FOSAF

THE FEDERATION OF SOUTHERN AFRICAN FLYFISHERS

PROCEEDINGS OF THE 11TH YELLOWFISH WORKING GROUP CONFERENCE

ELGRO RIVER LODGE, POTCHEFSTROOM
13 – 15 APRIL 2007

Edited by Peter Arderne

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CHAIRMAN'S REPORT

This year has been eventful and culminates with the launch of 'The State of Yellowfishes in South Africa – 2007' report at our 11th Annual Conference. This high quality popular report and accompanying poster on water quality will be widely distributed, especially in schools. Today's youth are tomorrow's leaders and we would like them to be well informed on the importance of clean water and its inhabitants. The associated scientific report, on CD, goes into a lot more detail and will create a benchmark for future reference and measurement of the effectiveness of interventions. I would like to thank the numerous authors and in particular the Water Research Commission, the Department of Environment and Tourism and the River Health Programme for the necessary funding.

It is encouraging to see that at last money is flowing into aquatic and fish research from government, industry and the fly fishing fraternity. I attended the annual awards dinner of FlyCastaway, a fly fishing guide tour operator. The MD Gerhard Laubsher and his company are very conservation orientated and dedicated the evening to the memory of the late David Ratray who was tragically murdered. David was the most impressionable client that Gerhard had ever guided. Most of the proceeds from the evening were earmarked for the Vaal River Telemetry Study being undertaken by the Johannesburg University under the guidance of Pierre de Villiers and Gordon O'Brien. The WRC provided the initial R200 000 which is running out, and additional funding has proved hard to find. Garth Wellman, one of our members, gave an impassioned talk on the plight of the yellowfish. You can understand the surprise and jubilation when fly fishers opened their hearts and their wallets and contributed the large sum of R250 000 during the auction. A trip to Cosmaledo valued at R100 000, donated by FlyCastaway, fetched R120 000 to start the trend. The balance came from beautifully framed photos of fishing spots at their venues and also donated by FlyCastaway. Another 20 guests donated R5 000 each to adopt a tagged fish used in the telemetry project. Well done Gerhard and your team!

Dr. Paulette Bloomer reports back on the genetic work being conducted at the University of Pretoria in collaboration with others and funded by AngloGold Ashanti. Further genetic work is being carried out with funding provided by the National Research Foundation. I am sure you will find the report-back in the Proceedings of great interest.

Peter Mills introduced the YWG to a new measurement tool entitled 'Threat Reduction Analysis' (TRA) at the customary workshop on the last day of the conference. The summary of threats lists water abstraction as the largest threat followed by habitat destruction (canalizing of rivers, estate and building developments and mining), pollution (industrial and agricultural and in particular mining) and sewage spills. We need commitment and positive action from central government to address these issues before it is too late. Garth Wellman said in his address that he and a colleague had caught a 3 lb largescale yellowfish in a river and five years later the river was dead. We do not have time to allow this to happen to our scarce water resources.

Politicians do not want to rock the boat. DEAT maintains that water pollution is the responsibility of DWAF who in turn do not want to prosecute perpetrators of pollution because they have no capacity to do their jobs properly. It is time that the buck stopped somewhere. One of the other problems we face is that a number of provinces do not have suitably qualified aquatic scientists and even more critical, senior provincial executives do not give the environment a high enough rating. What we need is a dramatic mind shift. We are seeing the storm clouds building up with global warming and the need for a unified approach to minimize man's negative influence on this planet. This will only come about with a Government that is focused at all levels.

The TRA process will become a regular feature of our annual conferences and will help us to focus on particular threats in specific catchments, and to develop strategies to counteract them. No doubt this will also involve other interest groups and NGO's with similar interests and will widen our scope, influence and effectiveness.

After eleven years in the chair, I have decided that it is time to step down and usher new leadership into the organization. I am very happy to hand over to Peter Mills who has impeccable credentials, is suitably experienced and has a strong commitment towards the conservation of our yellowfish and the environment. It has been a great privilege and honour for me to serve in this position and to have the support of so many committed members who 'by and large' are responsible for the achievements of the YWG over the past 11 years.

I will still remain active as an ordinary member of the YWG and a member of the FOSAF Northvaal Chapter committee, which organization, has the commitment and responsibility for the administration of the YWG under the excellent guidance and services of Peter Arderne, who adds value to everything he touches. Many thanks to FOSAF for providing this service and also much of the funding for the YWG to operate.

Best wishes for the future,

Bill Mincher

Chairman YWG
Hon. Vice President FOSAF
11 June 2007
Johannesburg

Press Release: The State of Yellowfishes in South Africa - 2007

WHY YELLOWFISHES ARE IMPORTANT TO US

The National Spatial Biodiversity Assessment released in 2005 by the National Biodiversity Institute in Pretoria reported a frightening 82% of our rivers are "threatened" of which 42% are "critically threatened". South Africans should be particularly concerned about this statement as most of our country can be described as semi-arid or arid and water is fast becoming a scarce resource. Rapid development of the economy and increasing population places even greater strain on water that must be used many times over before it flows to the sea. At the same time poorly maintained municipal treatment plants together with other factors have resulted in massive fish kills along the Vaal and other rivers. Therefore attention to the quantity and quality of our water, the very basic requirement of life, should receive the highest priority.

A major project undertaken by the Yellowfish Working Group (YWG) and funded mainly with a grant from the Water Research Commission (WRC) highlights this problem. Termed 'The State of Yellowfishes in South-Africa – 2007' it is the first-ever study aimed at the protection of our nine indigenous yellowfish species and their habitat. Yellows are excellent indicators of river health and are frequently used by the authorities for this purpose when monitoring the condition of our inland waterways. In addition these fishes are very valuable recreational angling fishes and are also an important source of protein for subsistence fishermen.

The project comprises several parts:

1. A popular report of 76 pages in full colour with about 100 photos. Among the contributors to this report are leading aquatic scientists, conservationists, anglers and a lawyer specialising in environmental legislation. This document covers the status of our nine yellowfishes as well as matters relating to their habitat, the threats to that habitat and how to protect it.

2. A detailed distribution map of the nine species.

3. A large poster depicting the upside of clean rivers and the intensely adverse effects of polluted rivers. This poster is a vital element in the publicity campaign and the WRC and the YWG intend distributing it to schools, clubs, municipalities, industry and riparian owners.

The main objectives of this report are to emphasize that by protecting our valuable yellowfishes there will be a significant and concurrent improvement in the quality of our rivers as well as in the quality of our life.

Copies of the report K8/719 may be obtained at a price of R50,00 each plus postage from the Water Research Commission by emailing orders@wrc.org.za or faxing 012-3312565.

LIMPOPO PROVINCIAL REPORT

Dr Wynand Vlok[1], Paul Fouche & Mick Angliss
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Summary
Although no specific work on any yellowfish is being done in the province a number of activities that relate indirectly to the species are taking place. The report focuses on three aspects namely: Research, the River Health Programme and Community outreach.

1. Research:
Shingwedzi River research project.
This baseline survey of the instream biota, water quality, riparian vegetation and geomorphology and EcoStatus determination of the Shingwedzi River and its tributaries is being undertaken at the moment.

This project forms part of a joint project between various institutions: University of Venda (Paul Fouche), University of Johannesburg (Prof Victor Wepener), Sanparks (Dr Thomas Ababio-Gyedu) and Bio Assets Consulting (Dr Wynand Vlok). The aim of the project is to draw on expertise, in a multidisciplinary approach, to ensure that a comprehensive final product will result from the research initiative.

The study will focus on the drivers (physico-chemical, geomorphology and hydrology) of the system, which provides a particular habitat template, and the biological responses of the fish, riparian vegetation and aquatic invertebrates within the system.

Twenty-seven sampling points, outside and inside the Kruger National Park, in the Shingwedzi River system, which include the major tributaries, have been identified. The tributaries included are the Phugwane, Mphongolo, Dzombo and the Shisha rivers. Sampling will extend over a three-year period and one of the final products is a management plan for the management of the system. It is also envisaged that this study would contribute extensively to the knowledge base of the lowveld largescale yellowfish in a seasonal river such as the Shingwedzi where *Labeobarbus marequensis* has only been recorded at one site namely Nkayeni which is within the boundaries of the KNP.

The first year of surveying has been completed and the majority of the sites have been surveyed during periods of low flow.

***Opsaridium peringueyi* project.**
This project is entitled "The development of a conservation framework for threatened African fish using *Opsaridium peringueyi* as a reference species". The project is funded by the Water Research Commission and is run by a multi institutional research group, which is to develop a conservation framework for African threatened fish species applicable to South African conditions. It is envisaged that the framework should also lead to an effective conservation strategy for freshwater fish in general and its integration into existing biodiversity conservation initiatives.

The aim is to define the macro-habitat and microhabitat of the species. This involves the development of a sampling process with the necessary development of field techniques, field forms, a database format and a sampling protocol. These will form the backbone of the project, as it will supply critical information in the habitat requirements of fish on a macro level. The feeding, genetics, distribution and artificial breeding of the species will also be studied.

A total number of 34 sampling sites, of which the majority is within the KNP, have been sampled and the preliminary results indicate a number of issues i.e. decline in fish diversity in some rivers and the obvious absence of *O. peringueyi* in certain river stretches. It is also a three-year project and the first year was completed at the end of 2006.

During the sampling all the fish species that make up the assemblage at each site and specifically in each biotope will be recorded. In the process data of *L. marequensis* distribution and its habitat requirements will be obtained which will contribute extensively to the understanding of the species.

***Labeobarbus marequensis* project:**
This project forms part of a PhD study and is entitled "Aspects of the ecology and biology of the lowveld largescale yellowfish (*L. marequensis*) in the Luvuvhu River (Limpopo River system)".

This project focuses on the habitat requirements of the different life stages, or age classes, of *L. marequensis* as far as macro- and microhabitat are concerned. These habitat requirements are linked to aspects such as the breeding biology and feeding needs as well as to specific habitat needs during the development.

Xikundu fishway project:
This project formed part of a larger project that was aimed as determining the design criteria for fishways in South Africa and focused on one particular weir in the Luvuvhu River. As part of the evaluation of the effectiveness of the fishway, a large amount of data on the migration of *L. marequensis* was generated. This data relates to the cues that stimulate migration, migrations patterns and water quality and physical parameters during migrations. The main project has been completed

2. River Health Programme
The State of the Rivers Report (SoRR) of the province that reports on the Mokolo River has recently been released. It is the fourth SoRR of the province and the last of the perennial river reports. As is the case with all the rivers that have been surveyed a technical report on the Mokolo River was also prepared. Where SoRRs supply a lot of data on the Ecostatus of the rivers, the technical reports are valuable in as far as matters such as biodiversity and species distribution are concerned. The technical report on the Mokolo River is no exception and a lot of data on the yellowfish distribution was collected.

3. Community outreach
During 2006 a few new sites were identified in the Great Letaba River to be used as fly fishing sites for both the yellowfish species in the province, *L. marequensis* and *L. polylepis*. This was done in conjunction with the Haenertsburg Trout Association and various

landowners. This led to the establishment of education programmes at some of the lodges. The programme includes posters, pamphlets, information boards, name boards for trees and hikes.

STATUS OF THE KWAZUKU-NATAL YELLOWFISH *LABEOBARBUS NATALENSIS*

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Introduction

Status of species – IUCN

The KwaZulu-Natal Yellowfish, *Labeobarbus natalensis*, commonly referred to as Scaly, is an endemic species of the province that is not scheduled in the IUCN red list. *L.natalensis* is widely distributed within KZN and occurs in all major catchments from the Umtumvuna River on the Transkei border to the Mkuze River in the north. This benthopelagic species that is fairly closely related to the carps is considered to be the most ubiquitous fish in the KZN province since it occurs in hundreds of rivers and smaller tributaries extending from the coast to the Drakensberg escarpment at altitudes of 1500 m or more. Waterfalls have historically prevented access of this fish species to the upper parts of some rivers, notably the Umzimkulu and Ingwangwana, which both flow for 80 kms or more before yellowfish are to be found in them. Freshwater fish generally pass from one river system to another, either through the interchange between headwaters, or from one river mouth to another. Due to the east-west flowing aspect, and consequently geographical isolation of many KZN rivers, most species probably colonized by traveling from stream to stream along the coast. Salt water is logically a barrier to most strictly freshwater fish, but fluctuations in the coastline within the last million years may have brought about a temporary connection between freshwater lagoons that were formed behind sand dunes that were deposited by the sea. Whatever the mechanism, there seems little doubt that *L.natalensis*, together with other species, entered each stream near the coast and then worked their way upstream. The most obvious way of accounting for the presence of yellowfish above what are now considered impassable waterfalls suggests that the fish were already present before the geological formation of these barriers.

The KwaZulu-Natal Yellowfish commonly occurs in shoals that migrate during spring and summer. They prefer the warmer areas of rivers and often congregate at the inlets of small tributaries where the water is warmer than that of the main river. They spawn in fast-flowing stretches of river that are algae free. They breed in summer, migrate upstream and spawn over gravel beds. Males mature at about 10 cm FL, females at 15 cm FL. The maximum size is a fish measuring 68.3 cm TL with a mass of 4,628 g.

Status of the Habitat

Three DWAF Water Management Areas (WMA's) occur in KZN; these include the Usutu to Mhlatuze in the north, the Thukela in central KZN and the Mvoti to Umzimkulu WMA in the south. KZN has also been divided into a number of ecoregions which can be defined as broad areas of ecological similarity in terms of physiography, climate, geology, soils and potential natural vegetation. Rivers occurring in a particular ecoregion will be shaped by

similar processes and will thus have certain similarities. KZN broadly encompasses the North Eastern Coastal Belt, South Eastern Uplands, Eastern Escarpment Mountains, North Eastern Highlands, Natal Coastal Plains and Lebombo Uplands. From a river health point of view a State of the River Report has only been developed for the uMngeni River System. The uMngeni River and neighboring rivers and streams cover 4,420 km^2 and have a mean annual runoff of 877 m m^3. Despite effective water management in the uMngeni catchment area, the demand for water is expected to increase exponentially due to unprecedented urban development in the Durban Metro area. Urbanization in the lower reaches has lead to increased contaminated runoff and faecal pollution, The rivers of the uMngeni and uMlazi catchments are also heavily regulated by dams, resulting in downstream flow reduction, and the degradation of downstream water quality, habitat and biotic integrity. The upper and middle reaches of the uMngeni River are in a good to fair state, while the lower reaches are in a poor state. The uMlazi River originates south west of Pietermaritzburg and flows out to sea in a concrete canal near Durban. Land use in this particular catchment ranges from forestry and agriculture to urban development. The ecological state varies from good in the upper catchment to poor at the sea.

DWAF have 638 national monitoring sites of which approximately 60 occur in KZN. Many of these are positioned above and below point sources of pollution and are not a true reflection of the general state of the rivers. There is also a bias towards chemical sampling methods that does not give an accurate assessment of the ecological integrity of KZN's river systems. Much of the river health work carried out currently has in most instances been carried out at the cost and goodwill of local authorities and service providers. Dr Chris Dickens and Dr Mark Graham, previously of Umgeni Water Board, were instrumental in developing and refining the current SASS 5 Rapid River Health Bio-Monitoring system which is used nationally. eThekwini District Municipality, in particular is to be commended in carrying out consistent and intensive river health sampling within the metropolitan area. Durban, with a population of 3.5 million people, shares many of the problems associated with Johannesburg, the only difference being that most of the storm water enters into the sea. eThekweni District Municipality have more than 200 river bio-monitoring sites, some of which are reference sites, more or less in a natural condition situated away from urban and industrial development. eThekweni Municipality is spending more than R 1 m each year monitoring their river systems. Several of the beaches like Umhlanga Rocks have received blue flag status. Since tourism is a major contributor to the local economy it is within the long-term interests of the municipality to ensure that rivers entering into the sea are in the best possible state.

A recent RHP study was conducted in 2006 by Dr Mark Graham in the Durban Metro area. Sixty one sites were sampled, 3 sites were found to be in a natural condition, 20 in a good condition, 17 in a fair condition and 21 in a poor condition. Ezemvelo KZN Wildlife assisted the consultant with the collection of fish data. Physical, biological and chemical components of the river systems were assessed in 32 rivers (61 sites) within the district municipality. 30 Species of fish were collected in the eThekweni Municipality District, a fair number of them estuarine species with a tolerance for fresh water. Of great interest was catching two juvenile kingfish (Caranx.sp) in totally fresh water above a stone rapid in the Umdloti River. Fifteen of the thirty-two rivers (47%) sampled, in terms of the current EKZNW Species Database, are known to support *L.natalensis*. Eleven of these 15 rivers produced yellowfish at the time of sampling. Since only thirty minutes were spent electro-

fishing, and habitat conditions were not always favourable for this species, sampling error would have occurred. The four rivers, which failed to produce yellowfish at the time of sampling, were the Palmiet, Lovu, Msimbazi and Msinyati Rivers.

It would appear from the EKZNW Species Database that *L.natalensis* seldom ever occurs below 100 m in KZN. This is attributed to the species preferring faster moving sections of river which are less likely to occur at low altitudes.

Threats

The biggest threat to this species is considered to be chronic pollution, siltation and physical habitat change.

The KZN Yellowfish can be considered to be a fairly robust species tolerant of, and in certain instances, taking advantage of man induced habitat change. The results from the Durban Metro river health survey indicate that *L.natalensis* is capable of surviving in rivers ranging from a very poor to natural ecostatus. It was our observation that the fish appeared in smaller numbers and were physically stunted in highly polluted environments. The Umsunduze River which flows through Pietermaritzburg had several fish kills this year and epitomizes the events which have occurred recently in the Vaal River. Although not as dramatic as the Vaal, it should indicate to us that the mechanisms are in place for repeats of these disasters. A common denominator in both instances is the accumulation of biological waste products in the river system that has the ability to trigger a mass mortality of fish due to a high biological oxygen demand. This event can be triggered by, amongst other factors, the ingress of storm water into sewage systems, disruption of benthic sediments, algal die off and general overloading of the system with biological and chemical contaminants. With 70 % of municipal wastewater treatments plants in KZN rated as being non-compliant we have a real reason for concern.

KZN Yellowfish have in many instances flourished in some of the larger state owned reservoirs like Chelmsford, Wagendrift, Midmar, and Albert Falls. The biomasses of fish occurring within these systems will often far exceed that which would have occurred naturally in the river. Dams help serve as nutrient traps, stabilize water temperatures and generally provide an abundant food supply. The fact that the KZN Yellowfish is an omnivorous fish feeding on algae, aquatic insects, snails and crabs and in certain instances frogs and small fish, means that it is a highly adaptable and opportunistic species. Mr. Charles Wright, who pioneered the breeding of KZN Yellowfish some thirty years ago, found that silt deposition was the biggest threat to developing ova.

Genetic contamination is another threat. At this stage we don't know whether KZN Yellowfish would hybridize with other closely related yellowfish species. Mike Coke in 1991 discovered both the Orange-Vaal Yellowfish *Labeobarbus aeneus* and the Orange-Vaal Mudfish *Labeo capensis* on the KZN side of the Thukela-Vaal Inter Basin Water Transfer Scheme. Opportunities currently exist for both these species to populate the Thukela system and to hybridize with *Labeobarbus natalensis* and the Tugela Labeo *Labeo rubromaculatus*, both endemic species to KZN.

Conservation measures to conserve yellowfish resource

Establishment of Conservancies

To date no formal conservancies have been established directly around the yellowfish angling resource. The angling potential of yellowfish has however been broadly recognized particularly amongst private game reserves and lodges on the Mkomazi River. The demand for fishing is mostly seasonal with hunting still remaining the main attraction. uMngeni Valley Nature Reserve (WESSA) in Howick now offers some excellent yellowfish fishing.

Stockings

Trial stockings have been carried out at Royal Natal National Park using yellowfish. On the 26 October 2006, 111 KZN Yellowfish were electro-fished from the local Thukela River and transported few kilometers to the Rugged Glen Dam. The stocking was most successful and the fish swam away confidently into deep water. The main aim of the trial, which has been carried out under the strict authority of an EKZNW permit, is to establish whether yellowfish are a suitable angling fish in small high altitude dams. At this stage it is uncertain whether the yellowfish will survive the cold winter temperatures in the region and whether they will be a suitable flyfishing candidate.

Genetic Considerations

Genetic material has been collected from the Umzimkulu, Umzimkulwana and Umtumvuna Rivers. These are in addition to the yellowfish samples which were collected in the Durban Metro 2006 River Health Study. The Umtumvuna River is the southern distribution limit of KZN Yellowfish as well as forming a provincial border with the Eastern Cape. These samples, which include fin clippings and whole specimens, will be forwarded to Dr Paulette Bloomer for analysis.

There was some concern about an unidentified fish species collected in the Sikwebezi River, a tributary of the Black Mfolozi River, in the Vryheid district. The fish species was collected by EKZNW District Conservation Officer Mr. Alex Wood in collaboration with local Honorary Officers. An investigation of the EKZNW Species Database indicated that the Lowveld Largescale Yellowfish *Labeobarbus marequensis,* a native of the Phongolo System in KZN, was collected in 1972 by Tom Pike from Bloemveld Dam, Vryheid. Some concern was expressed that this species may have hybridized with *L.natalensis* which occurs naturally in the Mfolozi River. Specimens were submitted to Dr Jim Cambray of Albamy Museum who confirmed that the fish collected by Mr. Alex Wood were in fact *L.natalensis*. It is a well-known fact that *L.natalensis* can have various mouth forms leading to identification problems. *The mouth is distinctly inferior in those specimens with a short, broad lower jaw, but is almost terminal in those with a longer, narrower jaw. A horny cutting ridge may be present on the edge of the broad type of jaw, without any lower lip development, in contrast to the rubber-lip variety with a rounded end to the lower jaw and a fleshy lobe on the chin (Crass).*

Education and awareness

Endowed with almost 50 % of the countries water resources, 500 kms of coastline, the second largest river in South Africa, numerous other rivers and thousands of dams, KZN remains an ideal angling destination. Yellowfish are commonly caught in Albert Falls, Chelmsford, Goedetrou, Klipfontein, Midmar, Spieonkop and Wagendrift Dams.
Fly fishing for the KZN Yellowfish is increasing in popularity although considerable ignorance still exists in terms of locating suitable venues and adopting appropriate angling techniques, for this reason many freshwater anglers are still content on pursuing the excellent trout and bass fishing. It is expected that fly fishing for this species will continue to grow as the cost of trout fishing and vehicular transportation continues to increase. Freshwater fishing is still largely unknown to a large component of KZN anglers who readily pursue rock and surf and other aspects of salt water fishing. A relatively new form of fishing, termed "Drop-Shot" fishing is currently becoming very popular amongst local anglers. The technique, which encompasses using ultra light spinning tackle and scented lures, is apparently deadly for many fish species. I predict that it won't be too long before this method is practiced on yellowfish in KZN. The Natal Chapter of the Yellowfish Working Group has contributed towards the awareness of this species through popular articles written for The Quill, a newsletter distributed widely in the Natal Midlands. The chairman of the Natal Chapter of the Yellowfish Working Group, Neil Button, a Protea angler, has also been instrumental in providing information to a new website www.artlure.co.za ,opening the way further for the pursuit of this species on both fly and spin tackle. UMngeni Valley Nature Reserve, which is managed by WESSA, is planning to hold a tagged fish competition soon.

Legislation

Legislation pertaining to the protection of ecosystems, the polluter pays principle, duty of care and sustainable utilization of the resource will go a long way in protecting this valuable resource for future generations. NEMA does much to secure these principles but can be rather bias more towards protecting threatened species and controlling alien invasive organisms. To this end provincial regulations, will hopefully also protect a more generic range of indigenous fish species, which although not yet threatened, represent a resource that is also important from socio-economic-cultural point of view. The minimum requirement in this context would at least be a daily bag limit while limiting the capture method to rod and line. Provincial conservation authorities in collaboration with stakeholders and interested and affected parties have a meaningful role to play in this regard. In this regard EKZNW has recently reconstituted its Fresh Water Fishing Liaison Committee which now serves as a valuable platform for the public participation process. Although yellowfish have developed into a highly sought after angling fish their new found popularity could ironically work against them. An increased danger exists that yellowfish will be moved increasingly outside of their natural range, and in certain instances, like the Eastern Cape, be dubbed alien invasive. The Natal Yellowfish is on record as being alien in the upper catchment of the Thukela and Umzimkulu Rivers (Bruton, de Moor). It has been translocated historically to the Save in Zimbabwe and more recently occurs on Swaziland's fish species list as an inhabitant of the Komati River.

Monitoring

There are no monitoring programs dedicated specifically to this species within KZN. A special trip was made down the South Coast recently to collect genetic samples but other than that this species continues to be collected as part of routine field surveys. Although this is a common species specimens are submitted to Albamy Museum as voucher specimens. This is a normal protocol carried out by EKZNW to ensure that only credible information is included the EKZNW Species Database.

Research

Research is currently being carried in 2006 out by Dr Paulette Bloomer to establish the genetic fingerprinting of KZN Yellowfish.

Value of Yellowfish resource to anglers and subsistence fishers

The KZN Yellowfish is classified as a freshwater gamefish and as such is a valuable natural resource to recreational and subsistence fisherman. The species has become a popular quarry of fly-fishermen and spin fishermen alike. With few exceptions all of these fish are returned back live to the water. Coarse anglers do take considerable numbers of fish during the spawning season but for most of the year catches tend to be low to moderate. The fish is a popular catch by subsistence anglers in rural areas who catch the fish on mostly worm and paste baits.

Literature on species

Yellowfish Fly Fishing Clinic by Paul Curtis and Jonathan Boulton

Concluding Remarks

The KZN Yellowfish is the most ubiquitous freshwater fish in Kwa-Zulu Natal. It is fairly tolerant of man induced habitat change and has in certain instances benefited from the building of large reservoirs. The fish is fairly tolerant of pollution but stands the risk of succumbing to low oxygen levels in highly polluted systems. Fly fishing for this species is becoming more popular as an alternative to bass, trout and carp. The KZN Yellowfish would benefit from a more integrated approach to catchment management.

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REGIONAL REPORT: GAUTENG

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The vacant ichthyologist post has been filled with the appointment of Siyabonga Buthelezi. He comes from the Western Cape River Health team where he undertook fish surveys under the watchful eye of Dean Impson. Siyabonga will start with a comprehensive fish survey of all the rivers in Gauteng in May 2007 during which he will record the current distribution of fish species found during the surveys. He will also record the occurrence of suitable yellowfish spawning habitat. A report on the distribution of yellowfish in Gauteng rivers will be presented to the YWG in 2008.

The results of the biomonitoring surveys done during 2005/2006 as part of the River Health Programme is currently being prepared for publication in poster format under the title - "Ecological State of Gauteng Rivers."

Although preliminary results indicate some deterioration of the rivers in the Upper-Vaal catchment, yellowfish species were recorded in all the rivers and in all three catchments; namely the Upper Vaal, Crocodile/West – Marico and the Upper-Olifants.

Both *Labeobarbus kimberleyensis* and *L. aeneus were* recorded in the Suikerbosrand- and Klip Rivers in small numbers, most of which were juveniles, while both adult and juvenile L. *marequensis* and *L. polylepis were* recorded in the rivers of the Crocodile/Marico and Upper Olifants Catchments. No *Barbus rapax* were recorded during the surveys, but anglers have claimed to have caught specimens in the Magalies River and the Elands River.

In conclusion it can be said that although most of the rivers in the southern catchment and some of the rivers in the northern catchments of Gauteng are in an unacceptably poor ecological state, yellowfish have for some or other reason managed to adapt and survive in these poor conditions. The occurrence of yellowfish species at the sample sites in the rivers however does not necessarily indicate the integrity of the populations and therefore further studies need to be initiated to assess the current population status and to determine the trend of these populations over time so that sound management strategies for the conservation of yellowfish can be formulated (based on scientific fact) and implemented at national level.

FREE STATE PROVINCE REPORT

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Summary

Background to the department

- Since the departure of Pierre de Villiers the directorate has not assigned the yellowfish projects to any particular person. Johan Hardy has therefore taken responsibility for this work together with his other environmental community- based and capacity building projects.

Yellowfish conservation as a project.

- Riparian landowners on the Vaal and Orange rivers are approached to join as yellowfish management associations or as formal conservancies.
- This conservation work to improve environmental management is solely done on a voluntary basis.
- The base for the current telemetry study project is on the farm Wag 'n Bietjie in the Koedoesdraai Conservancy in the Bothaville district.
- This project was given a good start when Johan Hardy organised an electro-shocker to capture samples for the study. This was an official operation organised through the Free State department.
- Honorary nature conservation officers working on a voluntary basis are assisting the project by constant monitoring of yellowfish in the rivers.

Fly fishing as an Eco-tourism industry

- Knowledge and skills are required to make this a success. The department assists by stimulating awareness and by site visits to farms that wish to participate.
- Awareness is of vital importance. It is also important that the river is not over-exploited, as it is the major asset.

Exhibits

- Awareness days at community centres are manned by honorary nature conservation officers thus assisting the department with this action.

Law enforcement actions

- Operations together with other provinces have been arranged. On occasions these have included SAPS.
- Prosecutions resulted from some of these operations. Illegal fishing equipment was also confiscated.

Pollution at Parys exposed on TV

- Regular sewage spills occurred at Parys and despite a number of complaints this became an ongoing problem.
- E.TV were therefore called in to expose the problem.
- The municipal manager was called to the site to discuss solutions to the problem and then to appear on TV.

Other pollution problems

- There is an ongoing problem at the Vredefort sewage works where the pumps cannot handle paper nappies and pads. The spills enter the Lesothospruit which joins the Vaal at the Vredefort Dome, a World Heritage Site.
- Honorary conservation officers at Vermaasdrift do constant monitoring. These officers also check on illegal fishing.
- Spills from the Kroonstad sewage works into the Vals River have been occurring since 1997. This Vals River water is then abstracted downstream by Bothaville for municipal use and then returned via the sewage works to the same river.
- The Vals then enters the Vaal River at Balkfontein where the Sedibeng council abstracts water for use in the Goldfields area.
- In the Goldfields area huge spills ran into the Sand River and ended up in Bloemhof Dam. In addition raw sewage was pumped into nearby pans resulting in very high fish mortality.
- In addition spills from mines on a sporadic basis killed all aquatic life in the river for months.
- A beef feedlot at Skandinawia's Drift is to be increased to 55 000 head of cattle. At present seepage from this feedlot creates a major problem for Vaal River water quality resulting in algal and hyacinth growth and discolouration of the water.
- The Drakensberg in the North East Free State that is an important source of water for the Vaal system has not been free of problems. A filling station on the N3 near the KZN border is a polluting a tributary of the Wilge River with sewage.
- Elsewhere in the province municipalities simply empty their 'honey-suckers' on the open veld.

ORANGE VAAL YELLOWFISH CONSERVATION AND MANAGEMENT ASSOCIATION: 2007 REPORT

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Introduction

The Orange-Vaal River system is South Africa's largest and has its origins in Lesotho (Orange River) and the Mpumalanga highlands (Vaal River). It has tributaries in most provinces in South Africa as well as in Botswana and Namabia, and eventually flows into the Atlantic Ocean at Oranjemund. This stately river is home to perhaps South Africa's best gamefish, the Orange-Vaal Largemouth Yellowfish *Labeobarbus kimberleyensis* and the Oranage-Vaal Smallmouth Yellowfish *L. aeneus*.

Both species is sensitive to changes in water quantity and quality, habitat destruction and utilization pressure and is often used by River Health authorities as a sensitive indicator species. These species play a vital role in allowing river managers to gauge the success or failure of any management interventions or programmes (e.g. river rehabilitation, catch and release).

Largemouth Yellowfish (*Labeobarbus kimberleyensis*)

The Largemouth Yellowfish is a sensitive indicator species that has been declared as a near threatened species (IUCN). It has a slow growth rate and low fecundity. It is a top predator that inhabits large rivers and is very sensitive to pollution and habitat destruction. Largemouth Yellowfish spawn over gravel beds during the warmer summer months.

Smallmouth Yellowfish (*Labeobarbus aeneus*)

The Smallmouth Yellowfish is also a sensitive indicator species but is not listed as vulnerable yet. While it also exhibits a slow growth rate low fecundity it is more of a generalist that inhabits both large and small rivers. The Smallmouth Yellowfish is sensitive to pollution and habitat destruction and has similar spawning requirements as the Largemouth Yellowfish. Both species may be serial spawners.

Threats (lack of management)

The lack of management of the various sources of polluted effluent is a critical issue that threatens all aquatic biota. Excessive abstraction of the available water resources and the altered flow regimes to facilitate year round water usage has a serious impact on the aquatic habitat and the associated aquatic biota. The lack of effective fisheries management results in inconsistent legislation in the different provinces. Illegal netting and the uncontrolled stocking of invasive alien fish species is proving to be an issue that needs to be continuously managed. The capture of or interference with spawning fish is an issue that needs to be monitored and managed.

Orange Vaal river Yellowfish Conservation and Management Association
The Orange Vaal River Yellowfish Conservation and Management Association was initiated in Bothaville in 1996. It is a cooperative association of people interested in the conservation of Yellowfish and the rivers they live in. It was established to assist government with the conservation and management of indigenous fish species. One of the major marketing tools used was to market the wise utilization of indigenous fish species. This would increase the value of the species as well as create critical social and economic benefits for people in rural areas.

Conservation areas and members
It was noted that landowner support is critical to the success of this initiative. The principle of managed access to the resource was implemented.
A total of 696.4 kilometers is listed as conservation area (mainly Vaal River between Bloemhof Dam and the Barrage). The initial massive success which has slowed down as active personnel and critical funding is lacking and new areas require additional travel/costs. An expansion strategy is required.

The present membership consistes of 749 members including anglers and interested people. A chairperson and a management committee was established (driven process). Four managerial meetings take place annually. Formal records are kept in the form of minutes. Adhoc meetings to address emergencies can be arranged if necessary. Funding and fund raizing was identified as a major constraint. This will be a focus point for the next 12 months.

The Association has had a significant impact on the increased compliance actions and monitoring taking place in the area. Arial inspections in association with ground follow up operations have been successfully completed. Several successful arrests have been made by compliance staff.

Discussions have taken place as to the use of a Newsletter and or a webpage as a method of disseminating information. Both will probably need to be used as some landowners do not possess the required IT equipment.

Catch and release, awareness and education
An example of process that has been required to implement the catch-and-release principle has been a lengthy process. A great deal of energy, time and commitment from critical people and agencies went into achieving this. It does provide an example of how a sound principle has caught on within angling circles.

It is critical to identify a simple but critical intervention that can be marketed to maximum effect.

Legislation
The various sets of applicable legislation were noted. NEM:BA (Protected Species Management Plan) was discussed in relation to the development of a managmeetn plan for the Largemouth Yellowfish. This would result in consistant legislation in all Provinces.

It was noted that the DWAF (Ecological Reserve) legislation if implemented in such a way that it took the habitat requirements of these fish species into consideration, would be an effective way of ensuring habitat management.

Provincial Ordinances vary but it was noted that most address some form of fisheries conservation. The lack of personnel to implement the legislation was also a problem.

Links between and the implementation of the various sets of legislation is problematic at present.

Monitoring
The only fisheries monitoring that is taking place in the Orange Vaal River system is associated with the River Health Programme operating in the various provinces. This includes the Free State, North West and Gauteng.

Research
Initial funding for the genetic study on the two Yellowfish was sourced and secured by the Association. AngloGold Ashanti provided these funds and further follow up funds which were co-ordinated by the researchers, the YWG and the funders themselves. A report was handed in and a presentation delivered at this YWG Conference 2007.

A Telemetry study sponsored by the WRC was motivated for and secured by members of the OVRYCMA, YWG and RAU. The programme was initiated in the Vaal River in the river reach adjacent to "Wag-'n-Bietjie" Lodge. Preliminary results were presented at the YWG Conference 2007.

Members of the OVRYCMA in association with RAU motivated for and secured funding for a social and economic study funded by the WRC. This programme has been initiated in the initial OVRYCMA conservation area. The aim is to assess the social and economic value of the Yellowfish angling industry that has been created by the initiative. There will be focus on flyfishing, lodges and the tackle industry amongst other things.

A proposal aimed at sourcing funds for an assessment of the distribution of Grass Carp in the Orange Vaal River system has been submitted to the WRC. This invasive alien fish species is fast spreading in the entire catchment. Its impact needs to be assessed.

Literature
It was noted that The Yellowfish Working Group Technical reports will address this. It was also noted that there is a need for additional research to support conservation decisions, especially regarding the Largemouth Yellowfish.

Concluding remarks
The use of a Yellowfish Conservation Association is a very effective way to introduce conservation principles into a wide area. However it was noted that the principles upon which it is based must be based on good science. While the Association type initiative assists government it must not be seen as replacing government and it must be understood that Governmental support is critical. There must be effective funding as the lack of funds can be

restrictive. There needs to be continual adaptive management and commitment from the management committee.

Acknowledgements

- OVRYCMA management team
- OVRYCMA members
- WRC (research)
- Provincial Environmental Departments
- DWAF
- AngloGold Ashanti (research and support)
- Free State Province Provincial Government
- CapeNature
- Bateleurs
- YWG & FOSAF

REGIONAL REPORT: STATUS OF YELLOWFISH POPULATIONS AND HABITAT INTEGRITY IN THE NORTH WEST PROVINCE - 2007

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Abstract

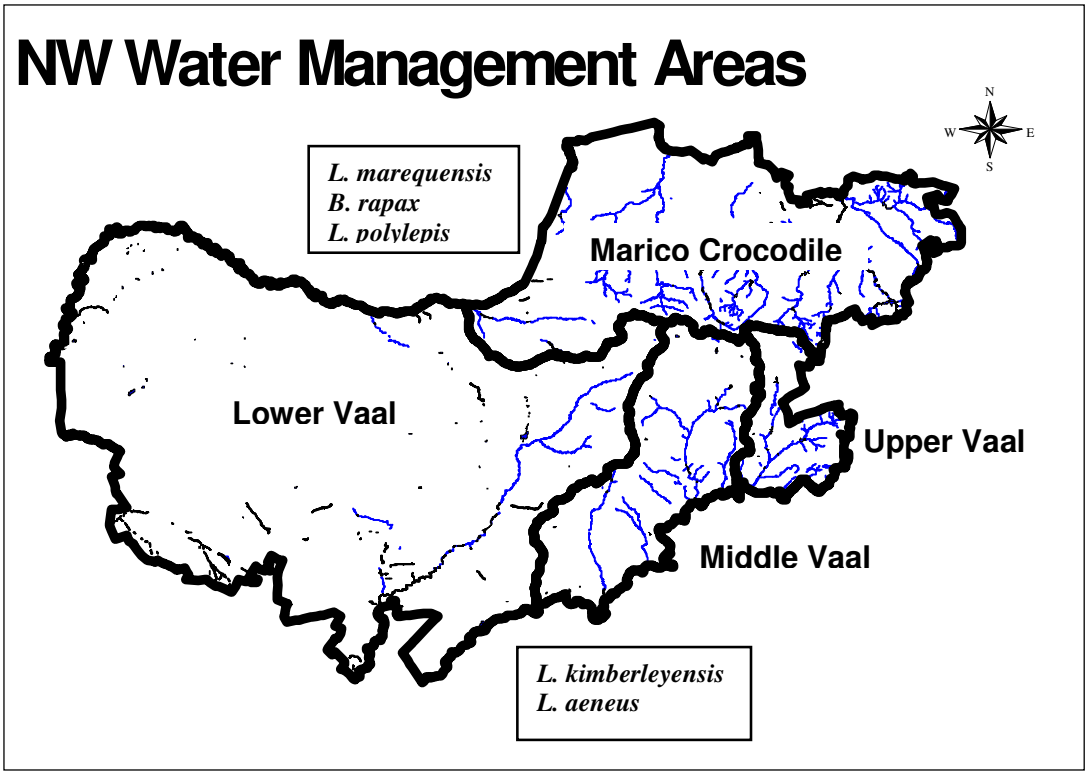
Four *Labeobarbus spp* and *Barbus rapax* occur in four Water Management Areas in the North West province.

Little yellowfish specific research is conducted in the province except for the work in the Vaal River. The efforts of the province regarding aquatic monitoring are focused on the River Health Programme, and some results are presented.

Severe pollution and flow threats are experienced in the "work horse" rivers originating in industrial areas, namely the Vaal and Crocodile Rivers, while rural rivers experience problems caused by dams and erratic water release regimes, alien vegetation and limited mining activities. However, there are some near-pristine rivers in the upper reaches and these are of high biodiversity value.

Introduction

Four water management areas (WMA) are present in the North West Province, namely the Upper, Middle and lower Vaal River WMA's in the south feeding into the west flowing Orange River and the Crocodile West and Marico WMA feeding into the east flowing Limpopo River in the north. The Vaal River WMA's harbour two yellowfish species and the Marico/Crocodile WMA also contains two yellowfish species and the papermouth (*B.rapax*).



Species present

Indigenous
Labeobarbus kimberleyensis and *L. aeneus* in the west flowing Vaal River system.
L. marequensis, L. polylepis and *B. rapax* in the east flowing Marico/Crocodile River system.

Rouhani (2004), in a survey of 10 large dams in the North West Province, recorded *Labeobarbus kimberleyensis* in the Taung dam, *L. aeneus* in the Taung and Koster dams and *L. marequensis* in Lindleyspoort, Vaalkop and Roodekopjes dams. Cochrane (1985) and Koekemoer & Steyn (2005) recorded *L. marequensis* in Hartebeespoort Dam.

Introduced?
De Villiers (1983) reported 12 specimens of *L. holubi (= L. aeneus)* caught at Molopo Oog, but none were recorded by Skelton *et al* (1994).

Status of species

Labeobarbus kimberleyensis - Vulnerable (VU A1c) (IUCN, 2004)

((A) Reduction in population size; (1) an observed, estimated, inferred or suspected population size reduction of >50% over the last 10 years or three generations & (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat.)

The other species are not listed.

Sub-populations present: Unknown
Sub-populations status: Unknown

Threats
Discussed under Monitoring.

Conservation measures to conserve yellowfish resource

Conservancies – Orange Vaal River Yellowfish Conservation and Management Association

Stockings – None by NW DACE

Education and awareness – Wetland Awareness Campaign by North West Wetland Forum, Crocodile (West)/Marico State of the Rivers Report and Poster.

Legislation – Angling license conditions are still based on the old Transvaal ordinance. New bag limits have again been submitted by the Biodiversity Specialist Support Unit (Table 1), but still await approval.

Table 1: New bag limits for NW awaiting approval

Species	Bag limit	Minimum size (Fork length)
L. kimberleyensis	Catch and release only	N/A
L. aureus	2	300mm
L. marequensis	4	300mm
L. polylepis	2	300mm

Monitoring - The National River Health Programme (RHP) is included in the Strategic Plan of NW DACE. Although not aimed specifically at yellowfish, the programme monitors the biodiversity at selected sites with different indices (including SASS5 and VEGRAI) and also (but currently to a much lesser extent) includes fish surveys.

Aerial surveys of selected rivers in the province have been conducted and the Index of Habitat Integrity (IHI) Project has been completed and will be available shortly.

A Systematic Conservation Plan for the Freshwater Biodiversity of the Crocodile (West) and Marico Water Management Area, a joint venture between the CSIR, DWAF, WRC and NW DACE has been produced.

A short overview of the state of NW rivers, based on the RHP and the IHI follows (more details can be obtained from Hermien Roux):

Different processes are followed to assign a category (ranging from A = Natural to F = critically modified) to each component (Table 2). Ecological evaluation in terms of expected

reference conditions, followed by integration of these components, represents the Ecological Status or EcoStatus of a river. Thus, the EcoStatus can be defined as the totality of the features and characteristics of the river and its riparian areas that bear upon its ability to support an appropriate natural flora and fauna. This ability relates directly to the capacity of the system to provide a variety of goods and services (Kleynhans & Louw 2006).

Table 2: River Health Categories

RHP category		**Description**
Natural	A	Pristine / Very close to natural The ideal condition
Good	B	Least impacted
Fair	C/D	Impacted but can still provide ecological services Rehabilitation still an option
Poor	E/F	Only very tolerant taxa Ecosystem very impacted Very hard/ almost impossible to rehabilitate
Artificial	F	Critically modified

Upper Vaal WMA

The Upper Vaal WMA consists of tributaries such as the Wonderfonteinspruit and Mooi River and also includes the Barrage. The average condition falls in the RHP C/D category because it is moderately to largely modified. Some of the extreme upper reaches of the Mooi River are still in an A category but potential residential developments and possible contamination of the dolomitic system from mines pose a threat. For example, the dolomitic eyes that fed the rivers in the mining areas around Carltonville, e.g. Wonderfontein Eye, have dried up because of the pumping of water from the mines, and the rivers are now kept flowing with polluted return water from the very same mines.

Modifications to the rivers in the Upper Vaal WMA include impacts from Gauteng such as mining and flow modifications, water abstraction, peat mining, dams and alien plants in NW.

Middle Vaal WMA

The middle Vaal WMA consists of tributaries such as the Schoonspruit, Wolwespruit, Leeudoringspruit and Makwassiespruit. No RHP categories could be assigned because only two sites could be sampled during 2007 because of the drought. Evidence of impacts were observed, though, mainly by peat mining, agriculture, existing mining around Klerksdorp and two new mines that are in the process of construction and which import vast quantities of water via a pipeline.

Lower Vaal WMA

Like the Middle Vaal, the drought restricted sampling efforts severely. Observed impacts were the Ottosdal sewerage works, a large petrol spill at Delareyville and flow modifications caused by the Vaalharts irrigation scheme, which was the only location where there was sufficient flow to sample.

Crocodile (West)/Marico) WMA

The average condition of the lower reaches ranged C to E/F categories, because of pollution from Gauteng, sewage spills, alien plants, flow modifications and other water quality impacts (e.g. platinum mining and agriculture).

The upper reaches of rivers such as the Skeerpoort, Marico and Hex are still in excellent condition and fall in the A and B categories.

Especially the Marico is in such a condition that it can be regarded as a reference site and should be a conservation priority. Unfortunately the river is diverted into irrigation canals just to the north of Groot Marico and the actual river was completely dry during the latter half of the past summer. There is an international agreement to export water from the system to Botswana, a portion of the water is allocated for domestic use and the rest is used for irrigation. Absolutely no provision has been made for an ecological reserve and with the main storage dams being depleted at a rapid rate, it seems unlikely that the river will return to an ecologically functioning system in the near future. Without exceptional spring rains, breeding by *L. marequensis* seems unlikely in large sections of the river in the coming summer.

Research – No yellowfish-specific research is done by NW DACE.

Action plan & Progress Report - The Conservation Plan for the Crocodile (West) and Marico Rivers will be integrated in provincial biodiversity conservation strategy and bioregional plans.

Value of yellowfish resource to anglers and subsistence fishers
No data available.

Concluding remarks

The rivers in North West are, as in the rest of South Africa, under severe threat from urban development, mining and agriculture. This has a severe impact on yellowfish populations, but fortunately there are still several river reaches in the higher lying areas that are in near pristine condition and with high biodiversity values.

The NW province is a stronghold for *L. marequensis* and thanks to research projects and conservation endeavours of FOSAF and the Orange Vaal River Yellowfish Conservation and Management Association, *L. kimberleyensis* and *L. aeneus* receive attention. There is some concern regarding the status of *L. polylepis* and a more intense survey of its preferred habitat is required.

Acknowledgement

Paul Fouche is thanked for conducting two fish surveys for the RHP in the North West Province and for the training given to our field staff.

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REGIONAL REPORT: PROGRESS IN THE WESTERN CAPE IN 2006/2007

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Establishment of a Western Cape chapter of the Yellowfish Working Group

- First meeting in January 2007 – 15 attended, mostly flyfishers, lots of enthusiasm
- Focal areas: awareness and on the ground action (stockings, code of conduct)
- Ratels River awareness day in March 2007. Also attended by members of the Ratels River Conservancy. Day involved snorkeling in the clear waters of the indigenous fish section of the river, viewing Clanwilliam yellowfish, Clanwilliam sawfin and Clanwilliam redfin. Fish were also caught in the river and stocked into two dams in the catchment
- Planned: constitution, finalisation of logo, another meeting, a whitefish awareness day on the Hex River

Cape Action for People and the Environment (CAPE) Alien Fish Control project

- Aim: to pilot the control of alien fishes in the Cape Floristic Region
- Focus on 4 rivers; 3 in Greater Cederberg Biodiversity Corridor (Krom, Rondegat, Suurvlei) and 1 in the Baviaanskloof Biosphere Reserve (Krom)
- Alien fish to be targeted – smallmouth bass, bluegill, rainbow trout
- None of these rivers are of angling importance
- Comprehensive EIA about to start which will be completed in 2007. If positive, alien fishes will be cleared from one or more of the above rivers in January to March 2008.

Research

- Bruce Paxton: PhD at UCT on the habitat and spawning requirements of sawfin and Clanwilliam yellowfish (Driehoeks/Matjies River)
- Sean Marr: PhD at UCT on alien fish impacts, alien fish control methodologies

River Health Programme in the W Cape

- River Conservation Unit: Loss of 3 of our 4 contract staff in previous year
- Recovery this year: 2 new staff members
- Pierre de Villiers now in W Cape and is co-ordinator of CAPE estuaries programme
- Focus areas for 2007/2008:

1. Gourits River State of River report (this river system has alien smallmouth yellowfish)

2. Breede River (home to Berg-Breede whitefish) comprehensive survey and State of River report
3. Technical reports for 4 rivers (Overberg river, Goukou / Duiwenhoks catchments, Olifants / Doring Water Management Area, Gourits River System)
4. River health assessments will including an estuarine assessment
5. 2-4 additional staff members dependent on funding provided by DWAF

Stockings

- Growing interest in yellowfish angling and conservation – Western Cape Chapter of the YWG wants to see on the ground action and dams stocked for angling purposes
- Establishment of refuges for highly threatened fishes – yellows will breed in suitable dams
- Only within natural distribution range, genetic principles apply
- Two dams stocked in Ratels catchment using Ratels River fish
- Goodwill and awareness created when indigenous fish are stocked

CHALLENGES IN THE CONTROL OF WATER HYACINTH, *EICHHORNIA CRASSIPES*, IN SOUTH AFRICA

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Introduction

Water hyacinth, *Eichhornia crassipes*, a free-floating perennial herb native to South America, is labelled the world's worst aquatic weed (Julien *et al.*, 1996; Hill, 1999) and has been South Africa's most problematic aquatic plant for many decades. It was introduced into South Africa from South America in the early 1900's (Cillers, 1991) as an ornamental plant because of its attractive lavender flowers and glossy dark green leaves (Center, 1994). It was quickly spread around the country by gardeners, aquarium owners and boaters (Jacot Guillarmod, 1979) and further spread was facilitated by flooding and water birds (Cilliers, 1991). As is the case with most exotic plants, they were introduced without their natural enemies which usually keep them 'in check' in the region of origin, preventing them from becoming serious pests. Not all introduced plant species becomes pests in their introduced ranges but those that do often have particular weedy characteristics of which water hyacinth has many. It is particularly aggressive competitor in the aquatic environment, having the potential to double its biomass in two weeks. Its rapid growth and reproduction (both vegetative and sexual) (Harley *et* al., 1996) are responsible for its rapid establishment and spread in new environments.

By the 1960's, water hyacinth was distributed throughout South Africa, with the exception of the more arid areas, and infestations consisting of dense mats of the plants covered many of river systems and impoundments. It wasn't long before the negative impacts of these infestations were realized. For example, due to evapotranspiration by water hyacinth, water loss can be 3 to 8 times than from open water (Timmer & Weldon, 1966; Wright & Purcell, 1995). There is an increase in the risk of water-borne and water-related diseases as the plants provide an ideal breeding ground for the vectors of diseases such as malaria and typhoid (Hill, 1999). Riparian communities that rely on water resources for transport and their livelihood are directly negatively affected (Jones, 2001). Economic losses can be substantial due to stock losses, blockages of irrigation pumps and damage to dam walls and bridges during flooding and heavy infestations interrupt recreational activities such as fishing and boating (Hill, 1999). Dense mats of the plants have serious negative ecological impacts as they cause anoxic and low light conditions causing death of fish and invertebrates (Ultsch, 1972). The plants also outcompete all indigenous vegetation both submerged and floating and what is left is a sterile environment except for monopsecific stands of water hyacinth. Water hyacinth can be considered to be one of the biggest threats to our aquatic ecosystem biodiversity as well as to our precious water resources.

Control of water hyacinth

Once it was realized that the plant was becoming invasive and problematic, the next obvious step was to look for control methods. There are three control options that are widely used around the world for the control of water hyacinth:

(1) Physical control methods which can be divided into manual removal and mechanical removal. Manual removal consists of removing the plants by hand or with hand-held tools and can provide some immediate relief to the problem but it's labour intensive, time consuming (Harley *et al.*, 1996; Julien *et al.*, 1996) and there are limitations, as to how much plant material one can actually remove from the water body. Mechanical removal uses harvesters to remove the plants from the water (Julien *et al.*, 1996). Many of these machines were designed and built specifically for harvesting aquatic weeds, particularly for removal of water hyacinth from Lake Victoria but most of these inventions failed the test, despite one having won the Prince of Wales award for innovation (Hill, pers. comm). Cranes can be very useful for clearing a water-body, but this is costly, time-consuming and only provides a short-term solution to the problem (Julien *et al.*, 1996). Reinfestation takes place rapidly through seed germination and more commonly, vegetative reproduction of plants not removed from the system.
(2) Chemical Control is the second control option and is probably the most widely used around the world as it is the only method that can reduce large-scale infestations of water hyacinth within a relatively short period of time (Julien *et al.*, 1996). However, herbicide application is expensive, has negative environmental impacts and also only provides a short-term solution to the problem. The use of chemicals has its obvious undesirable side-effects but the most serious cause for concern is spray drift (Hill, 1999) and the often negligible and incorrect application of the herbicide which often results in the death of indigenous riparian vegetation.
(3) Biological Control is the third control option for water hyacinth which is also widely used. There have been some spectacular successes with biocontrol of water hyacinth (Wright, 1981; Harley, 1990; Julien & Orapa, 1999; Julien *et al.*, 1999; Ogwang & Molo, 1999; Hill & Olckers, 2001) but there has also been a lot of variability in its success. Biological Control is the use of natural enemies of a target plant from the region of origin (DeBach, 1964) that have coevolved with that particular plant species, are host-specific and that appear to be damaging. Biological control is the only environmentally friendly, cost-effective and sustainable method of managing water hyacinth (Cilliers, 1991). The only negative aspect of this control method is that it usually needs time to be effective and the time frame usually given is 5 to 8 years.

Despite significant efforts over the last few decades, using all three control methods available, water hyacinth continues to persist in areas already invaded and to spread to new sites around South Africa.

The South African biocontrol programme

The South African biocontrol programme was reviewed by Hill & Cilliers (1999) and is summarized below. The programme was initiated in the 1970's with the introduction of the water hyacinth weevil, *Neochetina eichhorniae* Warner. The weevil is now widely established throughout South Africa and has made a significant contribution to the control of water hyacinth. The adults feed on the leaves but the most damaging life stage are the larvae which mine the petioles. At high densities, the plants become water-logged and eventually sink. A couple of years later, its congener, *Neochetina bruchi* Hustache was introduced into South Africa as a biocontrol agent. The two species are very similar, inflict the same type of

damage on the plant but *N. bruchi* usually occurs at lower densities than *N. eichhorniae*. Both species together are the most important biocontrol agents in the programme to date.

The next species to be introduced was the moth *Niphograpta albiguttalis* Warren. The most damaging life stage of this insect are also the larvae which feed internally on the petioles and can cause substantial damage, which at high densities causes death of the plants. This agent has been very effective in certain areas but is not widely established as it seems to have a strong preference for plants of the short bulbous type which are characteristic of new infestations and the outer edges of existing infestations where there is new growth. These types of plants aren't often available for the moth which then fails to establish.

Another biocontrol agent on water hyacinth which is considered to be an accidental introduction is the mite *Orthogalumna terebrantis* Wallwork. There is no record of it being introduced into South Africa, therefore it is assumed that it came in with plant material brought in from South America. This agent is fairly widely established, is considered to be cold-tolerant and can be very damaging. The nymphs and larvae mine the leaves and the adults feed on the leaf surface. Not much is known about this agent at this stage but studies have been initiated to determine what impact it's having on water hyacinth around the country.

The next species to be introduced into the biocontrol programme in South Africa was the sap-sucking mirid *Eccritotarsus catarinensis* Carvalho and this was also the last agent to be released against water hyacinth in 1995. The adults and nymphs extract chlorophyll from the leaves causing them to yellow and at high densities to turn brown. It appears to be quite a sensitive species and has not established all over South Africa but seems to be an important agent in KwaZulu-Natal where it was responsible for controlling water hyacinth on Clarewood Quarry. It is speculated that it may be an outbreak-species causing substantial damage to water hyacinth in relatively short periods of time.

There are also 3 pathogens on water hyacinth which were probably also accidental introductions. These disease-causing agents appear to be the most damaging when the plants have already suffered insect feeding damage and the pathogens move in at this stage causing the plants to weaken further. They are therefore considered to play an important role in the control of water hyacinth.

Biocontrol success

South Africa's most famous success story is that of the control of water hyacinth on New Years Dam in the Eastern Cape Province. The dam was almost completely covered in dense mats of water hyacinth which was considered a disaster because it is an important water use system. The two weevil species, *N. eichhorniae* and *N. bruchi* were introduced in 1991 and less than 5 years later the dam was less than 5% covered (Hill & Cilliers, 1999) and considered to be under good biocontrol. Lake Victoria in central Africa is also a remarkable success story for biocontrol, thanks to both weevil species, *N. eichhorniae* and *N. bruchi* (Cock *et al.*, 2000). More than 15,000 hectares of the surface area of Lake Victoria were covered with the weed having devastating effects on the shore communities that reside all around the Lake and relied directly on the water source for drinking, for transport and essentially their livelihood. Hundreds of mass-rearing stations were set up all around the lake and thousands of beetles

released with the result that the plant was brought under control within a couple of months (Oschiel *et al.*, 2001).

Despite biocontrol being successful in certain areas, the results and levels of control achieved have been variable. It has thus become important to determine what factors are facilitating success or hampering the efficacy of the biocontrol agents. The two factors identified and speculated to be responsible for reducing the potential efficacy of our agents in South Africa are eutrophication and the cold winters in areas where water hyacinth is a serious pest. A third factor is the use of chemical control.

Factors reducing biocontrol success

Eutrophication is nutrient enrichment of water bodies with nitrates and phosphate which enhance plant growth and productivity. Factors responsible for this nutrient enrichment include industrial effluent, sewerage spills/leaks and agricultural run-off rich in nitrates and phosphates from the use of fertilizers. Water hyacinth and other aquatic weed infestations are often a symptom of poor water quality (Hill & Olckers, 2001) and research has showed that biological control would be an extremely effective method if nitrate and phosphate levels were 'normal' according to the South Africa Water Quality Guidelines (Holmes, 1996). New year's Dam was a testament to this which has the lowest nitrate and phosphate levels out of 15 water hyacinth sites around the country that were monitored on a monthly basis for two years (Brudvig, pers. comm).

The second most important factor seen to interfere with effective biocontrol is temperature (Hill & Olckers, 2001). All of our agents on water hyacinth are from tropical South America and are therefore not adapted to the extreme cold conditions that prevail in winter in many areas in South Africa. One possible solution is to collect agents from an area with a similar climate in the hope that that particular biotype will be better adapted to colder climates in areas of introduction. While this is not always possible and is mostly speculation at this stage, it is definitely something worth considering, in the face of the difficulties water hyacinth biocontrol has experienced. Also, there are various programmes eg. CLIMEX where data of the thermal physiology of an insect and climate data from the region of origin and the country of introduction are used to predict potential distributions of agents in recipient countries (Byrne *et al.*, 2003). While this is a useful tool, it has its shortcomings and biocontrol practitioners would obviously be reluctant to reject candidate agents on the basis of these predictions, so rather than used for decision-making, it can be used to help explain establishment of agents in some areas and not in others. Also, it is becoming apparent that the microclimate experienced by the insects is vastly different from ordinary climatic conditions that are measured (King, pers. comm.), so microclimate data should be used in addition to normal climate data to get potentially more accurate predicted distributions.

A third factor seen to hamper and interfere with biocontrol programmes is chemical control. Some glyphosate products and their surfactants used for chemical control of water hyacinth can be directly harmful to the biocontrol agents (Ueckermann & Hill, 2001) but the major interference is that when the mats sink after a chemical spray, all the immature life stages of biocontrol agents are lost, resulting in population crashes (Hill & Olckers, 2001). Although adults can move off, there are often very little or no plants left to provide refuge thus entire populations can be lost. Biocontrol reserve sites which act as nursery sites can help in areas where herbicide applications are essential (Hill & Olckers, 2001) but these are often not

managed properly and can be difficult to have officially demarcated to ensure protection during sprays.

The way forward

Amidst all the problems facing water hyacinth biocontrol, we have a positive way forward and are still confident that this control method will be an important component in the management of water hyacinth in South Africa. The first step is to ensure integration of biological and chemical control. Unfortunately due to water use requirements and the current water quality issues we're dealing with, biological control alone cannot be used to combat the weed. The advantages of both methods need to be integrated to improve control levels. Studies on the use of sub-lethal doses of herbicides have been undertaken by Wits and Rhodes Universities. These will hopefully identify a concentration of glyphosate that can be used that stops plant productivity to prevent spread or that takes longer to kill the plants so that all the immatures have time to complete their life cycle and move off sprayed plants. Also, Roy Jones, manager of a KZN Wildlife Reserve implemented an extremely successful integrated control programme on the Enseleni River (Jones, 2001) and it is hoped that this will set the stage for similar programmes on other systems around the country including the Vaal. New biocontrol agents that are very damaging to the plant are currently under consideration for release in South Africa. The water hyacinth grasshopper, *Cornops aquaticum* Brüner, is being reared in the quarantine facility at the PPRI in Pretoria and is awaiting permission for release from the Department of Environmental Affairs and Tourism (DEAT). Extensive host-specificity testing (Oberholzer & Hill, 2001) and pre-release efficacy studies (Bownes, unpublished data) have been completed and indicate that this organism is safe to release and is expected to make a significant contribution to the control of water hyacinth, preventing biomass increase and spread of the weed. Another two insects, *Megamellus scutellaris* Berg. and *Taosa inexacta* Walker, both sap-feeding plant-hoppers, have been identified as potential new agents and may be considered in the future. And lastly, the most important factor that could put an end to re-infestation of systems once they've been cleared (which would also prevent further spread of the weed) is good management. Millions of rands are wasted every year and hundreds of litres of herbicide are unnecessarily sprayed into the aquatic environment because systems aren't managed efficiently and essential follow-up sprays aren't done. This is something that has been identified as a serious problem by all involved in control of water hyacinth and if resolved, will change the infestation levels of water hyacinth that we're currently experiencing. There is excellent collaboration between the ARC-PPRI, Wits University, Rhodes University and our funders, the Working for Water (WfW) programme and the Water Research Commission (WRC) and together with public and other institute support, control of water hyacinth is only expected to improve in forthcoming years.

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AN INVESTIGATION OF THE MICROHABITAT PREFERENCE OF *LABEOBARBUS MAREQUENSIS* IN THE SABIE, OLIFANTS AND CROCODILE RIVERS WITHIN THE KRUGER NATIONAL PARK

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1. INTRODUCTION

Of the six broad categories of threats to survival recognized by the IUCN three are directly applicable to Southern Africa fish. These are habitat destruction, exploitation and the introduction of alien species. In South Africa they can be prioritized in that order. Habitat destruction, which is rated as the worst threat, can be equated to the breakdown of the ecological functioning of rivers which in turn can broadly be categorized as either a decline in water quality or an interference with water availability or in the worst case scenarios - both.

According to Fouché *et al* (2005) the distribution of fish in a river is determined by the flow regime, which would include factors such as velocity, depth and seasonality. On a micro-scale, factors such as the availability of cover and food complicate matters and needs to be investigated.

A number of South African fresh water fish species are listed in the IUCN Red List or are regarded as threatened or vulnerable (Skelton, 2001) and in need of conservation. The lack of clearly defined methodology for fish species conservation planning and management could be detrimental to fish conservation. Proper conservation planning however depends on empirical data, which often lacks in South Africa. Project funding was granted to a group of researchers by the WRC to develop a conservation framework for threatened fish species, applicable to South African conditions that would lead to an effective conservation strategy. This framework was first to be developed for a specific species and a generic version would be developed from this. Because of its status as "vulnerable" (Skelton, 2003) and "sensitive" (Kleynhans, 1991) the southern barred minnow, *Opsaridium peringueyi,* was selected as the candidate species and its habitat characterization and preference was to be studied in detail. One component of this project was to determine the habitat preference by looking at macro-habitat characteristics such as pH, dissolved oxygen, turbidity, total suspended solids and conductivity. The second component of the study concentrated on the "microhabitat" characteristics such as substrate, depth of water column and velocity or flow. Other aspects that relate to cover were also included. Because of the spatial scale it was decided to use the term *biotope* when referring to the microhabitat.

During the research a number of lowveld largescale yellowfish, *Labeobarbus marequensis,* specimens were also collected in the biotopes surveyed and this report is based on this data and aims to investigate the microhabitat or biotope preference of this species.

2. MATERIALS AND METHODS.

2.1. SURVEYS

During 2006 three surveys were undertaken in the Kruger National Park and a total of nineteen sites, where *O. peringueyi* had historically occurred, were surveyed.

2.2 HABITAT AND BIOTOPE DETERMINATION AND FISH SAMPLING

a) General procedure

At each of the selected sites the site was first observed and investigated, then discussed after which the different biotopes, based on differences in substrate, depth and velocity, were identified. A sketch map was then drawn on which these biotopes were delineated. Each biotope was then numbered and surveyed as a unit within the boundaries. The fish was then collected in each biotope and the specimens of each biotope were kept separate in marked containers. After completion of the survey the species were then identified using the key provided in Skelton (2001) and recorded in the "fish data per biotope" section of the field form. Voucher samples, for species confirmation by SAIAB, were retained and the rest of the specimens returned to the river.

b) Determining the biotope characteristics.

In each biotope the following were then determined: substrate composition, cover, depth and velocity. The physical dimensions, namely the width and the length, of the biotope were then estimated and recorded.

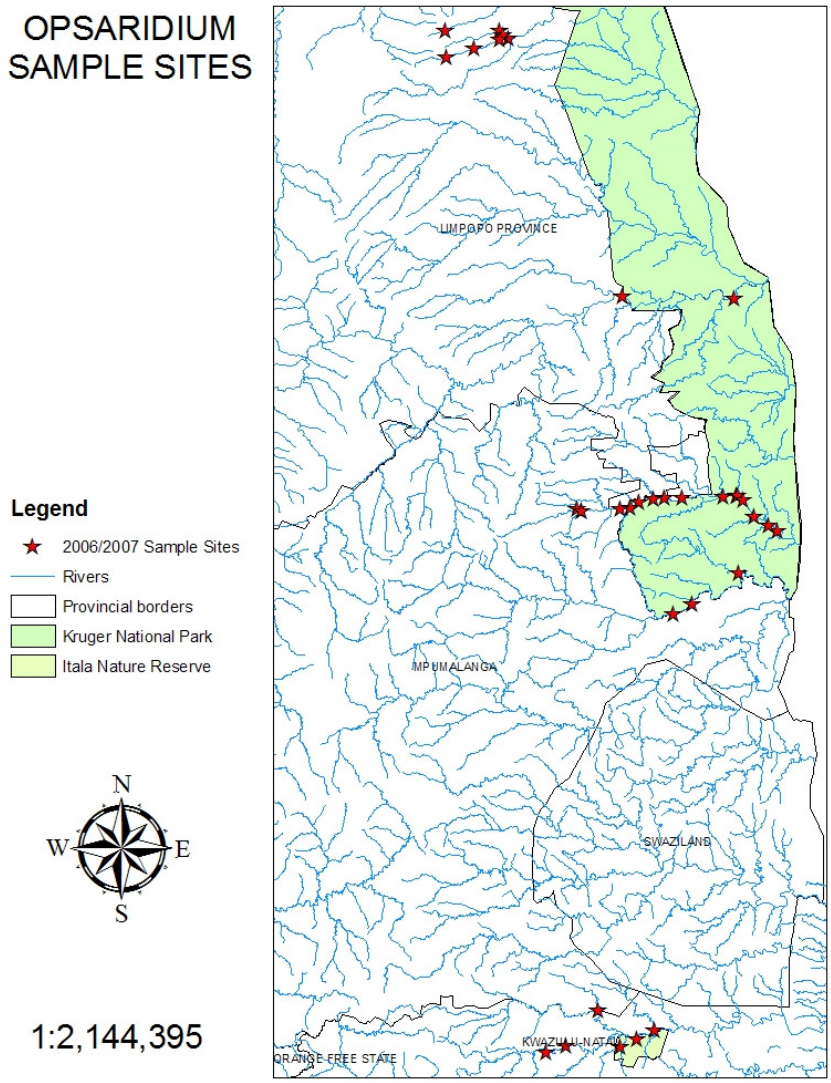

Figure 1: The historical *Opsaridium peringueyi* sample sites surveyed in the 2005, 2006 and 2007.

c) Collection of fish.

The method of collection depended on the biotope type and in general the protocol suggested by Kleynhans (1996) was applied. In the rheophilic habitats fish were collected by using electro-shocking and scoop nets. No time constraint was exercised and the biotopes were thoroughly sampled. Where possible the larger pools were sampled using a large seine net. In smaller pools and specifically where overhanging vegetation was present a small a pole seine net was used.

The following apparatus was used:

For electro - shocking fish were stunned using 220 volt AC electric current and the stunned fish were collected in hand-held scoop nets positioned downstream. The large seine net was

30 meters in length by 1,5 meters deep and constructed of 10mm knotless nylon netting. The pole seine, constructed of the same netting material, 2,5 meters long and 1,5 meters deep.

d) Substrate, velocity and depth determination
In each demarcated biotope the substrate, velocity and depth was determined at four randomly selected points within the boundaries of the biotope. At each point the velocity was determined with a Pasco Scientific PS 2000 velocity meter at two depths. The following standard procedure was followed. i) The velocity meter was placed directly on the substrate and the velocity measured. If the meter registered no flow it was then raised slowly until flow was registered and this was then recorded. ii) A second velocity measurement was then taken ten cm below the surface of the water. In shallow water where this was not possible the velocity was measured midway in the water column. The water depth was determined by means of the ruler on the shaft of the velocity meter to the nearest centimeter. The substrate types in each habitat were classified using the classification suggested by Rowntree and Wadeson (2000) and recorded. In this classification the diameters determining the classes are the following: Boulders are more than 256mm, cobbles are between 64 and 256mm, pebbles are from 8 to 64 mm, gravel is from 2 to 8mm and sand is smaller than 2mm. In silt the particles are not visible. The substrate was classified at the four points where the velocity meter touched the substrate.

The availability of cover, other than substrate, was estimated and recorded. The suggested rating applied in biomonitoring (Kleynhans and Louw, 2006) where a score of 0 is awarded if the type is absent, 1 if it is sparse, 3 for moderate, 4 for abundant and 5 very abundant was used. The cover types rated were: overhanging vegetation, undercut banks, root wads and aquatic macrophytes.

e) Analyses of the data.
To enable the comparison in these early stages of the project, with the little data gathered, the surveyed biotopes were classified into the four velocity depth classes as proposed by Kleynhans (1996). According to this classification flow that exceeds 0,3m/s is regarded as fast and below that as slow. Water deeper than 0,5m was regarded as deep while the rest was all regarded as shallow. In this report the classes are also referred to biotope types.

The BIOENV procedure in PRIMER was used to investigate combinations of substrate variables that would best explain the observed presence of the species in the biotopes (Clarke and Ainsworth, 1993).
When this data is presented some aspects should be taken into consideration:

- That not all biotopes types were sampled at all the sites because of the presence of crocodiles and hippos.
- Because of the nature of the aims of the project, sites where *O. peringueyi* were expected were selected.
- Because the project has only been running for a short while the sample size is quite small.

3. RESULTS

The first survey, in the Sabie River, was the first of three surveys within the boundaries of the KNP and took place in the week from the 19th to the 22nd of June 2006 and seven sites were surveyed. The second KNP survey, which included the Sabie and Crocodile rivers, was done during the week of the 21st to the 24th of August 2006. Five sites were surveyed in the Sabie and three in the Crocodile River. Two sites in the Olifants River were surveyed from the 13th to the 14th of September 2006. Seven sites were also surveyed in Luvuvhu River from the 1st to the 3rd of August 2006 and these results are included as a comparison. A number of sites in Kwazulu-Natal were also surveyed and in the Sabie River outside the KNP during 2005 and 2007 respectively. These results are not included. All the sites surveyed are shown in figure 1.

The fish biodiversity observed at the surveyed sites is illustrated in table 1 and it shows that *L. marequensis* was collected at nine of the Sabie River sites, two of the Crocodile River sites and only one site in the Olifants River. On the other hand all the sites in the Luvuvhu River had *L. marequensis* present. Table 2 shows the biotope diversity observed at each of the sites, the total number of specimens collected at each sites and the proportional number of specimens collected in each biotope type.

Table 1: Fish diversity observed at the sites surveyed in the Sabie, Olifants, Crocodile and Luvuvhu rivers.

SITE NR	RIVER	AMOS	AURA	BANN	BEUT	BLIN	BNEE	BRAD	BTRI	BUNI	BVIV	CANO	CENG	CGAR	CPAR	CPRE	GGIU	LCYL	LMAR	LMOL	MACU	MBRE	MMAC	OMOS	OPER	PCAT	PPHI	SMER	TREN	TSPA
OPS7	Sabie													X	X		X	X	X				X			X	X			
OPS8	Sabie								X		X			X	X			X	X					X			X		X	
OPS9	Sabie								X		X		X	X				X	X		X		X	X			X		X	
OPS10	Sabie										X		X	X	X								X			X	X			
OPS11	Sabie								X		X		X	X	X			X	X				X	X			X		X	
OPS12	Sabie								X	X	X		X		X			X	X					X			X			
OPS13	Sabie				X				X		X	X	X	X	X			X					X				X			
OPS14	Sabie				X				X		X		X	X	X		X	X	X		X		X	X			X	X		
OPS15	Sabie			X					X		X	X		X	X		X	X	X	X			X				X			
OPS16	Sabie				X				X		X	X	X		X		X	X	X	X							X			
OPS17	Sabie				X				X		X	X	X		X			X	X		X	X	X				X		X	X
OPS18	Sabie								X		X										X			X			X		X	
OPS19	Crocodile								X		X		X		X			X	X					X			X			
OPS20	Crocodile										X	X		X	X			X	X											
OPS21	Crocodile							X	X		X				X			X												X
OPS22	Luvuvhu	X									X		X		X	X		X	X	X										
OPS23	Luvuvhu		X		X	X	X				X					X		X	X		X		X		X		X			
OPS24	Luvuvhu										X			X		X		X	X	X		X				X		X	
OPS25	Luvuvhu						X		X		X					X			X				X	X						
OPS26	Luvuvhu		X				X							X		X		X	X	X			X							
OPS27	Luvuvhu		X				X									X		X	X						X					
OPS28	Luvuvhu		X		X		X									X			X					X	X					
OPS30	Olifants												X	X	X			X												
OPS29	Olifants													X	X			X	X											

The percentage frequency of occurrence of *L. marequensis* in the sampled biotopes as well as the average frequency of occurrence is shown in table 3. The averages indicate that the species more commonly occur in "fast" biotopes with a preference for the fast shallow biotopes. The percentage frequency occurrence observed in the Luvuvhu River was similar to that of the KNP rivers. The size distribution of the specimens collected at the KNP sites (table 5) should be considered when these results are analysed as it is clear that only juveniles and young adults were collected.

Table 2: The number of velocity-depth classes present at the surveyed sites and the number of *L. marequensis*, expressed as a percentage, present in each class/biotope type.

Site no	River	Total no of fish collected at the site	Fast deep		Fast shallow		Slow deep		Slow shallow	
			Total number of biotopes present	The no of fish collected. (% of total)	Total number of biotopes present	The no of fish collected. (% of total)	Total number of biotopes present	The no of fish collected. (% of total)	Total number of biotopes present	The no of fish collected. (% of total)
OPS7	Sabie	4	3	0	2	75	2	0	4	25
OPS8	Sabie	13	1	38.5	1	0	2	0	2	53.9
OPS9	Sabie	9	1	0	4	88.9	0	0	4	11.1
OPS10	Sabie	0	2		4					
OPS11	Sabie	12	3	8.3	1	91.7	2	0	0	0
OPS12	Sabie	6	2	100	1	0	1	0	1	0
OPS14	Sabie	6	1	0	4	100	1	0	1	0
OPS15	Sabie	4	3	75	1	25	0	0	0	0
OPS16	Sabie	1	4	100	1	0	0	0	1	0
OPS17	Sabie	7	1	100	3	0	0	0	3	0
OPS19	Crocodile	11	0	0	4	100	0	0	0	0
OPS20	Crocodile	1	0	0	1	100	1	0	0	0
OPS21	Crocodile	0	2		1					
OPS22	Luvuvhu	4	2	25	5	25	2	25	1	25
OPS23	Luvuvhu	10	0	0	1	0	4	100	1	0
OPS24	Luvuvhu	2	0	0	1	100	1	0	2	0
OPS25	Luvuvhu	51	1	72.6	3	27.5	1	0	2	0
OPS26	Luvuvhu	13	3	46.2	2	38.5	2	7.7	1	7.7
OPS27	Luvuvhu	1	4	0	1	0	1	0	2	100
OPS28	Luvuvhu	9	1	0	5	100	1	0	1	0
OPS29	Olifants	2	0	0	0	100	0	0	0	0
Averages				**29,8**		**51,1**		**7,0**		**11,7**

Table 4 shows the results of a Spearman rank correlation of the substrate variables resulting from the BIOENV procedure. It should be noted that none of the correlations were good but the ranking gives an indication of the order of preference. The placement of the "coarser" particles is particularly of note and there is a clear indication that the size groups of the species occurred mostly in biotopes where the preferred substrate classes were "boulders" and "cobbles". In the Luvuvhu River a high frequency of occurrence is observed in two of the slow biotopes types. When the substrate of these biotopes are investigated the same substrate sizes, namely boulders cobbles, are found to dominate.

Table 3: Percentage frequency of occurrence of *L. marequensis* in the sampled biotopes. (Fast = >0,3m/s; Slow = <0,3m/s; Deep = > 0,5m and shallow = <0,5m).

		FD			FS			SD			SS		
Site no	River	Total sampled	Where LMAR occur	% FOCC	Total sampled	Where LMAR occur	% FOCC	Total sampled	Where LMAR occur	% FOCC	Total sampled	Where LMAR occur	% FOCC
OPS7	Sabie	3	0	0	2	1	50	0			3	0	0
OPS8	Sabie	1	1	100	1	0	0	2	0	0	2	1	50
OPS9	Sabie	1	0	0	4	2	50	0			4	1	25
OPS10	Sabie	2	0	0	4	0	0	no habitat					
OPS11	Sabie	3	1	33.3	1	1	100	2	0	0	no habitat		
OPS12	Sabie	2	1	50	1	0	0	1	0	0	1	0	0
OPS14	Sabie	1	1	100	3	2	66.7	0			1	0	0
OPS15	Sabie	3	2	66.7	1	1	100	0			0		
OPS16	Sabie	4	1	25	1	0	0	0			1	0	0
OPS17	Sabie	1	0	0	3	1	33.3	0			3	0	0
OPS19	Crocodile	0			4	2	50	0			0		
OPS20	Crocodile	0			1	1	100	1	0	0			
OPS21	Crocodile	2	0	0	1	0	0	0			0		
OPS30	Olifants	4	0	0	2	1	50	0			0		
OPS22	Luvuvhu	1	1	100	3	1	33.3	2	1	50	1	1	100
OPS23	Luvuvhu	no habitat			1	0	0	4	1	25	1	0	0
OPS24	Luvuvhu	0			1	1	100	1	0	0	1	0	0
OPS25	Luvuvhu	1	1	100	3	2	66.7	1	0	0	2	0	0
OPS26	Luvuvhu	3	1	33.3	2	2	100	2	1	50	1	1	100
OPS27	Luvuvhu	4	0	0	1	0	0	1	0	0	2	1	50
OPS28	Luvuvhu	1	1	100	5	2	40	1	0	0	1	0	0
Average FOOC				**33.8**			**44.8**			**11.4**			**23.1**

Table 4: Correlation between the measured substrate and *L. marequensis* abundance in the Sabie, Crocodile and Olifants rivers.

Variables	Correlation
Boulder, cobble	0,088
Boulder, cobble, sand	0,081
Bedrock, boulder, cobble	0,077
Bedrock, boulder, cobble, sand	0,073
Cobble, sand	0,073
Cobble	0,068

Table 5: Size distribution of the fish collected at the sites in the Sabie, Crocodile and Olifants rivers.

	Fork length classes (mm)					
Site	21 - 40	41 - 60	61 - 80	81 - 100	101 - 120	121-140
OPS7		1				
OPS8	1	1				
OPS9	1	12	4			
OPS11	1	2	3	1	2	
OPS12	4	1	1			
OPS14						1
OPS15	1			1		1
OPS17	5	1				
OPS19	1					
OPS20						1
OPS30		1				

As far as the cover other than substrate is concerned table 6 shows that of the nineteen biotopes, where *L. marequensis* occurred, this type of cover was only recorded in six. The fast shallow biotope of OPS9 was the only biotope where one such cover, namely root wads, was classified as "abundant". In all other instances the classification ranged from "sparse" to "moderate" when present at all.

Table 6: Examples of the cover ratings at the sites in the Sabie, Crocodile and Olifants River.

SITE CODE	RIVER	Biotope types	Aquatic vegetation	Overhanging vegetation	Rootwads	Undercut banks
OPS7	Sabie	FS	0	0	0	0
OPS7	Sabie	FS	0	0	0	0
OPS7	Sabie	FS	0	0	0	0
OPS7	Sabie	SS	0	0	0	0
OPS17	Sabie	FD	0	0	0	0
OPS19	Crocodile	FS	1	3	0	2
OPS20	Crocodile	FS	0	0	0	0
OPS30	Olifants	FS	0	0	0	0
OPS8	Sabie	FD	0	0	0	0
OPS8	Sabie	SS	0	0	0	0
OPS9	Sabie	FS	0	0	4	0
OPS9	Sabie	SS	2	0	3	0
OPS11	Sabie	FD	0	0	0	0
OPS11	Sabie	FS	0	0	0	0
OPS12	Sabie	FD	0	0	0	0
OPS14	Sabie	FS	0	0	3	3
OPS15	Sabie	FD	0	0	1	3
OPS15	Sabie	FS	0	0	0	3
OPS16	Sabie	FD	0	0	1	1

4. CONCLUSION

It was originally envisaged that the relationship between the biotope characteristics and the species could be analysed in more detail to equate the presence or absence of the species to specific velocities and depths. The lack of data however did not allow this as is well indicated by the low levels of correlation resulting from the Pearson ranking. Although the findings are not as conclusive as expected at this stage of the research some interesting trends are observed. It is observed that the species prefers water flowing faster than 0,3m/s and that shallower water irrespective of velocity, is preferred. Again the size of the fish collected should not be disregarded. In a sense this agrees with the findings of a number of authors (Pienaar, 1978; Bruton *et al*, 1982; Bell-Cross and Minshull, 1988) who indicated that the species mostly occurs where the current is "swift and strong". This was confirmed by Fouche *et al.* (2005), when comparing the Mutale and the Luvuvhu rivers. These authors (Pienaar, 1978; Bruton *et al*, 1982; Bell-Cross and Minshull, 1988) also mentioned that when species occur in pools the substrate is "rocky". This fact is also pointed out in the results of this report where the substrate of the slow-deep biotopes was generally dominated by boulders and cobbles. Russell (1997) classified the habitat of the largescale yellowfish as lying midway between the rapid and marginal areas and that it is not always associated with rapids but frequently with strongly flowing waters. The preference to marginal areas, which could be regarded as "slow-shallow" were not observed in this study but agrees with the velocity aspect.

Russell (1997) reported that the species it is predominantly recorded in sites with fringing vegetation but is not collected among aquatic vegetation indicating that their dependence on aquatic plants is unknown but it is most likely low. The findings of this study confirm

the low rate of dependency on vegetation, both overhanging and aquatic, and show similar trends for cover other than substrate.

A preference for boulders and cobbles are observed which differs slightly from the gravel and cobbles reported by Russell (1997). The findings of this study on the substrate preference of the species are encouraging and it is envisaged that more conclusive results will be obtained as the research progresses.

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THRESHOLDS OF POTENTIAL CONCERN FOR LARGESCALE YELLOWFISH, A PROJECT IN THE CROCODILE RIVER, KNP.

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Abstract

Introduction
Little or no scientific work has been carried out on the ecology of this species *Leabobarbus marequensis*. Their distribution through out the Lowveld is continually under threat and this species has disappeared from certain reaches of the lower NKomati River in the Mpumalanga Lowveld Region (pers.comm.F. Roux) It is important therefore that this species be thoroughly researched and their habitat requirements, breeding biology and food preferences be clearly understood if the conservation and survival of this species is to be successful. They occur in the warm waters of the east flowing rivers throughout the Kruger National Park (KNP) yet are more prolific in some of these rivers than in others. Personal observations have shown that the Crocodile River has a "reasonably healthy" population of *Leabobarbus marequensis* and therefore is ideally suited for research of this nature. Furthermore the Crocodile River system is continually under threat due to diffused sources of pollution, poor water quality and quantity as a result of water extraction for agriculture. The construction of in stream structures and water diversions add a further dimension and inhibit movement of aquatic vertebrates through the system. The ecological reserve (ER) determination of the Crocodile River has as yet has not been finalized and therefore the dry season flow requirements are of particular concern. As the need to have adequate winter refuge habitat within the Protected Area is essential due to the illegal fishing activities taking place outside the Protected Area.

Research Objectives
The aim of this study is to use biotelemetry to contribute towards developing an understanding of habitat requirements, breeding biology, spawning requirements and/or cues triggering spawning and the possible negative impacts of man-made in stream structures.

1. Winter habitat preference and movements.
2. Summer habitat preferences and movements.
3. To identify spawning habitat and environmental factors, which may induce spawning.
4. To generate Thresholds of Potential Concern (TPC's) for *Leabobarbus marequensis* in order to assist Protected Area Managers. For example low flows at critical periods could negatively influence spawning, breeding, migration and population health. Understanding these impacts will help develop TPC's.
5. To document breeding biology and early life history stages.

This study was made possible with the support of FlyCastaway and SANParks.

THE SOCIAL, ECONOMIC AND ENVIRONMENTAL IMPACT OF SEWAGE POLLUTION IN THE VAAL RIVER BARRAGE

[1]Morné Viljoen, [2]Johan W Tempelhoff
with the assistance of theEco-Care Trust

Introduction

The massive fish kills that occurred in the Vaal River during the past two years, in typical "politician speak", "shocked and dismayed" people throughout the country. Anglers, in particular were negatively affected by these incidents. In fact, the fish kills that occurred on 16 January 2006 in the Vaal River Barrage area were the main topic of discussion at the Yellowfish Working Group's ("YWG") 2006 conference.

At that conference we were enlightened by various experts as to the causes, problems and effects of sewage pollution, specifically with regards to the Vaal River Barrage area[3]. It is not the intention to dwell on the causes of the sewage pollution, suffice to say that the Vaal River Barrage Area receives, because of numerous reasons, treated and sometimes untreated sewage water and sludge from the whole Witwatersrand and the Vaal Triangle.

I subsequently contacted Professor Johann Tempelhoff at the School of Basic Sciences, Vaal Triangle Faculty of the North-West University (formerly known as the Potchefstroom University for CHE) with a view to conduct research into the effect of pollution on anglers. As a result, a trans-disciplinary research group, working on the socio-economic and environmental impact of pollution in the Vaal River-Barrage was assembled. The "social" part of the study is of particular interest. It, *inter alia*, focuses on the impact of the pollution on anglers.

Role players in this study include: DWAF, Eco-Care, Metsi-a-Lekoa, Emfuleni Municipality, Sedibeng district Municipality, Free State Nature Conservation and SASOL.

What have we done so far?

1. ***A paper, "The Vaal River, South Africa's hardest working waterway: an historical contemplation" was delivered at a symposium at the Delft University of Technology (TUDelft).*** [4]

   This paper looked at the history of the hardest working river in the country. The Barrage area provides water to an estimated 10 million people in a catchment in

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[3] See papers by Dries Louw (ERWAT), Riana Munnik(DWAF), Francois van Wyk (Rand Water) and Steve Mitchell (WRC) in the Proceedings of the 2006 Yellowfish Working Group Conference
[4] "'Streams ran uncontrolled' history, water and engineering" at the Delft University of Technology (TUDelft), presented by TUDelft and the International Water History Association (IWHA) on 9 November 2006.

which there are 13 600 wet industries, more than 20 waste water treatment works and quite a number of mines. A huge number of these people live in informal settlements, with no access to sanitation services, the sewage of which goes directly into the tributaries of the Vaal River[5].

It is clear that the study area was, since the dawn of the gold mining era, on the receiving end of pollution, which culminated in last year's fish kills. A major setback for the sanitary services of the local authorities in the Vaal River Barrage catchment area was the fact that, in the transition to a new democratic dispensation, there was a rapid changeover in the structure of municipal services. White officials sought employment in the private sector or they went on early retirement. In the process valuable human resources with lots of experience were lost. These were mostly technical experts responsible for the maintenance and upkeep of old sewerage works that were prone to collapse in the face of an extraordinary increase in the population of the Witwatersrand.

Catchment Management Forums[6] were created as a result of a philosophy of catchment based management. The first such forum was the Blesbokspruit Catchment Management Forum and served as model for the subsequent Klip-, Rietspruit-, and the Leeu-Taai Catchment Management Forums. Together these catchments determine the water quality of the Barrage. The Vaal River Barrage's water quality is finally determined by the release from the Vaal Dam.

How well do the forums function? Dr Pieter van Eeden, Iscor whistleblower and chairperson of the Klip River Forum, sees the forums as places of accountability. They are open to the public and public groups, industries and regulators raise and discuss issues. But it only works as an accountability mechanism when the polluters are willing to attend the forum. Because the forum is voluntary, they have the option of saying "we only have to comply with the conditions of our water use licences and we don't have to care about your water fleas dying", says Van Eeden with some exasperation. The reward for a company that does attend the forum and improve its water quality care, is a reputation for environmental responsibility. That can be worth a lot, says Van Eeden. "Many industries do see the point and understand that proper environmental care can save them money," says Van Wyk.

It is noticeable that a number of committed water professionals attend the forums which range from 10 to 40 people per meeting. But public participation could be more extensive, says van Eeden. Municipal councillors soon become bored with attending. Some industries attend only when they need to push through a license application and vanish when they have achieved it. Some community groups – usually from the better off communities – attend and comment regularly. Poorer communities are badly represented. Participation requires organisation, financial resources (e.g. for transport) and access to information. For communities in informal settlements (who are paradoxically most directly affected by water quality issues) these conditions remain unmet. And should they make it to a meeting, the

[5] Especially the Klip River, which is estimated to be responsible for 90 per cent of the flow of the Vaal River Barrage, is heavily impacted on, F van Wyk, An integrated manual for the management, control and protection of the Vaal River Barrage reservoir, p. 6.

[6] This section is based on an interview with Pieter van Eeden, chairperson of the Klip Catchment Forum, Francois van Wyk of Rand Water, 1 Nov 2006, direct observation of Upper Vaal forum meetings and visits to the website www.reservoir.co.za.

chances of effective and informed participation seem remote. Despite efforts to provide information, mostly on a dedicated website, the information is not easy to understand at first sight, because a familiarity with the guidelines and function of the indicators is required. Improving information provision, for example through newsletters, once again raises budget obstacles.

The reality of the catchment forums reflects the reality of water quality regulation in South Africa. The "polluter pays" principle does not apply. The current or potential victims of pollution are expected to carry the costs of regulating pollution on a voluntary basis. If they cannot afford it, they remain excluded. Self-regulation remains the norm in practice. Polluters, or potential polluters, can choose whether they attend the forums or not. They have to be "kept on board". This opens the option for polluters to withdraw from forums, or to threaten to withdraw, and enables them to avoid censure or robust discussion of their pollution. Placing the burden on the polluted to keep the forums going, compromises their ability to protect themselves against pollution.

Despite their problems, the forum meetings provide fascinating insights into the realities of water quality challenges in the Upper Vaal. They also provide unique opportunities for information exchange, networking and building personal understanding between individuals who would otherwise remain opponents with little sympathy or understanding for each other's concerns and constraints. Rand Water's Francois van Wyk expects the forums to remain permanent features of water regulation, because of their local character and participation.

It is also clear that organised civil society will have to play a strong role to ensure that reasonable health standards are maintained. This role is increasingly taken up but, at the same time, it is the well-resourced who can do it, and those who with the least resources (and the most at risk) who are, for all practical purposes, excluded. It is really up to the DWAF to change this and provide a sustainable resource base for the forums.

The paper also looked at possible legal routes in order to clean up the Vaal River Barrage area. Sufficient legislation exists in South Africa to protect the Vaal River Barrage and its biodiversity. The ideal would be to have the legislation implemented and policed by the relevant spheres of government. At present this is not the case. Water pollution is more often than not caused by local authorities. No steps are then taken by the provincial or national spheres of government to resolve the problem. The question is, what should be done? The answer is very difficult. While a wide array of legal remedies exists, it entails legal action, which is inevitably costly. Therefore concerned citizens and organisations usually shy away from court action and rather use the media to vent their anger and frustration. In terms of the legislation it is possible to lay criminal charges against polluters. This, however, is also not occurring on a regular basis, basically because of the perception that exists that a criminal charge should be laid at a police station, and the police are, in addition to being ill equipped in terms of human resources, not trained in environmental law.

A non-confrontational approach which might be used successfully is to use the tools provided in the National Environmental Management: Biodiversity Act, No. 10 of 2004 (NEMBA). It is suggested that, with regard to the Vaal River Barrage and its whole catchment area, the following could be done in terms of the NEMBA:

- list sewage pollution as a threatening process in terms of Section 53;
- list the whole area as an eco-system which is threatened or in need of protection in terms of Section 52(1); and
- draft a biodiversity management plan for this area as an eco-system.

In addition, or as an alternative, the Largemouth yellowfish (*Labeobarbus kimberleyensis*) which is listed as a vulnerable species by the IUCN and which only occurs in the Vaal and Orange Rivers, could be listed as threatened species and a biodiversity management plan must be drafted for this species.

The advantages of this strategy can be summarised as follows:

- it is non-confrontational and would more likely lead to the co-operation of all stakeholders, especially the relevant spheres of government;
- the uncertainty of court cases will be taken out of the equation;
- by proclaiming a species or eco-system as threatened, as well as the publishing of the biodiversity management plan in the Government Gazette, will give such a plan the power of law, in terms of civil enforceability. In addition, the responsible minister can be asked to publish regulations to make the plan enforceable on a criminal basis as well;
- it is holistic and inclusive – all aspects that are a threat to the species or eco-system will be addressed and managed in terms of the management plan, including sewage pollution;
- the associated environment and biodiversity will be automatically protected;
- such a plan may be expensive to draft and implement, but one is more likely to obtain funding for the implementation of such a plan, than to obtain funding for litigation;
- a biodiversity management plan must preferably not be implemented by a state organisation, but by an organisation from civil society. This will mean that the management of the eco- system or species will be taken out of the hands of the government and, in fact, they will have to report to the implementing organisation. Thus, a huge load will be relieved from a government under pressure; and
- the whole catchment of the Vaal River Barrage Area should be included, thus encompassing all the sources of pollution.

2. Results of a Questionnaire

Angling forms part of both the social and economic aspect of the study and the research group felt that the voice of anglers should be heard - a group of water users who is directly affected by water pollution (they experience water pollution on

various levels: the see it, they smell it and they touch it) and who is never included when studies are done, or who does not have a collective body that can speak on their behalf (in this regard we refer to recreational fisherfolk, not angling clubs). Being a fisherman myself, I cannot recall having been included in any stakeholder participation session with regards to issues pertaining to fishermen. In addition, I have been told many times that government institutions make decisions or draft laws without taking the opinion of the person who will be affected most into account. Therefore, a questionnaire was created to gauge the impact of sewage pollution on fisherfolk.

The response was to say the least, very disappointing. From July 2006 to date, only 77 responses were received. If one takes into account that *Tight Lines* sells approximately 38 000 copies per month, this is very disconcerting. It is difficult to say what the reason for the low response is, but herewith a few guesses:

- People find it too time-consuming to go to a website and fill in the questionnaire;
- They mostly only have access to the internet at work, and cannot complete the questionnaire at their leisure.
- However, the response at the *Stywe Lyne* Angling Show was equally disappointing. People just did not seem willing to co-operate.
- Does this mean that they just do not care? Do South Africans in general have a tendency to criticise (the braai place is a favourite venue), but not to act, specifically when it comes to social issues? The question remains open.

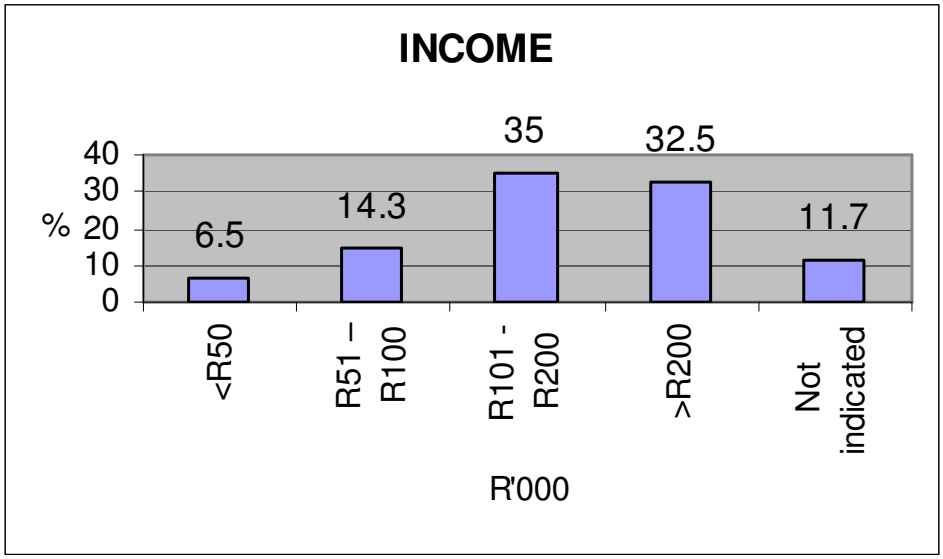
A "remote" survey may have been not the way to go. We intend to take a more direct approach soon. Additional surveys will include:

- obtaining information from tackle shops (it is rumoured that some shops - specifically fly fishing shops in the Johannesburg area were severely affected by the fish kills that happened in January 2006; and it is reported than some did not sell a single fly for the next month);
- visiting angling resorts to obtain information from both the anglers and the owners of the resort; and
- study the impact on subsistence fishermen.

The results contained in this report are therefore only preliminary. We assume, however, that certain trends will not change much – e.g. the proportion of men to women anglers, and the fact that the vast majority of anglers visiting the Vaal River Barrage do not reside in this area. This survey also tested, to a large degree, the **perceptions** of anglers. it cannot be expected from anglers to know - as a fact – who is the main culprit with regards to water pollution or what the actual effect of water pollution is on the edibility of fish. A few of the interesting results are discussed

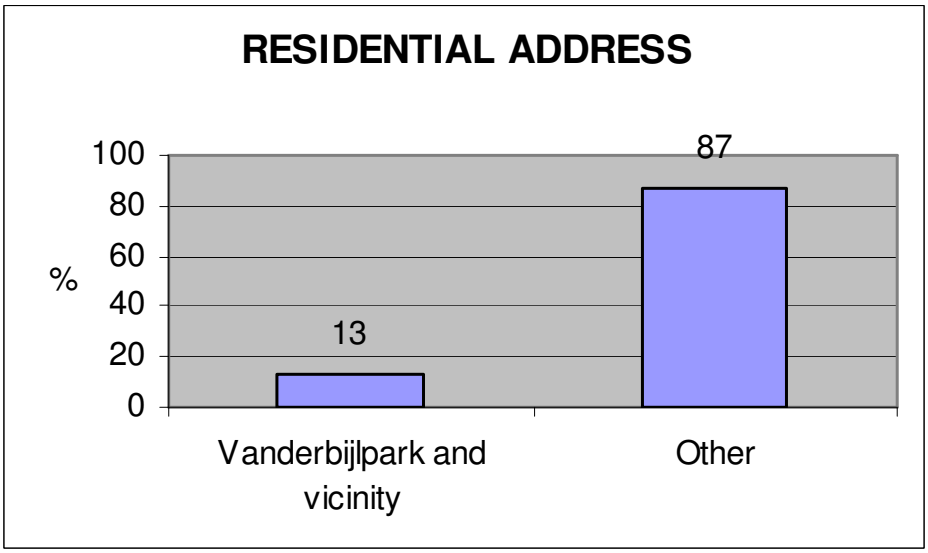
Income

11% of the respondents preferred not to indicate what their income was. Of the remaining 89%, 35% earned between R101 000 – R200 000 per annum, with the 33% earning more that R200 000p/a. It shows that angling is practised by the more affluent part of the community.



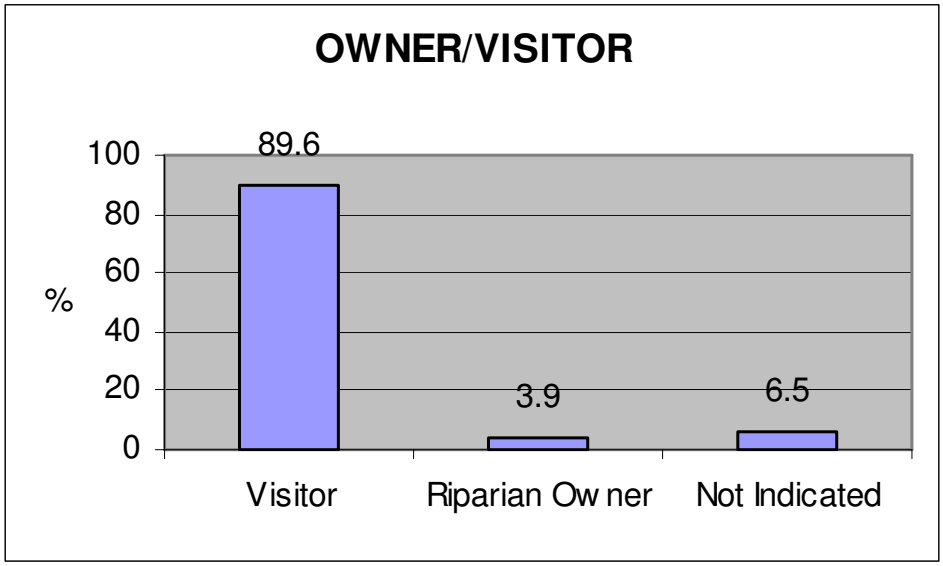
Residence

Because of the fact that the largest fish kills occurred in the Vaal River Barrage Area, we wanted to know which proportion of respondents are actually residing in the area flanking this area. Only 13% of the respondents reside in this area. This shows that the vast majority (87%) of the anglers are "bringing foreign currency" into this area.



Owner/Visitor

Nearly 90% of the people visiting the area do so as visitors. Only a small proportion are riparian owners.



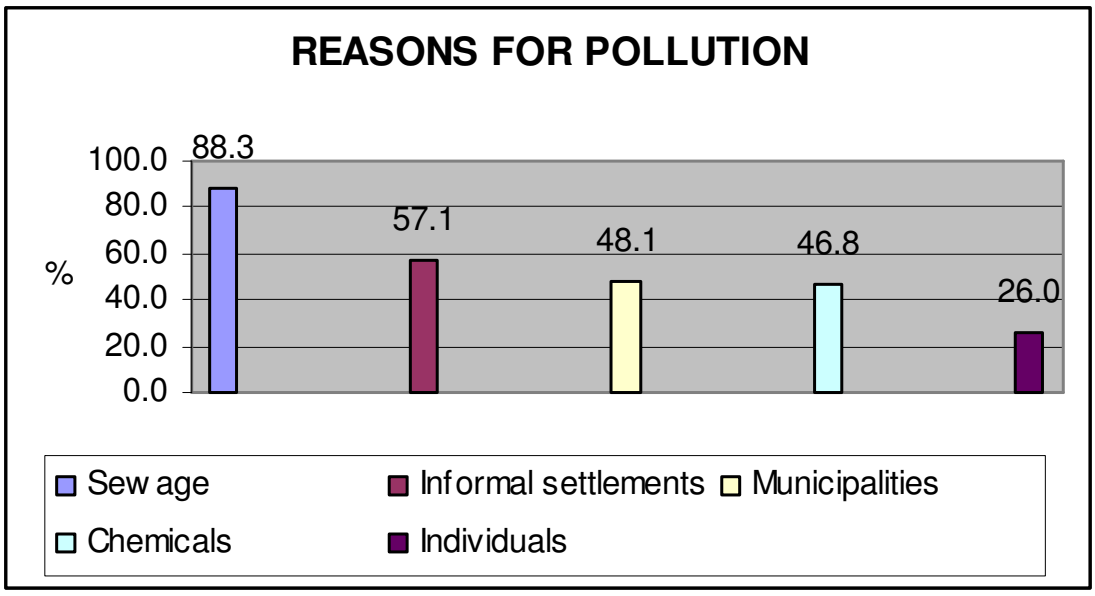
Reasons for Pollution

The respondents were asked whether they are aware that the water that they are fishing in might be polluted and if so, what they thought the reasons for the pollution was. It should be borne in mind that a respondent could give more than one answer with regards to the possible causes of pollution.

1,3% of the respondents did not think that the water may be polluted. Of the remaining 98,7% who were aware that the water is polluted thought the following were the reasons for the pollution:

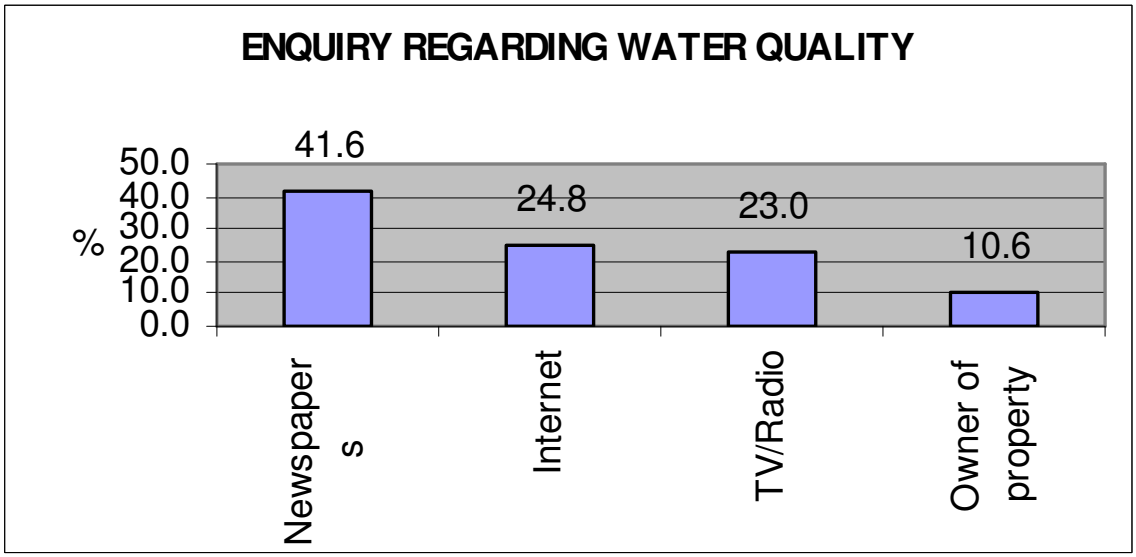
- 88% - sewage;
- 57% - informal settlements;
- 48% - municipalities,
- 46% - chemical pollution; and
- 26% - individuals.

It is clear that sewage pollution is anglers' main concern.



Do fishermen make enquiries with regards to the water quality before they go fishing? -

An astonishing 23 % of the respondents indicated that they do **not** enquire about the water quality prior to a fishing trip! Of the remaining 77%, 41,6% indicated that they use newspapers as a source of information, 24,8% use the internet, 23% get their information from television or radio and 10,6 make their enquiries directly from the management of the resort they intend to visit.

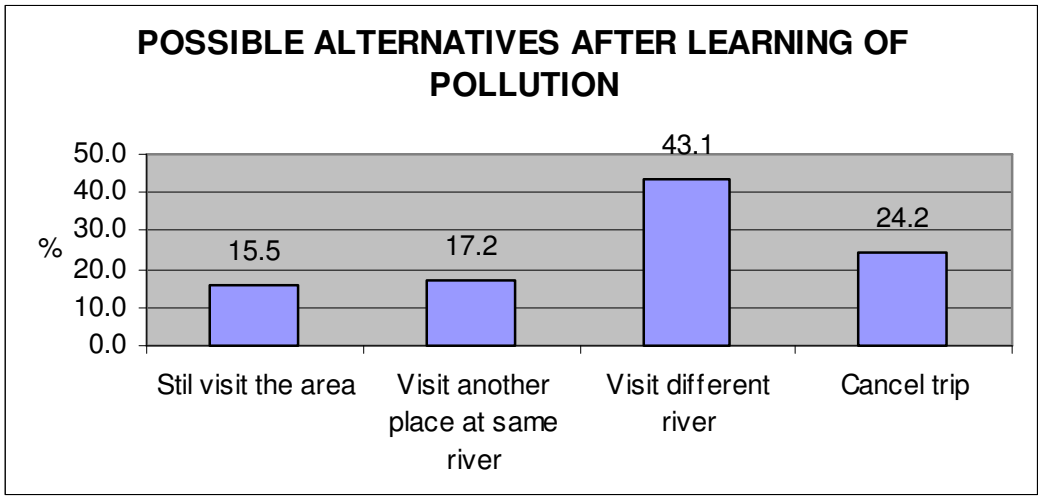


What do fishermen do when they learn that the water that they intended to visit is polluted?

15,5 % indicated that they would still visit the intended angling place! This correlates with an observation that I made on a visit to the study area a few days after the huge 16 January 2006 fish kills: namely hundreds of anglers at Erina Spa, the first resort

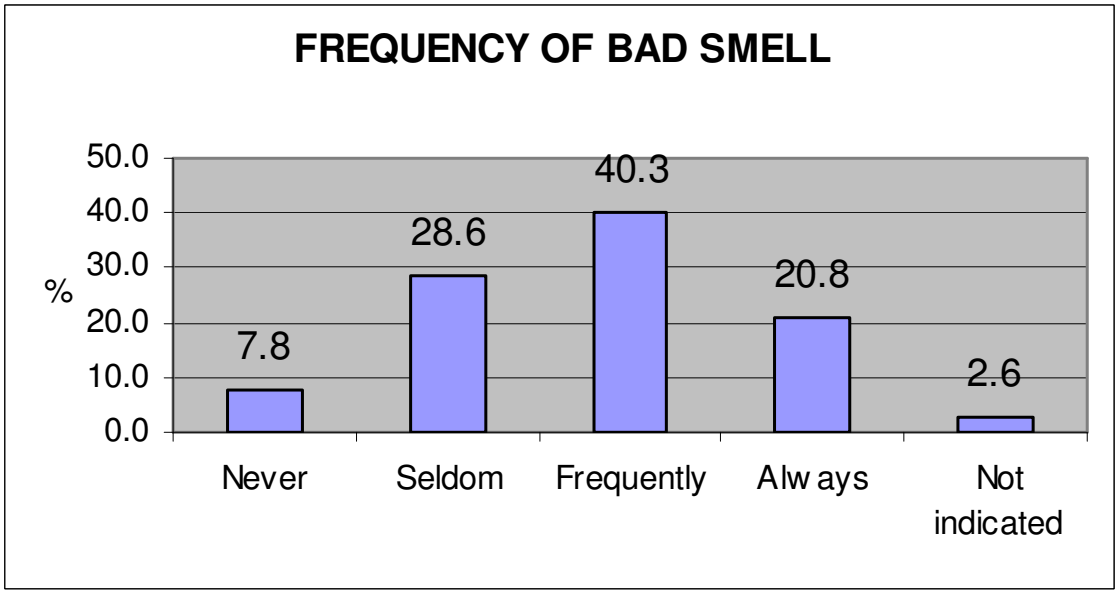
downstream from the Barrage itself. Children were even swimming in the water! This after the fish kills were widely reported on television, radio and the newspapers!

43,1% of the respondents indicated that they would rather go to another area, although in the same river system. 17,2% indicated that they would rather fish a totally different river system, while 24,2% indicate that would cancel their trip.



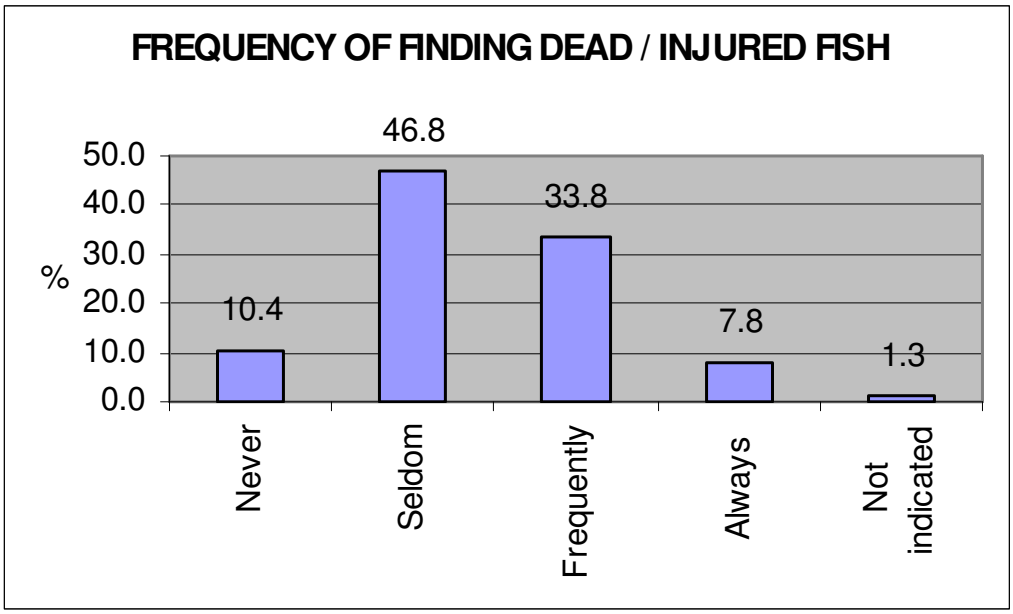
Bad Smelling Water

40,3% of the respondents indicated that the water they intend to fish in smells bad frequently, 28,6 said this happens seldom, while 20,8 reported that the water always smells bad.



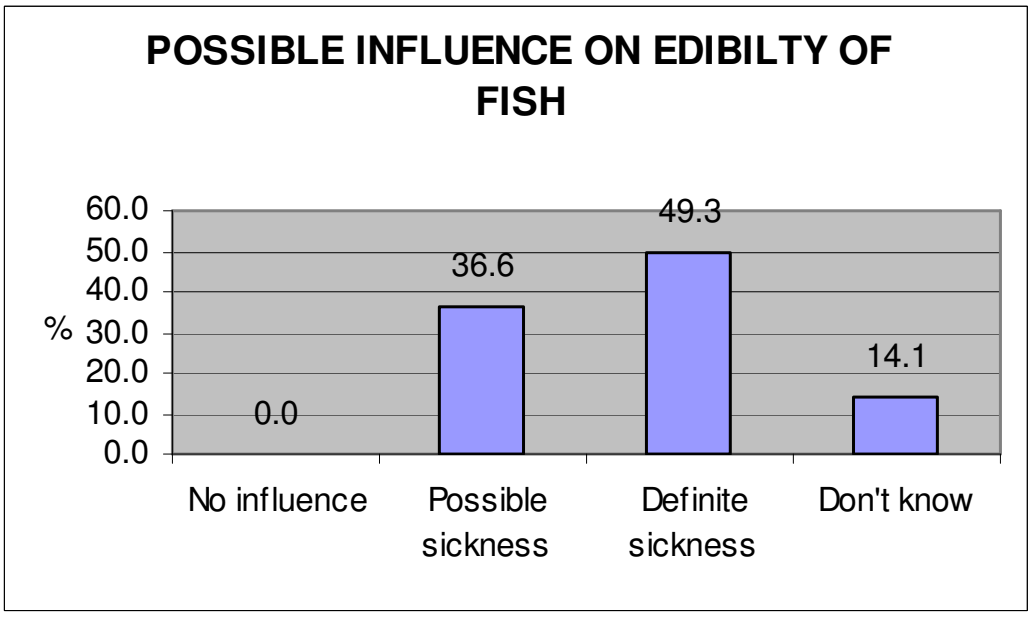
Finding dead fish

Nearly 47% of the respondents indicated that they seldom find dead fish at the water. However, a large group (nearly 34%) said that they frequently found dead fish at their angling waters.



Influence of pollution on the edibility of fish

The respondents were asked what they thought the influence of polluted water had on the edibility of fish. 36,66% thought one might get sick from eating fish caught in polluted waters, nearly 50% accepted it as a certainty that one WILL get sick, should you eat fish from polluted waters while 14,05% indicated that they were not sure what the impact will be.



Frequency of visiting the Vaal River

Vaal River downstream from the Vaal Dam and the Vaal River Barrage Area

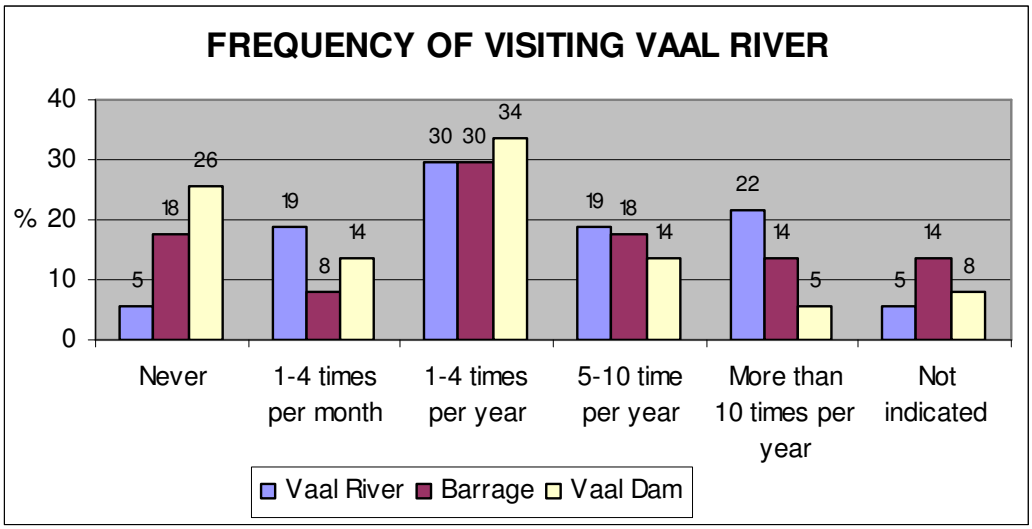
- 5% of the respondents indicated that they never visit the Vaal river
- 30% visits the Vaal River 1-4 times per year.
- 19% visits the Vaal River 5-10 times per year
- 22% visits the Vaal River more than 10 times per year
- 19% visits the Vaal River 1-4 times per month (ie more that 12 times per year.)

Vaal River Barrage Area

- 18% of the respondents indicated that they never visit the Vaal River Barrage Area.
- 30% visits the Vaal River Barrage Area 1-4 times per year.
- 18% visits the Vaal River Barrage Area 5-10 times per year
- 14% visits the Vaal River Barrage Area more than 10 times per year
- 8% visits the Vaal River Barrage Area 1-4 times per month (ie more that 12 times per year.

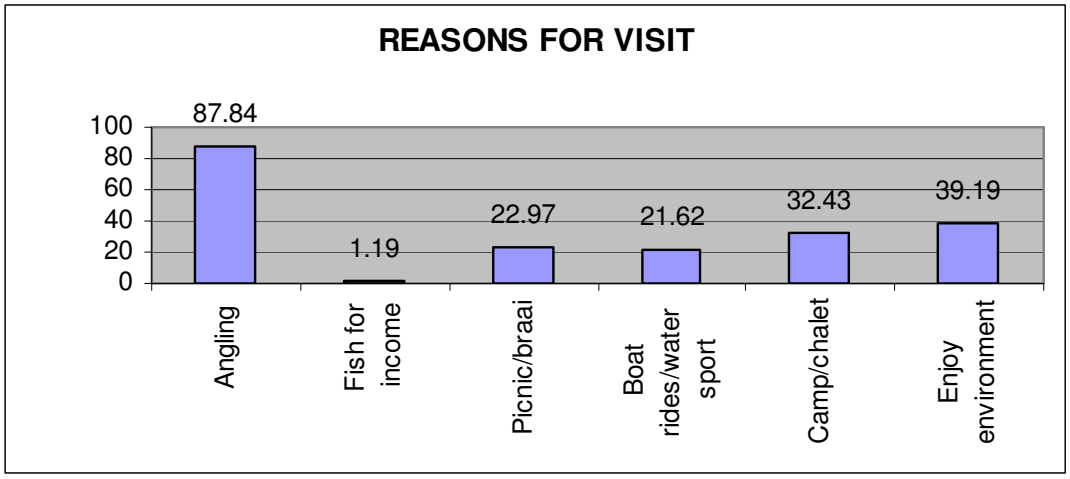
Vaal Dam

- 26% of the respondents indicated that they never visit the Vaal Dam.
- 34% visits the Vaal Dam 1-4 times per year.
- 14% visits the Vaal Dam 5-10 times per year
- 8% visits the Vaal Dam more than 10 times per year
- 8% visits the Vaal Dam 1-4 times per month (ie more that 12 times per year.



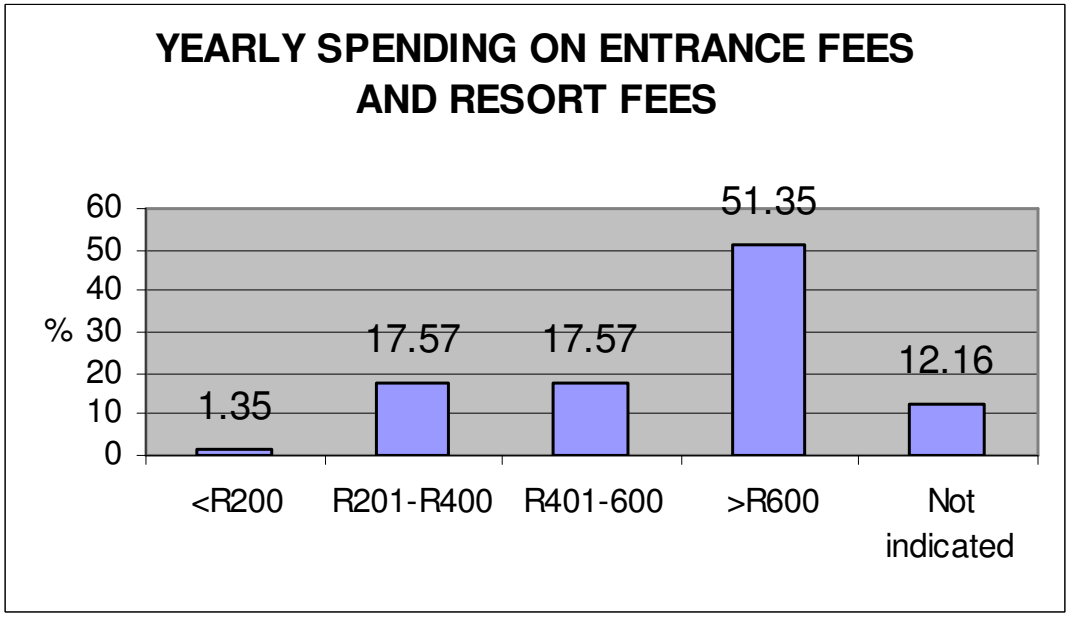
Reasons for visiting the abovementioned areas

In this question, the participants were asked what the purpose of their visits to the abovementioned areas was. More than one answer could be given. 87% indicated that it is to go angling. Of the other peripheral activities, 39% indicated that they went for the enjoyment of nature, 32% went camping, 22% to picnic or have braai and just more than 15 to fish for an income.



Entrance and Resort fees

51% of the respondents indicated that they spend more that R600 per year on entrance and resort fees along the Vaal River. 35% spent between R200 and R400 per year on these fees, with just over 1% spending less than R00 per year.



Some good news

In a meeting with a member of the Sedibeng District Municipality and Mr Fred Kolbe, an engineer appointed by DWAF, it was pointed out to us that:

- This year R50M will be spent on "patchwork to the current sewerage system in the area;
- In negotiations with the government, on provincial and national level, there has been a commitment to make available an estimated R500M, in terms of the ASGISA policy has been made available for a brand new regional sewage system. It is scheduled for completion in 2010.;
- The Sedibeng District Municipality acknowledges that the Vaal River is the "golden thread" running through the area and that this will form a central theme when the Municipality redrafts its Integrated Development Plan.

Even the NGO Save the Vaal Environment (SAVE) has suspended its legal actions against the Ekhuruleni Municipality.

One can only hope that all the plans will actually be implemented to create a clean Vaal River Barrage, a model that can be used by other Municipalities to solve the problems in their jurisdictions.

A CRITIQUE OF THE THREATENED AND PROTECTED SPECIES REGULATIONS ISSUED IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT 10 OF 2004 (NEMBA).

Morné Viljoen
Borman, Duma @ Zitha, Randburg. Email: mviljoen@bdz.co.za

Introduction

The Threatened and Protected Species Regulations ("the Regulations") were issued in terms of the NEM:BA on 23 February 2007 and will come into effect on 1 February 2008.

The Regulations list a variety of species as critically endangered, endangered, vulnerable or protected. The purpose of the Regulations is, *inter alia*, to:

- further regulate the permit system set out in the Biodiversity Act with regards to restricted activities involving specimens of listed threatened or protected species;
- provide for the registration of captive breeding operations, commercial exhibition facilities, game farms, nurseries, scientific institutions, sanctuaries and rehabilitation facilities and wildlife traders;
- provide for the regulation of the carrying out of a specific restricted activity, namely hunting;
- provide for the prohibition of specific restricted activities involving specific listed threatened or protected species; and
- provide for the protection of wild populations of listed threatened species.

These Regulations were recently in the news quite a number of times, specifically because it focuses on lion breeding and hunting and it seems that these Regulations will be the subject of litigation in the near future. I have been informed by an employee of the Department of Environmental Affairs and Tourism (who, for obvious reasons does not want his name mentioned) that the Department allowed the drafting process to be hijacked by the anti canned lion hunting lobbyists and that the focus of the drafters ultimately was never on fish. And herein lies the problem: The Regulations are so focussed on terrestrial organisms, that it is totally inappropriate with regards to angling and fish. Specific examples will be highlighted later in this paper.

Listed Species

The following fish species are listed in the Regulations:

Critically Endangered Species Indigenous species facing an extremely high risk of extinction in the wild in the immediate future	
Labeo seeberi	Clanwilliam Sandfish

Endangered Species Indigenous species facing a high risk of extinction in the wild in the near future, although they are not a critically endangered species	
Barbus andrewi	Whitefish
Barbus serra	Sawfin
Pristis microdon	Largetooth Sawfish

Vulnerable Species Indigenous species facing a high risk of extinction in the wild in the medium-term future, although they are not a critically endangered species or an endangered species	
Epinephelus andersoni	Catface Rockcod
Labeobarbus capensis	Clanwilliam Yellowfish
Labeobarbus kimberleyensis	Vaal-Orange Largemouth Yellowfish
Myxus capensis	Freshwater Mullet
Oreochromis placidus	Black Tilapia
Serranochromis meridianus	Lowveld Largemouth

Protected Species Indigenous species of high conservation value or national importance that require national protection	
Anchichoerops natalensis	Natal Wrasse
Brycinus lateralis	Striped Robber
Carcharodon carcharius	Great White Shark
Epinephelus lanceolatus	Brindle Bass
Epinephelus tukula	Potato Bass
Hydrocynus vittatus	Tigerfish
Latimeria chalumnae	Coelacanth
Lithognathus lithognathus	White Steenbras
Nothobranchius orthonotus	Spotted Killifish
Nothobranchius rachovii	Rainbow Killifish
Polysteganus undulosus	Seventy-four Seabream
Pristis zijsron	Longcomb Sawfish
Varicorhinus nelspruitensis	Incomati Chiselmouth

NEM:BA

In terms of Section 57, one may not carry out a restricted activity involving a listed specimen without a permit. "Restricted activity" is defined as, *inter alia*:

- the hunting, catching, capturing or killing any living specimen of a listed threatened or protected species by any means, method or device whatsoever, including searching, pursuing...lying in wait...luring, alluring...with intent to...catch, capture or kill any such specimen and
- having in possession or exercising physical control over any specimen of a listed threatened or protected species.

This means that yellowfish fishermen, if they want to fish for Witvis, Clanwilliam Yellowfish, or Largemouth Yellowfish, must have a NEM:BA permit to do so. One must also take into account that the listing of these species takes precedence over provincial legislation that might have dealt with these species. This means that in addition to the normal required angling licence, you must also have a permit issued in terms of the NEM:BA.

Are the Regulations really applicable to anglers?

There are those that argue that when one practices catch and release, the fish cannot be deemed to be under control of the angler and therefore should not be considered "caught" or "captured" for the purposes of the Act. I am of the opinion that this argument is not correct and while government officials may look the other way in these circumstances, the act is, strictly speaking, still applicable. Indeed it will be a criminal offence on the part of the law enforcement officer not to apply the law.

One must also not take it for granted that everybody practices catch & release. In these circumstances the catching of a listed fish can be defined as "hunting", which is defined as:

- to intentionally kill such species by any means, method or device whatsoever;
- to capture such species by any means, method or device whatsoever with the intent to kill;
- to search for, lie in wait for, pursue, shoot at, tranquillise or immobilise such species with the intent to kill; or
- to lure by any means, method or device whatsoever, such species with the intent to kill.

It is therefore clear that the Regulations are indeed applicable to angling.

Problems for anglers

Why am I of the opinion that these Regulations are inappropriate with regards to angling and fish? The reasons are numerous and there are many more questions than answers.

1. Fish, unlike their terrestrial counterparts, live in an underwater world and therefore, to a large degree, anglers do not know what they are going to catch. One may target smallmouth yellowfish on fly, but may catch a largemouth yellowfish, mudfish, moggel, carp or catfish instead. That is 5 species that you did not set out to catch! Bait, such as small frogs and crabs used to target barbel, may be picked up by a smallmouth or largemouth yellowfish. A friend of mine even caught a mudfish on a

platanna quite recently! While fishing for 'bottoms" in the sea, one may pick up a brindle bass! So, are we anglers now required to obtain a permit, to make provision for the fact than one may, by chance, catch a listed species, although it was not the targeted species?

2. Where can one apply for a permit? According to the act, either from the National or Provincial Departments of Environmental Affairs. This will make it difficult for anglers, as not every town has a relevant departmental office. The following questions arise:
   - Does this mean that some anglers will have to travel very far to obtain a permit?
   - What about instances where you want to fish in a province other than the one in which you live?
   - Will you have to make the application in person or will you be able to post, fax or e-mail the application?
   - If it is required to mail the application, one will, presumably, have to make use of a courier service or registered mail because of the fear that the original documentation may get lost when using the "normal" mail service.

3. When fishing on private property, you will need to obtain and submit the written consent of the landowner to fish for a listed species on his property, which written consent must be submitted with the application for the permit. The following problems arise:

- You will have to obtain the written consent from every landowner on who's property you are going to fish. We all know that we as anglers do not fish at one venue only. Does this mean that one will have to obtain a separate permit for each and every resort you are going to visit? If so, I know of some anglers that will have to apply for a huge number of permits – at R100 a permit!
- There are those who argue that fish, unlike terrestrial animals, do not belong to the owner of riparian property, and it is therefore not for the riparian owners to give permission with regards to something that does not belong to them.
- What about people who fish from a canoe – like me - who enters the water at one property, fishes for a few kilometres downstream (without getting out of the canoe) stretch of river per day and exit the river at somebody else's property. Who's written permission is now required? The first or the last landowner? Or both? Or all the landowners of the properties in between as well?

4. To obtain a permit will be a cumbersome and lengthy process. It is not as simple as buying an angling licence. You will have to apply for a permit **in writing.** It may take up to 39 **working** days (up to 53 normal days – nearly 2 months) to obtain a permit! The Regulations state that an issuing authority:
   - "...must consider and decide on the application within 20 working days;
   - may request within 14 working days of receipt of the application...additional information...for the proper consideration of the application;
   - ...must consider and decide on the application within 20 working days from the date of receipt of such additional information; and
   - after having taken a decision on a permit application, the issuing authority must, within 5 working days, notify the applicant in writing of the decision and issue the permit.

One may renew a permit, but you will have to do so in writing and such an application must set out the reasons for renewal.

5. A further indication that the Regulations are totally inappropriate with regards to angling is the following: Should one decide not to practice catch and release (which is, technically, "hunting"), the Regulations state that a listed species may not be hunted by luring it by means of bait (except in the case of listed marine and other aquatic species), sounds; smell; or any other induced luring method. This means that you may "catch and kill" when using bait, but when using a flavour or dip on your mieliebomb or fish with artificial flies or lures you may only practice catch & release (which is not regarded as hunting). Thus a tigerfish caught on bait may be kept for the pan, but not one caught with a Rapala – what is the sense in that? This clearly does not serve the NEM:BA and Regulations, namely to protect the listed species.

6. The level of service received from government departments and officials might be problematic. Will the department to which an application was submitted, issue the permit within the legal time frames or will you get an answer that "they did not receive the application, please send it again"? Readers should make up their own minds about this. Will the various departments have sufficient and trained staff to handle a possible huge influx of permit applications?

7. Despite all the abovementioned problematic areas, the Regulations then go further and state that it is an offence if one undertakes a restricted activity involving a listed species without a permit, upon conviction of which one is liable to a fine of **R100 000** or three times the commercial value of the specimen in respect of which the offence was committed, whichever is the greater or to imprisonment for a period not exceeding **five years** or to both a fine and imprisonment.

Possible solutions

At the time of writing (early April 2007), neither the National Department of Environmental Affairs and Tourism, nor the Provincial Authorities I spoke to had any idea of how they are going to implement these Regulations. I have two suggestions:

Integrated permits

The NEM:BA makes provision for an integrated permit. This means that when the fishing for a listed species is also regulated in terms of other law (e.g. an angling licence issued in terms of a provincial ordinance), a single integrated permit instead of a separate permits and authorisations may be issued. The Regulations state that a permit issued in terms of provincial legislation by a provincial department is regarded as a permit issued in terms of the NEM:BA and it's regulations. So everything is now hunky dory and I have made a mountain out of a molehill? Not quite.

1. In provinces where licences are issued by the provincial departments dealing with environmental issues, the obtaining of an integrated permit should not be too problematic. However, some provinces (e.g. KwaZulu-Natal and Limpopo) do not have angling licences any more. How will they implement the legislation?

2. An angling license sold by tackle shops will not be regarded as an integrated permit because firstly, the shops are not a provincial departments (and the NEM:BA and regulations does not provide for the "outsourcing" of the issuing of permits), and secondly, they will not have the capacity in terms of skills, manpower or knowledge to consider a permit application. A few of the myriad of factors to be taken into account include:
    - all applicable legal requirements must be met;
    - whether the species is listed as critically endangered, endangered, vulnerable or protected;
    - the IUCN Red List status of the species;
    - whether the application involves a listed threatened or protected species that will be taken or removed from a wild population;
    - all the information and documentation submitted by the applicant;
    - any additional information required by the issuing authority;
    - whether the restricted activity is likely to have a negative impact on the survival of the species;
    - the biodiversity management plan for the species concerned (if any);
    - any recommendation by the Scientific Authority regarding the application;
    - any risk assessment or expert evidence requested by the issuing authority;
    - any relevant information on the database that SANBI is required to keep in terms of section 11(1)(j) of the Biodiversity Act; and
    - any objections to the application.

No tackle shop will be able to process such an application.

The Regulations also state that a permit issued in terms of the Marine Living Resources Act by an organ of state (this is with regards to sea fishes and bait) is regarded as a permit issued in terms of the Biodiversity Act and these Regulations. The question now is that some marine angling licenses can be bought from Post Offices. The Post Office will surely not have the capacity to evaluate applications. How will one have to go about it in these circumstances?

It seems that there are just to many questions and uncertainties with regards to this approach. Therefore, I have the following suggestion:

Specific, separate Regulations pertaining to fish

The Regulations were clearly drafted to apply to terrestrial organisms. The Department of Environmental Affairs and Tourism should:

- Amend the current Regulations so as deal with fish and angling separately; or
- Separate Regulations should be drafted to apply to fish only. Only then will one have practical enforceable legislation and will the purpose of the NEM:BA be served and
- Publish a notice in the Government Gazette, suspending the application of these regulations indefinitely until this issue is resolved.

What should be contained in the "fish regulations"?

I do not claim to have all the answers and think that representatives of the freshwater and sea angling facets, together with representatives of the nine provincial departments dealing with environmental issues, the Department of Environmental Affairs and

Tourism and scientists should be part of the drafting process. I do have the following suggestions, however:

- The regulations should, with regards to each species set out a specific bag and size limit;
- Bag and size limits and all other conditions per species should be fixed and the permit should be able to be bought without an elaborate application process. This means that government should do its homework properly before promulgating the regulations;
- Catch and release must be promoted;
- Written consent of landowners should be done away with;
- Angling and NEM:BA permits must be integrated. Thus, only one licence should be issued, which caters for all the listed species;
- It should be made easy for anglers to obtain permits. It should be, for example, sold at every single SAPS office in the country and one should also be able to buy it on the internet; and
- A single freshwater angling license should be contemplated.

Let us hope that the Government will realise the errors of their ways and that we as anglers will not be subjected to these absurd, unimplementable regulations.

YELLOWFISH RESEARCH ENDEAVOUR OF ECON@UJ DURING 2006/7

Gordon O'Brien
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This brief report presents an overview of Econ@uj, the recently established Yellowfish Research Group, an introduction to new Yellowfish related research studies being undertaken by the Econ@uj/Yellowfish Research Group and a brief overview of the approach adopted by Econ@uj to work with affiliates (non-Econ@uj specialists and or research clients).

Econ@uj an overview

Econ@uj is a multi-disciplinary consortium of environmental specialists based at the University of Johannesburg (UJ). The consortium, formerly known as RAUEcon, has been offering environmental consultancy in the Aquatic Health, Aquatic Toxicology and Ecotoxicology fields since 1998. Econ@uj offers technical and specialist services, to both the government and private sectors, in a number of fields related to Integrated Water Resource Management in southern Africa. Our core activities relate to freshwater and more recently estuarine environments. These studies incorporate the assessments of aquatic fauna, aquatic and riparian vegetation, physico-chemical assessment of water and sediment, laboratory-based toxicology and ecotoxicology. Econ@uj has a proven track record with numerous completed projects and successful collaborations with government institutions such as the Department of Water Affairs and Forestry, the Water Research Commission, the South African Institute of Aquatic Biodiversity, and private partners representing the mining, agricultural and industrial sectors. Econ@uj is committed to capacity building and as such postgraduate students from UJ are offered the opportunity to carry out practical aspects of projects, gaining experience in the fields of Aquatic Health and Ecotoxicology. Please visit www.uj.ac.za/zoology or contact us at econ@uj.ac.za or phone 011 489 2445/3820.

The Yellowfish Research Group

A group of researchers within Econ@uj have initiated research endeavours relating to the value, biology, conservation and population management of Yellowfish species in South Africa. Following the initiation of these research projects, initial background assessments of the amount of information which is available relating to the biology, conservation and subsequent population management of Yellowfish in South Africa, has led researchers to believe that a great need exists to further characterise the value of and biology of these fishes in South Africa. As a result, a research initiative has been initiated to address this requirement. The Yellowfish Research Group (YRG) has been established by researchers at Econ@uj although the aims and objectives of this initiative are far reaching and not restricted to researchers of Econ@uj.

As such the Yellowfish Research Group is a non-profit research endeavour which aims to:

- Undertake focused research related endeavours which address concepts relating to Yellowfish biology, conservation, population management and utilisation in South Africa.

- These endeavours have been established to facilitate the communication between specialist researchers and any potential user of this information for education, conservation and or management purposes. In addition these initiatives are being established to support and develop sustainable relationships between the use and the conservation of the primarily aquatic resources that contain Yellowfishes.
- Facilitate research thrusts of specialists at the University of Johannesburg and other research institutions/specialists who wish to affiliate themselves with these approaches.
- These endeavours may be established to supply funding for research-based projects that are not within the current national and private funding domains of existing research support at the University of Johannesburg.

The YRG has just been established (2007) and major developments of this initiative are expected in the forthcoming few years. For more information relating to this endeavour visit our new website (work in progress) at: www.yellowfishresearch.co.za. If anyone has some specific research related questions related to Yellowfish conservation, use or biology please contact us. In addition if anyone can facilitate this research initiative in the form of resource sponsoring (equipment or financial resources etc.) please contact us.

Yellowfish related research being undertaken at Econ@uj/YRG

Specialists from Econ@uj have been undertaking Yellowfish related research since 2003. Yellowfish related research endeavours initiated in Mpumalanga where studies on an isolated population of the Bushveld smallscale yellowfish were carried out. These initial studies involved efforts to characterize the feeding biology, population state, morphology, genetic uniqueness and occurrence of parasitic infections of this isolated population. This research culminated in the development of the concept of the Elands River Yellowfish Conservation Area (ERYCA – refer to www.yellowfishresearch.co.za).

More recently, this endeavour has established three main research projects that have all been funded by the Water Research Commission. These studies include:

1. TITLE: The socio-economic value of a freshwater aquatic ecosystem conservation initiative in the Orange-Vaal River using Yellowfish (*Labeobarbus sp.*) as their flagship species.
    a. Project team: Econ@uj, The Sociology Department of the University of Johannesburg, Orange-Vaal River Yellowfish Conservation and Management Association, Yellowfish Working Group, Eastern Cape Nature Conservation, Future Works (Pty, Ltd.)
    b. Additional project support offered by: The Fly Shop, Catfish Joe's Productions, Jeffares and Green (Pty, Ltd.).
    c. Principle researcher: Melissa Brand.

2. TITLE: Aspects of the genetics, morphology and parasite host specificity of the Bushveld smallscale yellowfish, *Labeobarbus polylepis*.
    a. Project team: Econ@uj, The Zoology Department of the University of Johannesburg, Mpumalanga Parks Board, the Elands River Yellowfish Conservation Area, Yellowfish Working Group.
    b. Additional project support offered by: Horst Filter, George McAllister, Dave Hempson, Ebba Fry, Garth Johnson and Paulette Bloomer.

c. Principle researcher: Amanda Austin

3. TITLE: An assessment of selected biology aspects of the two Yellowfish species *Labeobarbus kimberleyensis* and *L. aeneus* from the Orange-Vaal River system, South Africa.
    a. Project team: Econ@uj, Orange-Vaal River Yellowfish Conservation and Management Association, Yellowfish Working Group, Eastern Cape Nature Conservation, Department of Ichthyology, Rhodes University.
    b. Additional project support offered by: Fly Castaway, Catfish Joe's Productions, The Fly shop, Horst Filter and Kobus Fourie.
    c. Principle researcher: Linda Nel.

Overview of the approach adopted by Econ@uj to work with affiliates

We offer complete confidentiality agreements with clients who have commissioned Econ@uj to undertake any contractual impact assessment or research assessments. As the service provider in these assessments we automatically adopt the approach that the information generated is the sole property of the client (or the University if agreed upon by the client). If additional confidentiality agreements are required by the client to safeguard the client this can arranged. Should any Econ@uj researcher intend to use any contracted finding related research for any other purposes (such as publications purposes) this will be formerly requested by Econ@uj and written permission will be sought from the client, who will be acknowledged for providing resources to generate the information.

In terms of Econ@uj associated research endeavours, we at Econ@uj are able to make all of the research generated by these associated research endeavours freely accessible with the following provisions:

- Only (if required) release information after the study generating the information is complete and the necessary permission has been obtained by the client.
- We may choose to release the information using our own methods (website, publications, presentations etc.).

At all time during and after completion of the studies, if any information is used by a third party (other than Econ@uj or the client) we require that Econ@uj (and possibly including the client) are acknowledged and or referenced where necessary (we can advise you in this regard).

Prior to any third party releasing information generated through any of our endeavours we require that we be allowed to review all articles etc. before they are released so that no misinterpretations etc. of the information occurs and as a result is released.

We (Econ@uj) hold copy right (unless stipulated otherwise by the client) to all research information and retain the right to decide whether to withhold or release any information without notification.

Conclusions:

It has been an incredible privilege to be involved in a community of interested, caring, passionate individuals: from unbelievably talented researchers to dedicated anglers who have given more time and effort into supporting our activities than we had ever

imagined. Our efforts have on more than one occasion been pulled back from the brink of disaster by caring and interested stakeholders who share our vision of wanting to conserve and understand our most prominent freshwater game fish, our Living Gold. As long as there is a need amongst the enthusiastic scientific, angling and conservation communities we will attempt to raise the resources required to find these answers. And in closing please take note of a recent, new addition to Vaal River, namely Fred our cute and cuddly crocodile – for more info please contact Kobus Fourie at Elgro Lodge.

ASPECTS OF THE GENETICS, MORPHOLOGY AND PARASITE HOST SPECIFICITY OF THE BUSHVELD SMALLSCALE YELLOWFISH, *LABEOBARBUS POLYLEPIS* (BOULENGER, 1907)

Amanda Austin
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Abstract
The aim of this study is to assess the differences in terms of the morphology, genetics and parasite host specificity of the Bushveld smallscale yellowfish. It is an Econ@uj commissioned study with financial backing from the WRC. This is a preliminary case study looking at five selected populations by carrying out allozyme population genetic assessments, multivariate statistical external morphological assessment and parasite host specificity assessment of the populations. The project started in 2006 and will be completed in 2007. The results can be used to facilitate the management of the *Labeobarbus polylepis* populations and for the conservation of the species. It can also solve taxonomic problems and identify the different populations. Thirty individuals from each population were sampled in the Elands, Komati, Assegaai and Phongolo Rivers and the Ngodwana Dam. Fifty-eight measurements were taken on each fish. The morphology assessment shows differences between the populations. The genetic assessment shows small genetic difference between the populations in the Phongolo River and Elands River. The parasite assessment was done by looking at external mucous, gills and stomachs. The results show heavy infection of *Lamproglena hoi* and slight infections of *Lernea* and *Diplozoon* species. In this M.Sc study support was received from Prof. F.H. van der Bank, Prof A. Oldewage, Gordon O'Brien, Horst Filter and Andrew McGinn.

UPDATE ON PROJECT: THE SOCIO-ECONOMIC VALUE OF A FRESHWATER AQUATIC ECOSYSTEM CONSERVATION INITIATIVE IN THE ORANGE-VAAL RIVER USING YELLOWFISH (*LABEOBARBUS SPP.*) AS THEIR FLAGSHIP SPECIES.

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Background and motivation

- The value of the yellowfish has been considered from an ecological perspective and now we will look at it from a social and economic perspective because we need to consider the protection of the yellowfish versus its utilization.
- In the past, fish were conserved but the increase in utilization at the present must be considered to make it a sustainable resource for the future.
- Yellowfish are used as a *flagship* species in conservation initiatives because of its marketing potential.
- We assume that if the social and economic value of the aquatic resource is established then it will be conserved.
- Use existing endeavour as a case study: Orange-Vaal River Yellowfish Conservation and Management Association (OVRYCMA).
- Promote the establishment of guidelines for establishing new yellowfish based conservation initiatives in South Africa.

Aims and objectives of the study

Aim: Establish the socio-economic benefits and implications associated with the establishment and operation of aquatic conservation initiatives using yellowfish in South Africa.

Objectives:

- Determine the criteria that make yellowfish a good flagship species.
- Assess the economic value of the use of this resource by various user activities.
- Determine if yellowfish conservation actions benefit other river users.
- Determine the economic value of the angling industry related to the use of the Vaal River (OVRYCMA).
- To identify future actions for research, development and management in the yellowfish industry.

Materials and methods

- Socio-economic assessment method
    - Questionnaire based assessment
        - Equipment retail outlets
        - Accommodation sector
        - Guides
        - Fishermen
    - Interview based assessment
        - Specialized equipment manufacturers
        - Municipalities

•

Time and work plan

- **Oct 06** Commission of project
- Outcomes of the OVRYCMA stakeholder steering meeting
- **Nov 06** Completion of literature survey
- **Dec 06** Outcome of the ERYCA (Elands River Yellowfish Conservation Association) stakeholders meeting
- **Jan 07** Preparing and planning for the new year
- **Feb 07** Initiation workshop
- Outcome of OVRYCMA stakeholders steering meeting
- **March 07** Compilation of questionnaires
- Registration of Sociology MSc student
- **April 07** Completion and review of questionnaires by stakeholders
- Yellowfish Working Group/ Survey
- **May 07** Surveying project area
- **June 07** Iteration of data
- Collaborators workshop
- **July 07** Writing of report
- Delivery of final report to WRC

Way forward

- Brochures
- YWG SURVEY – Members to complete relevant questionnaires
  - Equipment retail outlets
  - Accommodation sector
  - Guides
  - Fishermen
- Website – www.yellowfishresearch.co.za
  www.uj.ac.za/zoology (follow econ@uj prompt)
- WRC report available at completion of study
- Continuation of project into the future

WRC PROJECT K8/678: AN ASSESSMENT OF SELECTED BIOLOGY ASPECTS OF THE TWO YELLOWFISH SPECIES *LABEOBARBUS KIMBERLEYENSIS* AND *L. AENEUS* FROM THE ORANGE-VAAL RIVER SYSTEM, SOUTH AFRICA.

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INTRODUCTION

Yellowfish (*Labeobarbus spp.*) are amongst the most widely distributed and most easily related to of our indigenous fishes in South Africa. They are also actively targeted and utilised by various angling and subsistence fishing communities throughout the country, and used as indicator species by resource managers. As a result Yellowfish have a high ecological, economical and social value for South Africans. Although valuable, very little is known about these charismatic species, and unfortunately, before we have the chance to fully understand some of the biological attributes of these species we are losing them. Along with most of our aquatic biodiversity, Yellowfish are being adversely affected by the excessive, unsustainable, anthropogenic use of our aquatic ecosystems in this water stressed country. Specifically, from a Yellowfish population management perspective, for example, some populations of Yellowfish in South Africa have recently been devastated due to poor aquatic ecosystem management practices. On at least one occasion in South Africa a known isolated population of the Bushveld Smallscale Yellowfish (Letaba River system) has been driven into extinction. In other instances, from habitat destruction in the Olifants-Doring system affecting the Clainwilliam Yellowfish population, to effluent spills across the Highveld into the Crocodile and Vaal rivers or into the Elands River in Mpumalanga which affects the Orange-Vaal Large and Smallmouth Yellowfishes, the Bushveld Smallscale Yellowfish and the Lowveld Largescale Yellowfish, almost all Yellowfish species are being negatively impacted on in some form. These pressures have driven at least two of the six species of Yellowfish occurring in South Africa onto the IUCN Red Data List.

The Vaal River is one of South Africa's most highly utilised, "working rivers" and contains one of the two major distributions (excluding the Orange River) of the Orange-Vaal Large and Smallmouth Yellowfishes. The Vaal River is one of the South Africa's largest and most important river systems in South Africa. This system has been modified to provide most of Gauteng with water which originates from many sources including the Lesotho Highlands Water Interbasin Transfer Schemes (one of the largest and most costly water transfer schemes ever undertaken), and assimilates waste from this highly developed urban area which stands as South Africa's most important economic region. Both of these species are good indicator species which are used to provide the Orange-Vaal River ecosystem managers with vital information relating to the state of and trends of biological community stability in the systems. They are sensitive to water pollution, habitat destruction and harvesting pressure and populations readily respond when these impacts occur in excess on these systems. But again, only a very limited amount of information is available which pertains specifically to the biological attributes of these species, and this limits the potential use, and as a result, value of these species in ecosystem management.

The study has been established to generate a better understanding of the biology and behaviour of these two species of Yellowfish in the Vaal River, in order to develop the ecological, social and economic value of these species. Furthermore this study will attempt to characterise some vital biological aspects of these species to facilitate the direct management and conservation of these important species. Specifically, this study aims to describe the habitat selection/preferences and daily habitual behaviour of 24 Yellowfish (12 Orange-Vaal Largemouth and 12 Orange-Vaal Smallmouth Yellowfish) over an 18-month period on a reach of the Vaal River using radio telemetry tracking techniques. Some additional river ecosystem health assessments will be undertaken during the study which are all aimed to facilitate this research. These assessments include: the assessment of the ecological state of the reach of the Vaal River being studied, a characterisation of selected environmental variables (habitats, water quality variable changes for example) of the reach being assessed and an assessment of the seasonal changes of the invertebrate communities in this reach.

This study is being undertaken primarily by specialists from Econ@uj (Zoology Department of the University of Johannesburg) and by skilled and unskilled specialists from the Orange-Vaal River Yellowfish Conservation and Management Association. Finally this study is being supported by specialists from the department of Ichthyology and Fisheries Science, Rhodes University and by specialists from the Fresh Water Research Unit of the University of Cape Town.

STUDY SITE

The study is being carried out on a section of the Middle Vaal River downstream of the Orkney weir and upstream of the Bloemhof dam. The 10 km or so reach selected for this study is a reach owned by members of the Orange-Vaal Yellowfish Conservation and Management Association. This reach is controlled by the owners and for the duration of this study will generally be closed to other water use related activities to allow the tagged fish to adopt as close to natural behavioural patterns as possible. In addition, this reach is widely considered to contain some of the best Orange-Vaal Largemouth Yellowfish habitat in the Middle Vaal River and has numerous access points onto the river and has a footpath which runs parallel to the river for most of the reach assessed.

METHODS AND MATERIAL

The methodology implemented in this study is based on related methodologies which have been used to successfully track and study Tigerfish (*Hydrocynus vittatus*) and selected Cichlid species in the Inkomati River and the Zambezi system respectively.

Some specific specifications of the study which are being adhered to include the following:

- The life span of an individual tag is approximately 175 days. This results in researchers having to continually tag and release new individuals approximately every five months.
- Only a limited number of fish can affectively be studied at any given time. This additional limitation requires that researchers only have approximately between six to eight fish in water at any given time.
- Based on the nature of the study only mature fish are being tagged and studied. As such no Orange-Vaal Smallmouth smaller than 30 cm are being tagged and no Orange-Vaal Largemouth smaller than 40 cm are being tagged. In addition

should a fish lighter than 1.5 kg be caught it will not be used as individuals lighter than 1.5 kg are considered to be too small to bear the weight of the tag (+/-10 g).

- During the study an assessment of the state of the system is being undertaken on a seasonal basis. Accredited River Health Programme methodologies are being carried out to determine and monitor the ecological state of this reach of the system.
- During the study a complementary assessment of the changes in the environmental variables is being carried out on a continual basis. These variables which include water physico-chemical variables, flow and physical biotope changes, day/night cycles, moon cycles and atmospheric conditions, which are all being monitored as frequently as possible.
- Finally a low confidence seasonal succession assessment of aquatic macro-invertebrate communities is being undertaken in relation to a feeding biology assessment of these Yellowfishes. This assessment has been included to generate some information which relates to the feeding biology of the species.

Tagging procedure:

- Yellowfish will be caught using standard fly-fishing angling techniques. An angling technique is preferential to netting the fish as the netting process potentially damages the fish and results in secondary infections. There is as a result a high risk that the fish will not survive and the expensive tags will be lost.
- Before tagging, the fish will be anesthetized using 2-phenoxyethanol (0.2 ml per litre water). This is a standard fish anesthetic used at several fish hatcheries in South Africa. The water in the transport container will be aerated using oxygen.
- The telemetry tag will be surgically attached to the fish following standard attachment techniques.
- The fish will receive an antibiotic injection to treat any secondary infections (prophylactic). RANZOL RANBAXY (SA) (Pty) Ltd. 500mg will be administered.
- The tracking device is then tested; the fish is revived sufficiently and then subsequently released.

Data and tracking technology/equipment used in this study:

- A Global Positioning System (GPS) is being used to reference fish localities during the capturing and subsequent tracking surveys.
- An Advanced Telemetry Systems (ATS) receiver Model R210, Frequency: 142-143.999 MHz us being used to track the tagged fish. With this receiver an Element Yagi Antenna and specifically ATS F2030 Tags with a pulse rate of 35ppm, pulse width: 15ms is being used.

The tracking methods involved the routine determination of the location of the tagged fish from a small inflatable boat to an accuracy of about 10 metres is being carried out. The location of the fish and general habitat variables of the position are being recorded during the tracking period.

Initial findings:

Seven Orange-Vaal Smallmouth Yellowfish and three Orange-Vaal Largemouth Yellowfish have been tagged and tracked to date. The fish were not all tagged at the same time and as such the amount of data collected for each individual varies. The following section describes the results obtained from the tracking survey carried out on one Smallmouth Yellowfish and one Largemouth Yellowfish.

Figure 1 illustrates the capture point (#1) and movement information of the Orange-Vaal Smallmouth Yellowfish, tag no. 322 (Emmeline Pankhurst). The movement is general and the specifics of each habitat will be given at a later stage when more information is collected.

Collection information includes:

- Date captured: 09/08/2006
- Time caught: 16:30
- Captured by: Andre Hoffman
- Captured on: Atomic worm #16
- Fish information: Sex: Female
  Total length: 66 cm
  Girth: 35 cm
- Habitat information: Local habitat represented by a pool with smooth turbulent water of about 1 m deep. Individual captured in the pool close to the edge of the pool in shallow water of about 0.5 m deep.

The fish was not located in the first two weeks because the tracking equipment used requires direct line of site. Tracking was initially done from the riverbank on foot. An area of 10 km was searched and after two weeks a boat was used to search behind the island etc, and during one of these surveys fish no 322 was found behind an island.

After this, tracking was done from the boat as much as possible and fish no. 322 was generally observed in a deep pool with dense overhanging marginal vegetation on the sides of the island. The fish was frequently observed moving up and down the side of the island underneath the overhanging vegetation. The fish was mostly observed in this area and found to spend most of its time under overhanging marginal vegetation on the riverbank or in close proximity to the bank of an island. It did not move out of the area of approximately 100 metres during the six-month tracking period. The time of day spent tracking the fish varied from day to day in order to generate an understanding of the daily habitual patterns of the individual.

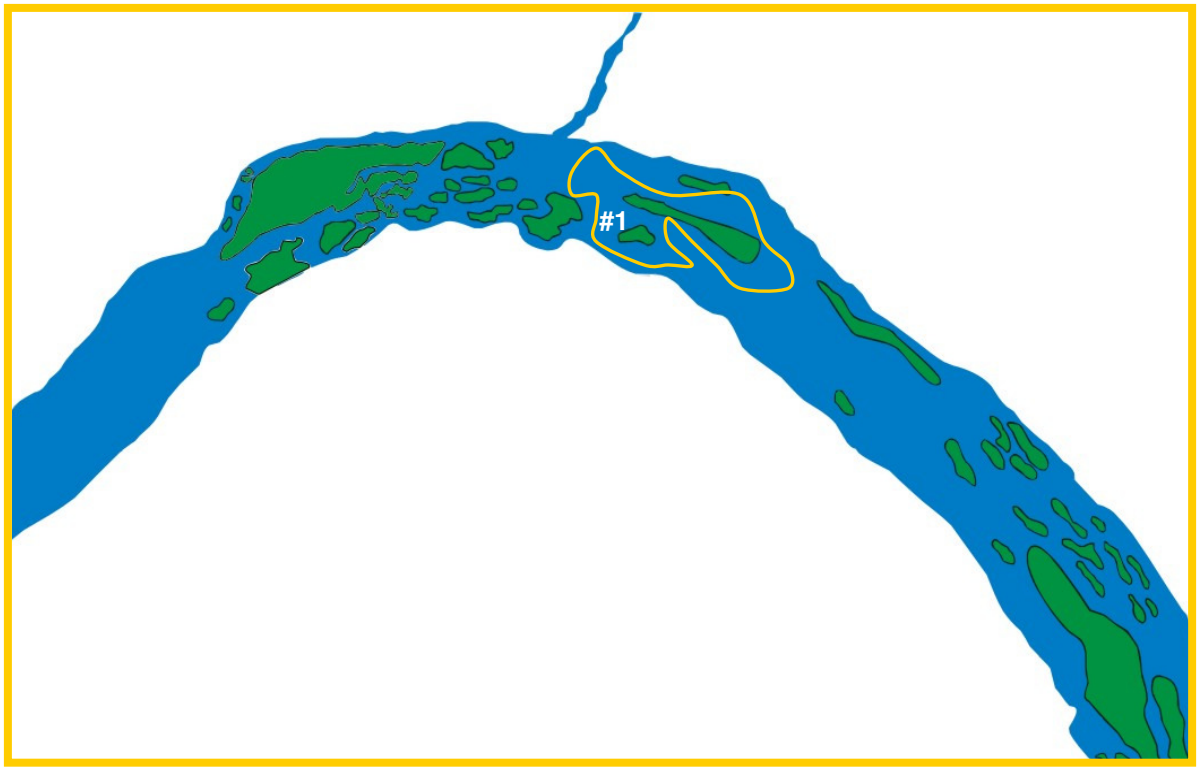

Figure 1. Vaal River on the farm Koedoesdraai with the Maaitjiesspruit entering it from the top. The figure indicates movement of a Smallmouth Yellowfish tag no. 322.

Figure 2 illustrates the capture point (#1) and movement information of the Orange-Vaal Largemouth Yellowfish, tag no. 036 (Ou Hardy). This is just a general movement and more details will be given at a later stage when more information has been collected.

Collection information includes:

- Date captured: 09/11/2006
- Time caught: 15:30
- Captured by: Johan Hardy
- Captured on: Electro Shocking
- Fish information: Sex: Female
  Total length: 72 cm
  Fork length: 67
  Girth: 38 cm
- Habitat information: Local habitat represented by a pool with smooth turbulent water of about 2m deep.

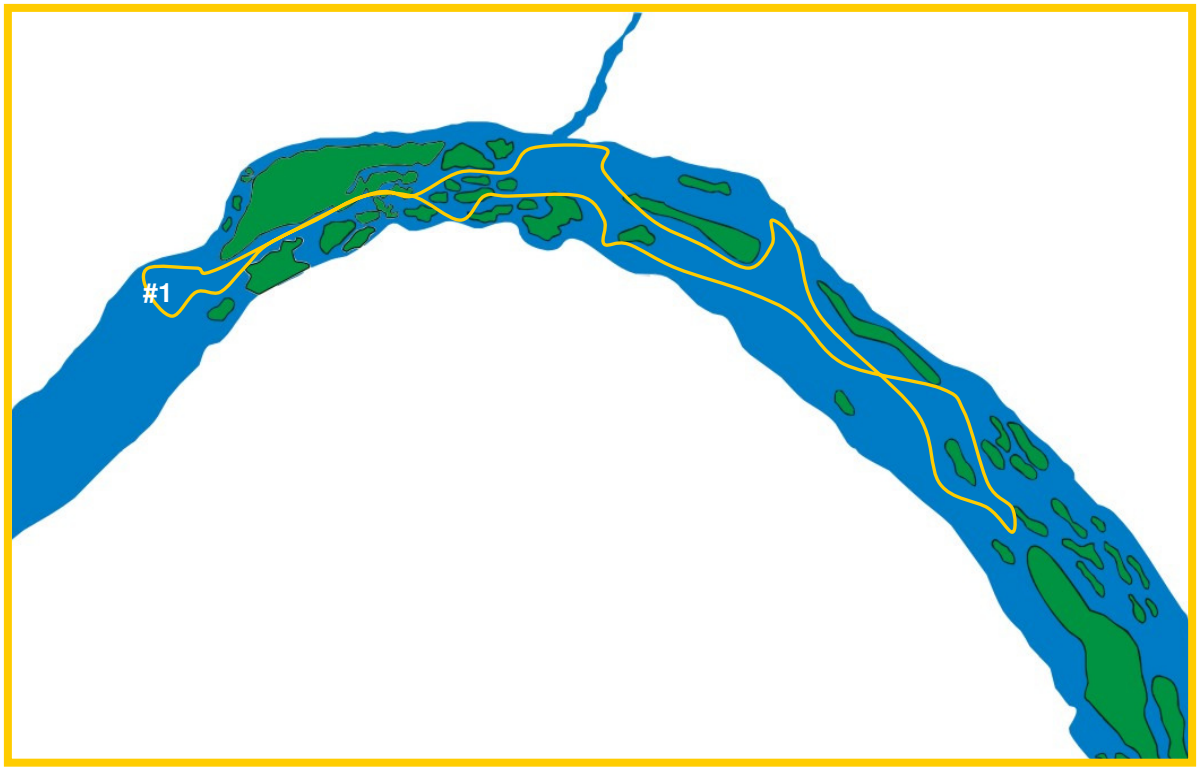

Figure 2. Vaal River on the farm Koedoesdraai with the Maaitjiesspruit entering it from the top. This figure indicates the movement of a Largemouth Yellowfish tag no. 036.

The Orange-Vaal Largemouth Yellowfish was tracked immediately after it was tagged and returned to the same location in which it was caught. This is a pool area about 1.5 m deep with a fast rapid entering it from upstream and shallow areas surrounding the pool. It remained in this area for a few days after which it started migrating out of this area. The behaviour of this individual was observed to be unlike that of the Orange-Vaal Smallmouth which would remain relatively stationery during the day, this individual would move continuously during the period. Tracking with the boat became a problem since it was never known where to launch the boat to track all the tagged fish. After battling to find some of the Orange-Vaal Largemouths for up to two weeks after they were tagged a pattern started forming and tracking was improved. All of the Orange-Vaal Largemouth Yellowfish moved noticeably more than the Orange-Vaal Smallmouth and would be in a certain area upstream in the morning and when returning to the same spot the afternoon they would have moved. The Orange-Vaal Largemouth was also found in very shallow water of about 0.5 metres deep on regular occasions. The Orange-Vaal Largemouth was then found quite a distance downstream and vice versa.

CONCLUSION AND THE WAY FORWARD

This information reveals that Orange-Vaal Smallmouth Yellowfish have very limited ranges (approximately 100 m) and show very specific daily habitual patterns. This leads us to conclude that these fishes are territorial and do respond to changing environmental conditions on a daily basis. This finding additionally indicates that Orange-Vaal Largemouth Yellowfish have a bigger range than that of Smallmouth Yellowfish but they do not seem to move out of an area of approximately 3 km.

Tagging of new fish will take place in the next few months and a more focussed effort will be given to find spawning fish from September 2007 to February 2008. We would like to start including feeding biology and age related study to get a better understanding of the Yellowfish. For more information on this project or how to get involved please visit our website at www.yellowfishresearch.co.za

The resources which are available for this study will allow us to continue until early 2008. We would like to continue for at least another 18 months. If anyone can financially contribute to this research initiative to extend the study we will be able to generate a much clearer understanding of these two species. Please contact us.

ACKNOWLEDGEMENTS

I would like to acknowledge and thank the Water Research Commission for the initial funding of this project and the University of Johannesburg for the opportunity to work on these interesting fishes. I would like to thank the Yellowfish Working Group and Orange Vaal River Yellowfish Management Association for their support in all areas of this study. I would like to thank the Hoffmann family at Wag-'n-Bietjie Ekoplaas for their support and housing and feeding me. I would like to thank Joe Lategan for his support in all the multimedia aspects for this project as well as giving me a computer, camera and fish finder to use during this project. I would like to thank Johan Hardy from Free State Nature Conservation for his continued support. I would like to thank Susan Groenewald and Eddie Scott from the Directorate Spatial Planning, Department Local Government and Housing for assisting in aerial tracking of the fish as well as Paul Luwff and Nora of the Battleurs. I would also like to thank Sophia Hubt of Africa for this project. In addition I would like to thank in appreciation Pierre de Villiers and Gordon O' Brien for all the assistance with this project and the continue support and motivation.

ORANGE-VAAL YELLOWFISH: MUCH MORE TO LIVING GOLD THAN MEETS THE EYE

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On behalf of: Roger Bills & Nick Jones (SAIAB), Martin Villet (RU) and Herman van der Bank & Gina Walsh (UJ)

The talk summarised the aims and main findings of the follow-up study on identification of conservation units in the two yellowfish species from the Orange-Vaal system. AngloGold Ashanti Limited, the YWG and the NRF were acknowledged for their funding contributions and the YWG and SAIAB for logistical support with sample collection.

Aims of the follow-up study

The aims of the follow-up study conducted in 2004-2007 were to use a multidisciplinary approach to assess differentiation and potential hybridisation between largemouth and smallmouth yellowfish and to make recommendations for management and future research. The scope of the study was to investigate these questions using two widely separated populations of the two species in the Orange River system. The sites chosen were the upper Orange River at Aliwal North (Eastern Cape) and the lower Orange River at Onseepkans and Pella Drift (Northern Cape). We compared morphological and genetic (allozyme and mitochondrial DNA) diversity between the species and the populations from these sites. The choice of populations to study was critical as one needs reference populations of the "pure" species in order to determine whether hybridisation is occurring. This was problematic in the case of *L. kimberleyensis* as there are no instances, to our knowledge, of areas where one would only find this species and not also *L. aeneus*. There are, however, areas where only *L. aeneus* can be collected, such as the Sak River that is also the type locality from which this species was first described.

Species distribution and sampling sites

The smallmouth yellowfish is typically the more abundant and widespread Orange River yellowfish. It occurs in the mainstream sections of the Orange and Vaal Rivers and also penetrates high up into smaller tributary sub-systems. In contrast the largemouth yellowfish appears to be confined to the mainstream sections on the Vaal and Orange Rivers. It also appears more common in the Vaal system than the Orange River.

Two collection regions were chosen on the basis of gaps in previous collections, observed genetic variation in earlier studies and perceived present upper limits of *L. kimberleyensis* in the upper Orange River. The regions chosen were the Orange River around Aliwal North (30º 40' 45" S 26º 43' 11" E) and the lower Orange River (below Augrabies Falls) between Onseepkans (28º 44' 31" S 19º 20' 07" E) and Pella Drift (28º 57' 39" S 19º 09' 50" E, 28º 57' 47" S 19º 08' 36" E). The features used to identify the two species in the field were a ratio of snout length and eye to pre-opercular groove distance, mouth size, mouth position and body colour. Sampling in the upper and lower Orange was conducted by Roger Bills and Nick Jones in January 2004. Dr Ernst Swartz and Mr Vusi Mthombeni (SAIAB) collected *L. aeneus* from the Sak River (31.7164 S 21.8483 E - 31.2544 S 22.1286 E) in July 2005, to serve as a reference population.

Morphological variation in Orange River Yellowfishes

(Roger Bills, Martin Villet and Nick Jones)

Initially, a pilot study measured 53 features of 10 specimens for each species and these data were analysed using Principal Component Analysis (PCA). From this initial analysis a smaller number of features (31) contributing significantly to factors were then selected for the larger study of morphological variation among 244 specimens collected from Aliwal North and the lower Orange. During the field collections all fish collected were clearly identifiable as one or the other species and no intermediate/hybrid individuals were observed. Laboratory analysis of yellowfish morphology confirmed that individual specimens were consistently assigned to correct species groups. *Labeobarbus kimberleyensis* specimens from both sites were not significantly different from each other in their overall morphology showing overlap in the PCA plots. In contrast, *L. aeneus* from the two sites was noticeably different in their morphology and colouration. The most obvious differences were that the lower Orange *L. aeneus* had significantly deeper bodies and longer fins. There were consistent morphological differences between the two species from Aliwal North and the lower Orange. Thus *L. kimberleyensis* and *L. aeneus* are morphologically distinct and identifiable using several features e.g. mouth position, mouth size, eye to preopercular groove distance, colouration and interorbital width.

Allozyme study

(Herman van der Bank & Gina Walsh)

Allozyme analyses were done of *L. aeneus* (127) and *L. kimberleyensis* (79) samples from Aliwal North and the lower Orange, as well as from the Sak and Vaal rivers, using *L. polylepis* (16) from the Elands System, as an outgroup. Ten enzyme systems were screened. Previous studies showed fixed allele differences at a few of these loci, however, no fixed differences were found between the three species analysed in this study. The only exception was for 12 individuals of *L. aeneus* and *L. kimberleyensis* from the lower Orange that showed a fixed difference at the Esterase-1 locus. It appears that genetically impure species occur at all localities. This extensive hybridisation calls for more careful sampling, additional parasite data and more polymorphic genetic markers to identify these endemic *Labeobarbus* species.

Mitochondrial DNA (mtDNA) variation

(Paulette Bloomer)

The mtDNA variation among the newly collected samples was interpreted within the framework of the variability characterised in the pilot study and also within the broader framework of mtDNA variation in the genus *Labeobarbus*. Twenty two unique maternal alleles were identified among 92 Orange-Vaal samples; some alleles are shared between many individuals and were recorded from several sites whereas other alleles occurred at low frequencies. In agreement with the pilot study, *L. aeneus* and *L. kimberleyensis* from the Sak River, upper Orange (Aliwal North) and lower Orange (Onseepkans and Pella), shared some maternal alleles. This could be due to the presence of shared ancestral alleles dating to before the split between the two closely related species or could indicate introgressive hybridisation of *L. aeneus* alleles into *L. kimberleyensis*. Variation within Orange-Vaal yellowfish is much lower than that observed in *L. natalensis* (KwaZulu-Natal scaly) based on a small pilot investigation of variation in the latter species. There is clear distinction between *L. natalensis* from the three river systems analysed to date (Umzimkulu, Tugela and Mkuze). With the exception of mtDNA alleles in the lower Orange, the remainder of the lineages within *L. aeneus* and *L. kimberleyensis* indicate a recent rapid spread of a few alleles throughout the system. Some of the *L. aeneus* from the lower Orange have more genetically distinct alleles and this area should be

investigated in greater depth and treated as a separate conservation unit. A preliminary analysis of the cytochrome *b* gene was used for a rough dating of differentiation. This indicates 5-6 million years of separation between the smallscaled *Labeobarbus* species (*L. capensis*, *L. polylepis*, *L. natalensis*, *L. kimberleyensis* and *L. aeneus*) and their other *Labeobarbus* and *Varichorinus* relatives, whereas differentiation within the group dates to 2-5 million years ago (mya). The divergent *L. aeneus* from the lower Orange appears to have radiated very early in the evolution of the Orange-Vaal lineage (1.8-2.3 mya). The cytochrome *b* analysis will be extended to include wider representation of smallscaled specimens and some nuclear DNA genes will be added to the analysis.

Recommendations for management and future research

No movement of smallmouth and largemouth yellowfish (or any other yellowfish species) should be allowed.

Rather than movement of fish, habitat should be rehabilitated to allow natural recolonisation.

The lower Orange below Augrabies Falls should be treated as a separate conservation unit.

More research should be conducted to investigate the contradictory morphological and genetic results.

A MOTIVATION FOR A NATIONAL ANGLING LICENCE AS PRESENTED TO WORKING GROUP ONE FOR BIODIVERSITY IN 2005.

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Situation analysis in South Africa

Angling permits in SA

There is a critical need for consistent legislation relating to freshwater angling in South Africa. Anglers are faced with different legislation pertaining to the same fish species in different provinces. Each province views angling and angling permits differently. Several provinces no longer implement angling permits. Each province is addressing the conservation and management of its freshwater resources in a different manner. There is a critical need to develop a consistent means to manage our freshwater heritage. Aquatic systems are recognised globally as the most threatened ecosystems. A national monitoring, managing and permitting system forms part of an overall conservation initiative aimed at addressing part of the complete problem. In addition to conservation the permitting system can generate valuable revenue that can be reinvested in the conservation of the natural resource. The Marine Resources Act is being used by Marine and Coastal Management to implement a National Marine Angling Permit to this effect. This is implemented across provincial boundaries according to the distribution of the resource. The same can apply to the freshwater resources.

The Biodiversity Act

The Biodiversity Act allows for a single integrated permit that can be applied on a National basis. The identification of designated agencies to develop, produce and implement the permitting system will have to be discussed.

DEAT National is using the Biodiversity Act to focus upon threatened species and alien species at present. The aim is to then address threatened ecosystems. These actions will produce lists. The implementation of conservation measures (endemic species and ecosystems) or management measures (alien species and ecosystems) for the species and systems listed will require the development of further strategies. One of these is the implementation of freshwater fisheries legislation. An angling permit is a method used globally to inform and regulate anglers (one of the users of endemic species, alien species and ecosystems), to implement consistent management tools in a specific country and to generate income to fund research and management in the field of freshwater fisheries research and management.

Potential income generated

Income from angling licences is substantial in countries like the United Kingdom (100 Million pounds per annum, Impson pers.comm.) and conservative estimates indicate that there are at least 50 000 freshwater anglers in South Africa over 12 years of age. There will be as many informal anglers in the country. Freshwater Sport Angling has a 16 000 membership which consists of 1% of the angling population which means that there are at least 1 600 000 in total. (Markinor research) Therefore, at R60 per license this equates to a national income of R96 million of which R90 million can be allocated to Nature Conservation and R6 million to Organised Angling. This will ensure the support of all

anglers. (SAFBAF is developing means of including the recreational angler within the organization) This will increase the support base. (Care should be taken to ensure that the funds do not disappear in the National Treasury and put to other use)

Funding research and conservation
Anglers have indicated that they will not support angling permits if the funds are not used for dedicated angling related purposes and to create the necessary capacity in South Africa to manage rivers, dams and wetlands within each Province.

There is a serious lack of aquatic research and aquatic management taking place in the different provinces. Some provinces do not have aquatic scientists (e.g. Kwazulu-Natal and Eastern Cape). The identification of freshwater management and research priorities by the provinces that can be funded by the proceeds of this process will go a long way regarding the acceptability of the national permit concept in the provinces. In addition to this, the angling fraternity will also find the concept acceptable if the funds are only used to fund aquatic research and the management of aquatic resources.

Permitting Scenarios
1. A single authority could be identified eg. DEAT or SANBI that will use local agencies to distribute the permits, eg. Post Offices (Best and most practical option and will make the Post Office more profitable)

2. A single authority eg. DEAT could use the Provincial Departments to distribute the permits, eg. DTEEA Free State. (Provided all the provinces have the capacity to manage!)

Other scenarios involving angling shops could also be investigated if necessary. (This option will work if the book is not restricted to one year only)

The appropriate permit fees needs to be agreed upon. The channelling of funds into the field of aquatic conservation needs to be investigated. (See previous comments)

Enforcement
The actual enforcement of the permitting system is critical. Without this it will be of no value to South Africa.

The Biodiversity Act identifies Environmental Management Inspectors. These officials may be employed by the Provincial Departments. More importantly, these officials may be identified, trained and employed by any organ of state. In other words Local Government can assist the country in enforcement within the local council area. This system will capacitate the Provinces and local authorities such that the National Angling Permit can be enforced.

A single authority, eg. DEAT can also manage Environmental Management Inspectors who will then operate across Provincial boundaries.

Some proposed angling regulations
National angling regulations must be disseminated on this permit. Ideally the permit should be kept simple, however enough information must be gained to assist in fisheries management and improve communication with anglers (i.e. Home and email address and

fax number). Catch returns could become part of this permitting system. (SAFBAF has been recording catch returns for the past 15 years)

INDIGENOUS SPECIES

List species conservation measures, e.g.
Orange-Vaal Largemouth Yellowfish – Catch and release
Lowveld Largescale Yellowfish, - Catch and release, Bushveld Smallscale Yellowfish and Orange-Vaal Smallmouth Yellowfish – 2 per angler per day/ only 2 in keep net at any one time/ minimum size is 30cm fork length (Natal Scaley?)
Tigerfish – Catch and release except in dams
Tilapia – Four per angler per day/minimum size 20cm
Clanwilliam Yellowfish, Sawfin, and Berg-Breede Whitefish – catch and release
All other indigenous fish species – 3 per angler per day (Exception Mudfish and Catfishl)

No netting, trapping or spearing of any of the above species
No interfering with the spawning of any of the above species
Recognition must be given to any local conservation initiatives at all times
Recognition must be given to any local closed seasons all times

INVASIVE ALIEN SPECIES

Alien species outside (Inside designated protected zones?) designated zones must be destroyed if caught.

Bass
Trout
Carp
Bluegill
Nile Tilapia
Grass Carp
Translocated indigenous species (i.e. outside of their natural distributional range) e.g., Sharptooth Catfish in Western Cape rivers

Stocking

No movement/transportation/stocking of any live fish without a permit from a Provincial Nature Conservation office. (Except for consumption)

Acknowledgements
Mr. D. Impson
Dr. G. Willemse
for their assistance

SUMMARY OF COMMENT AND DISCUSSION FOLLOWING EACH PRESENTATION

Limpopo Province Report – *Mick Angliss presented by Dr Wynand Vlok*
Dean Impson asked why it was necessary to stock *L. polylepis* in the Letaba and Dr Vlok said they had disappeared from the system due to extensive habitat modification which included dams and weirs and also the stocking of trout. In the meantime increased temperatures had made the river less suitable for trout and the stocking of trout had been halted.

ERYCA – *Gordon O' Brien*
Louis Wolhuter asked about signage on the road to promote the conservancy and Gordon said ERYCA was seeking sponsors for this.

KZN Province Report – *Rob Karssing*
Pierre de Villiers agreed that KZN were on the right track and that hatchery reared yellows were not the answer. Also, stocking should be the last resort, as in the case of the Letaba.
Gordon stated that they experienced problems obtaining permits from KZN Wildlife for samples for their study and Rob Karssing suggested they contact him in future.
Ramogale Sekwele asked how Durban Metro were performing and Rob stated that they were doing a great job and this was because it was linked to tourism which was very important to the Metro.
Dean Impson stressed the importance of not moving yellows above barrier falls.
Peter Mills asked about reports of *L. natalensis* in the Phongola system and Horst Filter said these reports were very vague and Rob Karssing emphasised the need to keep voucher samples to verify such reports and said that to support sightings 2 voucher samples should be sent to SAIAB.
Pierre de Villiers said it was important to look at age groups when sampling and Rob Karssing stated that in some polluted streams the yellows did survive but were stunted.

Gauteng Province Report – *Piet Muller & Siyabonga Buthelezi*
Pierre de Villiers said it was important that each province had a fish specialist but this was lacking in many provinces. A specialist was required for duties such as correct fish identification.
Horst Filter enquired about the state of the Crocodile and Piet Muller explained that it suffered badly from silt, algae and major floods. He also said that they had only had one record recently of papermouth (*Barbus rapax*) and that was from the Skeerpoort. Gordon O'Brien said it was important to watch for stonefly when measuring water quality.

Dean Impson remarked that the Water Act was frequently contravened by irrigators and Wayne Sinclair said the Magalies Action Group was faced with a massive problem as the source of the Magalies River at Maloney's Eye had virtually ceased to flow due to illegal boreholes and water abstraction by irrigation farmers. Piet Muller said they were fighting the development of an open cast mine that would threaten the Suikerbos.

In reply to a question from Morne Viljoen about angling in a World Heritage Site like the Cradle Peter Mills said the management authority had the right to issue permits.

Free State Province – *Johan Hardy*
Bill Mincher enquired whether a large conservancy like the Orange/Vaal could be zoned into more manageable portions and Pierre de Villiers replied that although this was the ideal it was difficult to find people to take responsibility for this.

Orange-Vaal Yellowfish Conservation & Management Association – *Pierre de Villiers*
Louis Wolhuter asked about the zones and Pierre de Villiers said that Johan Hardy was dividing up the river into zones where possible and not only in the Free State. Wayne Sinclair asked about the effect of change of ownership of riparian land and Pierre stated that new owners or family members tended to carry on with membership.

North West Province – *Daan Buijs & Hermien Roux.*
Dean & Pierre congratulated North West on the number of their RHP sites, but agreed that there was a need to ensure that the reserves be implemented as a matter of urgency. Hermien Roux stated that if they could only remove the alien plants and be allocated the additional flow resulting from this action this would represent an improvement. She also said they would have to monitor sewage from the municipaities.

They also informed Peter Mills that they were unable to find *B. rapax* (papermouth) and that they did not really know which of the indigenous species had survived the serious habitat destruction and water abstraction in the province.

Daan Buijs said that flyfishing on the upper Groot Marico had become very popular but unfortunately no records were supplied by the anglers. Pierre de Villiers stated that we should encourage lodges to set up programmes to capture this data. Bernard Venter offered the Artlure records which he said were very comprehensive.

Western Cape Province – *Dean Impson*
Pierre de Villiers noted that although the stocking of dams was important it was imperative that the focus be placed on the rehabilitation of rivers so the fish in the dams could be reintroduced.

Bernard Venter asked why catfish had such a dramatic impact on bass populations in the Western Cape. Dean Impson was unsure but said that possibly the fish populations of the northern provinces were more complex. Also, he felt that the sharp rise in the carp population had impacted on the bass. He also mentioned that the reduction in bass numbers might benefit yellows in the longer term or that we might see bass populations recover.

Rob Karssing asked whether triploid catfish could be used to control bass and Horst Filter mentioned that bass were increasing in Sterkfontein and this was a matter of great concern.

Orange-Vaal Yellowfish: Much more to living gold than meets the eye – *Prof. Paulette Bloomer.*
In response to a query from Pierre de Villiers on the mpact of water transfer schemes Prof Bloomer said we needed to set baselines as soon as possible and also include the hybrids from the Olifants system (Mpumalanga & Limpopo provinces).
Dean Impson mentioned that it appeared that *polylepis* and *capensis* were more closely related than they were with *aeneus* and Paulette Bloomer said the sample had to be expanded to verify this.

Challenges in the control of water hyacinth in South Africa – *Angela Bownes*
In reply to a question from Dr Wolhuter regarding impact on indigenous plants, M/s Bownes said the insects used for control were first tested on indigenous plants during a quarantine period of 10 years. Then prior to release they first had to issue a scoping report followed by an EIA.
Dean Impson asked whether the insects survived the cold Highveld winters and M/s Bownes said that they survived but only in small numbers.

An investigation of the microhabitat preference of *L. marequensis* in the Sabie, Olifants & Crocodile Rivers in the KNP. – *Paul Fouche, W. Vlok & J. Venter*
Paul Fouche confirmed that when *marequensis* was found in unexpected places it was close to the preferred habitat.

A threshold for concern for the largescale yellowfish in the Crocodile River in the KNP – *Bruce Leslie.*
Piet Muller pointed out that the KNP was on the receiving end of what was poor catchment management outside the Park. Bruce Leslie agreed but stated that Dr Gyedu Ababio was liasing with the CMA's in this regard.

The social, economic & environmental impact of the pollution in the Vaal River Barrage area – *Morne Viljoen*
Pierre said it was critical to contact municipalities regarding pollution and Morne Viljoen stated that good progress had been made in the Erkhuleni area.

A Critique of the Threatened and Protected Species Regulations issued in terms of the National Environmental Management: Biodiversity Act 10 of 2004 ("NEM:BA") – *Morne Viljoen*
In reply to a question from Wayne Sinclair, Morne Viljoen said the regulations would apply to all waters.
Pierre said we needed to seek practical ways of getting around the regulations and this could possibly done at provincial level. Morne Viljoen felt we needed to sit down and discuss the matter with the State. Daan Buijs said we could look at exemptions on the permits and Dean Impson stated that we had to distinguish between private and public waters.

The yellowfish research group – the strong arm of econ@uj, a consortium of ecological scientists: *Gordon O'Brien*
Dr Wolhuter asked about the distribution as shown on the map and Gordon O'Brien stated that this was partly determined by altitude as *polylepis* was found above 600 metres. However he agreed that the map might be changed in future.

Pierre deVilliers asked about the management of isolated populations and Gordon O'Brien stated that for the time being the moratorium should be maintained and then if an isolated population was found and is threatened urgent action should be taken.

Paul Fouche said that at recent WRC funded conference fish distribution was discussed. He said the workshop revealed that participants had a great deal of information and we should obtain a copy of the proceedings.

Paulette Bloomer said that genetic diversity is very difficult to protect and therefore it is important to identify unique lineages. Once a unique lineage is lost it is gone for ever.

Genetic morphology & parasite host specificity of the bushveld smallscale yellowfish – *Amanda Austin*
Paulette Bloomer asked about the source for the Letaba stocking and M/s Austin said it was the population closest to the Letaba River.
Gordon O'Brien enquired where they could find a hybrid population and Horst Filter suggested that one look at the weir above the Middelburg Dam which was a barrier for yellows at breeding time.

Assessment of the biological & physical habitat requirements of the yellowfish in the Vaal River – *Linda Nel*
Bill Mincher asked how frequently checks were done and Linda Nel said it was usually every day for 10-15 minute periods. The exception was over weekends if there were many anglers present.

Dean Impson said it was critical to measure spawning behaviour; when the fish aggregated and in what areas. Pierre de Villiers stressed that Linda had to do a vast amount of work to accumulate the data she had to date.

Guidelines for the national yellowfish regulations & management policies – *Dean Impson & Pierre de Villiers*
Morne Viljoen asked what leeway provinces would be given. For example would they be able to allow landowners to impose even stricter regulations on their properties. Dean Impson replied that this would be possible but these would have to be simple and practical. Horst Filter mentioned that guidelines were required for catch & release.

Wynand Vlok stated that permits should be in booklet or even logbook form to be able to record catch statistics but Pierre de Villiers said the marine licence which was in this format was seldom completed. Kobus Fourie felt that it would be better to get lodges to keep registers.

Wayne Sinclair asked about subsistence fishermen and Pierre de Villiers replied that there should be a 'subsistence permit' but a huge effort would be required from the authorities to implement it. Horst Filter said that subsistence fishing was increasing exponentially and it was unfair that these people were allowed to take everything while licensed anglers had to pay high fees and were subject to many restrictions. Pierre de Villiers stated that there had to be a practical way of issuing 'subsistence licenses' while Kobus Fourie said the licences should be low cost for everyone.

Conclusion: It was decided that Morne Viljoen would prepare a document in draft form to be considered by the YWG Exco. It would then be forwarded to the provinces and

angling groups for their input whereafter the YWG Exco would finalise it for presentation to the Minister. It was suggested that the delegation to see the Minister comprise Morne Viljoen, Wynand Vlok, Pierre de Villiers and Peter Mills.

THREAT REDUCTION ANALYSIS
THE LESSON PLAN FOR THE YWG WORKSHOP 2007: HOW WELL IS THE WORKING GROUP DOING?

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1. Introduction

Each year the Yellowfish Working Group (YWG) culminates in a workshop where pertinent issues concerning river conservation are addressed and the programme for the next year is discussed. As there is no fixed structure there are no specific directives that can be handed out to any specific member. This loose and independent nature of the Working Group does not allow for an executive function and the desire for anyone to act is entirely left to the individual. The deliverables are therefore left to those who are motivated enough to undertake projects by themselves or within their various job situations.

Having been in existence for eleven years it was time to attempt an assessment of how well the YWG was actually doing. An assessment process to this end, therefore, required careful selection. The dilemma facing the workshop planners was - how does one assess the successes of a working group known for its loose structure and the diversity of inputs which range between conservation practitioners, biologists, scientists, administrators, landowners, the media and anglers? There are many ways that this can be done. The process presented here was selected because of its simplicity and provides a basis from which delegates can proceed within their own spheres of influence to address river conservation issues during the upcoming year.

2. Methodology

Conservation projects are designed to change the condition of the environment for the better. The overall purpose of which is to conserve our biological diversity. Unlike business projects, which have clear economic objectives, the success of conservation projects are more difficult to define.

Target condition

Conservation projects will try to achieve one, or a combination, of the following elements that translate into environmental health. Projects vary in scale and could focus purely on individuals or systems, and more likely, a combination of species, habitat and systems. See below:

Individual species: Range or collection of species present.
Habitat area and Condition: Area of habitat present and degree to which it is intact.
Ecosystem functioning: Degree to which the habitat is able to maintain target system and processes.

There are a number of sophisticated methods of evaluating conservation effectiveness but these require time and expertise. The Threat Reduction Analysis, used here, was an easy way for the Working Group to assess matters relating to river health.

The Threat Reduction Analysis involves 9 steps:

Step 1: Defining in the **project area** in space and time. (In this case it was the various catchment regions)

Step 2: Develop a list of **direct threats**. Direct threats are factors that have a direct impact on biodiversity and are caused by the stakeholders living at the project site. Opposed to this are **indirect threats** which might be conditions such as poverty that will cause, for example, people to illegally harvest natural resources (a direct threat).

Step 3: Define the threats and what **100% reduction** in that threat would mean.

Step 4: Rank each threat for **Area**: The portion of habitats in the site that threat will affect. Will it affect the entire habitat at the site or just a small part?

Step 5: Rank each threat for **Intensity**: The impact or severity of destruction caused by the threat.
Within the overall area, will the threat completely destroy the habitat or will it cause minor changes?

Step 6: Rank each threat for **Urgenc**y: The immediacy of the threat. Is it a current threat or will it occur in the future?

Step 7: Add up **ranking scores**

Step 8: Determine the percentage by which each threat has been **reduced**

Step 9: Calculate **Raw Score**

Step 10: Calculate the **TRA Index**

Although the entire analysis process was followed at the workshop the results of the questionnaire will only be discussed up to point 7. This is because no conscious actions were actually taken by the group (or its members) to reduce the threats identified. The results, in this case, are merely speculated by group members (Steps 8 – 10). Although members may have been indirectly addressing these threats there was no empirical way of proving their effectiveness, or the results.

It must be noted that, apart from the KZN group, most other groups have acknowledged that very little has been done to address the main threats in their region. The identification of appropriate indicators against which success can be measured is a key challenge for conservation planners and managers over the next operational year.

A total for each graph shows the ranking of the threats per region and should give managers a focus point on which to base more decisive strategies. The following table is an example of the scoring sheet.

Table 1: Threat Reduction Analysis scoring sheet. The score of 7% at the bottom of the table reflects the final score (degree of success in reducing the overall threats to the system).

	Area	Intensity	Urgency	Total	% Reduced	Dec	Raw Score
Water Abstraction	5	5	5	15	0	0	0
Habitat Destruction	4	4	4	12	10	0.1	1.2
Alien Fish	3	3	3	9	0.05	0.05	0.45
Alien Plants	1	1	1	3	0.1	0.1	0.3
Pollution	2	2	2	6	20	0.2	1.2
	15	15	15	45			3.15
			3.15	**45**	**0.07**	**100**	**7**

The analysis looked at all catchments represented by delegates attending the workshop. The nature of the information was based on the collective knowledge and understanding of the situation by those present.

The information is represented by the score sheet and a graph comparing threat with threat factors. The results are shown per region or catchment and in histogram format only. This is partly to save on space but also because the threat reduction part of the analysis is, for reasons mentioned above, not accurate enough for any meaningful analysis of how effective river conservation projects really where.

3. Results

The results of the analysis are given here. The following is a summary of results. For the sake of space only basic assumptions have been made about the findings. There are a number of ways to display the information but in this case threats are evaluated against **area**, **intensity** and **urgency**. Each river catchment has been analyzed according to the major threats and possible strategies and main target audiences/stakeholders identified. Ideally this should be done in detail at regional level and very specific action plans designed to address identified problems.

a. KwaZulu Natal System (KZN)

The main issues in KZN are volume and quality related. Although habitat change is affecting large sections of the KZN rivers it is not as urgent or as intense as is abstraction of water from the system. Surprisingly, alien species do not rank highly and it is really development related issues which are seen as the main contributors towards poor river condition, a trend that is common to all the regions.

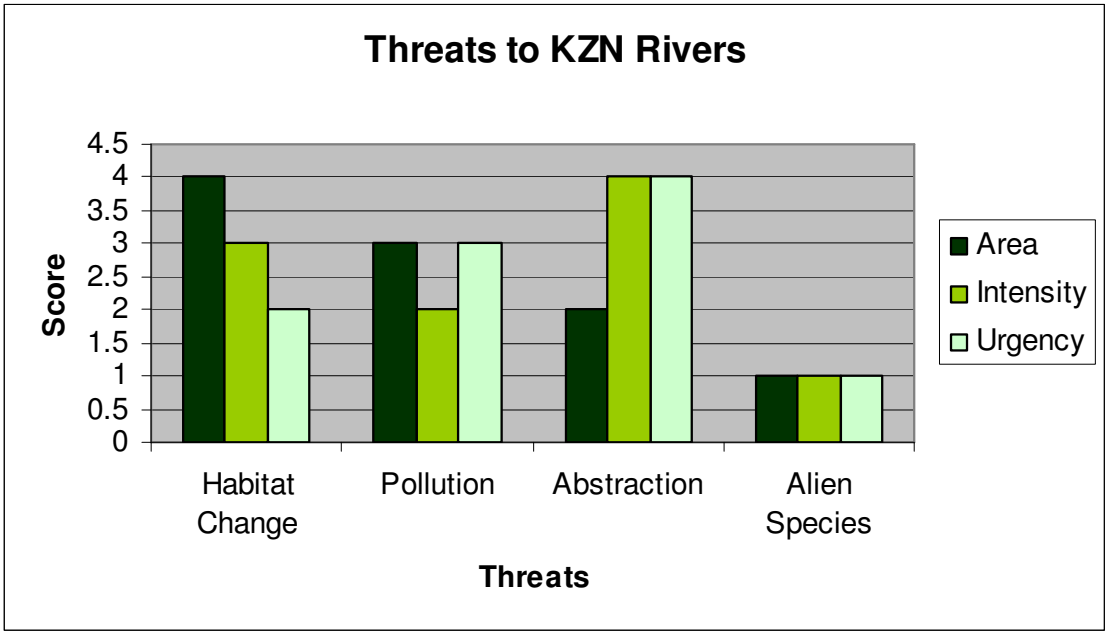

Figure 1: Histogram showing main threats in KZN Rivers

Analysis of Threats

Threat: Habitat change
Analysis: This threat refers to a number of activities like mining, agriculture and urban sprawl that will affect the structure of the river banks and bed as well as water quality and volume.
Stakeholder: Mining, agriculture, landowners, local authorities, industries and rural communities..

Threat Pollution
Analysis Pollution caused by poor management of storm water, bad agricultural practices and rural communities living to close to and using water directly from the rivers.
Stakeholders: Rural communities, municipalities Agriculture, mining and industry

Threat Abstraction
Analysis: Mainly as a result of agricultural and urban development. Inter-basin transfers are also a problem because large volumes of water are moved between systems changing the flow régime which negatively affects the river ecology.
Stakeholder: Agriculture, local authorities and government departments.

Threat: Alien species
Analysis: Alien plant and animal species are being released into the river system. Plant species change the structure and flow of the system while alien fish predate on indigenous fish species.
Stakeholder: Angling industry, pet trade and aquaculture

b. Crocodile/Marico System (Limpopo West)

The Marico River is situated in one of the more productive agricultural provinces which accounts for the high level of water abstraction. Large rural populations are now one of the main contributing factors of poor river health. Water abstraction and poor effluent management are the most serious issues that threaten these rivers. Chemical pollution associated with agriculture and the mining industry is also significant. The destruction of riparian vegetation is mostly likely where poor agricultural methods are being practiced.

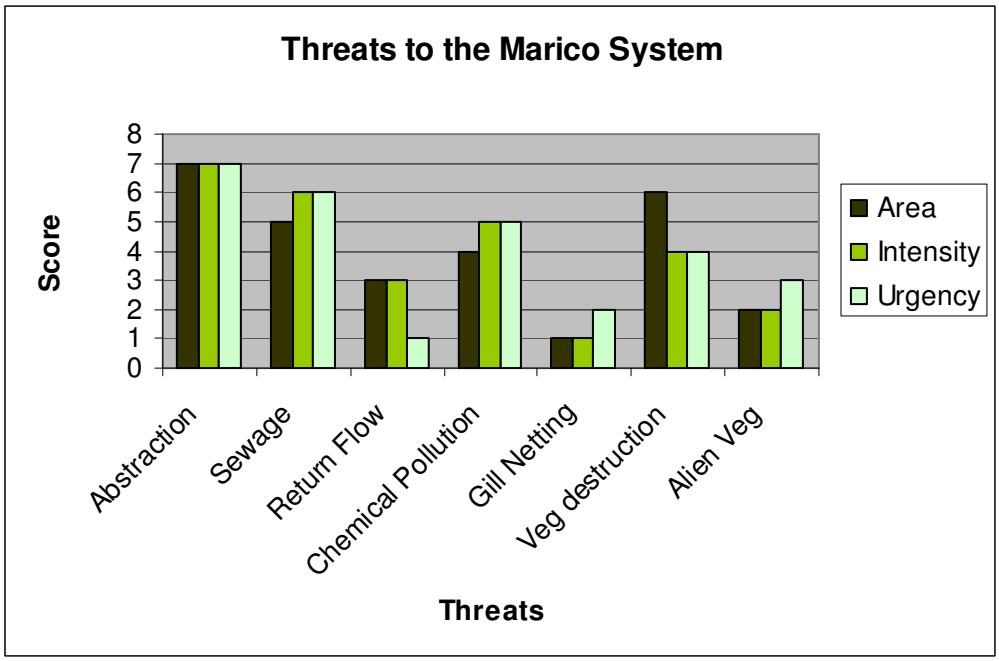

Figure 2: Histogram showing main threats to the Crocodile/Marico River System

Analysis of Threats

Threat: Pollution/sewage/return flow and chemical pollution are grouped together because they are part of the same problem.
Analysis: A combination of factors such as rural/urban townships and agriculture are polluting the river systems. The situation is exacerbated by the low flows which allow the buildup of toxins that eventually make their way into the system making the environment unsuitable for habitation by any species.
Stakeholder: Rural communities, local authorities, agriculture, mining and industry

Threat: Riparian destruction
Analysis: Vegetation that stabilizes river banks is being removed because of poor agricultural practices and communities living too close to the rivers edge and within the one hundred year flood line is also destroying riparian vegetation. Without the protection of vegetation along the river banks rivers become clogged with silt, destroying aquatic habitat.
Stakeholder: Agriculture and local communities

Threat: Gill Netting
Analysis: Gill netting is taking place as a subsistence activity as well as for commercial reasons.
Stakeholder: Local communities and individuals are exploiting the river's resources using methods that are unsustainable for both business and ecological reason.

Threat: Water Abstraction
Analysis: The Marico River and its tributaries are subject to high levels of water abstraction by irrigation and indiscriminate pumping is reducing perennial rivers to rivers that flow seasonally. The habitat is seriously altered to the detriment to aquatic plants and animals.
Stakeholder: Mainly agriculture because of poor farming practices, rural communities and township establishment

c. Mpumalanga (Limpopo East)

Mpumalanga is characterized by large rural townships with poor services. It is also a province that supports a large agricultural sector. Coal mining for power in the upper reaches of the Olifants River is taking place. This means that the river is badly affected by acid mine water that is making its way into the system from the mining regions. The high incidence of rural people living close to river systems accounts for the high score given to subsistence fishing. The latter is not a problem in itself but the harvesting systems used make this a significant impact.

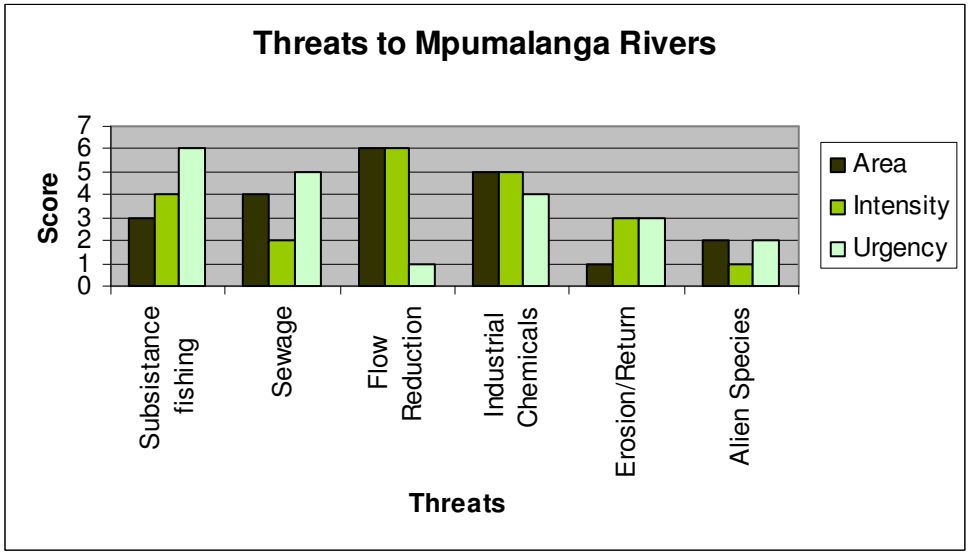

Figure 3: Histogram showing main threats to the rivers in Mpumalanga

Threat: Subsistence fishing
Analysis: Most of Mpumalanga residents are still rural and many still depend on their natural resources for survival. They depend on the rivers for much of their protein. With increasing pollution the capacity of the rivers to produce food for a growing population is diminishing by the year. Harvesting methods are indiscriminate which devastate the whole system and not only edible species.
Stakeholder: Mainly local communities who wish to supplement their diet with protein.

Threat: Industrial Pollution
Analysis: Most eastern flowing rivers of the Highveld feed the Olifants, Crocodile and Sabie Rivers. It is in these upper areas which is where coal mining is most prolific. These mines have a significant and negative impact on river water quality. Many rivers close to the mining areas have a pH of 2 or less and it renders these rivers sterile. Also significant is the fact that the rivers under these conditions are not able to support a growing human pollution downstream.
Stakeholder: The mining Industry.

Threat: Flow reduction
Analysis: Water is lost from the system for township establishment, agriculture and growing industries
Stakeholder: Rural communities, local authorities, agricultural sector and mining.

Threat: Sewage
Analysis: Is a problem to emerge from growing townships which are often placed far from centres and little money is spent on keeping the environment safe to live in. It has been noted above that the river upstream is very acidic. The pH value changes radically to become highly alkaline because of the use of detergents by those living along the course of the river.
Stakeholder: Local authorities.

Threat: Alien species (plant and animal)
Analysis: Trout have reduced the aquatic biodiversity in the upper reaches of the Mpumalanga rivers. Bass are becoming a much bigger problem because they can adapt to a wider range of river temperatures and quality and are thus affecting large sections of river. Plantations in the Dullstroom and Sabie area do not only take huge volumes of water out of the system they are also responsible for the introduction of a large number of alien plants infestations which is clogging river systems.
Stakeholder: Angling industry, forestry industry.

d. Orange/Vaal System

The Orange/Vaal system is under serious threat from two major quarters; industry and urban development. It is an interesting region in that the Mpumalanga Rivers and the Marico systems are all impacted on by the enormous urban and industrial developments of Gauteng. Water quality is already compromised at their source.

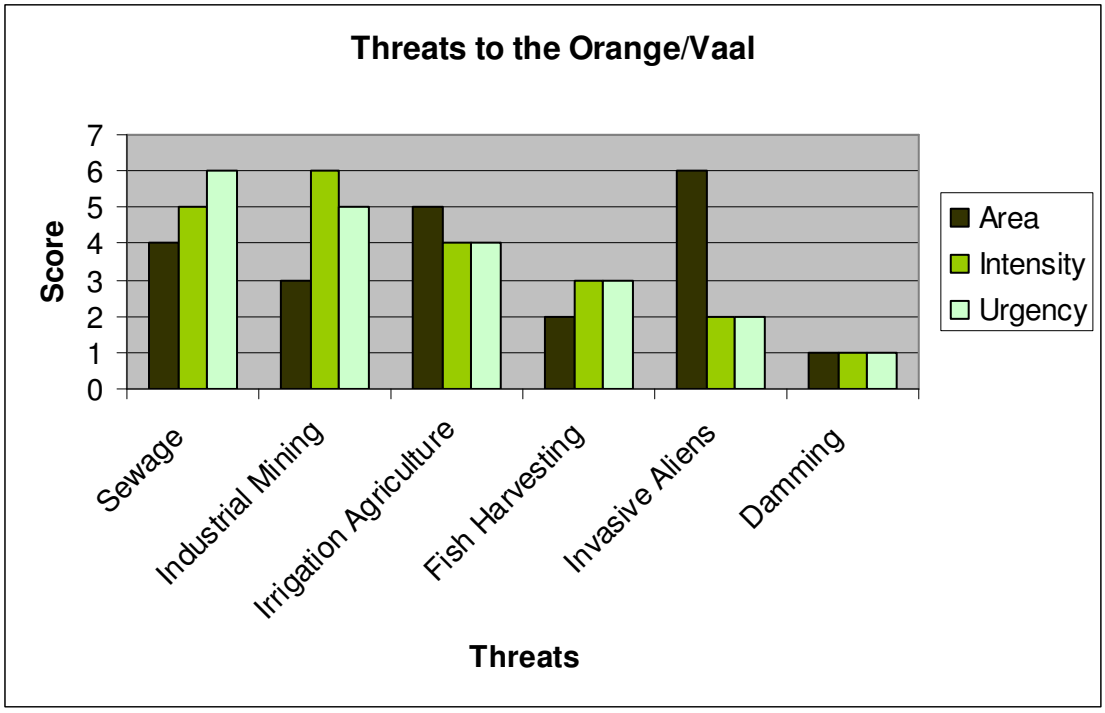

Figure 4: Histogram showing main threats to the Orange/Vaal System.

Threat: Sewage
Analysis: Water is routed via the Lesotho Highlands scheme to the Johannesburg region. The PWV area is responsible for a high degree of pollution in this system.
Stakeholder: Mainly local authorities who are not managing their waste systems effectively

Threat: Industrial Pollution
Analysis: Effluent is fed from the PWV industrial areas into the river system. Pollution affects water quality which in many cases can no longer support most forms of aquatic life.
Stakeholder: Mining and industry

Threat: Irrigation/Abstraction
Analysis: Same as above
Stakeholder: Agriculture

Threat: Alien species of plants and animals
Analysis: Alien plants and animals pose a serious threat to river biodiversity. Water hyacinth, for example, clogs river channels starving the water of oxygen. Annually many fish die-off at the onset of the wet season because of oxygen starvation.
Stakeholder: Landowners, anglers and DWAF

e. Western Cape Rivers

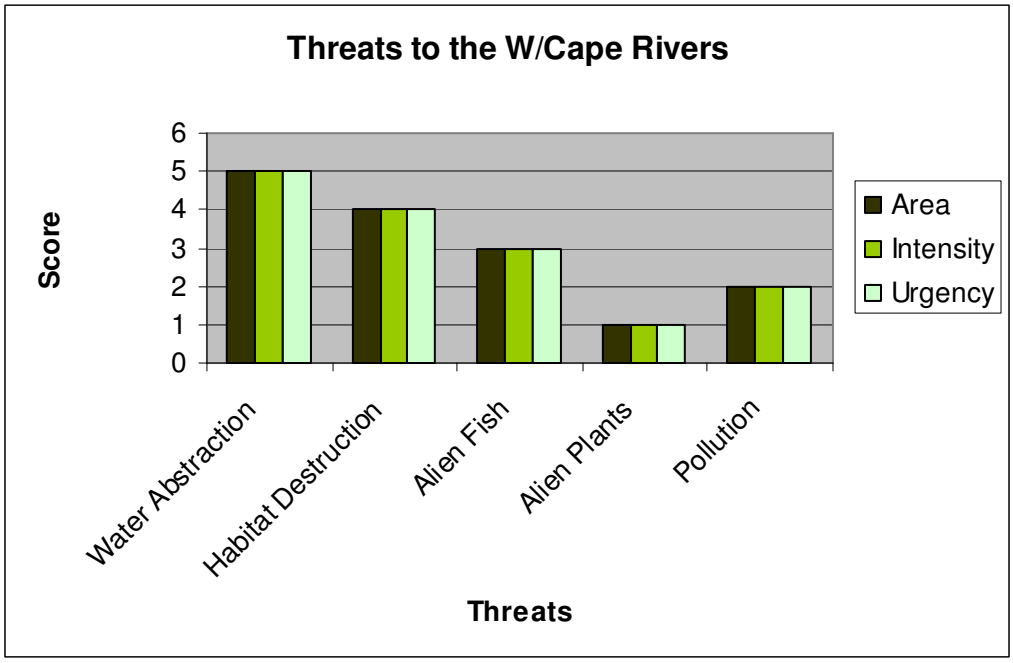

Figure 5: Histogram shown the main threats to the Western Cape River Systems

Threat: Water abstraction
Analysis: The citrus and wine industries both require huge amounts of irrigation water which is often pumped straight form the river into irrigation storage reservoirs.
Stakeholder: Agricultural sector (Citrus and wine industries), some industries and urbanization

Threat: Habitat destruction
Analysis: Agricultural practices have been responsible for the clearing of riparian vegetation in order to create crops and orchards
Stakeholder: Agriculture

Threat: Alien species: Plants and animals
Analysis: Trout and bass have played a significant role in exterminating indigenous fish from Western Cape Rivers. Many of these rivers are also infested with alien plants like Port Jackson Willow, Black Wattle and so on.
Stakeholder: Angling industry and agriculture

4. Analysis

It should be noted here that although habitat destruction scores highly in many regions, and is one of the main sourses of species loss, it is rather a collection of factors rather than a factor itself. It has been included in the analysis for each region only because habitat destruction has been mentioned by delegates as a major factor affecting our rivers. However, it must be understood that water abstraction, pollution, removal of riparian vegetation and destruction of the river bed all contribute to habitat degradation and is an effect rather than a cause.

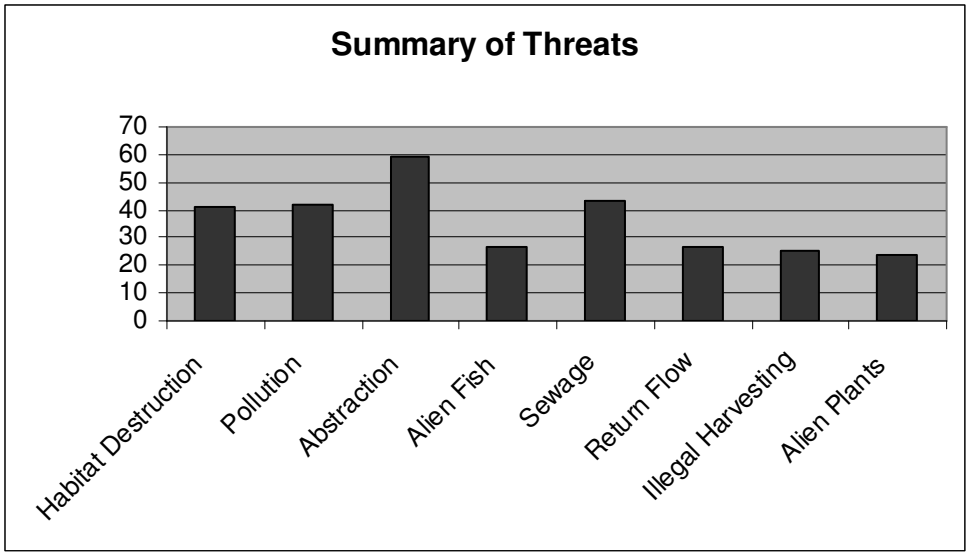

Figure 6: Histogram showing a summary of all threats identified by workshop delegates in relation to each other.

According to the results of this exercise the abstraction of water for mining, urban development and agriculture emerged as the most important threat to the country's river systems. Closely linked to these factors is the high level of raw sewage that is entering natural water courses. Disturbingly, the source of sewage is coming from two distinct sources; high density urban systems that are poorly maintained and managed water purification systems, the other source of sewage is emanating from large and poor rural communities with inadequate waste management systems in place. The focus of any intervention aimed at addressing river health must be directed at, and ellicit local authority support. Other important stakeholders should include local authorities and the Departments of Agriculture and Water Affairs and Forestry as well as Mineral and Energy Affairs if the situation of our river health is to improve at all. Interestingly alien species, especially fish, did not rank highly on a national scale. Notwithstanding that it is a huge problem in specific areas. However, as a threat to whole systems, nothing comes close to the devastating effect of those activities that effect water quality, quantity and habitat structure.

It is just as apparent that each region must prioritise threats and threat reduction strategies based on their capacity to address specific and pertinent problems to that area. The selection of the project will depend to a large extent on available skills and available funding. It is also up to managers and conservation practitioners to put in place management systems that allow for project management and tracking in order to evaluate project success. The analysis undertaken here will be more accurate if strategies are developed to address specific threats and for each threat verifiable indicators selected to accurately measure change and project effectiveness.

5. Summary and Recommendations

So how well is the Yellowfish Working Group doing? In an effort to promote fishing for local species the Working Group can regard its efforts as pretty successful. On the other hand it is not for the Working Group to usurp the functions of line function organizations like the Department of Water Affairs and Forestry and the various regional

conservation authorities. The working group is not structured in a way that allows for direct intervention but is rather a lobby campaigning for river health. It does provide a forum where line functionaries can identify key focus areas and from there plan to address key problems facing rivers, either nationally, or at local level. What seems to be apparent is that there are many different groups and individuals who are involved in rivers conservation but there is very little coordination of effort that is required to make a difference at a practical level. It is hoped that this exercise will provide a framework and give focus to the work that still needs to be done.

The following is a list of conservation tools which may be used to guide line-function organizations while developing management strategies. These "tools" for action can be divided into the following categories:
Direct protection: Developing public parks and reserves. These normally form part of the national strategy to conserve 10% of the countries' natural systems.
Policy Development and Advocacy: Changes in the law and through legislation that might ultimately have conservation result.
Education and awareness: Providing specific stakeholders and the general public with the knowledge and the skills that ultimately have a conservation result.
Changing incentives: Identifying specific motivation that cause people to behave in a desired way that has a conservation spin-off.
Community based Natural Resources management: Empowering people to manage resources on which they depend on a sustainable basis.

The actions that need to be taken for river conservation clearly require the use of all of the above tools in various degrees. Here we can include the establishment of river conservancies, changing legislation with regard to land settlement, agriculture, best mining practices and so on. Most of all the Yellowfish Working Group members should be identifying those stakeholders that have the greatest impact and/or influence on the river systems in their area of concern and develop knowledge and skills within those groups that will empower them to rectify the situation.

- The Threatened and Protected Species Regulations, which lists several yellowfish species as endangered, will come into effect on 1st February 2008. This together with the proposed regulations on alien and invasive species will have a significant impact on anglers. Although the YWG agrees with the purpose of these regulations it believes they cannot be implemented in a practical way. This is because the regulations treat fish in the same way as terrestrial organisms. The YWG will therefore present a proposal to DEAT, highlighting the problem areas including their unfavourable impact on anglers, and proposing alternatives, including a single, affordable, easy to obtain, national freshwater licence.

- That the 2008 conference be held in the Western Cape providing that the necessary sponsorship could be found so that key YWG members from the northern provinces could travel down to Cape Town.