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Evaluating water quality: a case study of two fish hatcheries in distress

***Anwa-Udondiah, E. P. and C. B. Okoro**

Nigerian Institute for Oceanography and Marine Research, P.M.B. 12729, Victoria Island, Lagos-Nigeria

Abstract

Some fish hatcheries situated at the Lekki stretch of Lagos State have recently experienced repeated production failures. Successful management of fish hatcheries to meet production goals assumes that the quality of the water used to fill the incubation and nursery tanks is consistently high. Analysis of water from two privately owned hatcheries located at Lakowe indicated water quality that is outside the acceptable range. Sources of the water quality problems varied between the hatcheries, but include poor exchange, and daily additions of nutrient-rich feed which exacerbates existing water quality problems if no exchange is carried out routinely. Complaints of total fish kills at days 3 to 5 of age had been presented by the hatchery owners. Extreme water parameter values were observed after an assessment of the water collected from the two hatcheries. Farm I showed low pH values that ranged from 4.5 – 6.5 while for Farm II it was 6.5 – 7.2. Lethal levels of phosphate and ammonia were obtained for Farm II which ranged from 0.5 – 10 mg/L and 1.5 – 8 mg/L respectively, however the phosphate and ammonia levels for Farm I were 0 mg/L and 0 – 1 mg/L respectively. Nitrite levels for both hatcheries were satisfactory at 0 mg/L. Poor water quality has a deleterious impact on fry survival and result in huge economic losses for a hatchery operator. This paper attempts to present the outcome of the water chemistry from the case studies and juxtapose them with water parameters from a fish hatchery in a research institute where successful breeding cycles have been obtained.

Keywords: Fish hatcheries, water quality, production cycle

INTRODUCTION

Ataguba and Okomoda (2011) stated that beginning from the 1970s, aquaculture has grown significantly due to advances in hatchery technology, pond husbandry and disease/water quality control. With the development of induced spawning of the African catfish in Nigeria, routine spawning has been common (Oresegun *et al*. 2007). Reproduction and the production of high quality fingerlings is the basis of every successful fish farming operation.

According to Dada and Fagbenro (2008), many hatcheries in Nigeria were functional at low capacity thereby producing only a total of some 30 million fingerlings per year, although Atanda (2007) puts annual fingerling production at 150 million fingerlings. The total existing capacity of hatcheries for fingerlings production in Nigeria could easily be 1 billion fingerlings per year as stated by Dada and Ajilore (2009).

Gaps in production and associated constraints of hatchery management are blamed on; a serious shortage of trained manpower, lack of knowledge on profitability of aquaculture as an industry, insufficient data on production and management techniques (Otubusin, 1986). Other factors are lethargy of farm hands, _____

Author for correspondence -*ekasampat@yahoo.com*
+234 8023636962

compromised hatchery materials in terms of handling, i.e. lack of proper cleaning/disinfection, reluctance to acquire water test kits, usually this is not seen as a requirement.

When productions fail, the general tendency is to repeat another cycle. Repeated failed cycles may lead to sack of farm hands, abandonment of hatchery, etc. For a successful hatchery operation, water quality is a crucial factor. The focus of this paper is on the importance of water quality analysis as a management tool to identify problem areas that need corrective action thereby proactively leading to a turn-around of events. Using a case study of two fish hatcheries in distress, the authors demonstrate the necessity of water analysis.

MATERIALS AND METHODS

Water quality parameters of two hatcheries located at Lakowe were evaluated at the same time with water parameters from the hatchery facility at Badore Research Centre (N06 30.598' E003 37.073'), Nigerian Institute for Oceanography and Marine Research, all hatcheries located in Eti-Osa LGA of Lagos State.

Water analysis

Water parameters were determined using Pondcare® Master Liquid Test Kit, while a mercury-

in-glass thermometer was used to determine temperature.

RESULTS AND DISCUSSION

Some hatchery operators at Lakowe along the Lekki-Epe stretch had been experiencing total kill of fry within 3-5 days of a successful hatch. Results of water quality monitoring indicated low pH and high ammonia from the two selected hatcheries. pH and ammonia levels obtained from their hatchery water analyses are presented in Tables 1 and 2, while Table 3 presents water quality parameters of the hatchery situated in Badore Research Centre of the Nigerian Institute for Oceanography and Marine Research. The physico-chemical characteristics of water from the Institute's hatchery were within acceptable limits for fish culture operations.

The minimum and maximum temperature values were 26.0 ^{O}C and 29.6 ^{O}C culled from the three hatcheries investigated and were within acceptable limits for tropical aquaculture (Viveen *et al*., 1986). The pH levels ranged from 4.5 – 6.5 and 6.5 - 7.2 for hatcheries in Farms I and II respectively. The Institute's hatchery had an average pH of 7.3. Ammonia levels for hatchery situated in Farm II ranged between 1.5 - 8.0 ppm respectively, while the ammonia levels for Farm I and the Institute's hatchery were consistent at 0 ppm. Phosphate values for Farm II ranged between 0.5 – 10 ppm as against 0 ppm for Farm I and the Institute's hatchery. The pH that is below 4 results in high fish mortality is described as the lethal death point. Adverse effects of low pH and high ammonia on the fish fry were observed to be total kill of fry.

Hatchery 1 owner experienced small hatch of fry that lasted for 5-7 days before death of fry, while Hatchery 2 owner experienced large hatch of fry that died in 3-5 days. For tropical freshwater aquaculture operations, the acceptable limits for pH, ammonia, phosphate, and nitrite are 6.8-8.2, 0-0.5 ppm, 0 ppm and <0.25 ppm.

Table 1: Water quality parameters obtained from Hatchery 1 at Lakowe

Weeks	pH	Temp. (^{O}C)	Ammonia (ppm)	Nitrite (ppm)	Phosphate (ppm)
0	6.5	26.0	0	0	0
2	6.2	27.2	0	0	0
4	5.0	29.6	0	0	0
6	4.5	29.1	0	0	0

Table 2: Water quality parameters obtained from Hatchery 2 at Lakowe

Weeks	pH	Temp. (^{O}C)	Ammonia (ppm)	Nitrite (ppm)	Phosphate (ppm)
0	6.5	28.3	1.5	0	0.5
2	6.7	26.7	6.0	0	1.5
4	6.5	27.8	6.0	0	8.0
6	7.2	28.1	8.0	0	10.0

Table 3: Water quality parameters obtained from The Institute's hatchery (NIOMR)

Weeks	pH	Temp. (^{O}C)	Ammonia (ppm)	Nitrite (ppm)	Phosphate (ppm)
0	7.0	26.8	0	0	0
2	7.5	27.0	0	0	0
4	7.3	26.9	0	0	0
6	7.5	26.8	0	0	0

CONCLUSION

Low pH which is an exacerbating problem in the Lekki-Epe stretch may affect fish hatcheries located in such environments. Optimum water quality is a pre-requisite for a successful hatchery operation. For a fish hatchery operator, good source of water and voluminous quantity is a "must-have". Effort must be put into locating good sources of water. Strategic planning will also ensure that portable test kits for constant monitoring of the water utilized for hatchery operations is a requirement for a proactive approach to this agribusiness.

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