NOTES ON THE GENUS XENOCLARIAS (GREENWOOD)

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Taxonomy :

One specimen of a small clariid hitherto unknown in Lake Victoria was collected by MICHAEL GRAHAM in about 15 metres of water at the western end of the Kavirondo Gulf and described by NORMAN (1928) as *Clarias eupogon*. In the late 1950's three further specimens were trawled by EAFFRO in 37 metres of water off the south west tip of Ukerewe Island. In a study of this material GREENWOOD (1958) found that "the supra-branchial respiratory organs were virtually absent and the suprabranchial chamber almost non-existant". As this condition is found in no other adults of the three subgenera of *Clarias*, GREENWOOD *(op. cit.)* used it as the definitive character for a new genus *Xenoclarias* and referred NORMAN's *Clarias eupogon* to the same genus. The three specimen and on the basis of these differences were referred to a new species *Xenoclarias holobranchus* (GREENWOOD). This differed from *X. eupogon* (NORMAN) in the follow-ing characters :—

1. Shorter circum-oral barbels

2. Narrower mouth

3. Narrow premaxillary and vomerine tooth bands
4. Slightly longer pectoral spine in relation to the fin rays

However GREENWOOD does state that "since *X. eupogon* is known only from a single specimen it is difficult to evaluate the differences separating it from *X. holobranchus*. Additional material may yet show that the two nominal species are really members of one variable species".

During trawling operations in the Entebbe area in 1966 and 1967, when a 1 inch mesh codend was used, a number of specimens of *Xenoclarias* were collected from a depth of about 25 metres, intermediate between the depth of the various specimens mentioned above. Preliminary measurements of the distinguishing characters indicated that GREENWOOD'S suggestion of a pos-sible variable species might in fact be the case. More recently a 1½ inch codend has been used in the eastern and northern parts of Lake Victoria and a large number of additional specimens have been caught over a depth range of 11 to 76 metres. A selected number of these specimens have been examined. In addition an opportunity was presented in February 1969 to re-examine the type specimens of *X. eupogon* and *X. holobranchus* now held in the British Museum (Nat. Hist.) in London.

Morphometric data

A detailed study has been made of material from the following localities :

Murchison Bay	9-11 metres	1 fish
Macdonald Bay	14 metres	3 fish

Dagusi Island	18.5 metres	25 fish
North of Kome Island	17-25 metres	12 fish
Damba Channel	22-28 metres	4 fish
North of Grand Bay	42 metres	5 fish
(Ukerewe Island)		
South of Hunters Rock	75 metres	4 fish

Holotype of *X. eupogon* B.M. reg. 1928-5-24. 57.

Holotype and one paratype of *X. holobranchus* B.M. reg. 1958-7-8-1 and 2.

The two paratypes of *X. holobranchus* were in very poor condition, one was used for some measurements and the other not used at all.

Frequency histograms of the morphometric measurements which GREEN-WOOD (1958) found to be most critical in distinguishing the two species he described are shown in Fig. C1. The measurements taken by the present author of the type specimens of *X. eupogon* and *X. holobranchus* are also shown (the former in solid shading, the latter in hatched shadnig). These agree fairly well with the measurements taken by GREENWOOD on the same specimens with the exceptions of the width of the mouth. The latter author gives the mouth width of *X. holobranchus* as 36.7 per cent to 41.0 per cent of headlength of *X. eupogon* as 48 per cent as opposed to 45 per cent and 50 per cent respectively as given here.

Fig. C1 shows that, with three exceptions the range of ' variation given by the present larger sample of specimens of *Xenoclarias* is greater than the differences between the two species as given by GREENWOOD. In most cases the distribution within that range is approaching a normal distribution, which might be expected when dealing with a single species. The three exceptions are the length of the maxillary and nasal barbels as a proportion of headlength (Fig. C1a and b and the width of the mouth as a percentage of headlength (Fig. C1g). In each of these cases the data for *X. eupogon* falls at the extreme upper end of the range whilst the data for *X. holobranchus* falls near the middle of the range. However Fig. C1 shows that of all the characters under discussion here, these three are the most variable. The two pairs of dorsal barbels are longer than the ventral pair and the thin terminal section is correspondingly longer and therefore more susceptable to damage and breakage resulting in more variation. The width of the mouth is a difficult measurement to take accurately as the extreme ends of the lower lip continue onto the base of the maxillary barbels. At this point the lower lip is very thin and delicate and is easily distorted and stretched during preservation and measurement.

Discussion of morphometric data

From the foregoing it would appear that the only characters on which these two possible species could be separated are the length of the nasal and maxillary barbels and the width of the mouth. The fact that these are the most variable characters may possibly reduce their significance.

In the data presentation in Fig. C1 no account has been taken of possible allometric variation with size of individual because not enough data is at

TABLE Cl. — Range of barbel lengths in various samples of *Xenoclarias* arranged according to depth :

Depth in metres	9—11	14	18.5	17—25	22—28	42	75
Sample in size	1	3	25	12	4	5	4
Nasal barbels	1.40—1.70	1.44—1.66	1.05—1.90	1.11—1.56	1.58—1.92	1.04—1.22	0.94—1.09
Maxillary barbels	2.37—2.38	2.12—2.49	1.60—2.66	1.72—2.28	1.73—2.32	1.57—1.99	1.53—1.81
Outer mandibular barbels	1.38	1.29—1.59	1.02—1.66	1.05—1.43	1.05—1.42	0.88—1.25	0.93—1.13
Inner mandibular barbels	0.89—1.00	0.82—0.99	0.67—1.24	0.68—0.90	0.73—0.89	0.65—0.82	0.58—0.74

Ranges of barbel lengths expressed as proportions of headlength.

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present available on small specimens. There are, however, indications that certain characters, such as eye diameetr and caudal fin length are negatively and positively allometric respectively and slight indications of positive allometry of the length to width ratio of the premaxillary tooth band, a character used by GREENWOOD (1958) for distinguishing his two species.

A rough analysis of the data at present available also suggests that there is a slight negative correlation between depth and the length of the circum-oral barbels (Table C1). The *Xenoclarias* from deep water tend to have slightly shorter barbels.

Both these tentative observations on allometry and depth variation are in accordance with the differences between the small ,shallow water *X. eupogon* specimen and the larger deep' water *X. holobranchus* specimens. At present no concrete data is available on variation within spacially separated populations and particularly, the present samples do not include any speci-mens from the Nyanza Gulf other than the type specimen of *X. eupogon* itself. Until more specimens have been examined in detail no concrete con-clusions can be drawn. However the available data does seem to support the hypothesis that within Lake Victoria there is only one species of the genus *Xenoclarias* (i.e., *X. eupogon*) but that this is very variable in certain charac-etrs. Such variation is not uncommon in the genus *Clarias*, as for example in the *C. allusaudi/C. werneri* group (see GREENWOOD 1966) and the *C. lazeri/C. mossambicus/C. gariepinnis group* (seeGREENWOOD 1966 and JUBB 1967).

Notes on the skull, swimbladder and Weberian apparatus of *Xenoclarias* sp. and *Clarias mossambicus*

As has been stated earlier, the principal anatomical difference between *Xenoclarias* and *Clarias* is the absence of suprabranchial respiratory organs and a reduction in the suprabranchial 'chamber in the former genus. This has been discussed at some length by GREENWOOD (1958) and has been associated with the adoption of a deepwater habitat. It has been recently shown however, that the genus *Clarias* is not confined to the shallow waters of Lake Victoria, as was once thought, but is in fact one of the main com-ponents of the catch in the deepest part of the lake (78 metres). It is nevertheless more common in shallow water whilst *Xenoclarias* is definitely more abundant in deep water (see below). A few preliminary observations on the food types of the latter genus also suggest that it is more closely tied to the bottom by its food preferences than the omnivorous *Clarias*.

,A characteristic of *Xenoclarias* which may be associated with its entirely bottom living habit in deep water (LAGLER, BARDACH and MILLER 1962) but more probably to the loss of the accessory breathing organs (i.e. the ability to carry air in the suprabranchial chamber) is the apparent en-largement of the swimbladder as judged by the size of the capsule in relation to the size of fish. The swimbladder has been studied only from dry pre-parations of skulls (of a 187 mm S. L. *Xenoclarias* and a 230 mm S. L. *Clarias*) which is not the most suitable method of study of these organs, and therefore the observations made here are only tentative.

The swimbladder of Clariids is situated transverse to the long axis of the body immediately behind the neurocranium. It is encased in a bony

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sheath formed by the enlargement of the transverse process of the complex vertebra. In *Xenoclarias* the swimbladder and capsule appear to be relatively larger than in *Clarias* and it is probable that the degree of ossification of the swimbladder capsule is also greater. Fig. C2a is a diagramatic representation of the shape of the swimbladder of these two genera and it can be seen that the two lobes of the bladder in *Xenoclarias* are more or less spherical and are connected by a discrete narrow transverse duct. In *Clarias* on the other hand, the lobes are more elongate and cylindrical, each tapering into a much broader transverse duct.

In Table C2 is given some of the dimensions of one skull of each of these two genera expressed as a percentage of skull length measured from the posterior tip of the supraoccipital process to the anterior, centre margin of the ethmoid. From this table it is evident that in *Xenoclarias* the bones of the skull, particularly the supraoccipital and pterotic are shorter, and in the case of the pterotic, slightly narrower than in *Clarias*. The supraoccipital process on the other hand is much longer in *Xenoclarias*. This indicates the way in which accommodation is made for the suprabranchial respiratory chamber in *Clarias* and the enlargement of the swimbladder capsule in *Xenoclarias*.

TABLE C2. — Preliminary comparisons of the dimensions of the neurocranium of *C. mossambicus* and *Xenoclarias* sp. expressed as a percentage of skull length.

	Clarias	Xenoclarias
Length of ethmoid frontol	57	51
Length of supraoccipital	26	21
Length of supraoccipital process	17	28
Width of supraoccipital	7	10
Width of supraoccipital and pterotic ...	23	24
Width of pterotic	16	14

Dissections of the Webrian apparatus of these two genera have also been made on dry skull preparations. In both these genera the Weberian ossicles are represented by the tripus and scaphium only, the intercalcarium and claustrum are apparently absent. As far as can be ascertained the arrangement in both genera is as described zy NAWAR (1954) for *Claruis lazeri* and by ALEXANDER (1964) for *Clarias walkeri*. There is however, considerable variation in the form of the tripus between the two genera as shown in Fig. C2b. In *Xenoclarias* this small, flat triangular shaped bone is shorter and broader than in *Clarias* and the articular and crescentic processes (NAWAR *op. cit.*) are less discrete. The crescentic pocess of the tripus is connected to a "thin triangular limina" which is apparently embedded in the tunica externa of the swimbladder. In *Clarias* this is an elongated process which lies, according to NAWAR (1954), along the dorsal wall of the airbladder. This bone was not clearly identified in the dry preparations of *Xenoclarias* but it is thought to be present in the form of a very thin bone which appears to be in the shape of an equilateral triangle, notched in the anterior margin

into which notch the crescentic process of the tripus fits. The bone is embedded in that part of the tunica externa adjacent to the centrum of the complex vertebra. For further study of he swimbladded and Weberian apparatus is necessary to supplement dry preparations with sections and alizarin preparations.

Distribution of *Xenoclarias* in Lake Victoria

Little is known at present about the distribution of the genus in the lake. The reason for this is that both the common sizes of gillnets used by fishermen and the $2\frac{1}{2}$ inch codend used in most of a recent bottom trawl survey, are too large to retain *Xenoclarias*. However they are retained in a $1\frac{1}{2}$ inch codend which has been used in the past few months.

Table C3 gives the number of *Xenoclarias* caught per hour trawling with a $1\frac{1}{2}$ inch codend in various depth zones (irrespective of locality). It can be seen that they are found in all depth over 8 metres, but with the exception of the 41-50 metre zone, there is a steady incrase in abundance with depth from just less than 2 fish per hour in water less than 10 metres deep to 10 fish per hour in water over 70 metres deep. The high figure of 19 per hour in the 41-50 metre zone is outstanding. It may indicate that this depth is their generally preferred habitat but there is evidence to suggest (see below) that this may be due to breeding concentrations.

TABLE C3. — The distribution of *Xenoclarias* by depth as given by the catch/hour (number) in a $1\frac{1}{2}$ inch codend.

Depth (m)	Time (hrs.)	Number	Catch/hour
4—10	12	22	1.8
11—20	17.5	79	4.5
21—30	10.6	45	4.2
31—40	33	174	5.3
41—50	40.5	772	19.1
51—60	33.3	228	6.9
61—70	30.5	291	9.6
Over 70	7	70	10.0

Xenoclarias appear to be confined almost entirely to a mud bottom, having rarely, if ever, been caught over a sand or rock bottom during the recent trawl survey.

Breeding

High numbers of ripe and ripe-running fish have been found in samples from south of Sigulu in 40-50 metres of water and from west of Igusi Island 2°07'5"S; 31°47'0"E) in 25-50 metres of water. Both these localities are near steep shelving rocky shores adjacent to the deep water of the open lake. The size at sexual maturity is in the region of 11.0 cm S.L.

These observations indicate that *Xenoclaris* probably breeds on or near rocky shores. If this is the case it is in accordance with the thesis of CORBET (1960) that for non-cichlids "the rocky shore may be considered to constitute an important transition habitat able to accommodate the least adaptable stages in the life histories of those riverine fishes in the process of becoming lacustrine". It is not known, however, that *Xenoclarias* does inhabit rivers such as the Victoria Nile, as is the case with other rocky shore breeders such as *Bagrus, Clariallabes* and *Mastacembelus*. Indeed the evidence of its preferred deep water habit and loss of supplementary aerial respiration along with the ability to breed in the lake all indicate that it either originated in a lacustrine habitat or has become completely adapted to the same.

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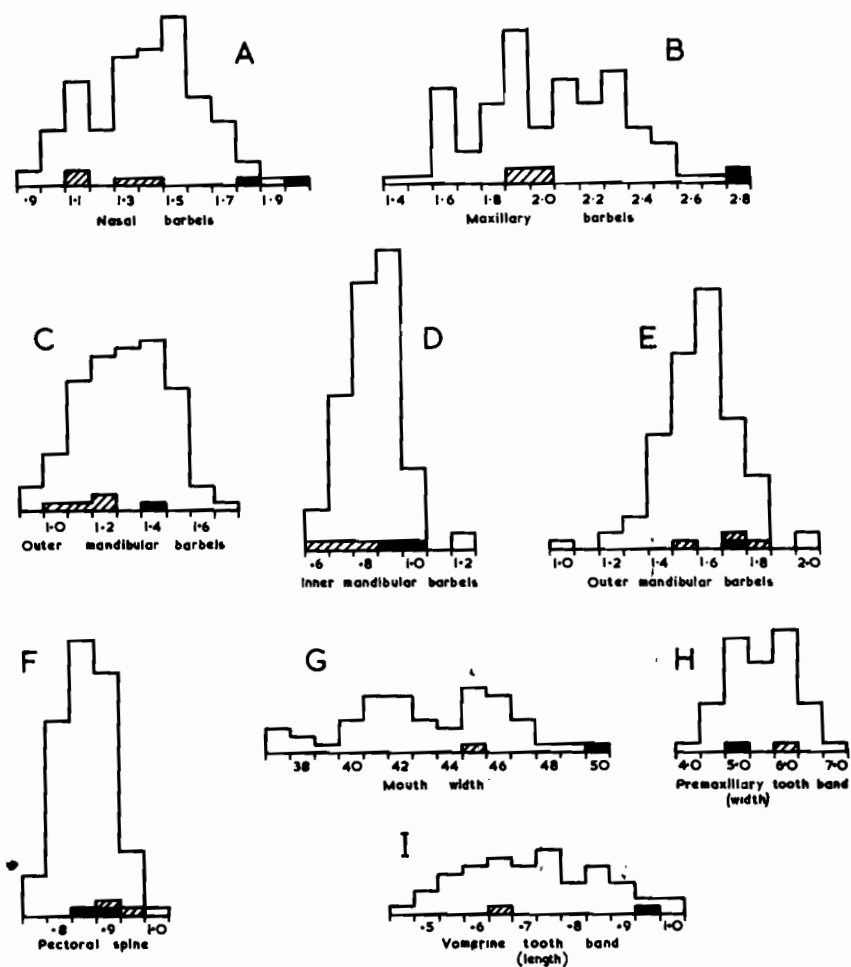NORMAN, J. R. (1920). XVI — Two new Fishes from Lake Victoria. *Ann. Mag. Nat. Hist. Ser. 10.* **II.**

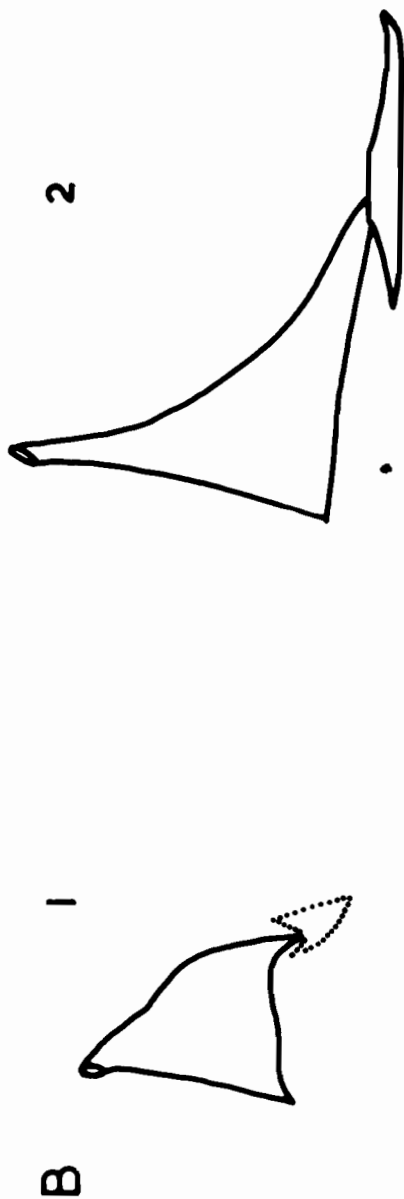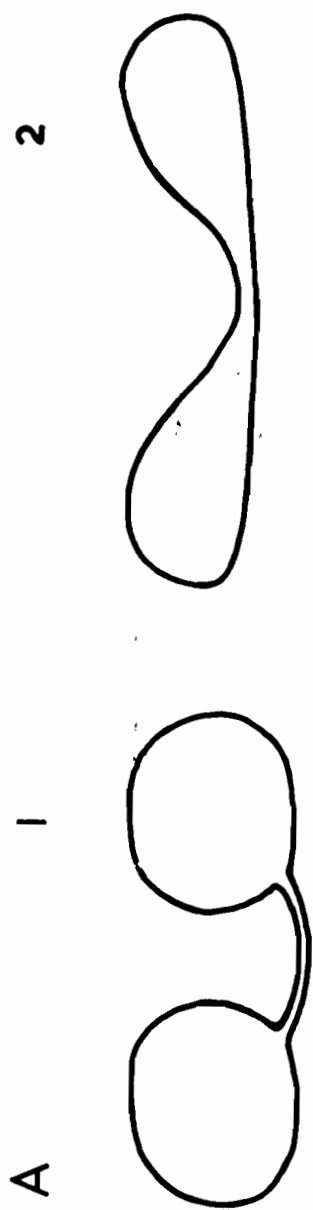Fig. C.1. Frequency histograms of certain morphometric data for specimens of *Xenoclarias* from Lake Victoria.

Fig. C.2. Diagrametic sketches of the Swim bladder and tripus in *Xenoclarias* and *Clarias mossambicus.*

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