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THE FISHES OF THE OKAVANGO DRAINAGE SYSTEM IN ANGOLA, SOUTH WEST AFRICA AND BOTSWANA: TAXONOMY AND DISTRIBUTION

by

P. H. Skelton, M. N. Bruton, G. S. Merron and B. C. W. van der Waal

ABSTRACT

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The publication of a new phase of research on the fishes of the Okavango drainage starts with this account which gives the valid names and broad distribution patterns of all species known from the system. Eighty species and subspecies are recognised, of which at least two (*Parakneria fortuita* Penrith; *Serranochromis gracilis* Greenwood) are endemic. Notes on early collections, synonymy, taxonomic status and distribution are given. New synonyms are recognized under *Aplocheilichthys hutereaui (A. schalleri), Aplocheilichthys johnstoni (Haplochilus carlislei)* and *Ctenopoma multispinis (Ctenopoma machadoi)* respectively. Recently published taxonomic changes are incorporated including two genera *(Mesobola* and *Afromastacembelus),* a species *Serranochromis (Sargochromis) gracilis* and the re-allocated *Amphilius uranoscopus*. The Zambezian *Hemichromis* species is re-identified as *H. elongatus*. A number of unresolved taxonomic problems are pointed out and certain dubious records are excluded from the checklist. The Okavango has a diverse fish fauna with tropical affinities. Many fish species are poorly studied. Man-induced threats to the continued natural functioning of this complex and dynamic system, especially large-scale water abstraction, overgrazing, deforestation and biocide spraying to eliminate tsetse fly, make it imperative that studies on the nature and role of the fishes are continued.

CONTENTS

THE FISHES OF THE OKAVANGO DRAINAGE SYSTEM IN ANGOLA, SOUTH WEST AFRICA AND BOTSWANA: TAXONOMY AND DISTRIBUTION

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INTRODUCTION

The fishes of the Okavango Delta represent a valuable natural resource for the people of Botswana. In order to manage this resource so as to provide a long term sustainable yield to the fishery, it is essential to have a thorough knowledge of the taxonomy, distribution, biology and ecology of the fishes of the Delta and its associated rivers and lakes. This information can then be used to formulate rational fisheries management policies, and to define the roles that the fishes play in this wetland. The fishes of the Okavango system are also an interesting tropical aquatic community which is eminently worthy of study to further our knowledge of wetland ecology.

This paper is the first in a series of publications that report on a new phase of research on the fishes of the Okavango Delta and associated rivers, and deals with the taxonomic status and broad distribution patterns of all species known from the system. The biological, ecological and management accounts of the fishes that are in preparation will build on this systematic foundation.

The Okavango River system is essentially an independant inland drainage basin (Fig. 1). However, due to presently tenuous direct links with the Zambezi system via the Magwegqana or ''Selinda Spillway'' in Botswana, the system has usually been considered to be part of the Upper Zambezi drainage. For this reason the fishes of the Okavango system have seldom been separately reported on. This work represents the first attempt to compile a complete checklist of the fishes of the Okavango drainage itself.

THE OKAVANGO RIVER DRAINAGE SYSTEM

The Okavango River rises in a series of headwater streams on the southern slopes of the Angolan highlands (Fig. 1). These streams flow south and south-south-eastwards, then gather to form a large mainstream (the Cubango), which turns eastwards shortly after reaching the Angola-South West Africa border. A second major branch of the system (the Cuito) also rises in the Angolan highlands and joins the mainstream before it flows across and forms the western boundary of the Caprivi Strip. The Omatako is the only tributary of any significance which enters from the south, but it is normally a dry river bed. The Okavango River enters Botswana from the north and meanders within a broad riverine floodplain (known colloquially as the ''panhandle'') before branching out to form the Delta.

The Okavango Delta consists of a series of semi-permanent drainage channels, lagoons and floodplains which link up and then separate again during the course of an annual flood cycle. Although local rainfall can influence hydrological conditions considerably, the magnitude of the annual flood is determined mainly by rainfall in the headwater catchments of the system in Angola. Large parts of the riverine floodplain and upper delta form a permanent swamp, but the middle and lower reaches of the delta are seasonal floodplain environments. At the lower (southeast) end of the delta the main drainage channels, the Boro and the Santandadibe, re-unite along a fault line to form the southwest flowing Thamalakane River (Fig. 2). The Thamalakane River abruptly changes course to the southeast at the confluence with the Nghabe (Lake) River and flows on as the Botleti (Botletle or Boteti) River. Lake Ngami, a sump lake in the southwestern corner of the Delta, was once fed by the Thaoge River in the extreme west but is now more dependant on the Kunyere and Nghabe Rivers for its water supply (Shaw, 1984). In recent years a man-made weir or bund at the confluence of the Thamalakane and Nghabe Rivers has apparently restricted flow into the latter and diverted the major volume down the Botleti River. The Botleti River empties into Lakes Xau (Dow) and Mopipi and, at high flood levels, into the extensive Makgadikgadi Salt Pans. A northeasterly extension of the upper swamp north of Moremi Game Reserve (the Moanachira and Kwaai Rivers) empties into the Mababe Salt Pan. The Nata or Manzamnyama River rises west of Bulawayo in Zimbabwe and drains into the northeast corner of the Makgadikgadi Salt Pans. The fishes of the Nata River are not included in this account.

REVIEW OF RECENT COLLECTIONS AND SYSTEMATIC LITERATURE ON FISHES OF THE OKAVANGO SYSTEM

Jubb and Gaigher (1971) reviewed the early history of fish collections from the Okavango drainage system. Important contributions were made by Castelnau (1861), Boulenger (1911a), Gilchrist and Thompson (1913, 1917), Fowler (1931, 1935), Pellegrin (1936), Barnard (1948), Jubb (1961) and an unpublished contribution by Maar (1965). Jubb and Gaigher (1971) did not mention the indirect but nevertheless important works of Jubb (1961, 1967) and, particularly, Poll (1967a). Poll (1967a) relied mainly on the publications of Pellegrin (1936) and Ladiges (1964), which were also not mentioned by Jubb and Gaigher (1971), as the major sources of his checklist of fishes in the Okavango River in Angola.

No specific checklist of Okavango River fishes has been published since Jubb and Gaigher (1971) but Bell-

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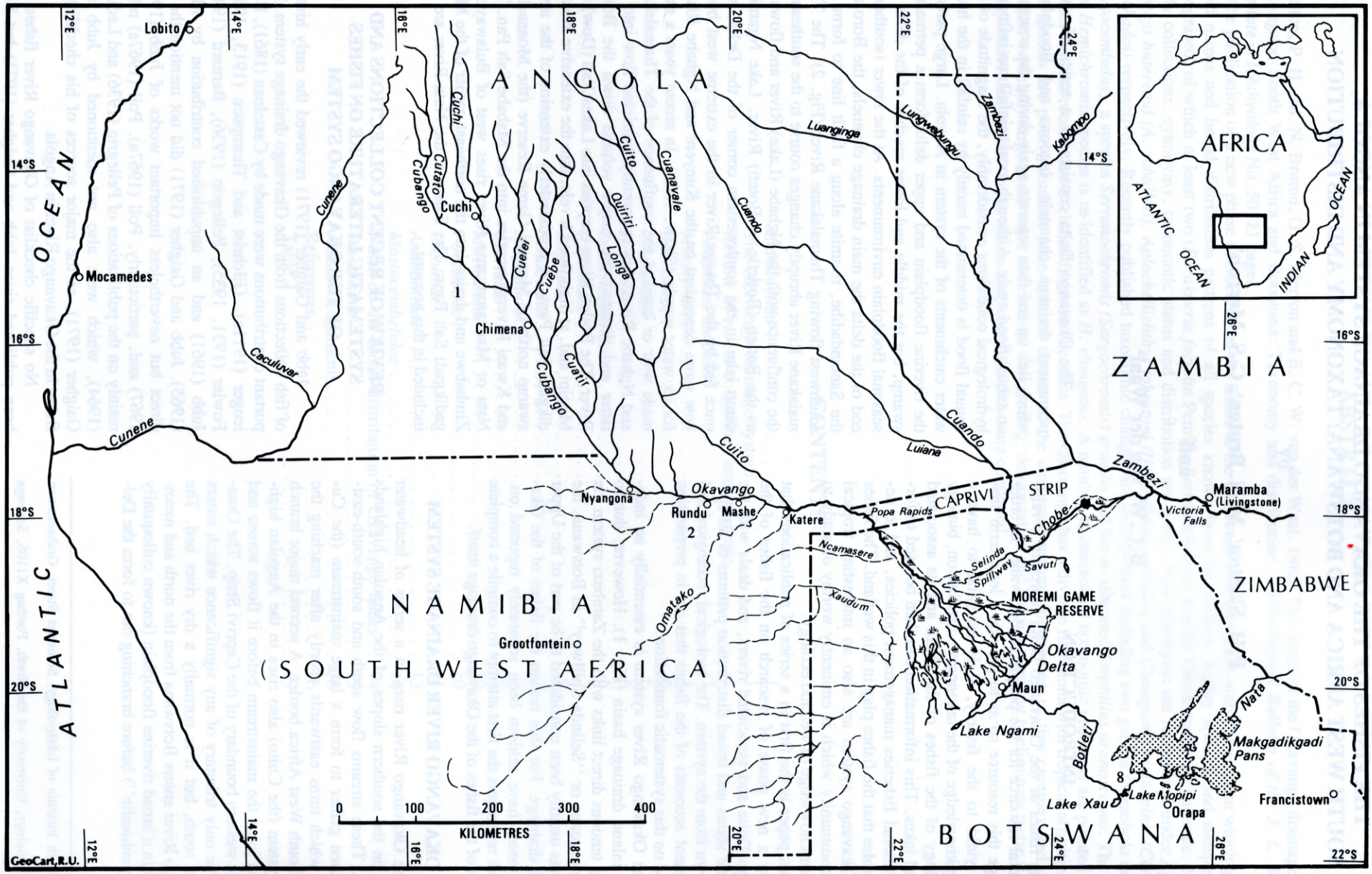

Figure 1. The Okavango Drainage system in Angola(1), South West Africa(2) and Botswana flanked in the west by the Cunene River and in the east by the Upper Zambezi system.

Cross (1972, 1976, 1982) and Bowmaker et al. (1978) present checklists of fishes of the Upper Zambezi River system which include fishes from the Okavango drainage. A number of collections of fishes from this system have also been made subsequent to Jubb and Gaigher's (1971) paper and, although internal reports of some of these collections have been prepared, none have been published. The State Museum in Windhoek (SMW) received Okavango material from several collectors including P. Scheide in 1957, P. Buys in 1964 and P. G. Olivier in 1969. The former curator of the SMW fish collection, M. Penrith, and colleagues undertook several expeditions to the Okavango system, including one in October 1972 to the upper reaches in Angola. The team from the State Museum made other collections in the river along the South West African-Angolan border downstream to Popa Rapids in September 1970, November 1970, August 1971 and February-March 1973. One of us (BvdW) surveyed the complete South West African stretch of the Okavango River in 1977 and lodged the collections in the Albany Museum, Grahamstown (AMSA). Three further collections from this same stretch of river are included in this study, one made by H. Schrader and S. Bethune of the Department of Nature Conservation (South West Africa) in October 1983 and two in February and October 1984 from Rundu to Popa Rapids by Skelton and Merron (1984, 1985). The material from the latter surveys is housed in the J. L. B. Smith Institute of Ichthyology, Grahamstown.

Accessible parts of the Delta region of the system in Botswana have been fairly extensively surveyed since Jubb and Gaigher's (1971) work. A survey in support of the UNEP anti-tsetse fly programme was made by K. Banister and M. Connelly in June-July 1975, and the specimens were lodged in the British Museum (Natural History), London. Several expeditions to Lake Ngami and the Delta have also been made by staff of Rhodes University and the J. L. B. Smith Institute of Ichthyology (Bruton, 1980; Skelton et al., 1983; Merron & Bruton, 1984; Merron et al., 1984). Several Zimbabwean school expeditions have made fish collections in the Okavango Delta since 1971 and these are housed in the National Museum, Bulawayo. Most of this material and Maar's earlier collections (*vide* Jubb & Gaigher, 1971) have been studied for this paper.

METHODS

The synonymies given in this account are preliminary and abbreviated; generally those given in the most recently published revisions form the basis of those adopted here. For the species from the Okavango that are also distributed to the north of southern Africa (e.g. the Zaire system and beyond), the synonymies are not necessarily inclusive of all nominal species or references that have been published. Furthermore, the synonymies are generally restricted to those authors who first considered the species with reference to the Okavango/Upper Zambezi drainage. Variations in spelling are not listed. Full synonymies of the mormyrids, kneriids, *Hepsetus,* characids, distichodontids and cyprinids are available in CLOFFA Volume 1 (Daget et al., 1984). The common names provided follow Jackson (1975) with recent modifications. Type localities are given as originally published. Only text references, original descriptions and references to synonymies from the Okavango River system itself are given in the reference list.

The following punctuation conventions have been adopted in this checklist:

a) Species name followed without punctuation by an author reference: ''*Barbus paludinosus* Peters, 1852'' indicates the original reference to the species. The author's name in parenthesis indicates a subsequent change of genus.

b) Species name followed by colon and reference: ''*Pollimyrus castelnaui:* Taverne, 1971'' indicates a reference subsequent to the original description of the species.

c) Where either (a) or (b) are followed by a further reference preceded by the term *vide,* the latter reference considered or used the synonymy in question.

A TAXONOMICALLY ANNOTATED CHECKLIST OF FISHES FROM THE OKAVANGO DRAINAGE SYSTEM

Ladiges (1964) and Poll (1967a) provided a list of fishes in the Okavango basin. In comparing the lists of these authors with material presently available, some disagreement occurs as to the identification of certain species. However, Ladiges (1964) worked with collections from Angolan tributaries and it is possible that he included species which we have not yet encountered. The problem will only be solved when an opportunity for comparison with Ladiges' material occurs. Although there is a rough parity of numbers of species in Ladiges (1964) list (78) and the present list (80), the two differ considerably in species listed. Poll (1967a) relied extensively on Pellegrin's (1936) and Ladiges' (1964) works in drawing up his list of Okavango fishes. He listed 68 species from the Okavango drainage but a number of these are here regarded as synonyms or misidentifications carried through the literature.

The list provided in the present paper is incomplete, especially with regard to the taxonomic status of several species. Taxonomic clarification of these species will only be possible once all available collections in overseas institutions have been examined and compared with the species identified in the southern African collections. There are also a few dubious records on Poll's (1967a) list which we exclude e.g. *Protopterus annectens brieni* (recorded on the strength of a photograph by Ladiges, 1964) and *Barbus burgi* (the latter clearly an oversight as this identification was refuted by Barnard, 1943). Poll's (1967a) record of *Aplocheilichthys myaposae* (Boulenger, 1908) is interesting, as there are several Upper Zambezi-Okavango fish species with relict populations in northern Natal (Bruton & Taylor, 1979; Bruton & Kok, 1980; Skelton, 1984a) from where *A. myaposae* was first described. In the Okavango we have not encountered this species either in the field or in any of the collections thus far examined and prefer to withhold the record as a possible misidentification until it can be confirmed.

The present list includes several species that were not recorded by Poll (1967a) and earlier authors but have been recorded from the ''Upper Zambezi'' in certain accounts since Jubb and Gaigher (1971). Several species such as *Clariallabes platyprosopos* Jubb, 1964 and *Tilapia ruweti* (Poll & Thys, 1965) have previously been collected in or reported from the East-Caprivi area (Kwando-Linyanti-Chobe tributary of the Upper Zambezi) by Bell-Cross (1972, 1976, 1982), van der Waal (1976) and van der Waal and Skelton (1984). The Upper Zambezi species that have not yet been recorded from the Okavango basin include *Kneria polli* Trewavas, 1936; *Barbus bellcrossi* Jubb, 1964; *Barbus caudosignatus* Poll, 1967; *Barbus neefi* Greenwood, 1962; *Barbus puellus* Nichols & Boulton, 1927; *Eutropius yangambianus* Poll, 1954; *Chiloglanis*

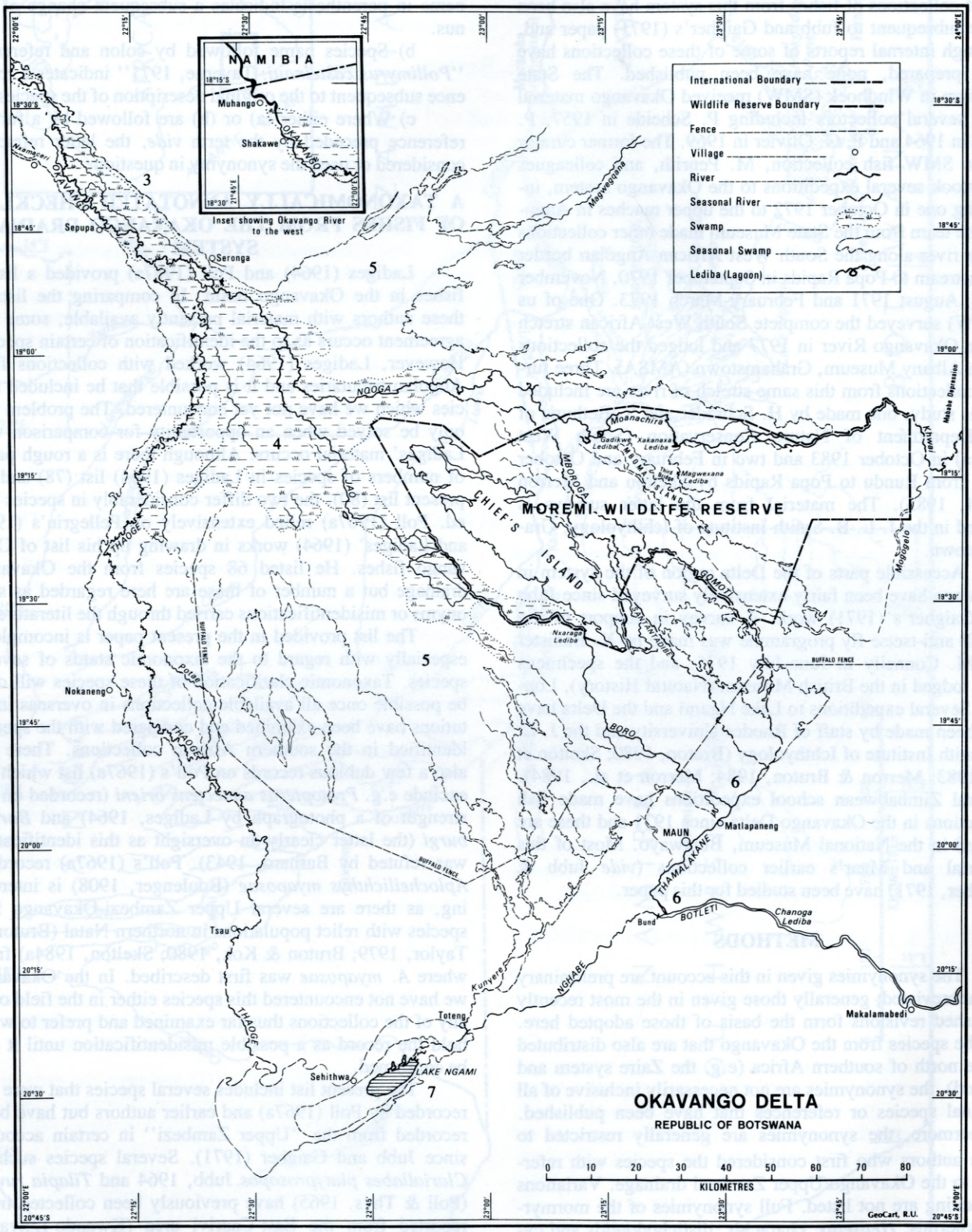

Figure 2: Map of the Okavango system in Botswana showing the major biomes designated in Table 1. Biomes 1 (Angolan headwaters) and 2 (Okavango River in South West Africa/Namibia) are shown on Fig. 1. The following biomes are shown: 3: Okavango riverine floodplain. 4: Permanent swamp. 5: Seasonal swamp. 6: Drainage rivers. 7: Lake Ngami.

neumanni Boulenger, 1911; *Hypsopanchax jubbi* Poll & Lambert, 1965; *Nothobranchius* species and *Serranochromis mortimeri* (Bell-Cross, 1975). *Barbus caudosignatus,* described from the Cuilo River, Zaire system, is mentioned by Poll (1967a, p. 173) as being conspecific with the species from the Kabompo River, Upper Zambezi system and referred to by Jubb (1967, p.109) as *Barbus* species. Practically all the above mentioned species are known from headwater or smaller tributaries of the upper Zambezi and may still be found in similar habitats in the Angolan reaches of the Okavango drainage. Okavango species which are not also found in the Upper Zambezi are *Parakneria fortuita* and the recently described *Serranochromis (Sargochromis) gracilis* Greenwood, 1984. An undescribed species of *Barbus* from the same locality (Cutato River) is also only known from the Okavango system. The fauna of the tributaries of the Okavango in Angola is poorly known.

The collections we have examined are housed in the J. L. B. Smith Institute of Ichthyology (RUSI) and the Albany Museum (AMSA) in Grahamstown, the Transvaal Museum in Pretoria (TM), the National Museum in Bulawayo, Zimbabwe (NMZ), the State Museum, Windhoek (SMW) and the National Museum in Gaborone, Botswana (NMB). Part of the collection of the Vernay-Lang Expedition in the Transvaal Museum, which includes many of Fowler's (1935) types, is on long term loan to the J. L. B. Smith Institute of Ichthyology. Gaigher's collection, which was used as the basis for Jubb and Gaigher's (1971) checklist, is housed in the Albany Museum (AMSA) and the J. L. B. Smith Institute of Ichthyology. Before a definitive checklist of fishes from the system can be completed, the collections of the De Schauensee and Vernay-Lang expeditions (Fowler, 1931, 1935) in the Academy of Natural Sciences, Philadelphia, of Pellegrin (1936) in the National Museum of Natural History, Paris, of Ladiges (1964) in the Zoological Museum, Hamburg, and of various collectors in the British Museum (Natural History) require examination.

The present account nevertheless provides a fairly thorough review of the fishes south of the Angolan border and is based on the examination of over 20 000 specimens.

MORMYRIDAE

1. ***Hippopotamyrus ansorgii*** (Boulenger, 1905). Slender stonebasher.
   Marcusenius ansorgii Boulenger, 1905a; type-locality: "between Benguella and Bihé, Angola".

First reported by Ladiges (1964) from the Okavango and confirmed in recent collections (AMSA 5668; 5728).

2. ***Hippopotamyrus discorhynchus*** (Peters, 1852). Zambezi parrotfish.
   Mormyrus discorhynchus Peters, 1852; type-locality: "Zambeze, Loc. Tette".
   Marcusenius cubangoensis Pellegrin, 1936.

Jubb (1967) and Jubb and Gaigher (1971) considered *M. cubangoensis* to be a synonym of *H. discorhynchus* but it was listed as a valid species by Taverne (1971, 1972). Pellegrin (1936) distinguished *M. cubangoensis* from *M. discorhynchus* by the following characters: a gibbosity on the chin, a shorter anal fin (A 20—22 versus A 23—27) and a more slender caudal peduncle. None of these characters appears to be trenchant and Jubb's (1967) suggested synonymy is accepted in CLOFFA 1 (Daget et al., 1984) and here.

3. ***Marcusenius macrolepidotus*** (Peters, 1852). Bulldog (Fig. 3).
   Mormyrus macrolepidotus Peters, 1852; type-locality: "River Rovuma".
   Gnathonemus angolensis Boulenger, 1905.
   Marcusenius angolensis: Taverne, 1971.

The full synonymy is given in CLOFFA 1 (Daget et al.,1984) which records two subspecies of *M. macrolepidotus, M. m. macrolepidotus* and *M. m. angolensis. Marcusenius m. angolensis* was first recognised as a subspecies by Poll and Gosse (1963) and applies to the Okavango River form.

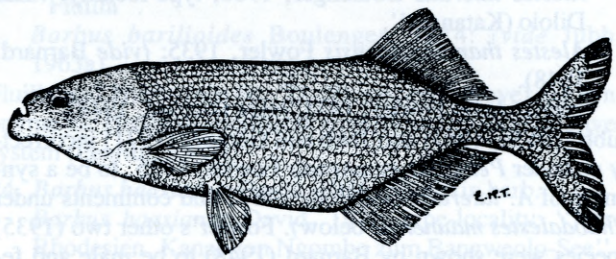

Figure 3. The bulldog, *Marcusenius macrolepidotus,* TL *ca* 150 mm .

4. ***Mormyrus lacerda*** Castelnau, 1861. Western bottlenose.
   Mormyrus lacerda Castelnau, 1861; type-locality: "Lac Ngami".
   Mormyrus ellenbergeri Pellegrin, 1914: (*vide* Jubb, 1963a).
   Mormyrus anchietae Guimares, 1885: *(vide* Jubb, 1961).

5. ***Petrocephalus catostoma*** (Günther, 1866). Churchill.
   Mormyrus catostoma Günther, 1866; type-locality: "Rovuma River".
   Petrocephalus stuhlmanni Boulenger, 1907: *(vide* Whitehead & Greenwood, 1959).

P. catostoma was first recorded from the Okavango by Barnard (1948) as *P. stuhlmanni* Blgr. Whitehead and Greenwood (1959) later synonymized the latter with *P. catostoma.* This species was not recorded from the Okavango drainage by Poll (1967a) who followed Pellegrin (1936) and Ladiges (1964) and listed *P. simus* Sauvage, 1879, for the species which we recognise as *P. catostoma.* Ladiges (1964) recorded two *Petrocephalus* species from the Okavango system: *P. stuhlmanni* and *P. simus.* All other authors have only recorded a single species: *P. catostoma. P. simus* was originally described from the Ogôoué River and is a widespread species from Liberia to Angola (Poll, 1967a). According to Boulenger (1909), the key differences between *P. catostoma* and *P. simus* are that the latter has more dorsal fin rays (24—30 vs 20—22) and more anal fin rays (30—34 vs 25—29) and there are more lateral line scales (38—45 vs 37—40). Preliminary observations on the Okavango species indicate that there is overlap of dorsal fin rays (21—24) and anal fin rays (28—32) with both the above nominal species. We therefore prefer to retain use of the most frequent name *P. catostoma* pending further analysis of the problem.

6. ***Pollimyrus castelnaui*** (Boulenger, 1911). Dwarf stonebasher.
   Marcusenius castelnaui Boulenger, 1911a; type-locality: "Lake Ngami".
   Pollimyrus castelnaui: Taverne, 1971.

KNERIIDAE

7. ***Parakneria fortuita*** Penrith, 1973. Cubango kneria.
   Parakneria fortuita Penrith, 1973; type-locality: "Cutato River at the bridge between Chitembo and Chimbangombe (about 200 metres north of Jamba Water Level Recorder, Southern Angola (13°3'S,16°25'E)".

This species was recorded by Penrith (1973) from the Cutato River and has not been reported elsewhere.

CHARACIDAE

8. ***Alestes lateralis*** Boulenger, 1900. Striped robber (Fig. 4).
   Alestes lateralis Boulenger, 1900; type-locality: "Lac Dilolo (Katanga)".
   Alestes thamalakanensis Fowler, 1935: *(vide* Barnard, 1948).
   Alestes langi Fowler, 1935: *(vide* Barnard, 1948).

Jubb (1963a, 1967) and Jubb and Gaigher (1971) incorrectly consider *Petersius maunensis* Fowler, 1935, to be a synonym of *A. lateralis* (see Poll, 1967b and comments under *Rhabdalestes maunensis* below). Fowler's other two (1935) species were shown by Barnard (1948) to be male and female *A. lateralis*. The full synonymy of this species in CLOFFA I includes two generic names which have been applied to this species *(Brycinus* Myers, 1919, and *Myletes* Poll, 1976) but have not been generally accepted.

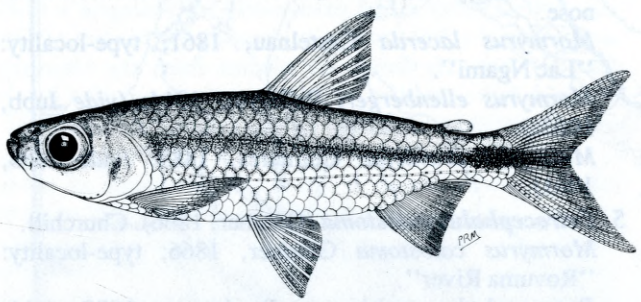

Figure 4. The striped robber, *Alestes lateralis*, TL *ca* 90 mm .

9. ***Hydrocynus vittatus*** (Castelnau, 1861). Tigerfish.
   Hydrocinus vittatus Castelnau, 1861: type-locality: "Lac Ngami".
   Hydrocyon lineatus Bleeker, 1862: *(vide* Boulenger, 1911b).

CLOFFA I (Daget et al., 1984) provides the full synonymy of this species.

10. ***Micralestes acutidens*** (Peters, 1852). Silver robber.
    Alestes acutidens Peters, 1852; type-locality: "Zambéze".
    Micralestes acutidens: Boulenger, 1899.
    Petersius woosnami (non Boulenger, 1907): Pellegrin, 1936.
    Micralestes humilis (non Boulenger, 1899): Jubb, 1961.

Further synonyms are given in CLOFFA I (Daget et al., 1984).

11. ***Rhabdalestes maunensis*** (Fowler, 1935). Okavango robber.
    Petersius maunensis Fowler, 1935; type-locality: "Thamalakane R. at Maun".
    Petersius rhodesiensis (non Ricardo-Bertram, 1943): Jubb, 1967; Jubb & Gaigher, 1971.
    Alestes lateralis (non Boulenger, 1900): Jubb, 1961.
    Hemigrammopetersius (Rhabdalestes) maunensis: Gèry, 1977.
    Rhabdalestes maunensis: Poll, 1967b.

Jubb (1967) and Jubb and Gaigher (1971) considered Fowler's *Petersius maunensis* to be a junior synonym of *A. lateralis* and consequently referred Okavango specimens to Ricardo-Bertram's (1943) *P. rhodesiensis*. We have examined the type of *P. maunensis* (TM 15276) which together with Fowler's (1935) figure and description clearly indicate that *P. maunensis* is valid. If *Rhabdalestes rhodesiensis* (Ricardo-Bertram) is synonymous with *R. maunensis,* the latter will by priority be the senior synonym.

HEPSETIDAE

12. ***Hepsetus odoe*** (Bloch, 1794). African pike.
    Salmo odoe Bloch, 1794; type-locality: "Coasts of Guinea".
    Hydrocyonoides cuvieri Castelnau, 1861.
    Sarcodaces odoe: Günther, 1864.
    Sarcodaces odoe var. *microlepis:* Boulenger, 1901.
    Hydrocyonoides odoe: Fowler, 1930.

The synonymy of this distinctive species is given in CLOFFA 1 (Daget et al., 1984). Bloch's (1794) original description of this species included two spellings of the species names: *Salmo odoe* and *Salmo odë,* the latter on the figure. The first spelling is correct in accordance with the International Code of Zoological Nomenclature, and use of the umlaut, as by many subsequent authors, is incorrect.

DISTICHODONTIDAE

13. ***Hemigrammocharax monardi*** Pellegrin, 1936.
    Hemigrammocharax monardi Pellegrin, 1936; type-locality: "Kukulazè, affluent du Kulu et Vila da Ponte (Cubango)".
    Nannocharax monardi: (vide Jubb, 1963a, 1967; Jubb & Gaigher, 1971).
    Included on the basis of one specimen from Pellegrin's (1936) type series of the species (Jubb & Gaigher, 1971). It is possible that this species is a junior synonym of *H. multifasciatus* as the only apparent difference is in the number of predorsal scales (13 for *H. monardi* vs 15—16 *H. multifasciatus)* (Barnard, 1948).

14. ***Hemigrammocharax machadoi*** Poll, 1967. Dwarf citharine.
    Hemigrammocharax machadoi Poll, 1967a; type-locality: "riv. Longa, afflt. riv. Lueno".
    Nannocharax multifasciatus (non Boulenger, 1923): *(vide* Barnard, 1948).

First recorded from the Okavango system by Jubb and Gaigher (1971), who pointed out the diagnostic characters of the species relative to *H. multifasciatus.*

15. ***Hemigrammocharax multifasciatus*** (Boulenger, 1923). Multibar citharine.
    Nannocharax multifasciatus Boulenger 1923; type-locality: "Shesheki, R. Zambezi".
    Distichodus stigmaturus Fowler, 1935: *(vide* Barnard, 1948).

Vari (1979) has shown that the difference between *Nannocharax* and *Hemigrammocharax* rests only on the dubious significance of the development of the lateral line. Jubb and Gaigher (1971) indicate that the lateral line development in this species is highly variable and the species' present generic placement is therefore insecure. Our placement of the species under *Hemigrammocharax* follows CLOFFA 1 (Daget et al., 1984). Fowler (1935) designated a new subgenus *Distichodina* for his species *D. stigmaturus* but this has not been generally used in the literature.

16. ***Nannocharax macropterus*** Pellegrin, 1926. Broad-barred citharine.
Nannocharax macropterus Pellegrin, 1926; type-locality: "Mongende, Kamaiembe, Tschikapa (Kasai)".

Previously reported from the Okavango system by Bell-Cross (1976). The presence of this species is confirmed by our collections (RUSI 20185; 20275; 20431).

CYPRINIDAE

17. ***Barbus afrovernayi*** Nichols & Boulton, 1927. Spot-tail barb.
Barbus vernayi Nichols & Boulton, 1927b: *(vide* Nichols & Boulton, 1927a); type-locality: "Capelongo, Angola".

18. ***Barbus barnardi*** Jubb, 1965. Blackback barb.
Barbus barnardi Jubb, 1965; type-locality: "Mwekera Fish Farm, about eight miles above the confluence of the Mwekera and Kafue Rivers".

This species was referred to as *'Barbus* juv. sp?' by Barnard (1948: 435-437).

19. ***Barbus barotseensis*** Pellegrin, 1920. Barotse barb.
Barbus radiatus var. *barotseensis* Pellegrin, 1936; type-locality: "Lealui, capitale indigène du pays des Barotses".
? *Barbus annectens (non* Gilchrist & Thompson, 1917): *(vide* Jubb, 1968).

Barnard (1948) elevated Pellegrin's *"B. barotseensis"* to full specific rank. Jubb (1968) and Jubb and Gaigher (1971) suggest that *B. barotseensis* is a junior synonym of *B. annectens*. We retain the species *B. barotseensis* in agreement with CLOFFA 1 (Daget et al., 1984) until the suggested synonymy is clarified. Examination of the type-specimens (P.H. Skelton) of Pellegrin's *Barbus radiatus* var. *barotseensis* (MNHN 1920—79) shows that the species is not *B. radiatus*.

20. ***Barbus bifrenatus*** Fowler, 1935. Hyphen barb.
Barbus bifrenatus Fowler, 1935; type-locality: "Tsotsoroga Pan".
Barbus viviparus (*non* Weber, 1897): Barnard, 1948; Skelton, 1984a.

The taxonomic status of Fowler's *B. bifrenatus* has been re-examined in the light of extensive collections from throughout southern Africa. Trenchant differences in pigmentation and osteology are evident between *B.bifrenatus* and *B. viviparus* Weber (Simpson, 1983; Skelton, 1984a) which refute the opinion of Barnard (1948) that the two taxa are conspecific. *B. viviparus* is an east coast species that does not occur, as far as we are aware, in the Upper Zambezi and Okavango drainage systems.

21. ***Barbus codringtonii*** Boulenger, 1908. Upper Zambezi yellowfish.
Barbus codringtonii Boulenger, 1908; type-locality: "Zambezi above Victoria Falls".
B. chilotes Boulenger, 1908: *(vide* Jackson, 1961; Jubb, 1963a).
B. hypostomatus Pellegrin, 1936: *(vide* Jubb, 1963a).
B. rhodesianus (non Boulenger, 1908): Pellegrin, 1936.

Poll (1967a) records both *B. codringtonii* and *B. marequensis* from the Okavango system but we accept a single species, *B. codringtonii*, pending a full investigation of its taxonomic status.

22. ***Barbus*** cf. ***eutaenia*** Boulenger, 1904. Orangefin barb.
Barbus eutaenia Boulenger, 1904; type-locality: "Huilla, Mossamedes".
Barbus kerstenii (non Peters): Gilchrist & Thompson, 1913: *(vide* Greenwood 1962a: 175-6).

It is possible that Pellegrin's (1936) *Barbus miolepis* and Ladiges' (1964) *Barbus holotaenia* refer to this species. The identity of *B. eutaenia* from the Okavango, the Upper Zambezi and elsewhere in southern Africa requires confirmation.

23. ***Barbus fasciolatus*** Günther, 1868. Red barb.
Barbus fasciolatus Günther, 1868: Type-locality: "Fluilla".
Barbus barilioides Boulenger, 1914: *(vide* Jubb, 1963a).

Fluilla and Huilla (see no. 22 *B. eutaenia* above) are synonyms for Huilla in southwest Angola on the Cunene River system (Penrith, 1982).

24. ***Barbus haasianus*** David, 1936. Sicklefin barb.
Barbus haasianus David, 1936; type-locality: "Nord Rhodesien, Kanal von Ngombo zum Bangweolo-See".
?Barbus wohlerti Trewavas, 1938: *(vide* Jubb, 1963a).

25. ***Barbus lineomaculatus*** Boulenger, 1903. Line-spotted barb.
Barbus lineomaculatus Boulenger, 1903; type-locality: "Lumi River".
Barbus lornae Ricardo-Bertram, 1943: *(vide* Jackson, 1961).

For a full synonymy see CLOFFA 1 (Daget et al., 1984). *Barbus lineomaculatus* was first identified from the Okavango system by Pellegrin (1936) and is similar to *Barbus barotseensis* in general appearance. The inclusion of *B. lineomaculatus* in the Okavango fauna is confirmed (SMW 871).

26. ***Barbus multilineatus*** Worthington, 1933. Copper-stripe barb.
Barbus multilineatus Worthington 1933; type-locality: "A swamp near River Luombo, 3900 ft"
Puntius carpenteri Fowler, 1949: *(vide* Jackson, 1959).

27. ***Barbus paludinosus*** Peters, 1852. Straightfin barb.
Barbus paludinosus Peters, 1852; type-locality: "Quellimane".
Barbus gibbosus Peters, 1852: *(vide* Greenwood, 1962a).
Barbus welwitschii Günther, 1868: *(vide* Boulenger, 1911).
Barbus tsotsorogensis Fowler, 1935: *(vide* Barnard, 1943).

28. ***Barbus poechii*** Steindachner, 1911. Dashtail barb.
Barbus poechii Steindachner 1911; type-locality: "Sumpflande des Tauche, Okawangaarm, 20 km nördlich von Toan bei dem Dorfe Ramakuatis in N'Gamiland".
Barbus pöchii Lohberger, 1930.
Barbus bernardcarpi Jubb, 1958: *(vide* Greenwood, 1962b).
Barbus trimaculatus (part): *(vide* Greenwood, 1962b).

This species has been referred to as *B. trimaculatus* Peters, 1852, in previous works on Okavango fishes (e.g. Fowler, 1935; Pellegrin, 1936; Barnard, 1948; Ladiges, 1964). Poll (1967a), records both *B. poechii* and *B. trimaculatus* from the Okavango drainage indicating that three-spotted forms of *B. poechii* may be present. Observations on living and preserved specimens from the Okavango show that certain

individuals display the characteristic caudal bar of *B. poechii* and one or two lateral "shadow" spots similar to *B. trimaculatus*. These observations are contrary to the reasons given by Greenwood (1962b) for upholding the species status of *B. poechii*. The distinctive caudal dash of the species remains and further detailed study is advisable before a formal taxonomic change can be proposed.

29. ?***Barbus puellus*** Nichols & Boulton, 1927. Dwarf barb.
Barbus puellus Nichols & Boulton, 1927b; type-locality: "Chitau, Upper Cuanza drainage".

This species is tentatively listed following Jubb and Gaigher's (1971) comment that the species recorded as *B. lujae* Boulenger by Pellegrin (1936) may possibly be *B. puellus*. Van der Waal and Skelton (1984) record *B. puellus* from the Caprivi region. It was not recorded from the Okavango system by Poll (1967a) except possibly as *B. lujae*.

30. ***Barbus (Enteromius) radiatus*** Peters, 1853. Beira barb.
Barbus radiatus Peters, 1853; type-locality: "Tete".
Barbus aurantiacus Boulenger, 1910.
Barbus (Beirabarbus) okavangoensis Barnard, 1941.
Barbus rogersi Boulenger, 1911.

Stewart (1977) argued that the characters used to distinguish *B. aurantiacus* from *B. radiatus* are phenotypic and influenced by hydrological conditions. The Okavango and Upper Zambezi subspecies is given by CLOFFA I (Daget et al., 1984) as *Barbus radiatus aurantiacus* Boulenger, 1910, and the synonymy refers only to this subspecies.

31. ***Barbus tangandensis*** Jubb, 1954. Redspot barb (Fig. 5).
Barbus tangandensis Jubb, 1954; type-locality: "Tanganda River".
?*Barbus manicensis* (*non* Pellegrin, 1919): Jubb, 1967; Bowmaker *et al.*, 1978.

Both Jubb (1967) and Bowmaker *et al.* (1978) recorded *B. tangandensis* and *B. manicensis* from the Upper Zambezi system which included the Okavango drainage. Van der Waal and Skelton (1984) report only one species with *tangandensis/manicensis* facies from the Caprivi and referred to it as *B. tangandensis*. This same species was collected by B.C.W. van der Waal from the Okavango River at Muhango, Katere and Nyangona and it was recently (Oct. 1984) collected at Mkena, South West Africa (RUSI 22184) and Sepopa in Botswana (RUSI 22820). In the Upper Zambezi/Okavango system this species lacks the bright red opercular spot characteristic of typical *B. tangandensis*, and further investigations into its identity are required. Greenwood (1962a) and Tweddle and Willoughby (1979) both point to the close similarity between *B. tangandensis* and *B. kerstenii*.

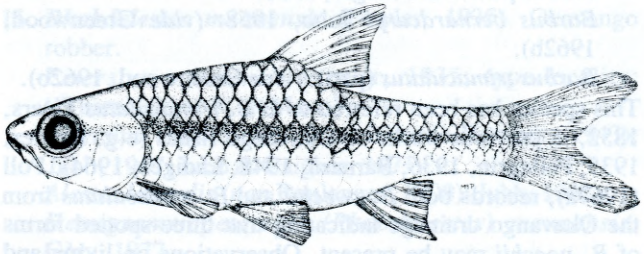

Figure 5. The redspot barb, *Barbus tangandensis*, TL *ca* 52 mm.

32. ***Barbus thamalakanensis*** Fowler, 1935. Thamalakane barb.
Barbus thamalakanensis Fowler, 1935; type-locality: "Thamalakane River at Maun".
Barbus fitzsimonsi Fowler, 1935: *(vide* Barnard, 1948).

33. ***Barbus unitaeniatus*** Günther, 1866. Longbeard barb.
Barbus unitaeniatus Günther, 1866; type-locality: "Angola" (from Steindachner, 1866).
Barbus macrurus Gilchrist & Thompson, 1913: *(vide* Jubb, 1963a).
Barbus inermoides Nichols & Boulton, 1927: *(vide* Barnard, 1948; Jubb, 1967).
? *[Barbus inermis* Peters, 1852]: *(vide* Barnard, 1948).

Barnard (1948) drew attention to the close similarity and possible conspecificity of Peters' (1852) *B. inermis* and Gilchrist and Thompson's (1913) *B. macrurus*. The latter species is now recognised as a junior synonym of *B. unitaeniatus* Günther. Jubb (1967), possibly influenced by Barnard's (1948) note, regarded *B. inermis* as a junior synonym of *B. marequensis*. Peters' (1868) figure fits *B. unitaeniatus* but, whilst the evidence appears in favour of this synonymy, its formal establishment requires the re-examination of the type-specimens.

34. ***Barbus*** sp.
This undescribed species with similarities to *B. paludinosus* was collected by M.J. Penrith from the Cutato River.

35. ***Coptostomabarbus wittei*** David & Poll, 1937. Upjaw barb.
Coptostomabarbus wittei David & Poll, 1937; type-locality: "rivière Kando près Tenke".

First reported from the Okavango drainage by Jubb and Gaigher (1971). This species is common in the Delta and in certain habitats within the riverine marshes of the Okavango.

36. ***Labeo cylindricus*** Peters, 1852. Redeye labeo.
Labeo cylindricus Peters, 1852; type-locality: "Mossambique".
Labeo darlingi Boulenger, 1902: *(vide* Jubb, 1963a).
Labeo parvulus Gilchrist & Thompson, 1913: *(vide* Barnard, 1948; Jubb, 1963a).

CLOFFA 1 (Daget et al.,1984) records the full synonymy of this species.

37. ***Labeo lunatus*** Jubb, 1963. Upper Zambezi labeo.
Labeo lunatus Jubb, 1963c; type-locality: "23 miles above the Victoria Falls".
Labeo forskalii (non Rüppell, 1835): Barnard, 1948.
Labeo greeni (non Boulenger, 1902): Pellegrin, 1936.

38. ***Mesobola brevianalis*** (Boulenger, 1908). River sardine. (Fig. 6).
Neobola brevianalis Boulenger, 1908a; type-locality: "the Mkuzi River, Zululand".
Engraulicypris brevianalis: Boulenger, 1911.
Mesobola brevianalis: Howes, 1984.

This species was first recorded by Jubb and Gaigher (1971) from the Okavango system and stated to be "widely distributed but not common in the Okavango region". It has not, as far as we are aware, been taken from the Delta region and is only known from the Okavango River and Angolan headwaters where it is uncommon in collections (e.g. SMW 771, 869, 1228; RUSI 20379). Howes (1984) does not mention its occurrence in the Okavango system.

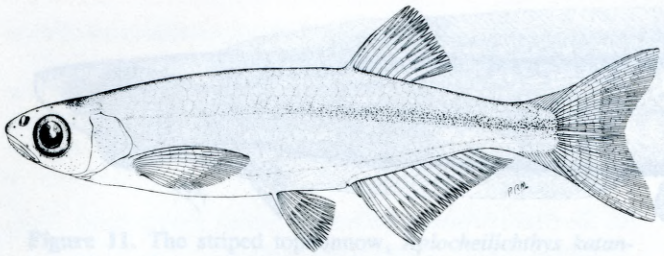

Figure 6. The river sardine, *Mesobola brevianalis,* TL *ca* 60 mm .

39. ***Opsaridium zambezense*** (Peters, 1852). Barred minnow (Fig. 7).
Leuciscus zambezensis Peters, 1852; type-locality: "Tete".
Barilius zambezensis: Günther, 1868.
Barilius neavii Boulenger, 1907: (*vide* Pellegrin, 1936 *(B. neavei);* Jubb, 1961).
Barilius stephensoni Gilchrist & Thompson, 1913: (*vide* Jubb, 1961).

Howes (1983) stated that the correct spelling of this species is *O. zambezensis*. However the correct ending *zambezense* is adopted here in agreement with CLOFFA I (Daget *et al.*, 1984) in accordance with the neuter gender of *Opsaridium.*

Figure 7. The barred minnow, *Opsaridium zambezense,* TL *ca* 80 mm .

BAGRIDAE

40. ***Auchenoglanis ngamensis*** Boulenger, 1911. Zambezi grunter.
Auchenoglanis ngamensis Boulenger, 1911; type-locality: "Lake Ngami district Bechuanaland".

The original description of this species is in Volume 2 of Boulenger's (1909-16) catalogue which was published in 1911. The collection from which the type material derives was reported on by Boulenger (1911a).

41. ***Leptoglanis rotundiceps*** (Hilgendorf, 1905).
Gephyroglanis rotundiceps Hilgendorf, 1905; type-locality: "Im Bubu bei Irangi".
42. ***Leptoglanis*** sp.
Leptoglanis cf. *dorae (non* Poll, 1967a): *(vide* van der Waal & Skelton, 1984).

The generic and specific identity of material placed in the genus *Leptoglanis* is currently under review (Eccles, in press).

SCHILBEIDAE

43. ***Schilbe mystus*** (Linnaeus, 1758). Silver catfish.
Silurus mystus Linnaeus, 1758; type-locality: "Habitat im Nilo".

The date of original description of this species has consistently been given as 1762 which was the date of the German translation of Hasselqvist's (1757) "Iter Palaestinum eller Resa till Heliga Landet förrättad infran ar 1749 til 1752". Fernholm and Wheeler (1983) show that the name *Silurus mystus* is correctly dated from Linnaeus (1758).

AMPHILIIDAE

44. ***Amphilius uranoscopus*** (Pfeffer, 1889). Stargazer mountain catfish.
Anoplopterus uranoscopus Pfeffer, 1889; type-locality: "Bad bei Ushonda (Ungúu); Bäche bei Mhonda".
Amphilius platychir (non Günther, 1864): Skelton, 1984b.
Amphilius platychir var *cubangoensis* Pellegrin, 1936.

The taxonomy and full synonymy of *Amphilius uranoscopus* has been discussed by Skelton (1984b). The Okavango River form is strikingly marked in dark mottled pigment relative to most other populations of the species. However pigmentation is notoriously variable within the species and this feature is therefore not considered to be taxonomically significant.

CLARIIDAE

45. ***Clarias dumerilii*** Steindachner, 1866. Okavango catfish.
Clarias dumerilii Steindachner, 1866; type-locality "Angola".

C. dumerilii was listed as in the Okavango system by Pellegrin (1936) and Poll (1967a) but was not recorded by Jubb and Gaigher (1971). Teugels (1982) mentions only the Zaire system under the distribution of this species. Confirmation of the identity of Pellegrin's (1936) specimens is required.

46. ***Clarias gariepinus*** (Burchell, 1822). Sharptooth catfish.

For details of the full synonymy see Teugels (1982). The main southern African synonyms are:
Silurus (Heterobranchus) gariepinus Burchell, 1822; type-locality: "Confluence of the Maap (Muddy River). Latitude 29°0'22"S. Longitude 24°43'40"E".
Clarias capensis Cuvier & Valenciennes, 1840.
Clarias mossambicus Peters, 1852.

47. ***Clarias ngamensis*** Castelnau, 1861. Blunttooth catfish.
Clarias ngamensis Castelnau, 1861: type-locality "lac N'gami".
Dinotopterus jallae Gilchrist & Thompson, 1917.

The taxonomy of this species is discussed by Teugels (1983).

48. ***Clarias theodorae*** Weber, 1897. Snake catfish (Fig. 8).
Clarias theodorae Weber, 1897; type-locality: "Natal: Umhloti-Fluss".

A synonymy of this species is given by Teugels (1982).

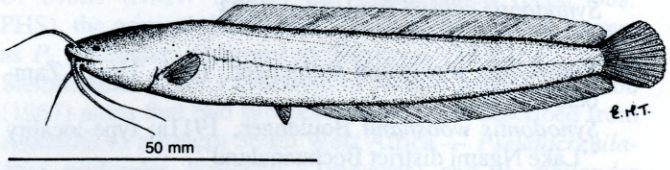

Figure 8. The snake catfish, *Clarias theodorae,* TL *ca* 100 mm .

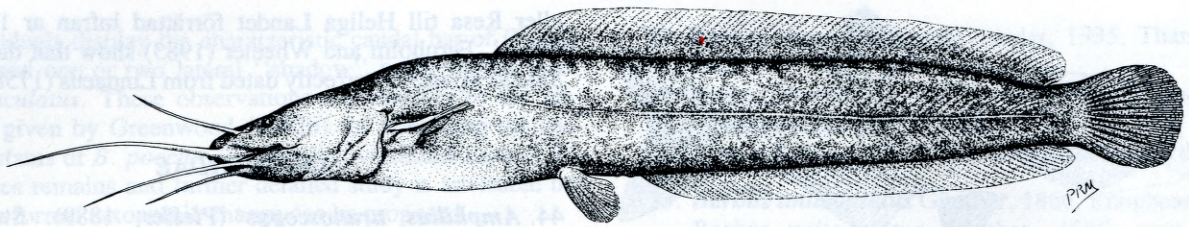

Figure 9. The broadhead catfish, *Clariallabes platyprosopos*, TL *ca* 300 mm .

49. ***Clariallabes platyprosopos*** Jubb, 1964. Broadhead catfish (Fig. 9).
Clariallabes platyprosopos Jubb, 1964b; type-locality: "the Upper Zambezi River about 15 miles above the Victoria Falls, Rhodesia".

This species was first collected from the Okavango River by B. C. W. van der Waal in 1977.

MOCHOKIDAE

50. ***Chiloglanis fasciatus*** Pellegrin, 1936.
Chiloglanis fasciatus Pellegrin, 1936; type-locality: "Cubango".

Jubb (1967), Bowmaker et al. (1978) and van der Waal and Skelton (1984) record *Chiloglanis neumanni* Boulenger, 1911, from the Upper Zambezi system including the Okavango drainage. Collections specifically from the Okavango thus far include only one *Chiloglanis* species, which is referable to *C. fasciatus*. The taxonomy of *Chiloglanis* species from Central Africa including the Zambezi River system requires extensive revision.

51. ***Synodontis leopardinus*** Pellegrin, 1914. Leopard squeaker.
Synodontis leopardinus Pellegrin, 1914; type-locality: "Pays des Barotsés (Ht-Zambèze)".
Synodontis jallae Gilchrist & Thompson, 1917.

The synonymy of this and other *Synodontis* species is based on Poll (1971). The taxonomy of these and other southern African *Synodontis* species is currently under revision by P.N. White of the J.L.B. Smith Institute of Ichthyology.

52. ***Synodontis macrostigma*** Boulenger, 1911. Large-spot squeaker.
Synodontis macrostigma Boulenger, 1911a; type-locality: "Lake Ngami district, Bechuanaland".

53. ***Synodontis nigromaculatus*** Boulenger, 1905. Spotted squeaker.
Synodontis nigromaculatus Boulenger 1905b; type-locality: "Lake Banguela".
Synodontis melanostictus Boulenger, 1906.
Synodontis colyeri Boulenger, 1923.

54. ***Synodontis woosnami*** Boulenger, 1911. Upper Zambezi squeaker.
Synodontis woosnami Boulenger, 1911a; type-locality "Lake Ngami district Bechuanaland".
Synodontis thamalakanensis Fowler, 1935: *(vide* Jubb, 1961).

POECILIIDAE
(Subfamily Aplocheilichthyinae) (Parenti, 1981)

55. ***Aplocheilichthys hutereaui*** (Boulenger, 1913). Mesh-scaled topminnow.
Haplochilus hutereaui Boulenger, 1913; type-locality: "de Dungu, dans district du Haut-Uelé".
Aplocheilus chobensis Fowler, 1935: *(vide* Jubb & Gaigher, 1971).
Aplocheilichthys schalleri Scheel & Radda, 1974. *Syn. nov.*

The type-specimens of *A. schalleri* Scheel & Radda (1974) in the Natural History Museum, Vienna (NMW 22393-4), have been examined (PHS) and are considered to be conspecific with *A. hutereaui* from the Upper Zambezi, Okavango and Zaire River systems. *A. schalleri* was described from specimens collected near Macovane in coastal Mocambique. There is a sample of *A. hutereaui* from near Beira in the Albany Museum (AMSA/P 2386).

Jubb and Gaigher (1971) confirmed the presence of this species in the Okavango but it was only later referred to under Boulenger's name *Aplocheilichthys hutereaui* by Bowmaker et al. (1978).

56. ***Aplocheilichthys johnstoni*** (Günther, 1893). Johnston's topminnow (Fig. 10).
Haplochilus johnstoni Günther, 1893; type-locality: "Fort Johnston".
Haplochilus carlislei van der Horst, 1934. *Syn. nov.*

Examination of the type-specimens (TM 15025) indicates that *H. carlislei* van der Horst, 1934, is not a synonym of *A. katangae* as stated by Jubb (1967), but is conspecific with *A. johnstoni* (Günther, 1893).

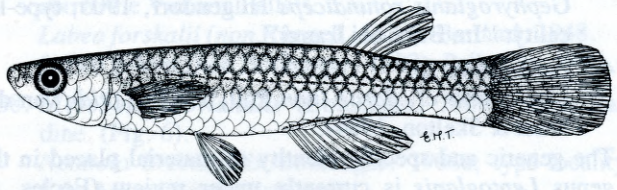

Figure 10. Johnston's topminnow, *Aplocheilichthys johnstoni*, TL *ca* 50 mm .

57. ***Aplocheilichthys katangae*** (Boulenger, 1912). Striped topminnow (Fig. 11).
Haplochilus katangae Boulenger, 1912a; type-locality: "d'Elisabethville, dans la rivière Lubumbashi".
Aplocheilus luluae (non Fowler, 1930): Fowler, 1935: 278.

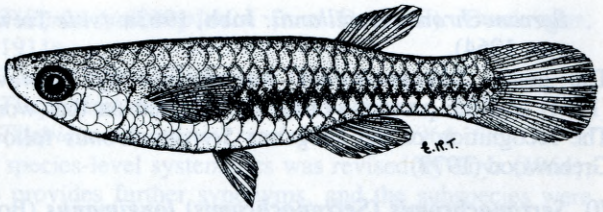

Figure 11. The striped topminnow, *Aplocheilichthys katangae*, TL *ca* 40 mm .

CICHLIDAE

58. ***Hemichromis elongatus*** (Guichenot, 1861). Barred jewelfish.
Chromichthys elongatus Guichenot, 1861; type-locality: "Gabon".
Hemichromis auritus Gill, 1862: *(vide* Loiselle, 1979).
Hemichromis fasciatus Peters, 1857 (in part): for all references to this species from the Zambezi system.

Loiselle (1979) revised the genus *Hemichromis* and placed the material he examined from the Zambezi River system in the species *H. elongatus*. The Zambezi species has previously been referred to *H. fasciatus*. The diagnostic difference between the two species is concerned essentially with colour and pigmentation. P. H. Greenwood has examined *Hemichromis* specimens of the Zambezi-Okavango species and agrees (personal communication) that they should be referred to *H. elongatus*.

59. ***Oreochromis andersonii*** (Castelnau, 1861). Threespot tilapia.
Chromys andersonii Castelnau, 1861; type-locality; "lac N'gami".
Tilapia andersonii: Boulenger, 1911a.
Sarotherodon andersonii: Trewavas, 1973; Jubb, 1974.

Trewavas (1983) provides a full synonymy of the *Oreochromis* species.

60. ***Oreochromis macrochir*** (Boulenger, 1912). Greenhead tilapia (Fig. 12).
[?Chromys sparmanni: Castelnau, 1861].
[?Chromys chapmannii: Castelnau, 1861].
Tilapia natalensis (*non* Weber): Boulenger, 1901 (in part).
Tilapia macrochir Boulenger, 1912b; type-locality: "Victoria Falls, Zambesi and Lake Bangwelu".
Sarotherodon macrochir: Jubb, 1974.
Tilapia andersonii (non Castelnau): Boulenger, 1911a, in part: *(vide* Trewavas, 1983).

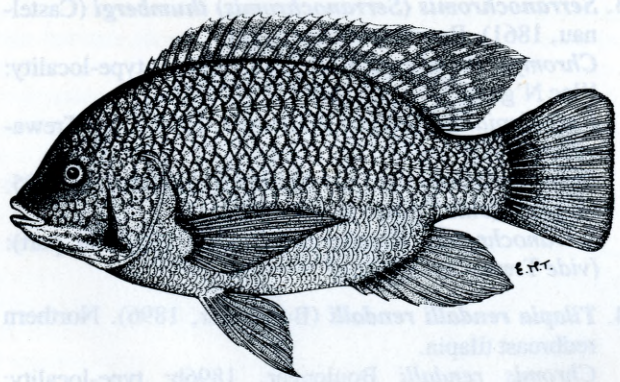

Figure 12. The greenhead tilapia, *Oreochromis macrochir*, TL *ca* 300 mm .

Tilapia intermedia Gilchrist & Thompson, 1917.
Tilapia sheshekensis Gilchrist & Thompson, 1917.
Tilapia galilaea (non Linnaeus): Gilchrist & Thompson, 1917; Pellegrin, 1936.
Tilapia squamipinnis (non Günther): Gilchrist & Thompson, 1917.
Tilapia alleni Fowler, 1932.

The above synonymy is derived from Trewavas (1983). The lectotype of this species was collected from the Upper Zambezi (Trewavas, 1983).

61. ***?Pharyngochromis*** cf. ***darlingi*** (Boulenger, 1911). Zambezi happy.
Pelmatochromis darlingi Boulenger, 1911b; type-locality: "Makabusi River (Zambesi System) near Salisbury, Mashonaland".
Haplochromis darlingi: Regan, 1922.
Paratilapia arnoldi Gilchrist & Thompson, 1917.
Tilapia rumsayi Gilchrist & Thompson, 1917.

The above synonymy is based on Jubb (1967) and Jubb and Gaigher (1971). Bell-Cross (1975), who has examined the holotype of *Astatotilapia ellenbergeri,* includes this taxon in the synonymy of *Serranochromis (Sargochromis) carlottae* (qv).

62. ***Haplochromis acuticeps*** (Steindachner, 1866).
Chromis acuticeps Steindachner, 1866; type-locality: "Angola".

The taxonomic status of this species is currently under investigation and Dr P.H. Greenwood (personal communication; see also Greenwood, 1984) informs us that several species may be involved in the complex. Certain specimens identified as *Haplochromis acuticeps* (Steindachner) in the Albany Museum fish collection which were examined by Dr Greenwood can be referred to the *P. darlingi* complex. Other *"H. acuticeps"* material in the Albany Museum collection represents juveniles of one or more *Serranochromis (Sargochromis)* species. Regan (1922: 255) tentatively included Gilchrist and Thompson's (1917) *Tilapia rumsayi* (spelt incorrectly by Regan, 1922, as *T. ramsayi)* from the Zambezi in the species *Haplochromis acuticeps* (but see under *Pharyngochromis* cf. *darlingi* above).

63. ***Pseudocrenilabrus philander*** (Weber, 1897). Southern mouthbrooder.
Chromis philander Weber, 1897; type-locality: "Natal: Fluss Umhloti bei Verulam. Bach Umhlasine bei Redcliff".
Chromis moffatii (non Castelnau, 1861): Boulenger, 1915.
Chromis ovalis Steindachner: Regan, 1922.
Tilapia ovalis (Steindachner): Boulenger, 1899, 1915.
Haplochromis philander: Trewavas, 1936.
Hemihaplochromis philander: Wickler, 1963.
Pseudocrenilabrus natalensis Fowler, 1934.

The above synonymy is based on Jubb (1967) and Trewavas (1973). *Chromis ovalis* Steindachner, 1866, may be the oldest valid synonym for this species. Although the type of *C. ovalis* (NMW 32597) has disintegrated (pers. obs. PHS), the original description applies to the species known as *P. philander*. Contrary to Trewavas (1936), *C. ovalis* Steindachner is not a synonym of *Tilapia sparrmanii*. Jubb (1967) notes that two subspecies have been described from sinkholes in northern South West Africa — *Pseudocrenilabrus philander dispersus* (Trewavas) and *P. philander luebberti* (Hilgendorf). Greenwood (1984) rejects these subspecies on the evidence available.

64. ***Serranochromis (Sargochromis) carlottae*** (Boulenger, 1905). Rainbow happy.
Paratilapia carlottae Boulenger, 1905c; type-locality: "immediately above the Victoria Falls, Zambesi".
Haplochromis carlottae: Regan, 1922; Barnard, 1948.
Paratilapia gibbiceps Boulenger, 1911a.
Astatotilapia ellenbergeri Pellegrin, 1920.
Paratilapia deschauenseei Fowler, 1931.

The synonymy of this and other *Serranochromis (Sargochromis)* species is based on Bell-Cross (1975) with the current generic placement as proposed by Greenwood (1979).

65. ***Serranochromis (Sargochromis) codringtonii*** (Boulenger, 1908). Green happy.
Paratilapia codringtonii Boulenger, 1908b; type-locality: "Zambesi above Victoria Falls".
Sargochromis codringtoni: Regan, 1922.
Haplochromis codringtoni: Bell-Cross, 1975.
Tilapia woosnami Boulenger, 1911a: *(vide* Bell-Cross, 1975).
Paratilapia marginata Gilchrist & Thompson, 1917: *(vide* Bell-Cross, 1975).
Paratilapia mellandi (*non* Boulenger): Gilchrist & Thompson, 1917 (in part): *(vide* Bell-Cross, 1975).

66. ***Serranochromis (Sargochromis) giardi*** (Pellegrin, 1904). Pink happy.
Tilapia giardi Pellegrin, 1904; type-locality: "Zambèze".
Pelmatochromis angolensis (non Steindachner): Boulenger, 1915.
Pelmatochromis robustus Gilchrist & Thompson, 1917: *(vide* Bell-Cross, 1975).
Sargochromis angolensis (non Steindachner): Regan, 1922.
Haplochromis giardi: Regan, 1922.
Haplochromis frederici (non Castelnau): Jubb, 1961, 1963a; Jackson, 1961 *(vide* Bell-Cross, 1975).
Sargochromis giardi: Jubb, 1967.

67. ***Serranochromis (Sargochromis) greenwoodi*** (Bell-Cross, 1975). Greenwood's happy.
Haplochromis greenwoodi Bell-Cross, 1975; type-locality: "The Okavango".
Chromis frederici Castelnau, 1861 *(nomen dubium).*
Chromidotilapia frederici: Boulenger, 1898.
Hemichromis frederici: Boulenger, 1905a.
Paratilapia frederici: Boulenger, 1911a.
Haplochromis frederici: Regan, 1922.

68. ***Serranochromis (Sargochromis) gracilis*** Greenwood, 1984. Slender happy.
Serranochromis (Sargochromis) gracilis Greenwood, 1984; type-locality: "the Cutato River at Jamba bridge (Cubango drainage), Angola".

This species was described recently by Greenwood (1984) from two specimens collected by M. Penrith in the Cutato River, Angola.

69. ***Serranochromis (Serranochromis) angusticeps*** (Boulenger, 1907). Thinface largemouth.
Paratilapia angusticeps Boulenger, 1907; type-locality: "Mossamedes, Angola".
Paratilapia kafuensis Boulenger, 1908: *(vide* Boulenger, 1915).
Paratilapia robusta: Boulenger, 1905b (in part, specimens from L. Bangweulu: *vide* Trewavas, 1964).
Serranochromis kafuensis: Ricardo, 1939; Barnard, 1948.
Serranochromis levaillantii: Jubb, 1963a: *(vide* Trewavas, 1964).

The genus *Serranochromis* was revised by Trewavas (1964) and the present synonymy is based on that work. The recognition of the subgenus *Serranochromis* follows Greenwood (1979).

70. ***Serranochromis (Serranochromis) longimanus*** (Boulenger, 1911). Longfin largemouth
Paratilapia longimanus Boulenger, 1911a; type-locality: "Lake Ngami Basin, Bechuanaland".
Serranochromis macrocephalus: non Regan, 1922 (in part).

Although the type-locality of this and other species (e.g. *P. castelnaui)* described by Boulenger (1911b) is given as the Lake Ngami Basin, it was made clear in the paper that the fishes (p. 400): "come in reality from the Okavango River and vast extent of marshes (of which Lake Ngami is part) into which the river opens out before it continues its way as a single great river known as the Botletle or Zouga".

71. ***Serranochromis (Serranochromis) macrocephalus*** (Boulenger, 1899). Purpleface largemouth.
Paratilapia macrocephala Boulenger, 1899; type-locality: "lac Moero".
Paratilapia angusticeps Boulenger, 1907 (in part), 6 specimens from Mossamedes, Angola: *(vide* Trewavas, 1964).
Pelmatochromis genisquamulatus Pellegrin, 1914: (*vide* Trewavas, 1964).
Paratilapia ellenbergeri Gilchrist & Thompson, 1917: *(vide* Jubb, 1961).
Paratilapia thumbergi (non Castelnau): Boulenger, 1916 (in part): (*vide* Trewavas, 1964)

72. ***Serranochromis (Serranochromis) robustus jallae*** Boulenger, 1896. Nembwe.
Hemichromis jallae Boulenger, 1896a; type-locality: "Kazungula, haut Zambèse".
Paratilapia robusta: Boulenger, 1898 (in part): *(vide* Trewavas, 1964).
Paratilapia thumbergi (*non* Castelnau): Boulenger, 1911a (in part, specimens from Okavango): (*vide* Trewavas, 1964).
Paratilapia zambesensis Gilchrist & Thompson, 1917: (*vide* Jubb, 1961).
Pelmatochromis ngamensis Gilchrist & Thompson, 1917: *(vide* Trewavas, 1964).
Serranochromis thumbergi (non Castelnau): Regan, 1922 (in part): *(vide* Trewavas, 1964).
Serranochromis robustus: Jubb, 1961.

73. ***Serranochromis (Serranochromis) thumbergi*** (Castelnau, 1861). Brownspot largemouth.
Chromys thumbergi Castelnau, 1861; type-locality: "lac N'gami".
Paratilapia thumbergii: Boulenger, 1898: (*vide* Trewavas, 1964).
Paratilapia robusta (non Günther): Boulenger, 1905: (in part): (*vide* Trewavas, 1964).
Serranochromis thumbergii: Regan, 1922 (in part): *(vide* Trewavas, 1964).

74. ***Tilapia rendalli rendalli*** (Boulenger, 1896). Northern redbreast tilapia.
Chromis rendalli Boulenger, 1896b; type-locality: "Upper Shiré River, British Central Africa".
Tilapia rendalli: Boulenger, 1898.

Tilapia melanopleura (non Duméril): Boulenger, 1911a.
Tilapia sykesii Gilchrist & Thompson, 1917.
Tilapia kirkhami Gilchrist & Thompson, 1917.
Tilapia melanopleura rendalli: Thys, 1964.

The species-level systematics was revised by Thys (1964), who provides further synonyms, and the subspecies were designated by Trewavas (1966).

75. ***Tilapia ruweti*** (Poll & Thys, 1965). Okavango tilapia (Fig. 13).
Pelmatochromis ruweti Poll & Thys, 1965; type-locality: "lac de barrage de la Lufira á Mwadingusha; á Cameia (Angola); lac Calundo".
Tilapia ruweti: Thys, 1968.

T. ruweti was first recorded from the Okavango River and swamps by Jubb (1974).

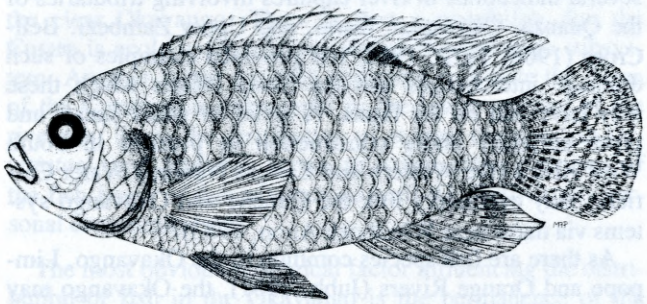

Figure 13. The Okavango tilapia, *Tilapia ruweti,* TL 90 mm .

76. ***Tilapia sparrmanii*** Smith, 1840. Banded tilapia (Fig. 14).
Tilapia sparrmanii Smith, 1840; type-locality: "freshwater streams to the north of the Orange River".
Chromis sparrmani: Günther, 1862.
Chromis niloticus (non Linnaeus): Peters, 1868 (in part).
Tilapia calliptera (non Günther): Gilchrist & Thompson, 1917.
Tilapia deschauenseei Fowler, 1931.

The above synonymy was derived from Thys (1964) who provides further synonyms.

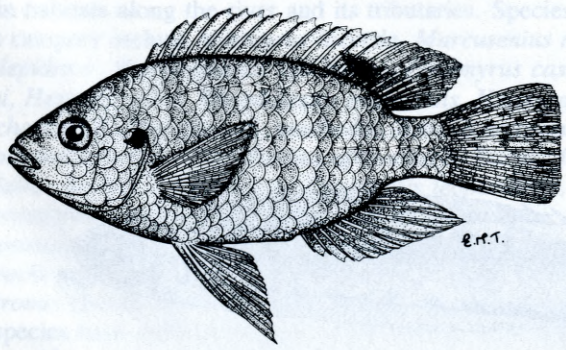

Figure 14. The banded tilapia, *Tilapia sparrmanii,* TL *ca* 100 mm .

ANABANTIDAE

77. ***Ctenopoma ctenotis*** (Boulenger, 1919). Blackspot climbing perch (Fig. 15).
Anabas ctenotis Boulenger, 1919; type-locality: "a ditch near the Lukuga River".
Ctenopoma nanum (non Günther, 1896): Poll, 1967a.

This species has previously been recorded by Jubb (1961) and others from the Upper Zambezi drainage *sensu lato,* but was not included in Jubb and Gaigher's (1971) checklist of the fishes of Botswana. Poll (1967a) recorded *C. nanum* from the upper Zambezi system, and several authors, including Boulenger (1919), have drawn attention to the close similarity between Günther's *C. nanum* and Boulenger's *C. ctenotis.* An examination of the type-specimens of both these species reveals a number of apparent differences (P. H. Skelton) and we prefer to refer the Okavango species to *C. ctenotis* (Boulenger) pending further investigation.

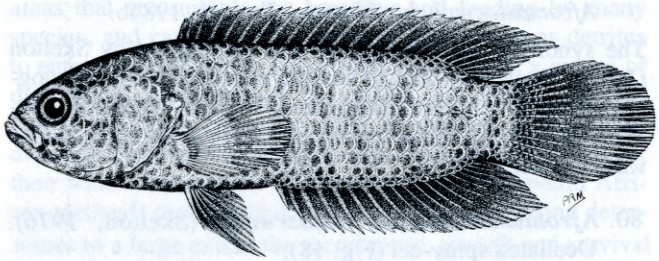

Figure 15. Blackspot climbing perch, *Ctenopoma ctenotis,* TL *ca* 50 mm .

78. ***Ctenopoma multispinis*** Peters, 1844. Manyspined climbing perch (Fig. 16).
Ctenopoma multispinis Peters, 1844; type-locality: "Bach bei Quilimane".
?Anabas scandens (non Daldorff): Bianconi, 1858; *(vide* Boulenger,1916).
Spirobranchus smithii Bianconi, 1859: (*vide* Boulenger, 1916).
Ctenopoma multispine: Günther, 1861: (*vide* Boulenger, 1916).
Anabas multispinus: Boulenger, 1905b: (*vide* Boulenger, 1916).
Anabas rhodesianus Gilchrist & Thompson, 1917: *(vide* Jubb, 1963a).
Anabas machadoi Fowler, 1930. *Syn. nov.*
Ctenopoma machadoi: Poll, 1967a.
Anabas vernayi Fowler, 1935: *(vide* Jubb, 1963a).

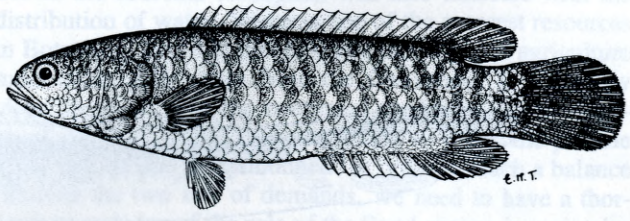

Figure 16. Manyspined climbing perch, *Ctenopoma multispinis,* TL *ca* 80 mm .

Anabas machadoi Fowler, 1930, is added to the synonymy as this species was stated by Fowler (1930, 1935) to differ from *C. multispinis* only in pigmentation. The difference in pigmentation is not in our view sufficient to justify separate specific status. Poll (1967a) records both species from the Okavango drainage on the basis of the identifications of Ladiges (1964) and Pellegrin (1936) respectively.

MASTACEMBELIDAE

79. ***Afromastacembelus frenatus*** (Boulenger, 1901). Short-tail spiny-eel (Fig. 17).
Mastacembelus frenatus Boulenger, 1901; type-locality: "the north end of Lake Tanganyika".
Mastacembelus taeniatus Boulenger, 1901.
Mastacembelus thompsoni Boulenger, 1917.
Mastacembelus mutombotombo Pellegrin, 1936.
Afromastacembelus frenatus: Travers, 1984b.

The synonymy of this species was established by Skelton (1976). Travers (1984a,b) studied mastacembeloid phylogeny in detail and established the new genus *Afromastacembelus* for many African species including *A. frenatus* and *A. vanderwaali*.

80. ***Afromastacembelus vanderwaali*** (Skelton, 1976). Ocellated spiny-eel (Fig. 18).
Mastacembelus vanderwaali Skelton, 1976; type-locality: "Zambezi River mainstream at Katima Mulilo, Eastern Caprivi. Approximately 17°30'S, 24°16'E".
Afromastacembelus vanderwaali: Travers, 1984b.

Skelton (1976) first recorded the presence of this species in the Okavango system. The record has been confirmed by subsequent collections (Skelton & Merron, 1984) (RUSI 22086; 11058; 20108).

NOTES ON THE BROAD DISTRIBUTION OF OKAVANGO FISHES

Ladiges (1964) and Poll (1966, 1967a) divided the Angolan fish fauna into five zoogeographical regions: Zaire basin, Zambezi, Angolan (coastal rivers excluding the Cunene), the Okavango and the Cunene. Although there is considerable overlap in the distribution of species between these regions, the fauna of the Zambezi, Okavango and Cunene are most similar and share a relatively high proportion of species (Bell-Cross, 1968; Roberts, 1975). Of the 80 species recorded here from the Okavango, 77 (96%) are also found in the Upper Zambezi and at least 43 (54%) in the Cunene. The Cuvelai drainage and the Selinda spillway provide potential links between the Okavango and the Cunene and the Okavango and the Zambezi across northern South West Africa (Namibia) and Botswana respectively. Bell-Cross (1968, 1982) and Poll (1966, 1967a) considered that there have probably been a number of direct links during the drainage evolution of these river systems. There are several indications of river captures involving tributaries of the Quanza, Okavango, Kasai, and Upper Zambezi. Bell-Cross (1968, 1972, 1982) has provided examples of such drainage interchanges and the likely effects which these may have had on the fauna. A series of water canals and pipes currently under construction or planned in South West Africa (the Western and Eastern National Water Carriers) may eventually link the Cunene and Okavango systems via dams near Windhoek Anon, 1983).

As there are fish species common to the Okavango, Limpopo and Orange Rivers (Jubb, 1967), the Okavango may have had direct or indirect links with these systems in the past (Jubb, 1964a; Jubb & Farquharson, 1965; Gaigher & Pott, 1973). There is circumstantial geological evidence to support a major drainage link between the Okavango and the Limpopo (Bond, 1975) and it seems likely that this was an important avenue of dispersal for several species that also occur in the tropical Mocambique-northern Natal coastal plain (Bruton & Kok, 1980; Skelton, 1984a).

Within the Okavango basin itself the distribution of the

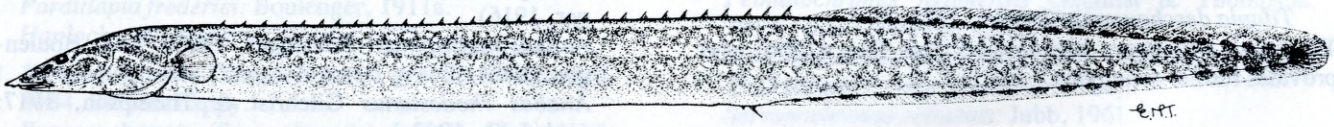

Figure 17. Short-tail spiny-eel, *Afromastacembelus frenatus*, TL *ca* 150 mm .

Figure 18. Ocellated spiny-eel, *Afromastacembelus vanderwaali*, TL *ca* 75 mm .

species has not previously been carefully mapped. Ladiges (1964) reported on ecological distributions at particular sites in the upper reaches of the river. Further specific occurrences from the literature and our own records are given in Table 1. These distributions are preliminary as comprehensive surveys of all reaches have not been carried out. Furthermore, the dynamic nature of the fish communities within the system means that populations and communities are continuously changing. Nevertheless a few pertinent observations on fish distributions can be made.

The major factor determining the distribution of fishes within the Okavango basin appears to be habitat preferences, with physical barriers playing a minor role. In general, fishes are not narrowly restricted to particular sections of the rivers or swamps, with the exception of *Parakneria fortuita, Serranochromis gracilis* and *Barbus* sp. which are only known from the Cutato River. Ladiges (1964) indicated that the Cutato is not distinct from other tributaries, but Penrith (1973) commented on the high turbidity of the water in the Cutato River, due to suspended silt, relative to the clear Okavango. There is thus a possibility that the Cutato is ecologically distinct within the Cubango subsystem. Another factor possibly operating to isolate the fauna of the Cutato is a steep rapid in the lower reaches of the river that limits the distribution of at least the tigerfish *(H. vittatus),* and probably serves to isolate other elements of the fish fauna of this tributary as well (G. Bell-Cross, personal communication).

The most obvious ecological factor influencing the distribution of fish in the Okavango is the permanence of the water and whether or not the water is flowing. This is not an absolute criterion as, even within the riverine reaches of the system, floodplains and marsh conditions are found; and within the swamp, flowing water conditions are found in the drainage channels. The specialized rheophilics such as *Hippopotamyrus ansorgii, Amphilius uranoscopus, Chiloglanis fasciatus* and *Nannocharax macropterus* have not as yet been found within the swamp. A few crevice-dwelling species such as *Afromastacembelus vanderwaali* and *Clariallabes platyprosopos* are restricted to rocks and rapids in the river. Other riverine species that are not usually encountered in the swamps are *Barbus codringtonii, B. tangandensis, Mesobola brevianalis* and *Opsaridium zambezense.* Several species are found in the swamps, but usually occur in channels and lotic habitats: *Hydrocynus vittatus, Micralestes acutidens, Barbus eutaenia, Barbus unitaeniatus, Hemichromis elongatus, Afromastacembelus frenatus* and *Leptoglanis* species.

Many of the species characteristic of the Delta region of the Okavango are also widely distributed in suitable floodplain habitats along the river and its tributaries. Species in this category include *Mormyrus lacerda, Marcusenius macrolepidotus, Petrocephalus catostoma, Pollimyrus castelnaui, Hepsetus odoe, Rhabdalestes maunensis, Hemigrammocharax multifasciatus, H. machadoi, Barbus haasianus, Coptostomabarbus wittei, Barbus afrovernayi, Barbus fasciolatus, Barbus multilineatus, Synodontis leopardinus, S. macrostigma, S. nigromaculatus, Clarias theodorae, C. ngamensis, Aplocheilichthys hutereaui, A. katangae, Oreochromis macrochir, Tilapia ruweti,* various *Serranochromis* species and *Ctenopoma ctenotis.* A large number of species have sufficiently generalized habitat preferences to be widespread and relatively common in both swamp and river. The most obvious of these are several small *Barbus* species including *Barbus barnardi, B. bifrenatus, B. poechii, B. paludinosus, B. radiatus* and *B. thamalakanensis* as well as *Petrocephalus catostoma, Pollimyrus castelnaui, Alestes lateralis, Synodontis* species, *Schilbe mystus, Clarias gariepinus, Aplocheilichthys johnstonii, Tilapia rendalli, T. sparrmanii, Pseudocrenilabrus philander, Oreochromis andersonii, Serranochromis macrocephalus, S. robustus, Pharyngochromis darlingi* and *Ctenopoma multispinis.* The hardiest of these eurytopic species (e.g. *Oreochromis andersonii, B. paludinosus* and *Clarias gariepinus)* are common in the lower extremities and sump lakes of the system, especially at low water levels.

DISCUSSION

The complex and diverse nature of the fish fauna of the Okavango drainage has been revealed in this paper. Although our understanding of the functioning of this large lotic and lentic system is still poor, it is clear that the annual rise and fall of the floodwaters is one of the most important driving forces in the Delta. The floods create vast, shallow areas that are suitable for breeding and feeding by many species, and cause large amounts of allochthonous detritus to enter the food chain. The floods also provide a means of distributing fishes through the system, and clear away biological blockages caused by rafts of papyrus. Many of the drainage rivers and sump lakes rely on the annual floods for their water. Welcomme (1979) has shown for several African wetlands that the timing and duration of flooding determines to a large extent the recruitment, growth and survival rates of wetland fish stocks, and this is likely to be the case in the Okavango swamps as well (Bruton & Jackson, 1983).

There are many threats facing the Okavango ecosystem, including insecticide spraying, encroachment of cattle onto the seasonal floodplain, pollution and erosion caused by outboard-powered boats, increased recreational fishing pressure, decreased fertilization of the water by game populations, disruption of natural food webs by the removal of crocodiles and other predators, but the most serious threats are those causing alterations to the flood regime. The Eastern National Water Carrier, which is under construction in South West Africa (Namibia), will remove vast quantities of water from the Okavango River, up to 80 x 10 m^3 p a especially during the dry season. The existing and proposed canalisation of the Boro and Santandadibe Rivers will reduce the retention time in the seasonal swamp as well as interfere with the lateral movement of water onto the floodplain. Lubke et al. (1984) have shown that the spoil heaps derived from the dredging of the Boro River channel in the early 1970's have had a marked effect on the distribution of water and the natural succession of plant species in the adjacent floodplain. Agricultural and stock-farming activities in the seasonal floodplain will also interfere with the distribution of water. Water is one of the scarcest resources in Botswana, and it is obvious that industry and agriculture must claim their share from the Okavango. It is equally clear, however, that the continued productivity and viability of the Delta depends on the extent to which the pristine flood regime can be maintained. In order to reach a balance between the two sets of demands, we need to have a thorough knowledge of the role of the flood regime in maintaining biotic diversity and productivity, especially among the fishes.

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Table I CHECKLIST OF FISH SPECIES COLLECTED FROM MAJOR BIOMES IN THE OKAVANGO DRAINAGE. Fish records from Castelnau (1861), Boulenger (1911a), Pellegrin (1936), Barnard (1948), Ladiges (1964), Poll (1967a), Jubb & Gaigher (1971), Bowmaker et al. (1978), Bruton (1980), Bell-Cross (1972, 1975), Skelton et al. (1983), Merron & Bruton (1984), Merron et al. (1984), Skelton & Merron (1984); Greenwood (1984) and the collection records of the State Museum, Windhoek; Transvaal Museum, Pretoria; Albany Museum, Grahamstown; National Museum, Bulawayo, Zimbabwe; Botswana National Museum and Art Gallery, Gaborone and the J.L.B. Smith Institute of Ichthyology, Grahamstown. The 'drainage rivers' include the Thamalakane, Botleti, Nghabe and Kunyere Rivers. The major biomes of the Okavango system numbered 1 to 8 in the Table are illustrated diagrammatically in Figs. 1 and 2. Fish records indicated by a ''x'' are based on personal examination of specimens by the authors. Records based only on literature are entered as alphabetical capitals as follows: A - Pellegrin (1936); B - Barnard (1948); C - Ladiges (1964); D - Poll (1967a); E - Penrith (1973); F - Bell-Cross (1975); G - Greenwood (1984).

	Angolan headwaters (1)	Okavango River in SWA/Namibia (2)	Okavango riverine floodplain (3)	Permanent swamp (4)	Seasonal swamp (5)	Drainage rivers (6)	Lake Ngami (7)	Lake Xau/Mopipi Dam (8)
Mormyridae								
Hippopotamyrus ansorgii	C	x	x	x		?		
H. discorhynchus	A/C	x	x	x	x	x	x	
Marcusenius macrolepidotus	x	x	x	x	x	x	x	
Mormyrus lacerda	x	x	x	x	x	x	x	x
Petrocephalus catostoma	x	x	x	x	x	x	x	x
Pollimyrus castelnaui	x	x	x	x	x	x	x	x
Kneriidae								
Parakneria fortuita	E							
Characidae								
Alestes lateralis	x	x	x	x	x	x	x	x
Hydrocynus vittatus	x	x	x	x		x		
Micralestes acutidens	x	x	x	x	x	x	x	x
Rhabdalestes maunensis		x	x	x	x	x	x	
Hepsetidae								
Hepsetus odoe	A	x	x	x	x	x	x	x
Distichodontidae								
Hemigrammocharax machadoi	A	x	x	x	x	x	x	x
H. monardi	A							
H. multifasciatus	x	x	x	x	x	x	x	x
Nannocharax macropterus		x	x					
Cyprinidae								
Barbus afrovernayi		x	x	x	x	x	x	
B. barotseensis	A	x						
B. barnardi	x	x	x	x	x	x	x	x
B. bifrenatus	x	x	x	x	x	x	x	x
B. codringtonii	A	x						
B. eutaenia	x	x	x	x				
B. fasciolatus	x	x	x	x	x	x	x	

	Angolan headwaters (1)	Okavango River in SWA/Namibia (2)	Okavango riverine floodplain (3)	Permanent swamp (4)	Seasonal swamp (5)	Drainage rivers (6)	Lake Ngami (7)	Lake Xau/Mopipi Dam (8)
B. haasianus		x	x	x	x			
B. lineomaculatus	x							
B. multilineatus	x	x	x	x	x	x		
B. paludinosus	A	x	x	x	x	x	x	x
B. poechii	A	x	x	x	x	x	x	
?B. puellus	?							
B. radiatus	x	x	x	x	x	x	x	x
B. Tangandensis		x	x					
B. thamalakanensis	x	x	x	x	x	x	x	
B. unitaeniatus	x	x	x		x	x	x	
B. sp.	x							
Coptostomabarbus wittei		x	x	x	x	x		
Labeo cylindricus	x	x	x	x				
L. lunatus	A	x	x	x	x	x	x	
Mesobola brevianalis	x	x	x					
Opsaridium zambezense	x	x	x					
Bagridae								
Auchenoglanis ngamensis	x	x	x	x	x	x	x	x
Leptoglanis rotundiceps	x	x	x		x	x		
L. sp.		x						
Schilbeidae								
Schilbe mystus	x	x	x	x	x	x	x	x
Amphiliidae								
Amphilius uranoscopus	x	x						
Clariidae								
?Clarias dumerilii	A	x						
C. gariepinus	A	x	x	x	x	x	x	x
C. ngamensis	A	x	x	x	x	x	x	x
C. theodorae	x	x	x	x	x	x		
Clariallabes platyprosopos		x						
Mochokidae								
Chiloglanis fasciatus	A	x	x					
Synodontis leopardinus	x	x	x	x	x	x	x	x
S. macrostigma	A	x	x	x	x	x	x	x

	Angolan headwaters (1)	Okavango River in SWA/Namibia (2)	Okavango riverine floodplain (3)	Permanent swamp (4)	Seasonal swamp (5)	Drainage rivers (6)	Lake Ngami (7)	Lake Xau/Mopipi Dam (8)
S. nigromaculatus	A	x	x	x	x	x	x	x
S. woosnami	A	x	x	x	x	x	x	x
Cyprinodontidae								
Aplocheilichthys hutereaui	A	x	x	x	x	x	x	
A. Johnstoni	x	x	x	x	x	x	x	x
A. katangae	A/C	x	x	x	x	x	x	
Cichlidae								
Hemichromis elongatus	A	x	x	x	x	x	x	
Oreochromis andersonii	A ?	x	x	x	x	x	x	x
O. macrochir	C	x	x	x	x	x	x	
Pharyngochromis darlingi	A	x	x	x	x	x	x	
Haplochromis acuticeps(?)	?	?	?	?	?	?	?	
Pseudocrenilabrus philander	A	x	x	x	x	x	x	x
Serranochromis (Sargochromis) carlottae		x	x	x	x	x		
S. (Sar.) codringtonii		x	x	x	x	x	x	
S. (Sar.) giardi		x	x	x	x	x	x	x
S. (Sar.) greenwoodi						F		
S. (Sar.) gracilis	G							
S. (Serranochromis) angusticeps	x	x	x	x	x	x	x	
S. (S.) longimanus				x	x	x	x	
S. (S.) robustus jallae		x	x	x	x	x	x	x
S. (S.) macrocephalus	x	x	x	x	x	x	x	
S. (S.) thumbergi	A	B	x	x	x	x	x	
Tilapia rendalli rendalli	A/C	x	x	x	x	x	x	x
T. ruweti		x	x	x	x	x	x	
T. sparrmanii	A/D	x	x	x	x	x	x	
Anabantidae								
Ctenopoma ctenotis			x	x	x			
C. multispinis	A/C	x	x	x	x	x	x	x
Mastacembelidae								
Afromastacembelus frenatus	x	x	x	x	x	x		
A. vanderwaali	x	x						

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