A Survey of Ichthyofauna of Lake Kanyaboli and Other Small Waterbodies in Kenya: Alternative Refugia for Endangered Fish Species

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Abstract

In 1988, the World Conservation Union (WCU) Red Book of Endangered Species listed hundreds of endemic fishes of Lake Victoria under a single heading—"ENDANGERED". Most of the endemic native food fishes are either endangered or extinct. However, a survey of the fauna of Lake Kanyaboli, revealed that a few remaining samples of these native fishes are actually thriving. These include several unidentified *Haplochromis* spp., *Oreochromis esculentus* and *Oreochromis variabilis*. As a result, a stock rehabilitation and management strategy has been designed to use Lake Kanyaboli and other small waterbodies as conservation 'Refugia' for endangered fish species of the larger Lake Victoria.

Introduction

The recent history of fishes of Lake Victoria exemplifies an alarming pace and magnitude of change. The fishery of the lake, that once drew on hundreds of species (mostly endemic), now relies on a native pelagic minnow called 'Omena' (*Rastineobola argentea*), the introduced Nile perch (*Lates niloticus*) and the introduced Nile tilapia (*Oreochromis niloticus*) (Kaufman 1992). The cannibalistic Nile perch is threatening to destroy not only itself but also the entire lake ecosystem. Table 1 lists the endangered fish species in Lake Victoria according to the 1988 WCU Red Book of Endangered Species. An attempt should be made to rehabilitate Lake Victoria.

Native food fishes can be restored to the food market through aquaculture if kept from extinction (Goldschmidt 1989; Ogutu-Onwayo 1990; Kaufman 1992). The Lake Victoria Fisheries Research Programme was established to provide a separate management area for the conservation of native fishes. As part of this program, the present study began in 1990 with emergency surveys of Lake Victoria fauna focusing on remnants of fish communities in the lake. The survey team recommended that it was essential both for scientists and conservationists to reveal the richness and ecological significance of some of the little known lakes and dams which could become conservation parks for endangered fauna. Thus far, those of interest include Lake Kanyaboli, Lake Nyabayo, Lake Sare, Tinga Dam, Futru Dam, Ulhinya Dam, Masawa Dam and Upper Yala river and the accompanying flood plains. This paper presents some results of the surveys conducted so far.

Table 1. Endangered fish species in Lake Victoria.*

Species/Group
Haplochromines
Oreochromis esculentus
Oreochromis variabilis
Astatoreochromis alluaudi
Clarias spp.
Ctenopoma murei
Barbus spp.

* Endangered species are defined as rarely appearing or not appearing at all in catches.

Methods

The area covered by this study is shown in Fig. 1. The survey was carried out using a rubber dinghy with an outboard engine. Fish samples were obtained using trawlnets, handnets and beach seines. Fish were identified and measured using a measuring board. Transparency and water depth were measured using a secchi disc (30 cm diameter). A Digital Leitwert Messgerat meter was used to measure conductivity. A digital pH/NV (Redox) Messgeret meter was used to measure pH and dissolved oxygen (DO). A Tetratest Laboratt Kit was also used to determine pH, total hardness and carbonate/bicarbonate values. Total hardness is given here as the amount of carbonate/bicarbonate present in

solution. Fish parasites were obtained from fresh specimens and identified under a microscope.

Results and Discussion

Fish species sampled and identified are summarized in Table 2. This survey has revealed that most of the species currently thought extinct or endangered are in fact abundant in Lake Kanyaboli and other small waterbodies. These include numerous Haplochromines although most cannot be identified until DNA analysis is completed. Lake Kanyaboli is the only waterbody with an abundant population of *Oreochromis esculentus*. The endangered mollusk crusher *Astatoreochromis alluaudi* was commonly found in the catches and was present in almost all waterbodies inhabited by Haplochromines. This was attributed to food chain links.

Oreochromis variabilis, feared extinct by fishers, was found in Tinga Dam. Since this is the first time that these waterbodies have been sampled since they were built in the early 1950s, it is not possible to examine exhaustively the changes that have occurred to influence their ecology and limnology. Despite high conductivity values, these waters still support fish communities that have almost completely disappeared from the larger Lake Victoria.

Water chemistry parameters are summarized in Table 3. Extremely high conductivity values were recorded in the water bodies during the survey. Secchi disc transparency in Lake Kanyaboli varied between 25 and 30 cm. Temperature and pH values in the waterbodies were 20.5-33.2°C and 6.2-8.0, respectively. Oxygen levels varied while carbonate hardness fluctuated between 16.1 and 35.8 mg/l (as $CaCO_3$). Large macrophytes that fringed most waterbodies included *Typha*, *Cyperus*, *Potamegaton* and occasional incidences of *Eicchornia crassipes*. Incidences of parasitic infection were observed in *Protopterus aethiopicus*, *Haplochromis phytophapous* and *Oreochromis esculentus*. Parasite groups identified were species of *Argulus* and nematodes.

A management strategy has been designed to improve the water chemistry of the small waterbodies to maintain their community richness. The strategy includes captive breeding of species found in these waters. Studies on biodiversity and ecosystem modeling are already at an advanced stage.

The fauna presently found in these waters has featured prominently in past studies of vertebrate evolution, speciation, ecological plasticity and tropical community

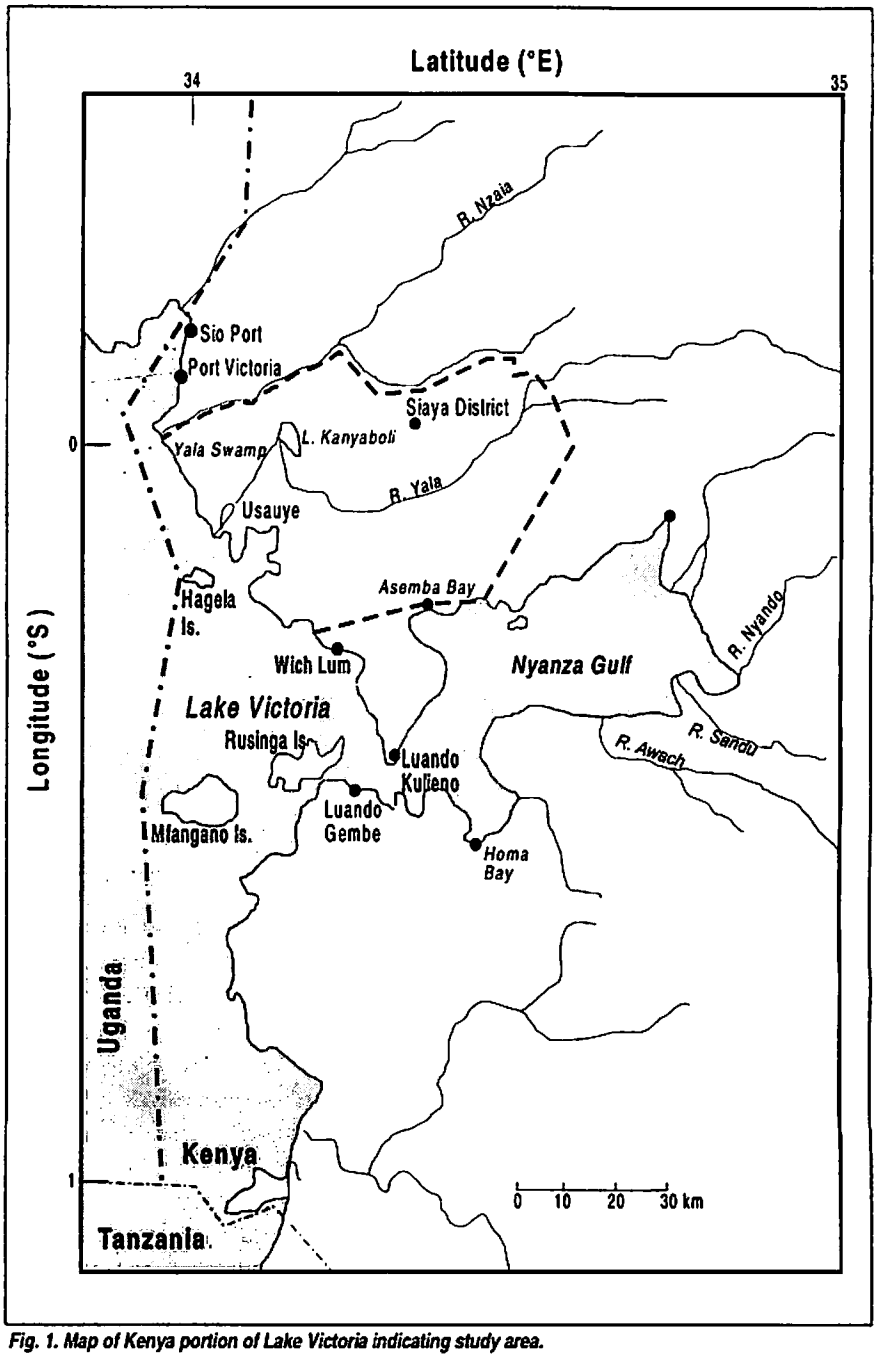

Fig. 1. Map of Kenya portion of Lake Victoria indicating study area.

structure (Fryer and Iles 1972; Goldschmidt 1989; Goldschmidt and Witte 1992). It is therefore important that these waterbodies serve as a natural living museum for conserving endangered fishes of Lake Victoria. The small size of these waterbodies makes management of such a conservation program feasible. Up to now, only preliminary surveys and captive breeding work are being conducted by KMFRI, Sangoro Research Centre, as an *in situ* conservation effort. Massive propagation through aquarium rearing of these endangered species is on the priority list of the World Bank sponsored Global Environment Facility Program, with the aim of reintroducing them into Lake Victoria.

Table 2. The ichthyofauna of Lake Kanyaboli and other small water bodies sampled by the Lake Victoria Species Survival Survey Team.

Waterbody (area)	Fish species identified
Lake Kanyaboli (10.5 km²)	*Oreochromis esculentus, O. niloticus, Haplochromis phytophagus, H. mexillaris, Protopterus aethiopicus, Clarias gariepinus, Astatoreochromis alluaudi, Aplocheilichthys pumilus, Haplochromis martini*
Lake Nyabayo	*Oreochromis esculentus, O. leucostictus, Haplochromis* spp. *Haplochromis nubilus, Astatoreochromis alluaudi*
Tinga Dam (200 x 100 m²)	*Oreochromis esculentus, O. variabilis, O. leucostictus, Astatoreochromis alluaudi*
Masawa Dam (70 x 70 m²)	*Clarias gariepinus, Oreochromis leocostica, Tilapia zillii*
Yala Dam and accompanying flood plains (173 m²)	*Ctenopoma muriei, Mormyrus kannume, Protopterus aethiopicus, Tilapia zillii, Clarias gariepinus, Synodontis victoriae, Aplocheilichthys putilus, Astatoreochromis alluaudi, Barbus* sp., *Haplochromis martini, Haplochromis* sp.
Uthinya Dam (50 x 50 m²)	*Barbus jacksoni, Barbus apleurogramma, Oreochromis leucostictus*
Futru Dam (100 x 50 m²)	*Oreochromis leucosticta, O. niloticus*

Table 3. Some physico-chemical parameters noted during the survey (surface waters) in the small water bodies. Ranges of physico-chemical parameters of Lake Victoria are also given for comparison.

Water body	pH	Temp. (°C)	Dissolved oxygen (mg/l)	Secchi disk transparency (cm)	Conductivity (µs/cm⁻¹)	Total hardness (mg/l as $CaCO_3$)
Lake Kanyaboli	7.7	21-28	10.2-11.0	25-30	349	107.4
Lake Nyabayo	6.2	22	9.7	-	62	53.7
Tinga Dam	7.6	26	-	-	670	125.3
Yala River and Floodplains	6.8-7.2	28-33.2	0.04	-	95	35.8-53.7
Masawa Dam	7.3	26.5	-	-	153	71.6
Uthinya Dam	7.5	23	-	-	-	71.6
Futru Dam	8	20.5	-	-	-	161.1
Lake Victoria	7-9	24-29	5-9.5	15-225	70-180	20-70

References

Fryer, G. and T.D. Iles. 1972. The Cichlid fishes of the Great Lakes of Africa. Oliver & Boyd, Edinburg. 622 p.

Goldschmidt, T. 1986. Niche differentiation in planktivorous Haplochromines in the Mwanza Gulf of the Lake Victoria and hypothesis on the speciation of Haplochromines in general. Ann. Kon. Mus. Mid. Afr. Zool. Wetensch. 251: 45-52.

Goldschmidt, T. 1989. An ecological and morphological field study on the Haplochromine cichlid fishes (Pisces: Cichlidae) of Lake Victoria. Rijks Universiteit, Leiden, 170 p. Thesis.

Goldschmidt, T. and F. Witte. 1992. Explosive speciation and adaptive radiation of Haplochromine cichlids from Lake Victoria: an illustration of the scientific value of a lost species flock. Mitt. Internet. Verein. Limnol. 23: 101-107.

Kaufman, L.S. 1992. Catastrophic change in species rich fresh water ecosystem. Biose 42(11): 846-858.

Ogutu-Ohwayo, R. 1990. The decline of the native fishes of Lake Victoria and Kyoga (E. Africa) and the impact of introduced species. Environ. Biol. Fish. 27: 81-90.

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