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CONTENTS

EDITORIAL NOTES:

This is the second issue of KENYA AQUATIC. The original idea was to publish the bulletin annually. The present issue has come after five months, because of our anxiety to release the accumulated material. The Kenya Aquatic aim is to treat Aquatic Science from a wider perspective and present compiled and well-documented information.

Efforts will be made to report activities related to Aquatic resources through KENYA AQUATIC. This will include scientific communications, critical reviews, seminar proceeding and other publications. This comprehensive coverage will be possible only through co-operative of various institutions, Departments, universities, societies and individuals who are concerned with aquatic resources.

KENYA AQUATICA is a technical and extension series for rapid dissemination of information on aquatic resources and allied information from Research Officers, Fisheries Officers and any individual for transfer of Technology to the fishermen and industry and any other relevant information needed for National Development.

The Editor wishes to invite comments and suggestions from readers with a view to improving the bulletin in the choice and arrangement of the articles, notes, summary, news briefs etc. It is our aim to see that this publication receives wide acceptance from the reading public and those interested in aquatic both within the country and abroad. It is hoped that this issue will stimulate further contributions from the readers.

We appeal to all concerned to send us regularly such Publications, at the following address:-

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A STATE OF FISHERY IN NYANZA GULF OF LAKE VICTORIA, EAST AFRICA

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Keywords: Nyanza Gulf, Mean catch rates,
Total catch, Lates niloticus,
Haplochromis, tilapia

Abstracts:
The endemic fishery in Nyanza Gulf of Lake Victoria has signs of severe overfishing. Bottom trawls were made in Nyanza Gulf from January, 1979 to December, 1981. Haplochromis spp. were collected infrequently in very low numbers and disappeared in Zone I and II in 1981. Lates dominated the catch. A hierarchical model showed that there are zonal and seasonal differences in Nyanza Gulf on fish species.

INTRODUCTION:

Earlier studies on the ichthyofauna of Lake Victoria (Bergstrand & Cordone 1971; Cordone & Kudhongania 1972; Kudhongania & Cordone 1974 and Marten et al., 1975) reported that the bionic and commercial contribution of the *Lates niloticus* to the ichthyofauna of Lake Victoria was insignificant, whereas *Haplochromis* spp. were significant. Cordone & Kudhongania (op. cit.) and later Kudhongania & Cordone (op. cit) observed that their sampling vessel "Ibis" was too large to operate in waters shallower than 6 m which meant that more than 50% of the surface area of Nyanza Gulf which is less than 6 m deep, was not trawled.

The importance of the Nyanza Gulf to the nutrition of the Kenyans around the Lake Basin region has shown that freshwater fish represents the largest single source of animal protein consumed. About 60,000 people depend directly on the fishery of the Gulf (Jansen, 1976). There are nearly 2,000 fishing boats (Canoes) within Nyanza Gulf and about the same number outside the Gulf (Wanjala & Marten, 1974). There is, however, a greater emphasis on seines inside the Gulf and large mesh gillnets outside the Gulf (Wanjala & Marten, op. cit.).

With the increasing human population in Western Kenya, it is of great importance to compare trawl catch rates in Nyanza Gulf, to find out whether there are changes in the fish stocks requiring different management techniques for maximum sustainable yield.

MATERIALS AND METHODS:

The study area is shown in Fig. 1 A description of the study are given by Okemwa 1983.

Fish were collected with an 85 hp diesel powered fibreglass trawler utilizing a conventional bottom trawl with a 13.7 m headrops and 36 mm mesh throughout. Three sets of replicate hauls were taken monthly in each of the fourteen sampling locations in Nyanza Gulf of Lake Victoria (okemwa, 1981). Sampling was carried out monthly from January, 1979 to December, 1981. The catch was sorted to species and weighed

Mean monthly catches for each fish species were tabulated in kilogramms and means, variances and standard deviations calculated. Due to the heteroscendasticity of standard deviations a logarithmic transformation, was utilized to permit the use of a two way analysis of variance (ANOVA model II to test simultaneously the differences among several populations and assigning to the various factors which effect the measured character their relative roles. A hierarchical model was formed to show the relationship between the factors and the fish species. Sokal & Rohlf, (1969) was used for all statistical methods.

RESULTS AND DISCUSSION:

Tables 1 through 3 list the yearly mean catch rate in kg h by species and by zones in Nyanza Gulf for the period January, 1979 to December, 1981 and shows that some species are increasing, while others are declining. The mean catch rates for the fishes in all zones show a decrease during the time the study was undertaken except for exotic species (Lates niloticus and Oreochromis niloticus) which increased (Tables 1-3). More than 90% of the catch by weight was lates in Zone $\underline{\underline{I}}$ and $\underline{\underline{II}}$, during the period this study was undertaken.

Nested ANOVA with unequal sample sizes was calculated on a hierarchical model on species and season in Nyanza Gulf.
The following summarized differences were determined:
1. Catches in Zones. A significant zonal difference by species was found with Fs - 9.014 and Fo.ol (2,11) - 7.21. The zones show an added variance among fish species in this study and may be caused by ecological factors.

2. Catches in Seasons. There was a difference among species which was significant Fs - 19.979 with Fo.1 (11,42) - 2.70. The season in this case show an added variance among fish species in Nyanza Gulf. The Two-way Analysis of variance was also used to test differences among locations, fish species and time. The result is summarized below:-

1. Total Catch. There were differences in total catch in all locations during the period 1979 to 1981 (F - 7.701 and 1.821; df - 14 and 70; P<0.001). Time had a great influence in the course of the difference.

2. Lates Catch. lates showed a significant difference among the locations and the months of (1979-1981) (F - 3.804 and 3.817; df - 2 and 12; P<0.001).

3. *Haplochromis* spp. Catch. There was a significant difference in mean monthly catch rate of Haplochromia spp. in all location during the period (1979-1981) (F - 32.271 and 11.034; df - 5 and 14; P 0.001). *Haplochromis* spp., *Bagrus docmac* , *Clarias mossambicus* and *Protopterus aethiopicus* were collected in most hauls in 1979 from all zones in Nyanza Gulf, except *P. aethiopicus*, which was not collected from Zone I and III. In 1981, *Haplochromis* spp., *C. mossambicus* were collected infrequently and in very low numbers from Zone I and II, whereas they appeared in great numbers in Zone III (Tables 1-3)

Bergstrand & Cordone (1971) recorded a mean catch of 200.2 kg h from 19 hauls made in zone I with a 38 mm codand. Marten et al. (1975) trawling in the same zone got a mean catch of 231.9 kg h from 69 hauls, whereas the present survey caught a mean value of 45.5. kg h from 433 hauls using a similar net. Non-cichlids constitute over 9.0% by weight of Nyanza Gulf Samples. Another comparison of the total mean catch rates for this study and 63 hauls from zone I and II (Benda, 1981) showed an increase in catch rate. The increase were 3 and 2 times for zone I and II respectively.

Predator fishes like Bagrus and Clarias constitute over 3% of 1981 mean catch rate (86.2 kg h) in zone I, but reached 14% of the same year mean catch rate (91.4 kg h) in zone III. The decline of Clarias and Bagrus in Nyanza Gulf may be attributed to competition from the introduced Lates which may be occupying the same niche with them. The efficient predator is likely to dominate the area, and it seems Lates is proving to be the one. The catch rate of 63.9 kg h in zone III in 1981 (Table 3) was obtained at Luanda Naya and Mbita (Shallow areas (0-10m)) and not in deep waters (20-30 m).

Sarotherodon esculentus , previously the fish of greatest commercial importance in Nyanza Gulf in the 1950's (Garrod, 1960), has vitually disappeared from much of the Lake. During this study two specimens of S. *S. esculentus* were caught.

S. leucosticus ostictus was found in zone III at 3 m depth. *S. Variabilis* and *Tilapia zilli* were found in the depth range of (0-9)m. *Oreochromis niloticus* inhabited a wider depth range of (0-14) m in all zones. Very few numbers of *Alestes* spp., Mastacambelus frenatus and *Shilbe mystus* were caught in the Gulf during the period 1979-81. *Xenoclarias* spp. was only found in zone III in 30 m depth, while *Mastacambelus frenatus*, had the narrowest bathymetric distribution (0-4) m in zones I and II

Fish total catch has been increasing during the three years of study. This increase is attributed to Lates. Lates is accepted as a food fish by the inhabitants of the Lake Basin (Okemwa, 1984). Since the rest of the fish species are declining drastically (Gerrod, 1960; Mann, 1965; Wanjala & Marten, 1974; Benda, 1979; Muller & Benda, 1981; Okemwa, 1981), Lates alone cannot continue to sustain the fishery of Nyanza GUlf because of about 60,000 people who depend directly on the fishery of the gulf (Jansen, 1976). It is suggested here that fishing of Lates can continue, meanwhile the people around the Lake shores are encouraged to establish fish ponds around Nyanza Gulf and use Lake

Research needs:
To give a clear explanation why endemic fishes in Nyanza Gulf have disappeared is difficult. Secondly no previous ecological baseline studies are available upon which to base any argument and comparisons.
Therefore, this calls for research on food chain dynamics to enable us to understand and interpret changes in fisheries, and eventual effect from pollution.

The fishery of Nyanza Gulf now depends on Lates. For better management of Lates, its biology and ecology must be understood. The fecundity of the species need to be better defined. Spawning location and substrate need to be defined by consistent spatial and temporal sampling for a year or longer period.

Migration pattern and distribution of fish species should be studied in Lake Victoria. This calls for a co-ordinated research amongst the East African states which own the waters of lake Victoria.

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Table 1. Mean of 21 monthly samples in kg/hr by fish species in Inner Nyanza Gulf for the period January 1979 - December 1981.

Location	Inner Nyanza Gulf						
Year	1979		1980		1981		
Number of months	7		7		7		
Number of hauls	107		161		73		
	Mean	S.D	Mean	S.D	Mean	S.D	F-test
Bagrus docmac	4.3	2.9	1.9	0.9	1.35	1.52	3.90*
Clarias mossambicus	3.5	3.4	11.9	0.9	1.4	1.5	1.41
Haplochromis spp.	6.6	10.3	0.6	0.4	0.0	0.0	2.24
Labeo victorianus	0.03	0.05	0.05	0.05	0.0	0.0	2.06
Lates niloticus	33.6	17.3	87.4	37.4	73.8	25.1	8.06
Protopterus aethiopus	0.0	0.0	0.05	0.05	0.67	0.16	0.73
Synodontis afrofischeri	0.3	0.4	0.1	0.1	0.03	0.05	1.67
Synodontis victoriae	0.10	0.1	1.3	1.9	2.1	3.1	1.35
Oreochromis niloticus	0.3	0.3	2.0	1.9	3.4	3.8	2.41
Sarotherodon variabilis	0.4	0.4	0.3	0.4	0.0	0.0	2.77
Tilapia zillii	0.1	0.2	0.02	0.04	0.0	0.0	1.67
Total mean catch in kg/h	46.1	26.1	93.9	36.6	86.2	22.1	4.71*

* *Calculated F-values greater than the tabulated values at - 0.05 (l(*

Table 2. Mean of 30 monthly samples in kg/hr by fish species in Middle Nyanza Gulf for the period January 1979 - December 1981.

Location	*Middle Nyanza Gulf*						
Year	*1979*		*1980*		*1981*		
Number of months	*10*		*10*		*10*		
Number of hauls	*138*		*148*		*170*		
	Mean	*S.D.*	*Mean*	*S.D*	*Mean*	*S.D.*	*F-test*
Bagrus docmac	*9.1*	*4.4*	*1.1*	*1.0*	*0.3*	*0.3*	*14.40**
Clarias mossambicus	*1.0*	*1.0*	*0.6*	*0.6*	*0.3*	*0.4*	*0.95*
Haplochromis spp.	*10.2*	*5.6*	*1.0*	*1.4*	*0.0*	*0.0*	*12.09**
Labeo victorianus	*0.7*	*0.4*	*0.7*	*1.4*	*0.1*	*0.0*	*0.05*
Lates niloticus	*43.1*	*37.4*	*74.1*	*69.8*	*124.2*	*97.4*	*1.05*
Protopterus aethiopicus	*4.3*	*7.5*	*0.2*	*0.4*	*0.2*	*0.3*	*1.32*
Synodontis afrofischeri	*0.5*	*0.6*	*0.6*	*0.5*	*0.1*	*0.2*	*1.25*
Synodontis victoriae	*0.8*	*1.4*	*0.2*	*0.3*	*0.1*	*0.1*	*3.53*
Oreochromis niloticus	*1.4*	*0.7*	*7.0*	*6.8*	*11.9*	*9.7*	*1.80*
Sarotherodon variabilis	*0.6*	*0.7*	*1.0*	*1.7*	*0.1*	*0.1*	*0.67*
Tilapia zillii	*0.4*	*0.4*	*0.2*	*0.3*	*0.02*	*0.05*	*1.45*
Total mean catch in kg/h	*72.1*	*41.2*	*86.7*	*183.5*	*137.3*	*48.8*	*0.50*

Table 3. Mean of 30 monthly samples in kg/hr by fish species in Outer Nyanza Gulf for the period January 1979 - December 1981.

Location	Outer Nyanza Gulf						
Year	1979		1980		1981		
Number of months	10		10		10		
Number of hauls	122		132		152		
	Mean	S.D	Mean	S.D	Mean	S.D	F-test
Bagrus docmac	9.2	8.3	4.7	8.0	4.1	4.5	0.68
Clarias mossambicus	0.4	0.5	0.2	0.3	8.4	3.1	10.94*
Haplochromis spp.	57.4	27.6	10.2	14.4	9.5	15.8	4.92
Labeo victorianus	1.9	0.7	0.8	0.8	0.4	0.2	0.62
Lates niloticus	0.4	0.1	0.1	0.1	63.9	78.7	1.09
Protopterus aethiopicus	0.0	0.0	0.1	0.1	0.0	0.0	1.88
Synodontis afrofrischeri	0.2	0.1	0.1	0.1	0.1	0.1	0.49
Synodontis victoriae	1.4	2.0	0.8	1.2	0.6	0.5	0.37
Oreochromis niloticus	0.2	0.1	17.3	22.6	4.4	7.5	1.22
Sarotherodon variabilis	3.0	3.6	0.6	0.9	0.02	0.05	2.09
Tilapia zillii	0.0	0.0	1.9	2.5	0.0	0.0	0.00
Total mean catch in kg/hr	74.1	13.7	36.8	12.2	91.4	70.0	0.37

* *Calculated F-values greater than tabulated F-values at - 0.05 (l).*