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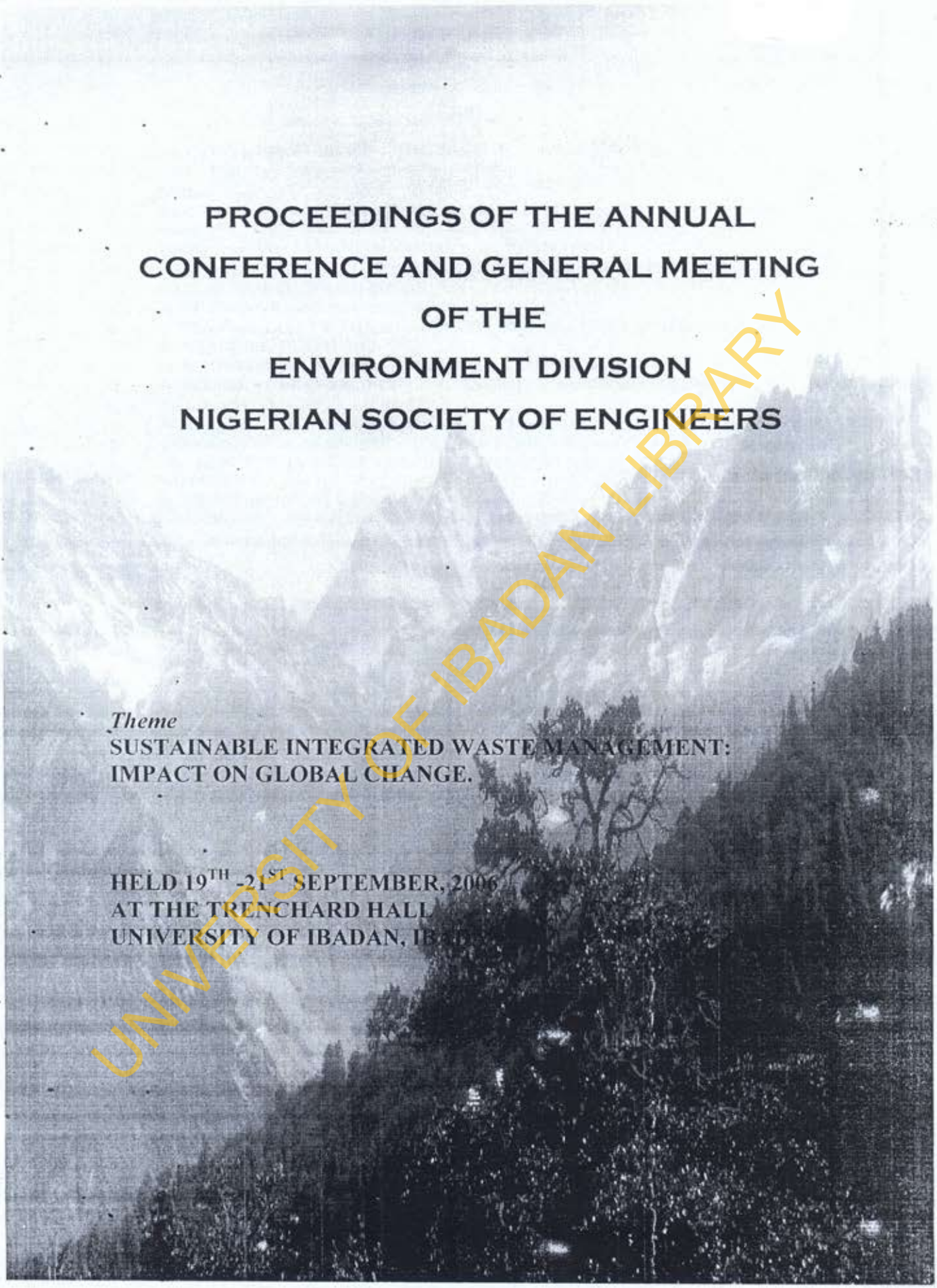

Theme
SUSTAINABLE INTEGRATED WASTE MANAGEMENT:
IMPACT ON GLOBAL CHANGE.

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CONTENT

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ASSESSMENT OF POLLUTION EFFECT OF DIRECT USE OF POULTRY FAECAL WASTE IN FISH PONDS

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ABSTRACT

The performance of some environmental parameters in fish pond of 1.5ha at the National Institute For Freshwater Fisheries Research (NIFER) in New Bussa, Kainji dam resulting from the direct utilization of fresh poultry faecal waste as fish food was assessed along with three other ponds; South West Pond One (SWP1) using wheat offal, dough, maggot plus some poultry waste as fish feed and South West Pond Two (SWP2) using 100% concentrate, wheat offal and dough as fish feed. A Natural Water Pond (NWP) containing some fishes was also used as control pond along with SWP1 and SWP2 to assess the pond at NIFER labeled Northern Pond (NP)

Environmental parameters of water quality in fish pond that are considered important in the assessment study are Dissolved Oxygen (DO); PH Value; Turbidity; Temperature, and 5-day Biological Oxygen Demand (BOD_5) The temperature range is between 26-35C throughout the assessment work and this correspond with the optimum temperature for warm water fish growth. PH value of the study ponds fall within the excellent range. Also, turbidity in NP and SWP1 are very good thereby promoting effective ecosystem while SWP2 and NWP turbidity values are rather on the high side, hence photosynthesis is slightly affected. Dissolved Oxygen (DO) for the four ponds fall within 5-12 mg/l which is excellent for fish culture in ponds. BOD_5 in the ponds is fairly high due to heavy manure loading with the exception of SWP2 which uses only concentrates as feed. NWP sources have the highest BODs value of 3.3 mg/l due to recharge from runoff water.

From this assessment work it is evident that the direct utilization of poultry faecal waste as fish feed in fish ponds has great prospects if well monitored.

1.0 INTRODUCTION

Livestock industries in Nigeria is expanding in such a great rate that presently, millions of birds are being reared in intensive and semi-intensive condition. In view of this, enormous quantity of waste is generated and for economic, social and environmental reasons, this waste must be managed perfectly to avoid environmental crises. Disposal of poultry wastes is an environmental concern for large poultry farm operators and the general public. Repeated dumping of these organic poultry wastes if not properly managed can contribute to the degradation of surface and ground water (Aldrich *et al*., 1997; Linsley *et al*., 1992)

The increasing cost of poultry waste disposal makes it timely and necessary for a re-appraisal of poultry waste utilization (Inglett, 1973) Also our society's growing concern over environmental quality and more efficient use of our limited resources (Land) has resulted in greater effort to control the production and disposal of wastes, its utilization being investigated as a partial solution to improving environmental quality (Hepher and Allen, 1976). Several biological assessment techniques have been used to quantify the effects of severe aquatic pollution of ecosystems which varies as a result of domestic, industrial and agricultural wastes.

A major pollution effect is eutrophication and its prominent consequence is excessive algae growth, high pH values and oxygen depletion by aerobic mineralization of deposited organic biomass. Muller and Stadelmann (2004) reported that reduction in nutrient input and increase in artificial aeration reverses the eutrophication processes. The degree of waste effects on aquaculture pond according to Ruimei et al. (2003) affects the water quality. The following pollution parameters are considered significant in the listed order DO, pH value, Turbidity, Water Temperature, Algae growth (Phytoplankton, Zooplankton), BOD, COD, Nitrogen, Salinity, Water Colour, Phosphorus and Pond Capacity (Ruimei *et al*., 2003). A principal component analysis (PCA) was applied by Lima-Junior *et al*. (2006) to verify which variables were more important in determining differences in water quality.

In view of the alarming rate at which poultry waste is being generated, it is incumbent upon indigenous Agricultural and waste management engineers to device alternative means of poultry waste disposal techniques with the following

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considerations in mind, which form the basic objectives of this study.

1. To evaluate the level of fish pond pollution as a result of the use of poultry faecal waste
2. To study the flaws and benefits of the use of poultry faecal waste as fish feed supplement
3. To study the extent of alteration of fish pond environmental parameters as a result of the use of poultry faecal waste in fish ponds.

Poultry raising integrated with fish culture is known to significantly cut down costs on fertilizers and feeds in fish culture and maximizes the use of space, saves labour in transporting manure to the ponds and poultry housing will be more hygienic (Gietema, 1997). Fish can be cultured in any enclosed body of water or excavated bodies of water which can be filled and drained according to management requirements. The optimum conditions for high quality production in fish culture are: topography, suitability of the soil, quantity and quality of water, and availability of pond-tolerant, fast growing and marketable fish species. (Ovie and Adeniji, 1990). The rearing of fish in ponds has the advantage that most non-arable soils can be utilized. The most important characteristic used in determining suitability is the non-permeability. The best soil is loamy clay with 70% clay (Gietema, 1997)

2.0 LOCATION OF STUDY PONDS

The major study pond; Northern Pond (NP) is located at New Bussa Niger State of Nigeria at the National Institute of Fresh Water Research (NIFER) and it falls between Mokwa Latitude 9^0 18^1 N with a rainfall of 1123 mm and Salka, Latitude 10^0 22^1 N with a rainfall of 1015mm. There is no climatological information for the control ponds (SWP1 and SWP2) since they are basically for commercial purpose only. SWP1 is located at Hope Farms Limited, New Gbagi Market off Old Ife Road, Ibadan. SWP2 is located at Itesi Village along Odeda-Abeokuta road. Also, the stream from which SWP1 water was sourced is considered as Natural Water Pond (NWP). This water is assumed to be similar to all the water used in filling our ponds.

2.1 DESCRIPTION OF PONDS

Northern Pond (NP): It has an approximate area of 1.5 ha and average depth of 1.8m, the pond is with a slope of about 0.75m depth from one end to a depth of 1.8m on the other end. It is located at the institute sewage runaway with a battery cage poultry house of 1000 birds capacity constructed mid-way over the pond at a height of about 3m from the pond floor (Plates 1 and 2). South West Pond One (SWP1): This is a private commercial pond of about $800m^2$ and depth of 1.5m with stocking density of between 5000-7000 fingerlings depending on water level. Fishes are fed with virtually concentrate for six weeks before the introduction of maggots and poultry faecal waste. The pond is fenced for security with poultry houses located few meters from the pond.

South West Pond Two (SWP2): This is located across a shallow stream with an area of about $500m^2$ and a depth of 1.5m. The feeding method is mainly with concentrate.

Natural Water Pond (NWP): This is assumed to be similar to the water used in filling the three ponds under consideration including the study pond. The stream has fairly high discharge capacity of water throughout the year and is fully loaded with water plant.

2.2 SAMPLING OF MATERIALS

Basically, four water samples were collected for analysis from our study ponds. The collection were done between the hours of 10am and 12noon, using 1.5 litres transparent plastic containers. Collection was done at half a meter depth; almost halfway to the centre of the ponds.

2.3 LABORATORY ANALYSIS OF SAMPLES

The samples were taken for analysis to determine the degree of some pollution parameters associated with poultry manure. In this study, some of the very important physio-chemical and biological characteristics of water which affects the survival, growth and reproduction of fishes are analyzed i.e. PH value, Turbidity, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD_5) and Temperature.

3.0 RESULT

There are so many pollution parameters of fish ponds but this study assume that with these five parameters used by previous researchers, fish production in ponds can be predicted adequately (Mason, 1996). The final assessment result was an averaged computation of the laboratory analysis of each of the four pond water samples. The final assessment result was shown in table 1 below:

4.0 DISCUSSION

No effort was made to regulate the temperature of the study ponds. Also, poultry manure effect on pond water temperature could not be ascertained because of the large volume of pond water, but there is an indication of heat generation during microbial activities. The assessment results were compared with the standards given by Ovie and Adeniji (1990); Swann (1990). This study was carried out in the peak of rainy season, the ponds

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PLATE 1: PICTORIAL VIEW OF NORTHERN POND SHOWING THE POULTRY HOUSE CONSTRUCTION OVER THE FISH POND

PLATE 2: PICTORIAL VIEW OF POULTRY HOUSE INTERIOR FEATURING THE BATTERY CAGE AND THE FLOORING

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Table 1: Final Assessment Result.

Pond	Temp(°C)	PH	Turbidity (JTU)	DO(mg/l)	BOD_5 (mg/l)
NP	27.15	6.80	16.03	8.14	2.60
SWP1	26.30	6.43	11.16	8.55	3.03
SWP2	26.13	6.63	34.43	6.30	1.88
NWP	26.30	6.60	30.21	7.84	2.98

temperature performance is within the safe range of 25°C-32°C which is best for warm water fishes to grow well.

The PH value in each pond is fairly stable. NP with direct loading of poultry faecal waste maintains a more excellent result of 6.80 when compared with other ponds.

The turbidity values of NP and SWP1 which were 16.03 JTU and 11.16 JTU respectively are very good thereby promoting effective ecosystem in the two study ponds. SWP2 has a bad turbidity of 34.43 JTU and this could be attributed to the continuous use of powdery concentrate which tends to pollute the pond water thereby impairing transparency, hence photosynthesis is slightly affected. NWP has a high clay turbidity of 30.21 JTU after analysis due to runoff resulting from high rainfall intensity.

Dissolved Oxygen (DO) analysis was carried out to be able to evaluate or assess the level or degree of alteration of NP from Natural water source. Fishes perform best at DO 5-12 mg/l (Ovie and Adeniji, 1990) The DO obtained from NP which is 8.14mg/l is excellent for fish culture in ponds. DO value of SWP1 is higher because of the indirect loading of poultry manure. NWP suppose to have an equally high DO value but for the effect of high clay turbidity and excessive vegetal cover which seriously impaired photosynthesis in the day time. SWP2 has much lower DO value of 6.30 due to low fertilization caused by continuous use of concentrate for fish feed. It is assumed that 25% of the poultry faecal waste or manure is being utilized by the fish while the rest settle down to fertilize the pond (Ovie and Adeniji, 1990)

BOD_5 can be used to predict the amount of dissolved oxygen consumed during chemical and microbiological action when a sample of water incubated for five days at 20°C in the dark. NP and SWP1 shows a high BOD_5 value of 2.60 mg/l and 3.03 mg/l respectively. This is due to manure loading in the ponds and also the ecology of pond fertilization that are similar in the two ponds.

If there is no further input of faecal waste or manure, Zooplankton will soon overgraze the phytoplankton and subsequently die from food shortage and probably lack of oxygen. These activities of microorganisms in the ecosystems of fish ponds is detrimental to fish life cycle in the pond and can best be managed by the use of direct loading of poultry faecal waste in the pond and this will help to maintain efficient ecology of pond fertilization whereby fishes can feed directly on about 25% of the manure and with the high nutritional value of the waste.

5.0 CONCLUSION

From this study, the benefits of well managed direct use of poultry faecal waste in fish culture in ponds are many. Protein, mineral and vitamins present in fresh poultry manure which could be lost during drying or recycling of wastes are made available for use by fishes. Also, elimination the nausatic and tediousness involved in moving tons of waste from unwanted places are overwhelming advantage for utilizing direct poultry faecal waste. No pollution effect was recorded judging from the final assessment (table 1), as a result of direct use of poultry faecal waste in ponds.

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