State-of-Rivers Report

the Mokolo River

a Catchment in the Limpopo Province

August 2006

River Health Programme

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Context of this Report

The Mokolo River Catchment was prioritised for study during 2002 by Limpopo Environmental Affairs, due to growing concerns relating to reed encroachment, the spraying of weeds with herbicides and water delivery for the agricultural sector downstream of Mokolo Dam. Furthermore, flows were released from Mokolo Dam to meet agricultural demand without due recognition of the downstream environmental consequences. The lack of a formal Ecological Reserve to address ecological flows was thought to be a serious omission in the ecological management of the lower Mokolo River.

The ecology of the Mokolo Catchment had never been addressed in a multi-disciplinary, holistic fashion; with only limited historical data being available from fish surveys between 1965 and 1984.

A detailed survey of the catchment was therefore long overdue, not only in terms of requirements for the River Health Programme (RHP), but also in terms of the provincial and national objectives to produce an up to date State of Environment Report (SOE).

Participating Organisations

Department of Environmental Affairs and Tourism (DEAT)

Department of Water Affairs and Forestry (RQS)

Water Research Commission

Limpopo Environmental Affairs:
(Department of Economic Development, Environment and Tourism - LEDET)

Rhodes University

Venda University of Science and Technology

Working for Wetlands

CSIR Natural Resources and the Environment

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Contents

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NOTE:

the **Mokolo River**
is also known as the
Mogol River
and the
Mogolo River

State-of-Rivers: Introduction

State-of-River reports are a sub-category of State-of-Environment reporting, which was promoted at the United Nations Conference on Environment and Development in 1992.

State-of-River reports provide information at a non-technical level to a wide audience: (politicians, managers, local authorities, farmers, scholars and the general public, etc.). The reports can help decision-makers and others see the complete catchment overview; guide scholars with projects; and provide information that may not have been easily available. Everyone can benefit from these reports, as they are easy to understand, provide a range of environmental information, and are freely available.

Making communities aware of their environment is a very important step towards helping them to conserve their environment.

The River Health Programme

The River Health Programme is a national monitoring initiative measuring and reporting on the ecological state of South African river systems. It measures the biological and habitat integrity of rivers, which enables assessments of the ecological state of the river systems in a consistant manner. Information from the River Health Programme identifies areas where unacceptable ecological deterioration is taking place. The RHP can also show the effectiveness of existing river management policies, strategies and actions.

Further information can be found on the River Health Programme website:

www.csir.co.za/rhp

State of Environment reporting

As a signatory to the Convention on Biological Diversity, South Africa is obliged to develop environmental indicators and to produce periodic State of Environment (SoE) reports.

The responsibility for producing detailed environmental reports, has been delegated to the provincial environmental authorities. It is the responsibility of the National Department of Environmental Affairs and Tourism to integrate provincial assessments and to provide the international community with a summarised national assessment. The first national assessment was completed in 1999.

State of Environment reports are intended to support sustainable development and decision making through the provision of credible environmental information. State of Environment reporting plays an important role in assessing and interpreting data, and making it readily available and meaningful to both decision-makers and the public, thereby creating an important communication channel between scientists and the authorities.

In Limpopo Province, Limpopo Environmental Affairs published an introductory, phase 1 State of Environment report in 2004, while a more detailed, phase 2 report is due for publication in 2006.

In terms of aquatic biodiversity, those monitoring indices developed within the River Health Programme, together with a structured monitoring plan, provide important information for the provincial State of Environment report.

State-of-Rivers: Limpopo Province

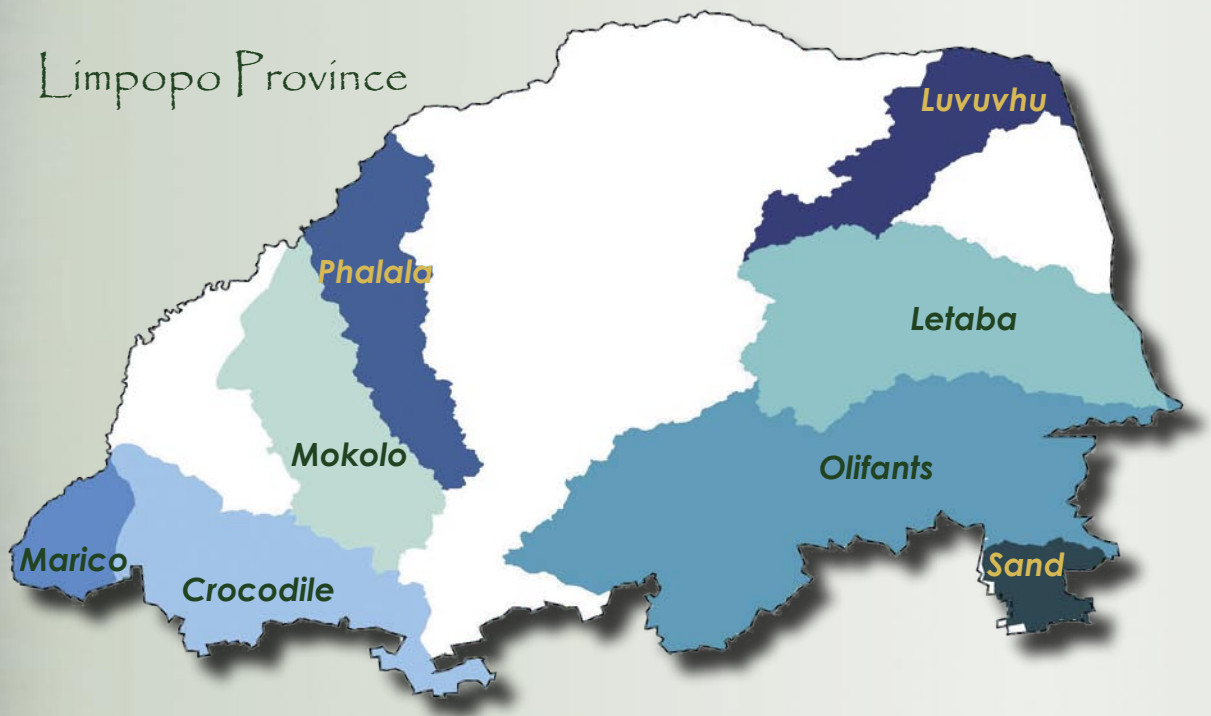
Published State-of-River reports in the Limpopo Province

Catchment	Years Surveyed	Indicies Used *	Training **	Technical Report	SoR Reports
Phalala	1997 DWAF	FAII, SASS4	Recieved	No	No
	2005	FRAI, SASS5, RVI, GI, IHI, Ecostatus, EIS	Given	In Prep.	No
Sand	1997	FAII, SASS4, RVI	Received	No	Yes
	2001	FAII, SASS5	Given	Yes	No
Olifants and Tributaries	1998 DWAF	FAII, SASS4, RVI	Received	No	Yes
	1999 DWAF	FAII, SASS4, RVI	Given	No	Yes
	2003	FAII, SASS5	Given	Yes	No
Luvuvhu	1999	FAII, SASS4, RVI, GI	Given	Yes	Yes
	2003	FAII, SASS5	Given	Yes	No
Letaba	2000	FAII, SASS5, RVI, GI, IHI	Given	Yes	Yes
	2003	FAII, SASS5	Given	Yes	No
Mokolo	2002 and 2006	FAII, SASS5, RVI, GI, IHI, Ecostatus, EIS	Given	Yes	**This Report**
Crocodile and Marico	2004 - 2005	FRAI, SASS5, RVI, GI, IHI, Ecostatus, EIS	Received and Given	Yes	Yes

** See page 4 for a description of indicies used* | *** Training received by, or given by, LEDET*

The Dept. of Economic Development, Environment and Tourism (LEDET) surveyed the rivers in collaberation with:

- Sand River, with the Kruger National Park (KNP), and Mpumalanga Province;
- Olifants River, with DWAF, KNP, Gauteng and Mpumalanga Provinces;
- Letaba and Luvuvhu Rivers, with the KNP;
- Crocodile (West) and Marico Rivers, with DWAF, Gauteng and North-West Provinces.



The map shows the location of catchments with existing State-of-River reports. The white areas are catchments where State-of-River reports still have to be produced.

River Health Programme Indices

	RHP Indices Used in this Report:	
	FAII: Fish Assemblage Integrity Index	Fish are good indicators of long-term influences on general habitat conditions within a river reach. The FAII is an expression of the degree to which a fish population differs from its expected undisturbed condition.
	RVI: Riparian Vegetation Index	Healthy riparian zones help to maintain the form of the river channel and act as filters for sediment, nutrients and light. Plant material from this zone is an important source of food for aquatic fauna. RVI is a measure of the degree of modification of the riparian zone from its natural state.
	SASS: South African Scoring System (macro-*invertebrates*)	Aquatic invertebrates require specific habitats and water quality conditions. They are good indicators of recent localised conditions in a river. SASS is an index, based on invertebrate families found at a site.
	Other Indices Used:	
D	**D-HI:** Desktop Habitat Integrity	Different types of habitat and their make-up help to determine the types of biota that are present in a river. This desktop version of the IHI extrapolates data, based on methodology in Kleynhans *et al*. 2005.
	GI: Geomorphological Index	Geomorphological processes determine the size and shape of river channels, which in turn define the type of habitat. The GI reflects the channel condition and channel stability.
	EcoStatus:	All the features and characteristics of the river and its riparian areas that influence its ability to support the natural flora and fauna, and its capacity to provide a variety of goods and services.
	EIS: Ecological Importance and Sensitivity	An indication of whether a river should receive a high level of protection or not: high meaning it should be protected in a natural or good state, and low meaning it has less conservation value or is already impacted, and may be more suitable for development, etc. (Importance refers to the diversity and rarity of habitats and biota; and sensitivity to the ability to tolerate and recover from disturbances and impacts).

River Health Category	Ecological Perspective	Management Perspective
Natural N	Little or no modification of in-stream and riparian habitats and biota.	Relatively untouched by humans; no discharges or impoundments allowed.
Good G	Ecosystems essentially in good state; biodiversity largely intact.	Some human-related disturbance but mostly of low impact.
Fair F	Sensitive species may be lost; lower abundances of biological populations are likely to occur, and/or higher abundances of tolerant or opportunistic species occur.	Disturbances associated with socio-economic development, such as: impoundment, habitat modification and water quality degradation.
Poor P	Habitat diversity and availability have declined; mostly only tolerant species present; biota can no longer reproduce, and/or alien species have invaded the ecosystem.	High human densities or extensive resource exploitation. Management intervention is needed to improve river health.

Glossary	
Biota	The term for a group of animals and plants in a certain area.
Ecology	The relationship of plants and animals to one another and their environment.
Fauna	The general name for the animal population at a certain place or time.
Habitat	Specific type of environment, such as stones, vegetation, river banks, mud, etc.
Invertebrate	Collective name for organisms with no backbone, such as insects, snails, crabs, jellyfish, etc.
Reach	A section of river, with end boundaries, either natural or man-made, such as dams, rapids, etc.
Riparian	The name given to the area along the banks of a river or waterbody.

Confluence of the Mokolo River and the Sterkstroom, showing a wide variety of riverine habitat conditions

Overview of Study Area

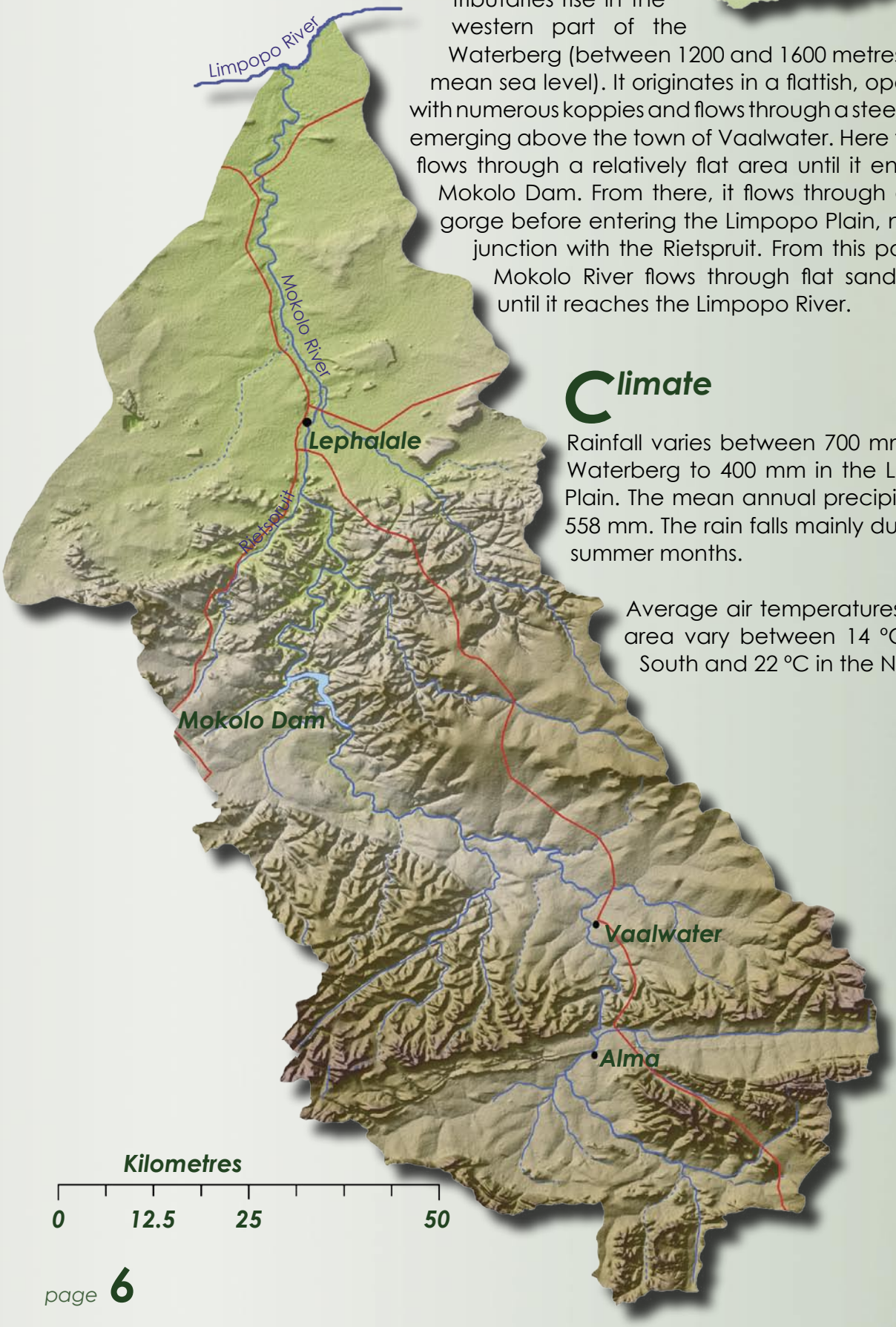
Terrain

The Mokolo River and its tributaries rise in the western part of the Waterberg (between 1200 and 1600 metres above mean sea level). It originates in a flattish, open area with numerous koppies and flows through a steep gorge emerging above the town of Vaalwater. Here the river flows through a relatively flat area until it enters the Mokolo Dam. From there, it flows through another gorge before entering the Limpopo Plain, near the junction with the Rietspruit. From this point, the Mokolo River flows through flat sandy areas until it reaches the Limpopo River.

Climate

Rainfall varies between 700 mm in the Waterberg to 400 mm in the Limpopo Plain. The mean annual precipitation is 558 mm. The rain falls mainly during the summer months.

Average air temperatures for this area vary between 14 °C in the South and 22 °C in the North.



Mokolo Dam and the Downstream Environment

The Mokolo Dam lies in a picturesque setting within the Provincial Mokolo Dam Nature Reserve and is a popular recreational resort for anglers and the boating fraternity. The dam has a full supply capacity of 145.4 million cubic metres and currently provides the only formal water storage facility in the Mokolo Catchment. The dam supplies water to the town of Lephalale, Matimba Power Station, Kumba Colliery and downstream irrigation farmers. The small capacity of the dam, when considered against the growth potential of Lephalale, means that there is limited capacity to manage water releases for environmental purposes. The downstream river is therefore dependant on flood flows that overspill the dam, and irregular water releases supplied to downstream irrigation agriculture.

However, in recent years, the downstream river has become heavily infested with reeds (*Phragmites mauritianus*), and irrigation releases have been increasingly hard to manage. The reeds not only consume large volumes of water, but also restrict flow through narrow encroached channels, delaying the delivery of released water to the lower reaches of the river.

Mokolo Dam outflow

The inability to deliver water effectively to the lower river is thought to impact adversely on water temperatures and ecological cues that could disrupt breeding cycles of aquatic fauna due to the unseasonal nature of the releases. The Mokolo Irrigation Board has, through consultation with DWAF and Limpopo Environmental Affairs, embarked on a regular aerial spraying program of the reeds using a herbicide. While the spraying appears to have a significant impact on the reeds, the effects of decaying weeds on water quality and the cumulative impacts of the herbicide on aquatic fauna, and other flora, have yet to be determined.

Vegetation

The catchment is dominated by mixed bushveld and sour bushveld. In the Limpopo Plain, arid sweet bushveld occurs while pockets of north-eastern mountain sourveld occur in higher lying areas to the south of the catchment.

Upper Waterberg landscape

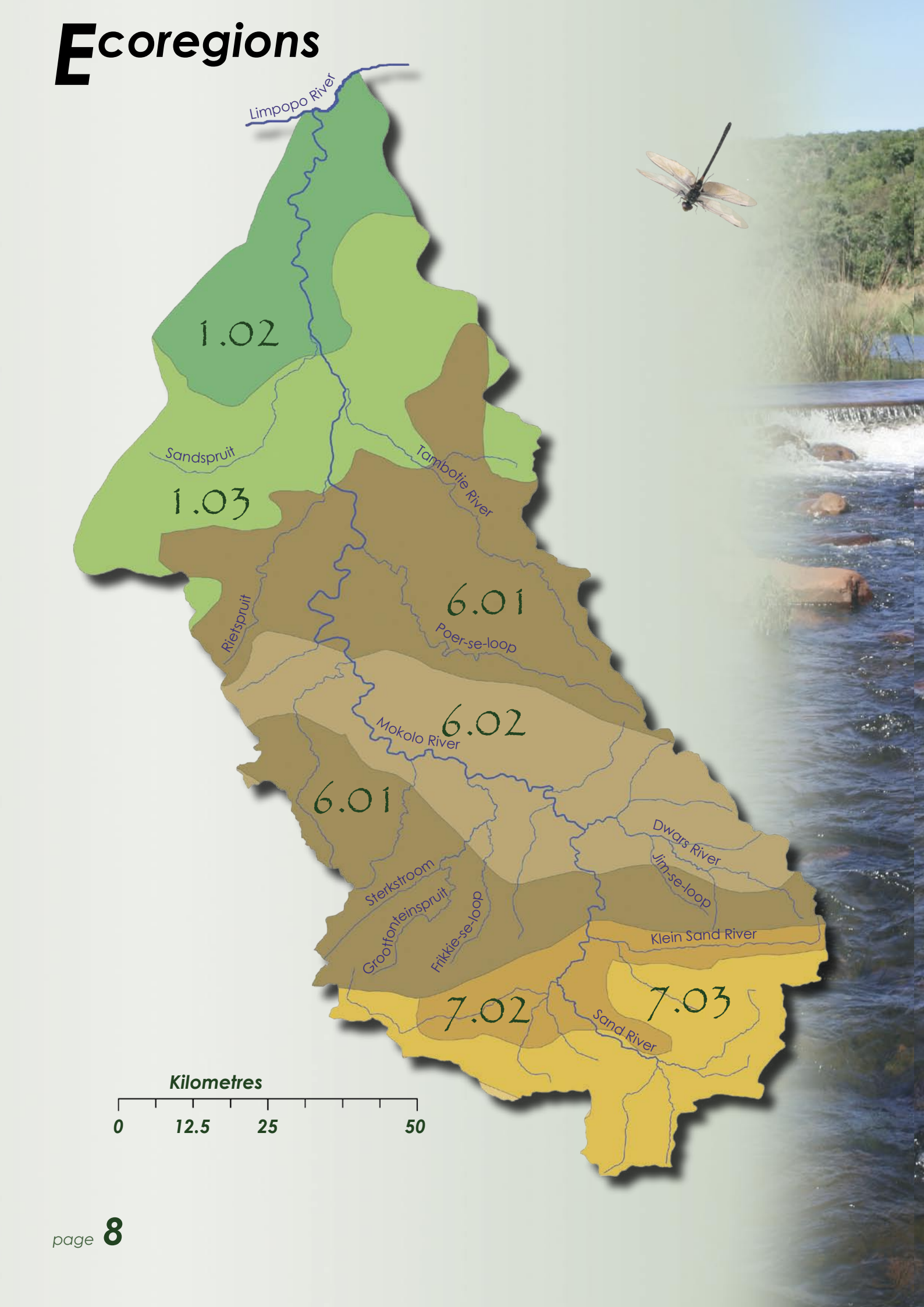
Geology

Most of the upper and middle catchment is comprised of conglomerates of the Waterberg Group and Glentig Formation. In the Limpopo Plain, the river also traverses sandstones of the Undifferentiated Karoo Sequence and Migmatites of the Limpopo Mobile Belt.

Land-use

The catchment is dominated by agriculture and game farming. The only towns of significance are Lephalale, Alma, and Vaalwater.

Ecoregions


Limpopo River
1.02
Sandspruit
1.03
Tambotie River
6.01
Rietspruit
Poer-se-loop
6.02
Mokolo River
6.01
Dwars River
Jim-se-loop
Sterkstroom
Grootfonteinspruit
Frikkie-se-loop
Klein Sand River
7.02
7.03
Sand River
Kilometres
0
12.5
25
50

Ecoregions are regions of broad ecological similarity. In other words, rivers that occur within a particular ecoregion will be more similar to each other than to rivers in other ecoregions. Variation in natural characteristics such as physiography, climate, geology, soils, and vegetation was used to delineate the ecoregions used in this report. Because of their similarity, these ecoregions provide convenient boundaries within which to do ecological assessments and set quality objectives.

South Africa has 31 level 1 ecoregions. A decimal value (eg. 2.04) represents a subdivision to level 2.

Loubadspruit, (ecoregion 7.03)

Ecoregion 7.02, and 7.03 - Western Bankenveld:

The Sand River forms the upper part of the Mokolo River and is located in a large flattish valley surrounded by hills. A number of streams flow through steep rocky areas in the mountainous sections. The area is characterised by Waterberg Moist Mountain Bushveld and Mixed Bushveld. Altitude varies between 1200 metres and 1600 metres and mean annual rainfall varies between 400 and 700 mm. Mean annual temperatures vary from 14 °C to 20 °C.

Ecoregion 6.01 and 6.02 - Waterberg:

The Mokolo River enters this region through a relatively steep gorge upstream of Vaalwater and flows out of the area at the junction between the Mokolo River and the Rietspruit. The river flows through a largely flat undulating plain interspersed with steep rocky areas and gorges. This area falls mainly in the Sweet Bushveld. Altitude varies between 900 metres and 1200 metres. Rainfall varies between 300 and 700 mm per annum. Mean annual temperatures vary from 14 °C to 22 °C.

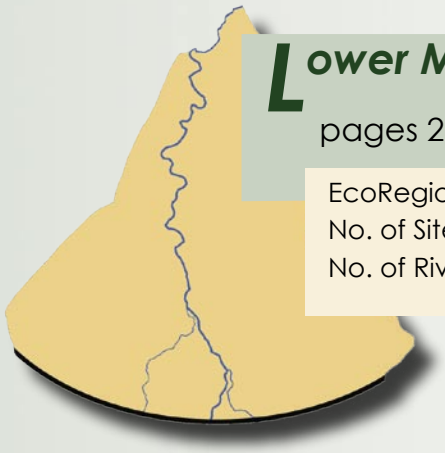
Ecoregion 1.02 and 1.03 - Limpopo Plain:

The Mokolo River enters the Limpopo Plain at the junction between the Mokolo River and the Rietspruit and continues down the Limpopo valley. The area is characterised mainly by flat plains with a low gradient. This area falls mainly in the Sweet Bushveld. Altitude varies between 780 metres and 1100 metres. Rainfall varies between 300 and 400 mm per annum. Mean annual temperatures vary from 20 °C to 22 °C.

Ecological Study Units

The study area was divided into six ecological study units, based on catchments, ecoregions, river and tributary importance from an ecological and land-use perspective, available information.

The 31 biomonitoring sites were selected and then assessed using standard River Health Programme (RHP) biomonitoring protocols between May and September 2002. A follow up survey of key sites was also undertaken during 2006 to reconfirm the accuracy of the results presented in this report.



Lower Mokolo

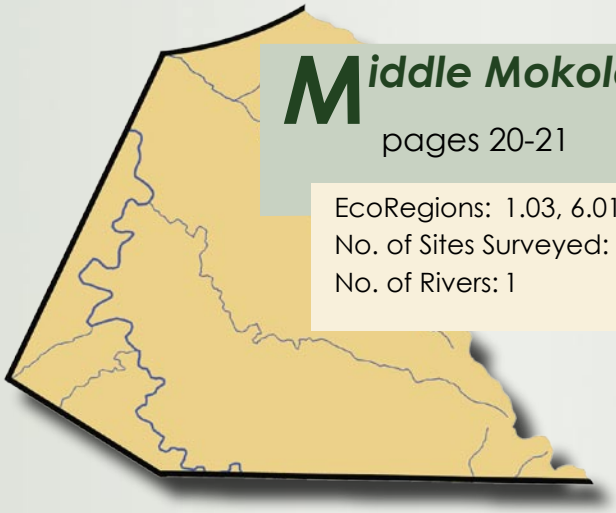
pages 22-23

EcoRegions: 1.02, 1.03, 6.01
No. of Sites Surveyed: 4
No. of Rivers: 1

Rietspruit

pages 16-17

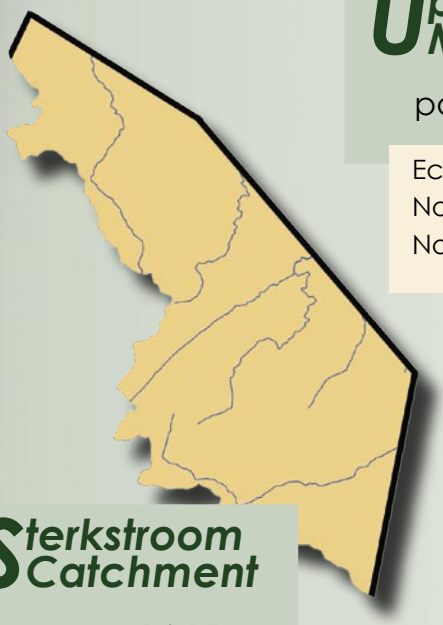
EcoRegions: 1.03, 6.01
No. of Sites Surveyed: 2
No. of Rivers: 1



Middle Mokolo

pages 20-21

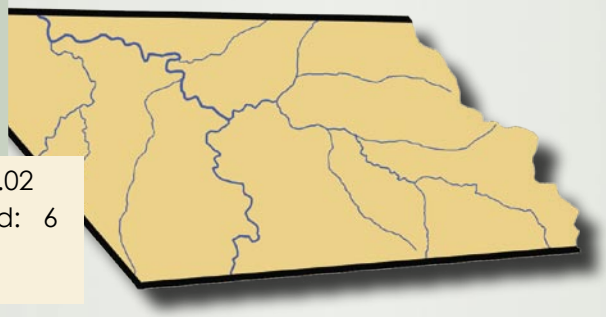
EcoRegions: 1.03, 6.01, 6.02
No. of Sites Surveyed: 4
No. of Rivers: 1



Upper Mokolo

pages 18-19

EcoRegions: 6.01, 6.02
No. of Sites Surveyed: 6
No. of Rivers: 5



Sterkstroom Catchment

pages 14-15

EcoRegions: 6.01, 7.02, 7.03
No. of Sites Surveyed: 6
No. of Rivers: 3

Sand Tributaries

pages 12-13

EcoRegions: 7.02, 7.03
No. of Sites Surveyed: 8
No. of Rivers: 5

The Sand Tributaries

Eight survey sites were located in the Western Bankenveld ecoregion. In this area, the main tributaries to the Mokolo River include the Sand River, Klein Sand River, Sandspruit, Loubadspruit and Grootspruit. Nearly all of this area is under agriculture. Near the town of Alma, which is situated in this study unit, is an extensive wetland system which is under rehabilitation by the Working for Wetlands Project (*see pages 24-25*). Landuse in the area is dominated by mixed agricultural lands and some informal settlements.

The streams of this area vary in gradient and are classified from mountain streams to upper and lower foothill streams. Plain bed, pool-riffle or pool-rapid reach habitat types predominate. Habitat diversity is moderate and marginal vegetation cover is good. Throughout this area there are a large number of bridges, weirs, dams, pumps and off-channel storage reservoirs. In many areas the river banks are impacted by vegetation removal and cattle tracks. In some areas there is evidence of past stream diversions. Alien vegetation is contributing to bank instability. Many of the streams in this area are considered to be seasonal under present flow conditions.

Most of the fish species expected in the main stem of the river were recorded, including a single African mottled eel (*Anguilla bengalensis labiata*) which was exceptional in size at 1.3m length and had obviously been resident in the river for many years. Both flow dependant species, the common mountain catfish (*Amphilius uranoscopus*) and the shortspine suckermouth (*Chiloglanis pretoriae*), were also recorded. In the

Alien vegetation (Poplars); Loubadspruit

smaller streams, catches were dominated by small barbs (*Barbus spp.)*, but little else was found.

A solitary alien largemouth bass (*Micropterus salmoides)* was recorded at the uppermost site in the Sand River, just below a farm dam. Historical data indicates that smallmouth bass (*Micropterus dolomieu*) may also be present in the catchment.

Upper Sand River

Given the seasonal nature of these small streams, the SASS survey revealed that the invertebrate community was in a moderate condition. Mayflies and dragonflies abounded in these clear water streams while very few caddis flies were recorded. Invertebrates normally associated with marginal vegetation were in abundance although few molluscs were recorded.

Sand River

The alien plant species, poplars (*Populus sp*.), the rattlebox (*Sesbania punicea*), and the syringa (*Melia azedarach)* were found at all sites in this study area. In places, poplar trees were growing in large concentrations. There was evidence that some alien vegetation removal had taken place, but tree debris had not been removed. Reed beds were prolific throughout and indigenous vegetation was dominated by the terrestrial species bluebush (*Diospyros lycioides)*, common spike thorn (*Gymnosporia buxifolia)*, and common wild current (*Rhus pyroides)*.

Mokolo River at Tweefontein

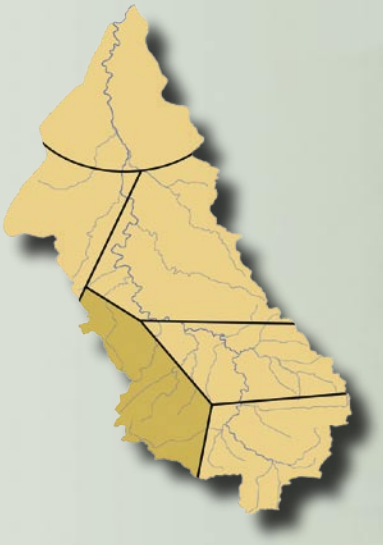
Loubadspruit

Sand River showing alien vegetation

Klein Sand River

The Sterkstroom Catchment

Six survey sites were situated in this study area, on the Sterkstroom, Taaibosspruit, and Frikkie-se-loop. The area falls entirely within the protected areas of Welgevonden, Marakele and neighbouring private nature reserves. Only the extreme upper catchments of the Frikkie-se-loop and the Sterkstroom are located on private farms.



In-stream habitat diversity is high in these upper foothill rivers. However, despite the protection afforded by the conservation areas, a large number of farm dams, weirs, bridges and crossing points are located in the catchment. These barriers contribute to the fragmentation of fish populations in this ecologically important area. There was some erosion at all the survey sites and bank stability was considered poor, showing the impact of the 2000 floods.

These historically perennial mountain streams have stopped flowing during the severe droughts experienced in recent years. Nevertheless, flow-dependant fish species such as common mountain catfish (*Amphilius uranoscopus)*, the shortspine suckermouth, (*Chiloglanis pretoriae)*, and the orangefin barb (*Barbus eutaenia)* still survive, largely due to the presence of deep, well-oxygenated pools.

Two species of alien fish are known to have been released in the upper catchments, (see page 28). They are the

Sterkstroom River at Welgevonden Causeway

Sterkstroom in Welgevonden Reserve

Taaibosspruit in Welgevonden Reserve

Frikkie-se-loop, Shambala Reserve

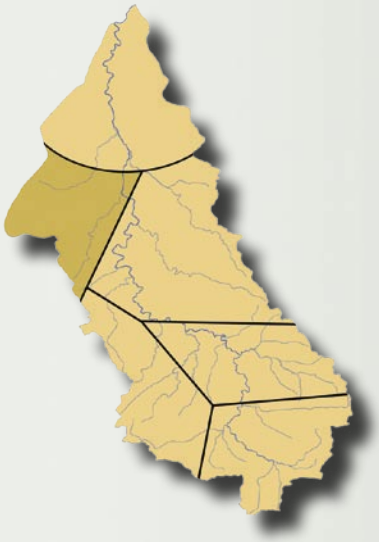
largemouth bass *(Micropterus salmoides)* and the common carp (*Cyprinus carpio)*. Bass have escaped into the Sterkstroom and Frikkie-se-loop during recent floods and in places are now abundant. They are also threatening the indigenous fish populations. Carp appear to be restricted to the larger dams of the upper catchment.

The aquatic invertebrate populations have remained stable in these fragmented rivers despite the floods and droughts experienced since 2000. This is largely attributable to the mobility of invertebrates in their adult, flying stage. The SASS results yielded high scores that reflect the good diversity of aquatic habitats and the high proportion of sensitive invertebrate families present. Stoneflies, mayflies, and caddis flies were abundant at all sites.

Vegetation was largely intact, with dominant riparian species including the water berry and water pear (*Syzygium cordatum* and *Syzygium guineense)*, the velvet leaved sweetberry (*Bridelia mollis),* and the buffalo thorn (*Ziziphus mucronata)*. Some flood damage was observed. The only alien plant species recorded were the rattlebox (*Sesbania punicea),* and syringa (*Melia azedarach)*. A limited amount of terrestrial vegetation was observed to be encroaching at all survey sites.

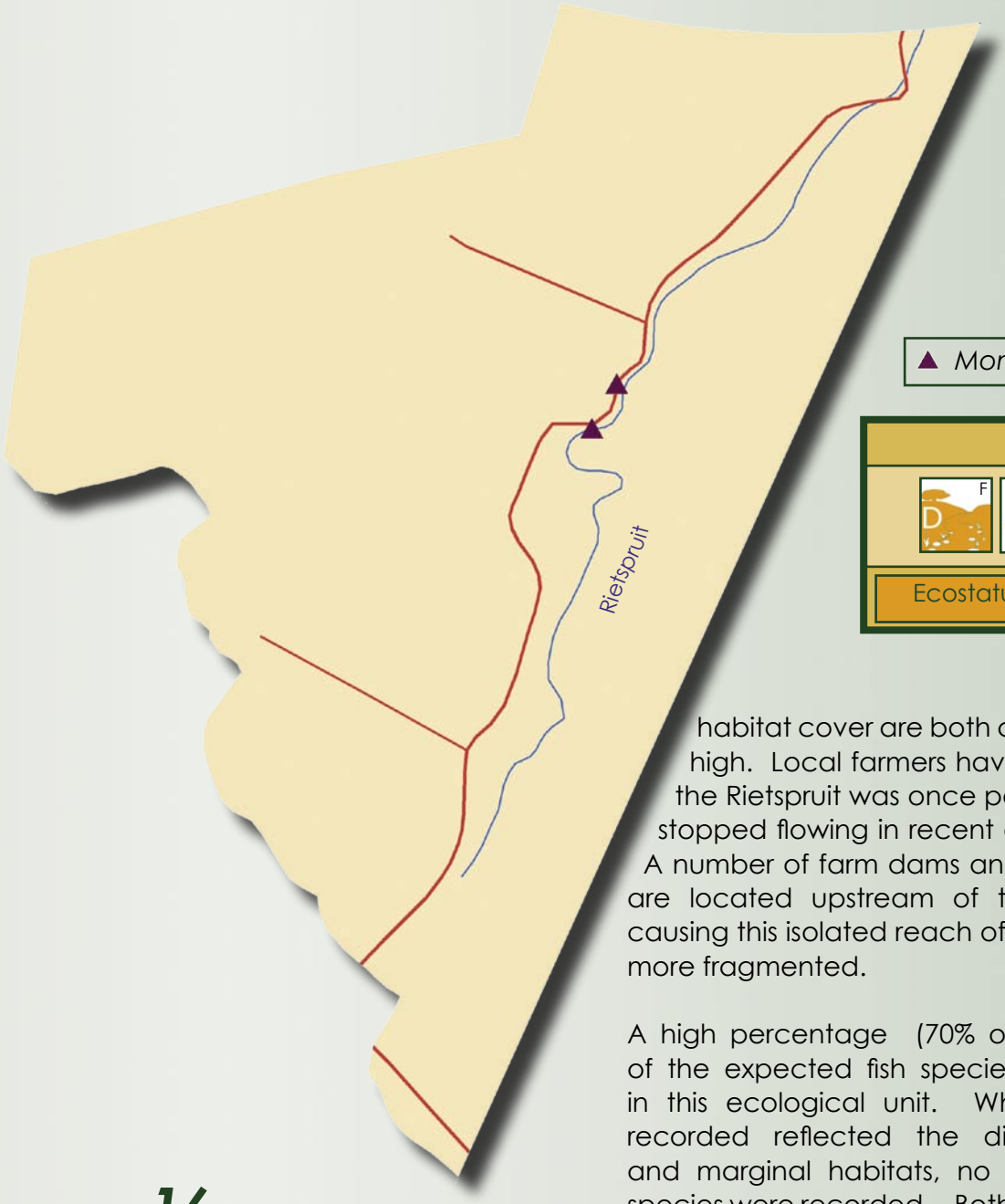
Common mountain catfish

The Rietspruit Catchment

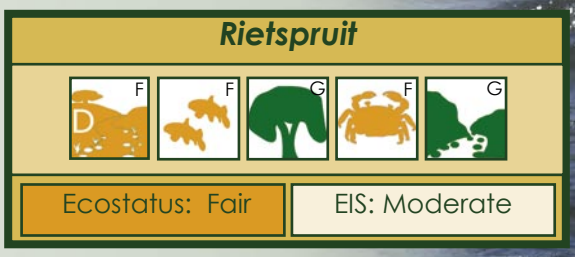


The Rietspruit is a picturesque stream supporting a wide variety of habitats. The stream rises and flows along the Waterberg before cascading over a waterfall which acts as a natural break. The river subsequently opens out into a large wetland lying on the Mokolo floodplain. The stream is very inaccessible and only two sites could be surveyed in the unique area above the waterfall. Both sites were located in private conservation areas.

The sites are located within a "mountain stream" zone in a mixed pool-rapid reach. Bed material is moderately embedded cobble. Bank stability is good, with only slight erosion having been noted on both banks. Habitat diversity and habitat cover are both considered to be high. Local farmers have indicated that the Rietspruit was once perennial, but has stopped flowing in recent drought periods. A number of farm dams and a fishing resort are located upstream of the survey sites, causing this isolated reach of river to be even more fragmented.



▲ *Monitoring Points*



A high percentage (70% or 14/20 species) of the expected fish species was recorded in this ecological unit. While the species recorded reflected the diverse in-stream and marginal habitats, no flow-dependant species were recorded. Both the largemouth

bass (*Micropterus salmoides)* and the common carp (*Cyprius carpio*) are thought to have been introduced into upstream farm dams, but were not recorded in the river during this survey.

Good SASS scores were recorded and once again, a high diversity of mayflies, dragonflies and caddis flies were noted. No molluscs were recorded. Molluscs tend to take a long time to repopulate a river following a dry spell and this tends to confirm the recent seasonality of this river.

The riparian vegetation of the Rietspruit was largely intact, with the water pear (*Syzygium guineense)* dominating and only a few plants of the alien castor-oil bean plant (*Ricinus communis)* being recorded. Some terrestrial trees such as the sickle bush (*Dichrostachys cinerea)* and the Transvaal silver leaf (*Terminalia sericea)* encroached into the riparian zone. Limited bush clearing and cattle tracks were considered to be the major impacts.

Natural mountain habitat of the Rietspruit

Pristine habitats: Natural vegetation of the Rietspruit

Reeds and Terrestrial Vegetation

The influence of flow regulation and the absence of normal flooding due to the Mokolo Dam, are clearly illustrated by the invasion of the riparian zone by reeds and terrestrial woody species.

In most of the tributaries and the main stream of the Mokolo River above the dam, the extent of the invasion, for both reeds and terrestrial species, is low. Below the dam however this situation changes, and the extent of the invasion, by both reed and terrestrial species is higher at all the sites, ranging from medium to high.

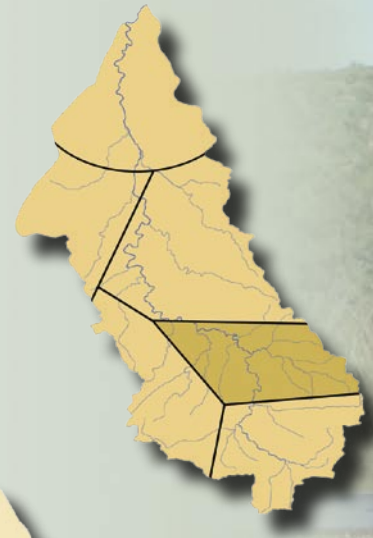
Although chemical spraying of the reeds had reportedly been undertaken, no marked effect of the exercise was visible at the sites that were monitored.

Alien Vegetation

Although only ten alien plant species were identified in the catchment, the extent of invasion by some of these species is a cause for concern. Three species involved are poplars (*Populus sp.*), mulberry (*Morus alba*), and syringa (*Melia azedarach*). At two sites (Alma bridge and the upper site in the Sand River), the extent of invasion by poplars were rated as **very high**. At these sites the plant density ranged from 1 - 4 plants per square metre, and in both cases more than 30% of the area investigated contained poplars. The invasion by alien plants could not be related to flooding as is the case with reeds and terrestrials, and seemed to be localised in certain areas.

The Upper Mokolo Region

Three survey sites are located in the Upper Mokolo River, while one site was located in the lower Sterkstroom, below Welgevonden Reserve and two sites in the Dwars River and its lesser tributary the Jim-se-loop. The Brakspruit was dry except for the occasional pool and was not surveyed. All sites surveyed lie within the Limpopo Plain ecoregion. The area includes the town of Vaalwater and is otherwise dominated by game farms and mixed agriculture.



The Mokolo has a mixed channel section with bed material consisting predominantly of large, moderately embedded cobbles. This reach is classified as pool-riffle and numerous sand or gravel bars are present. Flood plains are often present. Bank stability is considered to be moderate. The Dwars River and Jim-se-loop have lower gradient mixed bed alluvial channels with sand and gravel dominating the bed. For the most part, the river in this study unit is protected by private land owners, but impacts from bridges, dams, and weirs are common. Invasive alien vegetation is destabilising the river banks.

▲ *Monitoring Points*
▢ *Protected Areas*

Upper Mokolo

Ecostatus: Fair | EIS: Moderate

Dwars River and Jim-se-loop

Ecostatus: Fair | EIS: Moderate

Mokolo River at Vaalwater

The fish community of the Mokolo River main stem was largely intact and all species, (except the two migratory eel species), were recorded. Flow dependent species of fish were recorded in abundance. The alien largemouth bass (*Micropterus salmoides*) was recorded in the Mokolo River near Vaalwater.

It appears from anecdotal information that the Dwars River and Jim-se-loop have lost their perenniality and are now distinctly seasonal. The resulting absence of flow dependent species during this survey has confirmed this seasonality. A large number of dams in the extreme upper catchments, together with loss of wetlands, are thought to have contributed to this reduction in flow.

The invertebrate community of the Mokolo River was extremely diverse and reflected the good quality benthic and marginal habitats. The Dwars River community, although diverse, was indicative of the seasonal flows and poorer quality benthic habitats.

Mokolo River upstream of Vaalwater, (side channel)

Jim-se-loop

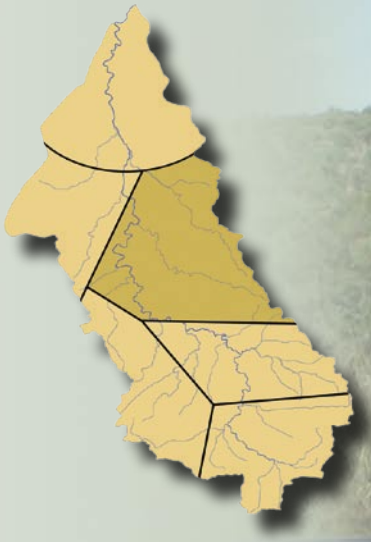
Indigenous riparian vegetation included the river bushwillow (*Combretum erythrophylum)* and the sweet thorn (*Acacia karroo)*, but in places there were heavy infestations of alien vegetation such as eucalyptus (*Eucalyptus sp.)*, syringa (*Melia azedarach)* and poplars (*Populus sp.)*. Reed encroachment is a growing concern in the Mokolo River Catchment.

It was reported by the local community that discharges from the Vaalwater sewage works into the Mokolo River were having an adverse impact on water quality. The results of this rapid assessment tend to suggest that the problem has yet to show an impact on the aquatic fauna. However, the situation should be monitored closely.

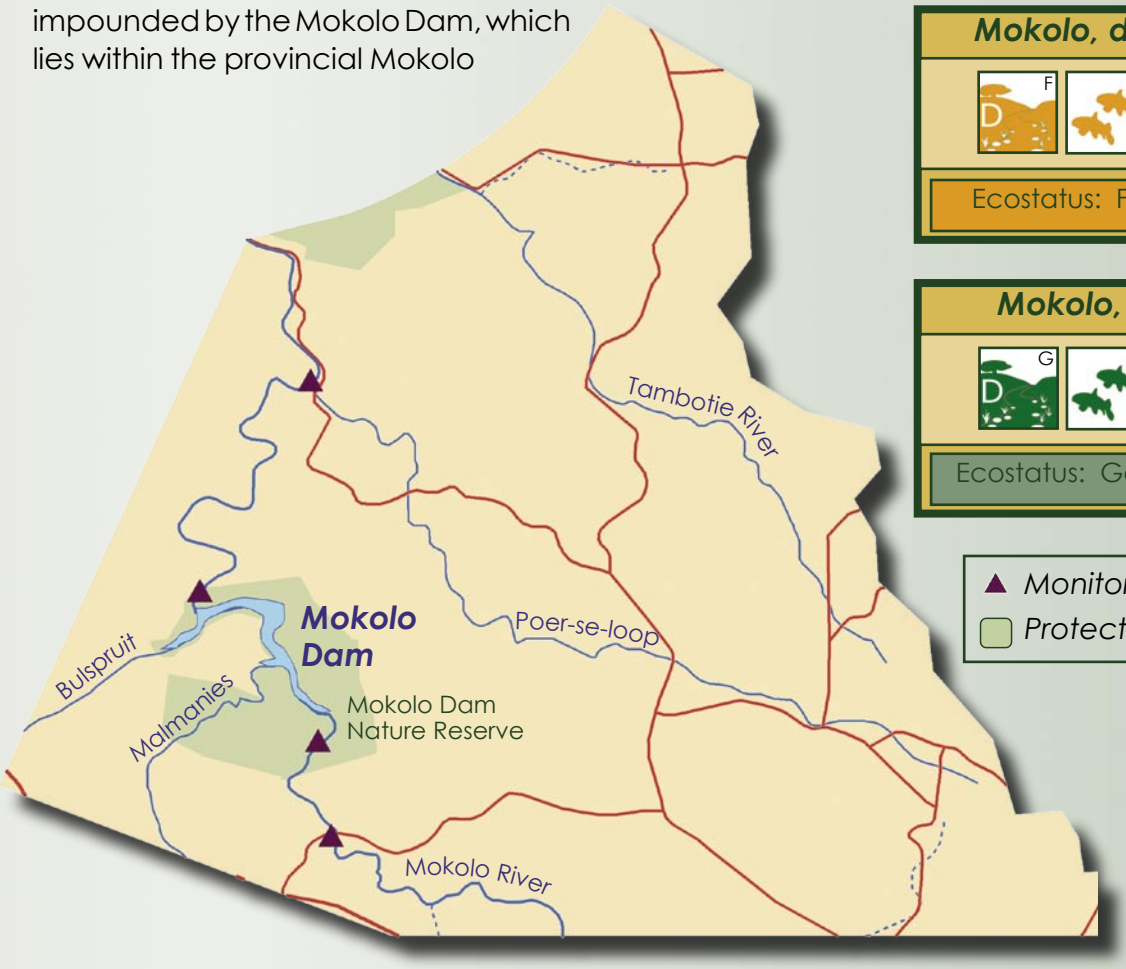
Dwars River

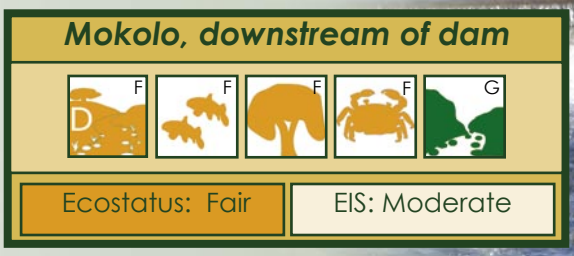
The confluence of the Mokolo River and the Sterkstroom

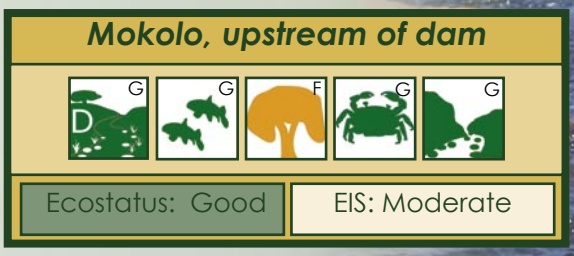
The Middle Mokolo Region



Four survey sites are located in the main stem of the Mokolo River, which was flowing strongly at the time of the survey. None of the main tributaries, the Poer-se-loop, Tambotie River, Bulspruit and Malmanies, were flowing, but all of them had occasional shallow pools. Throughout this study unit, the Mokolo River has a steep gradient and passes through a picturesque but inaccessible gorge. In the upstream section, the river passes through some irrigated farmlands but for the most part, the river passes through private game reserves. In the middle of the gorge, the river is impounded by the Mokolo Dam, which lies within the provincial Mokolo







Dam Nature Reserve. The dam supplies water to downstream irrigation farms, the town of Lephalale, Matimba Power Station and Kumba Colliery, (all located in the Lower Mokolo Region study unit).

The survey sites are located on a mixed channel section which has a pool-rapid morphology. Bank stability is good. Habitat diversity is high, with the dominant bed material being cobble and boulders. Impacts within this study unit are dominated by irregular water releases from Mokolo Dam to the lower section of the river. Causeways, a road bridge and an assortment of riparian impacts also occur away from the gorge area.

A very high percentage of the expected fish species (90 % or 19/21) were recorded

Gauging weir below Mokolo Dam

Mokolo River entering gorge at Mokolo Ranch (reserve)

upstream of the Mokolo Dam in this region. The only 2 species absent were the African mottled eel and the longfin eel (*Anguilla bengalensis* and *Anguilla mossambica*). All flow-dependent species were present upstream of the dam, confirming the near perennial status of the river in this section. Downstream of the dam, benthic habitat conditions were degraded and all flow dependent species were absent.

Mokolo Dam sluice gates

The Mokolo Dam itself has a substantial population of the two alien species of fish, the largemouth bass (*Micropterus salmoides*), and the common carp (*Cyprinus carpio*). However, none were recorded in the river in this study area. Crocodiles are also present in the dam. Hippopotamus are present in the catchment, but occur mostly downstream of the Mokolo Dam.

View towards the Mokolo Dam outflow

The invertebrate populations mirrored the situation identified in the fish survey. Upstream of the dam, very good SASS scores were recorded, with the sensitive stoneflies, mayflies and caddis flies in high abundance, while many families were absent downstream of the dam.

Vegetation was largely intact throughout the study unit with dominant riparian species including the river bushwillow (*Combretum erythrophylum*, water berries (*Syzygium spp.*), and the sweet thorn (*Acacia karroo)*. The only alien species recorded included the rattlebox (*Sesbania punicea),* and the syringa (*Melia azedarach)*. A limited amount of terrestrial vegetation encroachment was observed at all sites. This was predominantly the Transvaal silver leaf (*Terminalia sericea)* and the sickle bush (*Dichrostachys cinerea)*. Reed encroachment and cattle tracks through the riparian zone are also noticeable negative impacts.

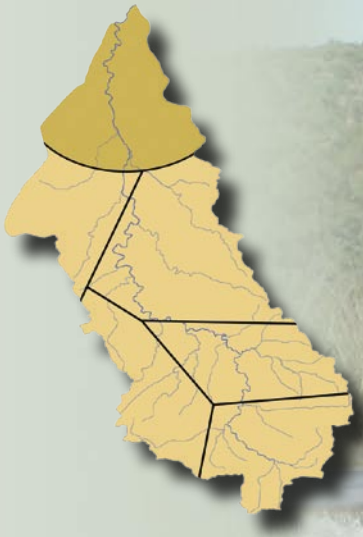
Small populations of the highly invasive alien weed parrots feather (*Myriophyllum aquaticum*), were noticed in pools below Mokolo Dam, as well as within the dam itself.

Parrots feather: (declared weed)

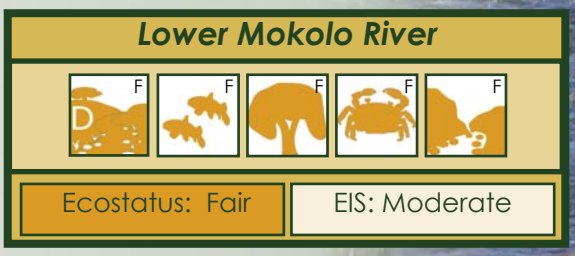
The Lower Mokolo Region:

The Limpopo Plain

Four sites were surveyed in the main stem of the Mokolo River, near to the town of Lephalale. The lower river was not flowing near its confluence with the Limpopo River at the time of the survey, but consisted of many large sandy pools. This section of river has several oxbows and isolated off-channel pools. A wide floodplain borders the river for much of this section. Both of the larger seasonal tributaries, the Sandloop and the Tambotie, were dry.



The river channel is dominated by sandy runs and pools, but is heavily infested with reedbeds (*Phragmites mauritianus*). Throughout this study area the river is afforded some protection by game farms and other private farms while the wide floodplain and reed beds also limit access. The river flow highly regulated from the Mokolo Dam with sporadic flows being released for the farming community. There are five major road bridges in this area. A number of farm dams are located in the Mokolo River close to the Limpopo confluence. Sand mining is widespread.



This study unit is dominated by hardy, pool dwelling species of fish. It is possible that some species may have been lost due to fragmentation of the river from the Limpopo River. No fish species requiring permanent flow were recorded, but several species that require flowing water for breeding purposes still remain, such as the largescale yellowfish and other labeo species (*Labeobarbus marequensis* and *Labeo spp*.) No alien fish species were recorded.

Poor habitat diversity accounts for an invertebrate assemblage that is dominated by hardy families associated with marginal vegetation and sand. The moderately scoring SASS assessments are likely to be as a result of the irregular flow regime.

Reed encroachment is considered the main vegetation impact and again there are clear indications that the regulated flow regime is contributing to this problem. Alien vegetation was very sparse in this study unit, with only a few syringa (*Melia azedarach)* being recorded. Downstream from Lephalale, disturbance to the riparian zone was limited to bridges, sand mining, and agricultural practices (mostly water abstraction pumps and the cutting of vegetation to the river's edge).

Mokolo River at Lephalale

Mokolo River at Lephalale

Lower Mokolo River, often used for sand mining

Sand Mining

Sand mining is taking place in the lower sections of the Mokolo River after the river exits the mountains and enters the Limpopo Floodplain area around Lephalale. Fine sand is being mined from the banks of the river and in the process riverine vegetation is being removed. Vehicle access to the river bed for mining purposes through the riverine vegetation results in a loss of vegetation. This removal of vegetation from the river banks results in loss or disruption of the stabilising effects on the banks and river bed. This in turn leads to increased erosion during periods of high flows or floods. The main river channels are modified and this also has a negative effect on the habitat for aquatic organisms which depend on the vegetated pools for survival during periods of low or no flows in the river. Sand mining appears to be uncontrolled and needs to be more carefully regulated to minimise the negative impacts on the river system.

Sand mining is a listed activity in terms of the National Environmental Management Act and must undergo an Environmental Impact Assessment process. It seems unlikely that the sand mining activities in this catchment have been properly evaluated in an EIA, and all appear to be poorly managed. It should also be noted that regulations concerning sand mining have recently been reviewed and changed.

Working for Wetlands

Report on the Mokolo River

In 1998, the Working for Water project was clearing invasive alien plants in the upper Mokolo catchments.

These wetlands play a crucial role in managing the water that ultimately feeds the Mokolo Dam, the main supplier of water to Lephalala, Iscor Grootgeluk coal mine, Eskom Matimba power station and the downstream farmers. Some of the largest wetlands in the Limpopo Province are situated here. They are breeding grounds for blue cranes and other birds, and are also of great importance for biodiversity. Nine of these portions were identified as having problems which had a significant negative impact on the Mokolo River Catchment.

As a result of the 1998 survey, Working for Wetlands, under the umbrella of Working for Water, started to develop a rehabilitation plan for the problems identified. Rehabilitation work started in 1999, and by April 2000 the work was completed.

After the success of the work done on the upper catchments of the Mokolo River, more surveys were conducted, and more problems were identified along the Mokolo River towards the town of Alma. Approximately 1 500 hectares have been surveyed to date, and rehabilitation work has been carried out.

The wetlands trap sediments and purify the water which is heavily laden with silt and agrochemicals from upstream. Wetlands also regulate the water flow which is of vital importance for reducing flood peaks during the rainy season and ensuring a continual water supply during the dry season.

A rock gabion, showing the structure and the water flow

Rehabilitation has been done using rock gabion interventions and leveling drains across the wetlands. There are now more than 100 rock gabion structures in the Mokolo River around Alma, and most of the rock gabion structures are working well. However, some are failing due to problems such as overgrazing and cattle trampling on the gabions. Maintenance will be carried out on these structures. Other structures are silted and their spillway's need to be raised in order to trap more sediment behind them. Raising the spillway will be repeated until the whole donga is filled with sediments.

There is a need to make land-owners aware of the wetlands and their functions, their ecoloigical value, and how to protect them from degradation by cattle trampling.

To date, R3 000 000 has been spent on Mokolo River rehabilitation. Plans are already in place for more work during 2006-2007, and further plans are to be developed for the period 2007-2010. The area's to be covered during this period will be the entire Mokolo downstream catchment, and some of the areas in the upper catchment that were initially left out.

If possible, only controlled grazing should be allowed in wetlands, and then only in successfully rehabilitated wetlands to prevent further degradation.

When cattle and game drink water in partially rehabilitated areas, they trample over and around the gabions, loosening the soil at the edge of the structures. Erosion then re-occurs in times of heavy rains.

Examining a rock gabion

Rock Gabions

In the Mokolo River catchment, different measures were used to arrest erosion, trap sediments, and raise the water table in degraded wetlands. One of the common methods is to use small weirs. Most of the weirs in Mokolo region were constructed with Gabions.

Gabion weirs are weirs that are constructed by packing rocks into wired baskets. These wired baskets are of double twisted mesh allowing the structure to settle and move with changing environmental and soil conditions, at the site being rehabilitated.

Different alloys and PVC coatings allow durability of up to a hundred years, depending on soil and water quality. Gabion weirs are efficient means of dissipating water energy over a short distance. The donga or gully bed slope is thus modified as the flow velocity is reduced by allowing suspended solids to settle, creating a flatter gully bed slope.

The gabions can be a barrier to fish movement in times of low flow, but not in periods of high flow or floods.

Fauna and Flora

Indicator fish species of the Mokolo Catchment

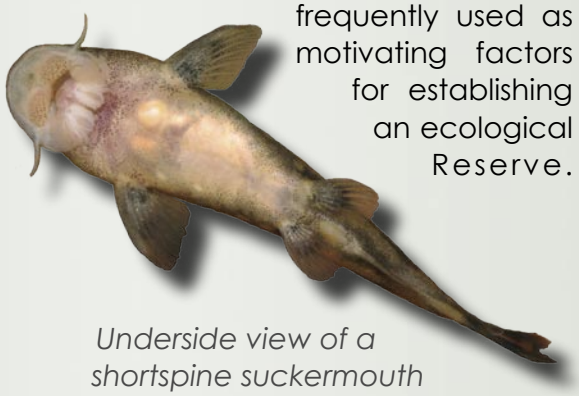
While all of the fish of the Mokolo River can be said to be indicative of certain habitat requirements, (at least through some stages of their life cycles), the following groups of fish are considered to be important in providing guidelines for the management of a river.

Red data fish

Red data fish are rare or threatened fish species, which due to their status, can be used to motivate high levels of river management for the purposes of conserving biodiversity. The only red data fish currently listed for the Mokolo Catchment is the shortfin barb (*Barbus brevipinnis*). However, the classification of this diverse fish species, which occurs across many catchments regions, is currently under review. It is likely that the status of the Waterberg population, which is both widespread and abundant, may change to a less-vulnerable status.

Flow-dependant or rheophilic species

Flow-dependant fish are very important indicators of permanent flow, and are frequently used as motivating factors for establishing an ecological Reserve.



Underside view of a shortspine suckermouth

In the Mokolo River, only three species of fish require permanent flow for all stages of their life cycle and all occur in the critical reaches of riffles and rapids. The common mountain catfish (*Amphilius uranoscopus*), the orangefin barb (*Barbus eutaenia*) and the shortspine suckermouth (*Chiloglanis pretoriae*) are all adapted to life in fast flowing, well aerated water, and are often lost from rivers if flow stops for even a short period of time.

Migratory species

Migratory fish species are those that move longitudinally along a river and which can indicate river fragmentation due to natural and artificial barriers. Two species of eel, the longfin eel and the african mottled eel (*Anguilla mossambica* and *Anguilla bengalensis labiata*) are known to have been widespread in the Mokolo Catchment but are now very scarce. Eels tend to move between the sea and freshwater during their life cycle, while other species such as the redeye labeo (*Labeo cylindricus*) migrate on a more local scale. Their absence may be indicative of weir and dam barriers in the lower Mokolo River, together with a modified flow regime, which does not suit their migration patterns. None of the dams or weirs in the Mokolo River or downstream Limpopo River, have fish ladders through which fish can move.

Economically important indigenous species

Economically important fish, by virtue of their nutritional value or sporting prowess, may stimulate river management goals in order to conserve the fish while promoting economic benefits. All of the fish of the Mokolo River provide a recognised nutritional benefit to local communities and some have value for recreational fisherman. However, largescale yellowfish (*Labeobarbus marequensis*) as with all other yellowfish, is rapidly becoming recognised as a desirable sporting fish. Habitat for this fish is ideal in the middle reaches of the Mokolo River and it is hoped that in due course "angling conservancies" may be established. The protection of yellowfish habitat coincidentally affords protection to most other fish species that may be present.

Largescale yellowfish

Scientific and common names for the fish species expected to occur within the Mokolo River Catchment.

Indigenous species	
Scientific names	***Common names***
Amphilius uranoscopus	Common mountain catfish
Anguilla bengalensis labiata	African mottled eel
Anguilla mossambica	Longfin eel
Aplocheilichthys johnstoni	Johnston's topminnow
Barbus annectens	Broadstriped barb
Barbus bifrenatus	Hyphen barb
Barbus brevipinnis	Shortfin barb
Barbus eutaenia	Orangefin barb
Barbus paludinosus	Straightfin barb
Barbus radiatus	Beira barb
Barbus trimaculatus	Threespot barb
Barbus unitaeniatus	Longbeard barb
Barbus viviparus	Bowstripe barb
Chetia flaviventris	Canary Kurper
Chiloglanis paratus	Sawfin rock catlet
Chiloglanis pretoriae	Shortspine suckermouth
Clarias gariepinus	Sharptooth catfish
Labeo cylindricus	Redeye labeo
Labeo molybdinus	Leaden labeo
Labeo rosae	Rednose labeo
Labeo ruddi	Silver labeo
Labeobarbus marequensis	Largescale yellowfish
Marcusenius macrolepidotus	Bulldog
Mesobola brevianalis	River sardine
Micralestes acutidens	Silver robber
Oreochromis mossambicus	Mozambique tilapia
Petrocephalus wesselsi	Churchill
Pseudocrenilabrus philander	Southern mouthbrooder
Schilbe intermedius	Silver catfish
Synodontis zambezensis	Brown squeaker
Tilapia rendalli	Redbreast tilapia
Tilapia sparrmanii	Banded tilapia
Alien species	
Scientific names	***Common names***
Cyprinus carpio	Common carp
Micropterus salmoides	Largemouth bass
Oreochromis niloticus	Nile Tilapia

Alien fish species in the Mokolo Catchment.

There are two species of alien fish in the Mokolo Catchment. Both have been recognised as problem species under the new National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEM:BA) and their stocking and utilisation will be regulated through a zoning process.

Anglers and the general public are requested to refrain from trans-locating any live fish. The illegal movement of live fish now carries substantial penalties.

Largemouth bass

(*Micropterus salmoides*)

A voracious predator that has a well documented history of depleting indigenous fish in dams and in clear flowing streams. While recognized as an important angling target species, no further introductions will be considered for this catchment and all largemouth bass caught in rivers must be removed and killed. Fish stocks in dams, including the Mokolo Dam, will remain unaffected since natural recruitment is taking place.

Common carp

(*Cyprinus carpio*)

A species which when left uncontrolled can severely impact on benthic habitats and water quality and can both directly and indirectly affect indigenous fish populations. Carp are less abundant in the Mokolo Catchment than bass and it is hoped that with the assistance of the public their distribution can be limited. New regulations, similar to those specified for bass, will now apply.

Have you seen this fish?

Nile tilapia

(*Oreochromis niloticus*)

The Nile tilapia is possibly the worst invasive species which is creeping into Limpopo Province rivers. Having escaped from dams in neighboring states, the fish now widely occurs in the Limpopo River. The Nile tilapia is entering our Limpopo tributaries, but is also being irresponsibly trans-located by anglers and the public. The fish interbreeds with our indigenous Mozambique tilapia (*Oreochromis mossambicus*) and is more aggressive, having the capability of eradicating other smaller fish. The loss of our pure indigenous gene pool of Mozambique tilapia is of great concern to the authorities. The Nile tilapia has yet to be recorded in the Mokolo River and the public are requested to keep a vigilant eye out for sightings. Pure Nile tilapia are easily distinguished from Mozambique tilapia by a distinct banding on the tail. Hybrids may show less distinct variations. Sightings should be reported to:

The aquatic offices of Limpopo Environmental Affairs (*Tel: 015 295 9300*)

If possible, specimens should be kept frozen or stored in alcohol.

Riparian Vegetation

Forty-one indigenous woody species that are commonly regarded as riparian species were recorded in the riparian zone (see table below). The impacts in the riparian zone were evident if the extent of alien invasion is considered. Three invasive alien species, namely poplars, mulberries and syringa dominated at the sites at Alma bridge. In the upper Sand River, the extent of invasion by these alien species was extremely severe.

Reed and terrestrial species invasion was not continuous but was confined to areas where flow regulation was experienced.

The vegetation in most of the river reaches was still reasonably intact, allowing the riparian zone to function properly *e.g.* as a migratory route, etc.

Classification of trees and shrubs for the Mokolo catchment

Indigenous species			
Scientific names	**Common names**	**Scientific names**	**Common names**
Acacia caffra	Common hook thorn	*Grewia flavescens*	Rough leaved raisin
Acacia erioloba	Camel thorn	*Grewia monticola*	Silver raisin
Acacia erubescens	Blue acacia	*Gymnosporia buxifolia (M. heterophylla)*	Common spike thorn
Acacia karroo	Sweet thorn	*Heteropyxis natalensis*	Lavender tree
Acacia rehmanniana	Silky acacia	*Hexalobus monopetalus*	Shakama plum
Brachylaena rotundata	Mountain silver oak	*Mimusops zeyheri*	Transvaal milkwood
Buddleja salviifolia	Quilted buddleja or sagewood	*Nuxia oppositifolia*	Water elder
		Olax dissitiflora	Small sourplum
Burkea africana	Red or wild syringa	*Olea europaea*	Wild olive
Celtis africana	White stinkwood	*Papea capensis*	Jacket-plum
Clerodendron glabrum	Tinderwood	*Pterocelastrus echinatus*	White candlewood
Combretum erythrophylum	River bushwillow	*Rhus chirindensis*	Red currant rhus
Combretum imberbe	Leadwood	*Rhus lancea*	Karroo tree
Dombeya rotundifolia	Wild pear	*Rhus pyroides*	Common currant rhus
Engelerophytum magalismontanum	Milkplum	*Schotia brachypetala*	Weeping boerboon
Euclea divinorum	Magic guarri	*Spirostachus africana*	Tamboti
Euclea natalensis	Largeleaf guarri	*Sterculia rogersii*	Common star chesnut
Faurea saligna	Beechwood	*Strychnos madagascariensis*	Black monkey apple
Ficus ingens	Red leafed rock fig	*Syzygium cordatum*	Waterberry
Ficus sur	Broom cluster fig	*Syzygium guineense*	Water pear
Gardenia volkensii	Savannah gardenia	*Ziziphus mucronata*	Buffalo thorn

A variety of riparian vegetation and habitat conditions

Status of the Hippopotamus: Mokolo/Limpopo River Systems

The population trend of hippopotamus in the Limpopo River System shows a significant increase in numbers between the Mokolo and Mogalakwena Rivers and a decline between the Sand River and Kruger National Park (KNP).

The highest concentration of hippopotamus are found in the Limpopo River between the Mokolo and Mogalakwena Rivers. This is mainly due to the large number of weirs and natural pools which are supplied irregularly with water from the Mokolo Dam. To date, habitat and grazing conditions have been sufficient to maintain these herds. Although habitat conditions seem to be sustainable, hippopotamus are fenced off which limits grazing potential, especially during droughts. During recent drought periods, animals have had to be fed in certain areas. Feeding is a joint undertaking between local farming organisations and Limpopo Environmental Affairs.

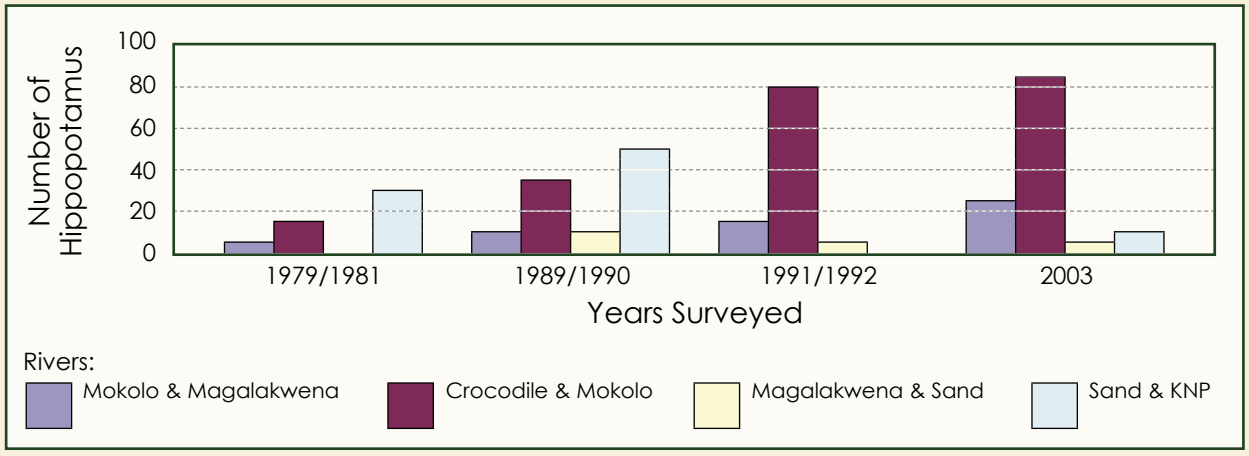
Hippopotamus

The variability of flow in the Mokolo River and the lack of permanent deep pools, restricts hippopotamus distribution in this river to a few large dams near the Limpopo River confluence. Although large floodplains with suitable grazing occur in the Mokolo River, the changeable aquatic environment limits the permanent residency of hippopotamus.

The hippopotamus population will not be sustainable over the long-term if no habitat improvement (including water and grazing) takes place as these factors will be more critical in future.

A long-term strategy is necessary to ensure a sustainable hippopotamus population and this includes habitat improvement. This should include a water management strategy, which ensures that the Ecological Reserve of the Mokolo River and the Limpopo River System is specified and met.

Graph Showing the Number of Hippopotamus per Surveyed Year



Herpetofauna in the Mokolo Catchment

Sixty-nine species of reptiles are known to occur within the Mokolo Catchment. Three of these, the southern African rock python (*Python natalensis*), Jalla's sand snake (*Psammophis jallae*), and the Nile crocodile (*Crocodylus niloticus*), are listed as threatened under The World Conservation Union (IUCN) criteria. An additional species, the Kalahari purple-glossed snake (*Amblyodipsas ventrimaculata*), has recently been found in the catchment. This is the first record of it occurring in South Africa, and it will probably be red-listed with a peripheral status in the future.

The Mokolo Catchment provides important breeding grounds for crocodiles, with offspring dispersing into the Limpopo River. Pythons in the region also make use of the river for hunting.

Southern African rock python

Fifteen frog species have been recorded in the Mokolo catchment. One of these, the giant bullfrog (*Pyxicephalus adspersus*), is listed as threatened under IUCN criteria. This species makes use of temporary pans and other non- or slow-flowing water bodies for breeding.

Giant bullfrog

Potential Catchment Developments

As with most rivers in the Limpopo Province, catchment pressures and limited water resources are causing diminished flows, which in turn are limiting the ability of the rivers to sustainably meet environmental requirements. Despite this, there is an urgent need for development and it is important that future development potential be recognized.

For the Mokolo Catchment, the Lephalale Municipality is anticipating a substantial boom in the local economy of Lephalale town in the very near future. This is attributed to the following:

- Eskom are investigating the possibility of a fifty percent expansion of Matimba Power Station.
- In conjunction with the possible expansion to Matimba Power Station, a feasability study is being undertaken for a water transfer scheme to the Mokolo Dam, including possible modifications to the dam, such as raising the dam wall.
- To supply Matimba Power Station, it will be necessary for the adjacent coal mining industry to expand.
- The expansion of the above industries will support the development of secondary industries and infrastructure. Personnel will be required and there will be a need for increased housing, domestic water supply, and waste disposal facilities.

Matimba Power Station

While the spraying of weeds in the lower river has some positive benefit on water supply to irrigation farmers, a dedicated irrigation pipeline has also been suggested.

With such developments in mind, it is imperative that a comprehensive Ecological Reserve study should be undertaken in the Mokolo Catchment in order to clarify issues of water availability.

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Summary

The present ecological state of the Mokolo River Catchment lies predominantly in a Fair to Good Ecological Class.

The fish populations of the catchment appear to be slightly more impacted than aquatic invertebrates. This is almost certainly as a result of reduced river flows due to the dams and weirs in the river system. Very few flow dependent or migratory fish species were encountered throughout the survey. Invasive alien fish were recorded in the river at two locations. Despite modified flows across the catchment, invertebrate populations remain in a fair to good River Health Category. The aerial mobility of many families of invertebrates has probably assisted in maintaining this status. The more sedentary mollusc families were seldom found, reflecting the periodic cessation of flow in recent years.

Surveys of the vegetation show the high occurrence of alien vegetation, encroachment of terrestrial vegetation and destruction of the riparian zone through poor land use practices.

Hippopotamus

The geomorphological state of the system reflects changes in flow and localised site impacts. As the geo-physical template for all other drivers, the geomorphological state also reflects reduced habitat availability and increased disturbance, which is often accompanied by invasive alien vegetation encroachment.

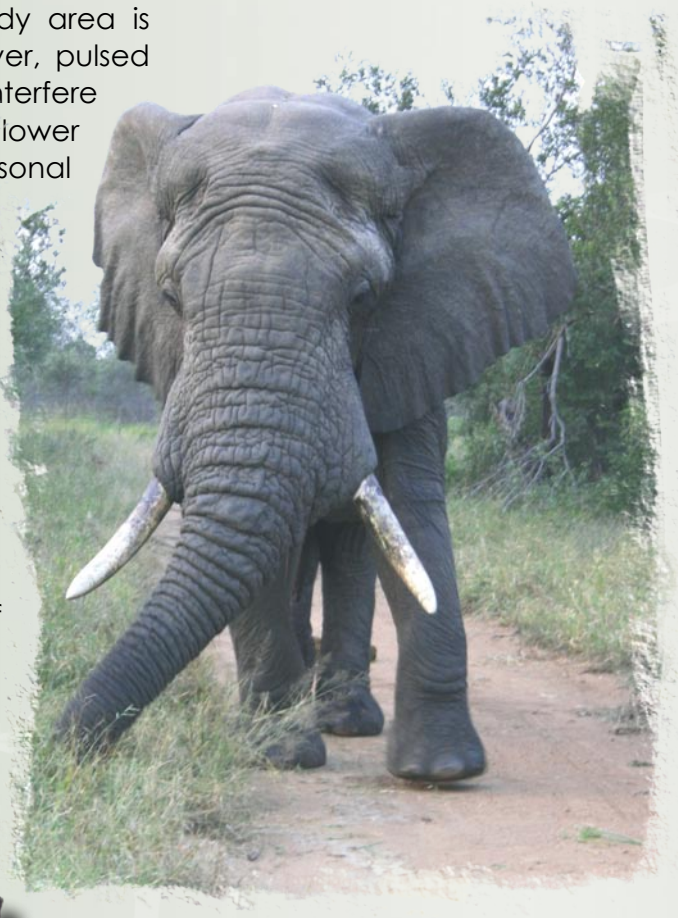
Southern red-billed hornbill

Water quality throughout the study area is considered to be good. However, pulsed releases from Mokolo Dam may interfere with water temperatures within the lower reaches of the river, and the unseasonal flow patterns may also adversely affect the lower river system.

Not one site within the catchment reflects a natural state or reference condition. Given the number of nature reserves on tributaries to the Mokolo, this fact is quite surprising. However, this is once again a reflection of catchmentfragmentation,irregular flow patterns, and the presence of alien fauna and flora.

No indication could be found to suggest that the spraying of reed beds was having an adverse effect on the fauna of the lower river.

Flow regulation is considered to be causing significant impact throughout the system.



Bull elephant

Scops owl

While the Mokolo Catchment is currently in a Fair to Good state, increasing water demands within the catchment are likely to cause a downward trend in the overall status of the system.

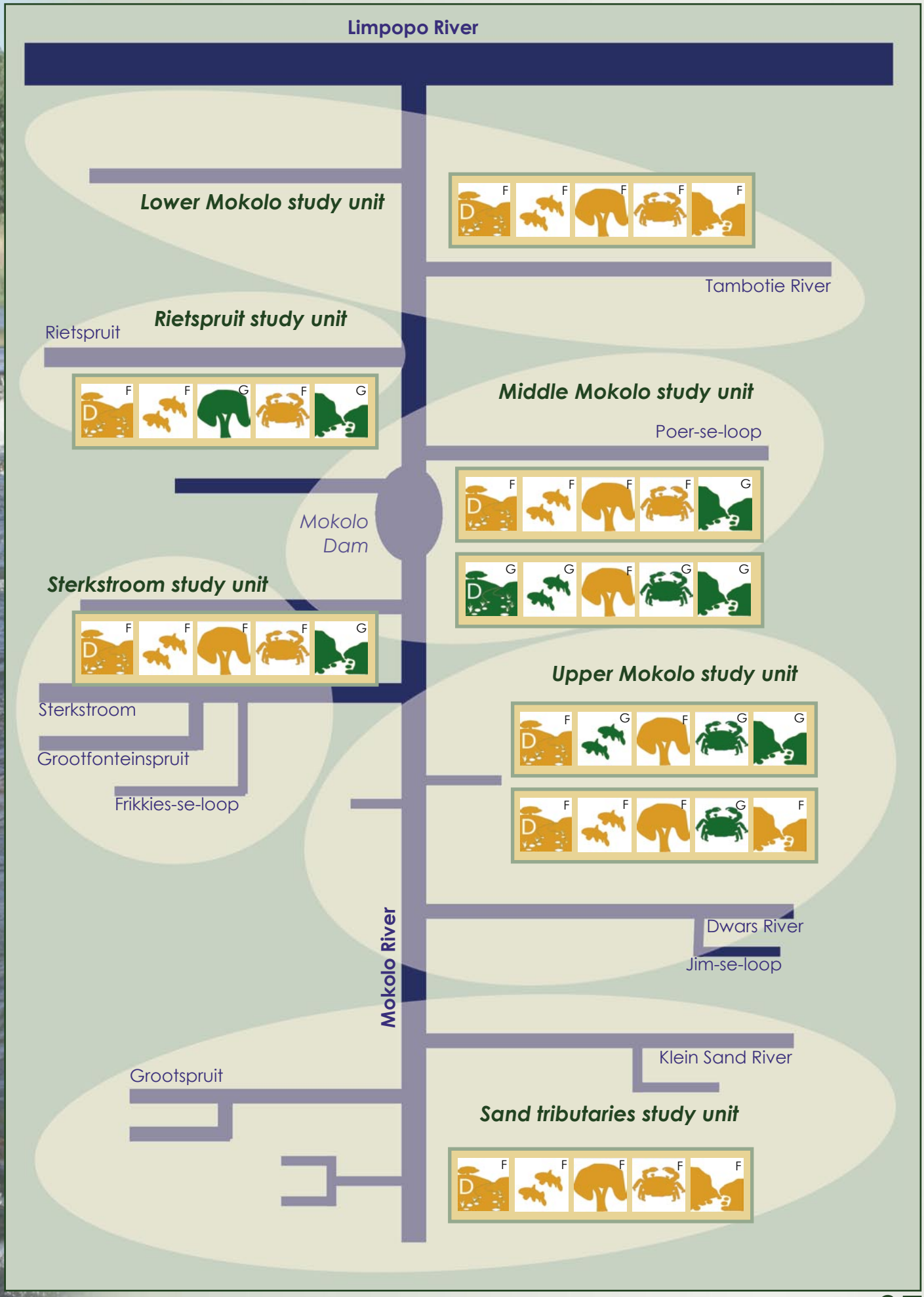
The study addressed the following components.

• Fish	Fish Assemblage Integrity Index (FAII).
• Invertebrates	South African Scoring System Version 5 (SASS5) .
• Riparian Vegetation	Riparian Vegetation Index (RVI).
• Geomorphology	Geomorphological Index (GI).
• Habitat Integrity	Desktop Habitat Integrity (DHI) - assessed at desktop level using 2006 methodologies.
• Ecostatus	Assessed at desktop level using 2006 methodologies.
• Ecological Importance and Sensitivity	(EIS) - Assessed at desktop level using 2006 methodologies.

Management Required

ISSUE	ACTION REQUIRED	RESPONSIBILITY
In terms of water supply for the environment, there have been no formal studies undertaken for the Mokolo to date.	Given the predicted increase in demand on the water resources of the catchment, the immediate determination of a comprehensive ecological Reserve is required.	**DWAF** is mandated to address this issue in terms of the National Water Act (Act No. 36 of 1998).
Pulsed water releases from Mokolo Dam are coordinated for agricultural purposes with little recognition of environmental requirements.	Releases should be coordinated in order to provide maximised benefits to downstream users and the environment. The maintenance of pools in the immediate downstream reach of the Limpopo River for hippopotamus should be a consideration in this regard. An ecological Reserve for the lower river would provide guidance on this matter.	**DWAF** to address the ecological Reserve with collaboration from the **Mokolo Irrigation Board** and **Limpopo Environmental Affairs.**
In some areas of the catchment, alien vegetation encroachment is a serious problem.	A concerted effort to eradicate alien invasive vegetation in the catchment should be prioritised. Poplars are recognised as the worst invaders in the catchment. The issue should be publicised with local land owners.	**Working For Water** and the **Plant Protection Research Institute.**
Large areas of the lower sections of the river near Lephalale are being mined for sand and this has a serious effect on the system.	Sand mining appears to be bypassing the necessary EIA procedures, (administered through Limpopo Environmental Affairs), and EMP's, (administered through the Department of Mineral and Energy). The situation needs urgent review by the respective departments. Public awareness combined with a formal audit of the current situation is required.	**Limpopo Environmental Affairs** and the **Department of Mineral and Energy.**
The current Limpopo monitoring team can only visit river catchments and report on their condition on a 3 – 4 yearly basis, due to a shortage of skilled staff.	Annual environmental monitoring of all provincial catchments is required. More staff should be appointed by Limpopo Environmental Affairs, for the purposes of conducting State of Environment Reports and State-of-River Reports.	SoE: **Limpopo Environmental Affairs.** SoR: **Limpopo RHP Provincial Task Team.**

Summary Diagram



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