to the problems caused by the use highly turbid water in the culture of *Clarias*, some scientist advocates the application of organic matter to reduce turbidity of water, but best result is obtained from the use of filler CAL(SO).14 (1+20).

Conclusion

Clarias lazera and other species of *clarias* are commercially important because, they are highly priced, they are muscular, fresh and available in most waters (fresh water in Africa particularly in Nigeria water. They do not have their skin covered by the usual scales but have either a naked skin or head covered with bony plates.

Besides, temperature that is quantified as hour-grades or day grades that is needed for gonadal development in *clarias lazera*. Other factors that can accomplish temperature includes photo period, water depth, salinity, pH etc).

The maturation of the gonads expressed as increase of gonadosomatic index is seasonal and is often associated with the rainy season. It has been observed in the tropical areas that eggs show maturation from April to December with peak maturity during July to September, (Micha, 1979).

Spawning in Clarias takes place mostly at night. The spawning runs of *Clarias* species are typically of short duration. Bruton (1979) refer to the selective advantage of the catfish spawning during dark night, as being less vulnerable by visual-oriented predator, catfish spawn readily in ponds, and in shallow water where the eggs are laid in a nest and guarded by the male.

References

Ayinla, O.A & Nwadkwe, G.F (1988). Preliminary studies on the early rearing of Clarias gareipinus in plastic pools NIOMR technical paper. N0. 30.

Bone, Q. Marshall, N.B, Blaxter J.H.S (1995). (Second edition) *Biology of Fishes*. Pp 152 -193.

Bruton, M.N (1979). The breeding Biology and early development of *Clarias Gariepinus* in lake sibaya, south Africa, with a review of breeding in species of the subgenus Clarias (Claris) trans. 2001. soc. Lond. 35.

Hickhing, C.F (1962) *Fish culture*. London: Faber and Faber, Pp295.

Hogendoorn, H. & Vismans M.M (1980), controlled propagation of the Africa catfish, *Clarias Lazera* (C&V) II Artificial reproduction. agriculture 21(1) Pp 39-53.

John, E.B, Ryther, J.H & Mclarney, W.O.E (1972), Agriculture, the farming & husbandry of fresh water & manure organisms. U.S.A.

Lagler, K.F, John, E.B, Robert, R.M & Dora, R.M, (1977), Ichtylology. 2nd Ed. Pp. 133-308.

Madu, C.T (1987), Production of *Clarias Anguillaris*. Fry and finqarlings under indoor and outdoor hatching conditions KLRI Annual Report.

Micha, J.C (1979). Etudes des populations piscicoles De'libangul Et Tantatives De-selection Et'D' adaptation De Ove'tques Especes A e tang De pisculture Notes Docum.peche piscicentre Techn. Forest Trop. 1979. Pp 1-10.

Onuoha G.C (1992) Water quality monitoring control of the principal physico-chemical of a short term training programme on fish farm management. African Regional Aquaculture centre (ARAC), Aluu Port-Harcourt.

Richter, J.J, Eding E.H, Leuven, S.E.W & Van des wisjst, J.M.C.M (1982); Ellects of feeding levels and temperature on the development of the gorods in the African catfish, *Clarias Lazera* (C&V) In: C.J.J Richter and H.J the Goods (ods), proc. Int Synp, *Reproductive Physiology of Fish*, wageningan, the Netherlands 2-6 August, 1982. pudoc Wangeninen.

Shahadah, Z.H (1975) Induced breeding techniques - A review of progress and problem FAD-EIFACT Tech. Pp 25.

Wognarovitch, E. & Horath, L. (1981). La Reproduction Artificielledes Poissons en eau Chaude: Manvel De Vulgarisation, FAO DOC. Tech Pe Ches (20).