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IMPACT OF EMERGENT MACROPHYTES ON FISH CATCH IN NGURU LAKE

Abubakar, M.M.
Department of Biological Sciences, Federal University Dutse, Jigawa State - Nigeria
mmabubakar2005@yahoo.com

ABSTRACT
The impact of emergent macrophytes on the catch of fish in Nguru Lake was studied from May 2006 to April 2007.Physico-chemical properties of the lake were studied in conjunction with the macrophytes. Experimental fishing was carried out in portions of the lake infested with the macrophytes and portions not infested.data collected were subjected to Student,s t-test. There was significant difference between fish catch in the two portions.. The infestation of macrophytes particularly Typha sp. leads to poor fish yield. The study recommended that farmers should be enlightened on the use of organic fertilizers and other safe farming practices and that further research should be carried out on the proliferation of Typha.
Keywords: Fish, Typha, Macrophytes, Infestation

INTRODUCTION

In recent years, there have been some efforts to understand the interactions responsible for differences in Macrophyte communities at different levels of nutrient availability. Aquatic plants serve many ecosystem functions including primary production, stabilizing sediments, maintaining water clarity and providing habitat for zooplankton, macroinvertebrates and numerous fish species. Aquatic macrophytes, when present in large abundance have the power of modifying the composition, abundance and distribution of other organisms in a water body. According to McVea and Boyd (1975), the calming of the water by macrophytes reduces upwelling of nutrients from the sediments by wind action, making them less available to phytoplankton in the photic zone. Yang *et al*., (1992) reported that there is evidence of allelopathy by water hyacinth on phytoplankton. Scheffer *et al*., (2003) also reported that a reduction in production is likely to occur in a water body covered by macrophytes since the weed shade out any photoautotrophs (both phytoplankton and submerged macrophytes) beneath them. According to Valley and Bremigan (2002) there is reduction in predator feeding rates as vegetation becomes dense. Denny (1987) recognized the following categories of aquatic macrophytes: emergent, surface floating, rooted leaves and submerged macrophytes. The objective of this study is to investigate the number and size of fish catch in two different locations: emergent macrophyte infested and uninfested areas of the lake, with a view to proffer management solutions.

MATERIALS AND METHODS

The Study area and Background to the Research Location.

Nguru Lake is a part of the Hadejia Nguru wetlands (HNW), which are located in northeastern Nigeria. Nguru lake occupies an area of approximately 58.100ha and is located between latitudes $12^0$40'N and $13^0$60'N and longitudes $10^0$20'E and $11^0$00'E. The lake developed from two main drainage systems. The Hadejia and Jama'are rivers. The lake is surrounded by a flood plain made up of a network of channels and pools producing a complete pattern of permanently and seasonally flooded land and dry land (Hollis *et al.,* 1993). Over half a million people depend upon the lake and the surrounding wetlands for their livelihoods, especially for water supply. Lafiyagi (1997) has identified about 65 species of fishes. Therefore, majority of the people living around the lake are either fishermen, or processors and marketers of fish.

Field Methods

The study was carried out on two portions of the lake on opposite banks. One portion (A) is infested with emergent macrophytes particularly *Typha sp.,* while the other portion (B) is open water with no emergent macrophytes. Fish samples were collected monthly from the five sampling stations using gill nets of various mesh sizes with the assistance of the fishermen.

Fish samples were identified and weighed fresh, at landing sites to the nearest gram. Fish identification was done using various reference materials such as Reed *et al*., (1967) and Leveque *et al*., (1992).

Temperature and pH were determined in the field using pH meter, Model 3150. Other physico-chemical parameters were determined in the laboratory using Hach 2010 spectrophotometer.

Data on fish catches from the fishermen operating on the lake were also collected. Data collected was subjected to Student's t-test to see if there is significant difference between the two sites. Duncan's multiple range tests was also used to measure differences between the means.

RESULTS

The temperature ranged from 7^0c to 32°C. In the rainy season (May-Sept) the temperature range is 15^0c to 32^0c, while in the dry season the temperature range is from 9^0c to 21^0c and 7^0c to 22^0c respectively. The temperature at Nguru Lake shows highly significant seasonal variation ($p < 0.001$), there was also highly significant spatial variation ($p < 0.001$).

pH showed a range of 7.6-9.5 with no significant seasonal or spatial variation. Transparency ranged from 11-147cm. The mean turbidity during the study period is 6.49 ±0.02ml$^{-1.}$ Conductivity and alkalinity showed significant seasonal and spatial variation during the study period, both showing maxima in the dry season. The nutrients, phosphorus, nitrogen and sulphate exhibited similar pattern, with all showing maxima during the rainy season mainly due to surface run-off from agricultural lands. All the nutrients showed significant seasonal variation.

Tables 1 and 3 show the mean number and weight of fish caught from the infested and uninfested portions of Nguru Lake over a twelve month period. The results show a higher fish catch in the portion of the lake not infested by emergent macrophytes.

The results of the number and weight of different fish species caught during the study period was subjected to Student's t-test to determine whether there is significant differences between the species, is presented in Table 4.

Table 1: Mean number of fishes caught in Nguru Lake

Month	Uninfested portion(B)	Infested portion(A)
May	326.00a	276.52b
June	303.33a	243.80bc
July	321.83a	209.52c
August	350.67a	190.85c
September	347.33a	231.90bc
October	335.00a	263.52b
November	325.00a	273.92b
December	305.83a	284.18b
January	308.17a	276.59b
February	325.00a	274.28b
March	321.17a	272.33b
April	291.67a	268.56b

Means with same letters in the same column are not significantly different using DMRT

Table 2: Mean results for physico-chemical properties of Nguru Lake for the two seasons

Parameter	Means for dry season	Means for rainy season
Temperature	16.83b	22.90a
Ph	8.11b	8.65a
Transparency	63.59a	59.33a
Depth	104.36a	105.06a
TDS	80.80b	86.30a
Suspended solids	3.51b	4.52a
Turbidity	6.19a	6.92a
Conductivity	170.69a	174.23a
Alkalinity	34.83a	33.88a
DO	6.89a	6.55b
BOD	4.61a	4.67a
COD	8.65b	10.26a
Total Phosphate	6.77a	6.98a
Total Nitrogen	6.09a	5.57a
Sulphate	3.74b	6.75a
Magnesium	0.07a	0.09a
Calcium	0.17a	0.19a
Iron	0.22a	0.24a
Zinc	0.97a	0.42a
Copper	0.07a	0.07a
Manganese	4.49a	4.14a

Means with the same letter in the same column are not significantly different using DMRT.

Table 3: Mean weight (kg) of fishes caught in Nguru Lake

Month	Uninfested portion(B)	Infested portion(A)
May	78.38c	51.42d
June	81.88bc	68.82c
July	83.70bc	69.11c
August	113.58a	96.90abc
September	98.45abc	71.60c
October	94.85abc	72.50c
November	105.45ab	82.90bc
December	97.68abc	84.92bc
January	92.07abc	83.80bc
February	79.38c	64.41d
March	78.65c	62.00d
April	76.33c	59.10d

Means with same letters in the same column are not significantly different using DMRT

Table 4: Result of t-test on fishes of Nguru Lake for the two portions of study.

Fishes	t-value
Oreochromis niloticus	0.56ns
Sarotherodon galileus	2.32*
Tilapia zillii	3.51**
Clarias gariepinus	3.31**
Heterotis niloticus	2.46*
Others	-4.96**

*- Significant, **- Highly significant ns- Not significant

DISCUSSION

Nguru Lake is part of the Nigerian Dry Belt (Sudano – Sahelian Zone) where the scarcity of water is an important limiting factor for development (Adams and Hollis, 1989).

The extent and nature of irregular and extreme ecological conditions of the savanna especially climatic variation through wind action could have a resultant effect in modifying lake ecosystems. The major physico-chemical parameters in Nguru Lake could be linked to the extent and size of the catchment area, soil characteristics, topography and vegetation covers. The water regime in this lake was mainly influenced by rainfall and discharge from its tributaries. So it is expected that any variation, whether seasonal or spatial in physico-chemical properties of Nguru lake may be influenced by climatic factors or catchment characteristics i.e. extent of human activities, and water volume fluctuations.

The results showed significant differences in number and weight of fish caught between the infested and uninfested portions of the lake. The lower catch in the macrophyte infested portion is due to the fact that, there is low temperature, low dissolved oxygen and poor light penetration. Therefore few fish can thrive well in that portion. Little (1969) reported that *Typha* decreased dissolved oxygen and lowered temperature of the water, which alter the fauna. Birnin-Yauri *et al.,* (2006), showed that there was reduced fish yield in water bodies that are infested by *Typha.* Aquatic macrophytes when present usually compete with the phytoplankton for light and nutrients, thereby depriving the fish that feed on the plankton. Best (1998) also stated that *Ceratophyllum demersum* was particularly known for its nitrophily, and its ability to grow rapidly in the upper water column enables it to maximize light availability for which it competes with phytoplankton, thus simultaneously adapting to and contributing to the light attenuation factor in the Lake. Macrophytes concentrate great amount of various substances (e.g. nutrients) and are consequently useful indicators of local pollution (Kumar *et al*; 2006). Balarabe and Abubakar(2007) also showed that dense stands of emergent macrophytes may bind up nutrient materials throughout the growing season so that they are not available for production of phytoplankton and other organisms that feed upon phytoplankton. This implies that, the chances for fish larval survival would greatly diminish. The results of the present study showed that the infested portions of the lake had less fish catch. This is in contrast to the findings of Cheruvelil *et al.,(2001)* which showed that areas infested by large monospecific beds of Eurasian watermilfoil tend to have more fish and invertebrates than do areas with diverse plants. Studies by Cross and McInerny(2001) showed that fish abundance is greater in vegetated habitats than in unvegetated habitats. Based on the results one can conclude that the proliferation of non native emergent macrophytes changes the nutrient balance of a water body. Thereby, changing the biotic composition of such a water body. It is therefore recommended that research should be carried out on ways to control emergent macrophytes particularly *Typha* , government and non-governmental organizations should undertake the clearing of water bodies of *Typha* and other macrophytes. However, care must be taken when clearing the lake of aquatic macrophytes, as any alteration to overall composition of aquatic macrophytes will invariably have some effect on the lakes fish community.

This view is supported by the work of Valley *et al.,* (2004) who conclude that overall whole lake aquatic plant treatment is risky. Significant biological risks associated with large scale manipulations include excessive removal of fish habitat and thus decline of fish populations, loss of sensitive plant species, decline in water clarity and potential long term cumulative effects of multiple treatments, since eradication of non-native plant species is highly unlikely. And farmers should be enlightened on the use of organic fertilizers and other safe farming practices.

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