

# THE FRESHWATER FISHES OF THE KRUGER NATIONAL PARK

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The mammals of the Kruger National Park are for the most part quite well known, even to our youngest visitors; its birds have been well catalogued, so also its reptile and amphibian fauna. To many the trees, shrubs and succulent plants of the Park are also familiar items. In view of their obscured aquatic existence, however, the freshwater fishes, inhabiting the waters of this great sanctuary, are rarely observed and the varied life patterns of these graceful creatures remain much of a mystery to most nature lovers.

When next the reader follows a road meandering along the banks of one of the perennial rivers of the Park, stops on a causeway overlooking the river or sits quietly watching the higher animals as they come down to drink at a waterhole, it would be well to contemplate that the permanent waters of this area, as well as many of the seasonal pools, harbour an animal life as varied and specialized in its own environment as that of the terrestrial communities.

The placid-flowing waters of our rivers and streams and the cool green depths of the seasonal pools and larger dams, afford life and sanctuary to 46 species of freshwater fishes, besides all the associated species of aquatic animals such as hippos, otters, crocodiles, water-birds and frogs of many diverse kinds, water tortoises, leguaans, freshwater prawns, shrimps and crabs, many aquatic insects, small invertebrates and the host of micro-organisms which collectively make up the freshwater plankton.

In this watery world the habits, environmental adaptations and delicate mosaic of interrelationships between members of these teeming legions evolve around an endlessly varied cycle of birth, growth and death; of eat and being eaten. For the student of freshwater biology, this affords a field of unlimited scope, whereas for the casual observer, the interesting life histories of our freshwater fishes may offer a particular attraction.

In many ways aquatic animals in general, and fishes in particular, play as important a role in the economy of the natural biome as do land animals, and they should, in consequence, be as stringently protected within the confines of a National Park as their terrestrial brethren. It is sad, therefore, that no facilities are available in the Park as yet, whereby this particular group of our wards may also be put on display for our visitors. Until such time as this may be accomplished, the interested nature tourist, en route to the Kruger Park, may find a visit to the excellent freshwater aquarium of the Provincial Fisheries Institute at Lydenburg both interesting and educational. Many of the species inhabiting the Lowveld waters of the Transvaal are exhibited here.

It is the purpose of this paper to introduce to our visiting public the diverse forms of this lesser-known animal group in the Kruger National Park, and to comment briefly on some notable aspects of their individual life-histories, such as distribution, habitat-selection, relationships with other animals, food preferences, breeding activity, predation, etc.

## ZOOGEOGRAPHICAL AND ECOLOGICAL CONSIDERATIONS

The Kruger National Park covers an area of some 7,340 square miles in the extreme north-east of the Transvaal Lowveld, between  $22^{\circ} 25'$  to  $25^{\circ} 31'$  latitude south and between  $30^{\circ} 50'$  to  $32^{\circ} 2'$  longitude east. It is separated from the adjoining Portuguese East Africa by the Lebombo mountain range in the east and from Rhodesia in the north by the Limpopo River.

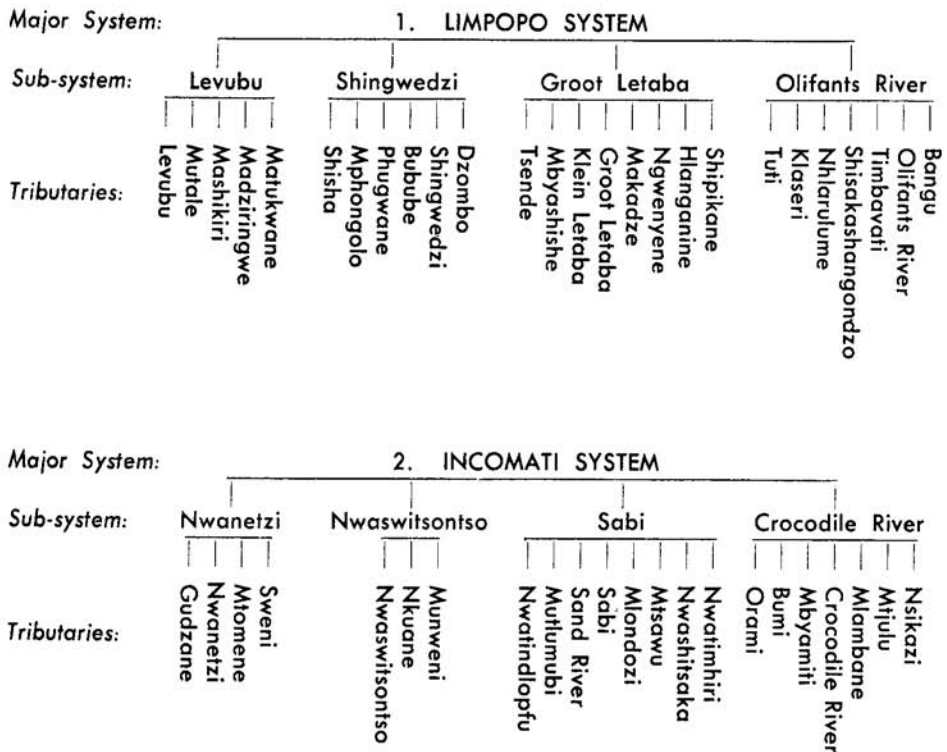
Topographically the landscape presents an undulating aspect, although it appears rather flat generally. The highest altitudes are attained in the south-west (2,750 ft. above sea level), and the country declines towards the Lebombo flats in the east, which are only 600-800 ft. above sea level. The Lebombo mountain range along the eastern boundary reaches its highest recorded level at Shilowa poort in the north (1,628 ft.).

The mean annual precipitation varies from 15 to 27 inches and the vegetational aspect, apart from the riverine and montane forests, grades between semi-arid scrub- or savanna-woodland to more luxuriant open woodland or savanna.

This vast area is drained by two major river systems — the Limpopo system, north of the  $24^{\circ} 15'$  latitude and the Incomati system to the south of this line.

Each of the major drainage basins comprises several sub-systems, which are primarily the perennial rivers passing through the Park from west to east, and which are fed en route by several important seasonal tributaries.

## DRAINAGE SYSTEMS OF THE KRUGER NATIONAL PARK



Of the eight subsystems and their respective tributaries, only the Levubu, Mutale, Groot Letaba, Olifants, Sabi and Crocodile are perennial rivers, and all the others are seasonal rivers which flow only for a short while during the rainy season, but normally incorporate a series of permanent and semi-permanent pools along their length.

The perennial rivers are generally placid-flowing streams during the dry season, except for the occasional rapid or narrow, and the water is relatively clear with the exception of the Levubu river, which is always turbid, even in mid-winter. During the rainy season, when the rivers are in full spate, they are characteristically muddy and turbulent.

The pH of the river waters during the dry season is usually slightly alkaline, and varies between 7.6 and 8.3, whereas that of the stagnant pools are often more alkaline (that of a pool in the Mbyamiti river was measured at 8.5 during April).

Exceptions are the stagnant pools in the acid, rhyolitic soils of the Lebombo range and here, for instance, the pH of the isolated *Notobranchius* habitat at Mtomene was measured at 6.7.

The temperatures of the waters vary from a midday temperature (April) of 19.8°C where the Sabi enters the Park in the west (at a height of some 1,300 ft. above sea level) to about 23°C at various points along the lowest reaches of our rivers (500-800 ft. above sea level). Although this temperature variation appears slight, it is sufficient to create a thermal barrier, which determines the distributional patterns of some temperature-sensitive species such as the mountain catlet, *Amphilius platyichir*, the orange-finned minnow, *Barbus argenteus* and others.

Zoogeographically the waters of the Kruger Park are included in a transitional zone which, although it contains mainly tropical elements with a wide range of distribution to the east and north, also harbours the eastern-most limits of distribution of several temperate forms, besides having also differentiated a few species which appear to be specifically adapted to the local environmental conditions, such as the small *Barbus* spp. *B. annectens*, *B. afrohamiltoni* and *B. toppini*, and the mud-fish *Labeo ruddi*.

It is significant that in the case of the temperate forms, a thermal barrier appears to operate. A species such as *Amphilius platyichir* has not been collected in waters warmer than 19.8°C (April) or at an altitude less than 1,300 ft. above sea level. The same applies also for *Barbus argenteus*. In the case of the latter, it would appear also that these fish can only enter our waters during the colder winter months and must therefore be considered as seasonal migrants.

Other temperate forms which inhabit the higher reaches of the Lowveld rivers, which enter the Park from the west, are even more sensitive to warmer, less well-aerated waters, as the above-mentioned species. It is, therefore, not surprising that the small-scaled large yellow fish of the Eastern Transvaal escarpment and middle veld, i.e. *Barbus polylepis* Boulenger and *Varicorhinus nelspruitensis* Gilchrist & Thompson, do not reach our waters. Neither do the small *Barbus* spp. *B. treurensis* Groenewald, *B. motebensis* Steindachner, *B. anoplus* M. Weber, *B. brevipinnis* Jubb and *B. barotseensis* Pellegrin.

It is more difficult to explain the absence from our waters of several tropical forms with a very wide distribution, such as the swamp barbel, *Clarias theodorae* Weber, and the lungfish, *Protopterus annectens brienii* Poll. *Clarias theodorae* has been found in the Umfolozi River and affluents of Lake Sibayi in Northern Natal, and the lungfish may yet be discovered in the vleis along the flood plains of the Limpopo River in the Pafuri area of the Park.

Although the distribution of the endemic freshwater fishes of the Park conforms in general with expected patterns, there are a few records forthcoming from our waters which are quite extraordinary. During an extensive survey of the fish fauna of the Incomati system Gaigher (1966) found that the vlei kurper, *T. sparrmanii* only inhabited waters above 2,000 ft. elevation. Furthermore, although this worker collected the yellow-bellied bream, *Chetia brevis* in substantial numbers along the length of the Lomati and lower Komati River, as far east as Komatipoort, it was conspicuously absent from the Crocodile River and its tributaries.

*T. sparrmanii* has, however, been recorded by us at three widely separated localities in the Park, at levels well below 1,000 ft. In corroboration with Gaigher's findings, we could discover no evidence of the presence of *Chetia brevis* or the related *Serranochromis meridianus* in the Crocodile subsystem, but the latter is an important constituent of the fish fauna of the Sabi River along its whole length (within the Park). Temperature obviously does not play a role in determining the distribution pattern here.

The question why the waters of the Crocodile subsystem appear to be unsuitable for sustaining a population of *Serranochromis* is intriguing indeed, and would suggest itself as an ideal study project to some interested student of freshwater biology.

The turbidity of the water is another factor which may determine freshwater fish distribution. It is significant that many species swim up the tributaries of the larger rivers during their summer spate in order to escape the muddy flood waters or to spawn.

The heavily silt-laden water of the Levubu River supports a very poor fish fauna when compared with our other rivers. A species such as the barred minnow, *Barilius zambezensis*, could not exist in these waters and has never been found in the lower reaches of the Levubu. On the other hand, the clearer pools in the seasonal tributaries of the Levubu often harbour a rich and varied fish fauna. The large numbers of crocodiles which find ideal cover and hunting facilities in the muddy waters of the Levubu, contribute significantly in depleting its fish life even further.

Several species of sea fish are adapted to live in fresh water and enter our waterways from the east. The gobies, *Glossogobius giuris* and *Platygobius aeneofuscus* find conditions so advantageous that they even breed in Park waters. Two species of eels, *Anguilla mossambica* and *A. marmorata*, also inhabit our rivers and permanent pools, and a third species, *A. nebulosa labiata* may yet be discovered here.

The Zambezi shark, *Carcharinus leucas*, which is also adapted to a temporary existence in freshwater, has on one occasion been found at Pafuri, at the confluence of the Levubu and Limpopo Rivers (more than 300 miles from the sea).

The remarkably adaptable cichlid, *Tilapia mossambica*, is our only indigenous freshwater species which can also survive in saline waters, such as that of estuaries and coastal lakes. It is very widespread throughout the Park and has even been collected in several of the warm springs of this region, such as at Matishibila, where the temperature of the water is 39.5°C.

Of the 46 species of fish collected in the waters of the Kruger Park, several were found only at altitudes below 1,000 ft. viz. tiger fish (*Hydrocynus vittatus*), dwarf tiger (*Alestes imberii*), Toppin's minnow (*Barbus toppini*), Hamilton's minnow (*Barbus afrohamiltoni*), red-eye minnow (*Barbus rubellus*), squeaker (*Synodontis zambezensis*), variegated goby (*Platygobius aeneofuscus*), Johnston's mosquito fish (*Aplocheilichthys johnstonii*) and the Zambezi shark (*Carcharinus leucas*).

The orange-finned minnow (*Barbus argenteus*) and mountain catlet (*Amphilius platyichir*) were collected only at altitudes in excess of 1,300 ft., whereas all the other species were recorded at all levels within the Park, ranging from  $\pm$  500-1,300 ft. above sea level.

Although most of our perennial rivers, particularly the Sabi, harbour such rich and diverse fish communities, the individual species comprising these communities occupy different ecological niches in their particular environments, competing only mildly with one another for food and shelter, and maintaining a balance of interrelationships with other forms of aquatic life which is essential for the survival of the community as a whole, as well as of the member species themselves.

There are many of the smaller forms, such as the small *Barbus* spp., the freshwater sardine (*Engraulicypris brevianalis*), silver minnow (*Micralestes acutidens*) and even the red-eye mudfish (*Labeo cylindricus*), which are important forage species, in the absence of which predating species such as *Hydrocynus vittatus*, *Clarias gariepinus*, *Eutropius depressirostris* and some large *Tilapia mossambica* cannot thrive.

On the other hand, the rapacious habit of these predating fish is an important natural regulating mechanism whereby the numbers of the smaller species are kept within bounds of their available food supplies. The larger fish, as well as many of the smaller species, again, are preyed upon by crocodiles, water leguans, otters and fish-eating birds such as fish-eagles, darters, cormorants and king fishers. The periodic drying up of pools in the seasonal rivers, and even the reduced flow of the perennial rivers themselves, constitute probably the most important natural regulating system, as many millions of fish succumb during these dry periods and are eaten by scavengers and predating mammals and birds. Severe cold spells during the winter months, when the temperature drops drastically over prolonged periods, are also instrumental in reducing the numbers of many thermo-sensitive species such as *Hydrocynus*, large *Barbus* spp., *Labeo* spp., *Tilapias* and even *Clarias*.

It is interesting to note that the different species of fish feed at different levels in the hydrosphere. Some forage for food near the surface of the water such as *Hydrocynus vittatus*, *Engraulicypris brevianalis*, the barred minnow (*Barilius zambezensis*), *Barbus argenteus* and the silver-fish (*Barbus mattozi*). Others are mainly bottom feeders, such as the *Labeo* spp., *Chiloglanis* spp., *Anguilla* spp., *Synodontis zambezensis*, *Amphilius platyichir* and the gobies, *Glossogobius giuris* and *Platygobius aeneofuscus*. The majority of *Barbus* spp., the *Tilapias*, dwarf bream (*Hemihaplochromis philander*), yellow-bellied bream (*Serranochromis meridianus*), annual killifish (*Notobranchius orthonotus*), *Aplocheilichthys johnstonii*, silver barbel (*Eutropius depressirostris*), *Micralestes acutidens*, *Alestes imberi* and the mormyrids *Petrocephalus* and *Gnathonemus* feed at all levels within their watery environment.

Habitat selection is another factor which has a distinct bearing on the distribution of our fishes within their natural habitat.

Some are partial to sections of the river or pools where there is a

rocky substratum with many loose boulders and stones, the cracks and crannies of which are utilised as shelter and protection. This is true for the mottled eel (*Anguilla marmorata*), bulldog fish (*Gnathonemus macrolepidotus*), red-eye mudfish (*Labeo cylindricus*), plumbeous mudfish (*Labeo molybdinus*), red-spotted mudfish (*Labeo rubropunctatus*), banded minnow (*Barbus eutaenia*), the chisel-mouthed and rubber-lipped forms of the large-scaled yellow fish (*Barbus marequensis*), the dwarf catlets (*Chiloglanis anoterus*, *C. paratus* and *C. sp. cf. C. pretoriae* and mountain catlets (*Amphilius platyichir*).

In the case of the gobies, *Platygobius aeneofuscus* and *Glossogobius giuris*, the rednosed mudfish (*Labeo rosae*), the thin-lipped form of *B. marequensis*, bearded catlet (*Chiloglanis swierstrai*), dwarf bream (*Hemihaplochromis philander*) and barred minnow (*Barilius zambezensis*), there is a definite preference for habitats with a sandy substratum, although a section is often selected close to a rupicolous area, such as a sandy-bottomed pool just below some rapids or rocky narrow. The remaining species may, on occasion, be found in both the previously mentioned habitat types, but more commonly along stretches of the river or in pools with a muddy or silt-covered bottom.

There are species which inhabit the open waters of rivers and pools, while others remain close to the weed covered or vegetation-clad banks. Some prefer the swift-flowing waters of the main current, while others roam the more placid waters of larger pools or the stagnant waters of backwashes or flood pools and vleis.

Species such as *Barilius zambezensis*, *Amphilius platyichir* and the rock-loving *Chiloglanis* spp., can only survive in clear, swift-flowing and particularly well-aerated waters, such as the torrential portions of our streams and rivers. Most other species dislike silt-laden waters and attempt to escape up less turbid tributaries of the main stream. Species such as *Clarias gariepinus*, *Synodontis zambezensis* and *Carcharinus leucas* however, seem to thrive in muddy waters, which often preclude all other fish life.

The seasonal killifish, *Notobranchius orthonotus* and *N. rachovii*, can only maintain themselves in waters which dry up completely during the dry season, whereas the closely related form, *Aplocheilichthys johnstonii*, can compete successfully with other weed-loving species in the rivers.

The *Tilapia* spp., *Tilapia mossambica* and *T. melanopleura swierstrae*, prefer large open stretches of water with profuse aquatic vegetation along the fringes of the pools, although the latter is more often found in the perennial rivers themselves, whereas *T. mossambica* is partial to the pools in seasonal rivers and dams. The vlei kurper, *T. sparrmanii*, in contrast, has been found locally only in habitats where the pools are all but completely covered with aquatic vegetation, presenting a swampy appearance.

#### SOME THOUGHTS ON CONSERVATION

Conservation and management practices concerning the freshwater fish community of the Kruger National Park should aim in the first instance at preserving the habitat in as natural a state as possible. If this could be achieved, the battle would be all but won, as natural regulating processes would then ensure the continued existence of the community and of individual species.

The first requisite in a conservation program would be the guarding against pollution (both chemical and biological) of the habitat, eliminating at the same time also all unnatural barriers which may interfere with annual migration patterns or abnormally influence the flow of the main water courses.

Where a river such as the Groot Letaba, a perennial stream of guaranteed and constant flow in the past, even during the driest spells, has of late become a seasonal river, in view of a succession of severe droughts and rapidly expanding agricultural activities along its banks, it is imperative that steps be taken to safeguard our indigenous fish populations from the disastrous effects which are bound to follow on this change.

A series of weirs along the course of such rivers through the Park is contemplated, thus ensuring large bodies of open water, which would tide most species over the dry spells. At the same time, a sluice system could provide a flow of some consequence, particularly along the lower reaches, and this would assist the survival of those species which are dependent on highly aerated and running water, such as *Barilius*, and the rock-loving *Chiloglanis* spp. The slaughter amongst these sensitive species in the Letaba River during the last dry season was shocking to behold, and if this was allowed to repeat itself over a succession of years, there is little doubt that many species will become extinct in our Lowveld waters.

The effects of such a loss and of the resulting impoverization of the fish community on associated species of reptiles, birds and mammals can well be imagined and will most certainly be significant.

Wherever a weir is erected, care should be taken that such a structure does not in itself, interfere drastically with the annual movement of fish during the wet season. This can easily be accomplished by the incorporation in the weir of a simple but effective fish ladder, but it is sad to reflect that this is so rarely done. In this respect authorities at even government departmental level fall down seriously. All too often a large river is dammed, or water conservation schemes are executed in order to provide the necessary water supply for industrial and agricultural expansion, without any consideration at all for the effects which this may have on our indigenous freshwater fish life.

The high weir at Coopersdal in the Crocodile River is a case in question, and is the scene during late summer of a most spectacular obstruction of young fish on their annual migration upstream. It is abundantly clear to anyone who has witnessed their struggle to negotiate the steep walls of this weir that such barriers must seriously impair the natural life cycles, and in the end, the survival of these species.

Countless millions of small fish (mainly *Labeo cylindricus*, *L. rosae*, *L. molybdinus*, *Barbus trimaculatus*, *B. afrohamiltoni*, and *Micralestes acutidens*) bank up against the base of this weir, compelled by the instinctive urge to move upstream. Here they concentrate in a seething mass, while predatory birds, leguaans, crocodiles and even human poachers exact a fearful toll. This, and other similar obstructions across the border in Portuguese East Africa, may already be a factor in prohibiting an unimpeded passage of



tiger-fish on their summer migrations upstream from their established spawning grounds in Mocambique.

A serious note of warning is sounded by the findings of Gaigher (1966) who, during the whole of a year's survey, which covered all of the Incomati system, captured 519 of a total of 524 tiger-fish in the vicinity of Komatipoort i.e. below the numerous weirs in the Crocodile and Komati Rivers.

It has also been noticed that, since the completion of weirs in the Sabi River in Portuguese East Africa, the population of this famous sporting fish, which invade the Park waters during the wet season, has dwindled considerably over the years, and it is feared that a similar fate is in stall for the tiger-fish and other migratory fish populations in the Olifants and Letaba Rivers, once the huge dam in the Olifants River is completed in Portuguese East Africa some 20 miles east of our borders. The latter will eventually store such a large body of water, however, that it may in itself provide suitable spawning grounds for tiger-fish, and may yet prove to be a boon to the local fish populations.

Be this as it may, it would be by far the most sensible policy to adopt the concept of an unimpeded passage to fish, particularly where data is still lacking with regard to their spawning cycles, migratory patterns, etc.

The intrinsic value to man of many of our indigenous fish species, apart from economic fish culture and annual harvesting of populations, is only now being brought to light, and particular attention has been focussed recently on the utilisation of certain species in biological control measures.

The Division of Environmental Health of the World Health Organization has, amongst others, seriously investigated the experimental introduction of *Notobranchius* spp., and other annual cyprinodont fishes as potential mosquito larvivores, and considerable success has already been reported. In similar vein, molluscivores amongst our freshwater fishes, such as *Barbus marequensis*, may some day play a significant role in the control of bilharzia-vecting snails such as *Biomphalaria pfeifferi* and *Physopsis globosus*.

All aesthetic and scientific merits apart then, and disregarding even our duty in preserving every species for posterity, it is still essential to the well-being of man himself that measures be adopted whereby our fish populations are not only protected from exploitation, but afforded the opportunity to conduct their own natural struggle for survival.

These remedial measures are relatively simple, and our National Parks could set the example for other bodies in this respect.

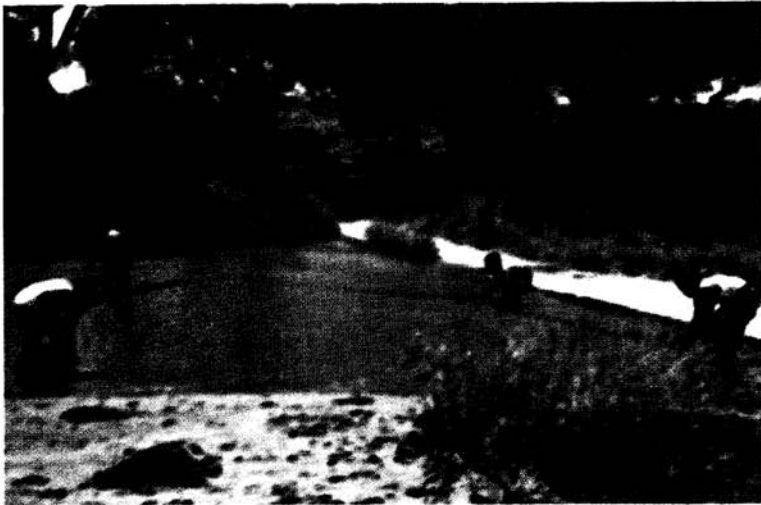
## SYSTEMATIC ACCOUNT OF THE FRESHWATER FISHES OF THE KRUGER NATIONAL PARK

The systematic list of field notes which follow, represent the result of a sporadic survey covering almost ten years. During this period fish were collected at selected sites along all our river systems and their tributaries, and notes were made, where possible, of all relevant aspects, such as feeding habits, breeding activity, natural enemies, etc.

Specimens were originally collected by means of a  $\frac{1}{4}$ " mesh seine net, with dimensions of 100 x 6 ft. This was subsequently augmented by an

electrical stunning apparatus of 220 volts AC and output of 800 Watts, which was used for collecting fish in inaccessible rocky sections of rivers, and in rapids and torrential streams where a net could not be operated.

A number of large eels, tiger-fish and others were also caught on hook and line by angling enthusiasts amongst the staff.



CLASSIFICATION OF INDIGENOUS FRESHWATER FISHES OF  
THE KRUGER NATIONAL PARK

- Phylum: *Chordata*  
 Subphylum: *Vertebrata*  
 Superclass: *Gnathostomata*  
   Class: *Chondrichthyes*  
     Subclass: *Elasmobranchii*  
       Order: *Selachii*  
         Suborder: *Galeoidea*  
           Family: *Galeorhinidae*  
           Genus: *Carcharinus* Blainville, 1816.  
           Species: *Carcharinus leucas* (Müller & Henle) 1841.  
                     Zambezi Shark.
- Class: *Teleostomi (Osteichthyes)*  
     Subclass: *Actinopterygii*  
       Order: *Mormyriiformes (Clupeiformes)*  
         Family: *Mormyridae*  
         Genus: *Gnathonemus* Gill, 1862.  
         Species: *Gnathonemus macrolepidotus* (Peters), 1852.  
                     Bulldog.
- Genus: *Petrocephalus* Marcusen, 1854.  
   Species: *Petrocephalus catostoma* (Gunther), 1866.  
                     Silver parrot-fish.
- Order: *Cypriniformes (Ostariophysi)*  
     Suborder: *Characoidei*  
       Family: *Characidae*  
       Genus: *Hydrocynus* Cuvier, 1817.  
       Species: *Hydrocynus vittatus* Castelnau, 1861.  
                     Tiger-fish.
- Genus: *Alestes* Muller and Troschel, 1846.  
   Species: *Alestes imberi* Peters, 1852.  
                     Spot-tailed dwarf tiger.
- Genus: *Micralestes* Boulenger, 1899.  
   Species: *Micralestes acutidens* (Peters), 1852.  
                     Silver minnow.
- Suborder: *Cyprinoidei*  
     Family: *Cyprinidae*  
     Genus: *Barbus* Cuvier, 1817.  
     Species: *Barbus marequensis* A. Smith, 1841.  
                     Large-scaled Lowveld yellowfish.  
                     *Barbus mattozi* Guimaraes, 1884.  
                     Silver-fish.  
                     *Barbus trimaculatus* Peters, 1852.  
                     Three-spot minnow.  
                     *Barbus paludinosus* Peters, 1852.  
                     Slender serrate minnow.

- Barbus afrohamiltoni* Crass, 1960.  
Hamilton's minnow.
- Barbus eutaenia* Boulenger, 1904.  
Banded orange-finned minnow.
- Barbus argenteus* Gunther, 1868.  
Orange-finned serrate minnow.
- Barbus unitaeniatus* Gunther, 1866.  
Single-banded or long-bearded minnow.  
(Includes forma *labialis* Gilchrist & Thompson, 1913).
- Barbus viviparus* M. Weber, 1897.  
Bow-striped minnow.
- Barbus annectens* Gilchrist & Thompson, 1917.  
Sabi minnow.
- Barbus toppini* Boulenger, 1916.  
Toppin's dwarf minnow.
- Barbus rubellus* (Crass), 1960.  
Red-eye minnow.
- Barbus (Beirabarus) radiatus* (Peters), 1853.  
Red-finned minnow.
- Genus: *Labeo* Cuvier, 1817.
- Species: *Labeo rubropunctatus* Gilchrist & Thompson, 1913.  
Red-spotted mudfish.
- Labeo cylindricus* Peters, 1852.  
Rough-nosed or Red-eye mudfish.
- Labeo molybdinus* Du Plessis, 1963.  
Plumbeous mudfish.
- Labeo rosae* Steindachner, 1894.  
Red-nosed mudfish.
- Labeo ruddi* Boulenger, 1907.  
Small-mouthed mudfish.
- Genus: *Barilius* Hamilton-Buchanan, 1822.
- Species: *Barilius zambezensis* (Peters), 1852.  
Barred minnow.
- Genus: *Engraulicypris* Gunther, 1893.
- Species: *Engraulicypris brevianalis* (Boulenger), 1908.  
Freshwater sardine or whitebait.
- Suborder: *Siluroidei (Siluri)*
- Family: *Clariidae*
- Genus: *Clarias* Gronow, 1763.
- Species: *Clarias gariepinus* (Burchell), 1822.  
Barbel or catfish.
- Family: *Schilbeidae*
- Genus: *Eutropius* Müller & Troschel, 1849.
- Species: *Eutropius depressirostris* (Peters), 1852.  
Silver barbel.

- Family: *Mochokidae*  
 Genus: *Synodontis* Cuvier, 1817.  
 Species: *Synodontis zambezensis* Peters, 1852.  
                     Squeaker.
- Genus: *Chiloglanis* Peters, 1868.  
 Species: *Chiloglanis anoterus* Crass, 1960.  
                     Penant-tailed dwarf catfish.  
*Chiloglanis swierstrai* v.d. Horst, 1931.  
                     Bearded dwarf catfish.  
*Chiloglanis paratus* Crass, 1960.  
                     Spiny dwarf catfish.  
*Chiloglanis* sp. cf. *C. pretoriae* v.d. Horst, 1931.  
                     Lesser dwarf catfish.
- Family: *Amphiliidae*  
 Genus: *Amphilius* Günther, 1864.  
 Species: *Amphilius platyichir* Günther, 1864.  
                     Flathead catlet.
- Order: *Anguilliformes* (Apodes)  
 Suborder: *Anguilloidei*  
 Family: *Anguillidae*  
 Genus: *Anguilla* Shaw, 1803.  
 Species: *Anguilla marmorata* Quoy & Gaimard, 1824.  
                     Madagascar mottled eel.  
*Anguilla mossambica* Peters, 1852.  
                     Common long-fin eel.
- Order: *Cyprinodontiformes* (Microcyprini)  
 Family: *Cyprinodontidae*  
 Genus: *Notobranchius* Peters, 1868.  
 Species: *Notobranchius orthonotus* (Peters), 1844.  
                     Tongaland top minnow.  
*Notobranchius rachovii* Ahl, 1926.  
                     Rachow's top minnow.
- Genus: *Aplocheilichthys* Bleeker, 1863.  
 Species: *Aplocheilichthys johnstonii* (Gunther), 1893.  
                     Johnston's mosquito fish.
- Order: *Perciformes*  
 Suborder: *Percoidei*  
 Family: *Cichlidae*  
 Genus: *Tilapia* A. Smith, 1840.  
 Species: *Tilapia mossambica* Peters, 1852.  
                     Large-mouth Tilapia or Blue bream.  
*Tilapia sparrmanii* A. Smith, 1840.  
                     Green-chested Tilapia or Banded bream.  
*Tilapia melanopleura swierstrae* Gilchrist & Thompson, 1917.  
                     Small-mouth Tilapia or Red-breasted bream.
- Genus: *Serranochromis* Regan, 1920.

- Species: *Serranochromis meridianus* Jubb, 1967.  
Concertina-mouth or Yellow-bellied bream.
- Genus: *Hemihaplochromis* Wickler, 1963.
- Species: *Hemihaplochromis philander* (M. Weber), 1897.  
Rainbow bream. Dwarf bream.
- Suborder: *Gobioidei*
- Family: *Gobiidae*
- Genus: *Platygobius* Bleeker, 1874.
- Species: *Platygobius aeneofuscus* (Peters), 1852.  
Variegated goby.
- Genus: *Glossogobius* Gill, 1862.
- Species: *Glossogobius giuris* (Hamilton-Buchanan), 1822.  
Flat-headed goby.

### KEY TO THE GENERA OF FISHES OF THE KRUGER NATIONAL PARK

1. Five external gill openings on each side of head:
  - Carcharinus* ..... page 19
2. One external gill opening on each side of head ..... 3
3. Body long and slender with dorsal, caudal and anal fins fused: no ventral (pelvic) fins present:
  - Anguilla* ..... page 56
  - Body with dorsal, caudal and anal fins separate; ventral fins present ..... 4
4. No scales present ..... 5
- Scales present ..... 6
5. Four pairs of circumoral barbels:
  - i. Long dorsal fin without spine: *Clarias* ..... page 47
  - ii. Short dorsal fin with sharp spine: *Eutropius* ..... page 49
- Three pairs of circumoral barbels:
  - i. Mandibular barbels long and branched; dorsal with sharp spine: *Synodontis* ..... page 50
  - ii. Mandibular barbels not branched, very short in some species with barbels fused to sucker-like lower lip; dorsal fin with sharp spine: *Chiloglanis* ..... page 51
  - iii. Mandibular barbels not branched, not fused with lip; dorsal fin with no sharp spine: *Amphilius* ..... page 55
6. Eye and mouth relatively large; opercular bones visible; dorsal fin with or without spines ..... 8
- Eye and mouth small; soft skin covering head and hiding opercular bones; dorsal fin without spines ..... 7
7. The lower jaw has a pronounced chin: *Gnathonemus* ..... page 20
- Mouth inferior with no chin: *Petrocephalus* ..... page 21
8. Ventral fins in thoracic position (i.e. near the throat) ..... 14
- Ventral fins in abdominal position (i.e. near the vent) ..... 9
9. Upper and lower jaws without teeth ..... 13

Upper and lower jaws with teeth .....	10
10. Rayed dorsal fin originates above ventral fins .....	12
Rayed dorsal fin originates distinctly behind origin of ventral fins .....	11
11. First ray of dorsal fin originates above, or slightly in advance of origin of anal fin: <i>Notobranchius</i> .....	page 60
First ray of dorsal fin originates well behind origin of anal fin: <i>Aplocheilichthys</i> .....	page 65
12. i. Teeth large, fang-like and sharp edged: <i>Hydrocynus</i>	
ii. Teeth small, with sharp serrated edges: <i>Micralestes</i> .....	page 25
iii. Teeth small, with thick bases and ridged crowns: <i>Alestes</i>	page 24
13. i. Dorsal fin originates distinctly in advance of ventral fins: <i>Labeo</i> .....	page 40
ii. Dorsal fin originates more or less above origin of ventral fins: <i>Barbus</i> .....	page 26
This includes the subgenus <i>Beirabarbus</i> .....	page 39
iii. Dorsal fin originates distinctly behind origin of ventral fins but in advance of origin of anal fin: <i>Barilius</i> .....	page 45
iv. Dorsal fin originates distinctly behind origin of ventral fins but over, or slightly behind, origin of anal fin: <i>Engraulicypris</i> .....	page 46
14. Dorsal fin long with 13-17 spines and 9-13 soft branched rays .....	15
Two separate dorsal fins; ventral fins joined to form sucker-like disc: <i>Platygobius</i> .....	page 76
and <i>Glossogobius</i> .....	page 77
15. Mouth oblique .....	16
Mouth horizontal and not extending much beyond vertical through nostril: <i>Tilapia</i> .....	page 66
16. Mouth large and markedly oblique, extending to below eye: <i>Serranochromis</i> .....	page 72
Mouth oblique, extending to vertical midway between nostril and eye; caudal markedly rounded: <i>Hemihaplochromis</i> .....	page 74

#### KEY TO FRESHWATER FISHES OF THE KRUGER NATIONAL PARK

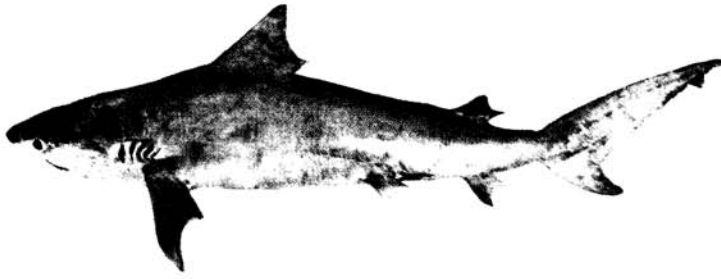
1. Five external gill openings on each side of the head: <i>Carcharinus leucas</i> .....	page 19
2. One external gill opening on each side of the head .....	3
3. Body long and slender with dorsal, caudal and anal fins fused; no ventral (pelvic) fins: <i>Anguillidae</i> .....	4
Body with dorsal, caudal and anal fins separate; ventral (pelvic) fins present .....	5
4. The skin has a mottled pattern: <i>Anguilla marmorata</i> .....	page 56
The skin has no mottled pattern: <i>Anguilla mossambica</i> .....	page 58
5. No scales present; three or four pairs of circumoral barbels, usually long: <i>Siluroidei</i> .....	6
Scales present; barbels absent or one or two pairs of relatively short maxillary barbels .....	13

6. Four pairs of circumoral barbels .....	7
Three pairs of circumoral barbels, mandibular barbels some- times short .....	8
7. Rayed dorsal fin long and without spines: <i>Clarias gariepinus</i> .....	page 47
Rayed dorsal fin short with sharp spine: <i>Eutropius depressi- rostris</i> .....	page 49
8. Mandibular barbels slender and branched; dorsal fin short with sharp spine: <i>Synodontis zambezensis</i> .....	page 50
Mandibular barbels not branched .....	9
9. Rayed dorsal fin short; no spine present: <i>Amphilius platychir</i> .....	page 55
Rayed dorsal fin short; sharp spine present .....	10
10. Spine of rayed dorsal fin serrated along posterior edge: <i>Chiloglanis paratus</i> .....	page 53
Spine of rayed dorsal fin not serrated .....	11
11. Mandibular barbels well formed and easy to discern: <i>Chilo- glanis swierstrai</i> .....	page 52
Mandibular barbels short and fused with lower lip .....	12
12. Adult males have elongated lower lobe to caudal fin, or median rays of caudal elongated: <i>Chiloglanis anoterus</i> .....	page 51
Adult males have emarginate caudal fin: <i>Chiloglanis</i> cf. <i>pretoriae</i> .....	page 54
13. Eye and mouth relatively large; thin skin on head; opercular bones visible; dorsal fin with or without spines .....	15
Eye and mouth small; soft skin covering head and hiding opercular bones; dorsal fin without spines: <i>Mormyridae</i> .....	14
14. Lower jaw with pronounced chin: <i>Gnathonemus macrolepi- dotus</i> .....	page 20
No pronounced chin, mouth inferior: <i>Petrocephalus catostoma</i> .....	page 21
15. Ventral (pelvic) fins in thoracic position (i.e. near the throat)	36
Ventral fins in abdominal position (i.e. near the vent) .....	16
16. Upper and lower jaws without teeth: <i>Cyprinidae</i> .....	22
Upper and lower jaws with teeth .....	17
17. Rayed dorsal fin originates above ventral (pelvic) fins: <i>Characidae</i> .....	18
Rayed dorsal fin originates distinctly behind origin of ventral fins: <i>Cyprinodontidae</i> .....	20
18. Number of scales along the lateral line 44-48: <i>Hydrocynus vittatus</i> .....	page 22
Number of scales along the lateral line 23-29 .....	19
19. Teeth in upper jaw, four outer and eight inner, sharp and serrated: <i>Micralestes acutidens</i> .....	page 25
Teeth in upper jaw, eight outer and eight inner, with thick bases and ridged crowns: <i>Alestes imberi</i> .....	page 24
20. First ray of dorsal fin originates above or slightly in advance of origin of anal fin .....	21
First ray of dorsal fin originates well behind origin of anal fin: <i>Aplocheilichthys johnstonii</i> .....	page 65



21. Lateral line series of pits; scales 28-33: <i>Notobranchius orthonotus</i> .....	page 60
Lateral line series of pits; scales 25-26: <i>Notobranchius rachovii</i> .....	page 63
ventral fins .....	23
22. Dorsal fin originates distinctly in advance of origin of Dorsal fin originates more or less above origin of ventral fins .....	27
Dorsal fin originates distinctly behind origin of ventral fins .....	36
23. Inside of upper and lower lips with transverse rows of small papillae in the form of plicae .....	24
Lips without plicae on their inner surface but lips fringed with large papillae .....	26
24. Hind margin of dorsal fin concave or notched .....	25
Hind margin of dorsal fin straight: <i>Labeo rubropunctatus</i> .....	page 40
25. Lateral line scales 34-37; caudal peduncle 12-16: <i>Labeo cylindricus</i> .....	page 41
Lateral line scales 38-41; caudal peduncle 17-21: <i>Labeo molybdinus</i> .....	page 42
26. Tubercles on snout red; lateral line scales 38-40, caudal peduncle 17-20: <i>Labeo rosae</i> .....	page 43
Tubercles on snout not red; lateral line scales 39-43, caudal peduncle 19-22: <i>Labeo ruddi</i> .....	page 44
27. Exposed portion of scales, if examined with a microscope, with more or less parallel striations .....	28
Exposed portion of scales with radiating striations .....	29
28. Lateral line scales 27-33; caudal peduncle 12: <i>Barbus marequensis</i> .....	page 26
Lateral line scales 38-44; caudal peduncle 16: <i>Barbus polylepis</i> .....	
29. Longest dorsal simple ray strong and bony .....	30
Longest dorsal simple ray flexible .....	32
30. Longest dorsal fin ray, serrated along hind edge .....	31
Not serrated along hind edge; lateral line 31-35, caudal peduncle 14; usually three spots on sides: <i>Barbus trimaculatus</i> .....	page 29
31. i. Caudal peduncle scales 16:	
Dorsal fin with predominantly 7 branched rays; lateral line scales 32-36: <i>Barbus paludinosus</i> .....	page 30
Dorsal fin with predominantly 8 branched rays; lateral line 30-34: <i>Barbus afrohamiltoni</i> .....	page 31
ii. Caudal peduncle scales 14:	
Snout long with depressed head; barbels thin, anterior pair often absent; lateral line 29-35: <i>Barbus mattozi</i> .....	page 28
Snout rounded; barbels well developed; lateral line 27-32: <i>Barbus argenteus</i> .....	page 32
iii. Caudal peduncle scales 12:	
Lateral line 24-27: <i>Barbus eutaenia</i> .....	page 33

32. Sensory ridges or pit-lines on the head and some of the anterior scales; barbels short: <i>Beirabarus radiatus</i> .....	page 39
No sensory ridges on the head .....	
33. Lateral line tubules confined to the first 6-13 scales: <i>Barbus toppini</i> .....	page 37
Lateral line tubules complete .....	34
34. i. Five rows of scales in a transverse line from origin of dorsal fin to the lateral line; lateral line 29-35, caudal peduncle 12-14: <i>Barbus unitaeniatus</i> .....	page 34
ii. Four rows of scales in a transverse line from the origin of the dorsal fin to the lateral line; lateral line 26-31, caudal peduncle 12: <i>Barbus viviparus</i> .....	page 35
iii. Three rows of scales in a transverse line from the origin of the dorsal fin to the lateral line:	
(a) Maxillary barbels well developed, lateral line 25-29: <i>Barbus annectens</i> .....	page 36
(b) Maxillary barbels very short; lateral line 24-25: <i>Barbus rubellus</i> .....	page 38
35. Dorsal fin originates in advance of origin of anal fin; lateral line scales 40-42: <i>Barilius zambezensis</i> .....	page 45
Dorsal fin originates over or slightly behind origin of anal fin; lateral line scales 45-59: <i>Engraulicypris brevianalis</i> .....	page 46
36. Single long dorsal fin with 13-17 spines followed by 9-13 soft rays: <i>Cichlidae</i> .....	37
Two separate dorsal fins, front one with 6 spines and hind one with 1 spine and 8-11 branched rays: <i>Gobiidae</i> .....	40
37. Gill-rakers slender, 8-20 on lower portion of outer arch .....	38
Gill-rakers coarse and knob-like in structure .....	39
38. i. Gill-rakers 15-20 on lower portion of outer arch: <i>Tilapia mossambica</i> .....	page 66
ii. Gill-rakers 8-12 on lower portion of outer arch; 8-9 vertical bars on sides: <i>Tilapia sparrmanii</i> .....	page 68
iii. Gill-rakers 8-12 on lower portion of outer arch; 5-6 vertical bars on sides of young fish, pink flush on throat of adult fish: <i>Tilapia melanopleura swierstrae</i> .....	page 70
39. Mouth large, markedly oblique, extending to below eye: <i>Serranochromis meridianus</i> .....	page 72
Mouth oblique, extending to between nostril and eye; a small species with rounded caudal fin: <i>Hemihaplochromis philander</i> .....	page 74
40. Scales in longitudinal series 30-35; lower jaw projecting: <i>Glossogobius giuris</i> .....	page 77
Scales in longitudinal series 58-65; lower jaw not projecting: <i>Platygobius aeneofuscus</i> .....	page 76



1. *Carcharinus leucas* (Müller & Henle), 1841.

Synonym: *C. zambezensis* (Peters).

Zambezi Shark.      Zambezi-haai.

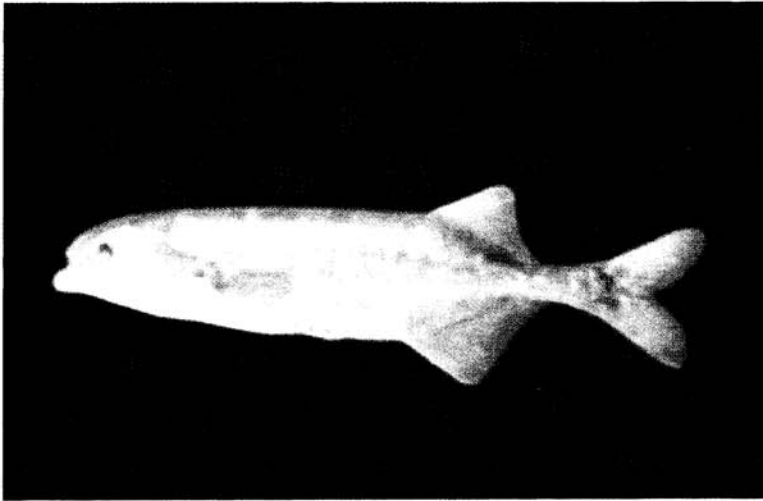
Although this shark is generally an inhabitant of the sea, it is also at home in brackish or fresh water.

Recent research has shown that this species is one of the ferocious sharks which attack bathers in the warm waters along the East coast of South Africa. Under normal conditions it is probably a scavenger and fish eater, but its voracity increases with the temperature of the water and it becomes particularly dangerous to human bathers when the water becomes discoloured by summer floods. Like other sharks, it is sensitive to vibrations and has a good sense of smell. Moving objects are perceived but it lacks colour vision.

Peters caught and described one of the first specimens known to science at Tete, Portuguese East Africa, in 1852, but it has subsequently been recorded at the junction of the Ruenya and Mazoe Rivers, the Lower Shire river, the Lower Limpopo, particularly above the irrigation works at Caniçado and near the confluence of the Pongolo with the Usutu river, at Ndumu Game reserve in Natal.

The only record of this shark from the waters of the Kruger Park is one that was found on July 4th, 1950, in the shallows of the Levubu-Limpopo junction at Pafuri by Mr. H. H. Mockford of the local W.N.L.A. recruiting station. (Fig. xlvi). This particular specimen was 4 ft. 10 inches in length and weighed 48 lbs. Unfortunately it was not possible to preserve this specimen and, although the skull was saved, the latter was subsequently taken by a hyaena.

It is believed that these sharks attain a length of some 7 to 8 ft. and weights in excess of 100 lbs.



2. *Gnathonemus macrolepidotus* (Peters), 1852.

Synonym: *G. pongolensis* Fowler, 1934.

Bulldog. Groter of Oopbek-snawelvis.

These peculiar and interesting fishes attain a length of some 10 inches and the colour is very variable, depending on the type of habitat and turbidity of the water. The usual colour is a dark chocolate-brown or bronze, but sometimes it is golden or olive-brown with marbling or mottling of dark brown.

It occurs generally in relatively restricted waters, such as the edges of larger rivers, dams, etc. To some extent it is weed-loving and particularly favours sections of the river where the banks are undercut or where loose boulders provide ample shelter. Running water is more essential to this species than to its near-relative *Petrocephalus*.

The diet is mainly insectivorous and consists of such items as midge larvae, mayfly nymphs, and small red aquatic nematodes. Occasional specimens are hooked by anglers using small hooks and earth-worm bait. An annual migration, probably for spawning purposes, has been recorded for this fish, but it also moves about a great deal during the dry season to escape deoxygenated waters.

Jaw-movements are restricted in this species and the tiny mouth remains open. Ventilation is achieved by the rapid fanning action of the gill covers.

Distribution: Has been recorded from all the perennial rivers of the Park, as well as a permanent pool in the seasonal Nwaswitsontso river. (Fig. i).