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Fish biodiversity and anatomical weight composition of fish from Al-Rahad Turda, North Kordofan State in Sudan

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ABSTRACT

This study was conducted in the area of Al-Rahad, North Kordofan State, it aimed to know the fish biodiversity in the manufactured water sources (Turda) and to determine the physiochemical parameters of the water (pH, temperature, dissolved oxygen, ammonia and water transparency), and the body weight composition of the fish species which is found there and fish condition factor in attempt to find out the impact of water characteristic on the fish status. Water analyses were done using water analysis devices. Fifty samples of fish were collected from each species found there. The total length, standard length (cm) and total weight (g) were determined and body weigh composition was done using measuring board and sensitive balance. Statistical analysis was done using One Way ANOVA. Test followed by least significant difference (LSD). Results of biodiversity indicates just five species were identified namely *Oreochromis niloticus, Clarias gariepenus, Lates niloticus, Bagrus bajad* and *Heterotis* sp. Water analysis were (0 mg/L) for ammonia, pH (8.5), dissolved oxygen (7.5 mg/L), temperature (23°C) and transparency (63 cm). They were in normal range of water for fish life. *Heterotis* sp. (Umkoro) fish had the most eaten parts (66%), followed by *Oreochromis niloticus* and *Lates niloticus* (50%) while *Bagrus bajad* gives 49% and *Clarias gariepenus* gives 44% which mean fish is in good condition and rich nutritionally environment.

Keywords: Fish biodiversity, tilapia, cat fish, fillets, Heterotis, Al-Rahad.

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INTRODUCTION

Fish are constituting about more than one – half the total number of around 54,711 lives vertebrate species. There are descriptions of an estimated 27,977 live species of fishes. Of 54,711 vertebrate species recognized the world over 27,977, under 515 families, and 4494 genera are live species of fish of which 11952 are of freshwater and 12457 species using freshwater (Nelson, 2006).

Al-Rahad is considered to be one of North Kordofan localities. Its geographical location adds to its strategic importance because, it's a cross road conjunction linking numerous parts of Sudan, its capital represents a commercial center and has variety of natural resources. All the afore said facts make of it a place of strategic aspects according to the report of Ministry of Aquaculture and Animal resources northern Kordofan (2017).The Turda region is a permanent water surface of 14 km long and 3 km wide with an average depth of 4 meters and a storage capacity of 64 million m^3, fed by creek, UmmTkrkr and Abu Habil in the fall season on which depends the city's population for drinking water and growing of vegetables, fruits and for fish production which became a source of food and economy for the local people and for the state . The locality enjoys the satisfactory fish resources which are available in Al-Rahad Turda. Prior to fish farming in 2010, it has been observed the presence of tilapia (*Oreochromis niloticus*) fish in small sizes due to Ministry of Aquaculture and Animal resources northern Kordofan (2017). Fishing is unfairly used, where inappropriate fishing and mosquito nets are used, and fishermen are not organized in

associations they consider the fisheries as a secondary profession and fish meat is sold at low prices inside the city. In 2010 fish samples were introduced with the funding of the Western Sudan Resource Management Program (IFAD 2010) in Al-Rahad Turda, where the amount inserted was 33,000 fish, such as tilapia, catfish and *Heterotis* sp. (omkuro), which presents periods of hibernation (Ministry of Aquaculture and Animal resources northern Kordofan, 2017). The fisheries sector makes an essential contribution to human development. The, fish as a source of "rich food for poor people", can play an important role in improving food security and nutritional status (Bakhiet and Farah, 2019). Studies on the effect of fish weight on yield, especially with regard to the presentation forms of the product to consumers (whole eviscerated fish, carcass, and fillet) may greatly improve meat yields and profits. Fillet and carcass yields depend on several factors, such as size, age, sex, anatomic shape of the body, head size and weight of viscera, skin and fins. The efficiency of the fillet machine and the expertise in handling are aspects that should be taken into account (Bakhiet et al., 2017).

However, there is paucity of information on the biodiversity and anatomical weight compositions of the fish species found in Al-Rahad Turda. Thus, Aims of this study were to investigate the biodiversity of fish in Al-Rahad Turda (North Kordofan), to determine its physiochemical characteristics of water (pH, temperature, and dissolved oxygen, ammonia and water transparency) and to identify the filleting yield characteristics of the fish species which are found.

MATERIALS AND METHODS

Location and periods of study

The city of Al-Rahad is located between long lines 30.18 and 31.21 and latitudes 12.45 and 13.42 in the North Kordofan state (Figure 1). There is a river called Rahad (Pease, 1909). It is adjacent to the locality of Umdm Haj Ahmed and the localities of south Khordofan south, its east border is Um Rawaba locality and its westward Shekan locality. It has an area of about 6,320 km^2 (Ministry of Aquaculture and Animal resources northern Kordofan, 2017). The study was conducted in Al-Rahad Turda, north Kordofan in summer, 2017 on three periods; any period contains one month.

Figure 1. Map of the study area.

Water analysis

Water samples were taken from the study area and examined for pH, temperature, dissolved oxygen, ammonia and water transparency, using water analysis devices. It was collected using water sampler devices and measuring using: (HANNA)-(HI8424 for pH, HI96700 for ammonia, DO 5509 for dissolved oxygen (50) samples for any period.

Fish samples and species

The fish were harvested with gillnets from different collection points, in order to discover all the species present. Two hundred and fifty fish specimens belonging to five different species (*Oreochromis niloticus*, *Clarias gariepenus*, *Lates niloticus*, *Bagrus bajad* and *Heterotis* sp.) (Figure 2 to 6) were collected. These fish found in Turda were used for the body weight composition.

Bodies weight measurements

fifty fish from each species were used for the total length (cm) and total weight (g) and filleting yield indices were determined using different materials (sharpened knives, balance and measuring board) and recorded in separated sheet.

Clearance ratio% = Total weight - Inedible parts (head, skin, fins,

Figure 2. *Heterotis* sp fish.

Figure 3. *Clarias gariepenus* fish.

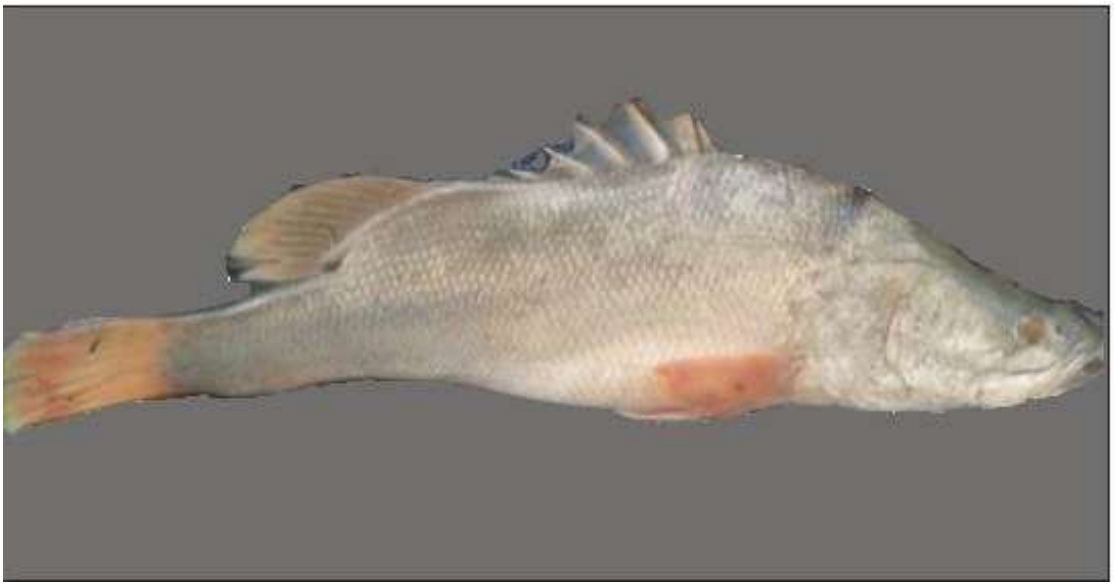

Figure 4. *Lates niloticus* fish.

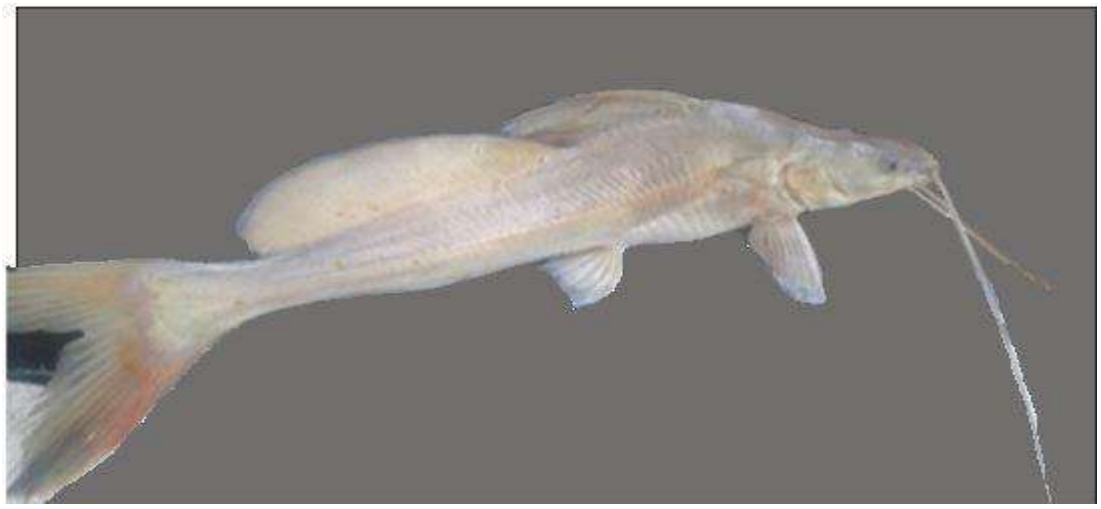

Figure 5. *Bagrus bajad* fish.

Figure 6. *Oreochromis niloticus*.

viscera and skeleton) %

Condition factor

Condition factor (Cf) was determined according to Busacker et al. (1990) as the following equation:

Cf = mean [body weight (g) / body length (cm)] × 100

Statistical analysis

Data were analyzed using -ANOVA- Test followed by least significant difference (LSD) using SPSS v.16 program.

RESULTS

The results are shown in Table 1 to 3.

DISCUSSION

The present study was conducted at Al-Rahad Turda, North Kordofan State. The main target of this study was to investigate the water quality and stocks biodiversity of fish species endemic in this region.

The results of the current study may shade alight to acknowledge of the biodiversity of fish in Al-Rahad Turda region and the physiochemical characteristics of the water. The water mean temperature obtained (23°C) was considered suitable for fish growth of the five species in the Turda. The pH value was around 8.5 or alkaline, maybe due to the nature of amount minerals in the soil and the waste chemical materials from boat activities. The dissolved oxygen is available in acceptable amount, and water mean transparency was 63 cm. Results of water temperature were higher than the results of Bastawy et al. (2006) who found that water temperature

Table 1. Physiochemical characteristics of Al-Rahad Turda water.

Parameters	First period	Second period	Third period
Ammonia (mg/L)	0	0	0
pH	8.5	8.5	8.5
Dissolved oxygen (mg/L)	7.5	8.2	8
Temperature (°C)	23°	24.4°	22.9°
Transparency (cm)	68	63	58

Table 2. Body weight compositions as M ± SD (g) of the studied fish species.

Fish species	Total weight	Head	Viscera	Skin	Skeleton	Fillet	Clearance ratio %
Oreochromis niloticus	372.20^{b}	96.40^{a}	28.10^{b}	13.20^{b}	53.30^{a}	185.00^{b}	50
Clarias gariepenus	744.00^{ab}	195.70^{a}	54.60^{b}	22.90^{ab}	69.40^{a}	430.60^{ab}	44
Bagrus bajad	378.80^{b}	110.10^{a}	16.70^{b}	12.80^{b}	42.50^{a}	165.50^{b}	49
Lates niloticus	458.30^{ab}	112.60^{a}	34.20^{b}	14.80^{b}	53.00^{a}	229.00^{b}	50
Heterotis sp	989.40^{a}	137.70^{a}	133.70^{a}	42.90^{a}	28.90^{a}	649.10^{a}	66
Sig	**	*	**	**	*	**	**

^{abc}Means in the same column without common letter are significantly different at P<0.01
* Significant
** Highly significant.

Table 3. Total and standard length (cm) weight (g) and condition factor of the studied fish species.

Fish species	Total length	Standard length	Total weight	Condition factor (k)
Oreochromis niloticus	25.10^{c}	14.70^{c}	372.20^{b}	2.3
Clarias gariepenus	42.60^{b}	28.50^{b}	744.00^{ab}	1.0
Bagrus bajad	39.60^{b}	24.90^{b}	378.80^{b}	0.6
Lates niloticus	30.40^{c}	16.50^{c}	458.30^{ab}	1.6
Hetrotics sp	58.30^{a}	45.80^{a}	989.40^{a}	0.4
Sig	**	**	**	**

^{abc}Means in the same column without common letter are significantly different at P<0.01
** Highly significant.

of White and Blue Nile was 21°C and lower than results of Ahmed et al. (2010) who found that the Blue Nile temperature ranged between 31 and 37°C. Talling and Talling (1966), Hill and Rai (1984) and Talling (2009) have noted that oxygen in fresh water decreases in some regions in autumn and summer. So the dissolved oxygen concentrations were at the saturation level, with no deficiency. The fish diversity was low, with just five fish species were found in this water sources (*Oreochromis niloticus, Clarias gariepenus, Lates niloticus, Bagrus bajad* and *Heterotis* sp). The last one, *Heterotis* sp is distinguished from the other species in that it presents a hibernation phase, appearing in a limited period of the year, that is, only during the summer.

Fillets yield and the body weight composition revealed significant differences $p < 0.01$ in head, viscera, skin, skeleton, and fillets of the five fish species. Fillets result of the current study is in disagreement with Eyo (1991) who studied carcass composition and filleting yield of ten fish species from Kanjilake and found the edible ratio were lower than the studied fish species. The study of Obonu and Ikem (1988) is also in disagreement with the present study. These authors verified the processing and yield characteristics of some fish in the Niger River, and mentioned that the fillets, head, viscera, and bones were in the range 33.5-68%, 11-3.89%, 9.8% and 1.32-15.3% respectively. The present result obtained also disagree with Mac (1992) and Salih (1995) who studied the body structure yield and physical analysis of *labeo niloticus* from commercial fish landing at Khartoum and mentioned that fillets yield of this species is about 37% of the total weight. Our results were higher than Siham (1999) who showed that the percentage of head viscera, skin, skeleton and fillet of *Protopterus oethipiopucus*, *Malapaterunu selecticus* and *Tetradon fahak* from Elmoroda fish market were as follows: 16.59–10.88%, 28.99%, 10.26% and 29.2-19.26%, 17-9%, 16.02-13.35% and 27.29-5%, 24.58%, 13.76%, 21.66%, 6.61% and

30.56%, respectively. On the other hand, this study agree with the finding of Jock (1996) who study the percentage of fillet, head, viscera and skeleton of four different fish species (*Bagaru bajad* and *synodontis* spp) at Nuba lake and his results were as follows: 49.86%, 5%, 4.78% and 20-45.17%, 11.40% and 18.43%, respectively. Adebona (1981) pointed that the percentage of bone and gut for *Chrysihys* was 47.87%, and 46.2% for *Bagrus* whereas, that of *Tilapia* was 35%. Also this results is in about the same range of Ogunga (1991) who studied the estimated catch and percentage composition remove about 40% fillet, thus leaving about 60% carcasses (skeleton and gut), with about 15 to 38% flesh still attached. Generally, the filleting yield of studied fish were reflection of another anatomy, species with large head, skin, and skeleton, relative to musculature lower filleting yield than those smaller head, skin and skeleton.

The computed condition factor for the studied fish species is shown in Table 3. Condition factor is one of the standard practices in fisheries which is used as an indicator of the variability attributable to growth coefficient. Here, the studied fish a species condition is determined based on the analysis of length weight data reflecting that the heavier fish at a given length is in better condition (Bolger and Connolly, 1989), hence indicating good condition. The differences between species were attributed to the effects of the biological aspects of the studied species as suggested by Khallaf et al. (2003). Similar result is also observed by Bhuiyan and Biswas (1982) in *Puntius chola*, Afroze et al. (1992) in *Amplypharyngodon mola*, Hoque and Hossain (1992) in *Mystus vittaus* , Alam et al. (1994) in *Ailia coila*, Mortuza and Mokarrama (2000) in *Botia lohachata*.

CONCLUSION

- From the results just five fish species were found in the Turda namely (*Oreochromis niloticus, Clarias gariepenus, Lates niloticus, Bagrus bajad and Heterotis* sp).
- The characteristics of water in Al-rahad Turda , shows the potentiality for fish aquaculture, while the pH of the water (8.2) alkaline stand as challenge.
- *Heterotis* spp shows the highest edible meet percentage in compare to the other four species, so that we can recommend being additional choice for consumers.
- The study presented basic information on the condition factor of *Oreochromis niloticus, Clarias gariepenus, Lates niloticus, Bagrus bajad* and *Heterotis* sp. of study area which would be useful for fishery managers as well as the sustainable management. Findings of the present work will help in future research.

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