I.J.S.N., VOL. 2(4) 2011:809-812 ISSN 2229 – 6441

INTERNATIONAL JOURNAL OF SCIENCE AND NATURE

www.scienceandnature.org

EVALUATION OF DIVERSITY INDEX OF FISH FAUNA IN A LOWLAND RICE FIELD IN SOUTHERN GUINEA SAVANNAH OF NORTHERN NIGERIA

[1]Yisa, T.A., [2]Adeyemi R.A, [3]Ibrahim, I.

[1]Department of Water Resources, Aquaculture and Fisheries Technology, [2]Department of Crop Production , School of Agriculture and Agricultural Technology, Federal University of Technology, Minna. [3] Niger State Secondary Education Board, Minna.

ABSTRACT

The data used in this paper was obtained from the National Cereals Research Institute (NCRI) experimental farm, Badegi, Niger State, Nigeria. A Simple Random sampling technique was adopted to evaluate the counts of some fish fauna species in a low land rice field. The study was to determine the fish fauna diversity in terms of species, abundance, genera and family index in relation to fish growth and rice production. The experimental site was divided into 6 plots of equal sizes. At every visit or sampling time 3 plots were randomly selected and all fish fauna species found were categorized under 7 families. A total of 12 species of fish fauna belonging to 10 genera and 7 families were harvested for 89 days fortnightly. The fish species caught were identified, collected and documented according to plots. Factors such as Dissolved oxygen, pH, temperature, conductivity were determined. Fertilizer application enhances rice yield while herbivorous fish such as Tilli zilli fed on aquatic weeds to reduce weed growth hence boost rice-cum-fish farming. The study revealed that plots II, III and VI were more productive in comparison to other plots.

KEY WORDS: Diversity, fish, fauna, rice-cum, lowland.

INTRODUCTION

Fauna are the animals found in a particular environment (Donald and David, 1974).They said that fish fauna diversity is a various types of fish found in a particular environment. Bone *et al*. (1995) noted that diversity of animals is the wide range and varieties of different types of organism found in a particular ecological habitat. According to Fasasi, (2003) herbivorous fish species have distinct preferences for plants such as duckweed and there is need to identify those that lead to growth and production. Fishes are the most numerous of the vertebrates with estimates of around twenty thousand (20,000) species (Lagler *et al*; 1977). Pandey, (2006) also reported that fishes represent just over 50 % of all the vertebrates' species. Rice fields have been used extensively for fish culture either on a rotation with rice cultivation as rice-cum-fish culture (Pandey, 2006). For many years now the task to develop needed technology for proper management of integrated rice-cum fish culture farming has been a major challenge to farmers generally and particularly rice and fish farmers. The major problems include lack of rice-cum fish culture technology, lack of awareness, willingness and general apathy by farmers to practice this farming system. Fish form an integral part of wetland ecosystem. Compton (1981) reported that rearing fish in paddies for 2 years running reduce weed infestation by 60 %. According to Moraes (1984) weeds in irrigated rice field can be controlled by herbivorous fish such as *Tilapia rendallis* and *Tilapia zilli*. Compton (1981) observed that common Carp *Cyprinus carpio* feed on rice pest while silver carp feed on plankton. Yaro (2001) reported that rice grains produced from rice-cum fish culture is of better quality as it contains more nitrogen, phosphorus and potassium hence of higher protein than in rice cultured only. Yaro (2001) also observed that fish grazing in the rice field stimulates the activities of micro-organisms and the availability of organic matter and increased release of nutrients for better rice growth and yield. It is in view of the importance of abundant and diverse of fish fauna in the study area that this research was conducted to explore its farming potentials for agricultural benefits. The herbivorous fish feed on rice vegetative parts, thus increases rice growth (2001). The catfish species thrive well in low water level but herbivorous fish requires deeper water to balance in the water body.

MATERIALS AND METHODS

Sampling site

Hectare of lowland rice field of National Cereals Research Institute (N.C.R.I) Badegi latitude 9^0 045 N and longitude 6^0 07 E with average rainfall 1187.5 mm designated as 'Federal Agricultural Research Oryza 44'(FARO 44) was mapped out using measuring tape and a wooden quadrate frame made of 2 by 2 m^2. The mapped out was divided into six plots measuring 50 m x 50 m with water depth of between 1.5 m to 4 m. Each plot measured 50 m^2 in length and breadth was marked with wooden pegs, and ropes were tied round the pegs to demarcate and wild fish of varied species were harvested during sampling time fortnightly for 89 days using seine nets from each plot. Rice was planted during sample time immediately when rain builds up; NPK fertilizer was applied at recommended dose of 80-40-40 kg per hectare. Species of fish harvested were collected, identified, counted and documented. Identification of various species caught was done to the specie level using identification guides and notes by Olaosebikan and Raji (2005). Water quality parameter such as Dissolved Oxygen, conductivity, temperature and pH were determined by taken the sample to the laboratory for analysis on weekly basis.

Statistical Method

In reporting the fish fauna diversity of the study field, the following diversity measures were computed: (a) Simpson's diversity index (D). (b) Total number of species in the community (richness) and (c) equitability (Evenness)

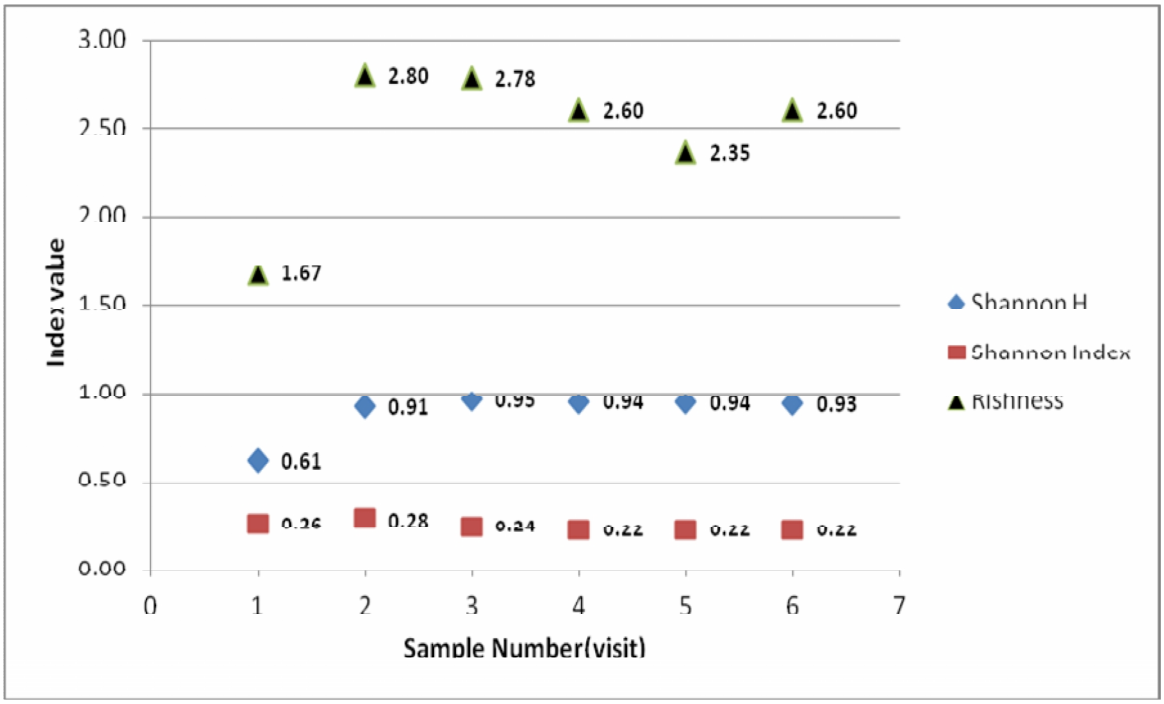
Simpson's diversity index (D) is a simple mathematical measure that characterizes species diversity in a community. The proportion of species I relative to the total number of species (p_i) is calculated and squared. The squared proportions for all the species are summed, and the reciprocal is taken:

$$D = \frac{1}{\sum_{i=1}^{s} p_i} \quad \text{---} \quad (1)$$

For a given richness (S), D increases as equitability increases, and for a given equitability, D increases as richness increases. Equitability (E_D) can be calculated by taken Simpson's index (D) and expressing it as a proportion of the maximum value D could assume if individuals in the community were completely evenly distributed (D_{max} which equals S-- as in a case where there was one individual per species). Equitability takes a value between zero and one, with one being complete evenness.

$$E_p = \frac{D}{D_{\max}} = \frac{1}{\sum_{i=1}^{S} p_i^2} x \frac{1}{S} \quad \text{--------------------------} \quad (2)$$

	Shannon H	Shannon Index	Richness
1	0.61	0.26	1.67
2	0.91	0.28	2.80
3	0.95	0.24	2.78
4	0.94	0.22	2.60
5	0.94	0.22	2.35
6	0.93	0.22	2.60



RESULTS

A total of 12 fish species belonging to 10 genera and 7 families were identified. The abundant distribution of fish species caught according to plots was shown below in Table 1. The mean percentage number of fishes caught during the period under study was presented in Table 2. The family Cichlidae dominated the fishes with 62.45% followed by family Claridae with 11.23% while family Bagridae is the least with 0.82%.

TABLE 1: Fish Species caught per Plot

Plot	Species caught
I	1, 2, 3 and 11
II	4, 3, 5, 10 and 11
III	6, 10, 11 and 9
IV	7, 3, 4 and 9
V	8, 11, 12 and 1
VI	10, 11, 3, and 9

Legend: 1 = *Protopterus annectens*
2 = *Polypterus senegalus*
3 = *Clarias gariepinus*

4 = *Clarias anguillaris*
5 = *Alestes dentex*
6 = *Auchenoglanis occidentalis*
7 = *Parachanna Africana*
8 = *Hemichromis faciatus*
9 = *Hemichromis bimaelatus*
10 = *Tilapia zilli*
11 = *Oreochromis niloticus*
12 = *Sarotherodon galilaeas.*

TABLE 2. Abundance of fish fauna in a low land rice field of NCRI, Badeggi between August and October, 2007

Family	% by Number	% by weight
Cichlidae	62.45	51.23
Claridae	11.23	16.29
Protopteridae	10.80	12.10
Channidae	9.10	8.44
Polypteridae	3.10	6.02
Characidae	2.50	5.45
Bagridae	0.82	1.05

TABLE 3. Check list of fish fauna in a low land rice field of NCRI, Badeggi between August and October, 2007.

Family Cichlidae
Tilapia zilli
Oreochromis niloticus
Sarotherodon galilaeus
Hemichromis faciatus
Hemichromis bimalatus
Family Bagridae
Auchenoglanis occidentalis
Family Claridae
Clarias gariepinus
Clarias anguillaris
Family Protopteridae
Protopterus annectens
Family Channidae
Parachanna africana
Family Polypteridae
Polypterus senegalus
Family Characidae
Alestes dentex

TABLE 4. Weekly mean water quality parameter for the study area for nine (9) weeks

Time (weeks)	DO.	TEMP.	PH	COND	Time (am)
1.	8.00	21.00	6.81	397	8.30
2.	7.10	22.24	6.88	482	8.30
3.	6.20	25.00	6.81	193	8.30
4.	6.30	26.28	6.98	152	8.30
5	7.10	26.09	6.75	233	8.30
6.	9.00	26.00	6.96	463	8.30
7.	7.50	26.58	6.85	220	8.30
8.	8.30	25.05	6.96	315	8.30
9.	6.90	27.00	6.75	183	8.30
Σx	66.40	225.24	61.75	2638	
$\bar{x}$	7.38	25.03	6.86	293.11	
± SEM	± 0.275	± 0.520	± 0.010	± 33.520	
SD	0.85	1.97	0.06	115.68	
n	9	9	9	9	

KEY:
DO = Dissolved Oxygen, Temp. = Temperature, Cond. = Conductivity, SEM = Standard Error of Mean, SD = Standard Deviation.

DISCUSSION

Plot I was with water depth 1.5 m, plot IV and V were with water depth 2 m, plot II, III and VI were with water depth 4 m. The family Cichlidae was most abundant in plot II, III and VI due to water depth that favours them for they prefers deep water body to balance while plot I, IV and V were most occupy by family Claridae because they possess accessory breathing organs hence can survive for a long time in moist ground, low water level or out of water. This agrees with the submission Ajana and Anyanwu (1995) that Clarias species can walk long distances on land especially on moist ground, mud and low water body.

As a result of abundance of herbivorous fish species such as *Oreochromis niloticus* and *Tilapia zilli* in Plot II, III, and VI (Table I) there is high yield, growth and production of rice about 350 kg. The herbivorous species prefers deep water body to balance hence their abundance in these plots. Herbivorous fishes feed on aquatic weeds such as duck weed and rice vegetative parts (Yaro 2001). These weeds are good source of high quality protein to Tilapia fish; this enhances their growth performance as observed by Moraes (1976) and Mbagwu *et al.* (1990). When herbivorous fish feeds on aquatic weeds on rice-cum fish culture farm, the farm become cleared of weeds and this enhanced rice yield and growth. This is the major reason why production of rice in relation to diversity of fish comparatively in all the plots were higher in plot II, III and VI. Also, it was discovered that in all the plots, II, III and VI as compared to other plots, had high production of fish and yield of rice. This corroborates with Yaro (2001) that availability of abundant water and absence of aquatic weeds stimulates the yield of fish and rice in rice-cum-fish culture practices. In plot I, IV and V Catfish species such as *Clarias gariepinus* and *Clarias anguillaris* were in abundance; this is because they thrive well in low water body.

Furthermore, carnivorous fish species such as Clarias sp.were used as biological control for the proliferation of Tilapia species. This also enhance fish and rice yield and production because stocking density of fish is been checked.

It is obvious that the study area showed fish abundance in terms of number and weight and there was also relatively high species diversity (Table II). The Cichlidae family had the highest percentage by weight (51.23 %) probably because they feed on rice vegetative parts and aquatic weeds which enhance their growth. This agrees with the report of (Yaro, 2001) that rice vegetative parts and aquatic weeds are rich in protein and enhances fish growth when fed upon. The least percentage by weight is in the family of Bagridae with 1.05 % probably because they are carnivorous. On the whole the relationship between the fish diversity, and the aquatic weed, fish and rice yield in the study area was profitable. This concurs the assertion made by Yaro (2001) that rice-cum fish culture is a profitable enterprise if properly managed. The values of the water quality parameters measured were within the tolerance range of warm water fishes (Table 4). The value of pH corroborates the observation of Pandey (2006) that pH range 6.5-9.5 is suitable for fish growth and production. Dissolved Oxygen pattern corroborates that reported by (Adekoya, 2004) that dissolved oxygen less than 3ppm causes discomfort to fish and lead to death. Tsadu (2009) recommend 23-35^0 C for fish rearing.

CONCLUSION

Based on the results obtained on the diversity of fish fauna, it could be concluded that the relationship between fish diversity, aquatic weed and rice yield would provide and stimulate rice-cum fish model hence productive in terms of fish and rice yield thereby boost food production for socio-economic transformation.

REFERENCES

Adekoya, B. B., Olunuga, O.A., Ayansanwo, T. O., Omoyinmi, G.A.K. (2004). Handbook on Manual of the second annual Fish seminar and training workshop held at Ogun State Agricultural Development Programme (OGADEP), Abeokuta, Published by Fisheries Society of Nigeria (FISON), Ogun state chapter. 19-25pp.

Ajana, A. M. and Anyanwu, P.E. (1995). Hetero Clarias fingerlings production (hybrid of *Clarias gariepinus* and Hetero Clarias sp.).Aquaculture extension guide No.7. Sponsored by the National Agricultural Research Project (NARP) produced by Nigerian Institute for Oceanography and Marine Research (NIOMR), Extension Research and Liaision services Department 1995. pp.3-15.

Bone Q., Marshall N. B. and Blaxter J.H.S. (1995) Biology of fishes 2nd ed Chapman and Hall London, pp.2-20.

Compton, J.A.F. (1981) Small farm weed control (An Annotated Bibliography).

Donald, P.B., David A.H. (1974) Introduction to Field Biology,2nd Ed. Edward Arnold pp.33-43.

Fasasi (2003), In: Omitoyin, B.O. (2007) Introduction to Fish Farming in Nigeria;1st Ed. 2007. Ibadan University Press.

Lagler, K.F., Bandach, J.E., Millar, R.R. and May Passomp, D.R. (1977) Ichthyology 2nd ed. John Willey and Sons. New York pp.1, 9 and 411-455.

Mbagwu, I.G., Okoye, F.C. and Adeniji, H.A. (1990) Studies on the use of duckweed (Lemna Pascus Cicostata Hegelm) as fish food. Technical Report Series No. 22 NIFFR. New- Bussa. Pp. 3, 5-11.

Moraes, C.E., Moody, K., Lubigan R.T., Paller, Jr. Ec. (1984). Major weeds of the Philippine. Weed Science of the Philippine. Laguna pp.171-264.

Olaosebikan, B.D. and Raji, A. (2005). Field Guide to Nigerian Fresh water Fishes: FCFFT publication. Decency Printers Ilorin pp.106.

Pandey, G. (2006): General and Applied Ichthyology, Fishery Research. 1st ed. 2006. ISBN: 81-219-26-29-7.

Tsadu, S.M., (2009). Construction and management of fish pond; management of sheep, goat and rabbit. A paper presented at workshop organized by Niger State Local Government Service Commission on 19th-20th May, 2009, Minna, Niger State.

Yaro, I. (2001): Development of Rice-Cum Fish Culture Model using NileTilapia (Oreochromis niloticus). Ph.D Thesis. Federal University of Technology, Minna. Pp.148-184.