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Notes on the Freshwater Fishes of Natal with Descriptions of Four New Species.

By

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With 4 Text-figures and 1 Map.

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CONTENTS.

I. INTRODUCTION.

A STUDY of systematics and distribution forms the basis for biological work on populations of indigenous fishes. Attention is therefore being given to the collection of adequate numbers of specimens from the inland waters of Natal and subsequent examination and analysis of the preserved material.

Taxonomic confusion still exists in several of the genera found in Natal, owing to the absence of any comprehensive work on the fishes of the eastern parts of South Africa. A final decision on several names cannot be made until further information is available, but a stage has been now reached in our work where publication of some of the results is justified.

The scope of this paper is indicated, however, by its title : it is not a final definitive account, but a series of notes on taxonomic matters and on the distribution of the various species that are known to occur in this Province.

Further publications will give details of the variations in morphological characters within the populations which go to make up each species. If a system of classification is to represent the true biological relationships of natural populations it must be based on adequate numbers of specimens. In the past, systematists have been obliged to work with isolated specimens which became the types of new species. Such nominal species may, or may not, coincide with biological entities, since freshwater fishes show morphological variations between individuals which are often of no taxonomic significance.

Barnard's work (1943) on the fishes of the South-west Cape is the only

publication on freshwater fishes in southern Africa which presents a systematic list based on adequate material. Records of Natal species have been based on sporadic collections made by many individuals and described by taxonomists in distant institutions. Investigations are therefore being carried out with the object of providing a really comprehensive picture of the systematics and distribution of the fishes of this Province. Population samples from localities representative of the full range of habitat of each species are being studied. This will indicate the extent of individual variation and also the variation between one group and another due to geographical and environmental factors. Growth changes will be followed over as large a size range as possible.

The data collected will be statistically analysed and presented in accordance with modern practice. Little advantage is gained by giving so-called life history tables based on the measurement of a few individuals, such as those of Groenewald (1958). His painstaking work threw much light on the classification of the large species of Transvaal *Barbus*, but his tabulation of actual measurements of short series of specimens gives little indicaton of the true specific diagnoses of certain small species.

Earlier works on South African fishes provide only a limited amount of information on Natal species, although Boulenger's publications are still a valuable contribution to taxonomic knowledge. Gilchrist & Thompson's monograph (1913–17) presents data available at that time, but in several instances they followed the unfortunate practice of using the material before them to redefine a species without reference to the original type specimens. Groenewald does the same thing, with dubious results, in some small species of *Barbus*. In general, Barnard's caution in identifying specimens from one area with species described from elsewhere is a sound principle to follow. *Barbus lineomaculatus*, for instance, may well prove to be synonymous with forms which occur in the Transvaal, but its type locality is in East Africa. The identification of Transvaal specimens by Gilchrist & Thompson and by Groenewald is based on patterns of pigmentation which are highly variable. Experience in Natal shows that *B. viviparus* includes specimens which match the Transvaal specimens described as *B. lineomaculatus*. It is therefore probably safe to say that Transvaal "*lineomaculatus*" is merely a form of *viviparus*, but only an investigation into *lineomaculatus* in its type area, and if possible farther south as well, can prove whether or not it is synonymous with *viviparus*. This is only one instance to illustrate a number of similar problems.

Natal is at the southerly limit of the range of several groups of tropical fishes and a study of our local populations will therefore be of interest for comparison with the results of investigations farther to the north.

Holotypes will be deposited in the Natal Museum ; where possible paratypes will be deposited in the following Institutions : Natal Museum, Pietermaritzburg ; South African Museum, Cape Town ; The Transvaal Museum, Pretoria ;

The Department of Ichthyology, Rhodes University, Grahamstown; the British Museum (Nat. Hist.), London; and the Academy of Natural Sciences, Philadelphia, U.S.A.

II. Methods.

Measurements and counts are made on specimens preserved in 5 per cent. formaldehyde solution (commercial formalin diluted 1 : 7 with water). All fishes, except very small ones, are injected with concentrated formalin in the field in order to prevent decay of internal organs.

Measurements are made with the assistance of a measuring board for large specimens or with a micrometer mounted in the eyepiece of a binocular microscope for small ones. A movable stage with vernier graduations is useful for intermediate sized specimens.

The following are definitions of some of the terms used in this paper:

Fork length.—This is used as a measure of overall length in those species with a forked or emarginate caudal fin. It is the distance in a straight line from the tip of the snout to the end of the middle caudal rays.

Standard length.—The distance from snout tip to caudal flexure (posterior edge of the hypural bones).

Pre-ocular distance.—This is used instead of the usual snout length as measured with calipers. It is the projected distance between snout tip (excluding lips) and anterior margin of the eye. A caliper measurement is difficult to estimate consistently in small fishes, whereas the pre-ocular distance can be measured with a micrometer eyepiece. In large specimens it can be measured on a measuring board by taking the distance between vertical lines coinciding with the snout and the edge of the eye.

Predorsal distance.—This is obtained by laying a large fish with its long axis down the centre of a measuring board and reading off the distance from snout to first dorsal spine on the longitudinal scale. Small fishes are measured with a micrometer eyepiece, also between verticals and not at an angle as normally measured with calipers.

Dorsal to ventral distance.—This is the distance along the long axis of the fish between verticals through the first dorsal spine and the first ventral spine.

Caudal peduncle length.—Measured along the axis of the fish from last anal ray to caudal flexure.

III. Acknowledgments.

Mr. F. L. Farquharson, B.Sc., has taken an important part in both field and laboratory work during the two years since his appointment as Assistant Fisheries Research Officer, and his assistance in measuring specimens and in the subsequent computations has been invaluable. He has also made many useful suggestions. Other members of the staff of this Board have devoted

time and effort to the collection of material, including Messrs. J. T. Geddes-Page, N. E. Shoobert, T. G. Fraser, A. L. Acutt, A. G. Jones, V. A. Ball, C. J. Ward and K. Tinley.

Mr. W. D. Oliff, of the Council for Scientific and Industrial Research, has assisted several times on collecting trips and has also given information on the chemical constitution of Natal inland waters.

To Professor S. F. Bush I offer my thanks for his interest and advice and for the facilities which he has placed at the disposal of my Board. The Natal Parks Board collection has been housed in the Zoology Department, University of Natal, and a laboratory has been made available for the work of Mr. Farquharson and myself.

Mr. R. A. Jubb, of the Ichthyology Department, Rhodes University, Grahamstown, has been unfailing in his generous help. He has placed valuable material at my disposal and has freely given information whenever it has been requested. He has passed on to me the results of his own work on many systematic problems.

Dr. R. F. Lawrence of the Natal Museum and Dr. J. Pringle, Director of that institution, have kindly made available to me collections of fishes and relevant literature. Mr. B. Stuckenberg and his wife have given me interesting specimens of fishes. The Director of the South African Museum, Dr. A. W. Crompton, and his staff, especially Mr. F. Talbot, have been most helpful. Dr. K. H. Barnard has been an ever-present source of inspiration, both through his published works and by his personal communications.

Mr. S. S. du Plessis, Senior Fisheries Officer, Lydenburg, Transvaal has co-operated on a number of occasions. Mr. A. A. van J. Groenewald exchanged useful information when he was working at Lydenberg.

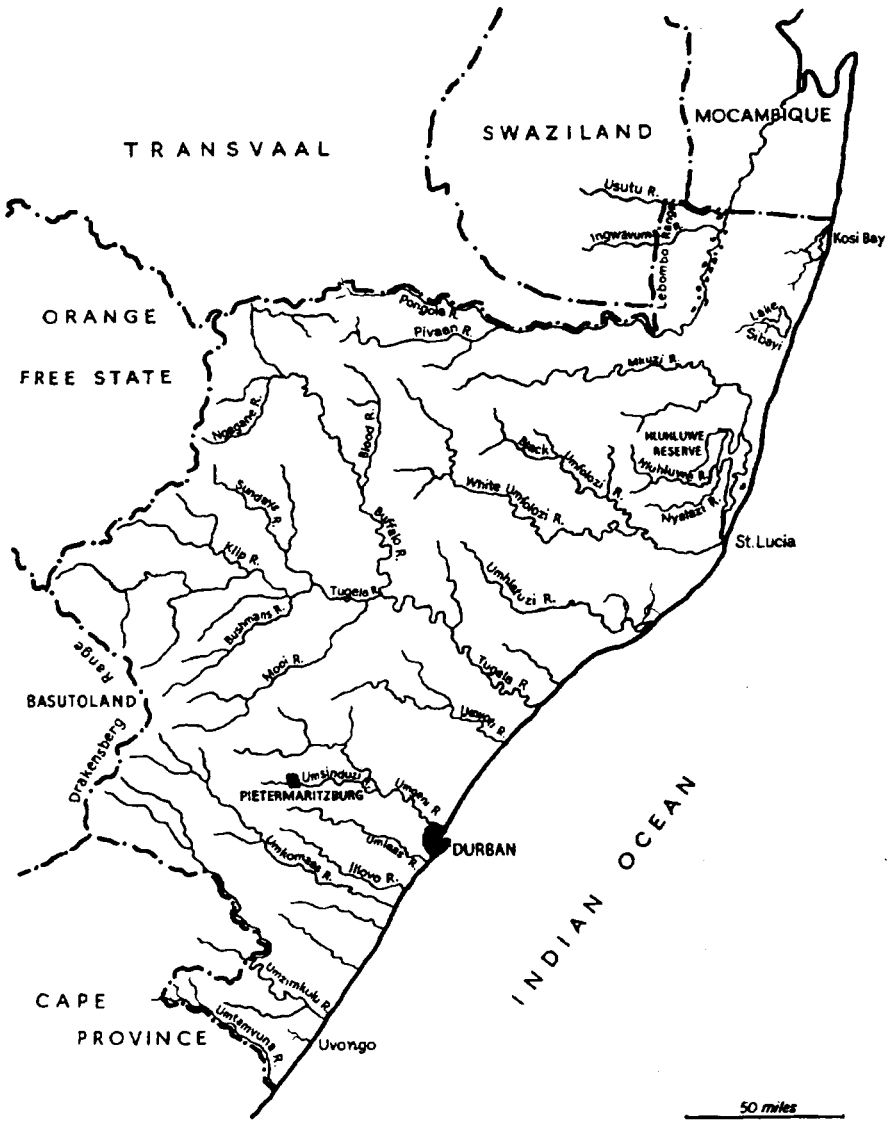
Acknowledgment is due to Mrs. E. Hennessy of Durban for the carefully executed and accurate drawings of the new species of *Barbus* and *Chiloglanis*.

Finally, I thank my Director, Col. J. Vincent, for his interest and encouragement, and Mrs. B. A. Tonge for the typing of the manuscript.

IV. Topographical, Chemical and Physical Features of the Natal Waters.

The 35,000 square miles of Natal are intersected by many rivers and streams. More than one-third of the whole area is drained by the Tugela system. The main river is over 300 miles from source to mouth and its tributaries spread fanwise north and south from the centre of the Province. The northern tributaries are the longest, but those rising to the south on the main Drakensberg range carry a greater volume of water owing to high rainfall at elevations of 6,000 to 10,000 ft.

North of the Tugela are the rivers and lakes of Zululand. The Umhlatuzi,


TRANSVAAL
SWAZILAND
MOCAMBIQUE
Usutu R.
Ingwavuma R.
Lebombo Mts.
Kosi Bay
ORANGE
FREE STATE
Pongola R.
Pivaan R.
Lake Sibayi
Mhlatuzi R.
Nogane R.
Blood R.
HLUHLUWE RESERVE
Black Umfolozi R.
White Umfolozi R.
Mhlatuzi R.
Nyalazi R.
St. Lucia
Sunduzi R.
Buffalo R.
Klip R.
Tugela R.
Umhlatuzi R.
Range
Bushmans R.
Mooi R.
BASUTOLAND
Drakensberg
Umgeni R.
Umsindusi R.
PIETERMARITZBURG
Umlaas R.
DURBAN
Umkomaas R.
Illovo R.
INDIAN OCEAN
Umzimkulu R.
CAPE
PROVINCE
Umtamvuna R.
Uvongo
50 miles

Umfolozi and Mkuzi rivers all enter the sea within 75 miles of the Tugela mouth. In the extreme north is the Pongola River, which forms the Transvaal border for a considerable part of its course before passing through the Lebombo range and thence north-eastwards through Zululand to join the Usutu River. This becomes the Maputa which flows through Moçambique to the sea in Delagoa Bay, over 270 miles north along the coast from the Tugela estuary. The Pongola, therefore, belongs zoogeographically more to the South-Eastern Transvaal and Moçambique than to Natal.

In the flat country east of the Lebombo range the Pongola River has formed a number of shallow lakes, or pans, of a permanent or semi-permanent nature, refilled occasionally when the river is in flood. To the eastward, nearer the sea, lies Lake Sibayi, fed only by small streams. Several other lakes are found farther south in the coastal plain of Zululand.

South of the Tugela only five rivers need be mentioned. The Umvoti and Umgeni rivers rise on the midland hills, in contrast to the Umkomaas and Umzimkulu rivers, whose origin is on the main range of the Drakensberg. Finally, the Umtamvuna on the Cape border has only a limited catchment area.

Natal rivers are subject to great fluctuations in flow. The Tugela, for instance, may carry only 300 cusecs during the dry season and as much as 5,000 cusecs in the summer rainy period, from November to March.

Gradients are usually steep in the upper reaches with slowly-flowing sections predominating lower down. Waterfalls on many rivers restrict access of indigenous fishes to headwaters. Mean temperatures rise as altitude decreases, but at any given point seasonal fluctuations are marked.

Chemically, an increase in richness of the water takes place as one proceeds downstream, but again seasonal changes are considerable. The concentration of dissolved solids reaches a minimum at the end of the rainy season and rises gradually in dry weather. The first rain after a dry period tends to increase total dissolved solids temporarily. River waters normally have a pH of 7 to 8, with bicarbonate alkalinity of about 10 to 30 p.p.m. in upper sections and 40 to 120 p.p.m. in lower areas. Total dissolved solids vary between about 20 to 50 p.p.m. in headwaters and 100 to 250 p.p.m. in the lower rivers. Corresponding values for calcium would be approximately 5 to 10 p.p.m. and 30 to 60 p.p.m. Suspended solids vary from negligible amounts in clear streams during dry weather to heavy concentrations during floods, when turbidity is high.

Temperature ranges differ according to the altitude and type of stream, but seasonal variations are always considerable. A species such as *Tilapia mossambica* which requires a temperature of over 10° C. cannot exist at elevations where frost is heavy in winter. *Hydrocyon vittatus* also succumbs in cold water and reports have been received of the death of this species after severe winter weather has reduced the temperature of the river. Several indigenous fishes, including *Barbus natalensis*, have been found in water ranging from just above freezing point to over 30° C.

V. Composition and Distribution of the Fish Fauna.

In the systematic list of freshwater species are included members of the genera *Megalops*, *Atherina*, *Anguilla* and *Gobius* all of which are able to live in salt water. Excluding these from the present discussion, 38 species are listed and their distribution shows a distinct tendency for tropical forms to disappear in the more southerly river systems (see Table I). Thus out of three Characinids, two are confined to the Pongola River system and the third does not reach the Umhlatuzi, which is the southernmost river from which a Mormyrid is recorded. Of the *Labeo* species, two occur in the Pongola and farther north while one extends as far as the Tugela. The two remaining *Labeo* species are each confined to a single river system within Natal. The distribution of *Varicorhinus* in Natal is uncertain. Of the two large *Barbus* species, one does not occur south of the Pongola and the other is found as far as the Umtamvuna. The ten remaining *Barbus* species (with radiate striations on the scales) include three rare ones, known only from their type areas. The other seven all occur also to the north of Natal and one occurs to the south of this Province. *Barilius* is represented only in the Pongola and farther north, while *Engraulicypris* extends south to the Umfolozi River. *Clarias* is found as far south as the Umtamvuna River.

Eutropius and one species of *Amphilius* are tropical fishes which extend only to the Pongola system, while a second *Amphilius* is restricted to the Tugela, Umvoti and Umgeni systems. Mochocidæ, represented by one widespread species of *Synodontis* and three hitherto undescribed *Chiloglanis* species, do not occur south of the Pongola. The cyprinodont genus *Micropanchax* has not been found as far south as the Tugela. Of the Cichlidæ, *Tilapia mossambica* finds salt water no obstacle and this fact is presumably a reason for its wide distribution down the east coast of Africa. The other two species of *Tilapia* extend respectively to the Pongola and to northern affluents of the Tugela River. *Haplochromis* has been collected as far south as Uvongo.

Table I shows the distribution of Natal freshwater fishes as known at present. Anguillidæ and Gobiidæ are not included, nor is *Barbus trevelyani*, which is a doubtful addition to the list (see p. 429). Six species are marked with an asterisk to show that the names used are only tentative. These names are doubtful owing to uncertainty in the true synonymy and when their status is finally settled the geographical range of each species will be subject to revision.

Of the total number of 38 species, 31 occur in the Pongola River, 17 in the Zululand rivers south of the Pongola but north of the Tugela, 13 in the Tugela River system, ten in the Umgeni and Umvoti systems, and nine in the rivers farther southward including the Umtamvuna. Although further collecting in the rivers of Pondoland may show that more species do occur than are known at present, so far only two Natal fishes have been reported from south of the Umtamvuna. Only three of the Pongola species are not known also

TABLE I.—*Distribution of Freshwater Fishes in the River Systems of Natal from the Umtamvuna River in the South to the Pongola River in the North.*

	South of Umtamvuna.	Umtamvuna to south of Umgeni.	Umgeni and Umvoti.	Tugela.	North of Tugela, south of Pongola.	Pongola.	North of Pongola.
MORMYRIDÆ							
Petrocephalus catostoma	—	—	—	—	—	P.	E. Africa.
Gnathonemus macrolepidotus	—	—	—	—	Umhlatuzi River	P.	E. Africa, Katanga.
CHARACINIDÆ							
Hydrocyon vittatus	—	—	—	—	—	P.	To Nile.
Alestes imberi	—	—	—	—	—	P.	To Congo.
Alestes lateralis	—	—	—	—	Hluhluwe area	—	Only in Zambezi.
Micralestes acutidens	—	—	—	—	—	P.	To Nile.
CYPRINIDÆ							
*Labeo cylindricus**	—	—	—	P.	P.	P.	To Abyssinia.
Labeo rubropunctatus	—	—	—	—	—	P.	To S. Rhodesia.
Labeo rubromaculatus	—	—	—	P.	—	—	—
Labeo quathlambæ	—	Umkomaas	—	—	—	—	—
Varicorhinus nelspruitensis	—	—	—	?	—	Recorded	E. Transvaal.
Barbus natalensis	—	P.	P.	P.	P.	P.	To Limpopo.
Barbus marequensis	—	—	—	—	—	P.	To Limpopo.
Barbus trimaculatus	—	—	—	P.	P.	P.	To Zambezi.
Barbus paludinosus	—	—	Umvoti River	P.	P.	P.	To E. Africa.
Barbus ivongœnsis	—	Uvongo area	—	—	—	—	—
Barbus afrohamiltoni	—	—	—	—	—	P.	To S. Rhodesia.
*Barbus argenteus**	—	—	—	—	—	P.	E. Transvaal, Zambezi.
Barbus gurneyi	—	P.	P.	P.	P.	—	E. Transvaal.
*Barbus viviparus**	—	P.	P.	P.	P.	P.	To Zambezi.
Barbus rubellus	—	—	—	—	—	Mzenyeni pan	—
Barbus anoplus	Widespread	P.	P.	P.	P.	P.	E. Transvaal.
Barbus toppini	—	—	—	—	Hluhluwe area	—	—
*Barilius neavii**	—	—	—	—	—	P.	To Zambezi.
Engraulicypris brevianalis	—	—	—	—	Umfolozi River	P.	E. Transvaal.

TABLE I.—*continued*

CLARIIDÆ							
Clarias gariepinus	—	P.	P.	P.	P.	P.	To Zambezi.
Clarias theodoræ	—	—	Recorded	—	Recorded	—	To S. Rhodesia.
SCHILBEIDÆ							
Eutropius depressirostris	—	—	—	—	—	P.	To E. Africa.
AMPHILIIDÆ							
*Amphilius grandis**	—	—	—	—	Mkuzi River	P.	To E. Africa.
Amphilius natalensis	—	Illovo River	P.	P.	Mkuzi River	—	—
MOCHOCIDÆ							
Synodontis zambezensis	—	—	—	—	—	P.	To Zambezi.
Chiloglanis anoterus	—	—	—	—	—	P.	—
Chiloglanis engiops	—	—	—	—	—	P.	—
Chiloglanis paratus	—	—	—	—	—	P.	E. Transvaal.
CYPRINODONTIDÆ							
*Micropanchax myaposæ**	—	—	—	—	P.	P.	?
CICHLIDÆ							
Tilapia mossambica	To Algoa Bay	P.	P.	P.	P.	P.	To Tanganyika.
Tilapia melanopleura	—	—	—	—	—	P.	E. and Central Africa.
Tilapia sparrmanii	—	—	—	Buffalo River	P.	P.	To Congo.
Haplochromis moffatii	—	Uvongo area	P.	P.	P.	P.	To Congo.

The symbol " P." indicates that a species in the Natal Parks Board collection has been found in the river systems named. " Recorded " indicates that an apparently reliable record has been published, but not confirmed by recent collecting. Specific names marked * are subject to revision for reasons of taxonomy or nomenclature.

from farther north and the lack of records for these three in the Transvaal does not indicate that they are definitely absent. In the Hluhluwe area north of the Umhlatuzi River there is one endemic species and another occurs in the Tugela ; one species is confined to the Tugela-Umvoti-Umgeni systems, and two other endemic species are found respectively in the Umkomaas River and in the Uvongo area.

VI. Systematic List.

Family Galeorhinidæ.

Carcharinus zambesensis Peters.

Smith 1953, p. 42.

One specimen, 900 mm., from Usutu River at confluence of Pongola in the Ndumu Game Reserve, about 50 miles from the sea.

Family Elopidæ.

Megalops cyprinoides (Broussonet).

Smith 1953, p. 86.

One male, 385 mm. Nyamiti pan, Ndumu Game Reserve. November 1956, I. Player.

Family Stolephoridæ.

Gilchristella æstuarius (Gilchrist & Thompson).

Smith 1953, p. 89.

Collected by K. Tinley in the freshwater Lake Sibayi, March 1958.

Family Mormyridæ.

Petrocephalus catostoma Günther.

Günther 1866, p. 22 (*Mormyrops catostoma*).
Boulenger 1909, 1, p. 57, fig. 42.
Gilchrist & Thompson 1913, p. 326 (*P. stuhlmanni*).
Barnard 1948, p. 412 (*P. stuhlmanni*).

Two species of *Petrocephalus* have been recorded from southern Africa, but the only specimen of the genus from the Limpopo River or farther south was that mentioned by Gilchrist & Thompson from Leydsdorp, Eastern Transvaal. Additional material from the Pongola River extends the range of the genus to Natal.

Gilchrist & Thompson record *P. catostoma* Günther and *P. stuhlmanni* Boulenger, but their key (p. 325) is contradictory to that of Boulenger (p. 47). Barnard (p. 413) points out that Gilchrist & Thompson give the number of caudal peduncle scales as 12 for *catostoma* and 16 for *stuhlmanni*, whereas Boulenger states the converse. Their description of other characters in the two species also differs from that of Boulenger and they evidently conceived their own idea as to the diagnosis of each form. It is significant that of six specimens collected at the same time and place (Kafue River) five were identified by Gilchrist & Thompson as *catostoma* and one by Boulenger as *stuhlmanni*.

On the other hand the Leydsdorp specimen identified as *stuhlmanni* would run out as *catostoma* on Boulenger's key. Since Boulenger originally described *stuhlmanni* and saw the types of *catostoma*, it is clear that he should be followed rather than Gilchrist & Thompson. The reason for the latter's diagnosis is a matter for speculation but a plausible suggestion is that the Leydsdorp specimen was a male which resembled Boulenger's figure of *stuhlmanni*, whereas the Kafue River material resembled the figure of *catostoma*. Once the identifications had been made Gilchrist & Thompson perhaps then proceeded to describe their representatives of each species without taking cognizance of the discrepancy between their descriptions and those of Boulenger.

The likelihood that a marked resemblance might exist between the Leydsdorp *catostoma* and Boulenger's figure of *stuhlmanni* is due to the fact that the noticeably irregular anal base of the latter is a sexual character. Barnard (p. 413, footnote) states that in *Gnathonemus macrolepidotus* the male has an irregular anal base, whereas in the female it is perfectly straight. Pongola specimens of *P. catostoma* show the same phenomenon. The largest female (89 mm. standard length) has a straight fin base in contrast to the largest male (81 mm. standard length) with a markedly irregular base. The difference is apparent even in the smallest individuals of the series, a 57 mm. male and a 62 mm. female. If, therefore, *catostoma* and *stuhlmanni* are two separate, but closely related species, confusion might easily result from the similar appearance of the male of the one to the male of the other. Two individuals of different species but the same sex would probably look much alike.

Whether or not *stuhlmanni* is conspecific with *catostoma* cannot be decided at present. The distinction between them is certainly slight and *catostoma* alone may come to be regarded as a valid species. Caudal peduncle scale count is the only character of those listed by Boulenger which appears to be diagnostic. Barnard examined the five specimens from Kafue River identified by Gilchrist & Thompson as *catostoma* and confirmed the count of 12 caudal peduncle scales. He found a similar number on six other upper Zambezi specimens and on one from the Okovango. These 12 specimens therefore all fit *stuhlmanni*. He agreed that the Leydsdorp specimen had 16 scales round the caudal peduncle. The ten Pongola individuals all have 16, indicating an

affinity with the Leydsdorp specimen and a distinction from representatives of the Zambezi-Okovango form.

Dorsal fin rays vary in number : Boulenger gives 20 to 22 for both species, whereas Gilchrist & Thompson assign 20 to 22 to *catostoma* and "iii 17" to *stuhlmanni*. The ten Pongola specimens all have three unbranched rays and one has 14 branched rays, one 16, two 17, three 18 and three 19.

Mr. R. A. Jubb has informed me (in litt., 5.xii.58) that he has material in his collection from the Lundi River, Southern Rhodesia, and from the Crocodile River, Transvaal. This material agrees with the Leydsdorp specimen of Gilchrist & Thompson and with my Pongola specimens, except that his smaller ones have only 14 caudal peduncle scales, although the larger ones have 16. In a later communication (30.i.59) he kindly passes on the results of a re-examination of type material of *P. catostoma* at the British Museum by Mr. P. H. Greenwood, indicating that these small specimens have only 10 to 14 caudal peduncle scales ; not 16 as in Boulenger's description (1909).

Gnathonemus macrolepidotus (Peters).

Peters 1852, Mon. Berl. Ak., p. 275.
Boulenger 1909, vol. 1, p. 112, fig. 91.
Gilchrist & Thompson 1913, p. 330.
Fowler 1934*b*, p. 419, fig. 6 (*G. pongolensis*).
Jubb 1958, p. 180.

This species has been found to be common in the Pongola River, especially in the shallow lakes or pans which exist in the river's wide flood plain east of the Lebombo range. Fowler's *pongolensis* was described from a single specimen taken in the upper Pongola, near Paulpietersburg. It appears to differ from typical *macrolepidotus* only in its more slender shape. Other species such as *Barbus aureus*, are commonly more slender in headwaters than farther downstream, and there seems no reason to regard *pongolensis* as a valid species. Besides the Pongola, Natal records include an affluent of Lake Sibayi (K. Tinley, September 1958), Hluhluwe (H. B. Potter, September 1958), Black Umfolozi River in Umfolozi Game Reserve (R. S. Crass, September 1956) and Umhlatuzi River, near head of Richard's Bay (Z. J. van Wyngaard, August 1953). The known distribution is therefore Central Africa south through the Eastern Transvaal and Zululand to the Umhlatuzi River.

Family MUGILIDÆ.

Trachystoma euronotus (A. Smith).

Smith 1953, p. 323.

This mullet is known to live in fresh water and is recorded from many estuaries, but it may be worthy of note that the species has been found in

specimens up to 45 mm. were collected in Lake Sibayi by K. Tinley, March 1958.

Family CHARACINIDAE.

Hydrocyon vittatus (Castelnau).

Castelnau 1861, Mem. Poiss. Afr. Austr., p. 65 (*Hydrocinus vittatus*).
Bloeker, 1862, Nat. Verh. Ver. Haarl., vol. 18, p. 125 (*H. lineatus*). Boulenger 1909, vol. 1 p. 182 (*H. lineatus*). Gilchrist & Thompson 1913, p. 338 (*H. lineatus*).
Barnard 1948, p. 413.
Jubb, 1952, p. 50.

Barnard (1948) and Jubb (1952) have discussed the distribution of the Zambezi tigerfish, which extends south to the Pongola River. It occurs below an altitude of about 1,000 ft. in the main stream and small specimens are common in the shallow lakes, or pans, bordering the river east of the Lebombo range.

Reports of the occurrence of this species outside the watershed of the Pongola in Lake Sibayi (see Barnard, p. 144) and the Mkuzi River (Jubb, p. 51) have not been substantiated. Collecting and observation by members of the Natal Parks, Game and Fish Preservation Board's staff have yielded no indication that tigerfish occur in Lake Sibayi or any other water which is not part of the Pongola-Usutu system. The distribution map in Jubb's paper should therefore be amended to exclude Lake Sibayi and the Mkuzi River.

Alestes imberi Peters.

Peters 1852, Mon. Berl. Ak., p. 276.
Boulenger 1909, vol. 1, p. 209.
Gilchrist & Thompson 1913, p. 339.
Jubb 1958, p. 180.

This is an abundant species in the Pongola pans east of the Lebombo range. The largest specimens in the Natal Parks Board collection are females of nearly 170 mm. fork length with males up to 146 mm. fork length. Maturity is reached at a length of about 100 mm. and in a collection from Kangazini pan males predominate over females in a ratio of 2 : 1.

Some of the characters listed in Gilchrist & Thompson's key (p. 339) are not reliable for separating the two species of *Alestes*. The number of scales in

series above the lateral line, however, besides the deeper body of *imberi*, the smaller eye and greater interorbital width all serve to differentiate *imberi* from *lateralis*.

The dark lateral streak of *lateralis* is also absent in *imberi*. This difference in pigmentation is accentuated by preservation in formalin. Fresh specimens of both species are bright silvery.

A deep body is characteristic of *imberi*, depth expressed as a percentage of standard length varying from 34 per cent. in the largest specimens to 29 per cent. in juveniles of 60 mm. fork length. In *A. lateralis*, the corresponding figures are 29 for large specimens and only 24 per cent. for small ones. Head length increases from about 25 to 30 per cent., as size decreases, in both species ; but the snout tends to be longer in *imberi*. The eye is 27 to 29 per cent. and the interorbital distance 35 to 40 per cent. of the head length in *imberi* compared to eye 30 to 34 per cent. and interorbital 28 to 34 per cent. in *lateralis*.

The lateral line scale count overlaps, being 23 to 29 in *imberi* and 27 to 34 in *lateralis*. The dorsal to ventral count is $4\frac{1}{2}/3\frac{1}{2}$ in *imberi* and $5\frac{1}{2}/3\frac{1}{2}$ in *lateralis*, showing a constant difference of one scale above the lateral line. Both species have eight dorsal rays; anal rays are 14 to 16 in *imberi* and 16 to 17 in *lateralis*. Gill rakers vary from 16 to 20 in *imberi* and 20 to 23 in *lateralis*.

Alestes lateralis Boulenger.

Boulenger 1900, Ann. Mus. Congo, Zool., vol. 1, p. 130, pl. 48, fig. 2.
Boulenger 1904, p. 155 (*natalensis*) ; 1909, p. 204.
Gilchrist & Thompson, 1913, p. 341.
Barnard 1948, p. 415.

Records of this species indicate a remarkable discontinuity in geographical distribution. The type locality is Lake Dilolo, Katanga, and *lateralis* appears to be widespread in the upper Zambezi. Boulenger had specimens from Natal and Zululand, which he originally described as *natalensis*. Later he made *natalensis* a synonym of his earlier species owing to the similarity of the southern specimens to those from the Katanga and Zambezi.

Recent collecting in this Province has produced only a single 59 mm. specimen in September 1956 from Amanzimbomvu pools, Hluhluwe River. This is not far from Elcheleselwane, where Toppin found two of the specimens mentioned by Boulenger. Elcheleselwane has not been located exactly, but evidence from Toppin's records indicates that it lies between Mtubatuba and Lake St. Lucia in the valley of either the Nyalazi or Hluhluwe rivers. Toppin's two females (93 mm. and 91 mm.) are in the Natal Museum (No. 203) as are two other specimens (♂, 118 mm.; ♀, 117 mm.) collected by C. Sutton in Umpangazi Lake (January 1946, Mus. No. 1360). This is a body of fresh water lying between St. Lucia Lake and the sea.

The five Zululand specimens which I have been able to examine, plus one of unknown locality (Durban Mus. No. 426) all agree with the description of

lateralis. They also agree with a series of six (64 to 70 mm.) from Luabo, lower Zambezi River, collected by P. J. Usher, July 1957.

This lower Zambezi record shows that *lateralis* occurs in the coastal part of the river as well as in the waters above the Victoria Falls. It is interesting that no *lateralis* have been found in any of the rivers of Southern Rhodesia (Jubb, personal communication) nor in the Limpopo, Incomati or Usutu-Pongola systems.

Exactly where the original type of *natalensis* was collected cannot be determined. It was merely recorded as presented by J. F. Quekett from "Natal". At that time it was customary to refer to any localities north of the Tugela as "Zululand", so one wonders whether this specimen did in fact come from south of that river. If so the distribution of *lateralis* is all the more remarkable. Further field work alone can throw light on the true geographical range of this species. If the apparent gap between the Hluhluwe population and that of the Zambezi is confirmed the southern form is widely separated from the main *lateralis* habitat and perhaps the name *natalensis* might be revived if any morphological differences could be found.

Micralestes acutidens (Peters).

Peters 1852, Mon. Berl. Ak., p. 276 (*Alestes acutidens*).
Gilchrist & Thompson 1913, p. 342, fig. 15.
Barnard 1948, p. 415.

An extremely widespread species, reported from the Nile, Niger, Omo, Congo, Zambezi and Eastern Transvaal. Specimens have been collected in the lower Pongola River, below the Barrage and in the pans east of the Lebombo range.

Family CYPRINIDÆ.

Labeo cylindricus Peters.

Peters 1852, Mon. Berl. Ak., p. 683.
Boulenger 1909, vol. 1, p. 319, ? p. 321 (*darlingi*).
Gilchrist & Thompson 1913, p. 350, ? p. 351 (*darlingi*), ? p. 352 (*parvulus*).
Fowler 1934*b*, p. 420.

Specimens of *Labeo* resembling the descriptions of *cylindricus*, *darlingi* and *parvulus* have been collected in Natal. Only one species appears to be represented by these specimens, however, and the synonymy of *darlingi* and *parvulus* with *cylindricus* is indicated. Investigations outside this Province can alone settle the question, and further analysis of material from Natal is still required, but pending a decision based on adequate evidence it is proposed to use *cylindricus* in preference to the other names. This proposal follows the opinion which Mr. R. A. Jubb has expressed (personal communication) that *cylindricus* = *darlingi* = *parvulus*.

In the Pongola River adult specimens measuring up to nearly 200 mm. fork length have been found in the rocky rapids below the Barrage and juveniles occur in other parts of the river and in the pans, east of the Lebombo range. The Natal Parks Board collection contains material from Mkuzi River and Hluhluwe River and recent collecting has proved that it is a common species in the rapids of the Tugela River in its lower reaches. The Mfongozi River where Fowler's specimen was taken is a tributary of the Tugela.

Labeo rubropunctatus Gilchrist & Thompson.

Gilchrist & Thompson 1913, p. 355.

This Eastern Transvaal species is now known from the Pongola River, where specimens of 94 to 340 mm. fork length have been collected below the Barrage.

Labeo rosæ Steindachner.

Steindachner 1894, Sitz. Ak. Wien., vol. **103**, p. 457, pl. 5.
Gilchrist & Thompson 1913, p. 357.

According to Mr. R. A. Jubb (personal communication) this may be merely a short-finned form of *altivelis*. It is represented in our collections from the lower Pongola, including the pans, and in December 1957, large numbers of mature fish were attempting to scale the wall of the Barrage.

Labeo rubromaculatus Gilchrist & Thompson.

Gilchrist & Thompson 1913, p. 359.
Barnard 1943, pp. 126, 127, 135.

This species is closely related to *capensis* of the Orange River system and to *tenuirostris* of the Limpopo system. The latter was made a synonym of *capensis* by Gilchrist & Thompson, but Barnard preferred to leave *tenuirostris* as a valid species until its status had been further investigated.

L. rubromaculatus resembles *capensis* in scale counts and bodily proportions, but the distance between the bases of the barbels appears to differ in the two species. In comparison with Barnard's statement (p. 131) that the distance between the bases of the anterior barbels is about 0·5 of snout length, the corresponding figure for *rubromaculatus* is over 0·6. Probably more significant is the ratio of distance between anterior barbels to distance from anterior to posterior barbels. This is subequal in *capensis* (according to Barnard) and 1·5–2·2 in *rubromaculatus*.

The occurrence of three such closely related forms as *tenuirostris*, *rubromaculatus* and *capensis* in the Limpopo, Tugela and Orange River systems is interesting. No representatives of this group have been reported from any of the rivers between the Limpopo and the Tugela, nor south of the Tugela. Each species appears to be confined to a single river system and the close phylo-

genetic relationship between the three is clear. The sources of certain tributaries flowing to the Orange River are close to those of affluents of the Limpopo and the watershed of the Tugela is also adjacent to part of the Orange River catchment. Three related fishes are found in three rivers whose mouths are situated far apart but whose headwaters are close together.

L. rubromaculatus occurs from the upper reaches of the Tugela at an elevation of about 4,500 ft. down to within a few miles of the estuary. Throughout the middle reaches it is the dominant species of fish, but it appears to be absent from some of the larger tributaries such as the Bushmans and Mooi which join the river from the south. Probably waterfalls have limited the invasion of these tributaries by *rubromaculatus*.

Labeo quathlambæ Barnard.

Barnard 1938, pp. 525–529 ; 1943, p. 129.

No specimens have been collected since the original material was obtained in 1938. The syntypes are in the Natal Museum. The Umkomazana River from which *quathlambæ* was collected, is a tributary of the Umkomaas River and not of the Umzimkulu, as stated by Barnard.

Varicorhinus nelspruitensis Gilchrist & Thompson.

Gilchrist & Thompson, 1911, p. 478.
Fowler 1934*b*, p. 421.
Groenewald 1958, p. 273, pl. 19, figs. 1–3.

Only a single specimen of this species is in the Natal Parks Board collection. It is a male, 167 mm. fork length, 145 mm. standard length, with 35 lateral line scales. It matches the original description and that of Fowler in having no barbels. The dorsal formula is iv 10 which agrees with Fowler's statement concerning his specimen from Paulpietersburg Dam.

Groenewald examined a long series of specimens and found the posterior barbels always present.

Unfortunately the locality from which our specimen was collected is in doubt. It was said to be in the Newcastle District, and this would indicate that *V. nelspruitensis* occurs in the Tugela River system. The collector may have mixed batches of fishes from the Tugela system and the Pongola system, however, so Fowler's record from Paulpietersburg (Pongola River system) is the only reliable one so far in Natal.

Barbus aureus (Cope).*

Günther 1868, Cat. Fish., vol. **7**, p. 102 (*gurneyi*, part).
Cope 1869, Trans. Amer. Philos. Soc. (2), vol. **13**, p. 406 (*Labeobarbus aureus*).
Boulenger 1907, p. 390, fig. (*aureus*). 1911, vol. **2**, p. 21, fig. 3 (*polylepis*) ; p. 23 (*holubi*, specimens from Groot Olifant R., Transvaal ; Ngoya Hills, Zululand ; p. 78, fig. 55 (*elephantis*) ; p. 89, fig. 67 (*bowkeri*) ; p. 90, fig. 68 (*aureus*) ; p. 93, fig. 71 (*lobochilus*).

* It is proposed that *Barbus aureus* be replaced by *Barbus natalensis* Castelnau 1861, see Addendum, p. 457.

Gilchrist & Thompson 1913, p. 375 (*holubi*, specimens from Durban Museum; Six-mile Spruit, Pretoria; Pienaars River, Transvaal); p. 375, fig. 36 (*lineolatus*); p. 376 (*zuluensis*); p. 379, fig. 39 (*elephantis*); p. 382, fig. 42 (*m'fongosi*); p. 387 (*robinsoni*); p. 387, fig. 47 (*aureus*). 1917, p. 562 (*aureus*).
Fowler 1934*a*, p. 407, fig. 2 (*marleyi*). 1934*b*, p. 421 (*holubi*); p. 421, figs. 7 and 8 (*stigmaticus*); p. 422, figs. 9 and 10 (*grouti*); p. 424, figs. 11 and 12 (*dendrotrachelus*); p. 425, figs. 13 and 14 (*tugelensis*). 1935, p. 369 (*bowkeri*).
Barnard 1943, pp. 160–162 (*marequensis*).
Crass 1957, p. 89 (*marequensis*).
Groenewald 1958, p. 289 (*robinsoni*); pp. 291–300 (*marequensis*); p. 296 (*zuluensis*, *m'fongosi* *æreus* [*sic*]; p. 298 (*lobochilus*, *robinsoni*, *bowkeri*, *elephantis*).
Greenwood & Crass 1959 (*aureus*).

Barnard (p. 161) pointed out that no one had yet recorded any specimens from the Marico River under the name *marequensis*. He examined five specimens of "*holubi*" from the Marico River and suggested that they were representatives of *marequensis* which he regarded as a species closely related to *holubi*.

Groenewald collected two species from the Marico River, one with large scales (about 30 in the lateral line series) and one with small scales (about 40 in the lateral line series). He recognized the latter as *marequensis*, accepting the accuracy of Smith's illustrator who showed about 45 lateral line scales.

Greenwood's investigations (see Greenwood & Crass, 1959) at the British Museum (Natural History) indicate, however, that Smith's description refers to the large-scaled species and that Smith's illustrator drew too many scales and also an anterior barbel longer than it was on the actual specimen. The proposal of Greenwood & Crass is that the small-scaled species be regarded as *B. aureus* (Cope).

Groenewald's "*marequensis*" is therefore referred to here as *B. aureus*, of which one of the types was re-described by Boulenger (1907). The tabulated data presented by Groenewald show the variations of proportional and meristic characters in his material. His new description of the species (p. 299) is a great improvement on what was hitherto available, but work in Natal has shown that the full range of variation is even greater than Groenewald indicated.

B. aureus is a widely distributed species whose distribution extends from the Limpopo River southwards to the Umtamvuna River on the Natal-Cape border.

Population samples, in some cases amounting to hundreds of individuals of various sizes, have been collected from over 30 localities throughout the Province. There are differences in the characters of specimens from different localities and it is easy to understand how various "species" have hitherto been recognized. The exact relationship of one population to another still awaits detailed analysis which will be presented on the lines suggested by Hubbs & Hubbs (1953). There is no evidence, however, to suggest that local variations are of specific rank. Only a single species is represented from the Pongola to the Umtamvuna, although there is a tendency for *aureus* from the more southerly rivers in Natal to have lateral line scale counts below the

average for Transvaal specimens. Groenewald gives the range as 36 to 44, whereas Tugela River specimens vary from 34 to 43 and the corresponding range for Umgeni material is 31 to 40, for that from the Umzimkulu system 34 to 39, and from the Umtamvuna 33 to 38.

It is now clear that certain amendments and extensions to Groenewald's description are required and the synonymy should include all large *Barbus* recorded from Natal, south of the Pongola system. His account of the form of the dorsal spine and of the mouth is correct for his own material, but not for the whole species. He contrasts the strong dorsal spine of *holubi* with the weak or moderate spine of *aureus*. This is not really a specific character at all, since it is related to the calcium content of the water (see Barnard, 1943, p. 160, footnote). In Natal rivers, specimens from upper reaches have weak spines, whereas those from lower down possess strong spines. In the Tugela, for instance, a 236 mm. specimen from an altitude of 4,500 ft. possesses a spine 36 mm. long and 1·6 mm. thick at the base, whereas another of similar size from 600 ft. altitude has a spine 50 mm. long and 4·2 mm. thick at the base. The average values for calcium in solution are about seven parts per million at the upper point and about 45 parts per million at the lower. The headwater fish shows weak spine development whereas the lowland one has a very strong spine. Both length and thickness are affected by environment.

With regard to the mouth, variation is comparable with *marequensis*, including all forms from extreme " rubberlip " to a " *Varicorhinus*-type " hard cutting edge. Groenewald's description (" lips thin, mental lobe short ", p. 299) should be taken to refer only to the " typical " form.

Groenewald's restricted conception of the range of variation in *aureus* led to untenable conclusions about synonymous species. He states (p. 298) that *elephantis* is not a synonym of *aureus*, since *elephantis* has a square, long lower jaw with a horny cutting ridge whereas " a mental lobe is always present " in *aureus*. This statement is erroneous, and just as *sector* is a form of *marequensis*, so *elephantis* is a form of *aureus*.

The only specimen of *aureus* with the *elephantis* form of lower jaw collected in the Transvaal is the original type of *elephantis* from the Great Olifant's River. Groenewald (p. 298) mentions material from Natal, however, which he saw in the South African Museum. He considers that the lower jaw of these Tugela River specimens is " identical to that of the Transvaal species of *Varicorhinus* ". Also in the South African Museum (S.A.M. 18503) is a single specimen from the Umzimkulu River, Natal. My colleague, Mr. F. L. Farquharson, has examined this specimen which was labelled *Varicorhinus brucii*. It has a lower jaw which is of the *Varicorhinus* type and rather short barbels for *aureus*, but the lateral line scale counts of 35 and the caudal peduncle count of 15 is quite normal for Natal *aureus*. The Umzimkulu " *V. brucii* " is therefore merely an example of the *elephantis* form of *aureus*.

The various forms of lip and jaw development in *aureus*, from " rubberlips "

to horny cutting edge, seem remarkably similar to the stages described by Groenewald in the series of *B. marequensis* from forma *gunningi* to forma *sector* and thence to *Varicorhinus brucii*. There can be no question as to the identity of specimens from Natal that have the *elephantis* type of jaw : they are a form of *aureus*. Now Groenewald states (p. 298) that he saw Natal material in the South African Museum " in which the lower jaw is in all respects a typical *Varicorhinus* jaw ". Since these small-scaled specimens are referable to *aureus*, there may be good reason to identify the large-scaled *V. brucii* with *B. marequensis*. Groenewald points out the great similarity between the *sector* form of *B. marequensis* and *V. brucii*. He admits his inability to separate the *Varicorhinus* from the *Barbus* on any character except the shape of the lower jaw. The fact that he found two specimens of *Barbus* which had almost the same structure as *Varicorhinus* indicates that further collecting might bring to light a complete series showing every gradation. On analogy with *aureus* this would not be unexpected.

As evidence against the identity of *B. marequensis* and *V. brucii*, Groenewald tabulates figures showing width and length of the lower jaw in seven specimens of each species. He states that the ratio of length : width increases in the series of *V. brucii* in contrast to a decreasing ratio for *B. marequensis*. If the first specimen in each series is excluded no such contrast is apparent. Anyway we know that the typical *Barbus* jaw has different proportions from the " *Varicorhinus*-type " jaw, so that proof of a difference in rate of growth of the jaw in one individual compared to that in another by no means proves that we are dealing with two separate species. If *B. marequensis* and *V. brucii* really are two distinct species it might be possible to account for the presence of intermediates by assuming the occurrence of hybridization. The hybridization of a *Barbus* and a *Varicorhinus* has been reported from Israel (Steinitz & Ben-Tuvia, 1957), but there is nothing to suggest that the phenotypic variation in South African species of *Barbus* might be due to natural cross-breeding.

The synonyms of *B. aureus* include Gilchrist & Thompson's Natal species, *B. robinsoni*. Groenewald saw the type at the South African Museum but he suggests that it is a synonym of *B. marequensis*, and includes the type specimen in his Table 14, with a series of *marequensis* forma typica. The apparent reason for doing so was that *robinsoni* has three scales less in the lateral line than any of the Transvaal specimens of *aureus*. He gives the range for *aureus* as 36 to 44, but Natal *aureus* may have a count of only 31. Thus an overlap does occur between *marequensis* (27 to 33) and *aureus*, causing a possible confusion in the identity of certain specimens. This confusion probably only applies to museum material since there is no evidence of an overlap in the field. Low counts are known at present in *aureus* only from localities to the south of the geographical range of *marequensis*. Nevertheless even if *aureus* with only 31 scales were to be discovered in the same locality as *marequensis*, one could still identify each species on other characters. The caudal peduncle

scale count is one criterion which is useful ; Groenewald records no *marequensis* with more than 12 caudal peduncle scales, whereas *aureus* normally has 16, with a range of 14 to 18. Farquharson examined the type of *robinsoni* in the South African Museum and although the scales were somewhat irregular, he decided there were 16 rows round the caudal peduncle. This number is a clear indication of the specimen's relationship with *aureus* rather than *marequensis* but even the count of 14 recorded by Groenewald is in keeping with the former species. Another diagnostic character of *aureus* compared with *marequensis*, is the length of the barbels, particularly the length of the first barbel. In the type of *robinsoni* the length of the first barbel is greater than that of any specimen of *marequensis* in Groenewald's Table 15. The length is quite normal for an *aureus* of that size, however.

Apart from the caudal peduncle scale count and length of the barbels, the type of *robinsoni* fits into the table with *marequensis* quite well. This merely indicates, however, that most of the characters listed are not diagnostic for the separation of the two species. To identify *robinsoni* with *marequensis* involves a disregard for the known distribution of *marequensis* and a misconception of the possible range of variation in *aureus*.

Groenewald also regards Boulenger's *lobochilus* as probably a synonym of *marequensis*, since the lateral line scale count is similar to that of *robinsoni*. Again, however, the caudal peduncle scale count and the length of the barbels are characteristic of *aureus*. The type locality (Durban) is far to the south of the geographical range of *marequensis* and, when one considers that *aureus* from that area are known to have a lateral line scale count of 31 to 38, no doubt remains of the true identity of *lobochilus*.

Groenewald mentions the resemblance of certain specimens from Natal to his Transvaal small-scaled species. He concludes that *aureus*, *m'fongosi* and *zuluensis* are all one species, despite marked variation in lip development and strength of the dorsal spine. Lateral line scale counts are also variable, some being as low as 35, but he accepts all specimens assigned to these three species as small-scaled. Yet *bowkeri*, with a count of 33 to 36 scales, is tentatively placed with the Transvaal large-scaled species.

In view of the taxonomic confusion which has hitherto existed, it must be emphasized that recent collecting in Natal has shown that only one species of large *Barbus*, with longitudinally striated scales, occurs south of the Pongola River and its tributaries. All previous Natal records should be assigned to *B. aureus* for geographical reasons alone. *B. marequensis* is present in Natal waters of the Pongola-Usutu system, but all previous authors, with one exception, examined material which came only from rivers where *marequensis* does not occur. The exception is Fowler, who had specimens from the upper Pongola; but even he had no *marequensis*.

The highly variable external structure of *aureus* may be illustrated by mentioning the minimum and maximum figures for a few of the measurements

made on Natal material : In percentage of standard length : head 18 to 35 per cent., depth 21 to 33 per cent., dorsal spine length 17 to 27 per cent. In percentage of head length : eye diameter 12 to 30 per cent., interorbital width 34 to 46 per cent. Other characters show comparable variation, so the tabulation of individual counts and measurements of a short series of specimens cannot be expected to be of any use in an attempt to define the characteristics of the various populations which go to make up the species. Statistical treatment of samples collected according to a definite plan can be expected to give the best results, but Pillay (1951) has shown that even a limited amount of material can yield much information if correctly handled. His work on Indian *Barbus* indicates a similar relationship between various forms of *B. sarana* as appears to exist within some African species, although no statistical studies have yet been made on this continent.

Barbus marequensis A. Smith.

Smith, A. 1841, Illustr. Zool. S. Afr. Fish, pl. 10, fig. 2.
Gilchrist & Thompson 1913, p. 380 (*sector*), ? p. 381 (*cookei*), p, 383 (*brucii*), p. 384 (*dwaarsensis*), p. 391 (*gunningi*), p. 392 (*swierstræ*), p. 397 (*sabiensis*).
Groenewald 1958, pp. 279–289, pl. lxi (*brucii*) (not p. 289 (*robinsoni*)).
Greenwood & Crass 1959.

Careful and detailed observations were made by Groenewald on the external structure of the lips and jaws of Transvaal material of *B. brucii*, which is a synonym of *B. marequensis* (see Greenwood & Crass). Barnard (1943, p. 167) had already drawn attention to the variability of the lips in South African *Barbus* species, but Groenewald was the first to show the full extent of this variability. He found that a series of forms existed from the " rubberlip " type of *gunningi* to the reduced lips and cutting edge on the lower jaw of *sector*.

The final stage in the series is that of *Varicorhinus brucii* Boulenger. Groenewald did not make *V. brucii* and *B. marequensis* synonymous, however, because he considered the form of the jaw sufficiently distinct to maintain their separation. He did find two specimens of the *sector* form of *marequensis* in which the jaw came very close to the " *Varicorhinus*-type ", and some of the material at the South African Museum would seem to provide evidence of a transition from " *Barbus*-type " to " *Varicorhinus*-type " jaw. The type of *B. cookei* is perhaps an example, and this specimen is included in *V. brucii* by Groenewald (p. 277) yet he also lists it on p. 279 as a synonym of *B. brucii*. Farquharson examined all the relevant material at the South African Museum and his notes and sketches (unpublished) indicate a most interesting gradation in the jaw of specimens of *sabiensis* (S.A.M. Nos. 13122, 13123), from a rounded form with no cutting edge to a wide, almost straight form that has a cutting edge and shows traces of a horny sheath. Two other specimens (S.A.M. No. 19569, Crocodile River, 1942, labelled *B. sector*) both

have cutting edges, but one lacks a horny sheath which the other possesses. The latter is identical to *V. brucii*, but the other should presumably be referred, on Groenewald's diagnosis, to the *Barbus* species.

Farquharson noted that the presence of a horny sheath is not always correlated with the wide, straight edge to the jaw which is characteristic of *Varicorhinus*. The *sabiensis* series showed that a short central horny portion might be present even on specimens with a narrower, curved edge to the jaw. A horny sheath can become detached in preserved material and Farquharson has suggested to me that such a structure might also be lost in living specimens. Its loss and subsequent regrowth would mean that an individual might show any stage in development of the sheath according to the stage reached in regeneration.

Material of the *B. marequensis-V. brucii* group is inadequate to give any proof of the correctness of this hypothesis, but it may be noted that the varying degrees of development of the horny sheath in the *elephantis* form of *B. aureus* might perhaps be explained along these lines. Only experimental evidence can be conclusive, however, and the question of the true relationship of *Barbus marequensis* and *Varicorhinus brucii* cannot be settled without further field collecting and observation.

The southern limit of the distribution of *B. marequensis* is the Pongola River and its tributaries. How far the species extends to the north cannot be decided until the true status of Rhodesian large-scaled *Barbus* has been settled.

Barbus trimaculatus Peters.

Peters 1852, Mon. Berl. Ak., p. 683.
Gilchrist & Thompson 1913, p. 401.
Groenewald 1958, p. 326.

This is an easily recognized species, which has been found to occur commonly throughout the area north of the Tugela River at an elevation of 1,500 ft. or less. It has recently been discovered in the main Tugela River, but it is a characteristic fish of smaller streams rather than waters broad enough to be known as rivers.

Barbus paludinosus Peters.

Peters 1852, Mon. Berl. Ak., p. 683.
Gilchrist & Thompson 1913, p. 404.
Groenewald 1958, p. 309.

Another species which is common throughout Zululand, from the coastal plain to an altitude of over 3,000 ft. It extends southwards as far as the Umvoti River, where specimens have been collected in a small tributary joining the main stream from the south.

Barbus ivongœnsis Fowler.

Fowler 1934*b*, p. 428, figs. 17 and 18.

The original description was based on a single specimen from Uvongo River, a small coastal stream in Southern Natal.

In September 1958, 14 specimens were collected by N. E. Shoobert and F. L. Farquharson from Ibilanhlolo Stream, less than five miles south of the type locality. These specimens are from 45 to 77 mm. fork length (38 to 68 mm. standard length). Their proportions agree with Fowler's description except that the eye is smaller, with a diameter less than the interorbital width. All our specimens are larger than the type however, so this difference is unimportant.

Meristic characters agree, except that predorsal scales are 12 to 13 (Fowler, 11). Caudal peduncle scales are 14 to 15.

Although very similar to *paludinosus*, this species can be separated morphologically while its known distribution is limited to a small area in Natal south of any recorded locality for *paludinosus*. Both predorsal and caudal peduncle scale counts are lower in *ivongœnsis* and the last dorsal spine (72 to 77 per cent. head length) is shorter.

Barbus afrohamiltoni nom. nov.

(Not *Barbus hamiltonii* Jerdon 1849, Madras Journ. Liter. Sci., pp. 311, 312.)

Gilchrist & Thompson 1913, p. 406, fig. 64 (*hamiltoni*).
Groenewald 1958, p. 311, pl. 15 (*hamiltoni*).

Fowler (1934*b*, p. 426) suggested that his *crocodilensis* was identifiable with *hamiltoni* Gilchrist & Thompson which name was pre-occupied by *hamiltonii* Jerdon.

Groenewald disputed Fowler's opinion and Mr. Jubb (personal communication) agreed with Groenewald. A letter from Dr. J. E. Böhlke of the Academy of Natural Sciences of Philadelphia, which confirms the opinion of Groenewald and Jubb, has been received by the present writer in reply to a request for certain information about Fowler's type specimen.

The number of lateral line scales is inconclusive for the separation of *hamiltoni* Gilchrist & Thompson and *crocodilensis*, but Dr. Böhlke's re-examination of Fowler's type shows that the other differences which Groenewald suggests are indicated by Fowler's figure do, in fact, exist. There are only 12 scales round the caudal peduncle in *crocodilensis*, the head is relatively longer, the depth less, the caudal peduncle more slender and the dorsal spine shorter.

Fowler did not describe the same species as Gilchrist & Thompson and *crocodilensis* cannot therefore replace *hamiltoni* which is a junior homonym of Jerdon's name. Mr. R. A. Jubb has suggested to me that *afrohamiltoni* should replace *hamiltoni* G. & T. He has generously given his permission for the publication of the new name in this paper.

In Natal we have no records south of the Pongola River where it is a common species, in the pans east of the Lebombo range.

Barbus argenteus Günther.

Günther 1868, Cat. Fish. vol. 7, p. 103.
Fowler, 1934*b*, p. 426 (*crocodilensis*).
Groenewald 1958, p. 312, pl. 15.

Groenewald identified specimens from tributaries of the Sabie River, Transvaal, with *argenteus* although this species had only been recorded from the Upper Zambezi. In the headwaters of the Pivaan River, a tributary of the Pongola in Northern Natal, occurs a fish which appears to be identical to Groenewald's specimens.

Also in the Natal Parks Board collection is a single specimen of 72 mm. fork length from the old Natal Fisheries Department (L. A. Day) collection, labelled Crocodile River. This fits into the series of recent specimens from the Pivaan River.

The specimen which Fowler described as *crocodilensis* also came from L. A. Day's collection and was most probably taken in the same locality as the one now in the Natal Parks Board collection. Both specimens were presumably from the Transvaal, but one can only speculate whether it was the eastern or the northern Crocodile River (see Barnard, 1943, p. 119).

It has already been shown that *crocodilensis* is not identifiable with *hamiltoni* Gilchrist & Thompson. If Fowler's description and Dr. Böhlke's recent notes on the type of *crocodilensis* are compared with Groenewald's account of his *argenteus*, however, no discrepancies of any importance are apparent. Fowler's type seems to match the largest individual in our collection (108 mm. fork length) in almost every respect.

The inference, therefore, is that Groenewald's material, our Natal specimens and the two from Crocodile River should be regarded as all belonging to the same species. For the present this species is considered to be *argenteus*, but if further investigation of *argenteus* in the neighbourhood of its type locality shows that it differs specifically from the Eastern Transvaal and Natal form, then the name *crocodilensis* Fowler should be used for this southern form.

The distribution of *argenteus* is curious, judging by information so far available. The two Transvaal localities both belong to the Incomati system, if one assumes *crocodilensis* came from the eastern Crocodile River, while the Natal locality is in the southernmost part of the Usutu system. No records exist for the Limpopo or Southern Rhodesian rivers.

Barbus trevelyani Günther.

Günther 1877, Ann. Mag. nat. Hist. (4) vol. 19, p. 313.
Gilchrist & Thompson 1913, p. 414.
Fowler 1935, p. 370.

This species is not represented in the Natal Parks Board collection and its inclusion in the Natal list is based on two doubtful records.

Fowler mentions 13 specimens received from H. W. Bell-Marley, but no

locality is given and they may not have come from Natal.

The other record is part of an undated typewritten list of identifications said to have been received from Dr. K. H. Barnard of the South African Museum. The list was in the Natal Fisheries Department files from the period about 1938, and *B. trevelyani* is recorded from the Illovo River, Richmond.

The single pair of barbels and very small serrations at the tip of the last dorsal spine make typical *trevelyani* easy to recognize. Two specimens from near King William's Town which I examined through the courtesy of Dr. Barnard, accord with the description given by Gilchrist & Thompson. Mr. Jubb has informed me that the anterior barbels may be present, but are always very short.

Barbus gurneyi Günther.

Günther 1868, Cat. Fish., vol. 7, p. 102 (part).
Boulenger 1902, p. 288 ; 1911, p. 150, fig. 127.
Fowler 1934*b*, p. 429.
? Groenewald 1958, p. 316 (*anoplus*, part).

A common species, characteristic of small streams in the Table Mountain sandstone formations of Natal. Although it occurs at elevations of up to 3,500 ft., most localities where *gurneyi* has been collected are from about 2,000 ft. down to below 1,000 ft. altitude. It is known from the Umtamvuna River on the Cape border northwards through Natal to the Eastern Transvaal.

Groenewald does not record *gurneyi*, but some of his *anoplus* material may be *gurneyi*. With reference to some specimens from Jukskei River, he remarks that " apart from the low caudal peduncle scale count (12 and 13) these specimens are unusual [for *anoplus*] in so far as males exhibit conspicuous warts on the head, body scales and all the fins during the spawning period ". Although I have not seen these specimens I am of the opinion that Groenewald's description indicates that they should be referred to *gurneyi* rather than to *anoplus*. Warts (or tubercles) are characteristic of *gurneyi*, but unknown in *anoplus*.

Proof that *gurneyi* does occur in the Transvaal is provided by two specimens (75 and 74 mm. fork length) collected in a tributary of the Sabie River by A. D. Harrison, May 1955. One of these specimens was submitted to Mr. Groenewald who considered that it was referable either to *gurneyi* or to a new species (litt. 19.iii.1956). Since all characters fall within the normal range for *gurneyi*, there seems no doubt as to the true identity.

Another group of specimens originally referred to *anoplus* by Weber (see Barnard, 1943, p. 216) should probably be identified as *gurneyi*. These specimens came from Klip River, Natal, and Barnard pointed out that they differed from *anoplus* in their lower caudal peduncle scale count and in having a more pointed snout. We have collected *gurneyi* in the Klip River area, and Weber's specimens seem more like *gurneyi* than *anoplus*.

Large specimens reach 100 mm. fork length and are easy to recognize, but the identification of smaller individuals may present some difficulty. The number of dorsal rays is very constant and serves to separate specimens of *gurneyi* (seven rays) from specimens of *viviparus* (eight rays). An occasional *viviparus* may be found with only seven rays, however, and possibly an abnormal *gurneyi* might have eight rays. Separation would then depend on other characters such as the scale count from lateral line to dorsal, which is $5\frac{1}{2}$ in *gurneyi* and $4\frac{1}{2}$ in *viviparus*. A more pointed snout and concave dorsal profile to the head are also characteristic of *gurneyi*.

To distinguish between *anoplus* and *gurneyi*, the following characters of the latter are diagnostic: caudal peduncle scales 12 to 14, predorsal scales 11 to 12, anterior barbel present from a size of 30 mm. or less, posterior barbel well developed (usually at least 15 per cent. of head length in 30 mm. specimens, increasing to over 30 per cent. in large specimens). Tubercles are developed in breeding adults of both sexes in *gurneyi*, but not in *anoplus* nor *viviparus*.

Barbus rubellus n. sp. Text-fig. 1.

Diagnosis.—DIII 8; third simple ray of dorsal slightly longer than head, not serrated, thin and flexible; two pairs of barbels, both short, posterior not more than about half eye diameter; first simple ray of ventral below anterior rays of dorsal. Scales: l.l. 24 to 25, p.d. 8, c.p. 12; 6 to 8 radiating striæ. Depth about 30 per cent. of standard length, slightly greater than head length.

Distinguished from other South African species with similar dorsal fin formula, and two pairs of barbels, by the smaller number of scales and shorter barbels.

Holotype.—An adult female, 65 mm. fork length, 57·5 mm. standard length; collected in Mzenyeni pan (27° 10′ S., 32° 23′ E.), Ingwavuma District, September 16, 1956 (R. S. Crass, J. Geddes-Page, T. G. Fraser). Natal Parks Board No. 146/1.

Paratypes.—One male, six females, 47 to 62 mm. fork length; same place and date as holotype. Two males, five females, 40 to 46 mm. fork length, same locality, September 17, 1956. Natal Parks Board Nos. 146/2 to 146/8 and Nos. 150/1 to 150/7.

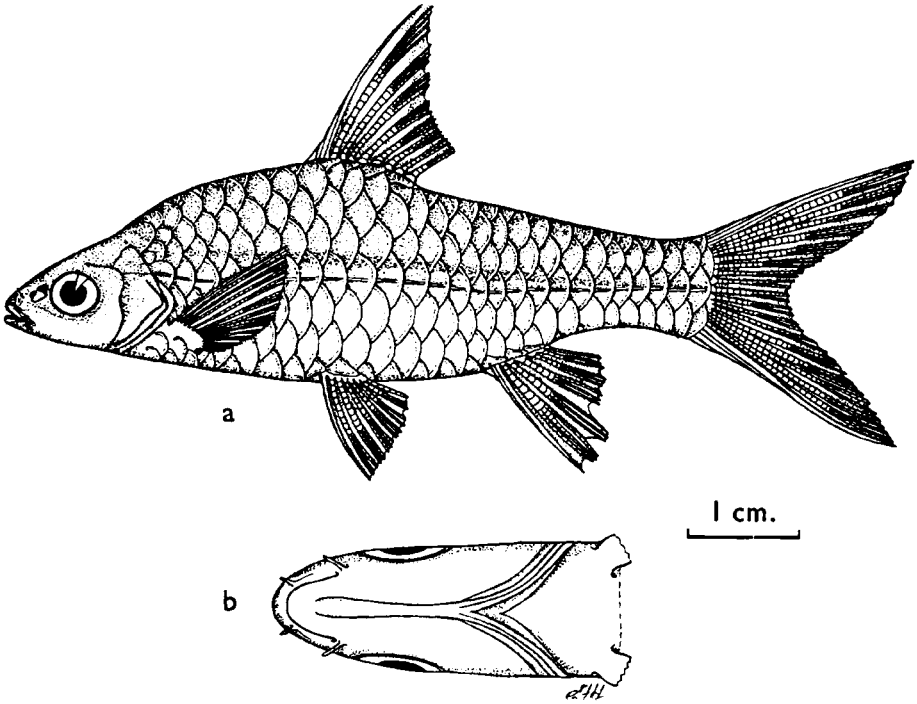
Description.—A small species in which development of the gonads has commenced in specimens of both sexes at 40 mm. fork length. Fresh specimens are bright silvery in colour, with a whitish stripe along the lateral line. Fins pale yellow, terminal one-third of caudal and dorsal orange-red, with a narrow black edging, the black more distinct on the dorsal. Adults of both sexes have a conspicuous blood-red area in the eye, occupying the top quadrant of the iris.

Specimens preserved in formalin lose all trace of red colour, but the dark edgings to the dorsal and caudal fins remain. The upper surface of the body

appears more pigmented than in life and a faint dark band runs along the side of the body above the lateral line, converging with it posteriorly. Scales on the dorsal and dorsolateral surface are pigmented, but the posterior border of each scale is pale, giving a somewhat speckled effect.

Measurements of 15 type specimens, range and mean, in percentage of standard length: depth 27 to 31 (mean 29·6), head 25 to 29 (mean 27·4),

TEXT-FIG. 1.



Barbus rubellus n. sp. (*a*) Lateral view of holotype, (*b*) ventral view of head of holotype (scale 2 × lateral view).

pre-ocular distance 5·6 to 7·8 (mean 6·7), eye 7·8 to 10·0 (mean 9·2), inter-orbital width 9·1 to 10·5 (mean 9·9), predorsal distance 43 to 47 (mean 44·9), caudal peduncle depth 12 to 15 (mean 13·4), anterior barbel 1·0 to 3·7 (mean 1·9), posterior barbel 1·5 to 4·7 (mean 3·0), distance of first simple ray of dorsal in advance of first simple ray of ventral 0·6 to 5·5 (mean 2·9), length of third simple ray of dorsal 27 to 31 (mean 29·2), length of longest ray of pectoral 19 to 21 (mean 19·7), length of median caudal ray 15 to 17 (mean 16·3), length of longest caudal ray 33 to 38 (mean 35·7).

Gill-rakers (of two specimens) short, knob-like, 8 to 9 on anterior arch. Lateral line complete, 24 to 25 scales (type, 24 on right side, 25 on left). Scales above lateral line to origin of dorsal, 3 ; below lateral line to origin of ventral, 2. Predorsal scales, 8 ; 12 round caudal peduncle. Striæ, 6 to 8 on all but one specimen (a male of 41 mm. fork length) which has only 4 to 5.

Mouth small, terminal. Snout (pre-orbital) length equal to eye in holotype, but less in paratypes, tending to decrease as a percentage of standard length with decreasing size of the specimens (see Table I). The eye shows the opposite tendency and the smallest specimens have a relatively bigger eye than the largest specimens. This phenomenon is, of course, normal for a series of fishes of increasing length. Eye diameter varies from 30 to 36 per cent. head length ; the corresponding values for interorbital distance are 35 to 39 per cent., the interorbital being consistently slightly greater than eye diameter. Caudal peduncle depth is about half of head length and its ratio of length : depth is about one and a half.

Dorsal is approximately midway between centre of eye and base of caudal and slightly in advance of ventral. The vertical distances between the first simple ray of the dorsal and that of the ventral are shown in Table II. The latter varies in position between approximately D1 and D4.

The uniform depth of body in 14 of the specimens is probably correlated with the fact that no great differences exist between them in degree of sexual development. The gonads are developing in all, but none are fully mature. The one specimen which is notably more slender than the others is the smallest male of the series.

Habitat.—This species is known only from Mzenyeni pan, a shallow sheet of water with a maximum area of about one square mile. Periodic inundations of the whole flood plain, including Mzenyeni and other pans, occur when the Pongola River overflows its banks after heavy rain. Both lots of specimens (collection Nos. 146 and 150) were taken in the same part of the northern shoreline of the pan with a ¼ in. mesh seine net. In the area netted the depth of the water did not exceed 3 ft. and there was no aquatic vegetation except a few tufts of *Potamogeton crispus*. The substratum consisted of silt overlying a mixture of sand and clay. The water was turbid, with a visibility of approximately 6 in., measured by Secchi disc.

Remarks.—The name refers to the red coloration of eye and fins.

Barbus viviparus M. Weber.

Weber, M. 1897, Zool. Jahrb. Syst., vol. **10**, p. 153.
Barnard 1943, p. 218 ; 1948, p. 426, fig. 3.
Groenewald 1958, p. 321, pl. 19.

The name *viviparus* is used here because Weber's type specimens came from Natal and a large quantity of material in the Natal Parks Board collection is referable to the same species as the one described by Weber. There is reason

TABLE II.—*Measurements of* 15 *Type Specimens of* Barbus rubellus *n. sp.*

	Specimen No.																	
	146/1	146/2	146/3	146/4	146/5	146/6	146/7	146/8	150/1	150/2	150/3	150/4	150/5	150/6	150/7	Mean.	S.D.	C.V.
Standard length (mm.)	57·5	54	50	49	46·5	45·5	43	41	40	40	38	36	36	35·5	34·5			
Sex	♀	♀	♂	♀	♀	♀	♀	♀	♀	♀	♀	♂	♀	♂	♀			
Percentage of S.L. :—																		
Body depth	29·4	30·0	29·6	28·6	30·4	28·3	29·5	30·7	30·8	29·8	30·8	29·5	30·0	27·4	30·0	29·6	0·96	3·2
Head length	26·1	27·0	27·7	28·6	28·7	28·0	27·9	27·6	27·0	25·5	26·3	27·2	27·2	28·0	27·4	27·4	0·87	3·2
Pre-ocular	7·8	7·1	7·4	7·6	7·8	7·2	7·0	7·4	6·0	6·0	6·1	6·1	5·9	5·6	5·8	6·7	0·63	9·4
Eye	7·8	8·1	8·9	8·8	9·1	9·1	9·5	9·7	9·5	9·0	9·6	9·2	9·4	10·0	9·7	9·2	0·61	6·7
Interorbital	9·1	9·2	9·3	9·8	9·9	9·9	10·2	10·5	10·0	10·0	10·2	10·0	10·3	10·9	10·1	9·9	0·47	4·8
Predorsal	44·2	45·5	44·2	45·6	44·1	46·2	45·9	44·4	47·0	42·9	43·1	44·4	45·9	45·6	44·6	44·9	1·28	2·8
Peduncle depth	14·1	14·6	14·1	13·7	14·6	13·8	14·0	14·1	14·3	12·2	12·4	12·5	12·3	11·9	12·0	13·4	1·0	7·6
Barbel 1	1·4	1·3	1·2	1·0	1·1	1·5	1·6	1·7	3·7	3·5	2·7	2·8	3·6	1·7	2·1	1·9	—	—
Barbel 2	2·1	2·0	1·8	1·7	2·6	2·4	2·3	1·5	4·5	4·7	4·3	4·7	3·9	. .	3·5	3·0	—	—
Length DIII	27·2	28·7	30·6	29·2	28·9	30·1	28·6	29·3	—	29·5	30·8	28·9	27·5	28·6	30·6	29·2	10·9	3·7
Distance DI–VI	3·5	3·5	0·6	2·3	2·7	0·6	3·0	3·2	0·9	5·5	4·3	4·2	3·2	2·9	3·0	2·9	—	—

Standard length in mm., other measurements expressed as a percentage of standard length, with mean, standard deviation (S.D.) and coefficient of variation (C.V.).

to believe, however, that this species is synonymous with others of the same group, including *B. unitæniatus* described by Günther in 1866. An even earlier name is *B. pallidus* A. Smith, revived by Barnard (1948) for Boulenger's *hemipleurogramma*, which is undoubtedly closely related to *viviparus*. Whereas typical *unitæniatus* will almost certainly prove to be merely a form of the same species as that represented by the type specimens of *viviparus*, there is some reason for recognizing *pallidus* as distinct, if only on a geographical basis. Whether this basis will remain after further collecting and examination of material is a question which cannot yet be answered.

In this paper *viviparus* is used to describe Natal material since it is uncertain which of the older names will be finally accepted to replace Weber's name.

Weber's original material came from the Natal coast to the north (Umhloti) and south (Isipingo) of Durban. Our collecting has proved that *viviparus* is a very common species all along the coastal belt from the Cape border to the border of Moçambique. It is the characteristic minnow of the lower country in Natal, but its distribution overlaps that of *gurneyi* which predominates in the midlands. It has even been found occurring alongside of *anoplus* at elevations of over 4,500 ft. Specimens of *viviparus* have been collected in many different types of water from small swampy springs, to forest streams, larger tributaries and even the main rivers. The colour of such waters may be clear, stained by humic acid, or turbid in varying degrees.

Remarkable differences in coloration may be observed between individuals or groups of individuals from different habitats. Although detailed study and analysis of all our material has not been completed, the specific identity of most specimens is not in doubt. Meristic characters, such as fin rays and scales, are generally in accordance with typical *viviparus*, although the range of lateral line scales goes as high as 33. A few individuals have only seven dorsal branched rays (cf. Barnard, 1943, p. 220), but such exceptions to the normal number of 8 are without significance. One Natal collection from near Utrecht (Wasbank Stream, September 1958) might possibly be referable to another species, since in quite a high percentage of specimens only seven rays are present and in addition there is a marked tendency to incompleteness of the lateral line. These two characters, together with the coloration, suggest *pallidus*, as described by Barnard. The range of variation of *viviparus* includes specimens which do resemble *pallidus*, however, and the identification of Natal material with the Cape species may or may not be justifiable. It is justifiable if the Cape populations merge with those of Natal, but the evidence for such continuity is still inconclusive. Barnard was dubious about the identification of Transvaal specimens by Gilchrist & Thompson with *hemipleurogramma* (= *pallidus*).

Groenewald (1958, p. 314) also records *hemipleurogramma* from the Transvaal (Mooi River, Potchefstroom). If he is correct in identifying his specimens with *pallidus* the possibility that this Eastern Cape species is the same as

viviparus becomes a probability. Groenewald uses his short series of specimens from a single locality to re-define *hemipleurogramma* (for some reason he ignores the name *pallidus*), but his description could well refer to specimens of *viviparus* in which the lateral line was incomplete (a variable character) and the coloration atypical. The colour pattern in his specimens was evidently inconstant, since he refers to the fact that " the whole series of spots may be obliterated by a dark stripe running from above origin of the lateral line to caudal ". The size of the eye is smaller than in his table of *viviparus*, but it is also less than the size indicated by Barnard's description of *pallidus*. None of Groenewald's specimens have the typical *pallidus* count of seven dorsal rays. If, therefore, his specimens really are *pallidus* the separation of this species from *viviparus* would be very difficult.

Groenewald records, in addition to *hemipleurogramma* and *viviparus*, *lineomaculatus* and *unitæniatus*. In his attempts to separate these forms, he relies on the colour of preserved specimens. On p. 267 he points out that the colour of preserved specimens of large species of *Barbus* is of no taxonomic importance. In small species he considers that distinctive patterns occur which are of taxonomic importance. This is true, but the question remains whether pigmentation is reliable for the separation of closely related species unless colour patterns are correlated with morphological differences.

In a mixed collection of *viviparus* and *anoplus*, for instance, the colour of each normally suffices to effect their separation. Similarly *bernardcarpi* Jubb (1958) is recognizable by its large caudal spot, as opposed to a smaller caudal spot and two anterior spots in typically coloured *trimaculatus*. In each instance, however, meristic or proportional characters also differ and no difficulty arises in identifying specimens with atypical coloration.

If colour patterns alone are to be used to diagnose species, these patterns must obviously remain reasonably constant. Barnard (1948) was able to use the presence or absence of an anal spot to characterize groups of specimens from the Okavango River but he was not in a position to test his conclusions. In his work on Transvaal *Barbus* species Groenewald (1958) used colour differences to assign material to *lineomaculatus*, *unitæniatus* and *viviparus* respectively. He admits that separation of the three forms is not easy " on scale counts or dorsal formulæ alone. The colour of these species is, however, so distinctive that it forms a reliable guide to the identification of fresh, well-preserved specimens ". This statement implies a conclusion that colour patterns are constant in each species, but a study of his own account of the material with which he worked shows that no such conclusion is tenable. When the findings of other workers are compared, further discrepancies become apparent. Barnard, for instance, places *lineomaculatus* with *unitæniatus* in the group without an anal spot, whereas Trewavas (1936) states that *lineomaculatus* does have an anal spot. Groenewald noted that neither Boulenger nor Barnard recorded an anal spot in *lineomaculatus* and he therefore concluded that "the

occurrence of an anal spot is not constant". With this statement I agree entirely, but it certainly does not accord with the use of the anal spot as a criterion for distinguishing one species from another.

In Natal *viviparus* the anal spot is present in the great majority of specimens from clear water and usually indistinct or absent in those from turbid water. Individual variations in any particular locality also occur. Even in four of the cotypes from Umhloti River (kindly loaned by Mr. F. Talbot, South African Museum) the anal spot is distinct in only two, moderate in one and slight in the fourth. In a series of 60 specimens collected at Durban (S.A.M. No. 19790) the spot is present to a varying degree in most, but is absent in two individuals. Fresh material in the Natal Parks Board collection confirms the fact that variability in pigmentation covers a wide range. Besides differences in the size and intensity of the anal spot, the short black stripe close to the bases of the posterior branched rays of the dorsal fin is by no means constant. The two dark lateral stripes are also highly variable. The lower stripe, along the lateral line, may be absent as Barnard noted in Weber's type specimens; and the upper one may be distinct and continuous, or fragmented to form a series of dots, or rather diffuse and ill-defined.

In contradiction to Groenewald's earlier statement about the distinctive colour pattern of *viviparus*, is his opinion expressed on p. 322 that specimens from two Transvaal localities belong to this species although they have no definite anal spot, besides other differences in their markings. If the specimens concerned are *viviparus*, the question then arises as to the justification for identifying other specimens as *lineomaculatus* and *unitæniatus*.

The four specimens from Matlapitsi River assigned to *lineomaculatus* appear to be typical *viviparus* in every respect except that the arrangement of lateral spots is more like the description of *lineomaculatus* than that of *viviparus*. Another group of 11 specimens from the Usutu River with variable markings is placed tentatively with *lineomaculatus*. They are said to differ from *viviparus* in having smaller eyes, presumably smaller in relation to head length, because in some of 50 mm. the eye diameter is given as 3·0 mm., which is identical to that of a 50 mm. *viviparus* in Table 68. The variable size of the eye in these small *Barbus* is shown by Groenewald's own data, however. From specimens of approximately equal size in his tables of measurements one notes that the eye in *viviparus* is 28·5 to 30 per cent. of head length and in the Usutu *lineomaculatus* 26 to 28 per cent., but in the "typical" *lineomaculatus* from Matlapitsi River the eye is 26 to 30 per cent. These data therefore fail to show that *lineomaculatus* has a smaller eye than *viviparus*.

The other point in which they are supposed to differ is the length of the barbels. Groenewald states that the barbels of *viviparus* never reach "distinctly beyond the posterior rim of the eye". This statement may apply to those specimens which he included in *viviparus*, but the Natal Parks Board collection includes individuals which fit *viviparus* in all particulars and do have

barbels reaching distinctly beyond the posterior rim of the eye.

In my opinion further investigation will show that the material assigned by Groenewald to *lineomaculatus* should be included in *viviparus*. This does not necessarily imply that the true East African *lineomaculatus* is conspecific with our South African species, although it may be.

If the Transvaal *lineomaculatus* should be regarded as a form of *viviparus*, can the same sort of conclusion apply to *unitæniatus* ? The evidence available at the time of writing suggests that the separation of Natal and Transvaal *viviparus* from *unitæniatus* cannot be maintained. From Groenewald's account it would appear that lateral line scale counts might be used to distinguish between the two and he states that *viviparus* has 28 to 31 and *unitæniatus* has 31 to 35. Such limits could be set by an arbitary placing of all specimens with a low count in *viviparus* and all with a high count in *unitæniatus*. It is certainly curious that from one locality (Black Umbeluzi River) came specimens of "*viviparus*", with no anal spot and the other markings indistinct, and also specimens of "*unitæniatus*". Groenewald considers that the eight specimens from Sabie River recorded by Gilchrist & Thompson as *unitæniatus* must have been indistinctly marked *viviparus* because of their low scale count. I have seen these specimens and they do appear to be indistinctly marked *viviparus*; but that does not mean that they should be separated specifically from what Groenewald considers to be *unitæniatus*. Natal *viviparus* material shows a continuous range from 28 to 33 scales. Boulenger gives 30 to 33 in *unitæniatus*, but Trewavas (1936) re-examined Boulenger's specimens from Luapula River, Bange Ngola and Zululand and found that in some the count was as low as 27. She concluded that the correct count was 27 to 32 or 33 scales.

All attempts have failed to divide Natal material of the *viviparus-unitæniatus* group into separate species. Groenewald recognizes four species: *hemipleurogramma*, *lineomaculatus*, *viviparus* and *unitæniatus*. The first name has been placed by Barnard in synonymy with *pallidus* and is no longer valid. This error in nomenclature is relatively unimportant, however, and the main criticism of Groenewald's conclusions must be that no trenchant diagnostic characters support the allocation of his specimens to the four different species. Reasons have already been given for doubting the basis on which Transvaal *lineomaculatus*, *viviparus* and *unitæniatus* are separated. The only morphological feature which Groenewald adduces to distinguish his *hemipleurogramma* from the *viviparus* group is discontinuity of the lateral line. This character certainly has no taxonomic significance in *B. gurneyi*, nor in *B. anoplus*, and Barnard (1943, p. 193) states that "the incompleteness of the lateral line, regarded as one of the specific characters of *hemipleurogramma* is not at all constant". He mentions specimens in which the lateral line is complete at least on one side. Conversely, *viviparus* may have a discontinuous lateral line; in South African material from Durban some specimens have as few as 13 scales with lateral line tubules. Transvaal "*hemipleurogramma*" specimens have eight

dorsal branched rays which is the usual number for *viviparus*, but Cape *pallidus* normally has only seven although eight is also recorded. Natal *viviparus* material includes a certain number of specimens with seven branched rays. The most logical inference to draw from the evidence at present available is that, at least throughout Natal and parts of the Transvaal, only a single species is represented by the various described forms.

Trewavas (1936) was unable to separate *lineomaculatus* from *unitæniatus*, which she considered extended to Zululand. Her remarks after studying the material at the British Museum were that "likenesses are perhaps more important than differences", and that the best conclusion was to regard these small fishes as "a single systematic unit likely to develop local peculiarities". Those words sum up the position as well today as they did in 1936. To set arbitrary limits within a range of variable characters in an attempt to provide specific diagnoses merely adds to taxonomic confusion.

Barbus anoplus M. Weber.

Weber, M. 1897, Zool. Jahrb. Syst., vol. **10**, p. 151 (part).
Gilchrist & Thompson 1913, p. 430 (*karkensis*) (not p. 428, *anoplus* from Cape localities).
Fowler 1934*b*, pp. 430, 431 (*karkensis*); 1935, p. 371.
Barnard 1943, p. 206, fig. 21.
Groenewald 1958, p. 316, pl. 18, fig. 2.

Barnard gives an excellent account of this species and he mentions the similarity of *karkensis* to typical *anoplus*. Abundant material is in the Natal Parks Board collection and study of this material has shown conclusively that the lateral line can vary in one population from the complete *karkensis* type to only a few tubules. Groenewald also states that the lateral line may be complete but is, as a rule, variously interrupted.

The slight difference in number of striæ, which Barnard mentions, is by no means constant and *karkensis* is now placed in synonymy with *anoplus*.

In Natal, *anoplus* occurs from the Cape border in the south to the Transvaal in the north. It is the common minnow of streams in the upper midlands and Drakensberg foothills (Middle and Upper Beaufort Series) at about 4,000–5,000 ft. altitude.

The number of caudal peduncle scales in Natal specimens agrees with Barnard's figure of 16 for adult individuals. The figure of 12 in Groenewald's key on p. 269 is erroneous and it has been suggested earlier that some of his specimens with low caudal peduncle scale counts, well developed anterior barbels and tubercles on the head should be referred to *gurneyi*, not *anoplus*.

Barbus toppini Boulenger.

Boulenger 1916, vol. **4**, p. 274.

Five specimens were collected by F. Toppin from Msunduzi River, Ubombo District, and these formed the type series which Boulenger stated was in the

Durban Museum. No record of any *B. toppini* exists at that institution, however, and it was therefore of particular interest to see a live specimen which is now preserved in the Natal Parks Board collection. Mr. C. J. Ward found it in an isolated pool at the headwaters of the Amanzimbomvu Stream, Hluhluwe Game Reserve, August 1957. It lived in his aquarium until January 1958.

The following notes were made on the colour of the living fish: Head dark olive with a golden iridescence laterally. Snout dark, exept a pale olive area near nostril and forward to behind lips. Lips dark. Iris pale golden with some dark colour towards the margin, especially dorsally. Lower parts of sides of head, including lower half of pre-operculum and operculum pale golden. Back pale olive, with dark pigment on the scales, concentrated towards the posterior border of each scale. A distinct blackish streak along the side, well marked anteriorly, becoming more diffuse in the middle of the body, where it is partly obscured by a silvery iridescent area. The dark streak becomes stronger again posteriorly and expands into a black patch at the base of the caudal fin, extending on to the central caudal rays. Flanks and belly very pale golden, translucent, the gut showing as a dark streak posteriorly. Fins almost colourless, except the proximal parts of the fin rays which have numerous melanophores.

In formalin, the golden and silvery iridescence disappears, and the dark pigmentation is more apparent.

The specimen is a mature female, fork length 34 mm., standard length 29·5 mm., with the following measurements, expressed as a percentage of standard length: Depth 27·5, head 28, pre-orbital 4·0, eye 9·0, interorbital 9·0, snout to dorsal 52, 3rd simple ray of dorsal 28, caudal peduncle length 23, caudal peduncle depth 12.

Scales with 8 to 12 radiating striæ; l.l. 28, c.p. 12, 4 between dorsal and lateral line, 2 between lateral line and ventral.

No barbels are present, but otherwise there is a close resemblance to the description of *B. umbeluziensis* Groenewald.

Barilius neavii Boulenger.

Boulenger 1911, vol. **2**, p. 199.
Boulenger 1916, vol. **4**, p. 275 (*peringueyi*).
Gilchrist & Thompson 1913, p. 432 (*peringueyi*).

The synonymy of *stephensoni* with *neavii* was pointed out by Boulenger (1916, p. 276). I follow Mr. Jubb (personal communication) in proposing that *peringueyi* should also be considered a synonym of *neavii*, but there appears to be no morphological basis for the separation of *B. zambesensis* (Peters). This name was published in 1852 and if only one species be recognized, *zambesensis* has priority.

This fish is found in the Pongola River and its tributaries but not in any

water to the south of that system. It has been collected from the upper part of the river near Paulpietersburg and is common farther down, especially in the rocky pools below the Pongola Barrage.

Engraulicypris brevianalis Boulenger.

Boulenger 1911, vol. 2, p. 211.
Gilchrist & Thompson 1913, p. 436.
Barnard 1943, p. 221.

Hitherto recorded from Dwaars River, Transvaal, Hluhluwe River and Mkuzi River (type locality), this species is represented in the Natal Parks Board collection by material from the following localities: Lower Pongola River; Hluhluwe Game Reserve; Black Umfolozi River in Umfolozi Game Reserve. The last-mentioned record (F. L. Farquharson, I. C. Player, September 1958) extends the known range farther south than was hitherto reported.

Clarias gariepinus (Burchell).

Burchell 1822, Trav. Int. S. Afr., vol. 1, p. 425.
Boulenger 1911, vol. 2, p. 228, fig. 193; ? p. 240 (*capensis*).
Gilchrist & Thompson 1913, p. 439.

The exact status of each of the various forms of *Clarias* which are related to *gariepinus* remains undecided, but specimens in the Natal Parks Board collection seem to agree well with Boulenger's description of this species.

The occurrence of *gariepinus* in Natal is mentioned by Boulenger who states that this species extends through Natal and the Transvaal, northwards from the Orange River to Rhodesia, Mozambique, Angola and Katanga. His statements on the geographical distribution of *Clarias* species were modified by David (1935) who suggested that four closely related forms could be distinguished, as follows: *lazera* from Syria to North Africa; *mossambicus* in East Africa south to Mozambique, occupying an area from Katanga to the Zambezi through Rhodesia and as far as the Orange River; *capensis* in Natal, and the Cape Province. These forms are supposed to be distinguishable on the relative widths of premaxillary and vomerine bands of teeth. The vomerine band is said to be one and a half times as wide as the premaxillary band in *lazera*, one to one and a half times in *mossambicus*, less than one in *gariepinus*. A narrow vomerine band interrupted in the middle characterizes *capensis*.

An obvious error in the distribution map (p. 130) is the inclusion of the Eastern, Southern and South-western Cape in the area assigned to *capenis*. Despite its name, *capensis* has only a very doubtful connection with the Cape Province since the original type came from an unknown locality and the specimen described by Boulenger came from Pietermaritzburg, Natal. Gilchrist & Thompson recorded a specimen from South West Africa as *capensis*, but no *Clarias* at all have been reported from beyond the Umtamvuna River on Natal's southern border, nor from any Cape river south of the Orange.

David's correlation of morphological forms with geographical areas presents an attractive picture which was accepted by Worthington (1940, p. 292) who regarded *lazera*, *mossambicus*, *gariepinus* and *capensis* as components of a cline.

Generalizations such as those of David require factual support, however, and one is struck immediately by the changes which she introduced to Boulenger's account which was based on all the material available at the British Museum. David had no fresh specimens of *capensis* and it seems strange that she regarded this as the characteristic form in Natal when Boulenger saw only two examples of *capensis* and placed the majority of his Natal specimens in *gariepinus*.

Clarias material in the Parks Board collection shows that no easy separation of species or even of recognizable geographical forms is possible on a single character, such as the vomerine teeth. Many individuals do have teeth which match *gariepinus*, but a continuous series can be obtained from those with a vomerine band broader than the premaxillary to others with a partially or completely interrupted vomerine band. A broad vomerine band is characteristic of *mossambicus* and a narrow interrupted band is supposed to be a diagnostic feature of *capensis*.

I can express no opinion about the status of *mossambicus* which Boulenger regarded as occurring far to the north of Natal but I suggest that *capensis* will in future probably be regarded as a synonym of *gariepinus*. The head to dorsal distance and the position of the ventral fins, which Boulenger (1908) emphasized as distinguishing *capensis* from *gariepinus*, are neither of any apparent significance judging by their variability in our collection of *Clarias*. It is notable that in his later key (1911, p. 222) Boulenger does not use the position of the ventral fin to separate *capensis* from *gariepinus*, but relies primarily on the head length in relation to body length. This character is variable, however, and may prove unreliable. There is no question about the lack of consistency in the ratio of head length to distance between occipital process and dorsal. Even Boulenger's material was evidently adequate to show a continuous gradation since he states the ratio is " at least $3\frac{1}{2}$ times " in the *gariepinus* group, whereas in *capensis* the distance between occipital process and dorsal is " 2/7 to $\frac{1}{3}$ length of head ". If these two apparently different figures are both converted to percentages of head length, they can be re-stated as " up to 29 per cent." and " 29 to 30 per cent." respectively. The Natal Parks Board collection includes numerous specimens not yet properly studied, but even among a few adults of 460 to 820 mm. total length, percentages cover a range of 18 to 31 per cent.

Many individuals will have to be studied before a true picture of variability can be built up, but it seems reasonable at present to assume that *gariepinus* is the only representative in Natal of the group of *Clarias* species which includes *mossambicus* and *capensis*.

C. gariepinus is common in the lower reaches of Natal rivers, apparently

predominating over all other species of fishes in the zone towards the coast, although it also extends up to an altitude of about 4,000 ft. in some waters.

Clarias theodoræ M. Weber.

Weber, M. 1897, Zool. Jahrb. Syst., vol. **10**, p. 150.
Boulenger 1911, vol. **2**, p. 262, fig. 218.

This species is recorded from Natal, but no specimens of *theodoræ* have yet been identified in the Natal Parks Board collection.

Family SCHILBEIDÆ.

Eutropius depressirostris Peters.

Peters 1855, Arch. f. Nat. p. 267.
Boulenger 1911, vol. **2**, p. 291, fig. 237.
Gilchrist & Thompson 1913, p. 449.

Hitherto recorded from East Africa and southwards to the Transvaal, this species is found in the lower Pongola River, which is the southerly limit of its distribution.

Family AMPHILIIDÆ.

Amphilius grandis Boulenger.

Boulenger 1905, p. 63, pl. 7, fig. 3. 1911, vol. **2**, p. 355.
v. d. Horst 1932, p. 246, fig. 1. (Specimens from Transvaal, not specimen from Krantzkloof, Natal.)
Barnard 1942, p. 257 (? specimens reported from Transvaal and Mozambique).

In the Natal Parks Board collection are five specimens from the Pongola River system up to a fork length of 131 mm. which are not *A. natalensis*. They have a bigger head, longer as a percentage of body length and relatively broader than in *natalensis*, the caudal peduncle is deeper and the dorsal fin is closer to the head. Owing to the smaller head of *natalensis*, the distance from snout to dorsal as a percentage of body length does not show a clear-cut difference, especially in small specimens but if the length of the head (*H*) is taken from snout tip to posterior edge of the operculum and the distance (*H–D*) is taken from opercular edge to vertical below 1st dorsal ray, the ratio $H : H–D$ is about 1·1 to 1·3 for *natalensis* and about 1·6 to 2·0 for the Pongola specimens.

These specimens are very similar to Boulenger's description of *grandis* and therefore they are tentatively assigned to this species which has already been recorded from the Transvaal by van der Horst. Other species listed by Boulenger, especially *hargeri* and *platychir*, are closely related and the diagnostic characters which are used in Boulenger's key do not appear very satisfactory.

Mr. Jubb (in litt. January 19, 1959) informs me that material submitted by him to the British Museum covers *grandis* and *hargeri*. This material is from Rhodesia and particulars kindly supplied to me by Mr. Jubb indicate that it is very similar to the Natal Pongola River specimens. If *grandis* is the correct name for the Rhodesian specimens it is probably also correct for the Pongola River species, but no definite conclusion seems possible at present, except to state that the *platychir-grandis-hargeri* group is represented as far south as the Mkuzi River. The inclusion of the Mkuzi River in the geographical range of *grandis* depends on the single specimen collected by Dr. R. F. Lawrence (see Barnard, 1942). This specimen has been kindly loaned to me by Mr. F. Talbot and it agrees with *grandis* and not with *natalensis*, as suggested by Barnard.

Amphilius natalensis Boulenger.

Boulenger 1917, p. 432.
Gilchrist & Thompson 1917, p. 558 (*longirostris*).
Fowler 1934*a*, p. 408. 1934*b* p. 418.
v. d. Horst 1932, p. 246 (*grandis*, specimen from Krantzkloof, Natal).
Barnard 1942, p. 257 (Natal specimens, *not* Transvaal and Mozambique material).

The headwaters of the Tugela, Umvoti, Umgeni and Illovo rivers and their tributaries form the habitat of this species of which hundreds of specimens are in the Natal Parks Board collection. The type locality, Krantzkloof, is in the Umgeni system.

In the Pongola River system *natalensis* is replaced by *grandis*, but apparently both species occur in the Mkuzi River. As mentioned above, one specimen in the South African Museum from the Mkuzi River is identifiable with *grandis*. I have also seen the three other specimens mentioned by Gilchrist & Thompson and by Barnard from "Zululand". The label accompanying these South African Museum specimens indicates that they were collected by H. W. Bell-Marley from the Mkuzi River. They are undoubtedly *natalensis* and are quite distinct from the specimen of *grandis* collected by Dr. R. F. Lawrence.

The identity of the specimen from Krantzkloof which van der Horst saw and included with his Transvaal specimens in *grandis* does not seem to be in doubt. Krantzkloof is the type locality for *natalensis*, where it has been collected recently (November 1958), and no *Amphilius* resembling *grandis* is to be found in the Umgeni River or neighbouring systems. As Barnard pointed out (p. 258) van der Horst gave no proper description of his three specimens, but the zoogeographical improbability of finding *grandis* at Krantzkloof amounts almost to a certainty.

The fact that *natalensis* is not confined only to headwaters is proved by a record of the species from the Umgeni River at Nagle Dam only just over 1,000 ft. above sea level. The type locality is only slightly higher, but the species is most abundant at altitudes of about 4,000–4,500 ft.

Maximum size of specimens in the Natal Parks Board collection is about 125 mm. fork length (110 mm. standard length).

A. natalensis is one of the few species of fishes endemic to this Province. I have seen specimens of an interesting form which appears to be related to *natalensis*, collected by Mr. Jubb in the Gairezi River, Southern Rhodesia (Zambezi system).

Family Mochocidæ.

Synodontis zambesensis Peters.

Peters, 1852, Mon. Berl. Ak., p. 682.
Boulenger 1911, vol. 2, p. 415.
Crass 1957, p. 89.
Jubb 1958, p. 181.

Until this species was discovered in 1952 by Mr. T. F. Elphick at Ndumu (lower Pongola River) it was not known to occur south of the Zambezi system. Further collecting has shown that it is fairly common in the Pongola pans, east of the Lebombo range.

Genus *Chiloglanis* Peters.

This genus of small catfishes has hitherto been recorded in South Africa only by van der Horst (1932) who described three new species from four specimens. Despite the inadequacy of his material all three species appear to be valid, since the diagnostic characters which separate them are as well marked as those separating other species of the genus.

The Pongola River system on the Natal-Transvaal border contains three species of *Chiloglanis*, all of which are new. Their descriptions follow and each is easily recognized. *C. anoterus* and *C. engiops* are known only from the Pongola system, but one of the paratypes of *C. paratus* comes from the Crocodile River, Eastern Transvaal. This eastern Crocodile River belongs to the Incomati River system and is not to be confused with the Crocodile River near Pretoria from which came one of van der Horst's specimens of *C. pumilus*. van der Horst's species all belong to the Limpopo River system and Mr. R. A. Jubb has kindly allowed me to examine five specimens of *C. pretoriæ* which he obtained, also from the Limpopo system, but some 300 miles to the north of van der Horst's type locality. Mr. Jubb's specimens were collected in Southern Rhodesia, but there seems no doubt about their identity with *pretoriæ* although the original type specimen is lost.

Evidence at present available suggests that the members of this genus show a greater degree of endemism than is usual among African fishes. In other genera many of the species proposed on the basis of descriptions taken from a few specimens have proved to be synonymous with related forms from

neighbouring areas, but *Chiloglanis* species are probably mostly valid, judging by the apparent reliability of the taxonomic characters.

No account had been published of the range of variation in the morphological characters of a series of specimens of any species of *Chiloglanis* until Whitehead's paper (1958) dealt with the material which he examined. The series of 16 *C. brevibarbis* Boulenger, whose measurements he tabulated, was the first group of more than half a dozen specimens of any species to be studied except *C. lukugæ* Poll (1952). The conclusions to be drawn from Whitehead's work and that on the three new Natal species are therefore of interest in deciding the validity of the characters used by earlier authors who described single specimens or very short series. The number of branched rays in the dorsal varies from five to six in specimens of each of the three Natal species and in *pumilus* van der Horst. This character cannot therefore be used to separate species as Boulenger does in his key to the genus.

All descriptions of *Chiloglanis* species state that only one dorsal spine is present, but in all three Natal species there is a short first spine in front of the main one. It is readily observed in *engiops*, but in the other species it is buried in the skin, especially in large specimens. The small spine can, however, be demonstrated in stained and cleared specimens even when it is hidden.

The number of anal rays is also variable and correct counts are rendered more difficult by the lack of distinction between the last simple ray and the first branched ray.

Poll (1952) pointed out the variability in body proportions, adipose fin length and proportions of the caudal peduncle in *C. lukugæ*, but with the exception of the length of the adipose these characters are reasonably constant in the species considered here (see Table III). The ratio of dorsal-to-adipose distance and length of adipose-base is a very variable character since these two measurements are inversely related, making the ratio less constant than either of the actual measurements.

The number of mandibular teeth is most inconstant since a replacement series lies postero-ventrally to the functional row and each is variable according to the stage of development.

Chiloglanis anoterus n. sp. Text-fig. 2.

Diagnosis.—Dorsal spine short, one-quarter to one-third length of head, two-thirds length of pectoral spine. Interorbital distance about twice eye diameter and slightly over one-quarter head length. Caudal peduncle length at least one and one-half times depth. Maxillary barbel one-fifth to one-third of head length, two to three times length of outer mandibular barbel. Lower lobe of caudal fin elongated in adult males.

Related to *C. pretoriæ*, in which the dorsal spine is longer, the interorbital

TABLE III.—*Measurements of Four Species of* Chiloglanis.

	C. anoterus n. sp. (17 specimens).				*C. pretoriæ* v. d. Horst (5 specimens).				*C. engiops* n. sp. (18 specimens).				*C. paratus* n. sp. (20 specimens).			
	Range.	Mean.	S.D.	C.V.	Range.	Mean.	S.D.	C.V.	Range.	Mean.	S.D.	C.V.	Range.	Mean.	S.D.	C.V.
Standard length (mm.)	46–64	—	—	—	30–48	—	—	—	29–55	—	—	—	28–45	—	—	—
Depth of body	16·7–19·4	18·0	0·80	4·5	17·9–22·5	19·6	1·80	9·2	14·4–16·7	15·3	0·66	4·3	14·7–20·7	17·2	0·89	5·2
Head length	29·1–32·1	30·6	0·89	2·9	31·2–34·9	32·5	1·61	4·9	26·9–30·8	28·8	1·12	3·9	30·1–34·8	33·5	1·38	4·1
Head width	24·6–27·2	26·2	0·52	2·0	25·6–28·1	26·7	0·95	3·6	20·5–24·5	21·9	1·08	4·9	23·4–26·7	25·1	0·87	3·5
Pre-orbital distance	16·0–19·2	17·6	1·02	5·6	14·0–18·1	16·1	1·81	11·4	12·5–15·1	13·7	0·93	6·8	15·2–17·7	16·5	0·58	4·6
Snout to ant. nostril	7·2–8·6	7·9	0·33	4·1	6·9–8·1	7·3	0·52	7·1	—	—	—	—	—	—	—	—
Between ant. nostrils	5·0–6·1	5·5	0·23	4·2	4·6–5·3	4·9	0·26	5·3	3·5–4·5	3·90	0·36	9·2	3·9–4·8	4·6	0·28	6·2
Post. nostril to eye	5·3–6·3	5·8	0·33	5·7	4·5–5·4	4·9	0·43	8·8	3·0–4·1	3·39	0·40	11·8	3·7–4·7	4·1	0·28	6·9
Eye diameter	3·3–4·3	3·8	0·28	7·4	3·6–4·4	4·2	0·34	8·1	5·1–5·7	5·40	0·21	3·9	4·0–4·6	4·3	0·16	3·7
Interorbital width	7·7–9·3	8·7	0·40	4·7	8·7–9·9	9·5	0·43	4·5	4·4–5·8	5·12	0·41	8·0	7·1–7·9	7·6	0·26	3·4
Snout to dorsal	33·8–37·7	36·0	1·10	3·1	37·3–39·0	38·1	0·76	2·0	32·0–37·0	35·2	1·27	3·6	35·2–40·3	38·2	1·53	4·0
Dorsal to adipose	22·4–28·0	25·2	1·60	6·3	19·7–25·0	22·2	2·25	10·1	19·8–25·1	22·9	1·22	5·3	19·7–25·8	21·7	2·31	10·6
Adipose base	13·8–18·4	15·6	1·42	9·1	16·2–21·6	19·5	2·06	10·6	19·5–23·8	21·2	1·53	7·2	14·7–20·0	17·0	1·48	8·7
Peduncle length	17·3–21·2	18·6	0·92	4·9	16·2–18·0	16·9	0·82	4·8	17·3–20·3	19·0	0·41	4·3	14·4–16·8	15·7	0·81	5·2
Peduncle depth	10·8–12·4	11·9	0·45	3·8	11·0–12·5	11·7	0·54	4·6	7·9–9·3	8·50	0·81	4·8	8·4–10·2	9·4	0·50	5·3
Dorsal spine	6·6–9·1	7·9	0·68	8·6	12·6–15·0	14·5	1·73	11·9	12·7–16·9	15·2	1·17	7·7	13·3–18·7	16·5	1·32	8·0
Pectoral spine	10·9 13·4	12·6	0·75	6·0	12·3–17·0	15·5	2·12	13·7	17·0–22·4	19·7	1·25	6·4	19·1–22·2	20·3	1·10	5·4
Maxillary barbel	6·4–8·4	7·5	0·65	8·7	9·0–10·9	9·8	0·77	7·8	13·0–18·8	15·3	1·50	9·8	7·1–11·7	8·6	1·02	11·8
Outer mand. barbel	2·2–3·6	2·8	0·37	13·2	3·9–5·0	4·0	0·54	13·3	9·7–12·8	10·7	1·30	12·2	3·5–5·0	4·2	0·41	9·9
Inner mand. barbel	0·6–1·5	1·1	0·28	25·4	1·9–2·7	2·2	0·31	14·1	6·3–10·3	8·5	1·11	13·1	1·7–4·3	2·5	0·51	20·6

Standard length in mm., other measurements expressed as percentage of standard length. The range, mean, standard deviation (S.D.) and coefficients of variation (C.V.) are shown for each group of specimens.

slightly greater and the caudal peduncle length less, being only about one and one-third times depth.

Holotype.—An adult male, 84 mm. total length 64 mm. standard length; collected from the upper Pivaan River (Pongola River system), altitude ±4,600 ft. (30° 28′ E., 27° 30′ S.), March 31, 1955 (J. T. Geddes-Page, T. G. Fraser). Natal Parks Board No. 55/1.

Paratypes.—Twenty specimens: 13 males, three females, four juveniles size range 26 to 62 mm. standard length; collected in same locality and on same data as holotype. Natal Parks Board Nos. 55/2 to 21.

Eight specimens: one male, one female, six juveniles; size range 30 to 48 mm. standard length; collected in Pivaan River slightly below previous locality, July 1957 (T. G. Fraser). Natal Parks Board Nos. 171/1 to 8.

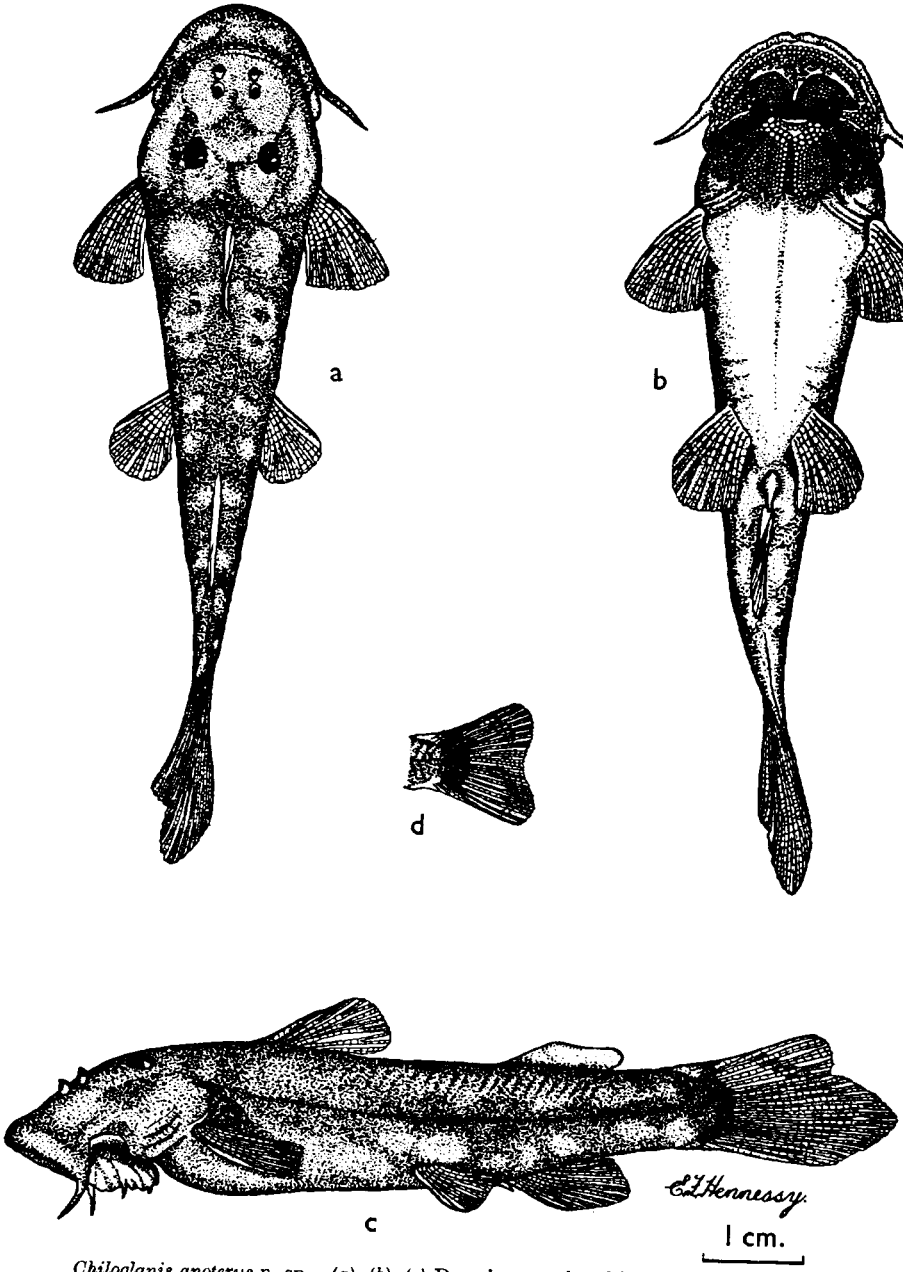
Description.—A relatively large species in which development of the gonads has not been observed in specimens of less than 45 mm. standard length. Colour olive-brown above with yellowish markings, belly and lips pale yellow. Head with ill-defined dark and pale areas, a dark band across the occiput, about seven irregular paired yellowish patches along the body. Fins pale proximally and distally with central darker area.

Measurements of 29 type specimens, range and mean, in percentage of standard length: depth 16 to 20 (18·0), head length 29 to 34 (31·3), head width 24 to 29 (26·8), pre-orbital (snout) 11·5 to 19·2 (16·9), snout to anterior nostril (only 20 measured) 7·2 to 8·6 (7·9), between anterior nostrils (only 20 measured) 5·0 to 6·1 (5·5), posterior nostril to eye 4·8 to 6·3 (5·6), eye diameter 3·4 to 5·2 (4·0), interorbital width 7·7 to 9·8 (8·7), predorsal distance (snout to dorsal) 34 to 40 (36·8), dorsal to adipose 23 to 28 (25·1), length of adipose base 14 to 21 (16·2), caudal peduncle length (only 20 measured) 17 to 21 (18·6), caudal peduncle depth 11 to 13 (11·9), dorsal spine 6·6 to 10·0 (8·2), pectoral spine 11·4 to 14·2 (12·6), middle caudal ray in 12 adult males 26 to 33 in three adult females 14 to 21, maxillary barbel (only 20 measured) 6·4 to 9·3 (7·6), outer mandibular barbel (only 20 measured) 2·2 to 4·6 (3·0), inner mandibular barbel 0·6 to 1·5 (1·1).

Body roughly cylindrical anteriorly, compressed posteriorly, depth five to six in standard length. Head one and one-quarter times as long as broad, its length three to three and one-third times in standard length. Eye in second half of head, its diameter increasing from about one-ninth of head length to one-sixth of head length as size of the specimens decreases. Interorbital distance one and one-half to one and three-quarters distance from posterior nostril to eye.

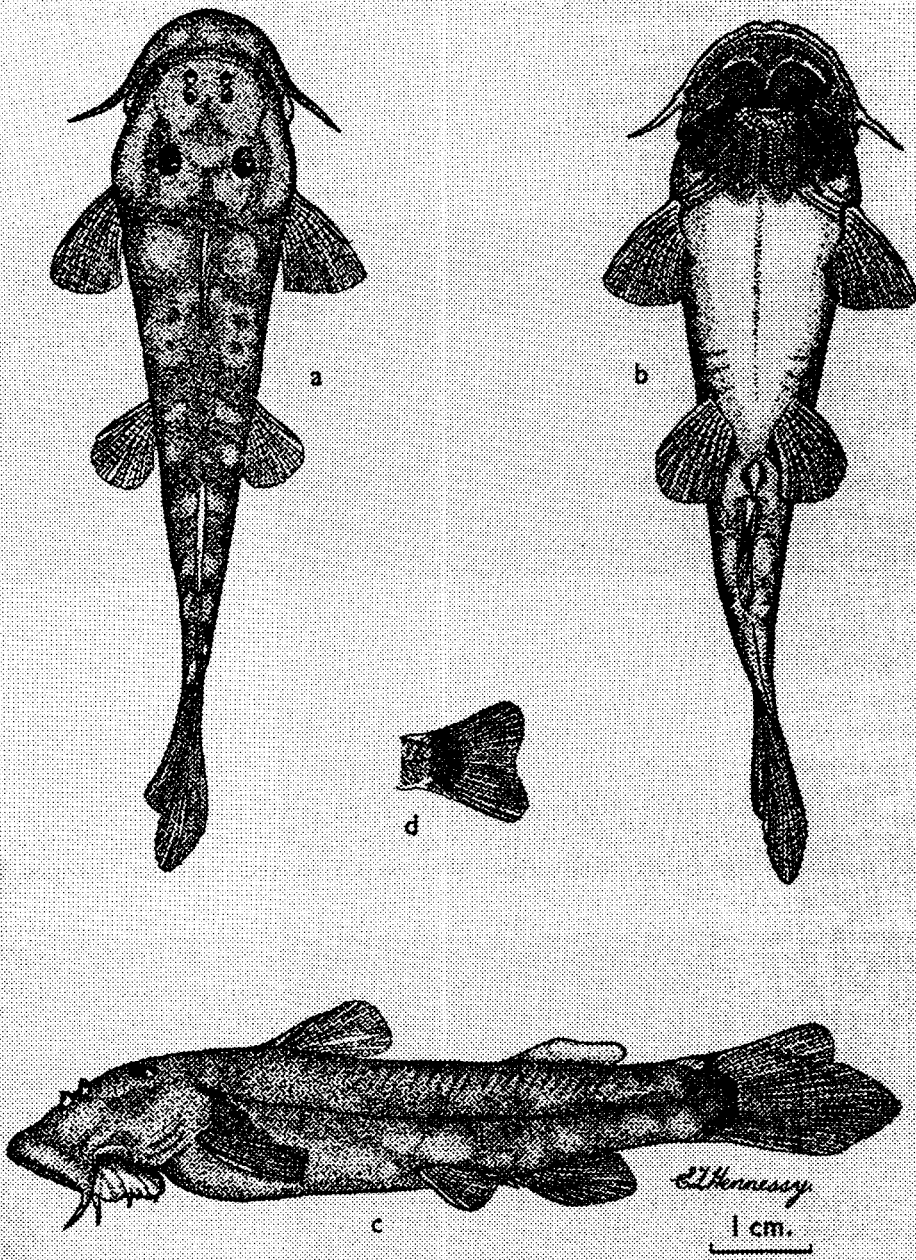
Premaxillary teeth on two oval pads, narrowly separated in the middle. Mandibular teeth up to 12 with a replacement series posteriorly. Maxillary barbel about twice eye diameter and one-quarter of head length; outer mandibular barbel about one-third to one-half of maxillary barbel and nearly three times as long as inner mandibular barbel. Mouth surrounded by large,

TEXT-FIG. 2.



Chiloglanis anoterus n. sp. (*a*), (*b*), (*c*) Dorsal, ventral and lateral views of holotype. (*d*) caudal fin of 42 mm. juvenile.

TEXT-FIG. 2.



Chiloglanis anoterus n. sp. (*a*), (*b*), (*c*) Dorsal, ventral and lateral views of holotype, (*d*) caudal fin of 42 mm. juvenile.

approximately circular lip, posteriorly strongly divided down the midline.

Dorsal with small, hidden first spine and short, unserrated main spine, followed by five (15 specimens), six (13 specimens) or seven (one specimen) branches rays. Adipose fin base variable, averaging about half head length and from half to nine-tenths distance from dorsal to adipose. Pectoral spine not serrated, about three-fifths head length ; eight branched rays. Ventral origin midway between eye and caudal flexure. Anal III 8. Caudal slightly forked in juveniles, but lower-median and median rays elongated in adults, especially in males, to form a long pointed lobe, with the shorter upper lobe above it.

In addition to the elongated caudal rays, adult males are easily distinguished from females by the well developed anal papilla, which is also present in the males of the other two Natal species. Apart from the markedly allometric caudal fin, the only character which shows any discernible increase or decrease in relative size is the eye. This increases in size relatively more slowly than the body and head.

Habitat.—This species inhabits swiftly-flowing parts of upland streams where stones and boulders provide a suitable substratum.

Localities.—In addition to the type specimens, material is in the Natal Parks Board collection from the following localities : Tributary of Pandaan River (affluent of Pivaan) ; Paulpietersburg area ; Pivaan River at bridge on Vryheid-Paulpietersburg road ; Pemvaan River (affluent of Pivaan).

Remarks.—The name refers to the habitat of this species, which occurs at higher altitudes than the other Natal species of *Chiloglanis*.

Chiloglanis pretoriæ van der Horst.

van der Horst 1932, p. 248, fig. 2.

Mr. R. A. Jubb very kindly sent for examination and comparison with *C. anoterus* five specimens of 30 to 48 mm. standard length which are undoubtedly *C. pretoriæ*. The locality from which they were collected is in the Matopos, S. Rhodesia (Limpopo River system).

They agree well with van der Horst's description and figure, and are also close to *anoterus* in many particulars. As in *anoterus* the distance from dorsal to adipose is greater than adipose length, thus agreeing with Van der Horst's figure but not with his description (this discrepancy was brought to my attention by Mr. Jubb).

Although *pretoriæ* is close to *anoterus*, they can be separated at once on the length of the dorsal spine. The mean spine length in 17 specimens of *anoterus* of the same size range as the five *pretoriæ* is 7·9 per cent. S.L., compared with 14·5 per cent. for *pretoriæ*. Although the spine length is variable in both species, there is no overlap in any of the individuals compared. In a statistical test of the significance of the difference between the two groups of

specimens, $t=8{\cdot}2$ which shows a highly significant difference. Using the graphical method of Hubbs & Hubbs (1953) the statistics for the two groups would show a separation of 367 per cent. which also indicates a character that can safely be used for specific differentiation, even though there are only five *pretoriæ* for comparison with the *anoterus* material.

Spine development in some genera (*e.g. Barbus*) is related to calcium content of the water, but in these two *Chiloglanis*, there is a marked difference in the ratio of dorsal to pectoral spines. In *anoterus* the pectoral is about one and a half times the dorsal spine, instead of only about one-tenth longer as in *pretoriæ*. The pectoral spines are, indeed, not noticeably different in length in the two species ($t=1{\cdot}5$). This increases the taxonomic significance of the difference in the dorsal spine, since environmental factors could be expected to affect the two spines to a similar degree. The greater average interorbital and smaller caudal peduncle length of *pretoriæ* are both probably significant differences.

Chiloglanis engiops n.sp. Text-fig. 3.

Diagnosis.—Dorsal spine one-half to three-fifths length of head, three-quarters length of pectoral spine, not serrated. Interorbital distance subequal to eye diameter, and less than one-fifth of head length. Caudal peduncle length more than twice depth. Maxillary barbel half length of head, about one and one-half times outer mandibular and nearly twice inner mandibular. Lip without posterior median incision.

This species is easily recognized by the slender body, relatively large eyes set close together, the long barbels and form of the lip, and the deeply forked tail.

Holotype.—An adult female, 63 mm. fork length, 55 mm. standard length; collected from lower Pivaan River (Pongola River system) altitude $\pm$2,000 ft. (31° 11′ E., 27° 25′ S.), June 24, 1955 (T. G. Fraser). Natal Parks Board No. 76a.

Paratypes.—One female, two juveniles, 31·5 to 40 mm. standard length. Pongola River at Barrage, altitude $\pm$1,000 ft., November 1955 (T. G. Fraser). Natal Parks Board Nos. 87/1 to 3. One male, two females, 34 to 39 mm. standard length; Pongola River, below Barrage, November 1955 (T. G. Fraser). Natal Parks Board Nos. 93/1 to 3. One male, three females, two juveniles, 29 to 39 mm. standard length; Pongola River at Barrage, September 11, 1956 (R. S. Crass, J. T. Geddes-Page, T. G. Fraser). Natal Parks Board Nos. 132/1 to 3 and 8 to 10. One male, four females, 37 to 47 mm. standard length; Pongola River at Barrage, December 5, 1957 (R. S. Crass, T. G. Fraser, F. L. Farquharson). Natal Parks Board Nos. 202/1 to 5.

Description.—A small, slender species in which sexual development begins at a standard length of about 35 mm. Colour pale brownish above almost

white below. Darker patches on head and near bases of dorsal, adipose and caudal fins. Fins colourless.

Measurements of 18 type specimens, range and mean, in percentage of standard length: depth 14·4 to 16·7 (15·3), head length 27 to 31 (28·8), head width 20·5 to 24·5 (21·9), pre-orbital (snout) 12·5 to 15·1 (13·7), between anterior nostrils 3·5 to 4·5 (3·9), posterior nostril to eye 3·0 to 4·1 (3·4), eye diameter 5·1 to 5·7 (5·4), interorbital 4·4 to 5·8 (5·1), predorsal distance (snout to dorsal) 32 to 37 (35·2), dorsal to adipose 20 to 25 (22·9), length of adipose base 19·5 to 24 (21·2), caudal peduncle length 17·3 to 20·3 (19·0), caudal peduncle depth 7·9 to 9·3 (8·5), dorsal spine 12·7 to 16·9 (15·2), pectoral spine 17·0 to 22·4 (19·7), maxillary barbel 13 to 19 (15·3), outer mandibular barbel 9·5 to 13 (10·7), inner mandibular barbel 6 to 10 (8·5).

Body elongate, depth six to seven times in standard length. Head about one and one-third times as long as broad, its length more than three to nearly four times in standard length. Eye in second half of head, almost one-fifth of head length. Interorbital distance less than, or equal to, eye diameter.

Premaxillary teeth on two pads almost joining in the middle. Mandibular teeth up to ten with a replacement series postero-ventrally. Maxillary barbel about three times eye diameter and over one-half of head length; outer mandibular barbel about two-thirds maxillary barbel and about one and a quarter times as long as inner mandibular barbel. Mouth surrounded by a large lip with three sub-triangular lappets between the four mandibular barbels.

Dorsal with small first spine and strongly developed main spine, without serrations; five branched rays (in type and one paratype) or six branched rays (all other specimens examined). Adipose base about equal to width of head and slightly shorter than, or subequal to distance from dorsal to adipose. Pectoral spine not serrated, about two-thirds of head length; eight branched rays. Ventral origin midway between anterior nostril and caudal flexure. Anal IV 8 (six specimens), IV 9 (eight specimens, including the type), IV 10 (four specimens). Caudal forked, with pointed lobes, the lower slightly longer than the upper.

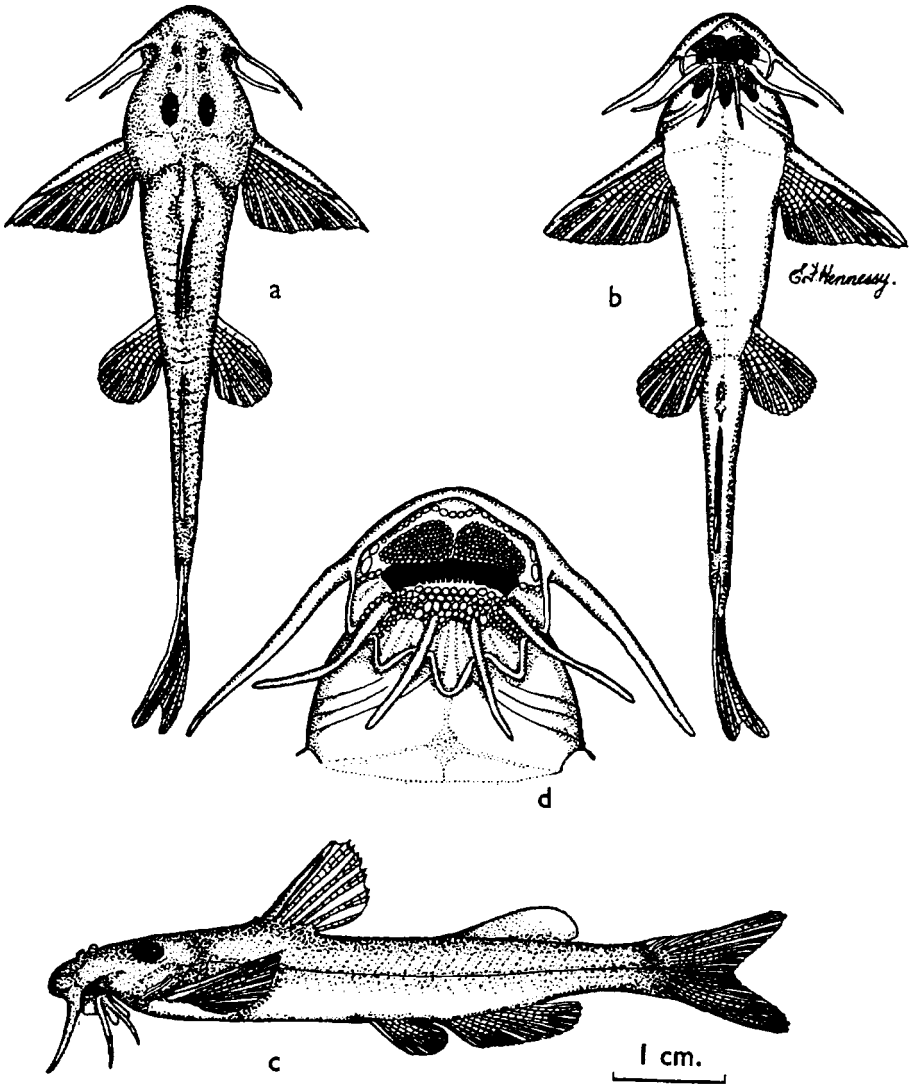
Habitat.—In contrast to the last species, *engiops* lives in sandy backwaters. The majority of the specimens were collected in pools immediately below the concrete wall of the Pongola Barrage. Besides the type specimens some 50 are in the Natal Parks Board collection.

Remarks.—The name refers to the position of the eyes, which are closer together than in other species of the genus.

Chiloglanis paratus n. sp. Text-fig. 4.

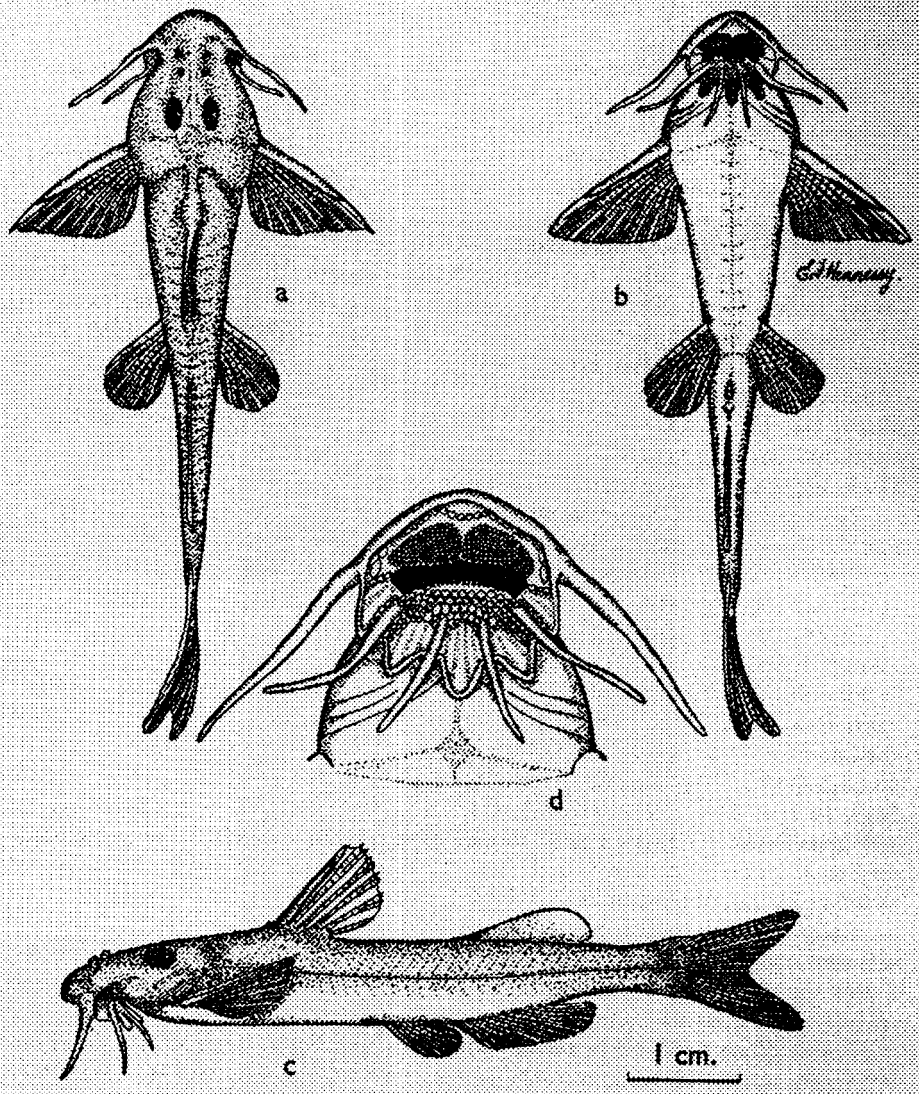
Diagnosis.—Dorsal spine serrated, one-half length of head, four-fifths length of pectoral spine which is also serrated. Interorbital distance about one and two-thirds times eye diameter and less than one-quarter of head length.

TEXT-FIG. 3.



Chiloglanis engiops n. sp. (*a*), (*b*), (*c*) Dorsal, ventral and lateral views of holotype, (*d*) ventral view of head of holotype (scale 2 × the other figures).

TEXT-FIG. 3.



Chiloglanis engiops n. sp. (*a*), (*b*), (*c*) Dorsal, ventral and lateral views of holotype, (*d*) ventral view of head of holotype (scale 2 × the other figures).

Caudal peduncle length about one and two thirds times depth. Maxillary barbel one-fifth to one-third of head length, two to three times length of outer mandibular barbel.

The serrated spines separate this species from others of the same genus. Mr. Jubb drew my attention to the serrated dorsal spine of the specimen which he kindly loaned for inclusion as a paratype.

Holotype.—An adult female, 43 mm. fork length, 37·5 mm. standard length ; collected from concrete wall of Pongola River Barrage, altitude ±1,000 ft. (31° 30′ E., 27° 23′ S.), December 4, 1957 (R. S. Crass, T. G. Fraser, F. L. Farquharson) ; Natal Parks Board No. 193/1.

Paratypes.—An adult female, same dimensions and data as holotype. Natal Parks Board No. 193/2. Two males, four females, ten juveniles, 28 to 36 mm. standard length ; collected in same place on December 5, 1957 (same collectors) ; Natal Parks Board Nos. 201/1 to 16. One adult male, 36 mm. standard length, collected in same place on September 11, 1956. Natal Parks Board No. 131/1. One adult female, 45 mm. standard length ; collected from Crocodile River (Incomati River system), Eastern Transvaal, March 28, 1958 (T. F. Elphick) ; Department of Ichthylogy, Rhodes University, Grahamstown.

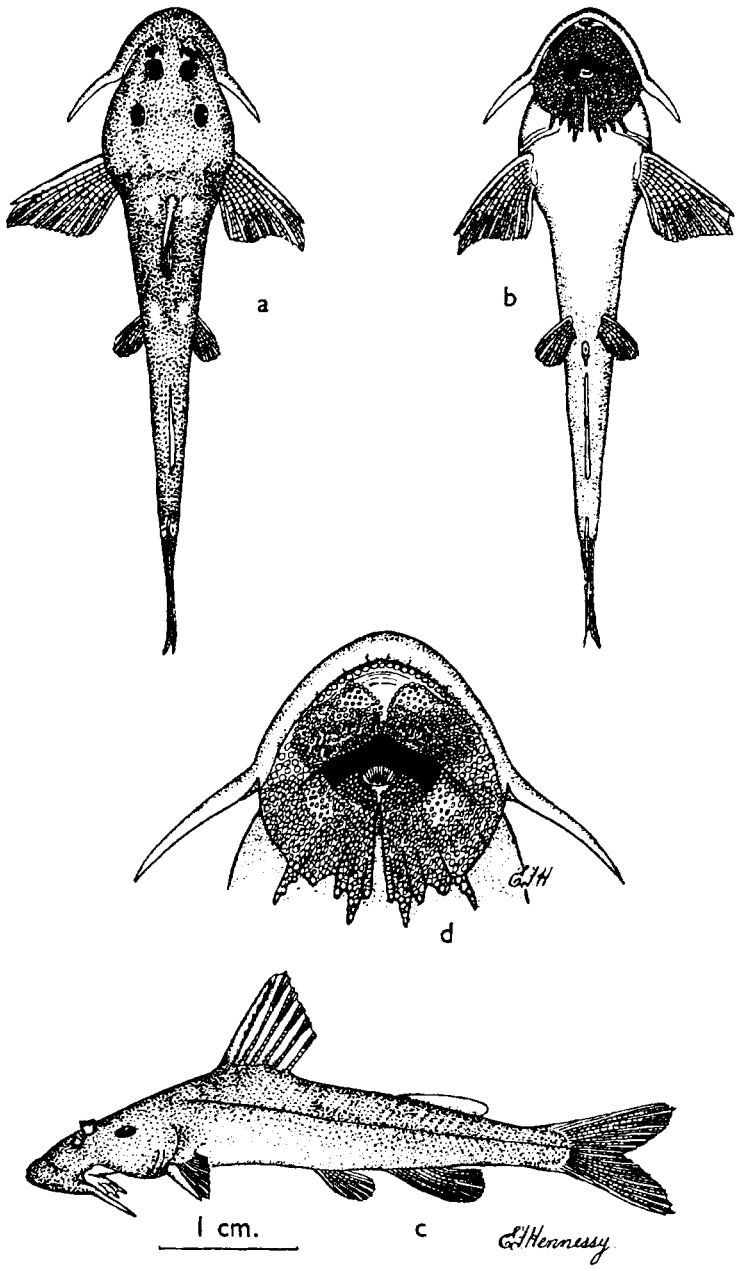
Description.—A species in which sexual development begins at a standard length of about 33 mm. Colour brown above, whitish below, with pale areas on the head and two pairs of light coloured spots, the first opposite the dorsal spine, the second above the insertion of the ventrals.

Measurements of 20 type specimens range and mean, in percentage of standard length : depth 14·7 to 20·7 (17·2), head length 30·1 to 34·8 (33·5), head width 23·4 to 26·7 (25·1) pre-orbital (snout) 15·2 to 17·7 (16·5), between anterior nostrils 3·9 to 4·8 (4·6), posterior nostril to eye 3·7 to 4·7 (4·1), eye diameter 4·0 to 4·6 (4·3), interorbital 7·1 to 7·9 (7·6), predorsal distance (snout to dorsal) 35 to 40 (38·2), dorsal to adipose 19·7 to 25·8 (21·7), length of adipose base 14·7 to 20·0 (17·0), caudal peduncle length 14·4 to 16·8 (15·7) caudal peduncle depth 8·4 to 10·2 (9·5), dorsal spine 13·3 to 18·7 (16·5), pectoral spine 19·1 to 22·2 (20·3), maxillary barbel 7·1 to 11·7 (8·6), outer mandibular barbel 3·5 to 5·0 (4·2), inner mandibular barbel 1·7 to 4·3 (2·5).

Body elongate, depth five to seven times in standard length. Head about one and one-third times as long as broad. Eye in second half of head its diameter about one-seventh of head length. Interorbital distance one and one-half to two times distance from posterior nostril to eye.

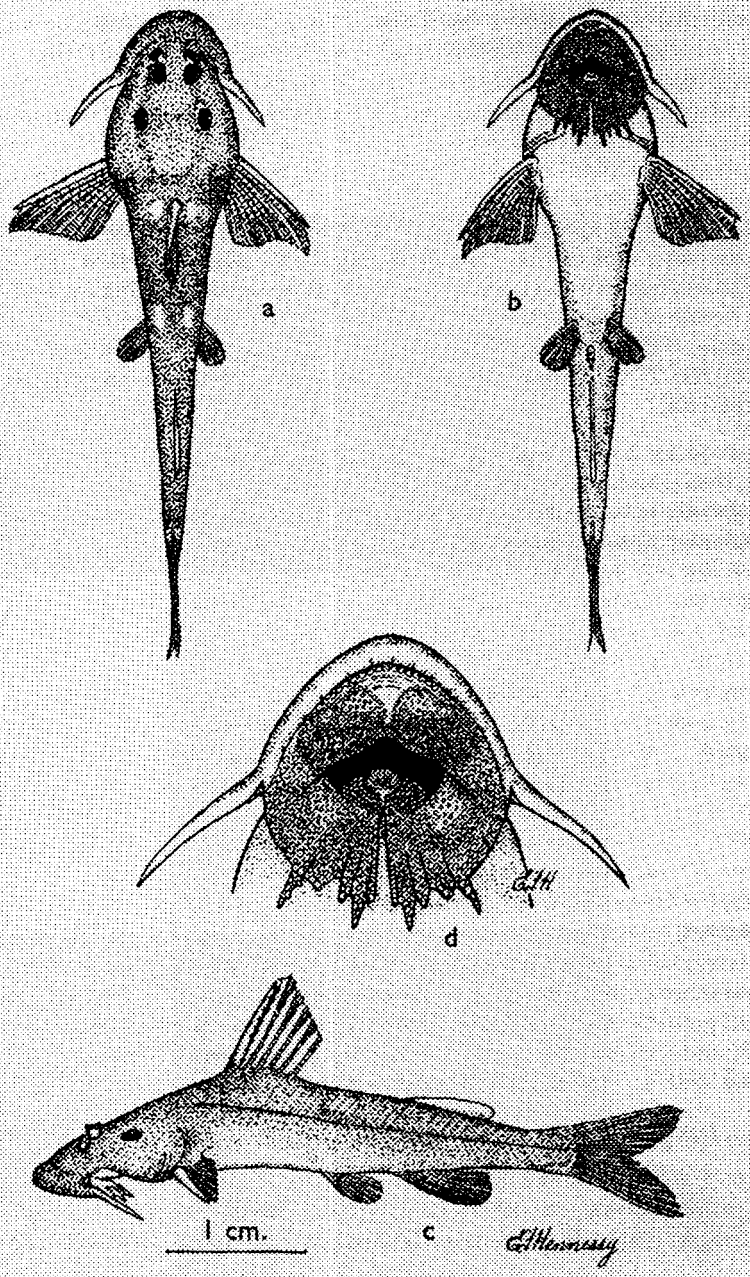
Premaxillary teeth on two oval pads almost joining in the middle. Mandibular teeth up to 12 with a replacement series postero-ventrally. Maxillary barbel about twice eye diameter and slightly over one-quarter of head length ; outer mandibular barbel less than one-half length of maxillary barbel and longer than inner mandibular barbel. Mouth surrounded by large, approximately circular lip, posteriorly deeply divided down the midline. Small protuberances on lip between mandibular barbels.

TEXT-FIG. 4.



Chiloglanis paratus n. sp. (*a*), (*b*), (*c*) Dorsal, ventral and lateral views of holotype, (*d*) ventral view of head of holotype (scale 2 × the other figures).

TEXT-FIG. 4.



Chiloglanis paratus n. sp. (*a*), (*b*), (*c*) Dorsal, ventral and lateral views of holotype, (*d*) ventral view of head of holotype (scale 2 × the other figures).

Dorsal with small, hidden first spine and strong, serrated main spine ; five (13 specimens) or six (seven specimens) branched rays. Adipose fin base variable, averaging about half of head length and from three-fifths to nine-tenths of distance from dorsal to adipose. Pectoral spine serrated, about three-fifths to two-thirds of head length ; eight branched rays. Ventral origin midway between anterior nostril and caudal flexure. Anal III 8 (15 specimens) or III 9 five specimens). Caudal deeply forked, median rays about half length of outer rays ; upper and lower lobes subequal.

Habitat.—All 19 specimens in the Natal Parks Board collection were found on the concrete wall of the Pongola Barrage. In places where a thin film of water was flowing over the surface the fish were observed clinging to the vertical wall by means of their sucker-like mouths.

Remarks.—The name of this interesting species refers, through his family motto, to Mr. T. G. Fraser, whose enthusiastic efforts have brought in much useful material.

Family Cyprinodontidæ.

This family is represented in Natal by at least one species of *Micropanchax* (=*Aplocheilichthys* = *Haplochilus*) but the material in the Natal Parks Board collection has not yet been adequately studied.

Family Cichlidæ.

The taxonomy does not appear to be in doubt for the three species of *Tilapia*, namely *mossambica*, *melanopleura* and *sparrmanii*, whose distribution is indicated in Table I. *Haplochromis moffatii* (Castelnau) occurs throughout most of the coastal areas of Natal, as far south as Uvongo.

VII. Summary.

General information is given on topographical and other features of Natal inland waters.

The composition and distribution of the fish fauna is discussed.

A systematic list includes all species recorded from fresh water in Natal except Anguillidæ and Gobiidæ. The taxonomic status of certain species is discussed and suggestions are made concerning the correct nomenclature. New synonymy and new specific names are as follows :

New Synonymy Proposed.

Synonyms : *Barbus aureus* (Cope, 1869), *Barbus natalensis* Castelnau 1861, *B. bowkeri* Boulenger 1902, *B. elephantis* Boulenger 1907, *B. lobochilus* Boulenger 1911, *B. zuluensis* Gilchrist & Thompson 1913, *B. m'fongosi*

Gilchrist & Thompson 1913, *B. robinsoni* Gilchrist & Thompson 1913, *B. marleyi* Fowler 1934, *B. stigmaticus* Fowler 1934, *B. grouti* Fowler 1934, *B. dendrotrachelus* Fowler 1934, *B. tugelensis* Fowler 1934.

Barbus anoplus M. Weber 1897. Synonym : *B. karkensis* Gilchrist & Thompson 1913.

New Specific Names Proposed.

Barbus afrohamiltoni to replace *B. hamiltoni* G. & T.
Barbus rubellus n. sp.
Chiloglanis anoterus n. sp.
Chiloglanis engiops n. sp.
Chiloglanis paratus n. sp.

Addendum.

It is proposed that *Barbus aureus* Cope 1869 be replaced by *Barbus natalensis*, which was described from the Tugela River by Castelnau, 1861, 'Mem. Poiss. Afr. Austr.', p. 59. The description was inadequate and no specimens have been assigned to *B. natalensis* by any author since Castelnau's publication.

Mr. R. A. Jubb (*in litt.* 10 November, 1959) points out, however, that Castelnau's description gives enough information to prove that he had a specimen of a large *Barbus* (17 cm. in length) with 38 lateral line scales. Since the large *Barbus* species of the Tugela River have been reduced to one, it is now obligatory to accept Castelnau's name. *B. aureus*, used by Greenwood and Crass (1959) and in the text of the present paper, should therefore be replaced by *B. natalensis*.

The proposal to accept *B. natalensis* as the correct name for the Natal small-scaled *Barbus* raises the question of a type specimen. Castelnau's inadequate description includes no drawing and his type specimen is lost. Mr. P. H. Greenwood has therefore suggested that a proposal be submitted to the International Commission asking for the types of Cope's *B. aureus*, to be recognized as the neotypes of *B. natalensis* Castelnau.

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