Distribution of *Oreochromis niloticus* (L.) in the Ugandan waters of Lake Victoria

AKUMU J.K.O., FIRI, P.O. Box 343, Jinja

Abstract: The Lake Victoria fish fauna was dominated by cichlids before the establishment of the exotic species *Oreochromis niloticus* (L.) and *Lates niloticus* (L.). With the alterations in the ecology of Lake Victoria, changes may be expected to occur in the population dynamics of the fish species. In two zones of Lake Victoria, the size structure, distribution and abundance, condition factors, length-weight relationship and sex ratios of *O. niloticus* were determined. Larger fish were found in zone II than in zone III, where very few larger fish were recorded. More *O. niloticus* were caught in zone III, especially in Itome Bay, than in zone II but catch by weight was greater in zone II. More males than females were encountered in both zones. *Oreochromis niloticus* had similar condition factors in both zones.

Introduction

Fish is an important resource in the nutrition of Ugandans. The fisheries sector makes a significant contribution to the gross domestic product and generates substantial incomes from fish harvesting, processing, and marketing. Tilapiine species including *Oreochromis niloticus* (L.) were ranked first in commodity prioritisation under the aquatic resources management programme of the Fisheries Research Institute/National Agricultural Research Organisation in 1994.

There have been dramatic changes in the environment of Lake Victoria affecting the biology, composition, abundance and distribution of fish communities. The changes included the establishment of the exotic *Lates niloticus* (L.) and *O. niloticus* (Ogutu-Ohwayo 1990). The Lake Victoria fish fauna was dominated by cichlids before the establishment of the exotic species (Greenwood 1966). *Oreochromis niloticus* was the most successful of the introduced tilapiines owing to its larger size, wider food spectrum, faster growth rates, greater fecundity and wider habitat tolerance (Welcomme 1964).

With the ecological changes in Lake Victoria, changes may be expected to occur in the population dynamics of the fish species. To provide information for rational management of the tilapia fishery, the present study has the following objectives:

1. to determine the distribution and abundance of *O. niloticus*,
2. to evaluate its size structure and distribution,
3. to evaluate maturity, condition factors, length-weight relationship and sex ratios of the species in Ugandan waters.

Materials and methods

Bottom trawls were carried out with 25 mm codend mesh using RV Ibis as described by Okaronon, Muhoozi & Bassa (1999). Results from zones II and III are reported on here. *Oreochromis niloticus* were counted, measured (nearest mm TL), weighed (0.1 g), and gonadal status assessed. Length frequency distribution, abundance, sex ratios, length-weight relationship and condition factor were recorded.

Results

In zone III, smaller length classes dominated and few larger fish were caught (Fig. 1). Fish of size range 20-34 cm TL were abundant in Itome Bay. Many juveniles were taken in Thruston Bay, an area covered until recently by thick water hyacinth mats. Larger fish were caught in zone II (Fig. 2) and thus, while more fish were recorded in zone III, the catch by weight was higher in zone II. In both zones, O. niloticus were caught in shallow areas less than 20 m deep, particularly in areas with macrophytes. The majority of fish caught in zone II were mature. Most *O. niloticus* were captured during the rainy seasons and ripe running males and females from 30-64 cm TL were encountered near the mouth of River Katonga particularly during the rains.

More males than females were encountered in all the zones sampled. In Itome Bay the ratio of females to males was 1:2.7; In Lingira Bay it was 1:1.5 and in Masese area 1:2.5. Only males were caught in Thruston Bay. The length-weight relationships and thus condition factors of *O. niloticus* were similar in both zones (Table 1).

Table 1. Length-weight relationships for *O. niloticus* in the two zones of Lake Victoria.

Location	Slopes	Intercepts	r^2	n
Zone III				
Kitamiro-Namasimbi	3.3	-2.082	0.975	252
Lingira Bay	3.2	-1.919	0.977	78
Masese	3.1	-1.899	0.976	196
Zone II				
Buninga to Goru	3.0	-1.669	0.968	189
Bussi to Kitubulu Bay	2.9	-1.543	0.968	50
Luyo to Lambu	3.1	-1.732	0.949	109

Discussion

The differences in size distribution between the two zones may be the result of several factors.

Habitat differences. The sampled areas of zone III may include more nursery areas occupied by smaller fish, whereas fishing in zone II sampled more open areas favoured by adult fish and possibly including spawning grounds.

Differences in fish behaviour by season and sex. The differences in catches between seasons suggests changes in fish behaviour and thus vulnerability to capture by the trawl, and suggests therefore that trawl catches are not fully representative of the tilapia population. Males are more vulnerable to capture in active gears such as trawls when on their nests during spawning seasons, and Ojuok (1999) discusses the differences in sex ratio of *O. niloticus* in the Kenyan waters of Lake Victoria in detail.

Differences in fishing mortality between zones. Selective removal of adult fish lead to decreased recruitment (Sanyanga *et al.* 1995). The lack of large fish in zone III may be due to selective cropping by commercial gillnets, for which the legal minimum mesh is 127 mm. This zone is also heavily fished by artisanal fishermen. Some fishing methods affect recruitment through disturbance of nest sites and breeding behaviour. Excessive use of cast nets in breeding grounds during peak breeding impacts the population of ripe males (Lowe-McConnell 1959, Gwahaba 1978). If this is the case, the sheltered bays and gulfs which are breeding and nursery grounds for this species need protection from destructive fishing methods such as small-meshed nets.

Acknowledgements

The study was funded by the European Union Lake Victoria Fisheries Research Project (Ref: ACP-RPR 227).

References

Greenwood P.H. (1966) The fishes of Uganda. The Uganda Society, Kampala. (2nd edition).

Gwahaba J. J. (1978) The biology of cichlid fishes (Teleostei) in an equatorial lake, Lake George, Uganda. *Archives Hydrobiologie* **83**, 538-551.

Lowe (McConnell) R.H. (1959) Breeding behaviour patterns and ecological differences between *Tilapia* species and their significance for evolution within the genus *Tilapia* (Pisces:Cichlidae). *Proceedings of the Zoological Society, London* **132**, 1-30.

Ogutu-Ohwayo R. (1990) The decline in the native species of Lake Victoria and Lake Kyoga (East Africa) and the impact of introduced species, especially the Nile perch, *Lates niloticus,* and the Nile tilapia, *Oreochromis niloticus. Environmental Biology of Fishes* **34**, 1-28.

Okaronon J.O., Muhoozi L.I. & Bassa S. (1999) Current status of the fish stocks of Lake Victoria (Uganda). This volume.

Ojuok J.E. (1999) Reproductive biology of Oreochromis niloticus (L.) in the Nyanza Gulf of Lake Victoria. This volume.

Sanyanga R.A., Machena C. & Kautsky N. (1995) Abundance and distribution of inshore fish in fished and protected areas in Lake Kariba, Zimbabwe. *Hydrobiologia* **306**, 67-78.

Welcomme R.L. (1964) Notes on the present distribution and habitats of the non-endemic species of *Tilapia* which have been introduced into Lake Victoria. *Report of the East African Freshwater Fisheries Research Organisation* **1962/63**, 36-39.

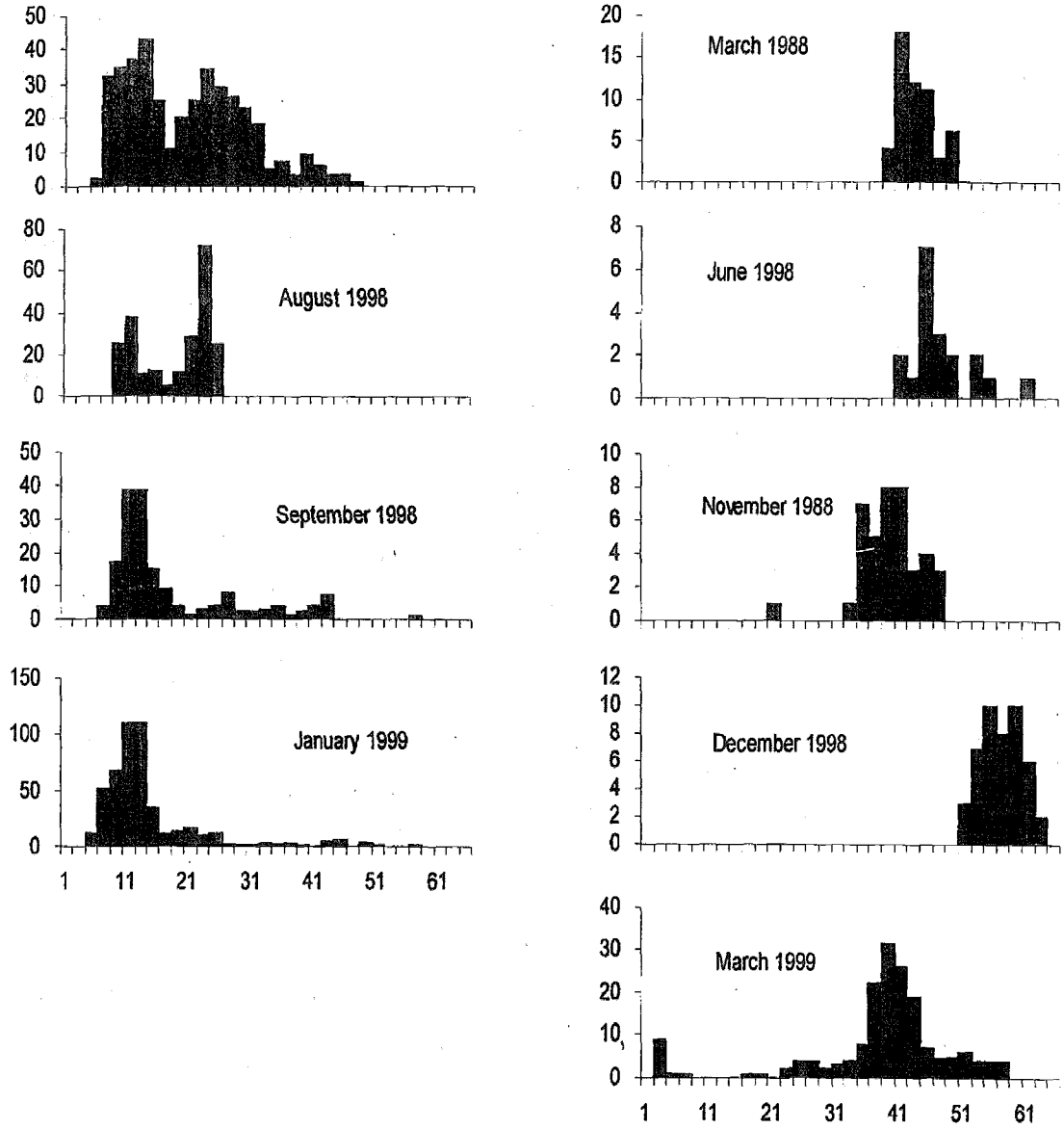

Fig. 2. Length frequency distribution of *O. niloticus* in zone II of Lake Victoria.