Innovations

Comparative Study on the Hatchability Performance Growth and Survival of African Catfish (Clarias Gariepinus) Larvae Produced, using Ovaprim and Catfish Pituitary Hormone

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***Abstract**: This research work on the Comparative Study on the Hatchability Performance and Survival of African Catfish (ClariasGariepinus) Larvae Produced, Using Ovaprim and Catfish Pituitary Hormone was carried out in the Department of Fisheries and Aquaculture Hatchery, University of Calabar, Nigeria. To determine between bio (natural) and synthetic hormones hypophisation, the one with the best yielding outcome that will catfish larvae production. Artificial breeding technique was adopted for this experiment and using Natural bio hormone (pituitary). The two experiments were successfully carried out with mean weekly length, weight growth and mortality rate recorded as follows for tank 'O' recorded an average length variation of 7.40mm, 10.60mm, 14.00mm and 18.00mm, while tank 'P' recorded 8.33mm, 10.97mm, 12.83mm and 16.70mm for the first, second, third and fourth week respectively. It was also observed from the same table that "O" recorded a mean weekly growth of 2.40, 3.20, 3.40 and 4.00 while tank 'P' records 3.33, 2.60, 1.86 and 4.40 for the first, second, third and fourth week respectively. Results were analysed using regression analysis and it shows that there was slight difference between the hypophisation "O" (injecting female with ovaprim) and "P"(injecting female with pituitary). Where "O" is best adopted in terms of growth rate, mortality rate and survival rate. In conclusion, there's is a slight difference between "O" and "P". And "O" is best suitable for production.*

***Keywords**: Hatchability performance, survival of Africa*n catfish (ClariasGariepinus), *larvae produced, pituitary hormone and ovaprim.*

Introduction

The study on techniques in catfish breeding and larval rearing management is important because it is capable of informing fish rearers or farmers on the best approach for optimal yield in fish production.

The African catfish "Clariasgariepinus" is a very resilient prolific freshwater fish. Others (catfish) are Clariasbatrachus, Clariasictalurus, Clariassilurus etc. Many farmers in Africa have successfully raised large tonnes of adult catfish for market purpose from fingerlings, but few of them, know how to produce the fry.

It is important to know how to produce catfish fingerlings. Producing fingerlings with diverse techniques reduces cost of production and provides assurance of getting better output. Fingerlings can be raised up to juvenile stage before stocking is done. One can also serve as a good source of quality and healthy catfish seeds supplier for other catfish farmers from his or her own hatching.

"The quality of output you will get depends on the quality of breeder catfish, breeding materials and of course the method used". A major pre-requisite for successful fish farming enterprise is a reliable and consistent source of fish seed of over-population in tilapia ponds and as a bait for the Nile perch fishery (Mosha, 2018).

The species is not readily breed in captivity all year round, therefore most farmers depend on fingerlings collected from the wild.

However, due to the problems associated with wild fish seed such as seasonality in availability, uncertainty of species of fish seed collected, disease infestation and limited quality of harvestable fish seed, wild sources are unreliable and hence the need for seed production using hormones. The hormones promote reproduction in fish which is controlled by several factors such as sex steroids in the regulation of reproductive processes. These reproductive processes are controlled through the brain-pituitary gonadal axis. The brain is stimulated by environmental cues (water rise, temperature, feeding, rainfall and photoperiod) to release gonadotropin releasing hormones. Then the ovulation and spermiation are affected as a result of the sex steroid that have been produced (Zarski et al., 2015).

Administration of these hormones to induce ovulation and spawning in fish is achieved through artificial propagation with either natural or synthetic hormones.

Materials and method

Description of the study area

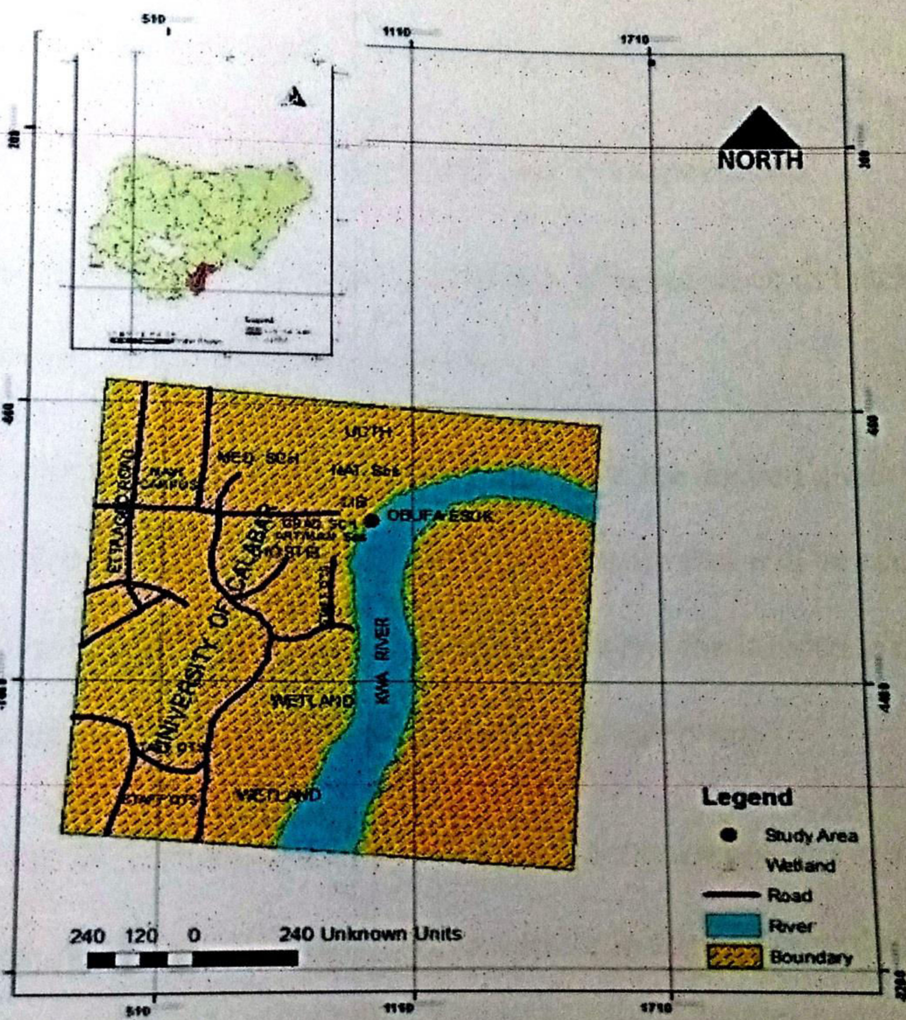

Fig 1. Map of university of calabar fish farm

(Source: https://www.unical.edu.ng/handbook)

The site of experiment for this work was the Faculty of Oceanography Hatchery, University of Calabar, Calabar located on the Western Bank of the staff quarters and University of Cross River State. This area covered a greater portion of western bank of the Great Kwa River. It lies between latitude 04.560, 020'N and longitude 08.200, 456'E in Cross River State, Nigeria.

Broad Stock Procurement and Transportation

According to Ajah (2019), the selection of broad stock in hatchery operation is essential for the following reasons:

To obtain the right brood fish that will yield the desired quality and quantity of fish fingerlings. To obtain the right brood stock that will be economically viable and early maturity. Proper selection eliminates the incidence of diseased parent and results in selection of disease resistant offspring.

A total of 6 females and 9 males of Clariasgariepinus making a total of 15 brood stock were procured from a reputable farm (Evason's Fish Farm) located at No. 19 Mayne Avenue Street Calabar, Cross River State. Fish transport was done carefully in order to reduce stress and successfully transport them to their experimental site.

Acclimatization

Temperature of the transporting water and the water where the fish were to be stocked was equalized before stocking the fish. After transportation and acclimatization, the brood stock was intensively fed and quarantined for two (2) weeks for further monitoring prior to breeding.

Hormone and Procurement

Hormone is an ovulating/spermiating agent used to promote and facilitate reproduction in many fish species.

The following hormones were used to induce the broodstock

* Synthetic hormone (Ovaprim)
* Biological hormone also known as pituitary hormone

In conclusion, the brood stock purchased from the market was quarantined first and prophylactic treatment administered. In the process of quarantining the broodstock, if disease conditions are noticed, chemotherapeutic doses are given until cure is achieved.

Water Quality Management

A standard hatchery must have a regular good water source because standard flow of water in the hatchery promoted healthy state of broodstock and fiy and also increased the bioweight of the fish.

So, regular good quality of water was provided and the following took place;
Introduction of fresh water into fish tank daily.
Floating system of water was practiced
The water was not to be acidic or too alkaline (pH 6.5-9.0)
It was not turbid
It did not have an offensive odour and colour
To ensure these standard is met, the following key parameters were measure:
water temperature, pH, Dissolved Oxygen.

Breeding Techniques that were employed

A total of eleven (15) broad stock (9 males and 6females) of Clariasgariepinus (catfish) received the following treatments:
(i) Injecting only the female with ovaprim hormone;
In this technique, only the female brooder was injected while the male was sacrificed.
(ii) Injecting only the female with pituitary hormone
In this technique, the female brooder was injected while the male sacrificed.

Hypophysation:

This is a method used in the breeding of fishes artificially. The technique of hypophysation employs the injection of hormones (Biological and synthetic) extracts that induces the breeding in fish as in 3.6 above. The method is useful to promote reproduction in fish where spawning conditions are not favourable (like in this experiment with catfish). The brood stocks were first weighed because their weight determined the dosage to be administered.
The following are steps that were necessary for a successful breeding of the brood stock.

- Harvesting the pituitary from the roof of the buccal cavity of the Clariasgariepinus
- Preparation of the brooders for injecting/weighing
- Isolation of the injected brooders in plastic containers to wait for about 10 to 12 hours before stripping was done
- Preparation for the stripping of brooder

They were then brought out after 10 to 12 hours in a gentle manner, their heads were covered with a clean, moist towel and then wiping of the body of the fish with a dry soft towel was done

- Stripping was carried out
- Stripped eggs was weighed
- The male brooder was brought out, killed and was cut open on the belly

- Removal of the milk sac was done
- Cutting of the testicles into bits to release sperm was done
- Saline solution was added to the milt

The above mixture was added to the stripped egg in the bowl
It was mixed thoroughly and addition of water was done to enhance fertilization
The fertilized eggs were then spread in containers filled with substrates for incubation
Hatching commences within 20 to 36 hours
Finally, the newly hatched eggs with yolk sacs still attached are separated into larvae rearing tanks to grow to fry and then become fingerlings.

Feeding Regime:
Feeding rates and frequencies depend on fish size. Two to three days after hatching and restoration of the yolk sac, feeding of the small larval fish and fry commenced, using a high protein rich diet (Artemia). Feeding was frequent and in excess because at this stage they have a high energy demand and must eat nearly continuously and be fed almost hourly.

Duration of Study
The experiment was carried out within a period of 4 weeks.
Determination of reproductive success parameters
Fertility rate: Fertility rate was determined with this formular

<u>% fertility number of fertilized egg</u>
total number of eggs counted. X 100 (Lambert, 2003)

2. Hatchability rate: Hatchability rate was determined with this formular

% (Hatchability <u>rate) = number of eggs hatched</u>
number of eggs incubated X 100 (Lambert, 2003)
3. Survival rate: survival rate was determined with this fermular
% survival rate = <u>final no. of fry (after the yolk disappeared</u>)
Initial no. of frey (with the yolk after hatching) X 100
(Lambert, 2003)

Result

For Ovaprim

1. Initial weight	2.30kg	
Final weight	2.15kg	
Weight of egg		0.15kg
Ovaprim weight	Ig	
2. Initial weight	2.00kg	
Final weight	1.85kg	
Weight of egg		0.15kg
Ovaprim measurement	1.00g	
3. Initial weight	1.6kg	
Final weight	1.35kg	
Weight of egg		0.25kg
Ovaprim measurement	0.8g	
4. Average fecundity		0.15
	0.15	
	+0.25	
	0.55	
	3	
	=0.18g	

Hatchability: refers to the number of dead eggs in relative to the number of green eggs. At the end the eggs was stripped and fertilized. Substrate was use to hold the eggs in different tanks in triplicate P1,P2, P3 and 01, 02, 03 respectively.

By visual assessment in an estimated collection of 100 eggs from each tanks P1, P2, P3 and 01, 02, 03, respectively. I observed that the number of white eggs where found more in tanks P1, P2, P3 compared to the number of green eggs. The number of white eggs in present in P1, P2, P3 is estimated to be about 80% 85%. While in O1, 02, 03 which showed a high fecundity as well as high hatch ability hence at the end of 12 hours when all fertilization have taken place and the viable eggs have been differentiated. By the estimated collection of 100 eggs a higher percentage of green eggs was visible about 60% in 01, 02, 03.

Plate 1: Stripping of eggs from gravid female

Table 1: Reproductive performance of catfish (Clariasgariepinus)

Parameters	P	O
Fertility %	40%	55.5%
Hatchability %	20%	60%
Survival %	40%	70%

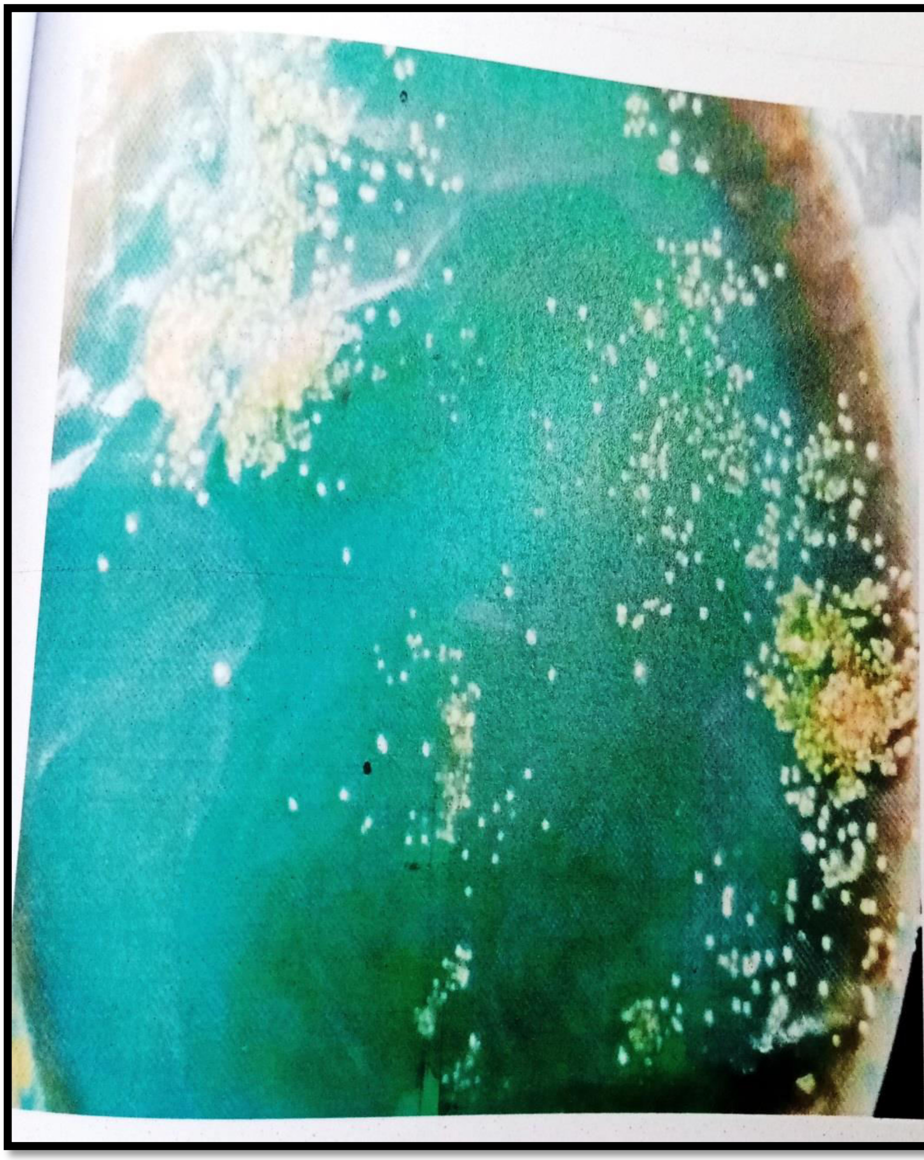

Plate 2: Utilized eggs after hatching

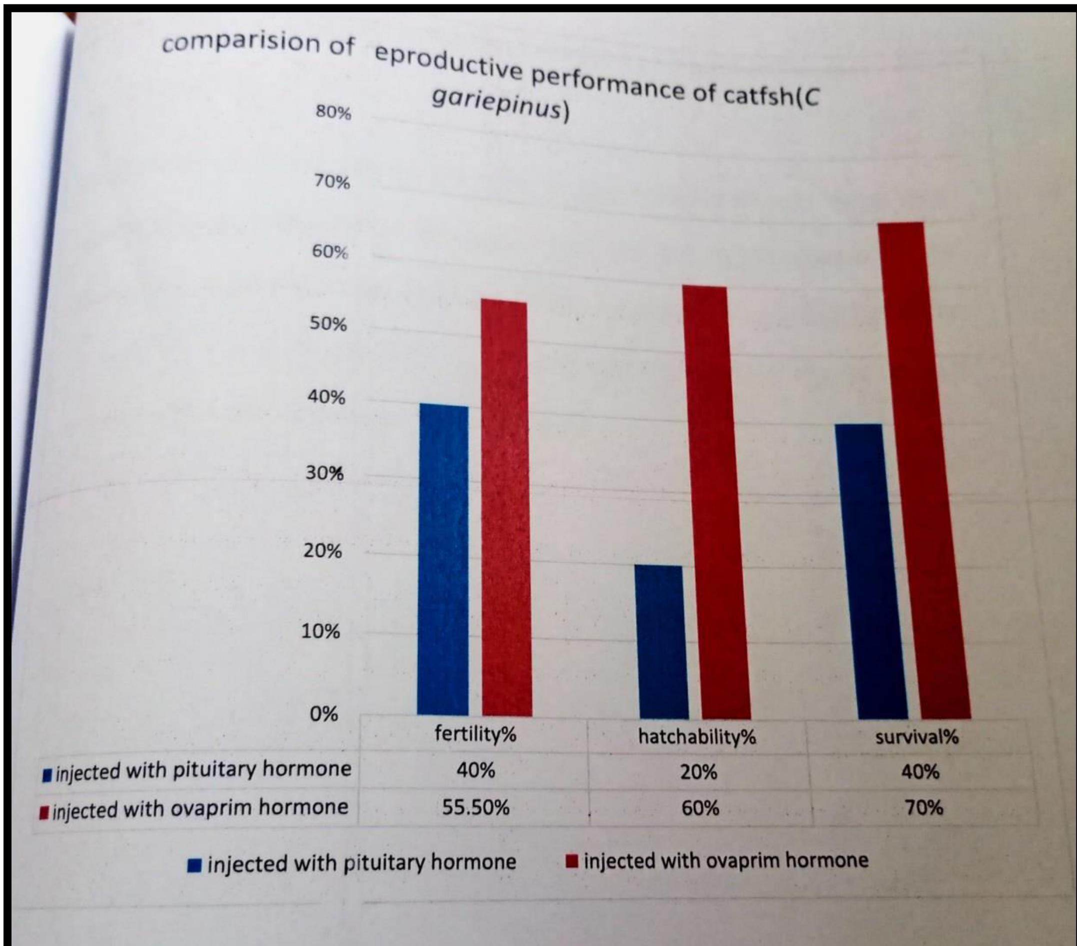

Fig 1: Comparison of reproductive performance of catfish (*Clarias gariepinus)*

Results of the water quality parameters were pH - 6.5, dissolved oxygen and temperature - 27.50C. -4.5,

Results showed that % fertility (Number of eggs fertilized divided by the total number of eggs counted) for 'P' and 'O' was 40% and 55.5% respectively. % hatchability (Number of eggs hatched divided by number of eggs incubated) for 'P' and 'O' was 20% and 60% respectively while % survivability for 'P' and 'O' was 40% and 70%. Final number of frys.

Plate 3: Survived frys in each tank

Discussion, Recommendations and Conclusions

Discussion

The results from the study on C gariepinus induced with two different hormones (pituitary and Ovaprim) showed that the two hormonal treatments induced ovulation in the experimental fish. Fecundity rates of those induced with ovaprim hormone was better than those induced with pituitary hormone although there was no significance difference ($p>0.05$) probability greater than. This result was in line with Olaniyi and Akinbola (2013) who reported that both African catfish pituitary extract and Ovaprim aided spawning in African catfish although they significantly differed ($P>0.05$), Fingerlings produced from female fish treated with catfish pituitary performed excellently well in terms of hatchability, survival and enhanced better growth Olaniyi and Akinbola (2013). Nwokoye et al. (2007) reported percentage fertilization of 98.31% and 96.01% for Heterobranchusbidorsalis induced with the synthetic hormone (Ovaprim), and homoplastic hormone (pituitary of Heterobranchusbidorsalis) respectively. In terms of hatchability, the results showed that fish induced with Ovaprim had a higher hatchability than those induced with pituitary although they do differ significantly ($p>0.05$) probability greater than 0.05 This was in line with

Nwokoye et al. (2007) who reported that Ovaprim performed better than pituitary in the hatchability of Clariasgariepinus. Ndimele and Owodeinde (2012) also reported that C. gariepinus induced with synthetic hormone (Ovaprim) produced quality offspring than those induced with pituitary hormone. Nwokoye et al. (2007) reported that gravid female of H. bidorsals injected with Ovaprim recorded the best result in all the reproductive parameters investigated: number of spawned and fertilized eggs, hatchlings, low number of deformed larvae, high survival rate and comparatively lower cost of administration, thus, much beneficial over homoplastic hormones for induced breeding of the clariid catfish. The difference in percentage hatchability obtained in this study might be due to difference in experimental design and species. In terms of survival rates, fish induced with pituitary had similar ($p>0.05$) survival with those of Ovaprim. This result was in contrast with Adebayo and Popoola (2008) who reported higher survival rates in Ovaprim treated fish. Adebayo and Popoola (2008) obtained survival rate of >60% after 30 days of fish rearing which was also inline with this study.

In terms of growth, fish induced with Ovaprim gained more weight than those of pituitary. This was in line with Ndimele and Owodeinde (2012) who reported higher growth rate in fish induced with Ovaprim than those induced with pituitary hormone. Faster growth rate was also observed in fish produced from Ovaprim induced group than those of pituitary extract after feeding commenced (Olaniyi and Akinbola, 2013). De Graaf et al. (1995) reported similar results for C. gariepinus raised withartificial propagation techniques where fish fingerlings from Ovaprim induced performed better than those of pituitary Findings also revealed that the percentage weight gain of the fish induced with Ovaprim hormone was more than those induced with pituitary hormone and this also differed significantly Odedeyi (2007). Similarly, specific growth rate was slightlyhigher ($p>0.05$) in fish induced with Ovaprim hormone than those induced with pituitary. These findings were in line with Ndimele and Owodeinde (2012) who reported higher growth performance among the fish induced with Ovaprim hormone compared to those induced with pituitary hormone. Similar findings were observed by Nwokoye et al. (2007). The results of water parameters were within the standard range and comparable with Boyd (1979) standard water quality for tropical aquaculture.

Conclusion

With the result and observations as expressed and explained using the bar chart and the regression line equation, it is clear that the progressive increase in weight as when injected with ovaprim was geometrical and the growth in terms of length was not uniform and but was still proportional to the weight increase. Also, the regression line equation enabled us to predict feature sizes as the lengths and weight of fish increased weekly.

Recommendation

From my experiment, aquaculture practitioners should adopt any of these two technique. Injecting the female with pituitary hormone or injecting the female with ovaprim hormone but in this experiment the technique injecting the female with ovaprim hormone appears to be the best in terms of growth rate, survival and low mortality, hence it is best suitable.

Suggestions for further studies

This experiment can also be carried out using other forms of synthetic hormones like ovulin, ovatide, ovafishetc, that are available in the market and their success compared to their economic value.

References

1. *Ajah, P.O. (2019). Fish Breeding and Hatchery Management.2nd Edition. Nature Printer, Calabar, Nigeria*
2. *Ali, M. Z., Hossain, M. A. &Mazid, M. A. (2005). Effect of mixed feedingschedules with varying dietary protein levels on the growth of sutchicatfish,*

Pangasiushypophchalnus (Sauvage) with silver cap, Hypophthalmichthysmolitrix (Valenciemes) in ponds. AquacultureResearch. 36, 627-634,

3. *Balon E. K. (1984b). Reflections on some decisive events in the early life of fishes. Trans. Arner. Fish. Soc. 113, 178-185.*
4. *Bolliet, V., Aranda, A. &Boujaid, T. (2001).Demand-feeding rhythm in rainbow trout and consumption, feeding pattern and growth of juvenile yellowtail flounder (Limandaferringinea), Aquaculture, 213, 279-292.*
5. *Bruton, M.N. (1996). Alternative life-history strategies of catfishes. In: Legendre, M. and J-P. Proteau (eds). The Biology and Culture of catfishes.Aqrrat. Living Res., Paris. 9 Hors. Series, pp. 35-41.*
6. *Bruton, M.N., (1989). The ecological significance of alternative life-history styles. In: M.N. Bruton (editor), Alternative Life-History Styles of Animals. Perspectives in Vertebrate Science. Kluwer Academic Publishers, Dordrecht, pp. 503-533.*
7. *Bruton. M. N.. (1979). The breeding biology and early development of Clariasgariepinus (Pisces:Clariidae) in Lake Sibaya. South Africa with a reviewof breeding in species of the subgenus Clarias. Trans. Zoo. Soc. Lond. 35.1-45.*
8. *Dwyer. K. S., Brown, J. A., Parrish, C. J. &Lall, S. P. (2002). Feeding frequency effects food consumption, feeding pattern and growth of juvenile yellowtail flounder (Limandaferruginea). Aquaculture, 213, 279-292.*
9. *Eding. E.H., Janssen. J.A.L... KleineStaarman. GH.J. & Richter C.J.J. (1982). Effects of human chorionic gonadotropin (HCG) on maturation and ovulation of oocytes in the ovary of the African catfish.Clariaslazera (C & V). In Richter C.J.J..GoosH.J.Th. (editors).Proceedings of International Symposium on Reproduction Physiology of Fish.Pudoc.Wageningen.The Netherlands. 195pp.*
10. *Egwui.P.C. (1986).Yields of the African catfish.Clariasgariepinus (Burchell) from a low input homestead concrete pond.Aquaculture.55, 87-9 1.*
11. *Spinach, Ros.A. ,Amutio , V. G. , Master Maple J.P. , Orti , G. &Nani . A. (1984).Induced breeding of the South American catfish.Rhamdia frog (C & V).Aquaculture. 37, 141-1*
12. *Ezechi, C. U. &Nwuba, L..A. (2007).Effect of different dietary items on the growth of African catfish hybrid Heterobranchusbidorsalis x Clariasgariepinus. Animal Research International, 4(2), 662-665.*
13. *Fagbenro, O. A., Nwanna, L. C., Adeparusi, E. O., Adebayo, O. T. &Fapohunda, O. O. (2005). An overview of animal feed industry and dietary substitution of feedstuff for farmed fish in Nigeria. In: Crops: Growth, quality and biotechnology (Current status and future prospects) (RamdaneAris editor (WFL) Publisher, Helsinki, Finland. Pp. 91-107.*
14. *Goetz, F. W. (1983). Hormonal control of oocyte final maturation and ovulation in fishes. In: Hoar, W. S. Randall. D.J. and Donaldson, E.M. (editors). Fish Physiology, 9 B, Reprodrection. Academic Press. pp. 1 17-170*

15. *Goos, H.J.Th., de Leeuw.R., Burzawa-GCrard.E., Terlou M. & Richter C. J. J. (1986).Purification of gonadotropic hormone from the pituitary of the African catfish.Clariasgariepinus (Burchell) and the development of homologous radiolmmuno assay. Gen. Comp. Endocrinol., 63. 162-170.*
16. *Goos, H.J.Th.. Joy K. P., de Leeuw. R.. van Oordt. P.G.W.S. van Delft. A.M.L &GielenJ.Th. (1987).The effect of luteinizing hormone-releasing hormone analogue (LHRHa) in combination with different drugs with anti-dopamine and anti-serotonin properties on gonadotropin release and ovulation in the Africa catfish Clariasgariepinus.Aquaculture, 63, 143- 156.*
17. *Goos.H.J.Th. & Richter, C. J. J. (1996). Internal and external factors controlling reproduction in the African catfish.Clariasgariepinus. In: Legendre M and Proteau JP (editors). The biology and culture of catfishes.Aquatic Living Resources. Paris. Vol 9 Hors Series, pp. 45-58.*
18. *Haylor, G. S. (1992). Some aspects of the biology and culture of the African catfish.Clariasgariepinus with particular reference to developing African countries. In: Roberts R.J. and Muir J.F. (editors). Recent Advances in Aquaculture Vol. IV.Blackwell Scientific Publications. Oxford. pp. 21-48.*
19. *Haylor. G. S. &Mollah, M. F. A. (1995). Controlled hatchery production of African catfish Clariasgariepinus: the influence of temperature on early development.Aquatic Living Resour. 8, 431-438.*
20. *Haylor. G. S. (1993), Controlled hatchery production of African catfish, Clariasgariepinus (Burchell): an overview. Aquac.Fish.Manag.24.245-252.*
21. *Hecht , T. &Lublinkhoff . W. (1985).Clariasgariepinus x Heterobranchuslongifilis (Clariidae: Pisces): a new hybrid for aquaculture. South Africa. J. S., 8 1,620-62 I.*