Nearshore Fish Resources and Fisheries Around Kigoma, Eastern Coast of Lake Tanganyika

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Abstract

The fish habitats along an inshore water stretch along the eastern/central coast of Lake Tanganyika are discussed and a quantitative analysis of the species composition, distribution and abundance of the littoral fishes within the area of study is presented. Seventy-one species of fish belonging to 48 genera and to 15 fish families were collected and identified during the study. The majority of species belonged to the Cichlidae family. Intensive beach seining for clupeids is suggested as one of the causes of low fish biomass in the area surveyed. The areas south of Kigoma appeared to contain more fish, with average catch rates of 11.7 kg/haul than those north of Kigoma where average catch rates of 7.6 kg/haul were recorded. Some suggestions for improved management of these resources are given.

Introduction

Lake Tanganyika is reported to contain 250 species of fish (Brichard 1978; Kawabata and Mihigo 1982). However, most studies on the biology, ecology and stock assessment around Kigoma, Tanzania, have so far been centered on six commercially important pelagic species: two clupeids (*Stolothrissa tanganicae* and *Limnothrissa miodon*) and four centropomids (*Lates stappersi, L. mariae, L. microlepis* and *L. angustifrons*).

This paper presents a quantitative analysis of the species composition, distribution and abundance of littoral fishes in the area between Kagunga and Sigunga on the eastern coast of Lake Tanganyika (Fig. 1).

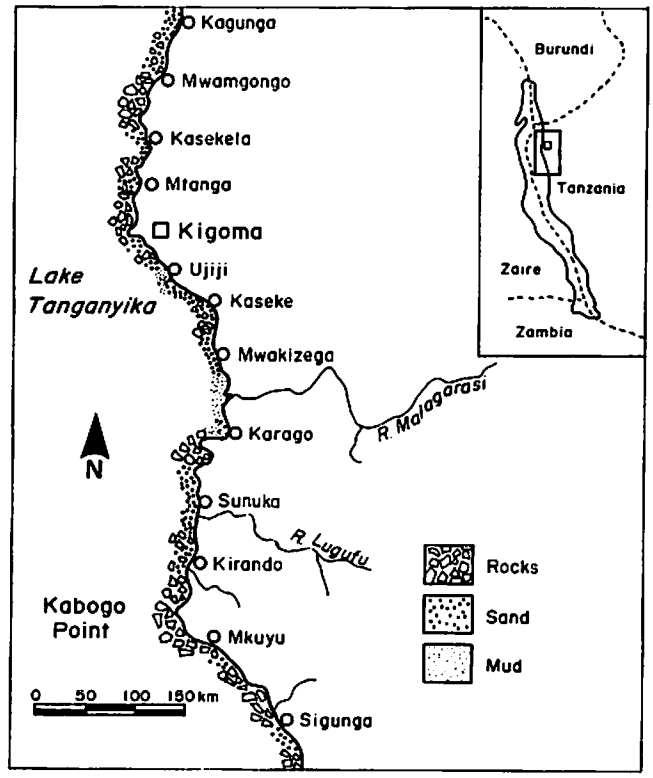

Fig. 1. *Map of the area investigated, showing the substrate condition of habitat and villages near which fish were sampled.*

Study Area and Methods

The areas considered here are in most cases close to mountains and there are only a few places where lowland stretches down to the shore. Only two major rivers, the Malagarasi and Lugufu flow into the lake, forming large deltas. Small clear torrents from mountain ridges, some of which dry up seasonally, flow into the lake, forming small deltas. In consequence rocky shores alternate with sandy shores or a combination of the two along the coast, except around major rivers where sand and mud flats prevail (Fig. 1). Around rocky habitats, hills and mountains stand very close to the shore, forming cliffs at some places; there the lake is deep even close to the shore. Along sandy shores, the lake is somewhat shallower, and the ground is covered with a mixture of sand and pebbles. Turbid water occur in and near the estuary of the Malagarasi River.

Fishes were collected by beach seine operated within the 20 m depth contour; several hauls were made in each area depending on local conditions. The catch from each haul was counted and weighted by species.

Results and Discussion

Catch composition

Seventy-one species belonging to 48 genera, included in 15 fish families, were collected and identified during this study. This is equal to 75% of all fish families known to inhabit Lake Tanganyika. Forty-one species (58%) belonged to the Cichlidae family. Unfortunately, a large part of the collection consisted of juvenile cichlids which were difficult to identify. This problem is apparently one of the causes of a relatively smaller number of species collected

Table 1. Percentage composition of catch sampled between Kagunga and Sigunga, eastern coast of Lake Tanganyika. (See Fig. 1 for locations.)

Survey number	Area covered	Percentage composition					
		All cichlids		Juvenile cichlids		Noncichlids	
		By Number	By Weight	By Number	By Weight	By Number	By Weight
1	Kigoma - Kagunga	97.8	94.2	61.0	37.5	2.2	5.8
2	Kigoma - Sigunga	88.0	80.0	74.5	39.2	12.0	20.0
3	Kigoma - Sigunga	93.4	73.9	56.2	22.6	6.6	26.0
4	Kigoma - Kagunga	97.3	82.3	46.0	12.0	2.3	17.7
5	Kigoma - Sigunga	96.0	89.0	68.4	37.8	4.0	11.0
6	Kigoma - Kagunga	95.7	80.5	71.0	15.6	4.3	19.5
7	Kigoma - Sigunga	80.6	73.9	41.0	9.4	19.4	26.1
	Average	92.6	82.0	60.0	25.0	7.0	18.0

Table 2. The percentage composition of cichlids, juvenile cichlids, *Limnotilapia dardennei* and noncichlids from catches collected during a survey conducted south of Kigoma. (See Fig. 1 for locations.)

Sampling station	Percentage composition							
	Cichlids		Juvenile Cichlids		*Limnotilapia* dardennei		Non-cichlids	
	By Number	By Weight	By Number	By Weight	By Number	By Weight	By Weight	By Weight
Sigunga	95.0	72.4	80.4	33.6	1.2	4.9	5.0	27.6
Kirando	96.0	87.6	64.9	18.3	7.4	22.4	4.0	12.4
Sunuka	97.1	90.3	56.0	31.8	11.1	9.6	2.9	9.7
Karago	77.2	24.8	22.0	2.5	2.5	1.9	22.8	75.2
Mwakizega	97.7	72.2	53.5	19.4	16.9	23.1	2.3	27.8
Kaseke	97.4	96.3	60.4	29.9	8.0	24.5	2.6	3.5
Average	93.4	73.9	56.2	22.6	7.9	14.4	6.6	26.0

and identified in this study, compared with figures reported by earlier authors.

Table 1 shows the percentage composition by number and by weight of the fish collected here. Table 2 shows the percentage composition by number and by weight of fish collected along stations south of Kigoma town. This again illustrates the dominance of cichlids, except perhaps around Karago.

Fish Distribution Patterns

Similar patterns of fish distribution were observed in the whole study area, i.e., most cichlids were collected at all stations; however, there was a noted preference of certain groups for particular habitats. Thus, on sandy shores, cichlids were more abundant than on muddy shores. Only a few noncichlid species were common to more than half the number of stations sampled; indeed, noncichlids appeared to be restricted to particular areas, particularly in Karago, near the mouth of the Malagarasi River, where *Auchenoglanis occidentalis, Hydrocyon lineatus, Citharinus gibbosus, Distichodus* sp., *Alestes macrophthalmus* and *Synodontis multipunctatus*, etc. contributed 22.8% and 75.2% by number and by weight of catches, respectively.

Boulengerochromis microlepis, Limnotilapia dardennei, Oreochromis tanganicae, Grammatotria lemairei, Tylochromis polylepis, Ophthalmochromis ventralis and *Cyathopharynx furcifer* commonly occurred on sandy bottoms, especially

Table 3. Ratio of distribution of cichlids: non-cichlids as calculated for different areas during various surveys north and south of Kigoma on the eastern coast of Lake Tanganyika. (See Fig. 1 for locations.)

Survey number	Date of sampling and area covered	Ratio of distribution between cichlids and noncichlids	
		By Number	By Weight
1*	9/11/87 - 10/11/87 and 14.12.87 - 15.12.87 (Kigoma - Kasekela)	47:1	11:1
2.	29/04/88 - 5/05/88 (Kigoma - Sigunga)	9:1	6:1
3*	12/04/88 - 15/05/88 (Kigoma - Kagunga)	36:1	5:1
4	24/07/88 - 28/07/88 (Kigoma - Mwakizega	18:1	16:1
5	3/05/89 - 13/05/89 (Kigoma - Sigunga)	27:1-	8:1
6*	12/09/89 - 16/09/89 (Kigoma - Kagunga)	81:1	4:1
7	20/11/89 - 23/11/89 (Kigoma - Sigunga)	4:1	8:1
	Average Distributional Ratios:		
	Overall	32:1	8:1
	North of Kigoma	55:1	7:1
	South of Kigoma	15:1	8:1

*Surveys made north of Kigoma.

in confined bays.

Generally, fish were sparsely distributed in the littoral area although some "pockets" of high densities were encountered in certain localities. For instance, in confined bays with pebble/sand shores, much higher fish densities were observed than on open sandy shores. However, the individual species contributed even there less than 10% both by number and weight of catches, i.e., every species was represented only by a few individuals. Cichlids, however, generally dominated over noncichlids (Table 3) though around river mouths; juvenile cichlids were fewer than elsewhere.

Petrochromis polydon, Lamprologus compressiceps and *Simochromis diagramma* were more frequently caught on rocky or sandy/rocky bottoms than elsewhere. As expected, riverine species were mostly caught near the mouths of rivers, particularly the Malagarasi. The paucity of noncichlids in areas north of Kigoma (Table 3) may be attributed to the absence of major rivers in that area.

Fish abundance and yields

I attribute the observed low densities of fish to the effect of traditional beach seining for clupeids (which peak during moonless nights and occurs in most open sandy shores), although the geomorphological nature of the inshore substrate (and thus quantity and distribution of food) can also play an important role (Brichard 1978; Hori et al. 1983). At Sunuka fish landing site alone, I found 45 canoes going for night fishing for clupeids on 1 May 1988, using 10 beach seines for use on the same beach. The inshore areas are breeding grounds for most littoral species and a nursery ground for many fish youngs (Brichard 1978). Frequent dredging on the lake floor by beach seines destroy fish nests, kill eggs and remove

Table 4. Average catch per haul and average percentage composition of catch by weight of cichlids, noncichlids and *Limnotilapia dardennei* recorded during a survey conducted south of Kigoma. (See Fig. 1 for locations.)

Station name	Total catch (kg)	Average catch per haul (kg)	Average percentage composition by weight		
			Cichlids	Noncichlids	*Limnotilapia dardennei*
Sigunga	61.6	8.8	72	28	3.4
Kirando	75.9	25.3	73	26.6	20
Sunuka	7	3.5	85.5	14.5	0
Karago*	11.2	11.2	83.9	16.1	1.8
Kasekel	2.1	6.1	90	10	21.5
Kigoma*	16	4.7	68.1	31.9	12.8

Note: Overall average catch per haul worked out from total catch and number of hauls during the survey gave 10.8 kg.

*Areas not covered well during this survey.

juveniles. Thus in the long run, the fish populations are reduced to low levels - or will tend to avoid such areas and restrict themselves to areas where such disturbances are minimal or absent (R.H. Lowe-McConnell, pers. comm.).

Table 4 gives among other things, the average catch per haul and the average percentage composition of catch by weight for cichlids, noncichlids and *Limnotilapia dardennei* south of Kigoma, where confined bays yielded higher catches (average 11.7 kg/haul) than north of Kigoma (average 7.6 kg/haul).

The inshore waters of Lake Tanganyika require special attention to safeguard both the environment and the resources. All processes harming the environment and the resource base therein must be carefully evaluated/stopped. Disposal of dangerous chemicals/pesticides, insecticides and oils or sewage disposal that may pollute the inshore water should be avoided.

References

Brichard, P. 1978. Fishes of Lake Tanganyika. T.F.H. Publications, New Jersey. 448 p.

Hori, M., K. Yamaoka and K. Takamura. 1983. Abundance and microdistribution of cichlid fishes on a rocky shore of Lake Tanganyika. Afr. Stud. Monogr. 3:25-38.

Kawabata, M. and N.Y.K. Mihigo. 1982. Littoral fish fauna near Uvira, northwestern end of Lake Tanganyika. Afr. Stud. Monogr. 2:133-143.

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Estimating the Maximum Sustainable Yield of Bonito (*Sarda chiliensis*, Scombridae) off Northern Chile from Monthly Catch Data

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Abstract

Monthly catch data of bonito *Sarda chiliensis* from northern Chile, from 1976 to 1989, were used to obtain a series of estimates of the "Z-G" parameter (i.e., total mortality rate minus the growth coefficient in weight). This series was then used to estimate a maximum sustainable yield of 4,500 t/year through a modified version of the surplus production model of J. Csirke and J. Caddy. The status of the fishery is discussed.

Introduction

In Chile, the resource of bonito (*Sarda chiliensis* Fam. Scombridae) is mostly exploited in the north (18°20'S-24°00'S) by small-scale fishers, especially during spring and summer when the bonito migrates toward the coastal zone. The products of the bonito fishery are fresh, frozen and canned bonitos. However, the catches have remained low especially when compared with those in Peru (Pauly et al. 1987).

This contribution is an attempt to estimate the maximum sustainable yield (MSY) of bonito off northern Chile, using a "catch curve method" modified to estimate the Z-G parameter, i.e., total mortality minus the growth coefficient in weight, from monthly catch data. Subsequently, the estimates of Z-G are used to estimate MSY by applying a modified version of the surplus yield model of Csirke and Caddy (1983), i.e., through a parabolic plot of total catch on Z-G.

Materials and Methods

The monthly catch data analyzed here, from 1976 to 1989, were obtained from "Statistical Fisheries Annual Reports" published by the National Fisheries Service of Chile (SERNAP).

The catch data were then grouped into seasons lasting from August of a given year to July of the following year because maximum catches of bonito tend to occur in (southern) spring and summer. Subsequently, these data were regrouped in bimonthly sets (i.e., August-