PRELIMINARY OBSERVATIONS ON THE FEEDING, HABITS AND REPRODUCTION BIOLOGY OF GYMNARCHUS NILOTICUS FROM LAKE CHAD*

by

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ABSTRACT

The preliminary results obtained from the study of stomach contents of specimens of Gymnarchus niloticus of a size ranging from 56cm (600 grms) to 152 cm (12.0kg.) from August to December, 1982 indicate for these sizes an exclusively piscivorous diet. The predominant prey species in Lake Chad are Tilapia/Sarotherodon, and Clarias. The prey is often cut in two parts before it is swallowed. Small prey may be swallowed whole. The implication of this prey capture method on preypredator relationship and therefore the impact of the predator is discussed.

The breeding season of Gymnarchus niloticus in Lake Chad has been deduced from observation of changes in gonad maturitystages and the results indicate that breeding takes place between August and November.

Data is also presented on the fecundity, size of ripe eggs and probable size at maturity.

INTRODUCTION

Gymnarchus niloticus is one of the most important commercial fishes in Lake Chad that attains a fairly large size; specimens of up to 12 kg in weight and over 150cm in length are found. The fish is endemic to Africa, and the genus is monospecific. It is like many of the mormyrids an electric generating fish and is known to emit continuous electrical signals from its tail (Lissmann, 1951). It has been shown to be able to use the electrical mechanism in the location of objects such as its prey (Lissmann, and Machin, 1958). Apart from studies of the electrical mechanism and its function and anatomy very little is known of its biology in the Lake Chad. Before the sahelian drought of the early 1970's which caused a reduction of Lake Chad's level and area G. niloticus was rather insignificant being less than two percent by weight of the gill net catches recorded by HOPSON (1964) while Lates niloticus, Labeo sp and Heterotis were dominant.

The Post Sahelian drought era brought about changes in the species composition of the Lake and consequently Clarias lazera, Tilapia/Sarotherodon and Gymnarchus niloticus now constitute the major economic species while Lates niloticus has become a rarity in the Lake.

The observations recorded in this paper on the feeding and breeding of G. niloticus are part of a study begun in August 1982 on the general biology and ecology of G.niloticus in Lake Chad which aims to provide information essential for the management of this important fish in the Lake and to investigate its suitability for fish culture in irrigation canals, reservoirs and fish ponds in the Lake Chad Basin.

MATERIALS AND METHODS

Fresh Gymnarchus specimens ranging in size from 56cm (600g.) to 152cm 12.0 kg were obtained from gill nets and hook and line catches of LCRI in Lake Chad at Baga; but additional specimens were purchased from local fishermen in the Lake at Baga and from nearby islands. The specimens were chilled and transported in a cold chest to Maiduguri where they were weighed.

Lenghths were taken with a standard one metre measuring board and then dissected. The stomach contents were identified and counted. Both the lengths, weights and volumes of the food items eaten were recorded for each specimen containing food. Portions of prey species were identified from visible identifiable remains of the prey.

The gonads were examined to determine the sex and stage of gonad development. The lengths, voluems or weights of the testes and ovaries were measured. A simplified 5-stage gonad maturity key based on actual observation of the gonads of Gymnarchus is described below:

i Immature - Young virgin fishes never previously engaged in breeding. Gonads are very small and transparent; not easily differentiated into males or females as eggs not yet visible to the naked eye.

ii Mature - Gonads developing or Opaque and developed; in females oocytes clearly visible to naked eye; in males in breeding season milt may be exuded when cut.

iii Gravid - Females with swollen ovaries, but eggs not yet ripe; eggs Yolky with maximum diameter of about 5mm; together with other smaller eggs of 2.5mm to 3.5mm in diameters testes swollen full of milt exuded on pressure.

iv Ripe/Running - Females with very large swollen ovaries; large spherical, golden yellow yolky eggs (8mm to 9mm in diameter) constituting about 80% to 90% of the eggs in the ovary. Fewer (10% - 20%), of the eggs are about 5mm in diameter. Testes full of milt, exuded on light pressure. The eggs may be easily separated and milt may flow from the vent freely with the slightest pressure on the abdomen.

v Spent - Ovaries and Testes empty or nearly empty. Recently spent ovaries are flabby and few residual eggs of 3mm to 5mm diameter may be found. The testes are depleted of milt and in both sexes the gonads are reduced, from the size attained in stages III and IV. As recovery proceeds residual eggs are reabsorbed and the ovary reverts to stage I.

The numbers of ripe eggs in stage III and IV females were determined by preserving the ovaries in Gilson's fluid for two weeks and then the large sized eggs were washed clean in water and the numbers determined by both volumetric method and direct counting.

RESULT:

1. Food and feeding behaviour of G. niloticus

of the 35 specimens examined between August and December, 1982 two had been eviscerated and their stomachs removed before arrival in Maiduguri.. Of the 33 stomachs examined, 26 (78.8%) contained food items while only 7 (21.29%) were empty.

The most important items of the diet of G.niloticus. were Clarias lazera and the Cichlids (Tilapia and Sarotherodon) which occurred in 48.4% and 38.7% respectively of the food stomachs as shown in Table I. The only species of Cichlilidae identified specifically was Sarotherodon niloticus.

The only other fish prey species found was Ctenopoma sp. while some unidentified highly-digested fish materials were believed to be either Cichlids or Clariids.

2. Prey capture by G. nilotics

The condition of the prey fishes in the stomachs of G. niloticus gave an insight into the probable prey capture method of this predator in Lake Chad. As shown in Table 2, nearly 60% of all the fish prey had only their tail ends swallowed compared with only 7% head ends swallowed. Whole fishes constituted 26% while about 5% had been cut in two but both halves were found in the stomach. It is concluded that G. niloticus attacks its prey from the rear end and cuts the tail

end off with its sharp incisor-like teeth and swallows it. The head end of the wounded prey may swim away or die instantly and be lost, but sometimes it may still be caught and swallowed.

It is usually a small prey that is swallowed whole. Examination of the triangular-shaped cut on the prey, a reflection of the pointed snout of Gymnarchus, shows the apex of the triangle to be pointing towards the anterior region of the prey which confirms the rear approach of the attacking predator.

The number of fish prey species found in individual stomachs of G. niloticus (Table 3) indicates that it generally feeds on one fish prey at a time. 42% and 31% of the stomachs contained only Cichlids or Clarias while only 15% were having both Clarias and Cichlids. It is concluded from this that Gymnarchus takes its fill from the available prey species immediately available to it.

Table 1: Occurrence of Food items in stomachs of Gymnarchus niloticus from Lake Chad

Food item	Number of Stomachs food item occurred	Percentage Occurrence
Tilapia/Sarotherodon	12	38.7
Clarias lazera	15	48.4
Ctenopoma sp.	1	3.2
Unidentified highly digested fish	1	3.2
Mud, sand, pieces of vegetation	2	6.5
TOTAL	31	100
No. of stomachs examined	33	
No. of stomachs containing food	26;	78.8%
No. of empty stomachs	7%	21.2%

Table 2: The condition of prey fishes found in stomachs of Gymnarchus niloticus from Lake Chad

Fish prey species	Tail end only	Head end only	Head and tail ends	Whole fish	Undetermined	Total
Tilapia/Sarotherodon sp.	7	2	2	6	-	17
Clarias lazera	18	1	-	4	1	24
Ctenopoma sp.	-	-	-	1	-	1
Total	25	3	2	11	1	42
Percentages	59.5	7.1	4.8	26.2	2.4	100

Table 3: Numbers of fish prey species found in individual stomachs of G. niloticus from Lake Chad. (N=26)

	Tilapia/ Sarotherodon only	Clarias lazera only	Tilapia/Sarotherodon and Clarias lazera	Other food items
Number	11	8	4	3
percentage	42.3	15.8	15.4	11.5

3. Prey/predator size relationships

In Table 4 the length of the prey fish is expressed as a percentage of the length of the predator for the three prey fishes found whole in stomachs of G. niloticus. For the Cichlids the mean percentage is 9.19% while for Clarias it is 8.7% . G. niloticus will however swallow whole prey of up to 14% of its length as shown in Table 3. It however attacks and kills much larger prey by cutting off pieces to swallow. Thus the impact of this type of predator is more devasting on the other fishes in the environment than those which can only swallow their prey whole. When the length of the prey is ploted against the length of the predator there appears to be no direct positive relationship. The data is however still too small for further detailed analysis of correlation.

Table 4: Prey/predator length relationship in G. niloticus from Lake Chad

Prey species	No. of whole prey	100 x prey length/predator length
Tilapia/ Sarotherodon	6	6.25 -12.3 (mean 9.19, std 2.62
Clarias lazera	4	6.2 - 14.0 (mean 8.7; std 3.59).
Ctenopoma sp	1	