Nigerian Journal of Ecology (2003) 5:64-68

ISSN: 1116-753X

Diversity, Abundance and Length-Weight Relationship of Fish Species Captured from the Lake International Institute of Tropical Agriculture, Ibadan

T. S. Olaniran
Department of Wildlife and Fisheries Management, University of Ibadan

(Accepted 10 July 2003)

ABSTRACT

The study assessed the diversity, abundance and length-weight relationships of common fish species in International Institute of Tropical Agriculture (IITA) lake. Fish species were sampled for 24 months (January 1998 – December 1999) using a combination of multi-mesh experimental and commercial gill nets and long lines with different sizes. A total of 1875 specimens representing 16 different species were collected. *Oreochromis niloticus* (35.5%), *Sarotherodon galilaeus* (22.1%) and *Lates niloticus* (14.7%) were the most abundant. Length-weight relationships using Total length (TL), Standard length (SL) and Somatic weight (SW) indicated an allometric growth for dominant fish species.

O. niloticus was defined by the regression equation $y = 2.917x - 3.041$ and $r^2 = 0.96$. For *S. galilaeus* it was also defined by the equation $y = 3.103x - 3.468$; $r^2 = 0.94$ while for the third most abundant species, *L. niloticus* the regression equation was defined by $y = 2.927x - 3.662$; $r^2 = 0.97$. The relationship was compared with species caught elsewhere in Nigeria and Africa.

Key words: Fish species, captured, diversity, length-weight relationship, lake.

INTRODUCTION

Effective management of any fishery requires considerable knowledge regarding population parameters such as species diversity, abundance, length-weight relationships and growth patterns of the fish species in the stock.

Froese and Pauly (1998) reported over 2000 different fish species from both tropical and temperate regions of the world, while the report of Ita (1993) on fish species diversity and abundance in some lakes and reservoirs in Nigeria revealed a range of 17 fish species in Bakori reservoir to 104 fish species in Kainji lake. The little information on IITA lake reported by Ita (1978) showed that it has supported diversity of fish species in the past, which possibly has change over the last two and half decades.

The length-weight relationship (LWR) is otherwise called the growth index. The need for length-weight relationship study in fish stock assessment include calculation of the fish's average weight at a certain length class and the conversion of an equation of growth in length into an equation of growth. The morphological comparison between populations of the same species is also possible using information on length-weight relationship. In addition, mathematical parameters of the relationship between the length and weight of fish give indispensable information on the condition factor of the fish stock.

This study was therefore designed to determine diversity, abundance and length-weight relationships of fish species in International Institute of Tropical Agriculture lake, Ibadan.

MATERIALS AND METHODS

Fish samples were collected monthly from January 1998 to December 1999 from IITA lake, Ibadan using a graded fleet of seven experimental gill nets each measuring 20m long and 3m deep with stretched mesh sizes ranging between 38.1mm and 139.7mm. The long-lines of five different hook sizes (6, 7, 8, 9 and 10) and commercial gill net of 152.4mm mesh size with 240m by 6m dimension were also used in order to capture fish of various species and of different sizes.

Fish species identification procedure was adapted from the methods of Lowe Mc Connell (1975) and Holden and Reed (1978). Fish morphometrics such as total length and standard length of individual fish captured were taken in centimeter on a fish measuring board. Weight of each fish (g) was determined on a top loading weighing scale. Length-weight relationship was calculated after Bagenal and Tesch (1978) using the equation: $W = aL^b$.

The equation was lincaralised to determine the growth pattern of each species.

$Log_{10}W = Log_{10}a + bLog_{10}L$

Where: W = body weight of fish (g)

L = Standard length of fish (cm)

a = constant b = exponent

RESULTS

Divesity, abundance and length-weight range of fish species caught in the IITA lake, Ibadan between 1998 and 1999 is presented in Table 1. A total of 1,875 fish specimens were recorded. Of these, 89.7% were caught with the experimental net while the rest were caught in the hooks and commercial gill net. The record of fish samples from all the fishing gears combined revealed that O. niloticus (35.5%) was the most abundant followed by *S. galilaeus* (22.1%) and *L. niloticus* (14.7%). *B. callipterus* was the least abundant with only one sample recorded throughout this study.

The morphometric parameters relating to the length and weight of the fish species captured from IITA lake in 1998 and 1999 differed considerably (Table 1). Whereas the ratio between the minimum and maximum weight of fishes caught was highest in *H. niloticus* (1:346), this was lowest in *A. occidentalis* (1:2). Similarly, the ratio between minimum and maximum standard length was highest in *H. niloticus* (1:9 but lowest in *H. fasciatus* (1:1) and *L. senegalensis* (1:1). The length and weight therefore varied considerably (Table 1). The length-weight relationships for common fish species caught from the lake between January 1998 and December 1999 are presented in Table 2, while Table 3 showed length-weight relationships by sex for the dominant fish species. In addition, the length-weight relationships for the most abundant species were represented in Figure 1. *O. niloticus* was defined by the regression equation $y = 2.917x - 3.041$ and $r^2 = 0.96$. For *S. galilaeus* it was also defined by the equation $y = 3.103x - 3.468$; $r^2 = 0.94$ while for the third most abundant species, *L. niloticus*, the regression equation was defined by $y = 2.927x - 3.662$, $r^2 = 0.97$.

Table 1: Diversity, abundance and length-weight range of fish species captured from IITA lake in 1998 and 1999

		Wt (g)		TL (cm)		SL (cm)	
Species	**n**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
H. niloticus	55	25.0	8650.0	13.0	117.3	11.5	108.7
S. galilaeus	414	10.0	2300.0	8.7	45.0	6.9	37.0
O. niloticus	666	10.0	4000.0	7.5	54.5	6.5	44.5
O. aureus	10	50.0	2400.0	12.0	48.5	9.5	38.5
T. rendalli	24	12.0	200.0	9.0	19.5	7.0	15.0
C. guentheri	54	10.0	80.0	9.3	14.5	7.5	11.5
H. fasciatus	5	20.0	25.0	10.0	12.0	8.0	9.5
L. senegalensis	24	3150.0	6900.0	61.3	79.5	50.0	66.0
A. occidentalis	27	250.0	5800.0	19.5	77.0	14.5	62.0
S. mystus	236	35.0	160.0	15.0	27.5	12.5	23.5
C. gariepinus	10	1700.0	2600.0	60.0	73.5	55.0	65.0
P. senegalus	3	150.0	270.0	30.4	36.0	26.0	31.0
G. niloticus	52	550.0	6800.0	62.0	190.0	52.5	146.6
H. odoe	20	25.0	350.0	19.5	38.0	15.5	34.0
L. niloticus	275	10.0	7600.0	9.5	132.6	8.0	113.9

TL = total length; SL = standard length; Wt = weight; Max = maximum; Min = minimum

$\Sigma n = 1875$ including only one sample of *Barbus callipterus*

Table 2. Length-weight relationship (LWR) for common fish species caught in IITA lake in 1998 and 1999

Species	n	Mean wt (g)	Mean SL(cm)	a	b	r^2	Level of Significance
H. niloticus	55	5818.4	77.9	-3.42	2.75	0.97	**
S. galilaeus	414	226.8	15.1	-3.48	3.10	0.94	**
O. niloticus	666	389.5	18.5	-3.04	2.92	0.96	**
T. rendalli	24	38.4	9.5	-4.11	3.31	0.88	**
C. guentheri	54	19.2	8.3	-2.60	2.70	0.25	**
T. senegalensis	24	4876.7	58.6	-3.45	2.90	0.84	**
A. occidentalis	27	1440	36.6	-2.77	2.75	0.90	**
S. mystus	236	66.4	18.5	-1.15	1.82	0.50	**
G. niloticus	52	3276.5	94.4	-5.25	3.29	0.79	**
H. odoe	20	182.5	23.2	-2.20	2.24	0.73	**
L. niloticus	275	1541.8	35.4	-3.66	2.93	0.97	**

n = population size; Wt = weight/g; SL = standard length/cm; **a** = regression intercept; **b** = regression exponent; r^2 = coefficient of determination; ** highly significant ($p<0.01$)

Table 3. Length-weight relationship by sex for dominant fish species in IITA lake.

Species	Sex	number	Mean SL	a	b	r^2	Level of signif-icance
S. galilaeus	Female	160	13.58 4.86	-3.59	3.14	0.94	**
	Male	254	14.39 4.77	-3.39	3.07	0.94	**
O. niloticus	Female	264	16.18 6.80	-2.92	2.88	0.96	**
	Male	402	17.07 6.39	-3.15	2.95	0.95	**
T. niloticus	Female	156	31.39 19.51	-3.46	2.86	0.96	**
	Male	119	34.42 19.42	-3.92	3.01	0.98	**

Wt = weight/g; SL = standard length/cm; **a** = regression intercept; **b** = regression exponent; r^2 = coefficient of determination; ** highly significant ($p<0.01$)

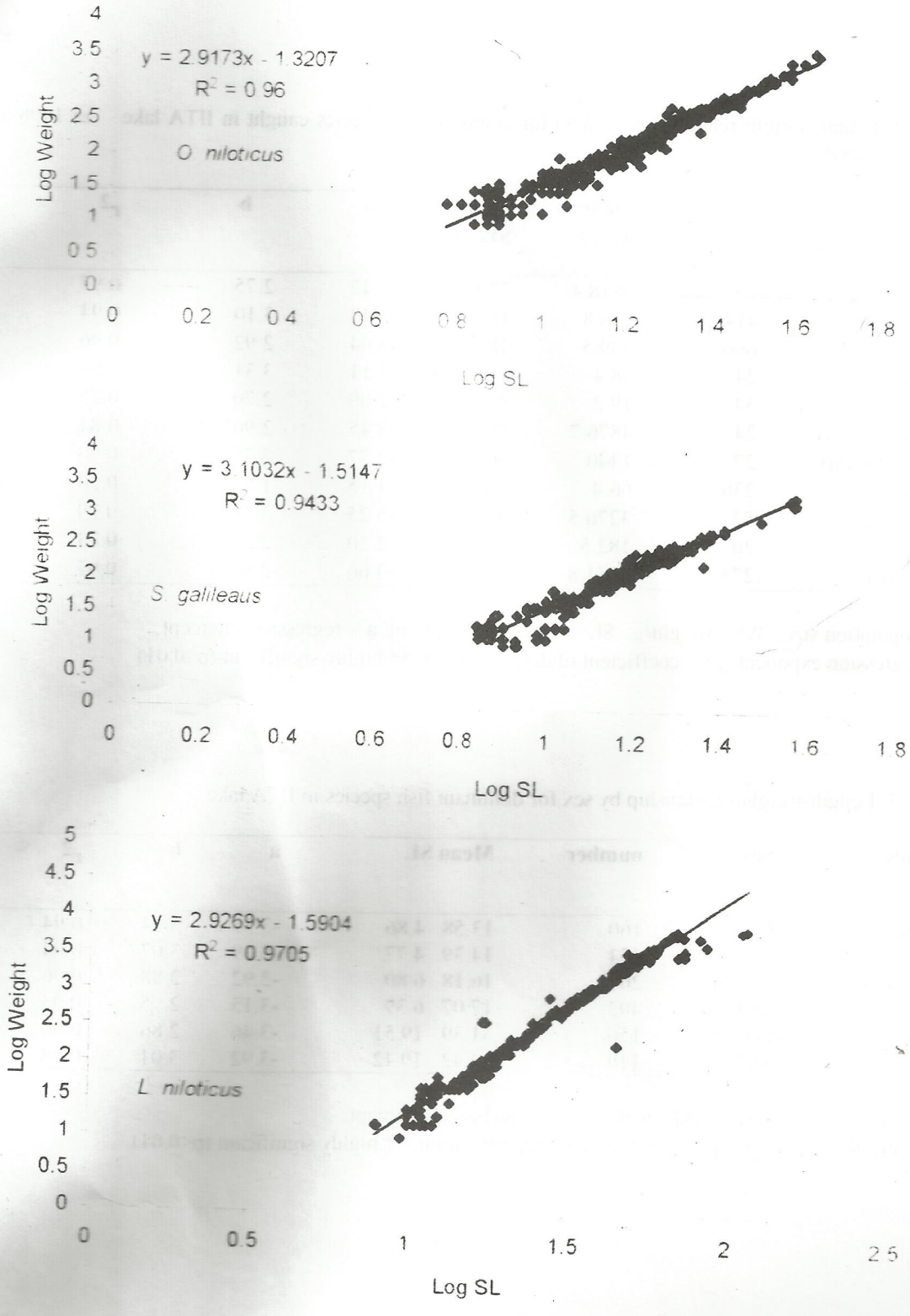

Fig. 1. Logarithm of standard length versus logarithm of weight of three species of fish.

DISCUSSION

The most dominant species in terms of abundance were *O. niloticus*, *S. galilaeus* and *L. niloticus*. The growth pattern in fish is often described either as isometric (b = 3) or allometric (b > or < 3). The isometric growth implied that an increase in different body parameters like length and weight occurred at different rate. From this study, it was found that the growth pattern of common fish species in IITA lake were allometric growth, the regression coefficient (b value) being from 1.82 to 3.31. This allometric pattern of growth observed agreed with the reports of Bagenal and Tesch (1978) that most fishes exhibit allometric pattern rather than isometric pattern. For instance, analysis of length-weight relationship of *L. niloticus* from different African countries showed values ranging from 2.6 to 3.3 (Froese and Pauly, 1998). In addition, the allometic pattern of growth exhibited by common fish species in IITA lake agreed with Fagade (1978) that reported b value of 2.95 for *Tilapia guineensis* in Lekki lagoon; Arawomo (1982) that recorded b value of 2.84 for *O. niloticus* in Opa reservoir, Ife, Nigeria and Froese and Pauly (1998) that reported b values of 3.34, 2.90 and 3.26 for samples of *O. niloticus* captured from various water in Congo, Indonesia and Philippines respectively. However, this finding did not agree with Olatunde (1979) and Olatunde (1983) who reported isometric growth pattern for *S. mystus* in Lake Kainji and *Clarias lazera* (*C. gariepinus*) from Zaria, Nigeria respectively.

This report also suggests that the species diversity of IITA lake and elsewhere in Nigeria and Africa is not different significantly. The study established fish species diversity in IITA lake with positive correlation between weight and length for the 3 most abundant fish species – *O. niloticus* ($r^2 = 0.96$), *S. galilaeus* ($r^2 = 0.94$) and *L. niloticus* ($r^2 = 0.97$). The diversity of the fish species in IITA lake agreed with the report of Sparre *et al* (1989) that the tropical water bodies are multi-species in nature. In addition, fish catch in the commercial gill net, which comprised mainly big size forage fish species (*O. niloticus*, *H. niloticus*, *L. senegalensis* and *A. occidentalis*) and few number of big carnivores - *L. niloticus* and *G. niloticus* was an indication of big fish biomass in the lake. It is therefore suggested that monthly setting of commercial gill net should be adopted to supply fish to IITA community.

REFERENCES

Arawomo, G. A. O. (1982): The growth of *Sarotherodon niloticus* (*O. niloticus*) in Opa reservoir. University of Ife. Proceedings of the 2nd Conference of Fisheries Society of Nigeria, 25th - 27th January, 1982, Calabar.

Bagenal, T. B. and Tesch, F. W. (1978): Age and Growth. *In Methods of Assessment of Fish Production in Freshwaters*, 3rd edition (Ed. T. B. Bagenal). Blackwell Scientific Publications, Oxford. pp. 101-136.

Fagade, S. O. (1978): On the biology of *Tilapia guineensis* (Dumeril) from the Lekki Lagoon. *Nigerian Journal of Science*, 12: 73-87.

Froese, R. and Pauly, D. (1998): FishBase 98: concepts, design and data sources. ICLARM, Manila, Philippines. 293pp.

Holden, M. and Reed, W.(1978): West African Freshwater Fish. Longman, London. 68pp.

Ita, E.O. (1978): A preliminary report on fish stock assessment and management proposal for the IITA, Ibadan irrigation and domestic water supply reservoir. *Kainji Lake Research Institute Technical Report* Series Number 1, New Bussa.

Ita, E.O. (1993): Inland fishery resources of Nigeria. *CIFA Occasional Paper* No. 20 Rome. FAO 1993. 120pp.

Lowe Mc Connell, R. H. (1975): Freshwater Fishes of the Volta and Kainji Lakes. Ghana University Press, Accra. 22pp.

Olatunde, A. A. (1979): Age determination, length-weight relationship and growth of *Eutropius niloticus* and *Schilbe mystus* in Lake Kainji, Nigeria. *Archaeological Hydrobiology*; 87: 49-83.

Olatunde, A. A. (1883): Length-weight relationship and the diets of *Clarias lazera* in Zaria. Proceedings of the 3rd Conference of Fisheries Societies of Nigeria, 22nd-25th February 1983, Maiduguri pp. 183-192.

Sparre, P., Ursin, E., Venema, S. C. (1989): Introduction to tropical fish stock assessment Part 1. Manual. *FAO Fisheries Technical Paper*, No. 306.1. Rome. FAO. 337pp.