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Spatial and temporal distributions and some biological aspects of commercially important fish species of Lake Tana, Ethiopia

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PEER REVIEW

Peer reviewer

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Comments

This is a valuable research work in which the author have demonstrated the importance of utilization the fisheries information on the degradation the aquatic environment.
Details on Page 594

ABSTRACT

Objective: To know spatial, temporal distributions and some biological aspects of commercially important fish species of Lake Tana.
Methods: Distribution of fish species in Lake Tana was studied from November 2009 to October 2012 based on samples collected every other month using gillnets of 60, 80, 100, 120 and 140 mm stretched mesh sizes. *Labeobarbus* species, *Clarias gariepinus*, *Oreochromis niloticus*, and *Varicorhinus beso* are commercially important fish species and form 68%, 18%, 14% and 0.5% of the pooled experimental fish catch. There was significant variability among years and sampling sites of both temporal and spatial aspects; Mann-Whitney U tests were used for pair wise comparisons of sites and years.
Results: The composition of *Labeobarbus* spp. and *Varicorhinus beso* shows significant decline. On the other hand, the composition of *Oreochromis niloticus* did not change, but *Clarias gariepinus* increased by 100% by catch composition. The most likely explanations for the total decline in abundance of fish species are the increase of the illegal commercial gillnet fishery targeting their spawning aggregations in the wetlands and river mouths, and the increasing trend of the degradation of spawning and nursery habitats both in the lake and major tributary rivers of the catchment area.
Conclusions: There should be a need for urgent development of a management plan focusing on ensuring sustainable utilization of a resource by fishing effort, gear mesh size and gear type restrictions, and controlling the spawning grounds from different types of human encroachment and designing closing seasons and spawning grounds during the breeding seasons of different fish species of Lake Tana.

KEYWORDS
Breeding season, Size at first maturity, Spawning aggregation, Species composition

1. Introduction

Ethiopia is a land locked country depending only on inland water resources for the supply of fish as a low-cost protein source. The inland water body of Ethiopia is estimated to encompass about 7 400 km^2 of lake area and a total river length of about 7 000 km[1]. As many other countries challenged in the world, population rise urbanization, agricultural development, industrialization and other water resource development activities have resulted in a decrease in the species diversity of freshwater fish species[2,3]. Potential threats to Lake Tana that hamper sustainable utilization of the fish resources include recession agriculture, silt load, pollution, drainage, water level fluctuation of tributary rivers and the lake itself, fishing on breeding seasons at breeding grounds by illegal fishing gears, over exploitation of specific fish species, deforestation of the surrounding area, overgrazing, population pressure end up with habitat degradation[4].

There are over 200 species of fish and numerous other aquatic resources in Ethiopian drainage systems, of which Lake Tana sub basin with diverse ecosystem (the lake,

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the wetlands and the rivers) support unique endemic fish species of Lake Tana[4,5]. In Lake Tana, there is one cichlid, *Oreochromis niloticus* (*O. niloticus*) (Nile tilapia), which is the most widespread tilapia species in Africa. The catfish family (Clariidae) is also presented by one species, *Clarias gariepinus* (*C. gariepinus*) (African catfish), which is the most common member of its genus. This species is a facultative piscivore, feeding occasionally on fish as well as on zooplankton, benthic invertebrates and algae. The largest fish family in the lake is the cyprinids which are represented by four genera: *Varicorhinus*, *Garra*, *Labeobarbus* and *Barbus*. *Varicorhinus* is represented by a single species *Varicorhinus beso* (*V. beso*) which scrapes algae from substrates, and which is a common species in the rivers and lakes of the Ethiopian Highlands[6]. The genus *Garra* is represented by four species in Lake Tana, *Garra dembecha* which is common and generally distributed in the Ethiopian Highlands, found on the northern part of Lake Tana and two endemic species, *Garra microstoma* and *Garra tana*, recently described by Anteneh *et al*[7]. The fish community contains furthermore three diploid species of small (<10 cm) barbs: *Barbus humilis*, *Barbus pleurogramma* and the recently discovered *Barbus tanapelagicus*[8]. The last two species are endemic in Lake Tana, *Barbus pleurogramma* is mainly present in the wetlands around the Lake, *Barbus humilis* is littoral species, whereas *Barbus tanapelagicus* is common in the large pelagic zone of the Lake.

However, the four main species groups targeted by Lake Tana fishery are a species flock of endemic, large *Labeobarbus* spp., African catfish (*C. gariepinus*), Nile tilapia (*O. niloticus*), and *V. beso*. Despite *Labeobarbus* unique fish species and other three commercially important fish species of the lake and its high economic value, fish resources are under pressure by several factors. The major threat is illegal fishing followed by habitat destruction (wetland, rivers and the lake itself) due to unwise resource exploitation. Therefore, the purpose of exploratory programme is monitoring and evaluating the dynamics of fish stock and other limnological parameters on yearly basis. This scientific paper is therefore, important to know spatial, temporal distributions and some biological activities of commercially important fish species of Lake Tana for both scientific community and developmental arenas to design good management plans for sustainable utilization.

2. Material and methods

2.1. Study area description

The study was conducted in the southern and northern part of Lake Tana. The lake is the largest one (3 150 km^2) in Ethiopia, comprising 50% of the total freshwater resources of the country[8]. It is a shallow lake with a mean depth of 8 m and maximum depth of 14 m, situated 1 800 m above sea level. Seven large, permanent rivers and about 40 small seasonal rivers feed the lake. The trophic status of Lake Tana is oligotrophic to mesotrophic[9,10]. Its bottom is volcanic basalt mostly covered with a thin layer of organic matter. Lake Tana and its adjacent wetlands both directly and indirectly provide a livelihood for more than 500 000 people[11] and about three million people live in the catchment. The population distribution is high in those areas to the northeast and south of Lake Tana. The population density ranges from 151-200 persons per km^2 in the north and in some parts of Fogera plain to the east, and from 101-150 persons per km^2 in the more fertile lowland areas to the east and southwest[12].

2.2. Sampling sites and data collection

A total of six sampling sites both from the southern and northern part of Lake Tana were sampled every other month from November 2009 to October 2012. The gill-nets used had mesh sizes of 60, 80, 100, 120 and 140 mm stretched mesh. The size of a single mesh panel was 3 m×50 m. The various mesh sizes were chosen because the gill-nets must be able to efficiently catch the whole range of species and size classes. Five panels were combined to form one multi-mesh gill-net. Fish sampling methodology was standardized throughout the project period to ensure comparability within and among years. The nets were set at 6:00 p.m. and collected at 6:00 a.m. and the catch data were adjusted to units of catch per trip as a standard estimate of relative abundance.

Representative sampling sites/habitats were selected. They are Abbay, Zegie, and Gerima in the southern part, and Dirma, Sekela, and Gedamat in the northern part of the Lake (Figure 1). The sites selected reflect the different habitat types present in the lake such as river mouths, deep water, muddy or rocky bottoms, and dense stands of aquatic macrophytes. The Dirma and Abbay sites are representatives of river mouth habitats. Sekela and Zegie represent a habitat of open water (>9 m) and Gerima and Gedamat represent a habitat of shallow water with dense stands of aquatic macrophytes. Littoral habitat in the southern part is similar to the northern part except that the human influence is significantly larger in the southern part.

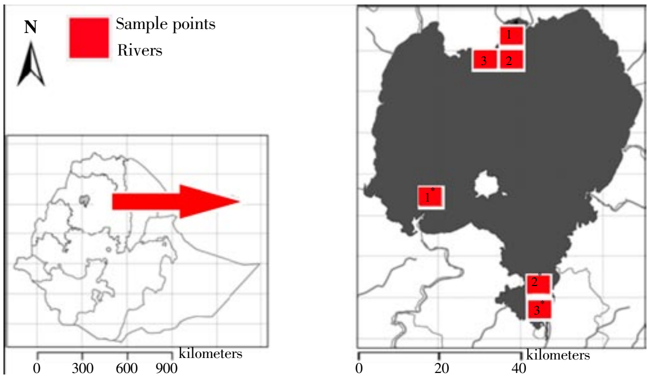

Figure 1. Map of the study area and sampling sites.
1: Dirma river mouth; 2: Sekela open water; 3: Gedamat littoral habitat;
1*: Abay river mouth; 2*: Zegie open water and 3*: Gerima littoral habitat.

Immediately after capture all specimens of total length, fork length, standard length and body weight were measured to the nearest 0.1 cm and 0.1 g precision of length and weight, respectively. Gonads of fishes were analyzed based on five maturity stage categories immature (i), developing virgin or recovering spent (ii), ripening (iii), ripe (iV) and spent (V). Of these maturity stages iii, iV and V were considered as matured gonads[13].

2.3. Data analysis

Data were analyzed using statistical softwares and simple descriptive statistics. PASGEAR, SAS for windows version 2.4 and Mintab for windows version 14 were used for analysis. An index of relative importance (IRI) and Shannon diversity index (H′) were used to evaluate relative abundance and species diversity of fishes, respectively.

IRI gives a better representation of the ecological importance of species rather than the weight, numbers or frequency of occurrence alone[14]. IRI (%) was calculated as:

$$\%IRI=\frac{(\%Wi+\%Ni)\times\%Fi\times100}{\sum_{j=1}^{z-1}(\%Wj+\%Nj)\times\%Fj}$$

Where %Wi and %Ni are percentage weight and number of each species of total catch respectively; %Fi is percentage frequency of occurrence of each species in total number of settings. %Wj and %Nj are percentage weight and number of total species of total catch. %Fj is percentage frequency of occurrence of total species in total number of settings.

The H′ is a measure of the number of species weighted by their relative abundances[15]. H′ was calculated as:

$$H'=\sum pi\ln pi$$

Where, pi is the proportion of individuals found in the ith species. H′ was used to indicate diversity at different sampling sites and/or rivers. A high value indicates high species diversity.

3. Results

3.1. Composition and abundance of fish

A total of 1 780 specimens representing 17 species in three families were collected from six sampling sites which represent river mouth, open water and littoral habitats. A biological indicator shows that spawners are delayed in their life time to spawn; this is a strategy to produce more eggs at a time so as to increase survival rate of juveniles. That means both breeding and nursery grounds of fishes are in critical problems including lack of maternity care due to heavy fishing at breeding and nursery grounds. Catch compositions of *V. beso*, Nile tilapia (*O. niloticus*), African catfish (*C. gariepinus*), and species flock of endemic, large *Labeobarbus* spp. were the four main species groups targeted by exploratory fishery program of Lake Tana and form 0.5%, 14%, 18%, and 68% of the pooled annual catch compositions by number of fish species during the study period, respectively (Figure 2).

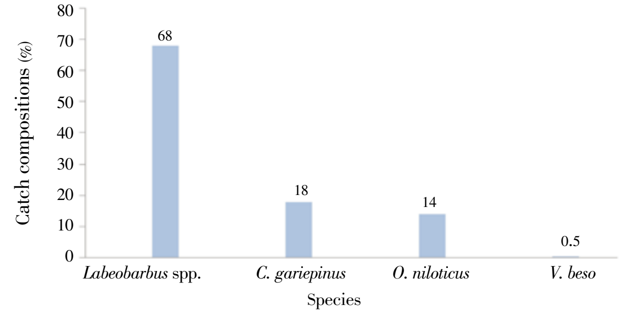

Figure 2. Species catch composition of Lake Tana by number from 2009 to 2012.

C. gariepinus catch composition increased significantly from 9% to 18% due to less demanded by the consumers as a result not targeted by fishers. *O. niloticus* catch composition did not show significant change. Of the *Labeobarbus* species, only one specimen of *Labeobarbus macrophtalmus* and none of *Labeobarbus dainellii* were found from the total catches of the present study. The composition in terms of fish weight also followed the same trend, as a result *Labeobarbus* spp. and *C. gariepinus* formed 54.5% and 31.4%, and *O. niloticus* and *V. beso* formed 14.1% and 0.2% (Table 1). The *Labeobarbus* spp. were composed of 15 large labeobarb species. Among the *Labeobarbus* spp., *Labeobarbus intermedius* (*L. intermedius*) dominated the catch by weight 24.3%, 8.6% and 4.5% followed by *Labeobarbus crassibarbis* (*L. crassibarbis*) and *Labeobarbus megastoma*, respectively (Table 1).

Table 1

Species catch composition and IRI.

Species	No	% No	Weight (kg)	% Weight	FRQ	% FRQ	IRI	% IRI	H`	J`
Int	798	41.5	155.914	24.3	136	50.2	3304	50.7	0.365	
Cla	288	17.9	175.118	31.4	111	41.0	2018	31.0	0.308	
Til	230	13.7	70.444	14.1	69	25.5	706	10.8	0.272	
Tsa	103	5.4	21.762	3.4	37	13.7	120	1.8	0.158	
Cra	54	2.7	47.304	8.6	25	9.2	104	1.6	0.098	
Meg	66	3.8	24.790	4.5	28	10.3	85	1.3	0.124	
Pla	46	2.9	19.753	3.3	26	9.6	59	0.9	0.102	
Bre	76	3.6	8.665	1.1	22	8.1	38	0.6	0.120	
Ned	31	2.1	10.579	2.2	17	6.3	27	0.4	0.080	
Acu	29	2.3	5.795	1.3	16	5.9	22	0.3	0.088	
Tru	20	1.4	10.131	2.2	12	4.4	16	0.2	0.058	
Sur	13	1.1	3.622	0.9	11	4.1	8	0.1	0.049	
Gor	6	0.5	6.326	1.6	6	2.2	5	0.1	0.028	
Bes	7	0.5	0.845	0.2	6	2.2	2	0.0	0.028	
Gon	7	0.3	7.823	0.7	3	1.1	1	0.0	0.016	
Lon	5	0.3	8.100	0.4	3	1.1	1	0.0	0.016	
Total	1780	100.0	576.971	100.0	:	:	6515	100.0	1.916	0.69

Int: *L. intermedius*, Cla: *C. gariepinus*, Til: *O. niloticus*, Tsa: *Labeobarbus tsanensis*, Cra: *L. crassibarbis*, Meg: *Labeobarbus megastoma*, Pla: *Labeobarbus platydorsus*, Bre: *Labeobarbus brevicephalus*, Ned: *Labeobarbus nedgia*, Acu: *Labeobarbus acutirostris*, Tru: *Labeobarbus truttiformis*, Sur: *Labeobarbus surkis*, Gor: *Labeobarbus gorguari*, Bes: *V. beso*, Gon: *Labeobarbus gorgorensis*, Lon: *Labeobarbus longissimus*. FRQ: frequency of occurrence; J`: evenness of the population.

3.2. Spatial distribution

The total percentage distribution of fish caught by number and weight, respectively during the research period in the river mouths of Abbay and Dirma were 33.6%, 41.7% and 13.8%, 11.6%; open water of Zegie and Sekela were 10.1%, 12.9% and 8.1%, 6.8% and shore habitats of Gedamat and Gerima were 20.7%, 18.0% and 13.5%, 8.8%, respectively. There were significant spatial differences in the numbers and weight of fish among the habitats of the experimental gillnet catch (P<0.05, n=3*48, Kruskal walias H test). The river mouth habitat had significantly higher numbers of fish and fish weight followed by shore vegetative habitat and the open water station had the lowest than others (Figure 3). Normally catches from open water sites are less than catches of shore habitats. But despite its importance of catch abundance, river mouth Dirma and shore habitat Gerima are sampling sites where human encroachment pressure is very high including heavy fishing, as a result it registered the lowest catch composition.

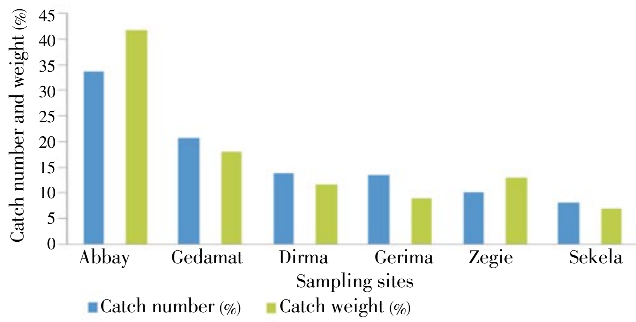

Figure 3. Percentage of catch number and weight in sampling sites.

The *Labeobarbus* spp. were the most dominant species in Lake Tana; this species comprised 58.2% IRI of the catches, of which *L. intermedius* was the most abundant species according to IRI (50.7%), while *Labeobarbus tsanansis* was second (1.8%) and *Labeobarbus crassibarbis* was third (1.6%) in the total catch (Table 1). The second most dominant commercially important fish species in the total catch was *C. gariepinus* that comprised 31% IRI (Table 1). *O. niloticus* was the third dominant species in the total catch, which comprised 10.8% IRI. The average weight (kg) per set was registered 1.5 kg/set, which is very small catch harvested with 250 m gillnet length with 3 m width set on over night. *C. gariepinus* was the first dominant fish species by weight, which was 0.5 kg/set followed by *L. intermedius* of 0.4 kg/set (Table 2).

Gillnet selectivity has been compared among 6 cm, 8 cm, 10 cm, 12 cm and 14 cm stretched mesh sizes. Of those, 6 cm mesh size has caught 43.6% of the total catch by number, followed by 8 cm mesh size of 28.6%. The total catch distribution along experimental stretched mesh size gillnets 6 cm and 8 cm has shown significant difference among the others during the study periods (Table 3). This implies that Lake Tana fisheries pressure has put a negative impact and small sized fishes become more abundant than table sized ones. Mean length of fishes caught by different stretched mesh size gillnets showed an overlapped length differences when the fish caught by wider mesh sizes than the smaller mesh sized gillnets (Table 3).

Table 2

Average number and weight of fishes caught per set of experimental gillnets.

Species	No	% No	Weight (kg)	% Weight	No/set	SD No/set	Weight kg/set	SD Weight kg/set
Cla	288	17.9	175.118	31.4	0.7	1.2	0.5	0.9
Int	798	41.5	155.914	24.3	1.7	2.6	0.4	0.6
Til	230	13.7	70.444	14.1	0.6	1.4	0.2	0.6
Cra	54	2.7	47.304	8.6	0.1	0.4	0.1	0.8
Meg	66	3.8	24.790	4.5	0.2	0.6	0.1	0.3
Tsa	103	5.4	21.762	3.4	0.2	0.7	0.1	0.2
Pla	46	2.9	19.753	3.3	0.1	0.4	0.0	0.2
Ned	31	2.1	10.579	2.2	0.1	0.4	0.0	0.2
Tru	20	1.4	10.131	2.2	0.1	0.3	0.0	0.3
Gor	6	0.5	6.326	1.6	0.0	0.1	0.0	0.2
Acu	29	2.3	5.795	1.3	0.1	0.4	0.0	0.1
Bre	76	3.6	8.665	1.1	0.1	0.6	0.0	0.1
Sur	13	1.1	3.622	0.9	0.0	0.2	0.0	0.1
Gon	7	0.3	7.823	0.7	0.0	0.1	0.0	0.1
Lon	6	0.3	8.100	0.4	0.0	0.1	0.0	0.1
Bes	7	0.5	0.845	0.2	0.0	0.1	0.0	0.0
Total	1780	100.0	576.971	100.0	4.1	3.9	1.5	1.6

Cla: *C. gariepinus*, Int: *L. intermedius*, Til: *O. niloticus*, Cra: *L. crassibarbis*, Meg: *Labeobarbus megastoma*, Tsa: *Labeobarbus tsanensis*, Pla: *Labeobarbus platydorsus*, Ned: *Labeobarbus nedgia*, Tru: *Labeobarbus truttiformis*, Gor: *Labeobarbus gorguari*, Acu: *Labeobarbus acutirostris*, Bre: *Labeobarbus brevicephalus*, Sur: *Labeobarbus surkis*, Gon: *Labeobarbus gorgorensis*, Lon: *Labeobarbus longissimus*, Bes: *V. beso*.

Table 3

Gillnet selectivity of 6 cm, 8 cm, 10 cm, 12 cm and 14 cm stretched mesh sizes.

	Gil (6)	Gil (8)	Gil (10)	Gil (12)	Gil (14)
No	776.0	510.0	194.0	187.0	113.0
% No	43.6	28.6	10.9	10.5	6.4
SD No/set	4.6	3.8	2.7	2.4	3.3
Length cm/No	23.9	30.0	35.5	37.4	40.5
SD Length cm/No	6.0	7.5	11.7	11.5	16.0
Weight g/No	171.9	306.6	557.0	754.2	952.0
SD weight g/No	165.3	163.3	491.3	626.0	860.3

No: Number, SD: standard deviation.

3.3. Some biological aspects of dominant fish species

3.3.1. Length–weight relationship

The relationship between total length and total weight for most dominant species of *L. intermedius*, *C. gariepinus*, and *O. niloticus* was curvilinear, and as a result the line fitted to the data was described by the regression equation shown in Figure 4. In fishes, the regression coefficient b=3 describes isometric growth, when the value becomes exactly 3, if the fishes retain the same shape and their specific gravity remains unchanged during their life time[16]. If the weight increased according to the fish length, it is said to be isometric growth[17]. However, fishes may have "b" value greater or less than 3, a condition of allometric growth[18]. Therefore, according to the present study, *O. niloticus* exhibits isometric growth, on the other hand *L. intermedius* and *C. gariepinus* exhibit negative allometric growth (Figure 4).

3.3.2. Sex ratio

During the sampling period, from the total population of catches those specimens which were considered matured by taking maturity stages of iii, iV and V as matured were 34% of the population. Of the matured population, percentage of

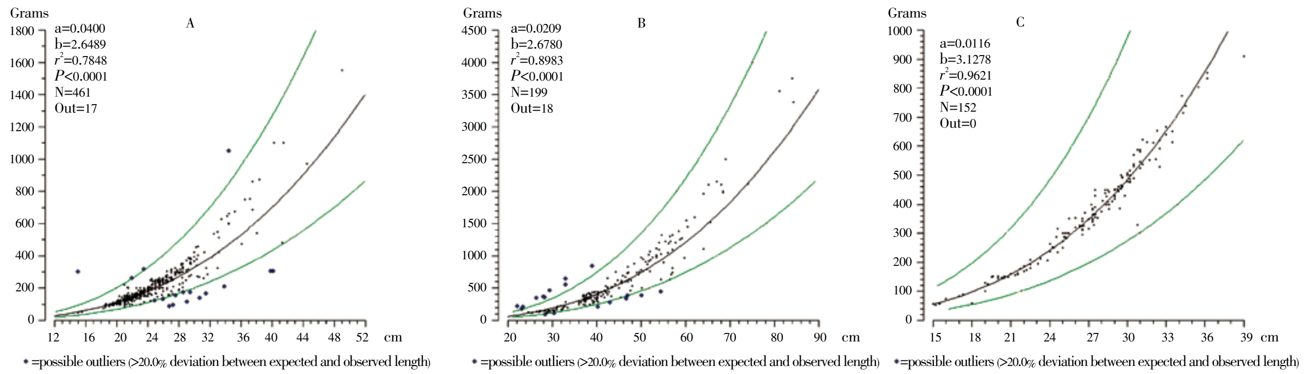

Figure 4. Length-weight relationship of the dominant fish species. A: *L. intermedius*, B: *C. gariepinus* and C: *O. niloticus*.

maturity for males was 53% and for females 24%. Of the 1 780 fish samples, 588 (33.03%) were males while the remaining 1 192 (66.96%) were females. The overall sex ratio of males to females was 1:1.9; this ratio was significantly different from the hypothetical ratio of 1:1 (x^2, $P<0.05$) (Table 4).

Table 4

Maturity stages by sex.

Sex	Maturity stages					Total
	i	ii	iii	iV	V	
Male	0	314	131	142	1	588
Female	1	945	106	139	1	1 192
Total	1	734	164	210	2	1 780

3.3.3. Breeding season

Matured fishes during the different time of a year were evaluated, as a result three months considered peak spawning seasons for commercially important fishes of Lake Tana, and these are May for *O. niloticus*, June for *C. gariepinus* and August for *Labeobarbus* spp. The proportion of fish with ripe gonads was relatively low during the other months. The above mentioned months might be very important for management options of Lake Tana to be closed seasons, so that spawners could have a chance not to be targeted by fishers.

The breeding season of *O. niloticus*, *C. gariepinus* and *Labeobarbus* fish species was determined from percentages of fish with ripe gonads taken monthly during the study periods. Therefore, May was found to be peak breading season for *C. gariepinus*, April for *O. niloticus* and August belongs to the peak breading season of *Labeobarbus* spp (Figure 5). *O. niloticus* exhibited a long peak breeding season where intensive breeding activity occurred during the months of April, May and June, where May is the most peak one. During the other months, even though considerable proportions of fish were found in breeding condition, their proportion was much lower than the main breading seasons mentioned above.

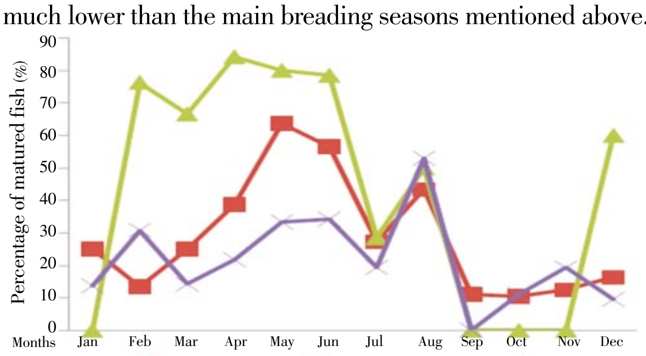

Figure 5. Percentage of matured fishes of *O. niloticus*, *C. gariepinus* and *Labeobarbus* spp. on monthly bases.

3.3.4. Size at first maturity

The percentage of male and female *L. intermedius*, *O. niloticus* and *C. gariepinus* species having gonad stages iii, iV and V[13] in different lengths were plotted against length for each species and sex using the data from the study period. The average length at which 50% of the *L. intermedius* males reached maturity was 25.9 cm fork length while the length at which 50% of the females attained sexual maturity was 35.7 cm fork length (Figure 6).

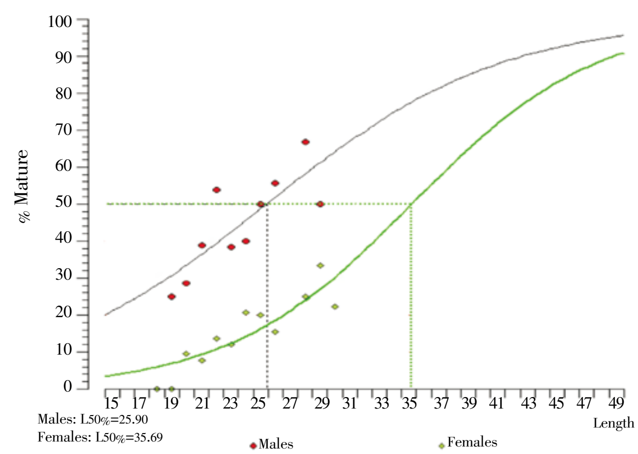

Figure 6. Size at first maturity of *L. intermedius*.

The average length at which 50% of the *O. niloticus* males reached maturity was 23.4 cm total length (TL) while the length at which 50% of the females attained sexual maturity was 21.2 cm TL (Figure 7). The average length at which 50% of the *C. gariepinus* males reached maturity was 43.2 cm TL while the length at which 50% of the females attained sexual maturity was 57.7 cm TL (Figure 8).

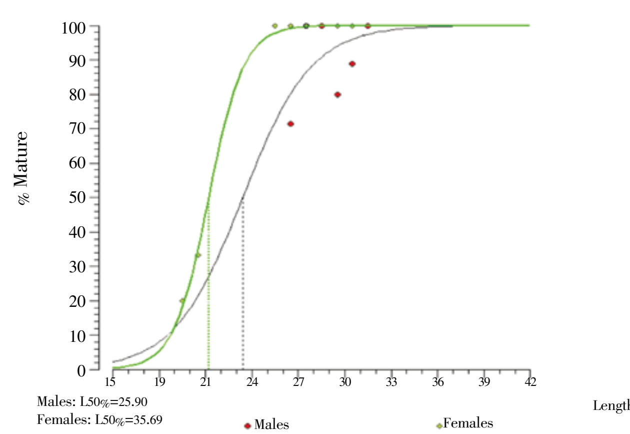

Figure 7. Size at first maturity of *L. intermedius*.

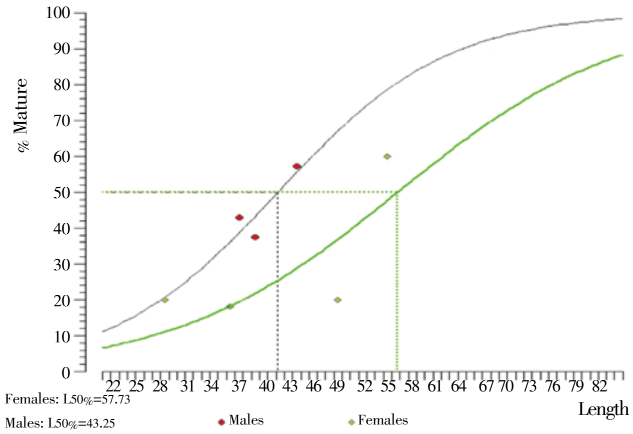

Figure 8. Size at first maturity of *C. gariepinus*.

Size at maturity is negatively correlated to the degree of fishing mortality. As the fishing mortality increases, fish population responds to the new environmental circumstances by changing their life history pattern in order to compensate the losses imposed by fishing activity by lowering size at maturity. But in this study, size at maturity found to be more elongated than it was before; this indicates that juveniles mortality due to different factors they imposed is much higher than the existing fishing pressure that targets table sized fishes.

4. Discussion

According to Goshu *et al*[4], a total of 14878 specimens, representing 18 species in three families were captured from the river mouth, open water and littoral habitats of the same sampling sites and duration of study periods as the present study and catch compositions by number was 77% and 13% for *Labeobarbus* spp. and *O. niloticus* and 9% and 1% for *C. gariepinus* and *V. beso*, respectively. Contrary results from the present study (isometric growth) were obtained for *Leptochondria* cf. *intermedius* in Lake Awassa and by Goraw *et al.*[4] in Lake Tana. It reported that the same phenomena of predominantly higher proportion of females in larger size classes was in another cyprinid fish *Labeo horie* (Heckel) in Lake Chamo. This could be because of the difference in growth rate of both sexes where females attain larger size than males. Other biological mechanisms such as differential mortality rates, or differential migratory patterns between the male and female sexes may also cause unequal sex ratios. Several environmental factors could be responsible for the high breeding activity of particular fish species such as change in temperature, water level, beginning of rainy season, change in conductivity. The sizes at 50% maturity of the above different fish species of females were much higher than those reported by other investigators of Lake Tana[8,10].

The spatial and temporal distribution and composition differences of fishes have been observed over the sampling years. As a result there is ten fold declines in number of specimens caught and of the *Labeobarbus* species; only one specimen of *Labeobarbus macrophtalmus* and none of *Labeobarbus dainellii* was found from the total catches of the study periods compared with a study in eight years time interval[4]. There has been also observed a significant species catch difference, which is more pronounced in *Labeobarbus* spp. that shift from 77% to 68% of the total experimental catch and *V. beso* has dropped from 1% catch composition of the former study period to 0.5% of the present study. On the other hand, *C. gariepinus* increased from 9% to 18% by catch composition. It is most likely that the commercial gillnet fishery targeting the spawning aggregations, illegal fishing with small mesh sized monofilament gillnets, beach seines, ecosystem degradation particularly spawning grounds through human encroachment, river disconnectivity and channelization had a harmful effect on the population densities and composition of the stock.

On top of this, lack of enforcement actions on fisheries resource legislation had severe negative impact on the stocks of the shoreline spawning *O. niloticus* and *C. gariepinus* and *Labeobarbus* species aggregations at river mouths during spawning seasons.

In order to protect the breeding population of fishes, fishing should be restricted in the shallow littoral areas and river mouths as well as up streams during the peak spawning months of the specified fish species. Since females start reproduction at larger size than males in the case of *L. intermedius* and *C. gariepinus* and at smaller size than males for *O. niloticus*, capture size of the stock should take the size into consideration at first maturity of females.

Conflict of interest statement

I declare that I have no conflict of interest.

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Comments

Background

Knowledge of the spatial and temporal distribution of commercially important fish is very important as well as their biology, for decision-making in the management of fisheries resources. Especially when it comes to inland freshwater resources under great anthropic intervention activities.

Research frontiers

The present research work depicts the Spatial and temporal distributions and some biological aspects from fourh fish species with commercial important, analyzing the landing composition, the decline abundance fish species and degradation their spawning and nursery habitats.

Related reports

Clearly, information of this kind are necessary for a better understanding of the life cycle of the species fish and their population dynamics, as they interact with the functioning of the aquatic ecosystem in the form attached, to achieve a commercial and sustainable use of fishery resources

Innovations and breakthroughs

Although any new knowledge about the biology of a species of commercial interest is always welcome, in this case the contribution is minimal, because considering that the volume of data is acceptable from a statistical point of view, and with a high potential for do a good job, the depth of his analysis was very limited and superficial.

Applications

Information about the distribution and natural history of the species of commercial fish, are fundamental to the design of fishery management plans or for mapping of fisheries resources in a particular region, in this case it is not. The information provided by ecological indices are very useful for studies of community ecology, but of little use in studies of fish population dynamics.

Peer review

This is a valuable research work in which the author have demonstrated the importance of utilization the fisheries information on the degradation the aquatic environment.

References

[1] Vijverberg J, Sibbing FA, Dejen E. Lake Tana: source of the Blue Nile. In: Dumont HJ, editor. *The Nile, origin, environments, limnology and human use.* Germany: Springer; 2009, p. 163-191.

[2] IUCN. Overview of the conservation status of cartilaginous fishes (Chondrichthyans) in the Mediterranean Sea. Switzerland: IUCN; 2007. [Online] Available from: http://cmsdata.iucn.org/downloads/med_shark_rep_en_1.pdf. [Accessed on 23rd July, 2013].

[3] Amhara National Regional State Livestock Resources Development and Promotion Agency. *Lake Tana fisheries management plan and processing manual.* Bahir Dar, Ethiopia: Amhara National Regional State Livestock Resources Development and Promotion Agency; 2011, p. 107.

[4] Goshu G, Tewabe D, Adugna BT. Spatial and temporal distribution of commercially important fish species of Lake Tana, Ethiopia. *Ecohydrol Hydrobiol* 2010; **10**(2-4): 231-240.

[5] Tewabe D, Getahun A, Dejen E. Diversity and relative abundance of fishes in some rivers of the Tekeze and Blue nile (Abay) basins, Ethiopia. *Ethiop J Biol Sci* 2010; **8**(2): 145-163.

[6] Gebremedhin S. Spawning migration of *Labeobarbus* species to Arno-Garno River, Lake Tana sub-basin, Ethiopia[MSc Thesis]. Bahir Dar, Ethiopia: Bahir Dar University; 2011.

[7] Anteneh W, Getahun A, Dejen E. The lacustrine species of *Labeobarbus* of Lake Tana (Ethiopia) spawning at Megech and Dirma tributary rivers. *SINET* 2008; **31**: 21-28.

[8] Mohammed B, de Graaf M, Nagelkerke LA, Mingist M, Anteneh W. Lake Tana's (Ethiopia) endemic *Labeobarbus* species flock; an uncertain future threatened by exploitation, land use and water resource developments. In: Lemma B, Getahun A, editors. Proceedings of the 3rd Annual Conference on Impacts of Climate Change and Population on Tropical Aquatic Resources; 2011 Feb 3-6; Harar, Ethiopia. Addis Ababa: The Ethiopian Fisheries and Aquatic Sciences Association; 2011, p. 285-297.

[9] Serena F, Mancusi C, Barone M. Field identification guide to the skates (Rajidae) of the Mediterranean Sea. Guidelines for data collection and analysis. *Biol Mar Mediterr* 2010; **17**: 204.

[10] Ajala OA. Livelihoods pattern of "Negede Weyto" community in Lake Tana shore, Bahir Dar Ethiopia. *Ethiop J Environ Stud Manage* 2008; **1**: 19-30.

[11] Wondie A, Mengistu S, Vijverberg J, Dejen E. Seasonal variation in primary production of a large high altitude tropical lake (Lake Tana, Ethiopia): effects of nutrient availability and water transparency. *Aquat Ecol* 2007; **41**: 195-207.

[12] Ricker WE. *Computation and interpretation of biological statistics of fish populations.* Ottawa, Canada: Department of the Environment, Fisheries and Marine Service; 1975.

[13] De Graaf M, van Zwieten PA, Machiels MA, Lemma E, Wudneh T, Dejen E, et al. Vulnerability to a small-scale commercial fishery of Lake Tana's (Ethiopia) endemic *Labeobarbus* compared with African catfish and Nile tilapia: an example of recruitment-overfishing? *Fish Res* 2006; **82**: 304-318.

[14] Kadri H, Marouani S, Bradai MN, Bouaïn A. Age, growth and reproductive biology of the rough skate, *Raja radula* (Chondrichthyes: Rajidae), off the Gulf of Gabes (southern Tunisia, central Mediterranean). *Mar Freshw Res* 2013; **64**: 540-548.

[15] Yeldan H, Avsar D. Length-weight relationship for five elasmobranch species from the Cilician Basin shelf waters (Northeastern Mediterranean). *J Appl Ichthyol* 2007; **23**: 713-714.

[16] Joung SJ, Lee PH, Liub KM, Liao YY. Estimates of life history parameters of the sharp spine skate, *Okamejei acutispina*, in the northeastern waters of Taiwan. *Fish Res* 2011; **108**: 258-267.

[17] Raje SG. Skate fishery and some biological aspects of five species of skates off Mumbai. *Indian J Fish* 2006; **53**: 431-439.

[18] De Graaf M, Nentwich ED, Osse JW, Sibbing FA. Lacustrine spawning: is this a new reproductive strategy among 'large' African cyprinid fishes? *J Fish Biol* 2005; **66**: 1214-1236.