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Short communication

ABUNDANCE, LENGTH-WEIGHT RELATIONSHIP AND BREEDING SEASON OF *CLARIAS GARIEPINUS* (TELEOSTEI: CLARIIDAE) IN LAKE TANA, ETHIOPIA

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ABSTRACT: An exploratory fishery program was conducted on fourteen representative sites in Lake Tana, Ethiopia, from July 1999 to June 2001. The river mouths at Dirma, Gelgel-Abbay and Gumara showed the largest aggregation of *Clarias gariepinus* among all sites. The length-weight relationship for this fish was constructed using the least squares method, and expressed by the equation $TW = 0.0089 * (TL)^{2.910}$, $r^2 \doteq 0.946$, $p < 0.05$. This was evaluated using previous estimates made for this fish in other African waters. The main spawning season extends from April to July, where 27–56% of the fish were at the running (ripe) stage.

Key words/phrases: Abundance, breeding season, *Clarias gariepinus*, Lake Tana, length-weight relationship

INTRODUCTION

Lake Tana is Ethiopia's largest freshwater lake found in the northwestern highlands at an altitude of about 1800 m above sea level. It has a surface area of about 3200 km², with maximum and mean depths of 14 and 8 m, respectively.

Clarias gariepinus Burchell, 1822 (common English name: African catfish, local Amharic name: *Ambazza*) is the most common member of its genus (Teugels, 1986). It is a clariid fish commonly found in Ethiopian freshwaters, with an omnivorous (facultative) piscivorous/benthivorous feeding habit (Jubb, 1967; Tesfaye Wudneh, 1998). A study made at the southern gulf of Lake Tana from 1990–1993 indicated that there is one peak-spawning season (in July) for this fish (Tesfaye Wudneh, 1998).

African catfish is one of the commercially important fish species in Ethiopia (Breuil, 1995). As compared to the other species in Lake Tana, it contributed about one-quarter (24.4%) to the total annual catches (in tons) from 1997 to 1999. During 1995–1998, its composition in the exploratory fishery catches of Gumara River (a tributary of Lake Tana) was only 3.7% by number, 7.7% by weight [with frequency of occurrence (%F) of 31.7, and Index of Relative Importance (IRI) of 2.0% (Abebe Ameha and Alemu Assefa, 2002). IRI combines and shows the relative numeric abundance (N), average size (W) and the commonness of a species (F); IRI = (%N + %W) * %F.

Previous efforts made to study the biology of the African catfish in Lake Tana focused mainly on the southern gulf of the lake. Recently, an exploratory fishery program was conducted for two years to assess the status of the 'large-sized' and currently commercially important fish species all around the lake (including the northern reaches). The information included in this paper is one of the major findings of the program. It is believed to present valuable information about the abundance (spatial and temporal), length-weight relationship and breeding season of *C. gariepinus* in Lake Tana.

MATERIALS AND METHODS

Fourteen sites have been selected in Lake Tana and an adjacent river, Gumara, for the exploratory

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fishery program coordinated by the Fisheries Research and Training Center (FRTC), Bahir Dar, Ethiopia (Fig. 1). The sites were found either in open water, inshore, at a river mouth, or upstream a river. A list and description of the sites is given in Table 1.

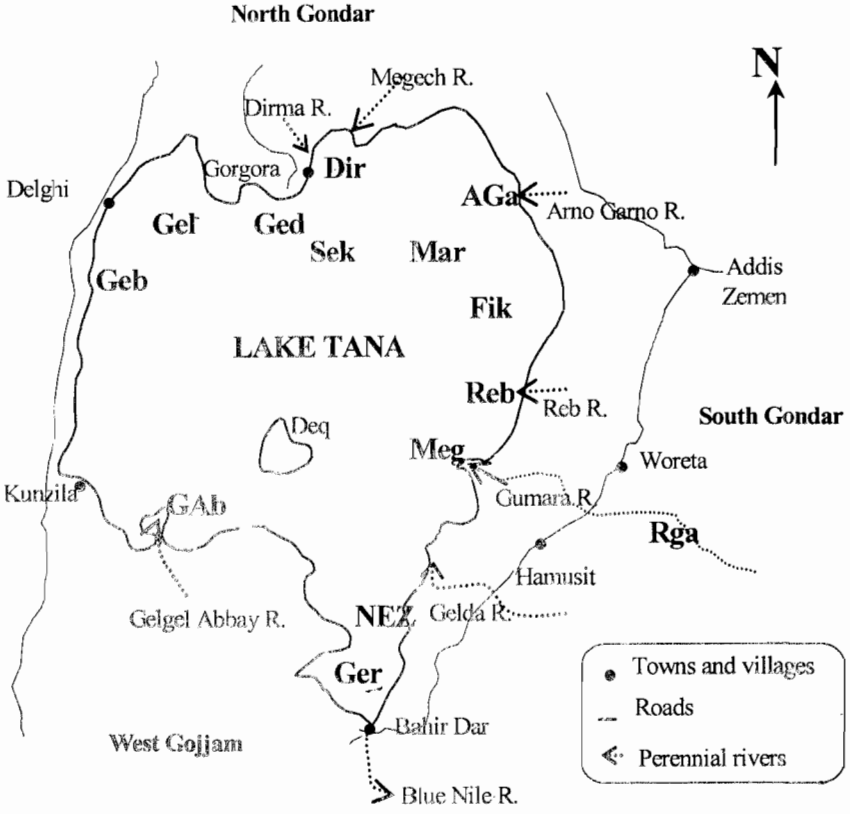

Fig. 1. Schematic map of Lake Tana and its major rivers showing the relative positions (or locations) of the fourteen exploratory fishing grounds (bold coded names); see Table 1 for description of the coded site names.

Table 1. Description of the fishing sites considered in the exploratory fishery program in Lake Tana.

Fishing site	Coded site name	Description	Nearest landmark (Woreda)
Arno-Garno	AGa	Arno-Garno River mouth, plain, muddy (2–4 m deep)	Arno-Garno River (Gondar Zuria)
Dirma	Dir	Dirma River mouth, plain, muddy (2–4 m deep)	Dirma River (Dembia)
Fikir Mecheresha	Fik	Open water (8–10 m deep)	Fikir Mecheresha Island (Libo-Kemkem)
Gebeza	Geb	Shore area, sandy/muddy (2–4 m deep)	Delghi town
Gedamat	Ged	Shore area, steep, rocky (6–8 m deep)	B/n Delghi and Gorgora
Gelgel Abbay	GAb	Gelgel Abbay River mouth, plain, muddy (2–4 m deep)	B/n Kunzila town and Deq Island
Gelila	Gel	Open water (8–10 m deep)	Delghi town
Gerima	Ger	Shore area, plain, rocky and vegetation (2–4 m deep)	Bahir Dar town
Mariam	Mar	Open water (8–10 m deep)	Mariam Church, Island (Gondar Zuria)
Megenagna	Meg	Gumara River mouth, plain, muddy (2–4 m deep)	Tana Kirkos (b/n Fogera and Dera)
Northeast Zege	NEZ	Open water, (10–13 m deep)	Zege town (Bahir Dar)
Reb	Reb	Reb River mouth, plain, muddy (2–4 m deep)	Nabega (b/n Libo-Kemkem and Fogera)
Rgarga	Rga	Upstream Gumara R., rocky pool (14 m deep)	Wanzaye (b/n Fogera and Dera)
Sekela	Sek	Open water, 8m deep	Gorgora (Dembia)

The study was conducted during the period July 1999 to June 2001 using gillnets (each sized 50 m x 3 m) having stretched mesh sizes of 60, 70, 80, 90, 100, 110, 120, and 140 mm. Twenty-four samplings were made (one per month) at each of the 14 stations over the two years period. The nets were deployed at the bottom using heavy stone loads. *C. gariepinus* specimens were collected and examined from the range of representative sites in Lake Tana. For every fish specimen caught during the study, the site, date, length (to the nearest 1 cm), weight (to the nearest 1 g), sex, and stage of gonad maturity have been recorded. For these, measuring boards, digital balances, and the five-stage gonad maturity key (discussed in Holden and Raitt, 1979) have been used. Stages 1 to 5 represent gonad states as immature, maturing (or recovering), ripening, ripe (running), and spent, respectively.

Abundance (spatial and seasonal) and breeding season are presented graphically. Length-weight relationship was established using the least squares method (Bagenal and Tesch, 1978; Sparre and Venema, 1992; LFDP, 1995, 1997), and the length-weight parameters a and b evaluated using Froese (2003) to see if the points with coordinates (b, $\log_{10}$a) tend to lie close to a straight line. The statistical analyses were performed using the computer programs SPSS for Windows 10.0 and MS Excel 2002. The significance level for all statistical tests was fixed at 0.05.

RESULTS

Spatial and seasonal abundance

Out of the 1,127 *C. gariepinus* specimens collected during the study period, the largest numbers were collected from Dirma River mouth (n = 383), Gelgel Abbay River mouth (n = 162), and Gumara River mouth (Megenagna) (n = 105). The months with the highest numbers of these fish specimens are April, May, June and July (n = 53, 78, 114, and 63, respectively). Monthly average catches of the aforementioned river mouths also indicate that May, June and July are represented by high catch levels; there is also exceptionally extended higher catch at Dirma until November.

Length-weight relationship

Descriptive statistics of the data considered in length and weight analyses is given in Table 2. The total length and total weight of *C. gariepinus* in Lake Tana show a curvilinear relationship expressed as: $TW=0.0089*(TL)^{2.91}$ (ANOVA, $p<0.05$, $r^2=0.946$, n=1119) Evaluation of these length-weight parameters indicates that the current estimates for Lake Tana are in line with previous findings for *C. gariepinus* in other African waters (Fig. 2).

Table 2. Descriptive statistics on length and weight data analyses of *C. gariepinus* in Lake Tana.

Measurement or Parameter	Female	Male
Sample size (n)	567	540
Total length range (cm)	22–94	24–106
Total weight range (g)	100–6800	100–9000
Mean total length (cm)	44.1	46.5
Mean total weight (g)	660.9	767.5
Intercept, a	0.0080	0.0091
Regression coefficient, b	2.940	2.903
r^2	0.949	0.947

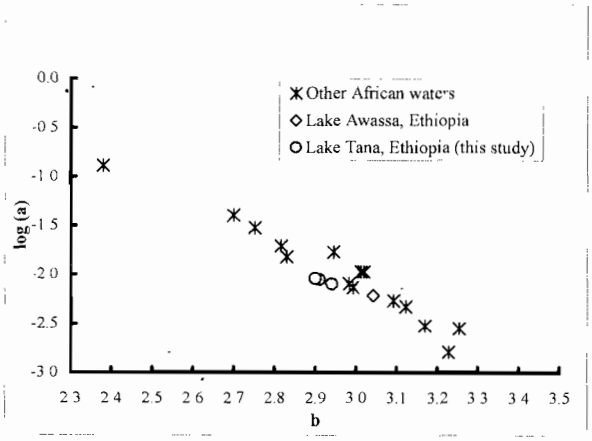

Fig. 2. Evaluation of the length-weight parameters (a and b) for *C. gariepinus* of Lake Tana using previous estimates made for Lake Awassa (Ethiopia) and other African waters (with reference to the technique presented in Froese, 2003).

Breeding season

The major spawning season of *C. gariepinus* in Lake Tana extends from April to July where 24 to 56% of the fish were found to be running (Stage 4). Following this, lots of spent (Stage 5) catfish were caught during August to November (17.1 to 58.1%). In the rest of the year (December to March) we rarely found running or spent catfishes in Lake Tana, as the majority would be in the recovering and/or ripening stages (Fig. 3).

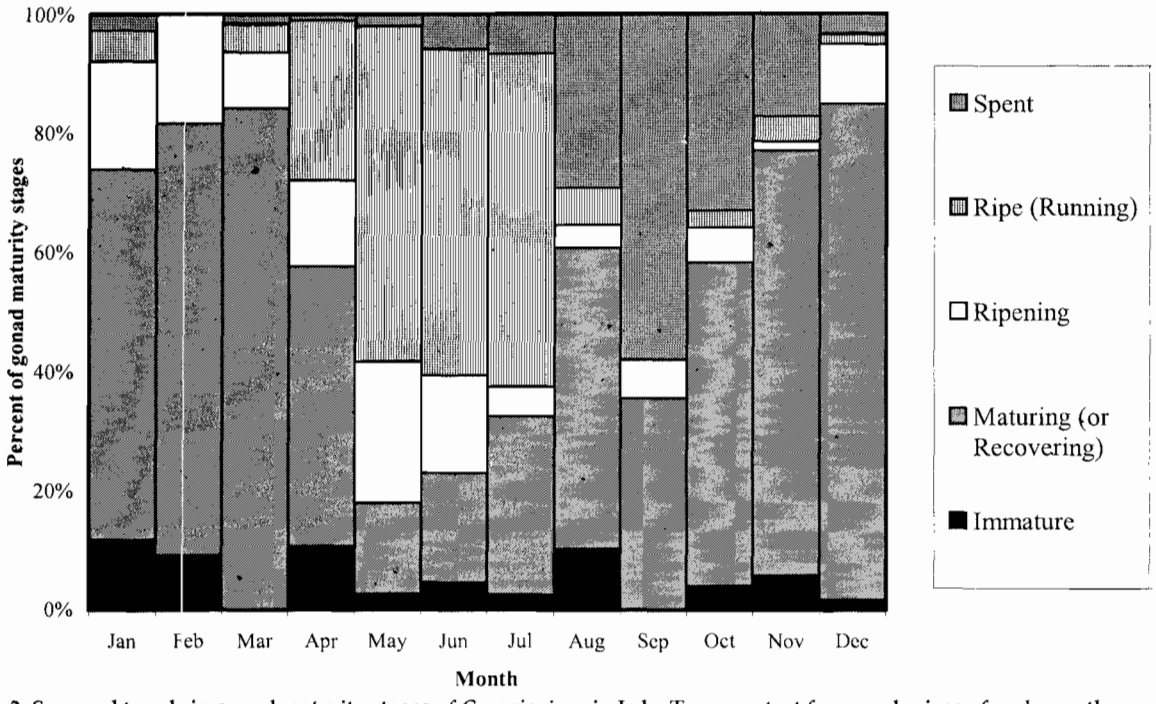

Fig. 3. Seasonal trends in gonad maturity stages of *C. gariepinus* in Lake Tana; see text for sample sizes of each month.

DISCUSSION

About 79% of *C. gariepinus* caught in this study came from the wider northern and eastern parts of Lake Tana outside the relatively well-searched, narrow southern gulf. Aggregations of these fish were found especially at the river mouths (Dirma, Megenagna, and Gelgel Abbay). The exceptionally high number of fish caught at Dirma River mouth could probably be a pronounced effect of the presence of another adjacent river mouth, Megech (Fig. 1). Dirma and Megech rivers serve as gates for the migration of *C. gariepinus* to the nearby Dembia Plain that becomes over-flooded from July to November. The higher catches at Dirma River mouth extending until November also could be attributed to the prolonged over flooding of this plain. Juveniles of the African catfish could be available in the littoral area of a lake (Clay, 1979a; Tesfaye Wudneh, 1998). However, sizes less than 22 cm were not observed in this study. That was due to the selective nature of the gillnets we used, the smallest stretched mesh size being 60 mm.

Length-weight relationships have already been established for *C. gariepinus* found in different African waters (Fig. 2); the website http://-www.fishbase.org presents a compiled list of L-W parameters for different African water bodies. Using samples collected from the southern gulf of Lake Tana, Tesfaye Wudneh (1998) presented length-weight relationship for these fish (a=0.005, b=3.05). The present estimates are made based on records of a wide size range (22–106 cm TL, and 100–9,000 g TW) collected from all around the lake over two years time. We evaluated the parameters estimated for the females, males, and both sexes combined, and found them to be in agreement with previous estimates for other waters. In the evaluation, we have also included L-W parameters for *C. gariepinus* of Lake Awassa (Ethiopia), then referred to as *C. mossambicus* (a=0.0061, b=3.042, n=918) (Elias Dadebo, 1988). Whether the catfish found in Lake Tana belong to a single population or comprise different stocks is yet to be explored. Until then, the present findings could be used as inputs for assessment of the catfish stock in Lake Tana.

The river mouths serve as gates for the breeding migration of these fish to and from the nearby floodplains (*e.g.*, Dembia and Fogera). This is evidenced by the high abundance of gonadally mature (running) *C. gariepinus* at the river mouths during April to July. This agrees with the notion that the catfish breeds in the floodplains of the feeder streams after the onset of the major rains (Greenwood, 1955; Willoughby and Tweddle, 1978; Clay, 1979b). Corbet (1961) and Thomas (1966) also have reported the migration of catfish populations.

The local people in the Fogera Plain expect invasion of the area by these fish around July 12 every year. At this time (in the evenings) large-sized (up to 150 cm TL, and 25 kg body weight) catfishes are caught in the floods using spears and hand torch to be marketed (for ETB 5 to 10 a piece) at the nearby towns (Abebe Ameha, 2001). Recently, rice cultivation is expanding in these plains during the flooding season, whose positive or negative roles on the migratory behaviour of these fish needs research focus. Traditional fish farming practices such as in the floodplains of Nigeria (Falaye and Olaniran, 2003) could be a good example to encourage catfish culture around Lake Tana.

CONCLUSION

The present findings could help as inputs to assess these fish stocks for proper utilization and conservation; we also need to broaden our knowledge about these fish through further research. Future studies on the biology of *C. gariepinus* in Lake Tana need to focus largely on the vast middle- and northern-parts of the Lake, the tributary rivers and the surrounding floodplains. These are places where the bulk of the African catfish in Lake Tana resides.

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