FOSAF

THE FEDERATION OF SOUTHERN AFRICAN FLYFISHERS

PROCEEDINGS OF THE 7TH YELLOWFISH WORKING GROUP CONFERENCE

ELGRO LODGE, POTCHEFSTROOM
22 – 24 MAY 2003

Edited by Peter Arderne

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PRESS RELEASE : 7th YWG Conference at Elgro Lodge.

The beautiful Elgro Lodge on the banks of the Vaal River near Potchefstroom was the venue for the 7th Yellowfish Working Group National conference from 22 to 24 May 2003.
The general consensus of the 60 delegates was this was by far the best conference in terms of the papers presented and the interaction between the participants.

After the conference ended at Saturday lunch the recently appointed Scientific Panel met for the first time. The Panel, which comprises some of the top aquatic scientists, has volunteered to give guidance to the YWG regarding research needs, project evaluation and to assist with the development of a management plan.

Considering the parlous state of the Vaal River, and in fact most of our river systems, it was pleasing to report the presence of top officials from the Department of Water Affairs & Forestry, Rand Water and Working for Water, all of whom made presentations and answered many questions. NGO's included Eko-Care Trust and River Rangers while there were also a number of riparian owners whose properties are part of the Vaal River Conservancy.

Conservation agencies from the provinces of Limpopo, Mpumalanga, Gauteng, North West, Northern Cape, KZN and Western Cape were represented as was the Swaziland National Fish Survey. As usual there was a good turnout of the top yellowfish fly-fishers, many of whom provide guiding services. However, it was not only the fly-fishers who were there as for the first time some of the other freshwater fishing organisations like the Bank Anglers were there in force. In addition, Mike Beaurain, President of the Confederation of Sport Anglers made a presentation to the delegates. A feature of the conference was the keen interaction between the various groups. For example, between sessions fly-fishers and riparian owners could be seen in earnest discussion with the top scientists and conservation officials.

The plenary session started with an excellent paper by Prof. Paul Skelton titled "What is a Yellowfish" and ended with a progress report on the genetic study of the two Orange/Vaal species by Prof Bloomer of the University of Pretoria. AngloGold, who sent three representatives to the conference, has provided most of the fundng for this study. Thereafter the delegates broke into four groups focusing on Legislation, Education, Management of Yellowfish and Structure of the YWG.

It was decided that the genetic studies on the 2 species of the Orange/Vaal system (*Labeobarbus aeneus & L. kimberleyensis*) should be completed with the additional work required to fully answer the question of whether these two species are hybridising or have only recently differentiated into 2 distinct species. Studies are also planned for the *Labeobarbus natalensis* found in

KZN and the two northern *labeobarbus* species of the north; *Labeobarbus polylepis* and *L. marequensis*. Furthermore it was strongly recommended that research be extended to look into biological aspects such as feeding, breeding and habitat, and it was felt that the leading fly-fishers in the Group could help immensely with field observations. All this of course will largely depend on the availability of funds.

Lastly, it was recommended that the moratorium on stocking remain in place for the time being, but where necessary conservation authorities may issue permits for stocking if the fish used are from a nearby source in the same river system.

It is hoped that the Proceedings will be available for posting to delegates by July this year. Copies will be on sale from the FOSAF office (contact 011 4626687 or email fosaf@icon.co.za). Alternatively the YWG secretary will be able to forward zipped copies by email if you contact him at mwardern@mweb.co.za.

WELCOME ADDRESS TO DELEGATES AT THE 7TH YWG CONFERENCE

I welcome all delegates to the 7th National YWG Conference. My only regret is that I am unable to attend for business reasons. It is rather gratifying to see the progress that the Working Group has made over the years since Pierre de Villiers and I discussed the need for this initiative. During the past year we have introduced more structure by establishing an executive committee that will meet as required to formalise decisions and actions taken by the Group. As we will be making recommendations on legislation we would like the involvement of other angling disciplines that may be affected and are pleased with their turnout at this Conference. We invite them to be represented and to serve on the YWG executive committee.

We have also formed an impressive Scientific Advisory Panel consisting of some of the country's top experts in their respective fields of expertise. Your participation is appreciated. Dr Wynand Vlok, who is well acquainted with our work, as he has been associated with us from our inception, leads the Panel.

Another appointment is that of Peter Mills who has taken over the task of project management and is officiating on my behalf at this Conference.

We appreciate the contribution, commitment and effort made by all members of the YWG and if anyone can be singled out for mention it is Peter Arderne and Pierre de Villiers.

Our mission statement is *"To promote the long–term conservation of the nine indigenous yellowfish species of Southern Africa and their natural aquatic habitat through sustainable land use management and wise water management."*

The YWG is concerned with the nine species popularly called yellowfish of which only six are true yellows (*Labeobarbus*) and we talk of Southern Africa. Not included in this number is another true yellowfish the Upper Zambezi yellowfish. Should we not invite the Zambians to join the YWG activities and make the number a round ten?

There is a new watchword today and that is the protection of biodiversity. Our predecessors must be turning in their graves. However the mistakes of the past pale into insignificance when we look at the present day threats. Worldwide more species are being lost due to loss of habitat as a result of development, overexploitation and pollution than for any other reason. Are these forces out of control? Are our laws adequate? Is law enforcement effective? Is there a low compliance? Are people well informed and motivated? Do we need a national independent river authority that has teeth?

We have over a million eyes and ears of anglers and riparian owners that love our rivers and impoundments. Who else cares? How can we motivate and mobilise this resource?

I wish you well in your deliberations and am sure you will have an enjoyable and fruitful conference.

BILL MINCHER

WHAT IS A YELLOWFISH?

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Abstract

From earliest times man has had a fascination for African yellowfish and they have been depicted as objects of art by both primitive and advanced societies. Yellowfish were prominent among the first freshwater fish species to be noted and illustrated following the arrival of western settlers in South Africa. *Cyprinus aeneus* Burchell, 1822 was the first freshwater fish to be described from southern Africa. The nature and identity of yellowfish species has been misunderstood scientifically ever since. Recent studies using new approaches such as karyology and molecular genetics are beginning to solve the riddles of the lineage. This presentation delves into aspects of history and the present understanding what African yellowfish are, and explains issues such as the recent change in genus name. It sets a stage for a new wave of knowledge that will deepen the heritage bestowed by this essential African lineage of striking fishes for Africa and its people.

What is a Yellowfish?

This is a question that few people could answer easily or accurately. And yet African yellowfish are some of the most spectacular and interesting fishes to be found. The question is also asked because of the great interest in these fishes from various quarters – and with good reason. On the scientific front, for example, a team from the Dutch University of Wageningen have been studying a 'flock' of 'large barbines' in Lake Tana in Ethiopia for the past decade, grappling with extremely complex systematic and taxonomic issues of defining what a yellowfish species is. This is not as simple as it sounds because these fishes have characteristics that are sometimes extremely plastic and variable and need to be understood before conclusions can be made. Mistakes in understanding yellowfish characters have confounded their taxonomy from the outset.

In this article I will focus on what are now known as *Labeobarbus* species and will not deal with the African sawfins, viz. *Barbus andrewi* and *Barbus serra*, although they too have a story to tell.

Yellowfish have long been associated with man in Africa. One species, *Labeobarbus bynni*, features prominently in ancient Egyptian tomb writings and archaeological remains. The symbolic associations of the fish are anything but positive though – and the hieroglyphic symbol for 'bad smells' or 'abomination' is *'bwt*' as represented by this fish! At times in ancient Egypt there was a taboo on the eating of fish by certain classes

Archaeological studies in Lesotho show that yellowfish have been a source of food for indigenous peoples there, for a long period of time. Rock-art images depict fishing scenes where people are fishing a large congregation of fish. Largemouth and smallmouth Vaal-Orange yellowfish bones as well as mudfish (*Labeo capensis*) bones are common in a Late Stone Age site at Likoaeng on the Senqu River – a buried rock shelter sealed over time by aeolian deposits. The deposits are aged from about 3000 BC till as recent as 1300AD. The nature of the deposits indicate that they were accumulated in short, rapid bursts, and the bone remains indicate that the fishes were adults of prime breeding age. There are round holes in some of the skulls probably made by spear points. The study indicates that fishing took place during the spawning runs of these fishes, at a site where they were concentrated and easy to catch.

Following the occupation of the Cape by western settlers in the 17th Century yellowfish are depicted in the earliest of records from the exploring expeditions sent out by Governor van der Stel in the 1680s. Illustrations were the equivalent of photographs these days and there are several similar copies of the yellowfish from the Olifants River depicted by Hendrik Claudius.

In the 18th Century one of the more prominent explorers was Robert Jacob Gordon, who led several expeditions to the Great or Gariep River in the 1770s and 1780s. Paintings from his expeditions are in libraries both abroad (in the Netherlands) and in local collections, including Brenthurst and the South African Museum. One of the paintings, again duplicate copies exist, is clearly of a yellowfish species we now know to be the Vaal-Orange smallmouth yellowfish, *Labeobarbus aeneus*. It was made during the Gordon's expedition of 1778 to the mouth of the Orange. The name given by the artist to the species is 'moggel' – a name that we now apply to the mudfish *Labeo umbratus*, and not to the yellowfish. There are no records of the 'moggel' from the mouth of the Orange. From this we can see that even common names change from time to time, and that it is not only scientists who change the names of creatures.

The Riet and Sak rivers near Sutherland in the Karoo are of significance for yellowfish history especially around the turn of the 18th Century following the British occupation of the Cape. In 1801, the first record of fly-fishing in South Africa, by a traveller by name of Dr William Somerville, took place on the Riet River. The record shows that the flyfishing effort was not successful and the anglers resorted to baited hook, with considerably better success. In 1803 the Prussian naturalist Henry Lichtenstein stopped at the Riet River and recorded "There were three different sorts of *cyprinus*, the largest of which was about two feet long, and resembled a very deep yellow carp, only that it had no whiskers." On his way back to Europe he stopped off at St Helena where he met a young English adventurer, William Burchell. It is possible he even mentioned to Burchell the fish in the Riet River because in 1811-1812 Burchell himself visited the Cape and undertook an expedition to the interior passing the Riet and Sak rivers in the Sutherland/Fraserburg district. Here he

caught and sketched a yellowfish species and described it as *Cyprinus aeneus* in his published 'Travels' in 1822. This represents the first formal description of a freshwater fish from southern Africa. A vignette of the species was presented with the description. His original sketch is in the MuseumAfrica in Johannesburg.

Scientists from SAIAB have returned to Burchell's original site and made collections of the fishes there – including that of the yellowfish. There is no evidence or trace that Burchell kept or preserved the specimens from which he sketched and described the species. Thus the painting represents an image of the type, or 'iconotype' for *Çyprinus aeneus* Burchell, 1822..

Dr Andrew Smith was another famous naturalist-explorer who travelled into the interior in the early 1830s, reaching the Orange River and beyond. In 1825, Dr Smith became the first curator of the first natural history museum in South Africa, the direct forerunner of what is today the South African Museum branch of the Isiko Museum Complex in Cape Town. The fish specimens collected on his expedition are amongst the earliest known from southern Africa – and some survive today in the Natural History Museum in London – including the two yellowfish he described in his famous work on the 'Illustrations of the Zoology of South Africa' published from 1841-1846. These are 'stuffed' specimens because preserving fishes in alcohol or formalin at that time was far too impractical under the circumstances.

Our story now jumps to the early 20th Century when Dr George Boulenger, a Belgian zoologist appointed to research fishes and lower vertebrates at the British Museum in London, described fish collections from the Nile. In this study Boulenger identified and used the structure of African barbine scales as a classifying character for the first time. He noted that African barbs have basically two classes of scales – those with numerous more-or-less parallel striae, and those with radial striae. In addition it was noted that the species with parallel striae were all 'large' fishes, meaning that adults reach a length greater than about 15cm or so. He used this same distinction to key out the species in his classic 'Çatalogue of fishes in the British Museum' in four volumes from 1909-1915. Gilchrist & Thompson (1913-15) in their 'Fishes of South Africa' used the same character to basically define the yellowfishes as a distinct group in this region for the first time.

The limits of what a yellowfish species was, at first, difficult to define. Every new collection arriving at a museum contained specimens that appeared significantly different from those before – especially in the development and form of the mouth structures, but also in body shape and development of finnage, etc. So a large number of new species were described under the underlying 'typological' paradigm of that time. This led to considerable confusion for ordinary field workers and anglers, dealing with these species, as much for the museum workers themselves. The problem of defining a 'barbus' species became one of the major ichthyological challenges. It took several decades to realise that the mouth structures and other features in these fishes were very 'plastic' and therefore were unreliable characters to

identify and delimit a yellowfish species. With this realisation the taxonomic pendulum reversed and several studies 'lumped' various nominal species together. Dr Keith Banister's 'Revision of large Barbus from East and South-Central Africa' in 1973 was possibly the high-point of the 'lumping' phase, with one species, *Barbus intermedius*, including about 50 junior synonyms.

Consequently the task to classify so-called *Barbus* became one of the major problems in ichthyology. Simply stated the '*Barbus*' problem is that the genus is so large and generally defined that it is a meaningless category for indicating the kind and relationships of its contained species. This is the basic taxonomic purpose of a genus name. '*Barbus'* species range from tiny fishes with distinct sexual dimorphism living in specialised habitats in specialised ways to huge monsters living in huge rivers or lakes. There is plenty of conclusive scientific evidence that the 'genus' as a whole is comprised of species derived from different evolutionary lineages. Systematists need to define those lineages and separate them from the amorphous aggregration of '*Barbus*'. The process involves identifying the defining shared derived characters of a lineage, determining the boundaries or limits of the lineage and giving it an appropriate (or the correct if one is already available) name to it. One reason why it has been so difficult to do for '*Barbus*' is that there are so many species that are so widely distributed across several continents that no one collection contains, or individual has been able to study, sufficient species to make the right decisions.

Modern communications and generations have broken down barriers that existed between researchers in the past. Scientists have been using new characters and means of analysis from which broad consensus on what the major lineages and how they are defined is emerging. One of the features studied that have given fresh insights into major lineages are the characteristic chromosomes of each and every species. Chromosomes are tightly folded strands of DNA inside the nucleus of each cell that contain the genetic material of the species. Each cell contains a set of paired chromosomes; one derived from the mother the other from the father.

We began to study yellowfish chromosomes in the 1980s and our discoveries have helped define the yellowfish lineage better than anything else before. My student Larry Oellermann discovered that the species in southern Africa have a complement of about 150 chromosomes. We published this in 1989 and our results were confirmed by other researchers soon afterwards. Most cyprinids have only about 50 chromosomes so yellowfish are considered to be 'hexaploid' i.e. have a six-fold set.

One thing the chromosome information did was to focus scientific attention on the '*Barbus*' problem. Researchers discovered that European barbs were 'tetraploid' i.e. have about 100 chromosomes. Because the genus name *Barbus* is taken from the European species *Barbus barbus*, African yellowfish could not be '*Barbus*'. Several wide-ranging genetic studies have been published recently all indicating strongly that, with the exception of certain species from the north-west corner (the Maghreb – Morocco, Tunisia and

Algeria) African barbs are not aligned or related to European barbs. Tetraploid species have been discovered in South Africa (these include the witvis, the sawfin and the redfin minnows as well as a few other minnow species from the Cape). However genetic studies indicate that the African tetraploids mentioned here are most closely aligned to African diploid species and not to European tetraploid species – showing that tetraploidy has developed more that once in cyprinine fishes.

Important defining characters for yellowfish are (1) that they are hexaploid, and (2) that their genetic configuration for the Cytochrome b and ATPase 8 and 6 genes is strongly consistent, and (3) their scales are striated with numerous striae that are aligned in sub-parallel fashion. There are other characters and features that are consistent (such as large size, osteology and skeletal conformity, etc) but these have not yet been studied in detail and derived characters identified for the lineage as a whole. The consensus of opinion therefore is that the lineage in Africa is monophyletic and should be placed in its own genus. This step has been taken in my recent revised book, and an explanation for it published in the African Journal of Aquatic Science.

Why is the name *Labeobarbus* used? This name seems to be a confusing mix of well known names for African large cyprinids. The answer is that *Labeobarbus* is the earliest available name that must be used according to the strict rules governing scientific zoological nomenclature. *Labeobarbus* was a name given by the German traveller and naturalist Willem Rüppell, who was born in Frankfurt in 1894 and died there in 1884. He travelled to Egypt in 1817-1818, in 1822-1828 and explored Abyssinia in 1831-34. He sent his large collections to the Senckenberg Museum in Frankfurt, and published descriptions of Nilotic fishes in 1835 – including that of a yellowfish species which he named *Labeobarbus nedgia*. Before this Burchell had described a species using the Linnean name *Cyprinus*. Andrew Smith's name *Cheilobarbus* was published in 1841 – after Rüppell's study. So Rüppell's name is the earliest and available name and must be used.

There is much still to learn about these fascinating fishes – in particular we need to know more about their phylogenetic relationships, their osteology, genetics, biology and ecology. We also need to understand their biogeography – and we need to ensure that the rivers and ecosystems where they live are conserved, that human use and exploitation of these marvellous creatures is sustainable. Here in South Africa the Yellowfish Working Group is a great step in the right direction.

WHY INVERTEBRATES AND FISH? – AN IMPORTANT LINK

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Abstract:

This paper will highlight the importance of habitat protection when conserving "keystone species". It will focus on the links between the environment, the river, invertebrates and fish. Questions to be addressed include: what is the result of specific events on the ecosystem as a whole, what is the impact on the microhabitat, and how should conservation relate to these issues.

The Luvuvhu River is an important tributary of the Limpopo River, and various anthropological impacts threaten this unique ecosystem. This paper will discuss the role of the invertebrates as a food source for *Labeobarbus marequensis* and the impacts of natural events such as floods on the macro-invertebrate community. Pre-flood and post-flood results will be discussed and we will try and indicate the importance of flood events in the natural cycle within a river ecosystem.

These preliminary results will form the basis of a more detailed research programme to investigate the ecological needs, habitat preferences, food sources and water quality and quantity of *L. marequensis* in the Luvuvhu River.

Introduction:

The Water Act (Act 36 of 1998) is a very progressive act and one of the most important features is the fact that the environment is considered as a "water user" and protected as such. This means that the environment has legal protection against abuse as far as water rights are concerned. The aspect under consideration is the "ecological reserve". This refers to the minimum flow needed to maintain the ecological status of a river. The implications of all this have lead to the implementation of "reserve determinations" for each river (not completed). These determinations will ensure that a study is completed for each river to determine the minimum flow needed to ensure that the ecological processes are maintained. Flood situations must also be addressed.

The reserve determination studies are done at various levels and these include desktop, rapid and comprehensive surveys or studies. Each type of study will be completed according to the needs at the time. The rapid studies will be done to compile some basic information on the specific river, whereas the comprehensive studies will be a detailed long-term study.

Currently only scant data are available to elucidate the process of instream flow requirements and whether these processes are operating as predicted? A study was done in Luvuvhu River (Newenham and Chavalala, 2001) to determine if the proposed reserve is actually functioning as intended. As a follow-up to this, Support Chavalala has started a master's degree study to gather information on flow dependence of various invertebrate families. His study was aimed at identifying some of the more prominent families found in the different biotope sub-habitats in the river. Currently SASS 5 (macro-invertebrate index) is used to "answer" many ecological questions. The index was originally developed as a rapid assessment technique to indicate trends of changes in the water quality (specifically organic changes). From this, it is clear that this index will not supply all the answers to a very complex issue. The idea of Chavalala's study was to add a further dimension to this index – the flow dependence of invertebrates to ensure survival and biodiversity of the invertebrate community.

In our endeavour to protect yellowfish species, we must start with the habitat. The trend in current research in South Africa is focussed on the holistic approach and in the water environment we refer to catchment management or the catchment approach. What does this mean? Simply that you must protect the whole environment around a river (its total catchment) and by doing this, you must include all possible issues. Another popular phrase today is "sustainable utilisation". Sustainability rests on three pillars – the environment, social impacts and issues, and the economic viability of the whole issue.

If we consider the Lowveld largescale yellowfish as an important species in the functioning of the fish community in the Luvuvhu River system, this fish will form the basis of the whole conservation drive of the river catchment. Due to the lack of basic knowledge of our indigenous fish species, Paul Fouché (University of Venda) will start his PhD studies to give us some answers on the feeding and breeding ecology, habitat requirements and water quality needs of *L. marequensis* (see p. 19-25, this volume).

The management of the ecosystem is therefore important to ensure the sustainable utilisation of the environment. Floods are naturally occurring events. Unfortunately we have very little long-term data about floods in southern Africa. Even accounts from the early inhabitants and settlers are not very reliable. They did not have the equipment to quantify flood data, and stories carried over orally from one generation to the next tend to become blurred in time. Nonetheless, although their accounts lack quantitative scientific information they still allow us to make inferences about the relative intensity and frequency of floods in historic times.

With the floods of 2000 ecologists had excellent opportunities to evaluate their effect, determine flood lines (1-in-100, 1-in-200 years), impacts of various anthropogenic activities on the environment and the influence of these on the floods, as well as the slow rehabilitation of the system afterward. In many cases, what we perceived as serious flooding, was just a natural flood event

(1-in-200 year floods). This gives us the opportunity to test current views and hypotheses, and to determine long-term impacts and rehabilitation requirements.

Macro-invertebrates provide us with one such a tool. What is the impact of floods, how will the populations recover, what is the impact of long-term flow regulation?

Results:

Table 1 reflects the various velocity ranges used during the initial Luvuvhu-IFR project. This was done to standardise the velocities used, as no specific ranges were set for this type of survey. It is a simple 5-category classification, ranging from very fast to no-flow. The other parameter to be standardised was the depth of the river by defining four depth classes. In table 3 we see some of the results from Chavalala's initial results at the Botseleni site in the Luvuvhu River. The data show that certain families are present in some of the biotopes but not in others. The Baetidae family is the only one occurring in all biotopes.

Table 1: Water velocity ranges used (Newenham and Chavalala, WRC Report submitted) in the IFR study in the Luvuvhu River.

Category	**Velocity range for each category**
Very fast	> 4,1 m/s
Fast	0,46 - 4 m/s
Medium	0,16 - 0,45 m/s
Slow	0,05 - 0,15 m/s
No-flow	< 0,05 m/s

Table 2: Water depth ranges used in the IFR study in the Luvuvhu River (Newenham and Chavalala, WRC Report submitted).

Category	**Depth range**
Very Deep	> 600 mm
Deep	301 - 600 mm
Shallow	150 - 300 mm
Very shallow	< 150 mm

Table 3: Families, which tend to prevail in various biotopes (Chavalala).

Biotope / Family	SP 1 Fast - shallow		SP 2 Slow - shallow		SP 5 Fast - deep		SP 3 Slow - shallow
Heptageniidae - flat-headed mayflies	18	16					13
Baetidae - small minnow mayflies	15	13	5	8	57	53	13
Elmidae - riffle beetles	59	20	10	16			17
Hydropsychidae - caseless caddisflies	46	63	15	11			54
Leptophlebiidae - prongills	5	10					12
Gomphidae - dragonflies			6	8			
Sphaeriidae - pill clams	30	22	13	12			11

Table 4 summarises the results of sampling done in August 1999 (pre-flood) and October 2000 (post-flood). Eight sites (Figure 1) were selected for the surveys in the Luvuvhu River: two sites above the Albasini Dam, four sites below the dam and two sites on tributaries below the dam. The data from the different biotypes were pooled for purposes of this paper. It includes the invertebrates from the gravel, mud and sand, overhanging vegetation, stones in-current and stones out-of-current. From the results (table 4) we see that a total of 46 families were recorded in both surveys, with 40 families present in 1999 and 34 families in 2000. During the 1999/2000 surveys, 28 families were present in these surveys, whereas 12 families were sampled during 1999 (not in 2000) and 6 families during the 2000 survey (not in 1999).

Table 4: Results from two surveys (biomonitoring) done in the Luvuvhu River in 1999 and 2000.

Taxon	99	00	Taxon	99	00
Hydra sp.	_		Corixidae* - water boatmen		_
Planarians	_	_	Gerridae* - pond skater	_	_
Oligochaeta - aquatic worms	_	_	Veliidae* - broad-shouldered water striders	_	_
Amphipoda - scuds	_		Hydropsychidae 2 spp - caseless caddisflies	_	_
Crabs*	_	_	Philopotamidae - caseless caddisflies	_	
Shrimps	_	_	Cased caddis types - No. taxa 1 5	_	_
Hydrachnellae - water mites	_	_	Dytiscidae (A*) - predacious diving beetles		_
Perlidae - stoneflies	_	_	Elmidae/Dryopidae (A*) - riffle beetles	_	_
Baetidae 2 spp - small minnow mayflies Baetidae > 2 spp	_	_	Gyrinidae (A*) - whirligig beetles	_	_
			Helodidae - marsh beetles	_	
Heptageniidae - flat-headed mayflies	_	_	Tipulidae - craneflies	_	_
Leptophlebiidae - prongills	_	_	Culicidae* - mosquitoes		_
Tricorythidae - stout crawlers	_	_	Simulidae - black flies	_	_
Caenidae - cainflies	_	_	Chironomidae - midges	_	_
Coenagrionidae - damselflies	_	_	Ceratopogonidae - biting midges	_	_
Chlorocyphidae - damselflies	_	_	Tabanidae - horseflies	_	
Gomphidae - dragonflies	_	_	Athericidae - snipe flies	_	_
Corduliidae - dragonflies	_	_	Muscidae - house flies		_
Libellulidae - dragonflies	_	_	Lymnaeidae* - pond snails	_	
Notonectidae* - back swimmer	_	_	Planorbidae* - orb snails	_	
Naucoridae* - creeping water bug	_	_	Physidae* - pouch snails	_	
Nepidae* - water scorpions	_		Sphaeriidae - pill clams	_	
Belostomatidae* - giant water bug		_	Unionidae - pearly mussel	_	

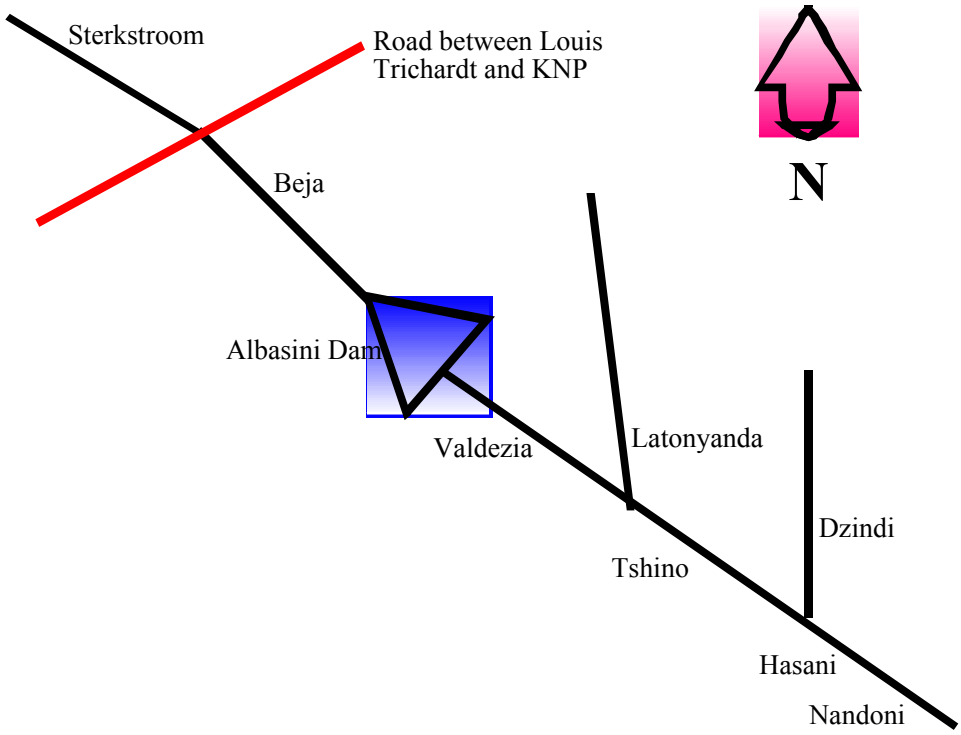

Figure 1: Map showing the eight sites sampled during the 1999 and 2000 surveys.

Discussion:

The initial results of Chavalala's master's project on the Luvuvhu River show that certain families inhabit all the biotopes investigated, whereas others are more restricted in their distribution (table 3). The baetid family is ubiquitous whereas Elmidae, Hydropsychidae and Sphaeriidae occur only in the SP 1, 2 and 3 biotypes. Heptageniidae and Leptophlebiidae are only present in SP 1 and 3 whereas Gomphidae is restricted to SP 2. From this we can readily see the preference of some invertebrates for specific habitat types and their related flow regime. SP 2 is the sand, mud and gravel substrate with a lower flow velocity.

From the 1999/2000 results it is also clear that changes in the habitat, specifically the substrate, will play an important role in the redistribution of invertebrates after a flood event. If we look at each family present during the 1999 survey and not during the 2000 survey (table 4), it seems that the lack of flow plays an important role.

Hydra and Amphipoda were present during the 1999 survey but not in 2000. In the case of Hydra, this may be attributed to their habitat requirements and size. They are very small organisms and not always easy to detect. They attach themselves to plants which had not yet regrown during the 2000

away during the initial flood event in 2000. Although there was mud at the time of the survey, the amphipods may not have recolonised it. The Helodidae family was also not present in 2000. Helodids prefer water with a lower pH, and when the water-quality parameters were examined, it was found that the lowest pH was measured at the site where the family was collected. This will be consistent with the low flow period during the survey when the higher concentration of pollutants and increased evaporation can lower pH levels. After the floods the poor water quality was back to a more normal level and, therefore, helodids were absent.

The lower number of Baetidae species (2 spp. in 2000, more than 2 in 1999) can also be attributed to the fact that not all species have recolonised the area. The absence of the Nepidae in 2000, which prefer vegetation on the edges of pools as habitat, may still not have had the chance to return after being washed away during the floods. Other families absent during the 2000 survey were Philopotamidae (present in silk tubes under stones in fast flowing water) and Tabanidae (muddy areas in slow flowing water). In the case of Philopotamidae, they have not recolonised the preferred habitat after the floods. The Tabanidae, although they are found in muddy areas, may also have not yet had time to re-establish themselves in the newly deposited sediment.

The presence of Belostomatidae in 2000 and not in 1999 may be due to a lack of habitat in 1999. They are found in shallow pools and backwaters and these specific habitat types were absent during the survey. A similar situation applies to Corixidae (pools, quiet muddy areas of streams), Dytiscidae (backwaters and edges of pools), Culicidae (pools) and Muscidae (moss and algal masses in still water) where the preferred habitats were also not present during the low flow period in the river.
Another group present in 1999 and not in 2000 are the snails. Five families (Lymnaeidae, Planorbidae, Physidae, Sphaeriidae and Unionidae) were found in 1999. After the floods, lots of sediment and the associated organisms had been swept away. During the 2000 survey, they had not recolonised the newly deposited sediments.

Conclusions:

Although the results represent a single survey before and after the floods, a pattern seems to be emerging. Further studies with a larger sample drawn from more sites will be needed to confirm these initial conclusions. I am of the opinion that this pattern will be confirmed in a more detailed study. The presence/absence of families during the two surveys seems consistent with habitat modifications.

The absence of certain families may be ascribed largely to poor water quality and the absence of the preferred habitat due to low water levels. This gives us some indication that any stream management strategy must definitely take water levels and flow velocity into consideration. Even in the few cases where habitat modifications were the “reason” for the absence of certain families of

invertebrates, regular flooding is important to ensure that the total diversity of the invertebrate community is maintained.

THE HABITAT PREFERENCES AND FOOD SELECTION OF *LABEOBARBUS MAREQUENSIS* IN THE LUVUVHU AND MUTALE RIVERS

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ABSTRACT

During surveys in the period of 2000 to 2002, selected sites in the Luvuvhu, Mutshindudi and Mutale rivers were physically divided in $2m^2$ blocks with metal pegs. In each block the fish were collected using electro-narcosis and the specimens collected were measured and weighed. Representative samples of the various length classes of *L. marequensis* were preserved and taken to the laboratory where the stomach contents were removed and analysed. In each of the blocks the following habitat characteristics were determined: water velocity, depth, dissolved oxygen, pH and temperature. The dominant streambed substrate in the blocks was identified and used in conjunction with other physical aspects, to determine the biotopes.

1. Introduction

Relatively little is known about the ecology, which includes habitat preference as well as niche differentiation, and the associated morphological adaptations of most of the indigenous fish of southern Africa. South Africa is no exception and literature surveys reveal that this lack of knowledge also applies to the South African cyprinids and to *L. marequensis* in particular.

The Lowveld largescale yellowfish, *L. marequensis,* is a "successful" species in the proposed study area because of its abundance and the fact that it apparently occurs in a wide range of habitats. Gaigher (1973) regards it as an unspecialised specie with a wide distribution that occurs in the Limpopo River system in pools and rapids of perennial streams at all altitudes. Records of the Institute of Aquatic Biodiversity (formerly JLB Smith Institute) of collections done by Polling *et al* (1983) and personal collections confirm these findings and it has been collected in most of the tributaries of the Luvuvhu River. In Venda it is known as “thanzwi” or “pupela” and it forms an important protein component of the diet of rural people. It is fished using various methods and for various reasons which include recreation and eating. Between 5 – 10% of the total mass caught by fishers in the Luvuvhu River (van der Waal, 2000) are largescale yellowfish. Although not traditionally a "target" of the flyfishing fraternity in South Africa, its dimensions (maximum size and length) and its general appearance could make it a worthwhile target species. In Southern Africa it is already regarded as one of the sport fish species with angling records indicating a record size of 5,75 kg in South Africa and 3,4 kg in Zimbabwe. (http//: wwwfishingafrica.co.za)

Various authors (Crass, 1964; Pienaar, 1978; Bruton et al, 1982 and Skelton, 1993) have indicated that the diet of this fish consisted of algae, plant detritus, the larvae and adult stages of aquatic insects, snails and even small fish. No reference to the food preference during the various growth stages was found

in the literature. As far as habitat preference is concerned Pienaar (1978) and Bruton et al (1982) found that this fish preferred flowing waters and was partial to swift and strong currents.
Although the literature cited above did indicate in which habitats the specie could be expected and what its diet consisted of, no reference could be found that was more specific on the habitat conditions and diet composition. Some questions therefore still remain unanswered. How fast was fast flowing water? Do all the size groups display the same habitat preferences and food selection? Was there a specific preference as far as substrate was concerned?

As part of a larger WRC funded project the aims of this study were: a) to determine in more detail what the habitat preference of this species is by establishing the water velocity of the areas inhabited by the fish. b) to determine the food selection displayed by the various size classes by investigating the stomach contents and intestinal morphology.

2. **Materials and Methods**

2.1 Sites and collection points.

The two sites in this report formed part of a larger study and were selected to represent an anthropogenic disturbed and an anthropogenic undisturbed site. Care was taken to select sites in the two rivers where most biotopes were present. The sites were sampled a total of 8 times apiece during the duration of the project which commenced in August 2000 and ended in February 2002. At both sites the river was divided into a grid consisting of $2m^2$ blocks using metal stakes. In each of these blocks the fish were collected using electro-narcosis and scoop nets. The scoop nets were placed at the downstream boundary of each block and at completion of the shocking period the fish in the nets were identified and recorded. The sample for each block was then placed in a container. After all the blocks had been sampled a rapid, a riffle and pools were identified outside the grid and fish collected in each. The fish collected in each biotope were then recorded separately and the fish placed in separate containers. The time that the fish were collected was also recorded.

2.2 Physico-chemical aspects.

In each block of the grid and in each biotope the water velocity, minimum and maximum depth and substrate composition was determined. The water velocity was determined with a Science Workshop velocity meter at approximately 3 – 5cm above the substrate level. The depth was determined with a meter rule and the substrate was classified according to the dimensions used by Wadeson and Rowntree (2000).

At each site the dissolved oxygen, pH, conductivity and temperature were determined. Water samples were also collected and in the laboratory the total suspended solids and turbidity were determined.

2.3 Morphological features of the fish

The fork lengths of all the *L. marequensis* collected were determined to the nearest millimetre on a measuring board and the mass determined with a Sartorius portable scale. Representative samples of each 10mm length class were placed on ice and transported to the laboratory.

In the laboratory the fish were again measured and dissected to expose the viscera, and the digestive tract was then removed and the stomach and intestines separated. The length of the digestive tract was measured, taking care not to over-stretch the organ. To enable comparison the intestinal lengths were converted into mean relative gut lengths (mRGL) where the intestinal length is expressed as a percentage of the fork length. To determine the stomach volume the length and diameter at the widest point were measured and the volume calculated using the formula for a cone.

2.4 Stomach contents
Stomach fullness was estimated as _, _, _ or completely full and where a stomach contained food the contents were removed and microscopically investigated. Individual food items were identified and the volumes of each food type were estimated with the aid of a grid (Gaigher, 1969) and expressed as a percentage of the stomach content.

2.5 Stomach structure
The structure of the stomach was investigated both macro- and microscopically. Tissue samples of the stomach wall were also removed and histologically investigated.

3. Results

When analysing the results it should at all times be borne in mind that the sampling took place in the period after the devastating floods of February 2000. The flood damage could contribute to the fact that no large specimens of *L. marequensis* were collected.

3.1 Water quality
The water in both rivers was well-aerated and displayed similar seasonal oxygen content trends. Tables 1 & 2 show that the water of the Luvuvhu River is however more turbid with higher loads of suspended solids and dissolved matter. The pH values indicate that the water in both rivers is slightly alkaline. The water of the Mutale is cooler than that of the Luvuvhu and in general it is shallower and slower flowing river.

Table 1: Water quality of the Mutale River at the confluence sampling site for the period August 2000 – February 2002

	M15/8/00	M22/8/00	M17/10/01	M24/05/01	M16/08/01	M20/9/01	M01/11/01	M07/02/02
PH	7.3	6.7	7		6.8	7.2	8.7	7.85
Conductivity uS	37	44	46		41.8	46	48.8	31
Dissolved Oxygen %	95	99	81.8	98	94	92	94	82
Dissolved O mgl	8.5	8.8	7.6	8.8	8.3	8.3	8.2	6.7
Temp. °C	15.6	15.7	20.7	16	15.5	19.5	23.2	22.3

Max. depth m	0.74	0.6	0.7	0.6	0.6	0.52	0.36	0.82
Max velocity m/s	1.22	1.3	1	1	1	0.67	0.56	1.29
TSS mgl	26	49.5	19	6.5	3.5	6.5	14	7.5
Turbidity NTU	20	20	25	8	2	3	3	2

Table 2 : Water quality of the Luvuvhu River at the Tshino sampling site for the period August 2000 – February 2002

	T8/8/00	T29/8/00	T7/11/00	T10/5/01	T02/08/01	T27/09/01	T31/10/01	T13/02/02
PH	7.4	7.8	7.95	7.36	7.1	8.1	9.4	7.8
Conductivity uS	108	115	118	92	90	103	109	109
Dissolved Oxygen %	95	85	90	94	92	90	90.5	87
Dissolved O mgl	8.4	6.5	7.8	8.3	8.2	8.5	8.6	6.7
Temp ºC	16	18.8	25	17	16.1	20.6	25.1	25.5
Max. depth m	0.9	0.85	0.82	0.9	0.7	0.6	0.52	0.66
Max velocity m/s	2	1.82	1	1.67	0.86	1	1	0.7
TSS mgl	26	63.5	50.5	30	25	30.5	35	21
Turbidity NTU	31	21	36	14	9	12	10	7

3.2 Intestinal morphology.

Macroscopic investigations suggest that *L. marequensis* does not have a stomach in the true classical sense. At the anterior end the changeover from oesophagus is distinct but at the posterior end the changeover is difficult to detect from the outside. The “stomach” is funnel shaped with a sharp curve towards the intestinal side. For this study this curve was regarded as the posterior boundary of the stomach. Microscopical investigations vindicated this decision as the curve proved to be an area with distinct changes in the internal topography where the rugae changed into typical intestinal rugae. Histological analyses also indicated that the stomach wall was thin with the muscle layer being 10% of the total thickness. Although this was thinner than the muscle layer in insectivores such as *Opsaridium peringueyi* and *Micralestes acutidens*, where the muscle layer made up 50 % of the stomach wall thickness, it was still double the thickness observed in the true detritivores such as the *Labeos.*

The mean relative gut length (mRGL) ranged from 109,5% to 202,7% with an average of 197,1 %. Although these intestines are shorter than that of the *Labeos* it is still considerably longer than that of the rock catlet (56,8%), the banded minnow (28,1%) and the silver robber (39,5%). No difference between the mRGL of the different length groups was found.

However when the stomach volumes of the various length groups are compared (table 3) it is clear that the volumes increase as the fish grow in length. When stomach length is expressed as a ratio of the fork length it appears that this increase actually reflects that the larger fish have relatively larger stomachs.

Table 3: The stomach dimensions of *L. marequensis.*

Length class (mm)	Stomach volume (mm^3)	Relative stomach length (% of fork length)
31 – 40	30	29
41 – 50	40	34
51 – 60	42	33
61 – 70	38	34
71 - 80	56	40
81 – 90	100	44
91 - 100	150	44
101 – 110	160	46

3.3 Stomach content analyses

Where the combined stomach contents of all the length class are considered, *L. marequensis* were shown to feed primarily on algae and detritus. Invertebrates and specifically the adult stages form a very small component of the diet. However when the length classes are viewed individually a slightly different pattern emerges (Table 4).

Table 4: Analysis of stomach content of the size classes of *L. marequensis*.
(The estimated % of each food component is represented by the figures in parentheses)

			Invertebrates		
Length classes	Algae	Detritus	Larvae (Chironomids)	Adult	Total
31 – 40	_ (63)	_(29)	_	_	(8)
41 – 50	_ (61)	_(40)			
51 – 60	_(55)	_(38)	_		(7)
61 – 70	_ (20)	_(70)	_		(9)
71 – 80	_ (30)	_(58)	_	_	(12)
81 – 90	_ (40)	_(60)			
91 – 100	_ (35)	_(55)		_	(10)
101– 110	_ (25)	_(60)	_	_	(15)

3.4 Habitat preferences

The data collected from the selected biotopes outside the blocks in the grid did not yield the expected results and are therefore not included in the discussion.

Depth and velocity.

Because of the variation in depth and velocity in the blocks it was decided to use the categories used for the Fish Assemblage Integrity Index (FAII) suggested by Kleynhans (1999). In these categories water velocity below 0.3

m/s is regarded as slow and above 3m/s is it regarded as fast. Water depth below 0,5 m is regarded as shallow and when it is deeper than 0,5 meters it is regarded as deep. On this basis the biotopes were then divided into slow/shallow, slow/deep, fast/shallow and fast deep. The findings are illustrated in table 5.

Table 5: The percentage frequency of three fish species per flow depth category collected from the Luvuvhu and Mutale rivers. (LMAR= *Labeobarbus marequensis*; CPRE = *Chiloglanis pretoriae*; LCYL = *Labeo cylindricus*)

Specie	Site	Slow/ shallow	Slow/ Deep	Fast/ shallow	Fast/ deep
LMAR	Mutale	67	0	33	0
	Luvuvhu	4	0	85	11
CPRE	Mutale	8	0	60	32
	Luvuvhu	4	0	57	39
LCYL	Mutale	0	0	17	83
	Luvuvhu	0	0	20	80

Substrate

The substrate in all the blocks varied considerably. In the faster flowing riffles and rapids it consisted of coarser material, such as boulders and cobbles, and in some instances also bedrock. Finer particles such as fine gravel, sand and sediment were found in the biotopes with the low velocities. No preference for any specific substrate or combinations of substrate classes could be illustrated.

4. Discussion

The results obtained from stomach content analyses, and the data on the intestinal morphology seem to indicate that the size classes investigated in this study are opportunistic feeders with a tendency towards the ingestion of plant and algal material. This is well illustrated in the smaller fish. However as the fish increase in size larger volumes of insect residues are found in the stomach content, which indicates a possible shift towards a more insectivorous diet. The increase in stomach volumes and the accompanying relative length increase in the stomachs underpin this.

As far as habitat preference is concerned the size classes do seem to prefer the shallower (< 0,5m) areas and do not inhabit pools which are deep and slow. As far as velocity is concerned no clear preference to fast water was illustrated. It should however be pointed out that on average the fish collected in the colder Mutale River belonged to the smallest size classes and it is thought that they would prefer slower shallow water.

5. Conclusion

Although this study provided some answers to the initial questions it should be borne in mind that only small fish were collected. This could have been because of the intense flood damage.

To increase our understanding of the Biology of the specie it is suggested that this study be expanded to include specimens of the larger size classes. This would mean that bigger pools where some flow exists and deeper rapids should be included.

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WATER QUALITY OF THE UPPER VAAL – TRENDS & CHANGES OVER TIME

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Abstract

The Vaal River system has often been called “South Africa’s hardest working river” It serves about 10 million people with potable water, and also drives the economic heartthrob of the country, supplying mines, industry, power generation and agriculture alike.

Due to the increased urbanisation, the demand on the Vaal is fast reaching a point where it will exceed supply. Already inter-basin transfers are operated from the Tugela River and Lesotho to augment the supply to Gauteng.

Such transfers however, also open the doors for new users to optimise the opportunity of previously unavailable water. Invariably, water use brings water pollution, and the Vaal has not escaped.

Changes in water quality has in some areas been more significant than others, but studies have focused mostly on domestic use of water, and very little has been done to determine environmental impacts of changes in water quality.

This paper highlights historical trends in water quality along the Vaal River, and also investigates the changes in water quality as a result of releases from the Lesotho Highlands Water Project.

The original power point presentation is available from the authors or the editor.

VAALDAM OPERATING RULES

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There are four different scenarios for the operational releases from Vaal Dam. Depending on circumstances it may be possible to accommodate the needs of other role-players, e.g. the requirements of the Yellowfish Working Group.

1st Scenario

Release water from Vaal Dam to control the water quality in the Barrage, maintain the TDS (total dissolved salts) to below 600mg/l. The outflow from the Barrage should be kept at a TDS level lower than 600mg/l.

With this scenario it is possible to opt to make a bulk release for dilution purposes rather than to make a constant low release. Such an option may have impacts on the river, in particular the stretch of river between the Barrage and Parys and just downstream of Vaal Dam. The rate of such a release will thus be limited to acceptable levels.

2nd Scenario

When no releases are required for dilution, DWAF only release enough water to satisfy the needs of Rand Water at their abstraction point at the Lethabo weir, a few km's downstream of Vaal Dam. DWAF is intending to raise this weir by 300mm. This additional, limited, capacity can be used in future for limited bulk releases. This will only have an impact on the stretch between Vaal Dam and Lethabo weir, it will not have any effect on the Barrage or area below the Barrage.

3rd Scenario

Drought releases to Bloemhof Dam. Should Bloemhof Dam level drop to an unacceptable level, releases are made from Vaal Dam to augment Bloemhof. These releases have in the past been made at a rate of $40m^3/s$. This pattern can be changed, if need be, to accommodate other needs.

4th Scenario

Flood releases. These releases are strictly in accordance with flood operating rules. No changes to this can be made to accommodate other needs.

AQUATIC WEEDS ON THE VAAL RIVER.

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INTRODUCTION

Thousands of plant species from other parts of the world have been introduced to South Africa for a range of purposes. These include crop, timber, firewood and garden ornament species. Also plants for stabilising sand dunes and as barriers and hedges. Others simply arrived as unannounced passengers on ships, aircraft, trucks and trains that serve the growing economy of our country. Many of these alien species have become naturalised, surviving in the South African landscape and waterways without needing to be tended. Some of these naturalised species have become invasive and are able to survive, reproduce and spread, unaided and mostly at alarming rates across the landscape and waterways.

The government's national Working for Water Program (WFW) is spearheading a campaign to deal with the problem of alien invasive plants. In 2002 the program took responsibility to successfully control water borne invasive weeds from the Department Water Affairs and Forestry.

AIMS AND OBJECTIVES

The aims and objectives of WFW can be described under five topics, viz. hydrological, ecological, social, natural resources and economic.

- Hydrological: To enhance water security. To promote equity, efficiency and sustainability in the supply and use of water.
- Ecological: To improve the ecological integrity of our natural systems. To protect and restore biological diversity.
- Social: To invest in the most marginalised sectors of society and to enhance their quality of life.
- Natural resources: To restore the productive potential of the land, in partnership with the *Land Care* initiative. To promote the sustainable use of natural resources.
- Economic. To develop the economic benefits (from land, water, wood and people) from clearing these plants, by facilitating training, economic empowerment and the development of secondary industries.

CATCHMENTS

In the Northwest we have the Crocodile River which is fed from the Hartbeespoort Dam which in turn is fed from various streams and rivers flowing out of Johannesburg and Pretoria.

The program allocated sections of river to the contracting teams who intend starting in the upper catchment and work toward the confluence of the Limpopo River. Separate contracting teams were allocated to work on Roodeplaat Dam together with the rivers and streams feeding this system. An additional contracting team is allocated to control the Apies River through Bonn Accord dam down to Themba Dam in Hammanskraal.

The other river concentrated on by Aquatic Weeds, which starts in the Northwest, and touches two other provinces, is the Vaal River. Contracting teams are set up in the Vaal River from the source of seed, which is the Barrage below Vereeniging down to Vaalharts weir. The last of the invasive plants were sighted at De Hoop weir.

METHODS

The program uses different methods to control these invasive species namely: natural, manual, chemical and biological control.

Natural: these include floods and strong winds. The problem however is that after these natural phenomena, the problem is just displaced downstream.

Manual: Contracting teams consisting of a contractor, 1 driver, 2 herbicide applicators, and 2 general labourers are issued with hayforks with which to physically remove the hyacinth from the water. The weeds are removed beyond the 50-year flood line to ensure that the weeds or seed do not get back into the system. They are placed in heaps and allowed to decompose.

Chemical: Chemical spraying- teams are equipped with knapsack sprayers and mist blowers. The team moves up and down the riparian zone of the river applying a foliage application of a glyphosate based herbicide to the weeds. If the area is too big for teams to control, or inaccessible, an aerial application is a more effective option. Either a fixed wing or helicopter is used, depending again on the size of the area.

Biological: The natural enemies of these plants are imported from the country of origin of the weeds and tested before being released onto the host plant. This is however a slow process because the insects need time to acclimatise. The insects are helped by spraying the hyacinth during their adult stages allowing the insects to catch up. Five species of insects are used and it appears that they are most effective when the mirid (*Eccritotarsus catarinensis*), the moth (*Niphograpta alobiguttallis)* and weevils (*Neochetina eichhorniae* & *Neochetina bruchi)* are present.

Chemical spraying- teams are equipped with knapsack sprayers and mistblowers. The team moves up and down the riparian zone of the river applying a foliage application of a glyphosate based herbicide to the weeds. If the area is too big for teams to control, or inaccessible an aerial application is the most effective option.

Contracting teams are trained and educated as a vital pillar of the program.
Thirteen contracting teams of 6 people each on each of the two rivers, do not cover every inch of the rivers. Every bit of help is appreciated. Landowners along the river phone in and we do site visits and in some instances, we are able to help the landowner with herbicide. Follow-up visits are then planned for about two weeks after spraying.

CONCLUSION: Lastly, the vision of the aquatic clearing teams is to sustainably control invading alien species, to optimise the potential use of natural resources, through a process of economic empowerment and transformation.
In doing this, the program will leave a legacy of social equity and legislative, institutional and technical capacity.

A FEW THREATS TOWARDS THE FUTURE EXISTENCE OF YELLOWFISH

Empirical observations regarding the influences of water pollution, gillnetting, alien fish species and sport fishing on yellowfish populations

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Abstract

It is commonly assumed that water pollution is the biggest threat to aquatic organisms, which of course includes the threat to yellowfish. It is further a known fact that there are almost no natural waters that are not to a lesser or greater degree polluted. The state of affairs in several dams and systems is discussed. In spite of these water quality problems, it appears as if all these river systems and dams do still have reasonably good fish populations.
Gillnetting is probably a most controversial issue in South Africa. On the one hand it is true that there is a big demand in our country for protein. The supply of fresh water fish can most definitely help to alleviate the much needed protein food shortage in South Africa. On the other hand is it true that illegal gillnetting (and other forms of fish poaching) could pose a danger, especially to our indigenous fish species, like yellowfish. Netting operations have proved to have disastrous effects on fish populations elsewhere in Africa. How will we manage netting in South Africa in future?
The influence that alien fish species like black bass, trout and carp has on our indigenous fish species is a subject that provoked fierce debate in the past. We would like to mention a few factors that might contribute to more clarity on this issue.
The influence that sport fishing has on our indigenous fish resource is most probably one of the minor influences. However, this does not mean that fish quotas are not very necessary. It is indeed the sport angler who needs to set the example regarding conservation of fish species.

Introduction

The Eko–Care Trust was founded in 1995 by concerned anglers with the aim of conserving our aquatic ecosystems. Our mission has since broadened to include the conservation of the whole water spectrum. Water is Life. Most of our attention in the last few years has been spent promoting water awareness projects and programmes in schools and communities.

“Watchdog” is one of the functions of the Trust: Watchdog is a Hotline receiving reports (especially from anglers) regarding water pollution and fish kills.

Observations in this dissertation are based on reports and own observations. It will probably raise more questions than answers in this debate. Some of the

observations may spark the attention of some of our educated specialists who hopefully may contribute to get some of the answers.

Water Pollution

It is commonly assumed that water pollution is the biggest threat to aquatic organisms, which of course includes a threat to yellowfish. It is further a known fact that there are almost no natural waters that are not polluted to a lesser or greater degree.
The Vaal, Olifants (Mpumalanga) and Crocodile (North West) river systems are good examples of poor water quality. The dams such as the Vaal, Witbank, Loskop and Hartbeespoort dams are all known for eutrophication and other water quality problems.

In spite of these water quality problems, it appears as if all these river systems and dams do still have reasonably good fish populations.

According to reports, during fishing competitions and at other times, it is remarkable that anglers still do make reasonably good catches of yellowfish in some river systems and dams. In Grootdraai Dam many anglers almost regard the Orange-Vaal smallmouth as a pest, preventing them from catching other species like carp. In the Vaal River many yellows are caught daily. In some areas, smallmouth yellowfish are abundant. In other areas, Orange-Vaal largemouth are more common than smallmouth.

Recent bio-monitoring studies in the River Health Programme have reported on the status of fish populations in the Crocodile (Mpumalanga), Sabie and Letaba river systems. The overall status, except in certain more industrialised and populated areas, is not that bad. However, the negative influence of water pollution in these areas correlated with fish populations.

Despite heavy water pollution in the Jukskei and Crocodile (flowing into the Hartbeespoort Dam) rivers, it is astonishing to still find yellowfish populations in the Hartbeespoort Dam. (Yellowfish are still found in illegal gill nets.) Recent catches of yellowfish (Lowveld largescale) have improved in the Roodekopjes Dam, further downstream in the Crocodile. The reason is unknown. The polluted Jukskei River is still yielding its yellows. The Apies River flowing through Pretoria is probably one of the most polluted river systems in South Africa. Astonishingly enough, yellows and ghielemeintjies (abundant) are still living in this river.

An intensive netting and angling programme (in conjunction with Eko-Care and Waterlab) a few years ago in the Rietvlei Dam (just outside Pretoria) revealed that the yellowfish populations and black bass (smallmouth and largemouth) were very low in this dam. Only one Northern smallscale yellowfish was netted. No bass were caught or netted. Anglers have occasionally caught only huge carp (10 kg and more). The carp have not successfully spawned for a number of years. The only fish species that survived the water pollution quite well were catfish, which were netted in numbers in our operation. (Significantly, all catfish that have been caught show signs of feminisation, an indication of endocrine disrupting substances in the water.) The reason for these low numbers of fish was attributed to poor

water quality. With the help of Mpumalanga Parks Board a few thousand Northern smallscale fingerlings have been restocked. According to recent reports smallscale yellows are now being caught quite regularly at Rietvlei.

The disappearance of the Bushveld papermouth in the Roodeplaat dam is worrying. A few years ago (10 years) papermouth was almost a nuisance in the Roodeplaat dam. In the last couple of years almost no papermouths were caught in this dam. It is a known fact that Roodeplaat dam is heavily polluted. Largescale yellows are still occasionally seen and caught in this dam.

Gillnetting

Gillnetting is probably a most controversial issue in South Africa. On the one hand it is true that there is a big demand in our country for protein. The supply of fresh water fish can most definitely help to alleviate the much needed protein food shortage in South Africa. On the other hand is it true that illegal gillnetting (and other forms of fish poaching) could pose a danger, especially to our indigenous fish species, like yellowfish. In certain areas like the Olifants River (Mpumalanga) and Sabie River illegal netting operations are a daily occurrence. Many other illegal netting operations in dams like the Hartbeespoort Dam, Roodekopjes, Molatedi continue without almost any policing whatsoever. Again it is indigenous fish species like kurper, catfish and yellowfish that are being caught mostly in these nets. In the Vaal and Bloemhof dams legal netting has been taking place for a number of years, without making any real difference to the carp and catfish population.

The question is whether or how we will control netting in the future? Is it scientifically acceptable to allow netting in any river or dam without knowing what species to target or not to target and how much fish may be removed? In Roodekopjes and Hartbeespoort Dams tons of kurper, especially in the breeding seasons when the fish are nesting in the shallow bays, were illegally netted. Is it viable to continue harvesting our inland fish stocks in this uncontrolled way?

Although stocks of carp and catfish seem not be influenced negatively by netting operations in the Vaal and Bloemhof dams, the question remains what influence do these netting operations have on the yellowfish populations in these dams? Does it matter if the yellowfish populations in these dams are reduced significantly during these netting operations? Is it worthwhile taking into account the advantage represented by employment opportunities and the provision of a much needed food source to the nation?

Netting operations have proved to have a disastrous effect on fish populations elsewhere in Africa. How are we going to manage netting in South Africa in future?

Alien fish species

The influence that alien fish species like black bass, trout and carp have on our indigenous fish species is a subject that has provoked fierce debate in the past.

It is commonly accepted, particularly by many scientists, that certain alien fish species, especially black bass and trout, do have a negative effect on our indigenous fish species, in particular yellowfish species. Pressure that the smallmouth black bass as a prime predator has had on the Clanwilliam yellowfish, Berg-Breede whitefish and Clanwilliam sawfin stocks, is commonly stated as an example of what damage alien fish species can cause to our indigenous fish stocks. Many other similar examples can be mentioned.

Without even trying to be exhaustive regarding this very sensitive issue, I would like to mention a few factors that might contribute to getting more clarity on this issue.

Firstly, it is a reality that these alien species have been introduced to our waters, and it is fortunately or unfortunately something that very little if anything can be done to change the status quo. It is further a reality that these alien fish species contribute to a multi-million Rand angling market with most of our anglers fishing for these species.

One wonders how our fishing waters would have been without these species and whether yellowfish, catfish and kurper would have been a sustainable fishing source, if the other alien species were not introduced in our waters?

The question may be asked what the real impact these alien species have had on our indigenous fish species? Do we really have enough scientific evidence that, for instance, black bass have negatively impacted on yellowfish in the Vaal River system? The black bass in this river system are mostly confined to certain areas, which are probably not the best habitat for yellows in any case. Did the building of dams, weirs, water pollution, etc, not have a much more damaging effect on our yellowfish population? How sustainable are bass populations in our waters? Thousands of largemouth bass have been stocked in Hartbeespoort Dam during the seventies. Before a huge (private) restocking in the nineties, the bass population was almost non-existent in Harties. How long will the current population last, before a restocking will be necessary (if allowed?). Many other examples exist where bass populations dwindled if not restocked from time to time. For example Vaalkop and Rietvlei dams (Pretoria) produced SA record size bass in the past, and do not have any numbers of bass currently. This is the status quo notwithstanding an ethic of catch-and-release by the bass anglers. Will the restocking of the Florida strain bass, which appears to be a much more adaptable breed, cause problems in future? Only time will tell.

In many of our waters we still have a diversity of species, despite the existence of alien species. Is water quality not the reason why much of the indicator and other juvenile species disappear in our waters? In Hartbeespoort Dam the numbers of small species and blue kurper have decreased

dramatically. The development of huge private resorts and golf courses around the shores of Hartbeespoort Dam has caused the disappearance of many of the shallow bays in the dam. These shallow bays are the save havens for small species and juvenile fish. Without them predators like bass and catfish are able to catch these small fish. The huge alga problem causes the shallow habitats to clog up compounding the fate of small species and juvenile fish species. They have to live in dangerous deeper waters, an easy target for predators. On the other hand is the fish diversity in dams with better water quality, despite the presence of alien predators, noticeable. Although bass have been released a number of years ago in Doringdraai Dam (Naboomspruit), only a small number has survived through the years, notwithstanding good water quality and a abundance of other species in the dam. Roodekopjes still has a variety of species despite record size bass. The fish diversity in the Blydepoortdam is still very good, despite the presence of smallmouth bass.

On the other hand many examples exist (especially in the Western Cape) of disastrous consequences that bass have caused to indigenous fish populations. In Rustderwinter dam no dwarf tigers have been caught in the past few years. Is this the consequence of the bass explosion in this dam? During the SA Artlure Championships it was noticeable how difficult it was to catch many of the smaller species like vlei and canary kurper. (However, glasies (river sardine) and dwarf tigers are still there in numbers, despite the presence of bass.)

It is clear that we still have much to learn to fully understand our ecosystems. In our view it is very important that the anglers and scientists share their knowledge and experience to better understand our ecosystems.

However, one thing is very clear, and that is that much better (self) control is needed to prevent the stocking of alien fish species (and indigenous fish species out of their natural distribution areas)! Currently the stocking of these species (especially Florida bass) is continuing unhindered on a huge scale!

Sport fishing

The influence that sport fishing has on our indigenous fish resource is most probably one of the minor influences. In relation to other influences like water pollution and illegal netting, sport fishing, i.e. fishing with a rod and reel, in our view does not compare. All the odds are against the sport fisherman. Taking into account the huge amount of money that the sport fishing industry ploughs back into the economy, it is surely the most expensive fish per kilogram to acquire.

However, this does not mean that fish quotas are not necessary. It is indeed the sport angler who needs to set the example regarding conservation of fish species. What conservation of fish species really entails, especially regarding alien fish species, is a debate in itself. For the purpose of conservation of yellowfish, the Eko-Care Trust is of the opinion that yellowfish quotas, lengths of catchable yellowfish species, angling ethic, etc needs urgent revision.

RIVER RANGER PROJECT

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The River Ranger concept is based on a programme of monitoring all the elements that exist within a stream or estuary. This concept also takes care of any increase of pollution levels or the misuse of water through over-irrigation, over-fertilisation of farmland, soil erosion, and damage to the habitat by domestic animals and in general monitoring any change within the system. This monitoring can be done daily, weekly or monthly as the river may require. That implies that if a river or stream is under "Intensive Care" due to excessive pollution, we can monitor the water on a daily basis and maintain records of all the tests. This function or service is one that we plan to offer the industry in the near future. Imagine owning a monitoring programme on a particular stretch of river or estuary with the full set of results detailed on a web page. Your company name would feature along this where you will be seen as a sponsor to this programme and major contributor to the improvement of our water.

This also implies that we must strive to improve our waters through improving the habitat of the area surrounding the river or stream. This can be done through stabilising the banks, eradicating invader plants, reducing soil erosion and working with communities to better understand the damage created in areas where there are high levels of nutrients being discharged into the water.

We believe that by this method, we will encourage tourism into these areas and will gain the support of the local communities from the increase in business. In addition to which, we will all be working towards the rehabilitation of our rivers to the benefit of all concerned - even the smallest of invertebrate that inhabit the system. The aims and objective of the River Ranger Programme is to assist disadvantaged communities in generating an income from national and international tourists. This we believe can be developed through the transfer of skills in environmental management and the use of a sustainable resource such as a river. Rivers can generate wealth for people living within the area and should be used to alleviate the poverty that surrounds them. This does not imply the abusive use of the system in fact it is the reverse.

Rivers and estuaries support a wide and diversified range of animals, insects and fish, all of which have an enormous amount of potential to the tourist market. We have regrettably ignored this and to the extent that we have chosen to pollute our rivers instead of respecting them as potential money earners. Birds, insects, animals and fish seen can be resold many times without touching them. We do not have to kill a thing nor do we have to capture anything and to resell it overseas.

The River Ranger program is designed to change this thinking and to train previously disadvantaged people to become the eyes and ears of the river. By this we mean that they are to become the knowledge base of the river or estuary. This implies that they are to develop an excellent knowledge on the birds found in the area, insects found in the water, fish types and the nature of the river's behaviour.

In addition to this they have been taught to detect pollution levels, soil erosion and where possible rectify the problem. They are also taught to read the quality of the water by monitoring the insect activity within the system and in this way keep records of the river's activity. Weekly readings of pH, temperature and dissolved oxygen (subject to available equipment) will also be taken and recorded. Any notable change will be reported. Where do they come from? The rangers are appointed from the local community closest to the river or estuary. They then undergo a training program for a period of twelve months.

There are too many stream, rivers and estuaries for one person to implement and to train as River Rangers. Having worked at it for nearly three years we can say with conviction that it is a hard slog most of the way requiring many hours of training. Many of the ideas in this concept are new and foreign to local communities and require "buy-ins" by the community leaders, councillors and chiefs. Having said this, we would however like to say that it has become most rewarding work.

In order to develop further, we believe that a River Ranger Manager programme should be set-up to train people to manage teams of up to twenty river rangers. This training programme would initially include most of the above except that of flyfishing, birding and E&E programme which may take 10 to 12 months to initiate. However, over a period of a few years, it would be possible to have well trained River Ranger Managers and River Rangers working our rivers as an income generator.

In order for this programme to become sustainable a major portion will depend on the marketing and communication to the market. We are also under no illusions in this regard and realise that a programme of this nature will require intensive marketing. Sponsors wishing to join in this programme and assisting in the marketing will receive full use of the River Ranger logo as well as many branding opportunities on the boats and clothes.

Imagine owning a monitoring programme on a particular stretch of river or estuary with the full set of results detailed on a web page. Your company name would feature along this where you will be seen as a sponsor to this programme and major contributor to the improvement of our water.

What is their main function? Their main function is to become the eyes and the ears of the river or estuary. The river can be a major income generator for a ranger and they are taught to realise sustainability by working at preserving it.

What are they to do? In brief, the River Ranger program includes working on the rehabilitation of a river system and to be in a position to identify and eradicate invader plants, repair banks, identify insect species, monitor water quality, guide birders and flyfishers.

How do they get paid? We, B2 Marketing, campaign for sponsorship, which includes the cost of training, clothing, salaries and equipment. We are however forever looking for sponsors to assist in developing the programme further - our details are at the end of this brochure. Other forms of payment would be from the tourist for their services.

Is a River Ranger limited to fresh water? No, River Rangers can be trained to work a saltwater system such as an estuary or an inland river where it is manageable to do so. Our estuaries offer many benefits to communities as they are in better condition than many of our fresh water systems.

What is a manageable river? A manageable river is usually under the control of a community, conservancy initiated by community leaders, local farmers or concerned conservationists.

What is a manageable salt-water estuary? A manageable saltwater estuary is usually a short stretch of water of up to 10 - 20 kilometres in length and one that the local communities are prepared to support.

How many River Rangers per river? This depends on the amount of funding we can obtain. We usually aim for ten on a stretch of 40 kilometres of a freshwater system and less on an estuary. Manageable estuaries are usually only a few kilometres in length.

Will a River Ranger threaten specialised guide operations? No, the River Rangers are there to assist these operations and can be used by the guiding company or tourist operator. The ranger must then be paid for his services by the guiding operation. This is irrespective of whether a sponsor is paying the River Ranger a salary or not. Are the River Rangers THETA approved? The training programme is based on the principals of guiding as set out by THETA. They will receive accreditation after a twelve-month programme. This accreditation can be at level 2 or level 4. Level 4 is the higher of the two and the one we aim to achieve.

Can the River Ranger enforce the law? No, they cannot. They may not enter into any discussion with anyone breaking the law. They can however note details such as car registration number or other forms of identification and report the incident to the conservancy manager, hotel owner or whoever is available on the management committee.

iTAG: THE WAY FORWARD FOR THE CONSERVATION OF TIGERFISH (*HYDROCYNUS VITTATUS*)

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Abstract:

iTAG Conservation Projects was formed in 2000, as the logistical and financial support group to the Mpumalanga Parks Board telemetry project in the Incomati system. iTAG employs a fulltime student and river guides as part of their commitment to river conservation. The goal of iTAG is to promote river health in the Crocodile and Komati Rivers using the Tigerfish as a flagship species. Holistically iTAG can be seen as the watchdogs in the Incomati River System and are actively involved as an NGO to promote sustainable, community driven conservation management of the rivers. They have been involved on a national level in IFR determinations and the fish ladder implementation programme. At present as part of the Tigerfish project iTAG is promoting the flyfishing potential of the species and are implementing a commercial, indigenous flyfishing operation.

The original power point presentation is available from the author or the editor.

AN INTEGRATED APPROACH TO CONSERVATION MANAGEMENT OF 'YELLOWFISH'

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INTRODUCTION

The unique animals and plants of our country cannot be viewed as single entities, since they are closely linked to their environment for their survival. Conservation managers ultimately seek to maintain functional ecosystems within wider protected landscapes in the face of severe human impacts. However, some conservation activities have to occur below the ecosystem level of biological diversity, since many species are threatened with extinction, therefore requiring urgent and intensive conservation actions to save them. Add to this the fact that management actions to achieve the above conservation goals cover many fields of social and biological sciences, which all have to be justified economically, and one can understand why a multifaceted approach is needed to conserve our biological diversity. Freshwater fishes form an important part of our natural heritage and aquatic environments and we are probably the last generation that can prevent many of our indigenous species from becoming extinct.

This forum has recognised that "yellowfish" can play an important role in:

- Conservation of ecosystems
- Conservation of threatened species
- Creating public awareness and interest in aquatic environments
- Ecotourism (economic benefits)
- Promotion of flyfishing

We feel, however, that the link between these different aims is often tenuous and counter productive. This all points towards the need for a clear vision for the group and a framework for the management of "yellowfish" to ensure their continued survival as natural entities and to ensure that they can be utilised in the future. Conservation and utilisation should proceed as two different fields, which could benefit each other, rather than viewing them as a case where success in one will cause success in the other. Here we focus on biological and conservation aspects and:

- Give a simple explanation of how speciation can occur and why it is important to consider for conservation management
- Emphasise the need for "within species conservation"
- Propose an integrated approach to the conservation management of "yellowfish" which can potentially be used to develop a framework for their conservation
- Propose a direction in which actions should proceed within the approach
- Point out the need for a clear vision for the YWG

SPECIATION

Naively, speciation modes can be divided into allopatric ("apart") and sympatric ("together") speciation. Allopatric speciation classically occurs when two populations are isolated from each other by a physical barrier, thus preventing migration and breeding between them. It is thought that in isolation, the two populations can become different genetically, morphologically, ecologically and behaviourally, which probably depends on how different the environments are. Examples of physical natural barriers for freshwater fishes are river captures and sea level changes that can isolate populations in different river systems or, for example, unfavourable habitat conditions within the same system (Fig. 1). The main driving force behind sympatric speciation is ecological adaptation, where for instance two forms adapt to different habitats within its natural distribution. In order for this kind of speciation to occur, the two forms must start breeding in their habitat of choice (Fig. 2).

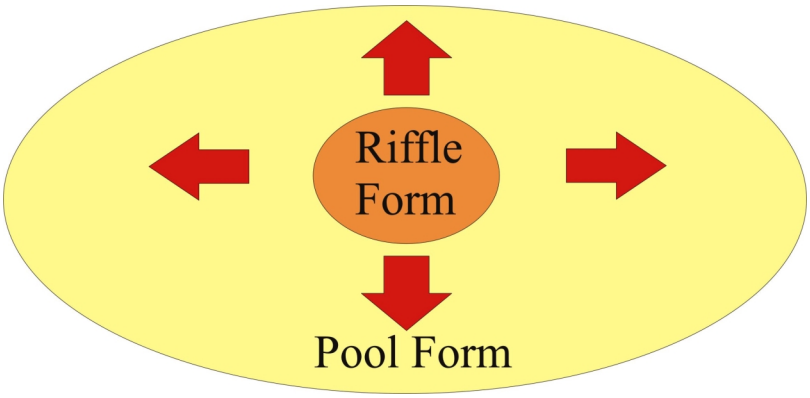

Fig. 1. Sympatric speciation where the one form ("riffle form" in this example) adapted to a certain habitat ("riffles" in this case) and started breeding in that habitat. After speciation it then spreads to other areas.

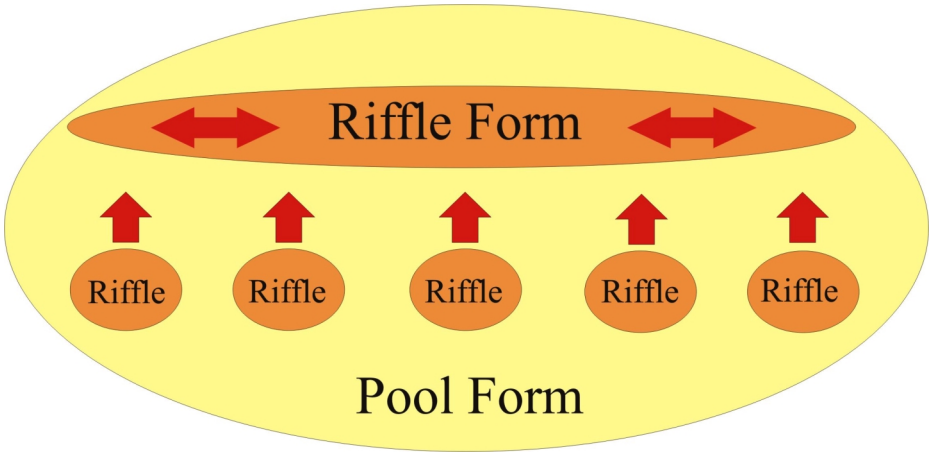

Fig. 2. Sympatric speciation where the one form ("riffle form") adapts to a certain habitat type ("riffles" in this case) across a wide area. This new "riffle

form" then starts to breed preferentially with "riffle" individuals from the same riffle and "riffle" individuals from elsewhere, eventually leading to complete speciation.

THE NEED FOR "WITHIN SPECIES" CONSERVATION

Intraspecific conservation (intra = "within", specific = species) has become more and more important in conservation management as more conservation biologists started realising that variation within species provides the raw genetic material for selection that enables species to adapt to changing environments. For example Quattro and Vrijenhoek (1989) has shown that genetic diversity can play a role in the fitness of populations and Leberg and Vrijenhoek (1994) showed that high genetic diversity can improve resistance to parasites. One of the biggest threats to the survival of threatened species is inbreeding, but since it is difficult to measure, it is often neglected in conservation planning. One of the aims of studying "within species" diversity is to estimate levels of inbreeding and to make recommendations to minimise its effects. "Within species" genetic diversity can be used to predict the long-term survival chances of species, which can be a very powerful tool to conservationists to help them to predict future trends and threats so that they can act before disaster strikes.

AN INTEGRATED APPPROACH

A summary of the approach is given in Table 1

Table 1. Integrated approach for the management of "yellowfishes" showing possible phases actions or aims within those phases and the data or benefits (for the conservation o "yellowfishes") that can follow from the actions. Aspects of this approach can possibly b used to construct a framework for the conservation and promotion of the "yellowfishes".

Phases	Actions or aims	Data or Benefits
Surveys	Documentation of the distribution	GPS localities
	Collection of biological material	Morphological samples (usually whole fish in formalin) Genetic material (tissue, fin-clips or whole fish in EtOH or frozen) Parasites & other invertebrates
Systematics	Molecular (Genetic) data collection & analysis	Sequence and frequency data
		Relationships and evolutionary history Gene Flow Ecology Adaptations
	Morphological & Morphometric data collection & analysis	Morphological adaptations Taxonomic classification

Observations and field and lab studies

Conservation Management		
Threatened species	Conservation assessments	Conservation Status (IUCN listing)
Approach	Prioritisation	Actions and money where needed most
	Targeted rehabilitation.	More habitat for threatened species and co-occurring species
	Establish number of populations	Geographic data and baseline information for PVA
	Assess population size	Monitoring, inbreeding risk and baseline information for PVA
	PVA	Predictive abilities
	Barriers	Prevents re-invasion by aliens
	Transplantation	Back-up populations and therefore security
	Utilization moratorium	Temporary prevention of exploitation of a vanishing resource
	Monitoring	Improvement of PVA (predictive abilities) and evaluation of recovery
	Custodianship	Preventing further impacts
Ecosystem Approach	ID areas with potential (GIS)	Biodiversity conservation & pristine areas for Ecotourism
	Prioritisation	Actions and money where needed most
	Community involvement	Success
	Eco-tourism	Further rehabilitation & maintenance of ecosystem
	Monitoring	Evaluation of rehabilitation & impacts from utilization
ID Flagship Taxa		
Promotion	Public & business interest	Eco-tourism, custodianship, community involvement and ultimately rehabilitated ecosystems
National Policy	Unifying conservation & public interests	Co-ordinated management

Surveys

Information gathered from biological surveys will always form the basis for planning conservation management actions for threatened species or ecosystems. The main product from surveys is most often, accurate distribution data of the species involved in the form of complete locality information. Specimens should be labelled properly and be clearly linked to tissues that have been dissected from it. This information can be fed into a database for future reference. Biologists and conservationists have to be able to trust locality information, since important and far-reaching decisions can be made on these. Typical locality or specimen information for freshwater fishes can include the following (underlined = essential information):

- Species name, preferably scientific name
- Locality (site) description including the name of the river, e.g. Trouble River under the bridge of the N1 between Pretoria and Johannesburg
- Latitude and longitude worked out from a map or measured with a GPS e.g. 33° 44' 55'' S 20° 30' 40'' E
- Date
- Preservation method (usually formalin for morphological samples and EtOH or frozen for DNA samples)
- Collectors
- Linking morphological specimens to DNA and other samples
- Tissue type, e.g. muscle
- River system name
- District, province and country
- General comments, e.g. weather, behavioural observations or impacts noted at the site

Typical tissues that are dissected from fish for genetic analysis are muscle, liver, heart, kidney, gills, fins, scales, etc. Only frozen tissue (preferably collected in liquid nitrogen and stored thereafter in a special ultra deep freezer at -80°C) can be used to study enzymes (e.g. allozyme electrophoresis). DNA methods can be done on tissues that have been dried, frozen or preserved in EtOH (95% ethanol). Frozen tissue or tissue preserved in EtOH is preferred. EtOH is not preferred for the preservation of morphological material, since the specimen dehydrates (loses water) which causes changes in the body proportions. Therefore formalin is used to fix specimens in the field. Museums will prepare the specimens thereafter for long-term preservation. These specimens are essential for future reference and identification.

Systematics

Genetic approach

Genetic studies typically produce sequence or frequency data that can be used to construct trees (similar to family trees called phylogenies) or to assess frequency differences among populations or species (to assess for example migration among populations as in population genetics). The great advantage of genetic studies is that they are able to give us a perspective on the evolutionary history and relationships of species. That allows one to identify populations that have been isolated from others for a long time, rendering them important for conservation efforts. This contributes to an

understanding of priority areas for conservation, especially if different species are compared in a landscape approach. It is also important to understand the movement of animals of conservation concern, since it helps to design recovery programs and indicates which areas or corridors are important for protection. But the molecular approach can and does also contribute to a better understanding of the ecology (often referred to as molecular ecology) and behaviour of species. The importance of this is discussed further below. A relatively new field in conservation genetics is the assessment of the adaptive value of genes. When more genes become available to assess in this way for our freshwater fishes, we would be able to make direct comparisons between genetic diversity and the "health" of populations.

Morphological and morphometric approach

The role of morphological ("form and structure") and morphometric ("measurement of body proportions") analysis is indispensable. Sound identifications are needed before any project starts. Morphological and morphometric analysis comes into its own right in species descriptions. These data sets also play an essential role in phylogenies ("family trees" and relationships) and the assessment of adaptive divergence.

Ecology and behavioural ecology

It is essential to assess ecological and behavioural adaptations of populations, since these might be localised and therefore need special protection. Also, behavioural or ecological differences might profoundly affect how one designs a conservation program or where protected areas are proclaimed. For example, different fish might prefer to breed in different habitats. Therefore, different habitat types have to be included in conservation areas to protect breeding grounds for all species. The feeding biology, breeding biology, age class structure, age of first breeding, lifespan, effective population size (number of individuals that breed), fitness (number of offspring surviving and that eventually breed), habitat preferences, interactions with other species, etc. are just some of the data sets that are needed to design an effective conservation strategy. The better the data sets, the more accurate the strategy will be. Probably the most important product of such data sets is that one can do a population viability assessment (PVA). This allows one to predict population growth, recovery time after disasters, what role inbreeding is playing in population decline, etc.

Conservation Management

Conservation authorities can only succeed in their conservation efforts if they proceed on both the species and ecosystem levels. Bowen (1999) suggests: "Perpetuating species without ecosystems makes as much sense as preserving ecosystems without species".

Threatened species approach

Probably one of the first actions to be taken under this approach is to assess the conservation status of the species of concern. The "health" of the species is evaluated and includes the following aspects (IUCN, 2000):

- Rate of decline
- Population size

- Area of geographic distribution
- Degree of population and distribution fragmentation

The species will then be listed under a suitable category, which ranges from "Extinct" to "Not Evaluated" (IUCN, 2000 and see their website for further information: www.redlist.org).

Recovery programs should be set up for species that are listed and prioritisation should be done to address the most threatened species first. Prioritisation has the advantage of channelling time, money and effort to where it is needed most. We are sadly lacking in this regard in terms of the threatened freshwater fishes. In terms of the "yellowfish", a moratorium should be placed on utilisation of the most critical populations of threatened species. This will prevent exploitation of a vanishing resource so that it can recover through rehabilitation. Landowners and other stakeholders will always play an integral role in this. If they take custodianship of a threatened species, it will at least prevent further impacts.

The most efficient way of designing recovery programs is to do a population viability assessment (PVA). Several aspects of the biology of the species is needed to do a PVA which was touched on in the "ecology and behavioural ecology" section above. A PVA allows the conservation manager to predict how a population will respond to the recovery program and which are the most critical threats to survival. In a way it acts as a scientific way of prioritisation within a recovery program, since it points out which aspects will benefit the recovery of the species the most. Again, this helps to focus time, money and efforts to where it is needed most. Survey, systematic and ecological data play a continuous role in improving knowledge of the species and is needed to re-evaluate the PVA. What follows naturally is targeted rehabilitation, designed to provide maximum benefit to the threatened species. A side product of this rehabilitation is of course that it can benefit other indigenous species, but it is not the main aim. In terms of threatened freshwater fishes in the Western Cape, it inevitably means that alien fishes have to be eradicated. Barriers will have to be constructed to prevent re-invasion by the alien fishes, but these are expensive. In very serious cases, transplantation can be considered, but this should preferably only occur in areas where the species occurred before. Extensive impact assessments have to be done including an assessment of the aquatic insects that may be affected by translocations. If another threatened fish species or any other organism is going to be affected negatively by this, then this action has to be re-evaluated or adjusted. Currently the only "yellowfish" species that can be considered for this type of conservation action is Berg-Breede whitefish (*Barbus andrewi*).

Ecosystem Approach

The first action in this approach is probably to identify suitable areas. Positive aspects include pristine habitat, the possibility to rehabilitate or the occurrence of unique species. It is very desirable for the area to cover a catchment, since it allows for "top to bottom" rehabilitation in rivers which is the only way in which most threats to rivers can be eradicated. Similar to the "threatened

them to maximise efficiency in terms of money, time and effort spent. Community involvement is very important, but is best left to social scientists to discuss. Suffice for us to say that the eco-tourism should benefit both the environment and the local community. Conservation managers should monitor the additional impacts that eco-tourism will bring to the region.

A possible recommendation later in the development of a protected area (conservancy) may be that there should be areas of high and low impact within the region to further benefit the conservation of the local species.

Flagship Taxa

Now follows the identification of flagship species that can be used to promote the protected area both in terms of funding for purely conservation efforts and for the eco-tourism market. The main aim of identifying flagship species is to create awareness for a particular species so that it can act as a representative for the protection of a wider ecosystem (Skelton, 2000). Any conservation efforts targeted at the flagship species will then benefit the general "health" of the ecosystem. One has to be careful, however, that one does not fix something that is working already. If identifying a particular species as a flagship causes additional threats from eco-tourism or conservation efforts, the entire strategy has to be re-evaluated. These additional threats have to be evaluated prior to promoting an area for eco-tourism.

Promotion and National Policy

If all of the above are in place, promotion of selected flagship species can proceed for selected suitable areas that can deal with additional eco-tourism impacts or for which mediating strategies are in place. A national policy (which should include national standards, aims and vision/mission statement) is needed at this stage to unify provincial ones. This, of course, includes the establishment of national regulations for catching indigenous species, which is being addressed.

CONCLUSION

If the national strategy for the conservation of "yellowfish" is to allow for sustainable utilisation, actions should proceed in the correct directions (see Table 1). If actions proceed in the wrong direction (e.g. "promotion" before a recovery program for threatened species is in place), serious problems can arise that could be counter productive to the YWG's aim of conserving yellowfish through its actions. Please note that we strongly believe that the philosophy for the conservation of "yellowfish" should be "conservation to improve potential for promotion and utilisation" rather than "promotion and utilization to improve conservation". One example of this is the promotion of catching all nine "yellowfish", where certain threatened populations are definitely not "ready" for utilisation since they should form part of a recovery program first, before being utilised. It may take some years before these threatened populations in rivers become available for utilisation, but if the YWG is serious about its mission, then it should be prepared to accept this reality and contribute to "true" recovery of threatened species. This will then be measured in the number of rehabilitated rivers that allow the threatened

species to recover by itself (Berg-Breede whitefish being the only one that can be considered for re-introduction into the Berg River System from the Breede River System). We hope the approach outlined in this article will stimulate debate and contribute towards establishing a national framework of actions for the YWG, so that scientific knowledge, the status of threatened species and their ecosystems and the potential for utilisation can improve.

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IDENTIFICATION OF CONSERVATION UNITS OF TWO YELLOWFISH SPECIES: *LABEOBARBUS KIMBERLEYENSIS* AND *L. AENEUS*

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The talk outlined the background and motivation to the current investigation of genetic variation within and between the two yellowfish species from the Orange/Vaal system and reported on sampling and preliminary genetic results. AngloGold Limited, Trans Caledon and FOSAF are funding this pilot study.

Background

Seven *Labeobarbus* species, commonly known as yellowfishes, occur within southern African waters (Skelton 1993). Relationships between these species are still uncertain but there appear to be two groups, namely the large-scaled (*L. codringtonii* and *L. marequensis*) and the small-scaled group (*L. polylepis*, *L. natalensis*, *L. capensis*, *L. kimberleyensis* and *L. aeneus*). The evolution of the southern African yellowfishes, especially the so-called small-scaled group, is centred on the Orange River basin (Jubb 1964). *Labeobarbus capensis*, *L. natalensis* and *L. polylepis* have relatively restricted distributions in the southwestern Cape, KwaZulu-Natal and Mpumalanga/Limpopo Provinces respectively and each occurs in isolation of other small-scaled *Labeobarbus* species. In contrast, *L. aeneus* (smallmouth) and *L. kimberleyensis* (largemouth) occur widespread and sympatrically throughout the Orange-Vaal system. Earlier authors suggested that these five species have diversified from a common ancestor that invaded the Orange River basin from the north during the mid-Pliocene (2-3 million years ago; Jubb1964) while Skelton (1994) proposed a much earlier invasion of the system during the early-Tertiary (40–27 million years ago; Oligocene to Miocene). Recent DNA data, tentatively date the split between *L. capensis* and *L. polylepis* to 500 000 to 1.5 million years ago (Tsigenopoulos et al. 2002) and the split between *L. kimberleyensis* and *L. aeneus* is therefore likely to be more recent.

Although some authors (Jubb 1964) are of the opinion that *L. aeneus* and *L. kimberleyensis* could be easily separated at species level, the morphological distinction between the species is not clear-cut (see Eccles 1986). Oellermann (1988) found a considerable degree of overlap between the two species based on linear morphological measurements. According to the key proposed by Skelton (1993) the species can be distinguished from each other based on the distance between the orbit and the preoccular groove relative to the snout length as well as the position of the mouth (terminal in largemouth and subterminal in smallmouth yellowfish).

There are some important life history differences between the species. *L. aeneus* is an opportunistic omnivore, and benthic feeder. The juveniles (50-

300mm) are predatory, feeding on zooplankton, insects and insect larvae, but change to a benthic lifestyle later (Allanson & Jackson 1983). Adults eat mainly filamentous algae, other aquatic vegetation and benthic invertebrates and detritus (Allanson & Jackson 1983). The species also feeds on large numbers of freshwater mussel (Tomasson 1983). *L. kimberleyensis* is a predator from its juvenile stage, initially having a similar diet to *L. aeneus* juveniles, up the 30cm length (Mulder 1973), but develops increasingly piscivorous tendencies with age (Tomasson 1983). The gut length is shorter than *L. aeneus* as expected for a carnivorous species (Eccles 1986). Tomasson (1973) noted two important differences between the two species; *L. kimberleyensis* appears to be adapted to warmer climate as it spawns 4-6 weeks later (into the summer) than *L. aeneus* and has a late resumption of growth. The survival of egg and larvae is related to time of spawning; a weak year class may result from the late spawning which may be a reason why *L. kimberleyensis* is less abundant than *L. aeneus*. *L. kimberleyensis* becomes increasingly piscivorous with size, allowing the species to reach a larger size than *L. aeneus*.

Why is it important to conserve species and variation within them?

The species category has been used extensively within a conservation framework including conservation legislation (Meffe & Carroll 1997). Yet, biodiversity incorporates much more than just species diversity. The Convention on Biological Diversity (CBD) defines biological diversity as: "variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems" (CBD Article 2). In addition, the debate over species concepts has led to the question of how to identify unambiguous "units" for conservation.

Loss of species diversity is more quantifiable than loss of genetic or habitat diversity (Meffe & Carroll 1997, Templeton et al. 2001). Even though the species category will therefore continue to play an important role in conservation, it is time within the South African context to move away from a typological view to a process orientated approach that aims to conserve entities but, more importantly, to conserve the ecological and evolutionary processes that generate diversity. For the effective management of biological resources it is therefore necessary to identify the level of genetic variation within and between populations (O'Connell & Wright 1997) as genetic variation is the raw material for evolutionary change including both adaptation and speciation (O' Connell & Wright 1997, Templeton et al. 2001).

Aims and preliminary results

The aims of the pilot study were therefore to identify conservation units within the two species and to formulate recommendations for the management of these units. In order to achieve these aims genetic variation was assessed between 71 *L. kimberleyensis* and 145 *L. aeneus* representing sites from the Upper and Lower Vaal as well as the Upper and Lower Orange. If two species have been distinct for a considerable length of time one would expect

to find distinct genetic differences between them. Furthermore, if this time of separation has been long (hundreds of thousands to millions of years) there would have been enough time for differences within each to develop and one would be able to identify distinct populations that should be managed independently.

The preliminary results do not show such a clear distinction between these two species, indicating one of two possible scenarios. Either the two species are very closely related so that insufficient time has elapsed to distinguish them at this level of genetic variation or there are instances of hybridisation between them. In order to determine whether they are hybrisiding the follow up investigation will look at a combination of morphology, parasites, allozymes (protein level variation) and DNA variation. The present data however did indicate the presence of some conservation units, for example, distinct genetic lineages were found in the lower Orange and this area should be managed as a separate conservation unit.

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CONFEDERATION OF SOUTH AFRICAN SPORT ANGLERS

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1.

President: Mike Beaurain – SA Fed.of Sea Anglers
Vice President: Gerry Leach – Bass Angling
Committee Members.
Secretary: Betsy von Vielligh – Deep Sea
Treasurer: Fred Visagie – Fresh Water
Development Officer: Neville McKenzie – Fresh Water
Other Members: Ruben Papenfus – SA Fed. of Casters
Glenn Kitchenbrand – SA Federation of Artificial Lure & Fly Angling
John Pledger – SA Fed. of Sport & Sea

2. Structure: SA Sport Anglers & Casting Confederation

refer to Organogram on the last page.

3. Vision

To develop and promote angling in the Republic of South Africa for all South Africans

4. Mission Statement

To develop and promote angling in the RSA, to enable all sections of our community to enjoy the benefits of a sport that offers so much to everyone who is interested in the organised and recreational sports.

5. Core Business (Key Performance Areas)

To facilitate, promote, engage, advance, develop and generally to assist and protect the interest of the game of Sport Angling and Casting.

To arrange, control, regulate and if necessary and possible finance the visits of overseas teams or players to areas

To arrange, control, regulate and finance visits of South African teams or players overseas, either solely or in conjunction with the governing bodies of the places visited.

To create mechanisms whereby individuals can access all forms of sport development, whether as a caster, angler, official, coach or administrator, from foundation to elite level.

To encourage participation of people who are not or were not encouraged to participate in sport, and priority will be given to the following target groups:

* Youth
* Rural Areas
* Black People
* Women
* Disabled

To increase the standard of angling and casting through education and training programmes.

To identify and develop talent into world class medal winners.

6. Communication of Development Plan

Structured analysis and approach to the implementation of a Confederation, Federation and/or Association National Development Plan.

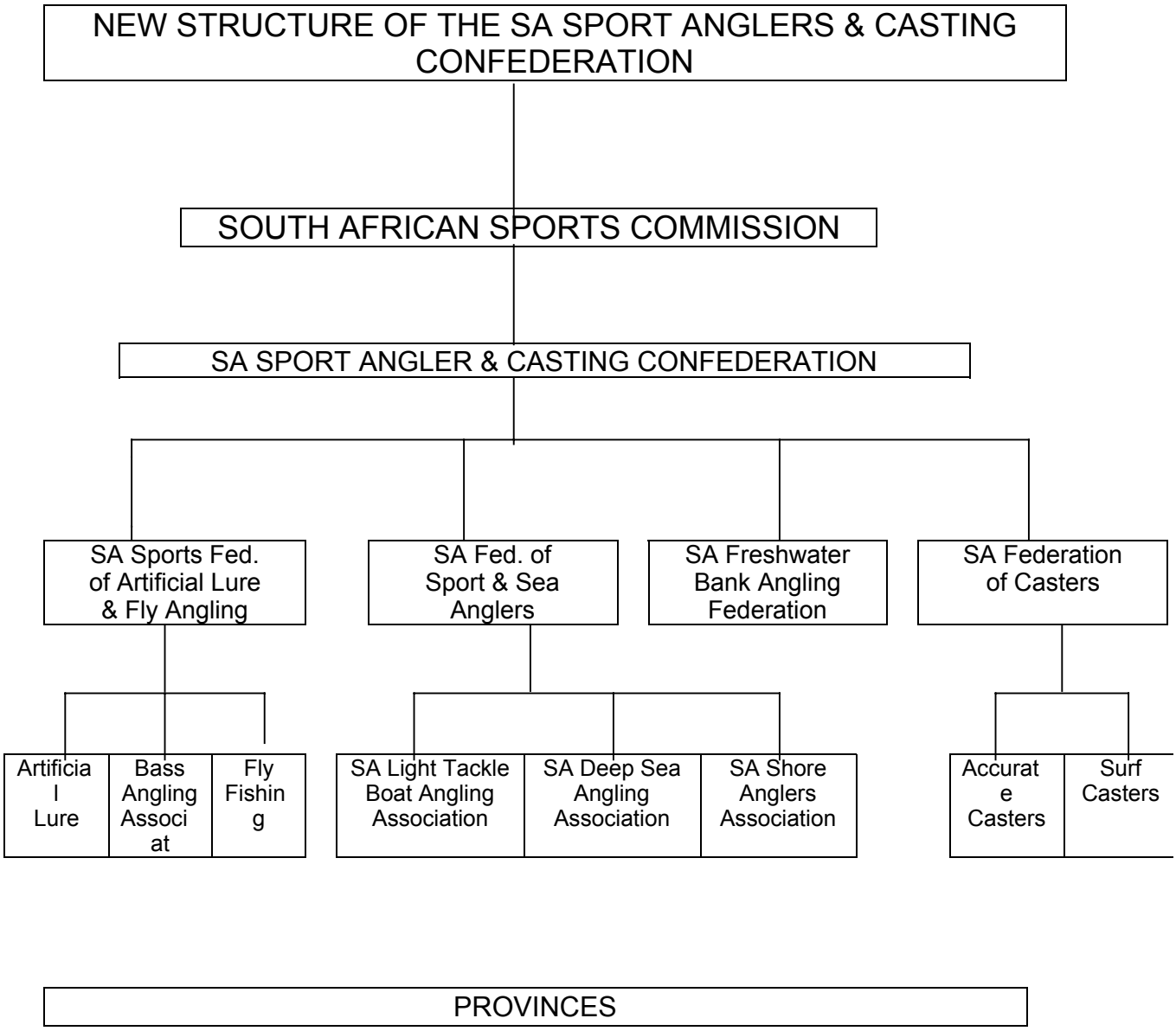
7. Funding

Compile budget structure for global funding that is from Club to Confederation level.
Define criteria's for every element in the budget (result driven)
Define source of funds (funds generators)

8. Affiliations

Affiliated to the following organisations:

Confederation Inter Nationale de la Peche Sportive
Federation Inter Nationale de la Peche Sportive
European Federation of Sea Anglers
SA Marine Linefish Management Association


NEW STRUCTURE OF THE SA SPORT ANGLERS & CASTING CONFEDERATION
SOUTH AFRICAN SPORTS COMMISSION
SA SPORT ANGLER & CASTING CONFEDERATION
SA Sports Fed. of Artificial Lure & Fly Angling
SA Fed. of Sport & Sea Anglers
SA Freshwater Bank Angling Federation
SA Federation of Casters
Artificial Lure
Bass Angling Associat
Fly Fishing
SA Light Tackle Boat Angling Association
SA Deep Sea Angling Association
SA Shore Anglers Association
Accurate Casters
Surf Casters
PROVINCES

SA FRESHWATER BANK ANGLING FEDERATION (SAFBAF)

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Abstract

The South African Freshwater Bank Angling Federation was established in 1957 and is dedicated to the promotion and control of bank angling as an organized sport. An executive committee ensures that the sport is conducted in accordance with legislation, rules and regulations. With environmental issues that are becoming more prominent, the federation has committed itself to the preservation of our natural resources.

1. Introduction

On behalf of the South African Freshwater Bank Angling Federation I would like to thank FOSAF for their invitation to participate in this important event.
The objective of this presentation is:

a) To introduce you to our organization.
b) To give notice of our approach to conservation, and
c) Particularly our position on Yellowfish.

2. Who are we?

South African Freshwater Angling came into being in 1957 as a sporting organization and is a category “A” sport with close to 10 000 affiliated members from 14 provincial bodies. In 1991 the South African Angling Union was disbanded and freshwater angling became an autonomous angling federation. In 2002 the term Bank Angling was added to the title in line with international terminology.

It is affiliated to the SA Sport Federation as well as FIPS the world controlling body.

Affiliated members participate in club and league competitions, attend provincial trials and through this avenue achieve provincial and national colours.

SAFBAF subscribes to the conservation of our indigenous fish species.

SAFBAF has formal angling rules that are applied by Provincial and SA Registered Officials. These rules exceed the requirements of all Acts and Ordinances.

3. How does SAFBAF stand on Yellowfish?

SAFBAF has taken note of the research that has been done on the yellowfish population and heeded the call to conserve the yellowfish population. This decision was taken in 2002 and reinforced at the annual general meeting in March this year.

The bag limit as specified by Free State Nature Conservation has been adopted as a national limit and applies to all provincial associations affiliated to SAFBAF. This has also been extended to club level competitions. This means that no largemouth yellowfish are to be taken. Smallmouth yellowfish are restricted to two in the bag at any time. The practice of releasing fish after the day's competition is encouraged.
If we take in consideration the social angler who is not a member of SAFBAF, who fishes with a canoe, makes a feeding spot (with marker) and slaughters the fish our efforts cover less than an estimated 1% of the angling population. If we look at the organizations represented in this Working Group we are talking to the converted and our efforts should be directed at the angling population at large by finding means of educating the public and methods of enforcing legislation.

4. What other conservation actions?

The use of live toads (platannas) has been banned by SAFBAF. However a dead toad may be used for bait. This was done in order to comply with the Animals Protection Act 71 of 1962 article 2.1. This Act implies that an animal must be humanely killed before use. This was specifically aimed at livestock and subsequently extended to other animals that are commercially bred for use.

The following items are under investigation:

a) When fishing with light tackle and a fish is hooked that has a mass exceeding the line strength, the ensuing fight causes the build-up of lactic acid in the body of the fish. Excessive lactic acid causes the death of such fish when released. This is based on research conducted in the United States and Australia. The ideal situation is to land the fish as quickly as possible.
b) Another concern is the line pollution that is taking place in our waters. This matter is starting to get out of hand and if not addressed, will lead to the loss of angling venues. This again will lead to the demise of sport angling.
c) Another subject is the use of polystyrene as a floating bait. Once ingested by fish this causes a blockage in the intestines, causing the fish to starve to death. Some research has been done by RAU and we are in the process of obtaining the research information in order to make a factual decision on the matter. In the mean time we have placed a moratorium on the use thereof.

5. SAFBAF Participation

SAFBAF regards this Working Group as an important avenue of interaction and communication and will endeavour to continue with active participation.

In closing; this forum can assist Government and the Sport Angler in coming to an equitable solution regarding our environmental concerns that will help to maintain and expand our resources for generations to come.

SAALAA (SOUTH AFRICAN ARTIFICIAL LURE ANGLING ASSOCIATION)

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- Better known as Artlure anglers
- Well-established angling facet in South Africa.

- Use only artificial lures (including fly fishing tackle)
- Do species angling
    - See how many different fish species a competitor can catch during a competition
    - This includes any fish species from dwarf species like glasie (river sardine), dwarf kurper, ghielemeintjies etc up to catfish, carp bass, etc.
    - Only one fish per species counts (no bags allowed)

- Bonus points for catch & release
- Depending on the particular dam about 5-15 different species usually caught on a day.

- Artlure very conservation minded
    - Keep only one fish per species
    - Very important to have a thorough knowledge of the aquatic ecosystem to know where to catch the different fish species

Suggestions regarding legislation on yellowfish conservation:

- Because we are doing species angling we only catch one fish per species
- We are very much in favour of strict bag limits
- We suggest that if strict bag limits are introduced the restraints on size of a species could be abandoned
    - In our sport this will prevent unnecessary handling of large numbers of under-sized fish, until a yellow that is big enough (legal size) for keeping is caught
    - The minimum legal size is normally the breeding-stock that is being kept – rather keep a limited number of any size which will include smaller ones
- If a minimum size is introduced, we need clarification whether Artlure can still weigh under-size yellows to prevent the large-scale handling of smaller fish until a big enough specimen is caught?

REGIONAL REPORT: KWAZULU-NATAL

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Draft Strategy for 2003
Committee: Focus on the establishment of a committee
Current members are:
- Hester Plank
- Mike Wentzel
- Allen O' Connor
- Neil Button

Further members are sought in the following areas:-

- Tourism
- Angling representative
- Farmers Union
- Black representation/government
- Nature Conservation
- Water Board

Short Term Ideal

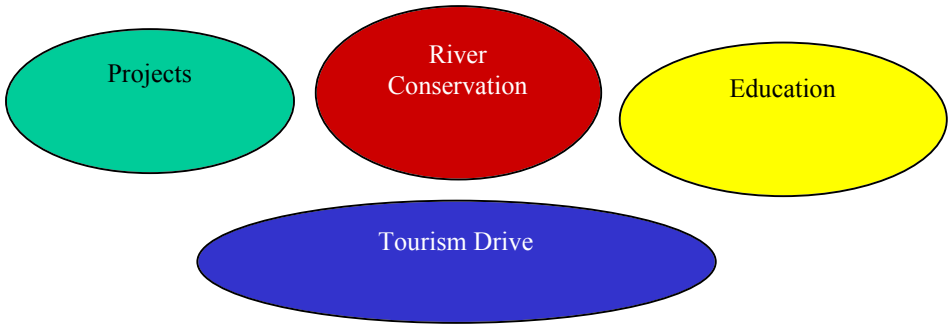
- Co-ordination of conservation and tourism of Yellowfish in KZN

Immediate Needs

- Full strategic plan (to be completed by Hester and Allen)
- Complete formation of committee

- Map of KZN
  (To accurately and clearly identify the major river systems and can be used as a
  source of reference for tourism and riparian owner tagging)

Draft Plan Structure
Key areas for planning of the KZN YWG



Goals 2003

- Completed Strategic Plan July 2003
- Committee formed Dec 2003
- River/ riparian owner pilot project completed Aug 2003
- Fish Sampling completed Aug 2003
- Angling survey completed Sept 2003
- River research done using existing information e.g. water quality, tourism opportunities Dec 2003

Fish Sampling - Volunteers used

– Horst Filter – Blood River – – Mkuze River	– Richard Arderne – Polela River – Upper Mkomazi River – Upper Mooi River –	– Alan Howell – Upper Tugela River – Klip River – Ngagane River
Andrew Howell – Mlaas River – Mdloti River – Lower Tugela River	Wally Schroeder – Duzi River – Mgeni River – Mvoti River	Rodney Owen – Mlalazi River Hester Plank – Lovu River – Lower and Middle Mkomazi
Tugela River – Special problems – Unsafe in tribal land around Tugela Ferry – Suspected genetic mixing Other sites proposed – Band of volunteers to test at Zingela Lodge	– Unallocated sites – Southern area – Mtamvuna River – Mzimkulu River – More North – Mfolozi River – Mhlatuzi River	

Issues

Fish sampling Mpofaan/Lion Rivers

Apparently fish samples have been taken from the Mpofaan/Lion rivers. To investigate whether genetic studies are being done here.

- **Fishing Licenses**
  - where are they?
  - proceeds to go to fishing conservation and riverine health projects

- **Scientific panel meeting deals with essential issues**
  - please include KZN representative as observer

REGIONAL REPORT: NORTHERN CAPE

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Introduction

The Northern Cape is host to four of the nine 'yellowfishes' (note that only six of the nine are *Labeobarbus spp*) in South Africa. The Orange River system is home to the Orange-Vaal largemouth and smallmouth yellowfish, with the Clanwilliam yellowfish and Clanwilliam sawfin occurring in the Doring River system in the Hantam region. Three of these 'yellowfishes' are threatened with extinction, therefore the Northern Cape has a major responsibility regarding conservation of the yellowfish.

Yellowfish Derby

During October 2002 the Northern Cape Artificial Lure Angling Club hosted the Yellowfish Derby. Prizes were awarded for the largest yellowfish caught on an artificial lure and the largest yellowfish caught on a fly.
The Northern Cape Yellowfish Working Group (NCYWG) wrote a letter to the organisers of the Derby to express the working group's fears regarding the derby. The letter stressed that every possible precaution be taken not to kill any of the fish caught. The organisers took this to heart and stressed to the participants that all the fish caught should immediately be taken for weighing to a weighing station in a suitable live well. No fish that could not swim away unassisted would be eligible for the competition.

Three officers from the Department of Agriculture, Land Reform Environment and Conservation (DALREC), as well as two members of NCYWG attended the event. One officer patrolled the river with a boat during the competition to keep an eye on the proceedings. The other two officers manned two of the four weighing stations.
Although no dead yellowfish were reported during the competition the Northern Cape Yellowfish Working Group believe that a competition like this still impacts negatively on the yellowfish. The working group suggested that the Yellowfish Derby should rather be changed into a Carp Derby therefore minimising the impact on the yellowfish.

I was pleasantly surprised at the number of juvenile Orange-Vaal largemouth yellowfish (under one kilogram) that were caught during the derby. Many of the anglers complained that the small fish were a nuisance since only fish of one kilogram and over were allowed to be weighed in.

Orange-Vaal largemouth and smallmouth samples

The Northern Cape Department of Nature Conservation in collaboration with the NCYWG was responsible for the collection of the Orange-Vaal smallmouth and largemouth yellowfish samples for the genetic study. John Southey easily collected the samples for the smallmouth yellowfish in one afternoon. The collection of the largemouth samples proved to be much more difficult and it took the better part of 5 trips to collect the 20 fish needed for the study. Many of the largemouth yellowfish samples were returned because the fish were so small that we could not be certain whether they were largemouth or smallmouth yellowfish. It seems that the largemouth as well as the smallmouth yellows are still breeding and doing fairly well in the Northern Cape region.

Doring River and other surveys

During early May the department did a fish survey of the Doring River. The survey started on the Oorlogskloof River in the Oorlogskloof Nature Reserve. Numerous juvenile Clanwilliam sawfin (*Barbus serra)* were recorded as well as both adult and juvenile Clanwilliam sandfish (*Labeo seeberi)*. Unfortunately no Clanwilliam yellowfish (*Labeobarbus capensis)* were recorded. This is quite alarming as Clanwilliam yellowfish were found in the reserve on previous surveys done in the eighties. Outside the reserve adult Clanwilliam yellowfish, sawfin and Clanwilliam sandfish were found in limited numbers. No juveniles were present and this can be attributed to the fact that outside the reserve the rivers are infested with smallmouth black bass and bluegill sunfish.

Surveys were also conducted on the Harts, Riet, and Modder rivers. As far as we could determine it was the first survey done on the Harts River in the Northern Cape. Most of the sampling was done by electro shocking in the riffles and rapids and the use of gill nets in the deeper parts of the river. The Riet and Modder rivers were only sampled using the electro shocker.

Illegal netting and long lines.

During last year (2002) two nets and one long line were removed from the Vaal River. Fortunately the nets were old and not very effective and only three yellowfish were killed by the nets, the rest of the catch included moggels, Orangeriver mudfish and some carp. Two nets were confiscated from the Harts River. The nets were fairly new and caught a lot of fish, mainly moggels and mudfish and fortunately no yellowfish were caught in the nets. During February this year one homemade net was removed from the Riet River. The net was confiscated before the owner could use it. The Riet River is one of the largemouth yellowfish strongholds and one can only guess how many yellowfish this net must have killed before it was destroyed. All the confiscated nets and long lines were destroyed and the owners (where possible) were prosecuted.

Bell's Flyfishing Festival

The Northern Cape Yellowfish Working Group hosted their first Bell's Flyfishing Festival from 6-8 September 2002 at the Lillydale Lodge situated on the banks of the Riet River. The event was attended by 45 flyfishermen from all over the country. Unfortunately the river was a bit too high for decent fishing, resulting in very few fish being caught. The participants did however enjoy the festival and the working group received good feedback from them. The second Bell's Flyfishing Festival is scheduled for the first week in October 2003 at the Lillydale lodge and hopefully the fishing will be much better.

Douglas Yellowfish Conservancy

The NCYWG is involved in the establishment of a yellowfish conservancy at Douglas. The proposed conservancy will start at the Douglas Resort extending past the town to the confluence of the Orange and Vaal rivers. John Southey is championing the project.

Current legislation and regulations.

The Department of Agriculture, Land Reform, Environment and Conservation still uses the old Cape Nature Conservation Ordinance and Regulations. The Cape Nature Conservation Ordinance came into effect in 1975 making our current legislation extremely outdated. At this stage the regulations regarding yellowfish in the Northern Cape stipulate that the minimum length for the Clanwilliam yellow fish is 400 mm fork length and 300 mm fork length for the largemouth yellowfish. There is no size limit on either the Orange-Vaal smallmouth yellowfish or the Clanwilliam sawfin. Currently no bag limit exists for any of the yellowfishes, which means an angler can catch and keep as many yellowfishes as he wishes.

Species	Bag limit	Minimum length (FL)
Orange-Vaal smallmouth yellowfish	None	None
Orange-Vaal largemouth yellowfish	None	300 mm
Clanwilliam yellowfish	None	400 mm
Clanwilliam sawfin	None	None

Proposed legislation and regulations.

The proposed regulations stipulate that catch and release will apply to the Clanwilliam sawfin and Clanwilliam yellowfish and none of these species may be kept. A size limit of 350 mm fork length will apply to the Orange-Vaal smallmouth yellowfish as well as a bag limit of two fish per person per day. The proposed size limit for largemouth yellowfish is 460 mm fork length and the bag limit is set at one fish per person per day. A further suggestion was that largemouth yellowfish should also be included in the catch and release group.

Species	Bag limit	Minimum length (FL)
Orange-Vaal smallmouth yellowfish	2	350 mm

Orange-Vaal largemouth yellowfish	1	460 mm
Clanwilliam yellowfish	Catch and release only	Catch and release only
Clanwilliam sawfin	Catch and release only	Catch and release only

REGIONAL REPORT: PROGRESS REPORT FOR THE WESTERN CAPE SINCE THE APRIL 2002 YELLOWFISH WORKSHOP

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Research

Two students from the University of Cape Town undertook BSc Honours projects in 2002 involving yellowfish conservation. Darragh Woodford's study (Woodford 2002) looked at the impacts of rainbow trout on the upper Berg River where whitefish have been recorded whereas David Christie looked at whitefish conservation in the Hex River, a tributary of the Breede River System (Christie 2002).

Woodford found that rainbow trout *Oncorhynchus mykiss* did have an impact on indigenous fish communities in the upper Berg River as Cape Galaxias *Galaxias zebratus* were not found in pools with rainbow trout. Large numbers of Berg River redfin *Pseudobarbus burgi* and Cape kurper *Sandelia capensis* were recorded in pools with trout, although the trout were relatively small (15-30 cm), which may have reduced trout predation pressure. The main food of rainbow trout in the study area were aquatic macro-invertebrates on which the trout may be having an impact on some families. No whitefish *Barbus andrewi* were recorded, further confirming the findings of other recent studies that this species is now extinct in the river.

Christie's study showed that smallmouth blackbass *Micropterus dolomieu* are having a severe impact on indigenous fish communities of the Hex River. This study looked at community composition in areas invaded by bass compared to those without bass. The results were striking (see Table 1), with large numbers of Burchells redfin (*Pseudobarbus burchelli*), Cape kurper and whitefish found in the "bass free" part of the river (above a causeway). In contrast below the causeway, where bass were abundant, only a few large whitefish were recorded. The results of this study confirm scientifically the very severe impact of smallmouth bass in rivers of the W Cape province. The Hex River is also regularly stocked with rainbow trout by the Worcester Trout Anglers Association. However, very few trout were recorded in either the "bass free" or "bass invaded" parts of the river. Surveys by our organization reveal that this river gets very warm in late summer (25-27 ^{o}C) which may cause high mortalities of trout at that time.

This year, a study is being done on the impact of smallmouth bass in the Witte River of the southwestern Cape. This beautiful and sensitive river, a tributary of the Breede River, has the same problem as the Hex River i.e. an upper "bass free" stretch and a lower "bass invaded" stretch. Another UCT student, Jeremy Shelton, examined the impact of smallmouth bass here for his BSc Honours project. Preliminary findings have showed that indigenous fishes like Burchells redfin and Cape kurper were abundant and widespread where bass were absent. In the bass invaded areas only very few small Burchells redfin

were recorded, mainly from shallow riffle areas. Unfortunately, no Berg-Breede whitefish were observed, further confirming the severe impact on this species by smallmouth bass.

In addition, Darragh Woodford, a MSc student from UCT, has started the long awaited Rondegat River rehabilitation study. This study was presented in the 2002 Yellowfish Workshop proceedings.

Table 1: Comparison of freshwater fish community composition in the upper Hex river in "bass free" versus bass invaded areas (from Christie 2002).

Species recorded	River area previously without smallmouth bass	Bass invaded river area
Smallmouth bass	5*	190
Rainbow trout	17	4
Whitefish	345	5
Cape kurper	453	
Burchells redfin	117	
Juvenile redfins or whitefish	714	

* this is the first time bass have been recorded above the barrier which separates the "bass free" and bass invaded sections. We believe these fish were deliberately placed above the barrier in early 2002.

Yellowfish promotion

The author wrote two articles on flyfishing for yellowfishes for the magazine *The Complete Flyfisher*, for which he was conservation editor during this period. In addition, a chapter on environmentally friendly flyfishing was published in the 2002 Nedbank FOSAF flyfishing book.

Stocking

The moratorium of the stocking of yellowfishes does not affect the Berg – Breede whitefish due to genetic studies having being undertaken and the likely extinction of the Berg River population in that system. No Clanwilliam sandfish or yellowfish were stocked during this period

Two private farm dams on the Berg River and Voelvlei, a large public dam next to the Berg River, were stocked with whitefish during 2002. The farm dams were stocked with whitefish from a dam near Porterville in the Berg River catchment. This dam had been previously stocked with Breede River whitefish by Cape Nature Conservation in the early 1980"s. Unfortunately, the new land-owner, had not been aware that the dam had whitefish and had stocked it with largemouth blackbass. The dam now has a large resident

whitefish stock that is no longer recruiting, so represents a good source population from which to restock suitable impoundments. The W Cape Artlure Anglers Association requested permission from CNC in 2001 to restock Voelvlei Dam with whitefish from the abundant Brandvlei Dam population. Several small stockings into Voelvlei took place in 2002.

The Western Cape Nature Conservation Board has been approached by two land-owners to establish culture facilities for Berg-Breede whitefish and Clanwilliam yellowfish. It should be noted that the WCNCB ceased culturing indigenous fishes in the mid 1990's due to a lack of capacity and inappropriate facilities. The first applicant, Francois Claasen was given permission and successfully produces sterile grass carp *Ctenopharyngodon idella* in a closed system at Bonnievale near the Breede River. The applicant works closely with us and has our trust. Are there good reasons why he should not be given permission to produce Berg-Breede whitefish under our supervision. If so, what would be the best founder population/s to use? Additional genetic studies may be required for this purpose.

Rondegat River Rehabilitation study

Funding of R300 000 was secured for the above project from the Table Mountain Fund in December 2001 subject to certain conditions being met. The project was delayed due to an inability to secure funding to construct a barrier weir just above Clanwilliam Dam. WCNCB is highly likely to secure funding from an international funder, the Critical Ecosystem Partnership Fund, to allow a barrier weir to be constructed in the lower Rondegat River. A student has been appointed to start research studies on the impact of smallmouth bass and alien plants on the indigenous fish community which includes Clanwilliam yellowfish and sawfin. The student will also look at the recovery of the indigenous ichthyofauna once the bass have been eradicated.

River ecologists

The Western Cape Nature Conservation Board and DWAF have signed a contract whereby the former organisation will undertake River Health and related work for DWAF. Four scientists were appointed in January 2003 and active fiield work has started to prepare State of Rivers reports for the Diep, Palmiet, Disa and Lourens rivers and a second report for the Berg River System, home to the whitefish. This contract will allow more effective river and fish conservation work to be done in the W Cape.

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YELLOWFISH POPULATIONS IN SWAZILAND AND A PROPOSED RIVER RANGER PROJECT

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Introduction and background

Swaziland has three major river systems the Nkomati, Mbuluzi and Usuthu that drain the country. The Usuthu forms a major component of the Phongolo system. Little was known of fish distributions in the country or of the potential for exploiting fishes for food in the larger rivers and man-made dams. The Swaziland Fish and Fisheries Survey was initiated to investigate the fisheries resources of the country so as to develop plans to utilise these resources in a sustainable way. The main objectives of the Swaziland Fisheries Survey are to:

- Determine distribution, abundance and seasonality of fish species throughout Swaziland
- Investigate the fisheries potential of the country's water bodies
- Assist in capacity building for the Swaziland Fisheries Section through the transfer of skills and by providing training in fish identification, survey techniques, fisheries research and fisheries management

During the survey the distribution and occurrence of the two yellowish species in Swaziland the Largescale yellowfish (*Labeobarbus marequensis*) and Smallscale yellowfish (*Labeobarbus polylepis*) were determined. The Largescale yellowfish (*L. marequensis*) is widely distributed in Swaziland from highveld to lowveld rivers. It attains a mass of up to 5,5 kg although specimens at high altitudes are usually below 1,5 kg. The Smallscale yellowfish (*L. polylepis*) occurs in the Nkomati and Usuthu (Phongolo) systems in Swaziland but is absent from the Mbuluzi system. It is at its most common in the upper Usuthu (Phongolo) rivers which includes the Ngwempisi. It attains a mass of over 6 kg and is slightly larger than the Largescale yellowfish. An attraction for the Ngwempisi River is the fact that both species of yellowfish occur at several sites in the area compared to all other regions of Swaziland.

A proposed River Ranger project

The Ngwempisi River rises in South Africa and flows through the western highveld region of Swaziland and drains into the Great Usuthu River just south of Manzini. A river ranger project is proposed for that section of the Ngwempisi south of Mankayane between the Ndwandwe and Dzanyana Schools, located respectively on the northern and southern side of the river. Once established and successful, expansion of the project area may be possible eastwards into the Ngwempisi Gorge, a recognised area of high conservation value.

Why a River Ranger project in the Ngwempisi valley?

The Ngwempisi River is an area worth conserving from a biodiversity point of view, with a high number of species including regionally and globally important species. Seventeen (17) species of fishes have been recorded in the main river from five sampling sites and twenty-three (23) species in its tributaries from thirteen sampling sites. Some of the more interesting species include the Silver robber (*Micralestes acutidens*), Southern barred minnow (*Opsaridium peringueyi*), Leaden labeo (*Labeo molybdinus*), Lowveld rock catlet (*Chiloglanis swierstrai*), Mozambique tilapia (*Oreochromis mossambicus*), Threespot barb (*Barbus trimaculatus*), Stargazer mountain catfish (*Amphilius uranoscopus*) and Sawfin rock catlet (*Chiloglanis paratus*). The Ngwempisi could also be more attractive to certain fishermen (perhaps members of Artlure Angling Association of South Africa) who are challenged by trying to catch many unusual small species and there are opportunities for those who might like to go snorkelling. An attraction in the form of a Swazi Cultural Village already exists in the area and this could be linked to the proposed river ranger project. The community is very interested in the idea and the Swaziland Angling Association as well as the Swaziland Tourism Authority have supported the proposal. Other positive aspects are listed below.

- River is in good condition with a variety of aquatic habitat types
- Biodiversity is high
- Two yellowfish species and other minor value fishing species present
- Other programmes working already – Swazi Cultural Village
- Good relations with local residents, local Chief and the local MP
- Good road access
- Support from the Swaziland Angling Association
- Support from Swaziland Tourism Authority
- Close to an area of high conservation value (Ngwempisi Gorge) which could allow for the expansion of the River Ranger area downstream

The river is sedimented in places and there are a number of alien plant species present. Nonetheless, through the good relationship prevailing with the local people and the chief it will be possible to try and improve catchment management by keeping cattle out of the river, restoring riparian vegetation by removing alien plant species and by improving farming practices.

Actions and opportunities

Several opportunities exist and a number of actions would be possible. Some of these are listed below.

- Develop a fishing circuit offering trout and indigenous fishing centred around the Ngwempisi region
- Establish infrastructure for River Ranger project (identify needs of fishermen, how locals can fit into this programme)
- Identify Swazi residents who can train River Rangers
- Encourage local residents to altering farming practices e.g. keep cattle out of river, enlarge riparian vegetation belt
- Maintain enthusiasm for the project at the local and national level

- Encourage adjacent River Ranger projects or conservancies in South Africa to protect the upper catchment
- Plea to South African agencies to carefully consider stocking in relation to other countries - either indigenous or exotic species of fishes and other aquatic life
- Ensure appropriate catchment management in Swaziland and South Africa

Concluding remarks

The Ngwempisi area is worth conserving as it has a high number of fish species, including regionally and globally important species. From a recreational point of view the area has unique opportunities for angling, particularly for yellowfish angling. A River Ranger project on the Ngwempisi River would create opportunities that would benefit the local communities and Swaziland and would ensure appropriate management of the natural resources in the area.

Acknowledgements

Acknowledgement is due to the following parties in respect of the Swaziland National Fish and Fisheries Survey: the Government of Taiwan, the Government of Swaziland, the South African Institute for Aquatic Biodiversity and the MAZDA Wildlife Fund. With regard to the presentation of the River Ranger project at the 7th Yellowfish Working Group Conference my attendance was made possible through the generous sponsorship of FOSAF and the angling shop “Fly-fishers” in Mbabane, Swaziland. We thank Derek von Wissel for proposing the idea of a River Ranger project on the Ngwempisi and for taking us into the area.

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REGIONAL REPORT: THE NATIONAL RIVER HEALTH PROGRAMME
Implementation and Management of the National RHP in Gauteng Province

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1. Introduction:

The National River Health Programme (RHP), mandated through the South African National Water Act, Act 36 of 1998, and has been implemented across SA in order to assess the ecological state of rivers in the country. The goal of the RHP is to assess the current ecological state of the river, to set a desired ecological state for all rivers, implement management actions to achieve the desired ecological state, and by means of a suite of biomonitoring protocols, SASS, FAII, RVI etc, measure the ecological integrity of the rivers at selected biomonitoring sites in order to detect change over time, to be able to assess whether the desired ecological state was achieved or not. This enables the manager to take corrective action and apply alternative management protocols in order to reach the desired ecological state of rivers in South Africa.

The Gauteng chapter of the National River Health Programme has been well established in the province under the leadership of the Department of Agriculture, Conservation, Environment and Land Affairs. Many institutions have bought into the programme and have committed themselves by contributing to the process of undertaking biomonitoring in the rivers across Gauteng.

2. Catchment Background:

Gauteng Province is situated within the source of three of the nineteen identified catchments in South Africa with the major development of both urban and industrial, concentrated on top of the watershed of two of the main catchments in the province.

The Greater Johannesburg lies on top of the watershed between the Crocodile-West/Marico catchment draining to the north via the Jukskei River, the Swartspuit, the Crocodile River with all their tributaries and the Upper-Vaal catchment draining to the south via the Blesbokspruit, the Suikerbosrand River, the Klip River and the Rietspriut. Further towards the eastern highveld, top ends of the Elands River, Bronkhorstspruit and the Wilge River form a portion of the source of the Olifants River Catchment draining towards the northeast and the eastern lowveld.
Both the Crocodile-West/Marico - and the Upper-Vaal catchments are heavily impacted upon mostly by urban development in the Crocodile-West/Marico

catchment and urban as well as heavy mining and industrial development in the Upper-Vaal.

3. Impacts on the Catchments:

Land use in Gauteng has changed dramatically in these catchments since the discovery of gold on the Witwatersrand in 1886. Once open highveld grassland with bubbling springs, large wetland and constant flowing streams of sound ecological quality has been transformed into a landscape of vast urban development, industrial nodes scattered throughout the area, and gold mines with their well known dumps all along the watershed from east to west.

Along with this development came all the other infrastructures such as highways, sewer systems, rail roads and airports, all contributing to the ecological degradation and serious pollution of the river systems in these catchment.

The influx of millions of poor people from rural communities in search of work and food, settling on sensitive areas like river banks and wetlands, also contribute to the degradation of the natural river systems.

The sealing of natural surfaces as result of the construction of houses, roads, malls with their vast paved parking areas, some 47% of the province, along with the inappropriate design of stormwater drainage systems are some of the major contributors to the destruction of riverine vegetation, fish and aquatic invertebrate habitats. The once pristine streams have been totally modified into urban stormwater drains purely as result of the concentrated stormwater diverted directly into these streams. The frequency of floods has increased dramatically as result of this, causing constant damage to the streams and rivers throughout the catchment.

The volumes and velocity of water in the drainage systems is also enhanced by the release of return-flows from water treatment works along the catchment. Both the Croc/Marico and Upper-Vaal catchments receive vast volumes of return-flow from water treatment works.
Water is imported from two other water transfer schemes, the Lesotho Highlands water scheme and the Tugela water transfer scheme into the Vaal River. Water from the Vaal River via Rand Water is distributed to all part of the province across the watersheds.
This water in turn is piped for human and industrial use from where it is treated and returned to the natural river systems via water treatment works.
(Lesotho - Vaal River - Rand Water - urban use – across watershed to Croc/Marico system – Water treatment works – into natural streams).
This results in the complete modification of the flow regimes of these streams and rivers causing a change from seasonal flow regime to perennial flow regime. This inevitably causes a dramatic change in the ecological integrity and character of the rivers.

The development of industries and mines in the source of the catchments, resulted in the degradation of water quality throughout the province. Highly polluted return-water from mines and other industries together with surface

quality of the water in the catchments. These in turn contribute largely to the poor ecological status of the rivers in Gauteng.

The indiscriminate construction of physical obstructions in rivers and streams such as weirs, gauging weirs, dams and culverts, has contributed greatly to the loss of biodiversity mainly through the restriction of fish migration, and the altering of the natural hydrological regimes of the rivers also causing habitat destruction.

4. Implementation of the RHP in Gauteng.

The multi disciplinary land use and high density development in Gauteng complicated the initial implementation of the RHP in the province. The success of the implementation and continuity of the RHP is directly dependent on the "will" and commitment of all stakeholders to participate in the programme. The process of gaining buy-inn from stakeholders into the programme was initiated in 1998 in the form of a Stakeholders Participating Meeting. Here all sectors of society were invited to participate. Introductory information regarding the RHP was given to the participants, and the foundation for the implementation was established.

In view of the establishment of Catchment Management Agencies. CMA's, in all nineteen catchments in SA, according to the National Water Act, the approach of establishing "River Forums" as first level management components was followed. Along with The Department of Water Affairs and Forestry (DWAF), a total of seven river forums were established, covering all the sub-catchments in Gauteng.
In time, these forums proved to be the main reason for the success of the implementation and anchoring of the RHP in Gauteng.

These forums act as platforms from where the stakeholders are identified and invited to participate, the impacts and stresses on the river systems are identified, the **"stressors"** are identified, and solutions to the problems are mitigated and implemented. The core business of these forums is to manage the river systems towards the ***desired ecological state*** through the participation of all stakeholders in the process. The RHP forms an intricate part of this strategy as it is based on measuring ecological change over time through the implementation of the prescribed monitoring protocols.

The National Environmental Management Act provides for any new development or change of land use to be subjected to the Environmental Impact Assessment process, or EIA . This process is normally undertaken by ecological consultants. Many of these consultants have been established in Gauteng and do biomonitoring as part of the ecological assessment of a planned development. These consultants play a major role in the RHP as they collect data across the province at a rapid rate. Forums are the ideal platform from where the standardization of the biomonitoring protocols as well as the collation of data can take place. By-inn from major mining companies,

industries and local councils into the RHP has led to the contribution of data form their biomonitoring actions to the National Rivers database.

5. Biomonitoring

Aquatic ecosystems biomonitoring in Gauteng is mostly restricted to the areas outside of the urban boundaries. This is mainly as result of the highly modified urban streams and drainage systems. The constant flow of urban and industrial effluent along with high incidence of flooding from the built-up areas transformed the streams into modified stormwater drains. As result of this, most of the natural habitat for riverine vegetation, aquatic invertebrates and fish have disappeared. This makes the selection of biomonitoring sites impossible. The unnaturally high frequency of flooding also prevents one from finding suitable habitat.

Some 49 biomonitoring sites were identified and selected in all three catchments together. A helicopter was used to identify possible biomonitoring sites from the air, while the approachability of the sites were checked as well.Ground truthing of all the sites were done after which suitable sites were selected.

The Upper-Vaal catchment was selected for the primary biomonitoring surveys because of the high incidence of mine and industrial pollution in the catchment. Biomonitoring was done by different organizations in the four river systems over a period of two years, 2000 – 2002. This came to be as result of a cooperative agreement between the mining and industry, local government and the private sector. Three different consultants were appointed by industry mining and local government. Grootvlei Mines, Sappi and ERWAT contracted consultant to do biomonitoring on the Blesbokspruit, Johannesburg Water contracted consultants to do biomonitoring in the Klip River and Rietspruit while Rand Water appointed consultants to do biomonitoring in other tributaries of the Klip river as well as the Rietspruit. The in-house biomonitoring team from Gauteng Nature Conservation who is responsible for most of the biomonitoring in Gauteng did biomonitoring in the Suikerbosrand River, the only river in the Gauteng region of the Upper-Vaal catchment which does not source in a urban area.

Standardization of the biomonitoring protocols was secured at forum level and was applied by all the consultants. Standardized reference conditions for ecoregion level 1 as modeled by Christa Thirion , IWQS , DWAF was used by everyone. This was decided upon purely because of the non-availability of reference sites in the region due to the long-term abuse of the catchment.

All biomonitoring data for the period was donated to the RHP along with the data collected by the RHP team. The data was pooled to be published in the form of a “State of the Rivers” report. Chemical water quality data for the same period was donated by Rand Water for use in the report. The report id currently being prepared in the form of a poster to be launched during Water

The same process is currently under way and will be followed in the assessment of the Crocodile-West/ Marico Catchment. Report on the ecological state of the rivers of this catchment will be published in March 2005.

6. Results.

Pooled results revealed mostly what was expected from a highly impacted catchment.

The general ecological state for the southern rivers of Gauteng is classified as **POOR** according to the RHP classification. The upper sections of the Suikerbosrand River, upstream of the confluence with the Blesbokspruit however yielded somewhat better results, **GOOD** and **FAIR**. This can mainly be contributed to the fact that the river has its source in non-urban or industrial areas.

Summarized results of biomonitoring data for the southern Gauteng rivers according to the RHP classification:

River	***Invertebrates***	***Fish***	***Riparian Vegetation***	***Habitat***	****Water Quality***
Rietspruit	Poor	Poor	No data	Poor	Poor
Upper Klip	Poor	Poor	Fair	Good	Poor
Middle Klip	Poor	Poor	Fair	Fair	Poor
Lower Klip	Poor	Poor	Poor	Fair	Fair
Upper Blesbok	Poor	Poor	Poor	Poor	Poor
Lower Blesbok	Poor	Poor	Good	Fair	Poor
Upper Suikerbos	Good	Fair	Good	Good	Fair
Middle Suikerbos	Fair	Poor	Poor	Fair	Poor
Lower Suikerbos	Fair	Poor	Poor	Fair	Poor

*It must be noted that the water quality classification that includes both chemical and physical properties related to the biota was analyzed and classified by experts from the IWQS and RAU.

7. Management of Rivers.

The prime goal of the National River Health Programme is to determine the current ecological state of the rivers, set the desired ecological state for the rivers and there after put a management plan into action in order to achieve

ecological state should the river be in an excepted ecological state. . Biomonitoring will continue as a means of assessing the ecological state of rivers over time in order to determine whether the implemented management plan has reached its objectives. Once the desired ecological state of a river has been reached, a maintenance plan should be put into place in order to maintain the desired state. The ongoing biomonitoring programme will once again over time detect whether the maintenance plan is sufficient or whether adjustments to the plan should be made. Pressure on the river system as result of development in the catchment or other impacts my lead to the revision of the desired state and therefor might lead to the change of objectives in order to manage the river within obtainable boundaries.

The National Water Act clearly states that no river should be aloud to degrade to the level where it loses its natural ecological functions. This in essence means that all the rivers in southern Gauteng have in fact degraded beyond this point according to the RHP classification – POOR.

Unacceptable poor water quality as well as poor stormwater management were identified as the main course of the current POOR ecological state of these rivers. Management objectives have been set through consensus at forum level by all stake holders. A desired ecological state for all the rivers have been set at one level up to that of FAIR. These management objectives include that of enhancing the water quality , better management of surface and stormwater runoff in the form of wetland rehabilitation, and the creation of artificial wetlands and retention ponds in order to decrease the velocity and volumes of stormwater before entering the natural drainage systems.
The development of new urban and industrial areas as well as the roads and services will have to include the management of all surface runoff generated as result of the development before entering the natural drainage systems.

The results of the long-term biomonitoring programme implemented in Gauteng will constantly reflect the success or failure of the management actions in order to restore the ecological processes within the river systems.

8. Conclusion.

The success of the Implementation and long-term management of the River Health Programme is directly dependant on the enthusiasm and drive of the person or team that champion's the process.

Human greed over time is the main course of the ecological degradation of our planet. To stop this continues degradation, means a paradigm shift in the thinking of the people, especially of those in Gauteng.
Upliftment, eradication of poverty, education and awareness, are some of the issues to be addressed in order for the RHP to succeed. Ignorance regarding the environment and it's processes, especially that of the so called "educated" society is rife and need also to be changed. Ruthless town planners, developer and consultants, do not forget the financiers, are as much to blame

for the indiscriminate proposals for the change of land use in our catchments. Do they do this for free?

The Gauteng RHP management team along with all the stakeholders have forged strong partnerships which are in the process of implementing management strategies at all sectors of society in order to better the aquatic environment not just for the sake of the ecological processes but to the benefit of all.

The effects of irresponsible water recourse management in Gauteng will not only affect the people and environment of Gauteng but will be felt as far as Oranjemund at the mouth of the Orange River and the Atlantic ocean, to Xai Xai in Mozambique at the mouth of the Rio Limpopo and the Indian ocean.

REGIONAL REPORT: LIMPOPO PROVINCE

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1. Introduction:

Prior to 1995, the area now known as Limpopo Province, was made up of four separate administrative regimes; Transvaal Provincial Administration, Gazankulu, Lebowa and Venda.

Since 1995, Limpopo Province Environmental Affairs has had an unstable structure. Environmental Affairs has been linked to no less than three Provincial Departments over this time and as a result has suffered from a lack of clear direction and a significant identity crisis. These factors, when combined with confusion surrounding provincial environmental legislation, emanating from the above administrative structures, have resulted in a demoralized regulatory section and largely ineffective laws. In 2002, a new Tourism Board was established which has confused matters further.

The above factors, when combined with critical staff limitations, have caused the aquatic section of Limpopo Environmental Affairs to concentrate on atlas programmes and habitat management rather than species conservation initiatives.

2. Core Projects:

Core projects which have relevance to the Yellowfish Working Group include the following.

- Atlas of biota. (Biobase)
    - Environmental Potential Atlas. (ENPAT)
- State of Environment Reporting (SOE).
    - State of River Reporting (SORR). (River Health Programme)
- Wetland Inventory Programmes.
- Communication, Education and Public Awareness. (CEPA)

2.1. Atlas of biota. (Biobase)

By 2003, more than 300 site distribution records exist for fish and other aquatic biota. This is made up of historically verified data from all of the above administrative regimes, together with new data generated after 1995. More than 50% of the site records have yellowfish species recorded. *Labeobarbus marequensis* is widely distributed while *Labeobarbus polylepis* shows a sparse and curious distribution. The biobase is used to support an Environmental Potential Atlas (ENPAT). ENPAT is used in the Environmental Impact Assessment process to highlight areas of concern surrounding potential developments.

2.2. State of Environment Reporting (SOE).

All provinces are obliged to produce SOE's which are compiled by DEAT into a national report. SORR is considered a critical component of such reports. In Limpopo Province, the following rivers have been surveyed, by applying standard biomonitoring protocols as developed through the River Health Programme. (Fish, invertebrates, riparian vegetation, geomorphology and more recently diatoms)

1997	Sand River (Inkomati)	14 Sites
1998	Olifants River Main Stem	15 Sites
1999	Olifants River Tributaries	33 Sites
	Luvuvhu Catchment	43 Sites
2000	Letaba Catchment	35 Sites
2001	Sand River	14 Sites
2002	Mogol Catchment	31 Sites
2003	Luvuvhu	15 Sites

2.3. Wetland inventory programme.

A new National Land Cover dataset (NLC2000) will shortly be released which will allow the province to map and inventory wetlands greater than 1ha. In the Limpopo Province, most rivers are becoming stressed due to over utilization of the water resource. Wetlands play a critical role in conservation of water and in the maintenance of river flows. Their conservation is seen as a critical link in conserving riverine fauna.

2.4. CEPA

All of the above programmes are undertaken through the scientific office of environmental affairs and the dissemination of such information to the public is achieved through CEPA. The section relies on television, radio, press, and public information meetings to pass on and discuss results, while also presenting river and wetland awareness courses in the region and at national institutions.

3. Legislation:

A Limpopo Environmental Bill has been in circulation since 1995. Departmental placement and lack of political will are the main reasons for it not being promulgated. However some progress is now being made and it is anticipated that the bill will shortly be promulgated.

Main changes in the Aquatic section are…

- A fishing licence will no longer be required to fish public waters.
- A licence will be required to establish an aquaculture venture.

Regulations pertaining to the size and numbers of fish which may be retained are documented as follows.

SCHEDULE 3
NUMBER AND SIZE OF CERTAIN SPECIES OF FISH WHICH MAY BE CAUGHT AND RETAINED IN CERTAIN WATERS (REGULATION 23(1))

Column A Species of fish
Column B Number of fish which may be caught and retained on one day
Column C The minimum length of fish which may be caught and retained
Column D Waters in the Province in which the fish may be caught and retained

A	B	C	D
1. Yellowfish -Smallscale Yellowfish (*Labeobarbus polylepis*) Largescale Yellowfish (*Labeobarbus marequensis*)	6	300mm	Any aquatic system
2. Tiger fish (*Hydrocynus* species)	2	300mm	Any aquatic system
3. Eels (All *Anguilla* species)	2	500mm	Any aquatic system

Policies:
The following policies are in force at this time. All are amended from the National Aquatic Conservation Committee documents developed from February to October 1995. All were implemented in January 1997.

- Management and Stocking of Black Bass.
- Management and Stocking of Trout.
- Management and Stocking of Grass Carp.
- Management and Stocking of Problem Alien Aquatic Species. (Carp, Crayfish etc etc)
- Barriers to Migration in Rivers.

4. Conclusion:
Through the biobase programme and the State of Rivers programme, the province has built up a noteworthy data set of fish and invertebrate distribution and is actively disseminating such information to the public sector. The system approach is currently extending to the conservation of wetlands. Shortfalls in provincial legislation are being addressed and it is hoped that a new Provincial Act will shortly be promulgated.

REGIONAL REPORT: STATUS OF YELLOWFISH IN MPUMALANGA

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ABSTRACT

Mpumalanga contains a huge diversity in topography and climate and is situated in the headwaters of four major river systems (Inkomati, Usutu, Olifants and Vaal). Therefore it is one of the provinces boasting a relatively high diversity of yellowfish. These will include the two Vaal River species, the Orange-Vaal largemouth yellowfish (*Labeobarbus kimberleyensis*) and the Orange-Vaal smallmouth yellowfish (*L. aeneus*), and the two northern species, the Lowveld largescale yellowfish (*L. marequensis)* and the Northern smallscale yellowfish (*L. polylepis*). In terms of angling, two other species may also be considered in this category, namely the Bushveld papermouth (*Barbus mattozi*) and the Inkomati chiselmouth (*Varichorhinus nelspruitensis*).

However, the picture is not so bright as there are presently several aspects that threaten the integrity of species as well as the existence of these species

1. Mining poses a threat, especially in the upper catchment of the Vaal and Olifants Rivers in terms of reduced water quality and habitat destruction. Many of these cases are legacies of the past where rivers were reduced to little more than acid trenches. Presently there is, however, a much greater understanding amongst larger mining companies, but there are still some companies that do not comply with environmental requirements.
2. Erosion and habitat destruction caused by bad farming practices and poor design of culverts has reduced the available habitat in many of these rivers to almost nothing. Large sections of these rivers are now so shallow that water temperatures become lethal during summer.
3. Interference with the historical movements of fish in several of our rivers has probably compromised the genetic integrity of many populations.
4. Large scale illegal gill netting and seine netting in many of our rivers is presently completely out of control. Law enforcement is not effective and penalties inadequate to discourage entrepreneurs.
5. Excessive inundation occurred in several streams and yellowfish are almost absent from these areas.

REGIONAL REPORT: NORTH WEST PROVINCE

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1. Presently we are trying to register all the landowners along the Vaal River in this province, as members of the Vaal River Yellowfish Conservation and Management Association. The membership of this Association is free and the landowners only need to fill in the application form. The Vaal River has also been divided into different sections and Mr. Pierre Wynberg, Mr. John Harvey, Mr. Dries Visser and this office are taking responsibility for different sections in order to get the landowners involved. The sections are as follows: Parys to Schoemansdrift, Schoemansdrift to Skandinavia, Skandinavia to Bloemhof. Many of the landowners have already signed up, but a great deal of work remains to be done.
2. The officers from this office who are involved are law enforcement officers from the southern region of North West Province. Working on the Yellowfish Conservation Association project is only a small part of their work. As an officer myself who is also involved I have to attend other working groups and meetings, which means that the Yellowfish Working Group is only part of the work for which I am responsible. Manpower is sometimes a problem which makes it difficult to undertake all the responsibilities, but we are doing our best.
3. Presently there are also three Nature Conservation legislations used in the North West Province, and the law enforcement officers have the authorisation to apply these three Ordinances where applicable. The Department is in the process of developing a Nature Conservation Ordinance for the North West Province.
4. Angling licenses were not available for a long period of time, but were recently issued by the permit office, and licenses can be obtained from the cashier at the Agricultural College. The permit office is in the process of providing these licenses to angling shops in the Province so as to improve availability to the public. The licenses can be bought for R 50-00, and the permit conditions are the same as for the previous angling licenses.
5. Illegal netting of fish in the Vaal River is a great problem in the Potchefstroom, Klerksdorp and Stilfontein areas and complaints are regularly investigated. Suspects who were illegally netting in the Klipdrif Dam have been prosecuted. The fish that are netted are mostly sold in the townships. This is a continual problem with ongoing investigations.
6. Complaints were also received and investigated where flyfishing anglers were fishing in prime spawning areas on the property of Mr. Willem van Rensburg in the Vredefort Dome Conservancy. They were coming from the Benjoh holiday resort and were trespassing on the property of Mr. van Rensburg. They also made a braai on the property without cleaning up after they had finished. Mr. van Rensburg had put up signboards indicating the borders of his property. There will be also a signboard erected in the

Vaal River at this sensitive spawning site to warn the anglers not to fish here.

The idea of identifying and marking sensitive spawning areas so as to keep anglers out was discussed at the Association's meetings, and will be investigated in the future. The Association will provide the signboards to inform anglers of these sensitive areas.

The main activities for the rest of the year will be the registration of landowners as members of the Association.

REGIONAL REPORT: PROPOSED FISHERIES REGULATIONS FOR THE FREE STATE

These may be used as a basis upon which National Freshwater Fisheries Policy and Regulations may be developed.

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1. Largemouth Yellowfish (*Labeobarbus kimberleyensis*)

This fish must become a protected species in the Free State rivers. The Free State will thus become a safe haven for this Red Data species.

Regulations
a) If caught this fish must be released immediately.
b) No Largemouth Yellowfish may be kept in any form of keep-net.
c) If targeting this fish one must use barbless hooks.

The fine for transgressing any of the above should be R1000 and the confiscation of all the angling equipment.

2. Smallmouth Yellowfish (*Labeobarbus aeneus*)

There has been an increase in angling pressure aimed at this species over the past few years. Fisheries regulations should be imposed but not as strict as those above.

Regulations
a) The angler may keep only two fish on any one day.
b) A minimum size of 30cm (total length) should be imposed.
c) Only two Smallmouth Yellowfish may be kept in any form of keep-net on any one day.
d) Yellowfish must be kept in separate keep-nets

The fine for transgressing any of these regulations should be R1000 and the confiscation of all the angling equipment.

1. The policy recognises that no-kill zones will be identified in various rivers. These will be zones of high conservation importance. No angler may keep any fish caught in these zones.

The fine for transgressing this regulation is as above.

2. No angling competitions, which involve the keeping and the weighing of

The fine for transgressing this regulation will be R5000

4. Commercial net or line fisheries may be developed in dams only. The fishery will operate under permit with a quota and daily catch returns. Fishery regulations will be applied in order to create a sustainable operation.

5. No member of the public may interfere in any way with fish that are spawning.

The fine for transgressing this regulation will be R1000.

6. No netting will be allowed in any rivers

The fine for illegal netting will be R5000 and the confiscation of the nets.

7. It seems as though the general public is under the impression that they can net fish where their property or communal property borders on a river or dam. This is also the case with regard to the use of fish traps, cages and long lines. The river is the property of all the people of South Africa. There is no individual ownership. Only in instances where an impact study has been completed may a fishery be initiated.

Regulation
a) No netting or trapping of fish is allowed in any water body without a permit.
b) No long lines or cages may be used without a permit.

The fine for transgressing a) above should be R5000 and the confiscation of all equipment.
The fine for transgressing b) above should be R500 and the confiscation of all equipment.

8. The minimum mesh size for legal nets is 100mm.

The fine for transgressing this regulation is R3000. The nets will be confiscated and the fishing permit will be retracted.

9. It has become critical to control and regulate the movement of indigenous fish around the province and between provinces. If fish are taken to rivers outside their natural distribution ranges they could cause havoc in the new habitats. Species could become extinct where they are out-competed by new species, or hybridise with new species thus losing the original species. The hybrid may be sterile thus slowly reducing the breeding potential of the total population

Regulation
No indigenous fish may be transported or stocked without a permit.

The fine for transgressing this regulation should be R5000 and the confiscation of the transportation equipment.

10. Alien species are also being moved around the country to create what landowners think are commercially viable fisheries. This is also unacceptable as indigenous species could be out-competed or could be predated upon which may result in their extinction.

Regulation
No alien angling species may be transported or stocked without a permit.

The fine for the transgression of this regulation should be R5000 and the confiscation of the transportation equipment.

11. The ornamental trade is based mainly on tropical species. Most of these will not survive in the temperate conditions in the Free State. Therefore only those alien species that can withstand the cold winters or can hybridise with the indigenous fish species have been identified and placed on a black list. These problem species must be kept out of the Free State and South Africa.

Regulation
a) No fish on the black list may be imported into the Free State without a permit.
b) No trade in the listed species will be allowed.
c) No trade in CITES listed species will be allowed.

The fine for transgressing these regulations should be R5000 and the confiscation of the alien species.
If these species cannot be returned to where they originated from they should be humanely destroyed.

12. The importation of alien species for proposed aquaculture ventures has resulted in many unwanted species being imported into the country and the Free State. To date only Trout and farmed successfully. Thus before an alien species is imported an assessment of its production potential and its possible damage to the natural environment should be made.

Regulations
a) Before any alien species is brought into the Free State for aquacultural purposes an environmental impact assessment must be carried out.
b) The production potential must also be assessed in the area from where they are going to be imported.
c) The proposed importer is responsible for the costs incurred.

The fine for transgressing these regulations should be R10 000 and the closure of the illegal operation.

13. If a fish species becomes scarce it is listed in the South African Red Data Book. All species listed in this book may not be kept. They must be release immediately. This should be a national law.

14. Kalkfontein Dam is recognised as an aquatic reserve for Yellowfish species in the Free State. All Yellowfish caught should be released unless official signboards state otherwise.

The fine for transgressing this regulation should be R1000 and the confiscation of all the angling equipment.

15. Any river conservation areas that are developed and managed by the private sector will be recognised as long as the following criteria are used to manage the areas:

a) The management of the fish populations must be based on sound conservation principles
b) The management of the riparian area must be based on sound conservation principles
c) The riparian land should be registered as a conservancy.
d) An evaluation of the conservation area may be carried out at any reasonable time by Departmental officials.

If the area is visited and it is not being managed using sound conservation principles the conservancy may be deregulated and the area will no longer be recognised as a riparian conservation area.

SUMMARY OF COMMENT & DISCUSSION FOLLOWING EACH PRESENTATION

"Welcome address" – *Bill Mincher and read by Peter Mills*

Regarding an enquiry about the forthcoming Biodiversity Act Prof Skelton said that it might come into force as early as September 2003. Some of the main goals of the Act would be:

1. To establish a National Biodiversity Institute.
2. Control endangered species
3. Control alien species
4. Control bio-prospecting by pharmaceutical companies.

"What is a yellowfish" – *Prof Paul Skelton*

Dr Wolhuter asked about the theory that there was interbreeding between *Labeobarbus kimberleyensis* and *L. aeneus*. Prof Skelton replied that it had been reported (Le Roux) that *L. kimberleyensis* bred slightly later than *L. aeneus* and therefore the two species did not mix. However, as the Orange/Vaal system was now highly regulated with a large number of dams and weirs on both rivers this had possibly resulted in the interruption of breeding patterns and the loss of separate breeding sites. He also said that this was mere speculation at this stage.

Ernst Swartz asked about popular names for yellowfish. Prof Skelton said that one had to go back to the earliest name used for describing the scientific name of a species which was how the genus *Labeobarbus* was arrived at. In the case of common names these were merely guides or tags and there was nothing legal regarding their use.

Prof Bloomer enquired about the dating of the rock art paintings showing scenes of San capturing yellowfish with spears. Prof Skelton said that the dates were from 1300 BC to 800 AD.

Mick Angliss asked about *Barbus matozzi* and Prof Skelton said this was a diploid species and differed from the Angolan papermouth and there was still much work to be done to resolve its lineage. It also differed completely from the true yellowfish (*Labeobarbus*) genetically (hexaploid species), morphologically and biologically.

Prof Skelton confirmed John Southey's statement that eels were very rare in the Orange/Vaal system, but that it was possible for elvers to traverse watersheds from the east flowing rivers.

Gordon O'Brien enquired whether sampling had been done on the yellows of the Zambezi. Prof Skelton replied that although samples of *L. codringtonii* and *L. marequensis* had been received no work had been done on them.

"Why Invertebrates & Fish? – An Important Link" – *Dr Wynand Vlok and Paul Fouche*

Stephen van Staden said that although there appeared to be plenty of studies done on the major rivers there was little on the tributaries. Dr Vlok replied that follow-up studies would look at tributaries and Prof Skelton pointed out that there was a shortage of researchers to do this work.

Pierre de Villiers asked where this study was headed and Dr Vlok said that it was vital to focus on the flow requirements.

Johann Grobler said that the Australian legislation was a good model and Peter Mills said it was important that the studies reach the right people so they could take the correct decisions.
Horst Filter mentioned that the Assegaai River was suffering from poorly planned releases from the Heyshope Dam upstream and pollution emanating from Piet Retief.
Dr Vlok said it was clear that in a water-poor country like ours we were using what water we had available incorrectly.

"The Habitat Preferences & Food Selection of *Labeobarbus marequensis* in the Luvuvhu & Mutale Rivers" – *Paul Fouche, Dr Wynand Vlok & Mick Angliss.*
Keith Wallington said larger fish may have moved away before sampling commenced and he doubted whether chironomids were accidentally ingested while Pierre de Villiers stated that fish capture was difficult where sludge, algae and rocks were present. Paul Fouche replied that they gave each area a 2 hour rest before sampling and that due to the 2000 floods in-stream vegetation was missing.
Prof Skelton stated that food availability at any particular time was important for a species like the yellowfish.

"Water quality of the Upper Vaal – Trends & changes over time" – *Francois van Wyk & Thomas Gyedu-Ababio.*
Johann Grobler observed that there appeared to be more yellows at the Vaal side of the Dam than the Wilge side. In addition few were found in the Barrage reservoir where bass were present.
Pierre de Villiers stated that although the water from Lesotho had the benefit of diluting the pollutants the erosion in the As River was bad. In addition the water temperature which was 12º centigrade near Bethlehem was far too low for breeding yellows. Furthermore it had been agreed in the planning stages that releases from Khatse were to be from the surface to avoid the problem of low temperature. This had never been implemented.
Francois van Wyk agreed that these problems were unacceptable. He said that the team in Lesotho tended to do what they liked and they were not correctly motivated. He said he would raise this matter of water releases with the Khatse team at the next forum which was scheduled for July.
Prof Skelton said that the erosion in the As watercourse was probably South Africa's fault because the authorities had been warned about it.
Dr Vlok stated that we must not think that pollutants will disappear with dilution and this problem should be followed up.
Ernst Schwartz said that the erosion lead to turbidity and asked if this was later resolved whether clearer water in Vaal Dam could lead to a greater algal problem. Francois van Wyk said this had not happened yet but could be a major problem if the Dam cleared.
It was agreed that these problems must be resolved at the relevant fora.
Dean Impson queried the water quality in the Vaal at Elgro. Francois van Wyk said the data did not include sampling from below the Vaal Dam wall and that many of the pollutants came from tributaries entering from the below Vaal Dam.

"Management of the Vaal Dam" – *Walther van der Westhuizen*
Walther van der Westhuizen agreed that the method of releases from the Heyshope Dam into the Assegaai River was not acceptable. He promised to contact Horst Filter about this matter.
Kevin Downey queried the location of the Lethabo weir where Rand Water abstracted water and Mr van der Westhuizen stated that this was at the upper end of the Barrage reservior.
Dean Impson queried the Vaal flow at Elgro and Mr v d Westhuizen said that only 3 cumecs were released from Vaal Dam at present for dilution purposes and the rest of the flow which averaged about 15 cumecs came from the Barrage Reservior and its tributaries. Regarding the relatively low level of Vaal Dam (below 70%) he pointed out that evaporation rates in the shallow Vaal Dam were very high.
Dr Wolhuter queried the registration of water users along the Vaal. Mr v d Westhuizen said that in terms of the new Act registration was mandatory, particularly as the situation regarding usage had become unclear due to problems created by previous proclamations.
Mr v d Westhuizen stated that they could simulate floods below Vaal Dam and that they had flood statistics for certain stations going back up to 100 years.
Kevin Downey pointed out that anglers have access to the Vaal by moving upstream or downstream by boat but they could not cross private property without permission.

"Water hyacinth on the Vaal" – *Robert Littleford*
Kevin Downey enquired about stacking hyacinth and Robert Littleford stated that seeds were viable for 15 years. However, if decomposition took place in stacks the seeds rotted.
Dean Impson asked about the efficacy of biological control and Mr Littleford said that although the method was effective the insects were swept downstream in the floods and therefore they needed to hold a reserve of insects to replace those lost in this manner.
Mr Littleford agreed with Francois Botha that the prolific hyacinth growth indicated a very high nutrient load in the Vaal.
Pierre de Villiers asked whether manual removal was not desirable as hyacinth sprayed with chemicals or killed by insects sank to the bottom and Mr Littleford agreed.
Mr Littleford stated that although barges were used in the USA the areas in the Vaal for clearing were relatively small by comparison and therefore this method would not be practical.
Francois van Wyk asked whether hyacinth was not spread by bass fishermen trying to establish suitable habitat for this species.
Dean Impson said that although biological control was an ideal method we must realise that it will never provide 100% control.

"A few threats facing the future existence of yellowfish – empirical observations" – *Adv. Bernard Venter & Dr Louis de Wet.*
Dean Impson stated that bass and rainbow trout had a severe impact on populations of indigenous species in the Western Cape and this message

needed to be conveyed while Keith Wallington queried the legality of bass stockings of Hartebeespoort Dam. Adv Venter said the first stocking was done by Transvaal Nature Conservation and the second by Bassmasters.
Keith Wallington also asked how pollution reports were dealt. Adv. Venter said that as an NGO they (Eko-Care Trust) had a network of people reporting pollution problems and these were passed on to DWAF.
Erwin Schroeder denied that Bassmasters were responsible for the spread of hyacinth. Francois van Wyk said that it was spread to the Vaal when boat owners from Hartebeespoort launched their boats in the Vaal.
Turner Wilkinson said that bass were becoming a problem in parts of the Vaal and Johann Grobler said they had appeared in Koppies Dam.
Keith Wallington queried the fluctuation in daphnia populations in the Vaal Dam. Dr de Wet stated that there were natural summer and winter cycles. He also said they were very sensitive to pollutants and their populations varied according to salt levels and dilution levels. Replying also to a question on the impact of carp he said that it had been shown that when these fish stirred up the bottom sediments this released nutrients which could promote the growth of algae
Francois van Wyk stated that although Hartebeespoort property owners had been asked to help clean up the dam the response had been very poor.
Dean Impson said the illegal stocking of catfish in the W. Cape was having a very detrimental impact on these waters.
Francois van Wyk asked how much was known about the water quality requirements of yellows as they sometimes seemed to exist in heavily polluted waters like the Jukskei. Pierre de Villiers agreed but said there were other factors and Dr Vlok stated that one should not only look at adult fish.

"The River Ranger Programme" – *Garth Brook*.
Peter Mills said the programme was a good example of local people getting involved and asked what threat vetifer posed. Garth Brook said the plant posed no threat.
Stephen van Staden asked what permission was required for the programme and Garth Brook said that one needed to work with farmers and the local black community. No permission was required for the destruction of aliens and Dean Impson said in the case of stream modification one should speak to the local conservation officer and submit an EIA.
Garth Brook said the dumping of logs in the river was illegal and that it led to considerable damage of riverbanks and bridges.
Regarding KZN and communication Mr Brook said the programme was being extended to a test site in KZN. He also said River Rangers were required to speak English (matriculant level) and also act as General Guides. In answer to a question from Johann Grobler he said that unit standards were being applied and that overseas visitors will demand an improvement in standards and fortunately service from Theta was improving.

"iTag, the way forward for the conservation of Tigerfish" – *Domien van Buynder*
Dean Impson said that this was a good example of private enterprise

supporting biodiversity and Pierre de Villiers said a similar project was needed on *L. kimberleyensis* in the upper Vaal.
Ernst Schwartz said that fish ladders should be placed at the weirs but Domien van Buynder said that weirs could be removed as most were no longer needed.
Dr Wolhuter asked how far up the river systems were tigerfish now found.
Domien van Buynder replied:
Crocodile River – up to Kaapmuiden
Lomati River – up to Driekoppies
Komati River – about 30km into Swaziland
Richard Boycott said that in the past tigers had been found well into Swaziland but with the exception of the Usuthu this was no longer the case.
Peter Mills said that there was conflict between land use and the survival of many species. The implementation of the new Acts, the activities of the catchment management boards and a reduction in the number of weirs could only address this.

"An integrated approach to conservation management of yellowfish" – *Ernst Swartz & Prof P Bloomer.*
Also
*"*Identification of Conservation Units of two Yellowfish Species (*Labeobarbus aeneus & L. kimberleyensis*)" *– Prof P. Bloomer &Daksha Naran*
On the question of hybridization Francois van Wyk asked whether controlled environment experiments could be carried out during the breeding season. Ernst Swartz said possibly one should study the two species where they spawn together to see if they hybridize.
Turner Wilkinson asked how similar the Orange/Vaal species were to the other species such as *Labeobarbus polylepis* and *L. capensis*. Prof Skelton replied that they were very similar morphologically and therefore we must expect close genetic similarities (as in humans & chimps). Therefore we must be very careful when investigating the genus. The genetic expression represents the totality of the animal. In yellowfish we must also understand plasticity.
We must accept that there have been changes in the river systems and therefore we have to work with what we have. We also have to be practical in stocking of dams.
Prof Bloomer explained about the marker gene used for the study. She also agreed with Prof Skelton and said we were dealing with a natural situation and how to manage it.
Dr Wolhuter asked whether the results were reproducible. Prof Bloomer said they were. Multiple individuals were done and then repeated. Moreover a second laboratory would get the same results.
Dr Wolhuter asked about the accuracy standard. Prof Bloomer said two repeats were done – forward and then reverse direction and they then had to match. It was also lined up with international standards.
Prof Skelton said that a Dutch study of the 16 species in Lake Tana showed that they were all morphologically distinct and he said it would be interesting to know how they evolved. He said only half of these species bred in the rivers and the rest in the lake. He also mentioned the Hardap Dam where compression of environmental factors caused hybridization. Likewise the Orange/Vaal system was also highly regulated and compressed right down to the lower Orange. The only natural part of the system in South Africa was the Kraai.

"SA Freshwater Bank Angling Federation (SAFBAF)" – *Johann Grobler*
Johann Grobler said they were promoting catch & release. Regarding keep nets, metal keep nets were banned and fish were not permitted to be kept for longer than 8 hours in a keep net. Furthermore the use of longer keep nets was being promoted.
Kevin Downey said that many bank anglers were unaware that carp were aliens and 'undesirable' from a conservation point of view.
Horst Filter noted that the attempt to reduce carp numbers from Heyshope had resulted in an improvement in bass fishing.

"Regional Report: Northern Cape" – *Johan Jonk*
Stephen van Staden asked about the impact of mining activities (habitat

destruction) on the Vaal River. Johan Jonk said that this was a major problem as guidelines were not followed and permits were also being issued for prospecting which led to major habitat destruction. In addition Minerals & Energy Affairs were not sympathetic and saw this activity as job creation. Pierre de Villiers said that Minerals & Energy and DEAT were working on new legislation.
Dean Impson stated that in the West Cape all sawfin, whitefish and Clanwilliam yellows must be released as they were endangered.

"Regional Report: Swaziland" – *Richard Boycott*.
In answer to a question by Pierre de Villiers about the presence of alien crayfish, Mr Boycott said they had been found but not in rivers. He also said they were concerned about the problem of sedimentation which was also being caused by the activities of timber companies.

"Regional Report: Gauteng" – *Piet Muller*
Keith Wallington asked about the activities of mining companies who continued to create major problems. Piet Muller said that the provincial minister for the environment, Mary Metcalfe, was capable and should get things right.

"Regional Report: North West" – *Gustav Engelbrecht*
In answer to a question from Kevin Downey about the bag limit for yellowfish, Gustav Engelbrecht confirmed that it was still 10 for both small- and largemouth.
Turner Wilkinson said that many anglers were opposed to paying for licences as the money went into the general coffers and was not used to improve fishing.

"Regional Report: Free State" – *Pierre de Villiers*
In answer to a question from Mike Beaurain, Pierre de Villiers confirmed that the department was still committed to looking after the environment.

" Artlure" - *Bernard Venter*.
Dean Impson said he agreed with the suggestion that there be a maximum limit, say 40cm, to conserve the prime breeding stock. He also said that Artlure should adopt an 'agreed list' for each system to remove the incentive for introducing species to a system where they do not belong. It was recommended that Artlure prepare such a list with the help of conservation bodies.

RESULTS OF THE SATURDAY WORKSHOP SESSION

Group 1: Legislation

Mission:

This group made no specific comments about the mission statement.

Function/Objectives:

Pierre de Villiers has been tasked to review existing fresh water legislation for all nine Provincial Conservation Authorities. A positive outcome of this process could mean one angling license that would be valid throughout the country. More importantly uniform legislation will apply to all river systems nation wide. The group agreed that this would stop a huge proportion of the public who fish without licences. The group agreed that existing of legislation, on all fronts, was inadequate for the protection of the countries river systems. Reference was made here to the Department of Water Affairs and Forestry, The Department of Mineral and Energy Affairs as well as the Provincial Conservation Authorities. However, the process that is being undertaken by Pierre for the Nine Provincial Authorities was seen as a step in the right direction. The process of drafting this legislation will go through a rigorous public participation programme and everyone in this group would have the opportunity to comment on the document by July/August. It was hoped the final draft would be submitted to Working Group 1 by the end of September.

Outputs: Unified legislation for fresh water fish management for all nine provinces should be in place by the September this year.

Who: Pierre de Villiers

Group 2: Structure of the Yellowfish Working Group

Mission:

Exclude reference to nine yellowfish because this is not a true reflection of the definition of what true yellowfish are.

Function/Objectives:

The group suggested a formalised structure for the working group although it was felt that an effort should be made to keep operations flexible. The merits of shifting the management of the YWG to another authority were debated. It was felt that the working group had a good home with FOSAF, but that it might be easier to achieve greater recognition and raise more funds if it were to move to an NGO like the Endangered Wildlife Trust (EWT). Furthermore the focus of the YWG was now shifting away from flyfishing and yellowfish per se to conservation of the whole ecosystem. A formal structure would be necessary if the group were to fall under an organisation like the Endangered Wildlife Trust (EWT).

It was clear that the existing structure required restructuring since it was very difficult to keep track of projects. It was also difficult to raise funds for the group because of the group's informal nature. Some in the group considered the looseness a strength of the YWG. Whatever was decided the group felt strongly that a certain amount of flexibility should remain as this kept the

group dynamic and allowed for the free flow of ideas and projects. The group also felt that a certain amount of control should be exercised on the various projects that are undertaken under the banner of the Working Group and this could be encouraged by instituting a registration system. This would prevent the possibility of anybody doing anything under the banner of the Group. A new structure may consider including other angling bodies as members.

Outputs: A plan of the process to formalise the structure of the Working Group.
The group would function as it does at present but there will be a certain amount of liaison with other NGO's to establish the viability of shifting the management structure elsewhere.
An informal approach to be made to EWT.
Who: Dr Gert Steyn, Peter Arderne and Peter Mills. Recommendations will be taken to the YWG Steering committee for further consideration and action. The final decision will be made by the FOSAF executive committee.

Other issues raised during the discussion.
Stakeholders: The following stakeholders were identified during the discussion.
Scientists, conservation staff, anglers (recreations & sport). The working group should always try to identify and drawn in relevant role players. There is no fixed group and affiliations will change over time.
WESSA/EKO-CARE
Riparian owners
GOVT: DEAT, DWAF, DSR and the conservation authorities

Group 3: Yellowfish Management.

Mission:
A suggested change of the mission is as follows.
To promote the long-term conservation of yellowfish as a flagship group within their natural habitats through sustainable utilisation practices and as a means to create an awareness of conservation with the relevant decision makers.
Immediate Objective:
How to use yellowfish as a flagship group.

There is a need to generate information about yellowfish and this will include the following information:

1. Species integrity. A description and understanding of the conservation problem.
2. Critical biology & ecology (breeding, feeding, space and shelter). Additional ecological information is required as nothing really exists at present.

The above knowledge and information must be communicated to a variety of interested and affected parties.

<u>What information must be communicated?</u>

- Conservation status of the yellowfish and the systems in which they occur

- Species and their identification.
- Biology/ecology information.
- How to conserve the fish

<u>To whom must this information be communicated?</u>

1. Conservation Concerns to:
- Fellow anglers
- Conservation authorities
- CMA's
- River Health Programme
- Landowners
- General Public
- Scientists

2. Cons. Biology and Ecology (Knowledge/data).
- Angling community
- Conservation scientists and managers
- CMA's

3. <u>How is this information going to be communicated?</u>
- Questionnaires, newsletters, magazines
- Anglers: Club communication, magazines, articles
- GOVT: Meetings, protests lobby's
- Landowners: Various.
- General Public – Media
- Scientists – e-mail.

Group 4: Education

Persons Participating in this group were:

Dean Impson	Hester Plank	Werner Hattingh	R Niemann
Erwin Schroeder	Kobus Fourie	Bernard Venter	John Southey

Mission:

"To promote the long-term conservation of the nine indigenous yellowfish species of Southern Africa and their natural aquatic habitat through sustainable land use management and wise water management"

Suggestion:
Retain the "nine species" to protect those species in danger and popularly known as "yellowfish".
Add "sustainable" in the phrase '*sustainable* long-term conservation'

Education and awareness for Yellowfish needs to be addressed towards the following:

Target Population (who should be trained?)	12 year olds guides riparian owners anglers governing bodies of anglers government (local, provincial, national) media conservation-orientated bodies landowners PDI's Black community leaders Tourism (value of resource) Honorary rangers (conservation)
Educators (Who should train?)	Nature conservation bodies Individual regional YWG's Conservancy managers Eko-Care Magazines Angling clubs Guides and river rangers School teachers Outdoor educators NQF

4 Training Objectives:

- Flagship animals for riverine underwater world
- Indicators of River Health
- Threatened Yellows and how to save them
- How to catch fish
    - Sport fishing and tourism
    - Subsistence fishing for aliens species

How will Objectives be met?	Use sub-groups of YWG for a regional focus
	Get tourism personnel involved in YWG regionally
	Funding and sponsorship
	Awareness of plan of action (To take to funders/sponsors)
	Nature Conservation
	Honorary rangers

Tools	Yellowfish route This is a map of where to fish for yellows and where to stay. It will start off with the known information and be built on from there
	Poster (map) Dean's project where the various species will be indicated with their correct natural distribution
	Pamphlet (SAPPI) This is already in print for the Mpumalanga area. Designed to be used for outdoor educators and in education centers. Need to get out to other regions as well. Can be used as a good source of
	Use appropriate media to get to those needing education ❖ Articles ❖ Support for the cause ❖ Use effective mechanisms e.g. Ari Bert
	SMS Send a blanket SMS re the "living gold" message to promote yellowfish conservation
	One pager on the YWG and information on Yellowfish for general distribution to all interested parties
	Use of E-mail Send information and use YWG and well know distribution groups to send out messages re education and awareness

Action Plans for 2003

WHAT	WHO	WHEN
Email FOR awareness of YWG and Yellowfish "Living gold of our rivers"	Hester and Dean (draft) Send to Erwin ASAP. Send to YWG and major e-mailers e.g. Ari Bert	10/6
Distribution Poster	Dean Who else can assist him?	Draft by end June
SAPPI YF pamphlet	Send electronic copy to distribution list of YWG Erwin to send	End July
9X9 – televised with Ari Bert	Dean Impson	12 month project
YF Route	John Southey - get info from other areas - Dean to assist with map	End 2003
YWG proceedings	John Southey 1 article per month Use e-mail distribution list Use extract and send full article on request	Start June (as soon as proceedings available)
Article in TCFF	Turner Wilkinson	End 2003
Article in Tight Lines	Bernard Venter	End 2003
Article in Bass Anglers	Erwin Schroeder	End 2003
SA Bank Anglers article	Dean Impson	End 2003
Article in Flyfishing	Peter Mills	End 2003
SMS "living gold" message	Kobus Fourie	End July
Logo – for education and awareness	Turner Wilkinson	End July

Way Forward

The outcomes of each of the above sessions will be discussed at the next YWG steering committee meeting and decisions made will be communicated to all the delegates who attended the Workshop at Elgro.

SUMMARY OF THE MAIN RESOLUTIONS TAKEN DURING THE CONFERENCE AND THE SUBSEQUENT SCIENTIFIC PANEL MEETING

1. The 2004 National Conference to be held in Mpumalanga. Venues suggested included Loskop Dam, Bronkhorstspruit, Blyde River Canyon and Badplaas.
2. It was agreed that the moratorium be maintained until the new regulations, which were being drafted by Pierre de Villiers, were promulgated. In the meantime if stocking was required it was recommended that this be done after the authorities had issued a permit. If necessary the relevant nature conservation authorities should supervise the stocking. Fish for such a stocking could only be obtained from a local source in the same system.
3. Pierre de Villiers has been tasked to review existing fresh water legislation for all nine provincial conservation authorities. A positive outcome of this process could be that one angling license that would be valid throughout the country. More importantly uniform legislation would apply to all river systems nation wide.
4. It was decided that the genetic studies on the 2 species of the Orange/Vaal system (*Labeobarbus aeneus* & *L. kimberleyensis*) should be completed with the additional work required to fully answer the question of whether these two species are hybridising or have only recently differentiated into 2 distinct species.
5. In addition a follow-up allozyme study for the Orange/Vaal is to be completed by Dec 2003 with further sampling to include the lower Orange and the Orange at the Lesotho border. In addition it was agreed that we should also look at aspects of the biology of these species including feeding, breeding and habitat preference.
6. The Green Trust application for funding to be updated. In addition to the genetics work the application will include the biology/ecology aspects. The intitial submission will be for *L. natalensis* followed by *L. polylepis* and *L. marequensis*.
7. The YWG Steering Committee to look at the structure of the YWG in order to make it more streamlined and effective.
8. The yellowfish will be promoted as a flagship species so that in future any conservation efforts targeted at this flagship species will then benefit the general “health” of the ecosystem.