

Review of the Changes in Fish Population of Three Flood Water Pools in Dinder National Park, Sudan

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ABSTRACT

Fish samples were collected from three flood water pools located on the eastern and western banks of Dinder National park (DNP) during the dry season of the year 2016. The survey included Gerrisa and Ras Alfeil "mayas" and Birkat el-Timsah pool. Fish were caught by using five multifilament gillnets of mesh size 4, 6, 8, 10 and 12 cm, a length of 25 m and a depth of 1.5 m, in addition to a standard Lundgren survey type gill net. The results of the survey revealed the presence of eight species of fish belonging to six families, representing about 25.0 % of the total number of 32 fish species previously recorded in Dinder River flood water pools. *Clarias gareipinus*, *Citharinus citharus* and *Heterotis niloticus* dominated the catch in the three flood water pools. The highest total biomass of fish was recorded in Birkat el-Timsah pool using a gill net of 12 cm mesh size.

Considerable reduction was observed in the fish species composition during the survey. This may be due partly to loss of habitat and shelter, low levels of dissolved oxygen, relatively high water temperature, high water turbidity and insufficient amount of food during the dry period which is usually associated with low levels of water in the flood water pools.

Hence, it is recommended to conduct a comprehensive biological study on the fishery potential of the DNP during both dry and wet seasons in order to formulate a sound policy for management and exploitation of the fisheries of this vital resource. It is also essential to establish a viable aquaculture program to culture Nile tilapia (*Oreochromis niloticus*) and African catfish (*Clarias gareipinus*) to enhance fish production in the DNP area.

Key words: Dinder National Park, Birkat el Timsah, freshwater pools, Greirisa "Maya", Ras el Feil "maya", water pools, Species composition.

INTRODUCTION

The Dinder River is the largest tributary of the Blue Nile in Sudan. It has a seasonal character where it starts surging in June, peaking around the middle of August each year, and in normal conditions ceases flowing in November. The entire basin ranges in elevation from 2646m on the Ethiopian Plateau to 407m at the northwestern point, where it joins the Blue Nile. The Dinder River basin drainage system consists of four sub-drainages, namely the Khor Galegu drainage system, which is the biggest tributary of the Dinder River, Khor Masaweek, the eastern bank, and the western bank of the Dinder River. Each one of these sub-drainages consists of a number of mayas, which are mainly fed by the main River stream and its

tributaries through distinct feeder channels according to the amount of overflow of the river in the flood months (Basheer *et al.*, 2016).

The DNP is one of the largest natural reserves in northeastern Africa. It was established in 1935 following the London Convention and was declared one of only two reserves which were designated the status of a Biosphere Reserve for the conservation of African flora and fauna in Sudan in 1979 (Dasmann, 1972). The entire area of the DNP is located inside Sudan boundaries (Fig. 1). The regional significance of the DNP stems from the fact that it lies between two important ecological zones; the arid and semi-arid Sudano- Sahelian zone and the Ethiopian zone. The park has a unique biodiversity containing a variety of birds, larger and smaller

mammals, some of which are listed by the International Union for Conservation of Nature (IUCN) as endangered, vulnerable, or threatened species (HCENR, 2001), in addition to a good number of freshwater fishes. Therefore, the park is considered to be an adequate habitat for a large number of animals during the dry season and a few numbers when it rains from June through October.

Generally, the drainage system of the DNP includes the rivers Dinder and Rahad, their tributaries, and flood water pools, locally known as “mayas”. “Mayas” are a special feature of the drainage system, irregularly scattered along the low-lying basins, river meanders and oxbow-shaped small lakes. They are subject to seasonal inundations and hold water and vegetation up to the end of the dry season (November-June). They vary in size from small productive wet “mayas” to large non-productive dry ones. The wet “mayas” form a major source of water, green fodder and fish species during the dry season (Abdel Hameed *et al.*, 1997).

Most of the previous investigations of the fish and fisheries of the DNP flood water pools were carried out during the flood season. Mahmoud (1984) surveyed the ichthyofauna of the small water bodies of Dinder National Park in Sudan and recorded 21 species belonging to 11 families. Khalid and Adam (2002) sampled a number of “mayas” and “Birkat” in the DNP area and recorded 31 species belonging to 20 genera and 13 families.

The diversity and Ichthomass of fish in Dinder National Park was reported by Khalid *et al.* (2002). However, no investigations were conducted on the fish fauna of DNP during the dry season. Hence, the present survey was undertaken mainly to document the changes that occurred in the species composition of three DNP flood water pools during the dry season, and suggest sound management measures for rational exploitation of the fisheries of the DNP, as they constitute an important source of livelihood and income for the local population inhabiting of River Dinder area.

MATERIALS AND METHODS

Description of the Study Area

Dinder National Park (DNP) lies on the south-eastern part of Sudan, about 400 kilometers southeast of Khartoum. It is located between coordinates 12° 17' N, 35° 39' E and 12° 29' N 35° 48' E, and at an elevation of about 700 to 800 metres above sea level. It lies along the sides of the Dinder River and bounded to the north by

the River Rahad. The park covers an estimated area of about 7,123 square km, and in 1983 the area of the park was extended by 2,630 km² towards the west. Vegetation in the DNP consists of thorn-bush savanna in the north and woodland in the south; along the riverbanks there are palm forests and swampy areas (Fig. 1).

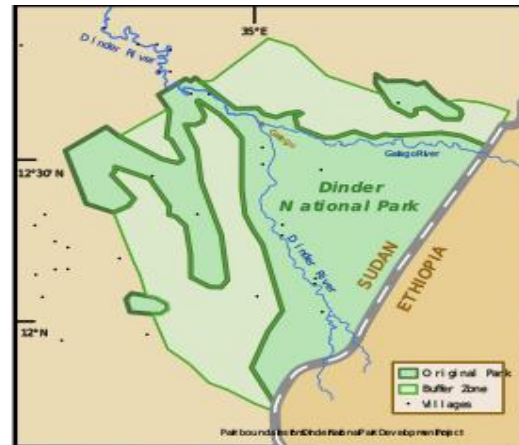


Figure 1. Dinder National Park in Sudan

Collection and Measurement of Fishes

Fishes were collected from three sampling stations located on the eastern and western sides of flood water pools. The selected sampling stations comprised small depression lakes and pools, known locally as “mayas”, namely, Greirisa “maya” with an estimated area of 2.11 km², Ras Alfeil “maya” having an area of about 0.002 km² and Birkat El Timsah pool with an area of approximately 0.009 km².

Fish were caught by using five multifilament gillnets with a mesh size of 4, 6, 8, 10 and 12 cm stretched mesh and a length of 25 m and a depth of 1.5 m, in addition to using a standard Lundgren survey type gill net used estimate the biomass of fish in Greirisa “maya”. Sampled fishes were identified down to the species level according to (Abu Gideiri, 1984; Bailey, 1994). Total length of each individual fish was measured to the nearest millimeter from the tip of the snout to the end of the upper lobe of the caudal fin using a standard measuring board. Total weight was measured to the nearest gram using Sartorius weighing balance (model 1106, Texas, USA).

RESULTS

Table 1 shows the composition of fish species caught in the three DNP flood water pools. The results revealed the presence of 8 species of fish belonging to six families, representing about 25% of the total number of 32 fish species previously recorded in Dinder River flood plains. The catch was comprised of

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Oreochromis niloticus and *Sarotherodon galilaeus* (Cichlidae), *Clarias gareipinus* and *Heterobranchus bidorsalis* (Clariidae), *Citharinus citharus* (Citharinidae), *Bagrus*

bayad (Bagridae), *Heterotis niloticus* (Osteoglossidae) and *Protopterus aethiopicus* (Protopteridae).

Table 1. Composition of fish species in three DNP water pools during the study period

Family	Genera	Species
Clariidae	2	<i>Clarias gareipinus</i> <i>Heterobranchus bidorsalis</i>
Cichlidae	2	<i>Oreochromis niloticus</i> <i>Sarotherodon galilaeus</i>
Citharinidae	1	<i>Citharinus citharu</i>
Bagridae	1	<i>Bagrus bayad</i>
Osteoglossidae	1	<i>Heterotis niloticus</i>
Protopteridae	1	<i>Protopterus aethiopicus</i>

The percentage composition of the catch of the five most abundant species in the three floodwater pools is shown in Table 2. *Heterotis niloticus* was most abundant in Birkat el Timsah pool catch forming 57.10 % of the total catch; followed by Ras el-Feil and Greirisa “mayas” in which it contributed 40.5 % and 18.2 % of the total catch respectively. *Clarias gareipinus* ranked first in abundance in the catch of Greirisa “maya”, followed by Birkat el-Timsah pool and Ras el-Feil “maya” forming 52.5 %, 25.0 % and 23.8 % of the total catch in the three water bodies respectively.

Oreochromis niloticus, *Citharinus citharus* and *Protopterus aethiopicus* ranked third in all of the three flood water bodies contributing 26.4 %, 18.2 % and 16.7 % of the total catch in Ras el-Feil “maya”, Greirisa “maya” and Birkat el-Timsah pool respectively (Fig. 2, 3 &4). The highest biomass (103.6 kg) was recorded for *Heterotis niloticus*, followed by *Clarias gareipinus* (45.35 kg), then *Protopterus aethiopicus* (30.35 kg). However, *Citharinus citharus* and *Oreochromis niloticus* were rare in the catch with a recorded biomass of 1.45 kg and 0.67 kg respectively (Table 3).

Table 2. Percentage composition of the catch of the five most abundant species in the three flood water pools

Species	Greirisa “mayah”(%)	Birkat el- Timsah pool (%)	Ras el-Feil “mayah”(%)
<i>Clarias gareipinus</i>	52.5	25.0	23.8
<i>Heterotis niloticus</i>	18.2	57.10	40.5
<i>Oreochromis niloticus</i>	7.5	0.40	26.4
<i>Citharinus citharus</i>	18.2	0.80	3.2
<i>Protopterus aethiopicus</i>	3.6	16.7	6.1
Total	100.0	100.0	100.0

Table 3. Biomass of fish species caught in Greirisa “maya” using a gill net of 12 cm mesh size.

Species	Weight (kg)	Percentage (%)
<i>Clarias gareipinus</i>	45.350	25.0
<i>Heterotis niloticus</i>	103.600	57.1
<i>Oreochromis niloticus</i>	0.674	0.40
<i>Citharinus citharus</i>	1.450	0.80
<i>Protopterus aethiopicus</i>	30.350	16,70
Total	181.424	100,0

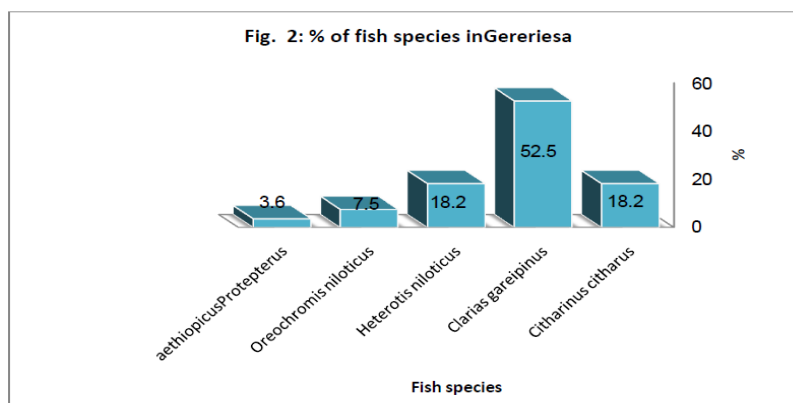


Figure 2. Percentage composition of the total catch of the five most abundant species in Greirisa “maya”

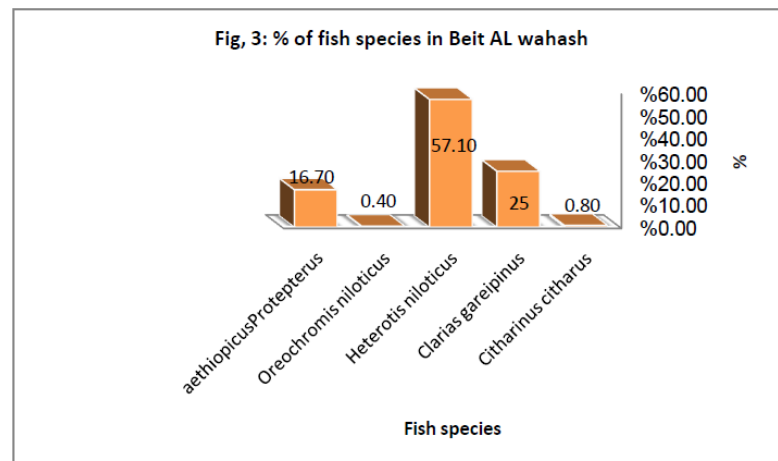


Figure 3. Percentage composition of the catch of the five most abundant species in Birkat el Timsah pool

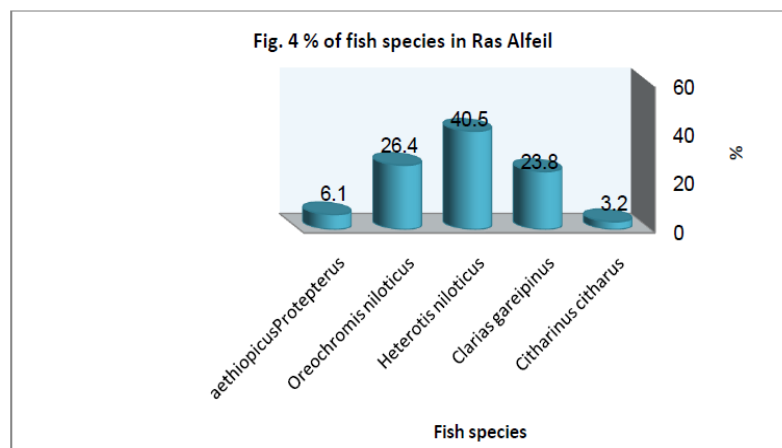


Figure 4. Percentage composition of the five most abundant fish species caught in Ras el Feil “may

DISCUSSION

A significant change was observed in species composition in Greirisa “maya” and Birkat el Timsah pools during the study period. Some species, like *Clarias engelseni*, *Distichodus rostratus* and *Hydrocynus vittatus* and *Citharinus latus*, which were previously present in the catch of Greirisa “maya” had disappeared from the catch obtained during the present study. Similarly, *Sarotherodon galilaeus* and *Hydrocynus vittatus* were absent from the catch of Birkat el Timsah pool. However, *Clarias gareipinus* and *Heterotis niloticus* dominated the catch in the three surveyed flood water pools. This may be attributed to the benthic feeding behaviour of the two species which usually feed on the bottom where abundant food is available due to the decomposition of organic matter at the bottom of the pools and “mayas”, especially during the dry season. In addition, the two species are known to tolerate low levels of dissolved oxygen in semi-stagnant water conditions prevailing in the three water bodies during the dry season. *Citharinus citharus* and *Oreochromis niloticus*, which are surface feeders, occurred in fairly good numbers in

Greirisa “maya”, but were scarce in Birkat el-Timsah pool and Ras el-Feil “maya”. This may be due partly to the relatively large surface area of Greirisa “maya” which offers more room for surface dwellers. On the other hand, the small surface area of Birkat el-Timsah pool and Ras el-Feil “maya”, create unfavourable conditions in the two water bodies during the dry season, such as low level of water, high surface water temperature, low dissolved oxygen, high water turbidity, few breeding sites, absence of suitable food during different stages of the life cycle and absence of shelter (Paller and Gladden, 1992). The few number of fish species in the three water pools is further supported by the findings of Khalid *et al* (2002) who reported the presence of 5 species in Greirisa ”maya”, and 4 species in Birkat el Timsah pool.

Protopterus aethiopicus occurred in very small numbers in all of the surveyed flood water pools. It is a low quality fish which usually aestivates in burrows in the mud of stagnant water in ponds, pools and other small water bodies. On the other hand, *Oreochromis niloticus* and *Clarias gareipinus* possess good potential for aquaculture in DNP area. Both species are

popular food fishes in the local markets, and can easily be cultured in earthen ponds to increase fish production, and provide an alternative source of livelihood and income for the people inhabiting in the DNP area.

However, due to the decrease in the amount of river discharge and rainfall, over the past few years, coupled with repeated fires, the ever increasing size of human population, and seasonal trespassing of pastoralists during the dry and wet seasons, the catchment areas of “mayas” have deteriorated significantly, causing many of them to silt up to almost complete dryness (Basheer *et al.*, 2016). Hence, it is necessary to formulate and implement an integrated development and management program to ensure optimum use of land in the area surrounding the DNP flood plains.

CONCLUSION

The catch composition of the three Dinder National Park (DNP) flood water pools revealed a significant change of fish species in terms of species composition and the number of species caught, as compared to previous surveys. Only two of the previously recorded species, namely *Heterotis niloticus* and *Oreochromis niloticus* were present in Greirisa “maya” and Birkat el Timsah pool. Species, like *Clarias engelseni*, *Distichodus rostratus*, *Citharinus latus*, *Hydrocynus vittatus*, and *Sarotherodon galilaeus* had disappeared from the catch and were replaced by *Clarias gareipinus*, *Citharinus citharus* and *Protopterus aethiopicus*. Such changes in species composition may be partly due to conducting the survey during the dry period which is usually associated with low levels of flood water in the pools, non-availability of sufficient amount of food, high water temperature, and low levels of dissolved oxygen, loss of habitat and shelter, and partly due to intensive fishing through the use of destructive fishing gear such as small mesh gill nets. Hence, in order to restore the fisheries of this vital resource, it is imperative to carry out a comprehensive biological investigation covering both the dry and wet seasons, as an essential step towards formulating a sound policy for

proper management and exploitation of the fisheries of the DNP flood water pools, in addition to establishing a viable aquaculture program to culture Nile tilapia (*Oreochromis niloticus*) and African catfish (*Clarias gareipinus*) to augment its fisheries production.

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