Journal of Cell and Animal Biology Vol. 1 (5), pp. 078-081, December, 2007
Available online at http://www.academicjournals.org/JCAB
ISSN 1996-0867 © 2007 Academic Journals

Full Length Research Paper

Reproductive fitness of stressed female broodstock of *Clarias gariepinus* (Burchell, 1809)

Aiyelari, T. A., Adebayo, I. A. and Osiyemi, A. S.

Department of Forestry, Wildlife and Fisheries Management, Faculty of Agricultural Sciences, University of Ado-Ekiti, Nigeria P. M. B 5363 Ado-Ekiti, Ekiti State, Nigeria.

Accepted 3 December, 2007

Reproductive fitness of female brood stock of *Clarias gariepinus* was determined using three different stress conditions; confinement and starvation for 12 hours before hormone injection; keeping fish out of water after hormone treatment (Latency period) and transportation. Broodstock of eight months old with an average weight ranging between 450 and 750 g were used for the experiment. There was no significant different (p>0.05) in hatchability of eggs among the stressed conditions. Survivability of fry within twenty one days of hatching was also not significantly different (p>0.05) among the conditions. Whatever mortality observed in injected females was attributed to stress while fry mortality was due to cannibalism as a result of congestion. The result showed that female broodstock of *C. gariepinus* can accommodate or withstand some level of stress beyond which damaging effects may be seen in the reproductive performance.

Key words: Reproductive fitness. Stress conditions. *Clarias gariepinus*. broodstock.

INTRODUCTION

In Nigeria, the major family of catfish that is of commercial interest is the family claridae. *Clarias gariepinus* is mostly farmed due to its fast growth rate and other culturable characteristics. It hardly reproduces in captivity (Howerton, 2001). However with proper artificial propagation techniques which permit spawning, incubation, hatching of eggs and rearing under environmental weather independent conditions, it can be successfully propagated. Induced breeding has made it possible for out of season propagation, thus making the seeds to be available all year round (Ayinla, 1988).

Stress induced by common practices in fish seeds multiplication such as handling, sampling, transportation, confinement and poor feeding can increase the incident of poor performance and mortality, consequently affecting the growth of aquaculture. Bamimore (1994) describe stress as an energy drain. Energy that might be used for growth and reproduction is thus channelled into catabolic uses. Sensitivity of fish to stress differs markedly among species (Huisman and Ritcher, 1987). There is strong evidence that the degree of stress in female affect the quality of eggs in induced spawning (Pickering et al., 1995). Fecundity which is the total number of eggs produced by fish expressed in terms of eggs/spawns is known to be affected by stress and nutritional deficiency (Hogendoorn and Vismans, 1980). The stress of capture and handling has profound effects on the blood chemistry and stimulates gonadotropin, androgens and the stress hormone cortisol (Barton et al., 1991).

The physiological effects of stress are highly pronounced under induced spawning procedure, that using the right hormone at the right time can still result into failure (Ayinla, 1988). Broodstock are sensitive to handling stress and may consequently die due to the condition under which they are stressed. There is need therefore to establish the effects of such improper treatment to avert the problems of breeding failure. This study is therefore designed to investigate the effects of some stress conditions on the reproductive fitness of *C. gariepinus* vis-à-vis the hatchability and fry performances.

MATERIALS AND METHODS

Twenty pairs of sexually matured and healthy fishes of average weight between 450 – 750 g were selected for the experiment. Fishes were purchased from a reputed farm (Success fish farm, Nigeria Limited. Alagbaka, Akure, Ondo State, Nigeria) two weeks before the experiment and fed with 40% crude protein and 12kcal of energy commercial feed at 3% body weight in an earthen pond.

*Corresponding author. E-mail: antofunmi@yahoo.com

Table 1. Mean morphometric data and mortality records of the female broodstock

Stressed condition	Mean standard length (c)	Mean weight before stripping (g)	Mean weight after stripping (g)	No of fish injected	No of fish stripped	Broodstock mortality after stripping
Confinement/starvation (T_1) 24 hours	25.38 ± 3.96	630.00 ± 0.02	560.00 ± 0.10	06	05	1
Keeping out of water (T_2) after hormone injection	8.88 ± 2.0	535.33 ± 0.01	440.32 ± 0.02	06	04	2
Transportation (T_3) four hours	26.50 ± 1.41	525.00 ± 0.01	475.00 ± 0.15	06	04	1
Control (T_4)	27.10 ± 0.01	545.00 ± 0.02	455.00 ± 0.03	06	06	Nil

Table 2. Rates of hatchability six days after hatching among treatments.

	Average weight of eggs stripped (g) and incubated	Hatchability rate %		
		Live	Deformed	Dead
Confinement/starvation (T_1)	95.20	65.70	12.85	21.45
Keeping out of water (T_2)	86.40	62.40	14.50	23.10
Transportation (T_3)	72. 50	45.35	15.60	39.05
Control (T_4)	82.70	94.50	2.37	3.20

However, experimental fishes for transportation as a means of stress were subjected to some hours of transportation from Ibadan to Akure on the day of the experiment.

Experimental procedure

Twelve rectangular concrete tanks of 6 - 7ft each with flow through system were used for the experiment in the indoor hatchery complex. All hatchery materials such as towel, kakaban (tufts of nylon fibres), feather and the tank were thoroughly prepared. Fishes were sampled, weighed and subjected to various stress conditions. They were artificially induced through injection with artificial hormone (ovaprim) intramuscular at the rate of 0.5 ml/kg of fish.

At the expiration of the latency period of twelve hours, eggs were stripped, fertilized and incubated according to each stress conditions. Hatchability rates of the eggs was determined on the basis of the percentage o the unhatched as used by Aluko et al. (2001), an estimation which assumed hatching rate of flow through water system to be calculated on live/dead ratio of incubated eggs. Survival rate was determined based on Jensen (1996) method.

The normal healthy larvae were estimated on percentage basis of dead and deformed hatchlings. The physico-chemical parameters of the water used were determined. Temperature was recorded with a 0 – 50^{o}C mercury- in-glass thermometer. Dissolved oxygen was determined using Winkler's tetrimetry method (APHA 1990) and pH was determined by using pH meter. Gamete quality in female *C. gariepinus* was determined by fecundity/Ganado-somatic index ratio (GIS) (Fernandez Palacios et al., 1998).

The diameter of ripped eggs was determined by using a simple ruler calibrated in millimetre scales. Data collected were pooled, mean values determined and subjected to two ways analysis of variance (ANOVA).

RESULTS

The survival of the fish in the control experiment after stripping was high compared to the other experiment as shown in Table 1, while also the rate of hatchability was equally high in the control with lower percentage of deformed eggs and mortality of fry.

After twenty-one days of the hatching, survival of the fry compared favourably between treatment 1 (1,291.3) and the control (1,674) Table 3.

The mean morphometric data of female broodstock stripped *C. gariepinus* as well as the mortality records after injection and stripping are presented in Table 1.

The rates of hatchability of eggs six days after hatching in percentage among the treatment in relation to stress are represented in Table 2.

DISCUSSION

There was strong evidence that the degree of stress affects the quality of eggs produced as indicated in significant different among the treatment means. This was in agreement with the finding of Shreck (2000) that stress appears to reduce reproductive fitness in fish. It was observed in this study that contact with nets and hands stripped away the protective mucous layer of the skin and promote infection, consequently leading to mortality in female brood stocks six days after stripping (Table 1).

Weight loss which ranges from 50 – 100 g (Table 1) was due to stripped eggs and fish response to stimuli

Table 3. Survivability of fry twenty-one days after hatching among stressed conditions

No of replicate	Treatment 1	Treatment 2	Treatment 3	Treatment 4
R1	2,004	780	985	2,082
R2	840	440	380	1,100
R3	1,030	965	505	1,840
Total (∑)	3,874	2,185	1,870	5,022
Mean (x)	1,291.3	728.3	623.3	1,674

Table 4. The mean water quality parameters of the incubated eggs and fry.

Treatment	Temperature (^oC)	pH	Dissolved Oxygen (mg/l)	Nitrate (mg/l)	NH_4N(mg/l)
Confinement/starvation(T_1)	24.00	6.74	6.50	0.18	0.24
Keeping out of water (T_2)	25.30	7.01	6.45	0.22	0.23
Transportation (T_3)	24.50	6.94	6.34	0.21	0.26
Control (T_4)	26.60	6.75	6.24	0.23	0.28

with a predictable pattern of physiological changes. The energy needed for growth was channelled into metabolic uses. It was also observed that reduction in gamete quailty manifested directly in live/dead ratio of resulted fry. Healthy fry was highest in the control experiment (94.50%) with the highest death of fry (39.03%) recorded in treatment three. There was a gonadal regression as reported by Shreck (2000). Re-absorption of oocytes other than peritellogenic was observed in the stressed broodstocks.

The mean quantity of eggs spawned was greater in stressed fish compared to the control (Table 1). This was in line with the findings of Morehead et al. (2000), thus the milder the stress, the lower the fecundity and the severe the stress, the higher the fecundity but with poor quality of eggs.

There was no significant fluctuation in the physico-chemical parameters of the water. Despite the flow through arrangement, the longer the days in the tanks, the higher the ammonia build-up. Temperature was between 24 – 26^{o}C. This lowered the rate of hatchability and pH was within the optimal range of 6.5 - 8.5 for the period as shown in Table 4.

Conclusion

External factors such as confinement, starvation, transportation and dryness result into predictable pattern of physiological changes which among other things attributed to weight loss and poor gamete quality of stress broodstock of *C. gariepinus*. Therefore, it is recommended that stress should be minimal to guarantee optimal gamete quality production in fish. Fish culture objectives should include understanding the effect of each stressor in the developmental process of life as to reduce the cumulative effects of stress on reproductive stage of fish.

ACKNOWLEDGEMENTS

The authors are grateful to the Management of Success Fish Breeding, Nigeria Limited, Akure for providing the facilities and support during the research work.

REFERENCES

Aluko PO, Ali MH (2001). Production of eight types of fast growing intergeneric hybrids from four Clariid species. J. Aqua. Trop. 16(2): 139-147.

APHA (American Public Health Association) (1990). Standard methods for the analysis of water and waste water,15th edition.

Ayinla OA (1988). Nutrition and reproductive performance of *Clarias gariepinus* (Burchell 1822). PhD thesis, University of Ibadan, Nigeria. p. 433.

Bamimore MA (1994). Performance of Clarias gariepinus fingerlings raised under varying culture conditions. PhD thesis, University of Ibadan, Nigeria. p. 226.

Fernandez Palacios H, .Izquierdo M, Robaina L, Valencia A (1998). Combined effects of dietary a-tocopherol and n-3 HUFA on eggs quality of gilthead sea bream brood stock (*Sparus aurata*). Aquaculture. 161: 475- 476.

Hogendoorn H, Vismans MM (1980). Controlled propagation of the African catfish *Clarias lazera* (C&V). 11 Artificial reproductions. Aquaculture. 21(1): 39-53.

Howerton R (2001). Bets management practises for Hawaiian Aquaculture. Centre for Tropical and subtropical Aquaculture Publication. 148: 7-31.

Huisman EA, Ritcher CJ (1987). Reproduction, growth, health controls and aquaculture potential of the African mud catfish, Clarias gariepinus (Burchell, 1822). Aqua. 63. pp. 1-14.

Jensen AL (1996). Berverton and Holt life history invariants results from optimal trade-off of reproduction and survival. Can. J. Fish. Aquat. Sci. 53: 820-822.

Morehead DT, Ritar AJ, Pankhurst NW (2000). Effect of consecutive 9 or 12 months Photo-thermal cycles and handling on sex steroid levels, oocytes development and reproductive performance in female stripped trumpeter *Latris lineata* (Latrididae). Aqua. 189: 293 - 305.

Pickering AD, Pottinger TG, Balm PHM (1995). Sexual maturity modifies responsiveness of the pituitary – inter renal axis to stress in male rainbow trout. Gen. Comp. Endo. 98: 311-320.
Shreck CB (2000). Accumulation and long term effects of stress. In: Moberg G.P, March J.A. (Ed). The biology of Animal stress. Assessment and implication for welfare. (AB international, Wallingford).