EAST AFRICAN COMMUNITY

EAST AFRICAN FRESHWATER FISHERIES RESEARCH ORGANIZATION

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Ten Shillings

$$\hat{Z}_i = M + bf_i \qquad (12)$$

The Z-intercept gives an estimate of M (i.e. mortality when fishing intensity is zero) and the slope gives a conversion factor from fishing intensity (f) to F. It is then possible, with M known, to prepare a graph like Fig. 1, position the existing levels of fishing on the graph, and evaluate them with respect to the optimum.

Fish samples taken in Kenya by Wanjala and Marten (presented elsewhere in this report) have demonstrated a striking difference in average length inside and outside of Nyanza Gulf, corresponding to a known difference in fishing densities. During 1975, length frequency information will be collected on all species of fish occuring in bottom trawls. Samples will extend over the entire year to average over seasonal variations in length frequency distributions, and the data on average lengths will be used to calculate Z using equation (11), M using equation (12), and Y using equation (7).

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APPENDIX G

SURVEY OF THE LAKE VICTORIA FISHERY IN KENYA

BENNY WANJALA
AND
GERALD MARTEN

The purpose of the survey, begun in 1973, has been to assess the condition of breeding stocks in the heavily fished Kenya waters of Lake Victoria and evaluate existing fisheries regulations. Although tabulation of data from the survey is not yet complete, some initial results are available for presentation. A detailed geographic breakdown of the composition of fish population and commercial catches will be given at a later date.

The procedure in the survey was to visit a different region each month, such that each major fish landing was sampled three to four times a year. At the same time that length-frequency distributions of the commercial catch were being sampled at a particular landing, we fished nearby with a 450 meter beach seine and a fleet of gillnets ranging in size from 1½ to 7 inches at ½ inch intervals. Fish we caught ourselves were measured as to length, weight, sex and gonad maturity state. This allowed us to compare the commercial catch with fish available in adjacent waters and provided information for estimating length at maturity. We were then able to judge on the basis of length how many immature fish were appearing in the commercial catch.

(1) *Composition of fish effort:*

There are approximately 2000 fishing boats inside Winam (formerly Kavirondo) Gulf and 2000 boats outside the Gulf. The fishing inside the Gulf is more intense because the area inside the Gulf is less than half the area accessible to fishing canoes outside the Gulf. There is also a greater emphasis on seines inside the Gulf and large mesh gillnets outside the Gulf (Table 1). The percentage

shown in Table I for 2½ gillnets may be underestimated because nets in this size range are illegal and therefore difficult to record.

The quantity of fishing gear per boat is similar inside and outside the Gulf (Table 1), except there are some areas inside the Gulf where the number of 1½-1⅞" gillnets per boat exceeds one hundred and the number of hooks is low.

Table 1. Gear composition of the fishery.

	INSIDE GULF		OUTSIDE GULF	
	Percentage of boats	Number of nets or hooks per boat	Percentage of boats	Number of nets or hooks per boat
1½"–1⅞ G.N	31	55	29	50
2½"–3½" G.N	1	—	2	—
4"–4½ G.N	17	40	27	45
5"–8" G.N	26	40	21	50
Hooks	11	600	15	750
Beach seines	8	—	4	—
Mosquito seines	7	—	4	—

Table 2.

	Length at first maturity (cm)	Recommended minimum mesh sizes (inches)	Percentage of immatures in commercial catches:	
			In Gulf	Outside Gulf
T. variabilis	17	4	5	30
T. nilotica	24	5	20	10
T. zillii	16	3½	50	90
Bagrus	29	4	35	20
Clarias	40	5	25	5
Synodontis	10	1.5	10	5
Protopterus	80	7	50	5
Labeo	11	2½	10	5
Schilbe	12	2½	25	15
Barbus	15	2½	75	20
Haplochromis	8–12	—	20	20
Pagraulicyprus	4	—	20	20

(2) *Length at maturity*

Table 2 gives the lengths at which the different kinds of fish reach reproductive maturity. There are indications that some fish like *Tilapia variabilis* and *Mormyrus*, reach maturity in the heavily fished Gulf at a length 2 cm shorter than the values shown in the table.

(3) *Gillnet selectivity and recommended minimum mesh sizes*

It is sound fisheries practice not to use gillnets which catch fish before they have an opportunity to spawn. The smallest mesh size for each species without catching a significant number of immature fish is shown in Table 2.

Table 2 also gives for each species, the proportion of the commercial catch which is immature, both inside and outside the Gulf.

(4) *Trends for various species*

Following are notes on the gillnet mesh sizes in which we captured the various kinds of fish, as well as changes in fish sizes observed in the commercial catch during the survey period.

Tilapia esculenta: This fish has virtually disappeared from the scene. Most of the few individuals we captured at the beginning of the study were immature fish captured by beach seine.

Tilapia variabilis: Immatures are fished heavily by beach seines. The average catch in our beach seine was 20 fish per haul. Assuming the longer beach seines in commercial operation to catch at least twice as many fish, it appears that as many as eight juvenile fish may be taken by commercial beach seines for every one mature fish taken by commercial gillnets.

The maximum length common inside the Gulf has decreased about two centimeters during the two years of the survey. Catches are highest in 3-3½ inch nets, though considerable numbers are also caught in 1½-2½ inch and 4 inch gillnets.

Tilapia nilotica: Catches have been increasing continually over the past few years. This fish does not seem to be affected so much by beach seining as *T. zillii* and *T. variabilis*. The average catch in our seine was 10 fish per haul. Less than five juveniles are taken on commercial seines for every adult taken in gillnets, *T. nilotica* is not often caught in gillnets smaller than 5 inches.

Tilapia zillii: Not so common as *T. variabilis* and *T. nilotica*. Immatures are heavily cropped by beach seines and gillnets. Although seine nets often take no *T. zilli* on other occasions they take hundreds of juveniles. The average catch in our beach seine was 30 fish per haul. It appears that as many as 30 juveniles may be taken by commercial seines for every adult taken by gillnets.

Bagrus: Captured by all mesh sizes of gillnets, but increasing in abundance during recent years and may have increased average length as well, despite the capture of a large number of immatures in the smaller mesh gillnets.

Clarias: Outside the Gulf caught mainly with hooks and large gillnets

(6-7 inches). Inside the Gulf, significant numbers are caught in gillnets down to 2½". The maximum length has shown a reduction during the survey period. The commercial catch commonly contains fish up to 80 cm outside the Gulf, but only to 65 cm inside the Gulf.

Synodontis: Caught mainly in 1½-1⅞ inch gillnets, with some appearing in 2½ inch nets. Immatures can be caught in nets of any size because they are caught by entangling. Fish over 20 cm in length, common outside the Gulf at the beginning of the survey, were rare by the end of the survey.

Protopterus: Outside the Gulf, situation similar to Bagrus. Inside the Gulf, all gillnets from 2½ to 6 inch take significant numbers of immatures. Has shown a reduction in maximum size inside the Gulf during the survey period.

Labeo: Not common. Outside the Gulf, appears in nets up to 2½ inches mainly the smallest mesh nets. Appears only in 1½-1⅞ inch nets inside Gulf. The populations cannot be expected to recover as long as large numbers of *Haplochromis* gillnets and river traps remain in use.

Schilbe: Same situation as *Labeo*, except it appears occasionally in gillnets up to 3½ inches outside the Gulf.

Barbus: Same situation as *Labeo*, except it appears occasionally in gillnets up to 5 inches outside the Gulf.

Mormyrus: Outside the Gulf, caught primarily in 2½ to 3½ inch gillnets, though caught also in the smaller meshes. Caught only in 1½ inch nets inside the Gulf.

Haplochromis and Allies: These contribute more to the commercial catch than any other kind of fish. 14 to 16 cm fish, common outside the Gulf at the beginning of the survey, were rare by the end. Maximum length has declined to 12 cm in some areas inside the Gulf. The commercial catch is as much as 35% immature in the South Nyanza region of the Gulf, including large numbers of fish down to 6 cm in length, It is likely that some of the larger species of *Haplochromis* have been virtually exterminated by overfishing in recent years, though we have no information on this because individual species of *Haplochromis* were not recorded separately.

Engraulicypris: Catches are at least five times greater than five years ago,

due to increased mosquito seining at night with lanterns. The commercial catch inside the Gulf averages one cm smaller than outside the Gulf. The commercial catch appears to have as much as 30% immature in the south Nyanza region of the Gulf.

(5) *Evaluation of the nets of intermediate size*

These nets, in the range of 2½-3½ inches, were originally banned to protect *Labeo*, particularly during spawning runs up streams. We are not able to sample any runs, because of their scarcity, and cannot comment on the impact of these nets in this situation. However, it appears they are not the only threat to *Labeo* because so many *Labeo* are caught by *Haplochromis* nets before they grow large enough to be caught in the 2½-3½ inch nets.

Nets of the 2½-3½ inch size do not appear profitable because they catch about the same number of fish as the 4-5 inch nets, but the fish are much smaller. However, there could be an incentive to use these nets in areas where *Tilapia variabilis* has become so small that catches in 3-3½ inch nets are better than 4 inch nets. The use of these nets should be discouraged because they concentrate on the immatures of not only *Tilapia variabilis* but also numerous other species.

Evaluation of seines

The nearly 1000 beach and mosquito seines operating in Kenya are responsible for catching all *Engraulicypris*. A large proportion of *Haplochromis*, and large numbers of spawning and immature *Tilapia*. Although *Engraulicypris* and *Haplochromis* may be overfished in areas where the seine is in heavy use, the beach seine is most damaging by capturing large numbers of juvenile *Tilapia*.

A closed season does not solve the problem because a beach seine can take large numbers of juvenile *Tilapia* at any time of the year. A more effective solution would be to have a large number of closed beaches which act as breeding sanctuaries. It is possible that enough beaches are already left unfished because of rocks etc. This should be the object of further investigation. If enough beaches are not free of seining, management steps should be taken to set aside sanctuary beaches.