Friends of the South African Institute for Aquatic Biodiversity

Ichthos

June 2004, Issue Number 74

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Telemetry – a means to investigate the lives of fishes underwater

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Fish movements are mostly studied using traditional techniques that involve marking (tagging) and releasing a fish, then recapturing it at a later date. This method, however, only provides two data points: where the fish was initially tagged and where it was recaptured. Consequently, all movements of the fish between those two points, which could be days or even years, is lost. Besides conventional tagging, scientists have also used diving observations and even submersibles to study fish movements. Unfortunately such techniques only yield data for short periods, and due to disturbance can influence the behaviour of the fish under investigation.

Underwater telemetry (the wireless transfer of data from one place to another) enables fish researchers to track the movements, behaviour and activity patterns of individual fish equipped with transmitter tags. The use of this technology provides a means to collect continuous data for extended periods, up to years, and investigate the lives of fishes in their natural habitats. The type of aquatic telemetry system used depends on the environmental conditions in the area of interest. For example, radio signals are best transmitted in freshwater, while acoustic (sound) signals are required for studies in sea water and estuarine environments. In some cases acoustic telemetry is used for freshwater applications, particularly in water with high conductivity and/or deep lakes. Radio telemetry systems commonly make use of antennas to establish "listening" zones for signal detection, whereas acoustic systems use hydrophones for the same purpose. Detected signals are then relayed to a receiver, which vary immensely from straightforward manual receivers to advanced data collection computers that combine data logging, data interpretation and automatic receiver control in a single unit. The signals are conveyed via transmitter tag, which can either be pulsed or digitally encoded. Pulsed signals – producing the familiar "beep-beep-beep" – provide identification of the tagged individual through the use of tags with unique frequencies. By contrast, digitally encoded tags transmit a unique numerical code that separates it from other tags. The advantage of the digitally encoded tags is that many fish (carrying different coded tags on the same frequency) can be studied at the same time.

Paul Cowley on the boat & a grunter which was caught

Researchers can either manually track the movement of the tagged fish, or use a network of receivers moored in the water to automatically monitor the data transmitted from the tags. Manual tracking usually employs pulsed pingers that emit a signal every few seconds; allowing the researcher to continuously track the real-time movements of the fish underwater.

Acknowledgements

Editorial Team
Margot Collett
Lee-Ann Fargher

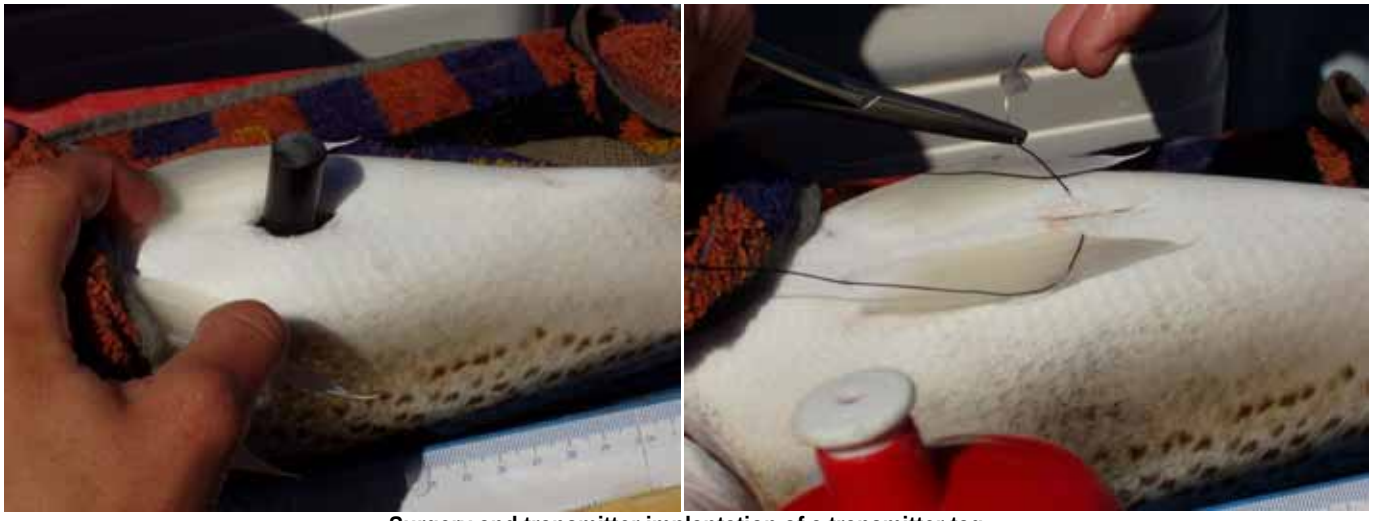
Printing
Dupli-Print Litho. CC.

Guest Scientific Editors
Tor Naesje
Paul Cowley

Sponsorship
I&J

Production, Layout and Design
Lee-Ann Fargher

ISSN 1011-7490

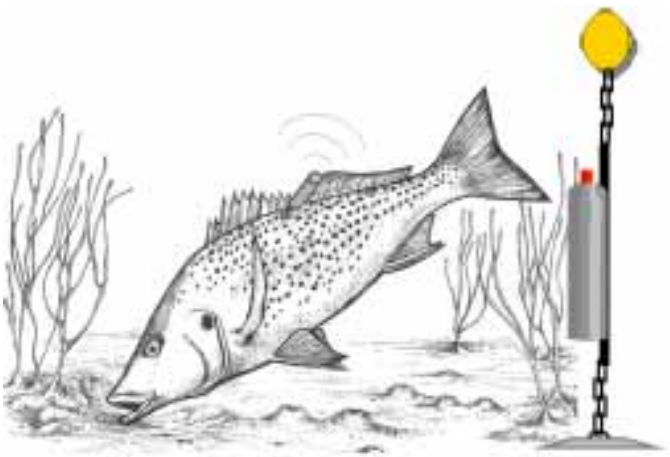


Surgery and transmitter implantation of a transmitter tag

Unfortunately these tags have a short battery life (up to six weeks) due the frequent pinging. Data logging receivers moored in the water automatically record and store signals from tagged fishes within their detection range (see diagram below). These receivers make use of digitally encoded tags that transmit signals less frequently, allowing for extended battery lives (up to a year or more).

With the rapid advances in telemetry a wide range of transmitter types is now available. For example, tags can be equipped with various sensors that allow the recording of external and physical parameters like temperature, salinity and depth. Other sensors can measure internal and physiological parameters like muscle activity and heart rate. Another recent development is the GPS tag, which uses the Navstar Global Positioning System (GPS) to provide an accurate position of the tagged animal. A requirement for using GPS tags is that the animal breaks the water surface, to allow the tag to communicate with satellites. These tags are unfortunately large and their use is therefore restricted to animals such as sharks, whales and turtles. Other tag types include data storage tags (DST) or archival tags and Passive Integrator Tags (PIT). DST tags can store large amounts of information in a small processor within the tag. The stored data can later be downloaded to a computer after tag retrieval or conveyed wirelessly to a remote receiver (commonly referred to as CHAT technology). PIT tags are tiny identification chips that are injected into animals for later identification. The chip is read by means of a reader (e.g. a wand that is waved over the fish), which provides the unique code (number) of the tag. The advantage of PIT tags is their small size (ideal to study small fish), while their disadvantage is the short reading distance (less than 1 m). Telemetry transmitters can either be attached externally or implanted into the fish (internal tag). Internal tags are either surgically implanted (see photo below) into the abdomen after capturing and anaesthetizing the fish, or fed to the fish with food. Surgical implantation is more difficult but the tag remains inside the animal, while ingested tags can be excreted.

The application of telemetry research in aquatic environments is extremely diverse. This research tool has been successfully applied to investigate human impacts on aquatic environments, such as the effects of pollution, fish-ways, weirs and hydroelectric power stations. As a tool for biodiversity research, telemetry studies have investigated the interactions between alien and native species, and assisted with the planning and evaluation of conservation measures. Telemetry research has also been applied within the aquaculture industry to optimise commercial production, assess fish welfare (health) and the environmental effects of aquaculture. The management and sustainable utilisation of fishery resources has also benefited from telemetry research (see below). Clearly, telemetry is a valuable tool for scientists to study aquatic organisms in their natural habitats and probably the most effective way to study:



A spotted grunter (with external transmitter) and an automated data logging receiver

- Where animals reside, their position and presence
- Movement, activity patterns and migration patterns
- Habitat utilisation and preferences
- Swimming speed and duration
- Temporal and spatial activity patterns
- Home range size and area use
- Individual variations within single species
- The effects of, and preferences for, different environmental parameters (e.g. temperature & salinity)
- Behavioural responses to environmental changes (e.g. floods)
- Physiological parameters (e.g. heart rate)
- Effects of manmade constructions (e.g. dams and weirs)
- Effects of human activities on behaviour, survival and productivity
- Interactions between different species
- Effects and management measures

Telemetry as an important management tool to study fishery species.

Example one: Radio telemetry in the Zambezi River.

The successful management of freshwater fisheries depends on a good understanding of the fish migrations and habitat preferences in often complex and variable ecosystems. Management tasks are often complicated when rivers, such as the Zambezi River, form borders between states. Large rivers also often flow through several countries, illustrated by

the Zambezi River that flows through Zambia, Angola, Namibia, Botswana, Zimbabwe, and Mozambique. Fishes can therefore move freely between states as a common resource.

Studies of the movements and habitat utilisation of fish tagged with radio transmitters in the Upper Zambezi River were, therefore, initiated by the Namibian Ministry of Fisheries and Marine Resources in collaboration with The Norwegian Institute for Nature Research (NINA). The movements and habitat utilisation of tigerfish (*Hydrocynus vittatus*), nembwe (*Serranochromis robustus*) and threespot tilapia (*Oreochromis andersonii*) were studied. All three are popular recreational angling species and important in the floodplain subsistence and commercial fisheries. Today NINA and SAIAB are partners in promoting telemetry as an important management tool in Africa.

Telemetry studies in the Upper Zambezi River aimed to investigate the movement behaviour and habitat utilisation of important fish species, and their implications for the management of subsistence and recreational fisheries.

To obtain the information on their movement behaviour 15 tigerfish (body length 30 to 54 cm), 13 nembwe (32 to 40 cm), and 6 threespot tilapia (25 to 50 cm) were tagged in the Upper Zambezi River, 25 to 60 km south of Katima Mulilo in Namibia. The study lasted for 6-7 months before and during the flood in the summer of 2000. The fish equipped with radio tags were manually tracked and on average positioned every 4th day. The radio tags used were attached externally below the dorsal fin of the fish.

The movement patterns of the three species differed considerably. The nembwe was the most sedentary (stationary) species, while tigerfish displayed extensive movements and the threespot tilapia revealed intermediate movements. Average distance moved between tracking surveys was 16 times longer for tigerfish (1447 m) than for nembwe (93 m), and 4 times longer for threespot tilapia (391 m) than for nembwe. Mean length of the river stretch used by the fish was 14 times longer for tigerfish (18.8 km) than for nembwe (1.3 km), and 4 times longer for threespot tilapia (5.4 km) than for nembwe.

Most riverine cichlid species are regarded as having a highly resident life style. Although systematic migratory patterns were not demonstrated in this study, the cichlids displayed considerable movements, especially the threespot tilapia. Thus, the large riverine cichlids may not be as highly resident as previously suggested. The results also indicate that adults of all three species were more associated with vegetation than previously assumed, although tigerfish to a lesser extent than threespot tilapia and nembwe.

This study provided fisheries managers with important information on their fish resources. Co-ordination of local and regional management regulations is recognized as being important to sustain fisheries and protect the fish resources. In rivers that flow through or border on several countries such as the Upper Zambezi River, multilateral management regulations are needed, especially for management of migratory species such as the tigerfish, and for other fish species that frequently cross the river into neighboring countries, as all the three species studied. However, tigerfish may be less vulnerable to high exploitation in a specific area than the more resident species (nembwe and threespot tilapia), as it is more likely that a locally depleted population can be re-colonized by fish from other areas.

Management regulations are often implemented with the use of gear and fishing effort restrictions, and introduction of sanctuaries and no fishing periods. In the Upper Zambezi River, local stocks of nembwe and threespot tilapia will be depleted if the fishing mortality exceeds their local carrying capacity. In addition to gear and effort restrictions, sanctuaries within areas with high fishing pressure will protect resident fish such as nembwe. Threespot tilapia may require larger sanctuaries for protection, since they seem to utilize larger river stretches. Small sanctuaries, however, will not protect the long-distance moving tigerfish.

The most important results from the radio telemetry research in the Zambezi River is that tigerfish, nembwe and threespot tilapia are international resources, and management regimes need to be harmonized to secure a fair distribution among stakeholders and sustainable utilization of the fish resources. This is presently a prioritized task among fish managers and researches in Namibia, Zambia and Botswana, countries bordering the Upper Zambezi River.

Example two: Acoustic telemetry in the Great Fish River

Many important coastal fishery species spend a portion of their lives in estuarine habitats. During this estuarin- dependent phase of their lives, some species are heavily exploited for food (subsistence) and recreation. Due to the poor status of many estuarine-associated fish stocks, the sustainability of these fisheries is questionable. It is therefore urgent to provide sound management advice based on knowledge of the population biology, habitat use and migratory behaviour of the targeted species.

An acoustic telemetry study investigating the movements and migrations of important estuarine fisheries species, namely spotted grunter (*Pomadasys commersonnii*) and dusky kob (*Argyrosomus japonicus*), was initiated in the Great Fish River estuary in 2003. The aims of the project are to investigate the movement behaviour, periods of estuarine residency and habitat utilisation of these species. In addition, the project researchers will collate fishery statistics and angler catch data with the observed daily movements of the fish in order to assess their vulnerability to local depletion. Ultimately the findings of this study will assist in developing a sustainable exploitation strategy for the different fishery sectors (subsistence and recreational) on the estuary and contribute to the overall management of these important fishery species.

This study makes use of an array of automated data logging receivers, which were placed in the estuary to provide information on the presence (or absence) of tagged fish in different regions of the estuary. To obtain high-

resolution positional data on each individual, researchers manually tracked the fish from a boat equipped with a hand-held hydrophone attached to a receiver. To date, 20 juvenile spotted grunter, 20 adult spotted grunter and 30 juvenile dusky kob have been tagged with acoustic transmitters in the estuary.

Results from the study on juvenile spotted grunter, conducted between 7 February and 16 April 2003, revealed that one individual migrated to the head (freshwater) of the estuary, five individuals remained within the estuary for the entire period, while seven fish migrated into the marine environment (sea) and did not return. The remaining seven fish most likely also migrated to sea or were captured by anglers fishing in the lower reaches of the estuary. The movements of individuals, while in the estuary, displayed large variability. Some fish were sedentary and revealed very little movement (less than 500 m) away from the initial catch and release site, while others moved as far as 12 km away from the release site. However, most fish used between four and five kilometers of the estuary over the entire study period. There was a strong correlation between the area of high utilisation by juvenile spotted grunter and the distribution of anglers on the estuary. The analysis of this spatial data suggests that juvenile spotted grunter are vulnerable to over-exploitation during the estuarine dependent phase of their lives.

British Petroleum – one of the world's leading energy businesses - have a progressive policy on environmental awareness, research and education, and recently pledged a donation of R50 000 to support the SAIAB/NINA telemetry project on estuarine fishery species.

Mr Merrick Dunster – corporate affairs manager of BP southern Africa - recently met with Drs Paul Cowley and Tor Næsje and Ms Amber Childs to discuss the objectives and significance of the SAIAB/NINA telemetry project. At this meeting it was noted that the project was worthy of financial support from BP's corporate social investment fund because of its potential to yield multiple benefits. These include management and sustainable utilisation of estuaries and their fishery resources, local community and public involvement and the education and training of students.

The funds will be used to augment ongoing research projects and improve our understanding on the movement behaviour of important estuarine fishery species (namely spotted grunter and dusky kob) using acoustic telemetry techniques.

The project aims to describe the distribution and movement patterns of individual fish in relation to their changing physical and biological environments on daily and seasonal scales. In addition, the fish telemetry data will be compared with data on the distribution of fishing effort in the estuary to assess their vulnerability to overexploitation. The findings of this research will provide fisheries managers with information needed to ensure an equitable distribution of fishery resources among the different user groups and assist with the development of sustainable estuarine fisheries.

Sources of information:

Thorstad et al. 2003. Space use and habitat utilisation of tigerfish and two cichlid species nembwe and threespot tilapia in the Upper Zambezi River. Implications for fisheries management. NINA Project Report 24. (email: eva.thorstad@nina.no)

Biotelemetry- a versatile tool for aquatic management and research. Booklet published by Norwegian Institute for Nature research. (email: tor.naesje@nina.no)

Farewell to the Old Gaol

Margot Collett, SAIAB: M.Collett@ru.ac.za

After much negotiation between the South African Institute for Aquatic Biodiversity (SAIAB) and the Knysna Municipality, the Angling Gear Collection, which has been housed in the Old Gaol Complex for the past 10 years, has been packed into storage.

The Knysna Angling Museum was opened to the public in July 1993 with a view to tracing the history of various fishing methods and angling tackle over the decades and to raise levels of public awareness about the aquatic environment. Prof Mike Bruton, at the time Director of the JLB Smith Institute, initiated the development of the angling gear collection as a means to inform people and to encourage long-term responsible angling. Many Knysna residents, and others further afield, loaned and donated items of interest and value to the collection which grew to represent a great variety of historical and more modern angling equipment. A coelacanth display, which included the 'Pik Botha' coelacanth specimen and exhibitions on the history of coelacanth research, added an unusual element to this collection. This specimen has subsequently been returned to SAIAB for curation in the National Fish Collection.

An indigenous fishing display

Old fishing rods and reels

In March 2000 the Municipality and SAIAB agreed to keep the collection on display in the Old Gaol for a further two years, and so by the end of 2002 the time had finally come to find another home for the angling collection, which needed to be a suitable and financially viable option. After another year and more negotiation, it was the Thesen Island Development Company (TIDC) who agreed to take custody of the Collection that will ultimately be exhibited in the Environmental Science Centre on Thesen Island, presently being designed and built.

SAIAB Collections Manager, Victor Clarke and myself, assisted by Picca de Bruin of The Muse Factory (company moving into the Old Gaol) spent a few days in February at the Old Gaol compiling a detailed inventory of the Collection before Stutterford Van Lines packaged and removed the display for storage. SAIAB donated the original display cabinets to the Knysna Municipality for their use in other museum displays.

Aquatic anecdotes from the Otter Trail

Ofer Gon, SAIAB: O.Gon@ru.ac.za

On Friday 13 February 2004 a group of hikers from Kenton-on-Sea and Grahamstown, including my wife Jenny and I, embarked on the Otter Trail. The 41 km long hike is one of the most popular in South Africa, starting in the Tsitsikamma National Park at Storms River Mouth and ending at the Nature's Valley village. During our five days of walking along this scenic coastline we did not see any otters, but we had several unusual encounters of the aquatic kind. Members of our group reported dolphin sightings almost every day, but then dolphins are commonly seen along this stretch of coast.

On the morning of the second day of the hike, after the long climb from the Ngubu Hut, I stood at the top of the cliff letting the cool breeze dry the sweat off my face. Looking at the large, flat blue surface of the calm sea below me my eyes came to rest on a crescent-shaped area of white water a fair distance out to the west of where I was standing. My instinctive thought was of waves breaking over rocks, but there were no rocks to be seen and it was far enough off shore that no waves would be breaking over submerged rocks in such calm conditions. A second look established that the splashes of white were too irregular to be waves and, astonishingly, the area was moving eastward at a good pace. It was a large school of fish with the leaders breaking the surface. Surprisingly, there were only a couple of seagulls flying over the shoal. By the time Jenny joined me, some 15 minutes later, the shoal was already well east of our position, traveling a distance of about one nautical mile in that period of time. I have never seen a shoal of fish moving at such speed. Some of the fish came closer to shore for a short while and we could see that they were fairly large, close to 1 m long, and swimming close to the surface. Unfortunately, we were too far above the sea to try and identify them. The large size explains the absence of birds, the fish were simply too big for them. Although positive identification was impossible, the size and the speed of the fish point to the family Scombridae (tunas, mackerels, bonitos). Indeed, schools of the Atlantic bonito (*Sarda sarda*) are known to occur along the south coast at this time of the year and it may have been this species.

The day's hike ended at the Scott Hut that comprises two wooden structures each sleeping six hikers. The huts were situated just above the pebbly beach of a small shallow inlet. The mostly rocky bottom of the inlet gave the water a dark blue colour. We dropped our packs at the huts and jumped in the water to cool off and let the gentle swell rinse the sweat off our bodies. Later on, in the dim light of the early evening we were sitting around the fire we had started in front of our hut when we heard shouts from the other hut calling our attention to the inlet. Looking in that direction we could see several dorsal fins moving slowly through the water in the nearshore. I joined the other guys on the rocks and soon enough several small sharks swam past us with their anterior dorsal fin breaking the surface. There were about 10-15 individuals slowly circling around the eastern, rocky side of the bay. We watched them until darkness and went back to the hut. Everybody was excited and wondered what they were, but we could only guess. The sharks were about 0.8-1 m long, dark grey on top with no other markings, but we could not see the colour of the lower part of the body due to the poor light conditions. The snout was rounded and the first dorsal fin was distinctly larger than the second, but it was impossible to tell whether or not there were spines in front of these two fins. The caudal fin was heterocercal, the dorsal lobe almost horizontal and with a distinct sub marginal notch. The smooth-hound shark (*Mustelus mustelus*) fits this description.

Magnificent views in the Tsitsikamma National Park

On the next day our party spread out as we walked along the rugged coastline. The next time we all met was at the wide lagoon of Elandsbos River Mouth, an ideal place for a swim that nobody missed on. We exchanged experiences and two of the hikers reported having seen what they believed to be an elephant seal in one of the gulleys along the trail. The seal was lying on its back with the flippers up in the air and every so often raised its head. They were too far to be able to discern details of the characteristic snout of the adult male of this species, but the size they described left no room for doubt. Elephant seals are rarely seen along our south coast and they are as much as four times larger than the local Cape fur seal. So this was indeed an unusual and rewarding sighting. The same two hikers also reported seeing two anglers on the rocks somewhere along the same section of the trail. These fishermen were clearly breaking the law as no fishing is allowed within the boundaries of the Tsitsikamma National Park.

We came across another sign of illegal activity on the fourth day of the hike. The crossing of the Witels River was in stark contrast to our previous river crossings due to the unsavoury presence of plastic refuse. It was obvious to me that people upstream were dumping garbage in the riverbed and floods carried it down to the coast. This was the only time we came across pollution on the hike. Still on environmental concerns, we also noticed several pine trees in the fynbos, which must have originated from the commercial plantations bordering on the Tsitsikamma National Park. Black wattle was found on the banks of the Lottering River a short distance upstream from the mouth. While these individual sightings do not at present represent any threat to the indigenous vegetation they should be eradicated before they become one.

While the hiking is at times tough, particularly with a heavy backpack on one's back, the natural beauty of the Park and experiences like ours make the hike a highly rewarding experience.

The Pendulum Swings

Paul Skelton, SAIAB: P.Skelton@ru.ac.za

At present scientific opinion is that the world's biodiversity is in crisis. The crisis is all about the impact of humanity on the earth and its life-sustaining systems. Simply put, there are too many people exploiting renewable and non-renewable resources in ways that are not sustainable. In spite of this overwhelming crush of humanity on biodiversity some life forms seem to display extraordinary resilience and tenacity. That is one aspect I want to describe in this article. Another aspect I will raise concerns the changing perception of natural diversity that in its progress science brings to humanity. Both examples derive from the same experience – namely encountering two remarkable fish species in a tiny stream on the flanks of Table Mountain in the very heart of affluent Capetonian suburbia.

Bob, Jim & Ernst fishing for specimens

Kirstenbosch Botanical Garden is South Africa's premier botanical showcase – and forms part of a barrier to the ceaseless encroachment of suburbia on the mountain slopes of the Cape Peninsular. One of many small streams from the mountain arises in the gardens and adds a welcome element of a water feature to its floral splendour. This stream is a source of the Liesbeeck River, a system that in its lower reaches has long-since given up the struggle to be natural and exists for large part only as a canalized concrete sewer. However, on leaving Kirstenbosch the stream passes first under a road and a row of houses and then opens up in a relatively undeveloped park before again being confined to a concrete channel. In this short stretch within the park below Kirstenbosch the stream still retains its own bed of rocks and gravel.

During a recent visit to Cape Town I met a small team of ichthyologists including Dr Bob McDowall from New Zealand, Dr Jim Cambray from the Albany Museum and PhD student Ernst Swartz, in this park to collect the Cape Galaxias, a tiny fish species found only in the coastal streams of the southern and south-western Cape. The Cape galaxias is unique in Africa, but there are other species of this fish family in South America, Australia and New Zealand. Within the Park where we gathered, the stream braids into two channels, but one of these, where I had seen galaxies previously, was completely dry. The remaining channel was flowing, but was no more than about half a metre wide in most places. It suffers from the scourge of human interference – all sorts of junk, alien weeds and plants, and even secretively laid pipes for pumping out water for the gardens of neighbouring houses. The sorry state of the Liesbeeck River is well described in the book 'Vanishing Waters' by Professors Bryan Davies and Jenny Day of the University of Cape Town. Given this state of affairs, it is amazing that we actually found some living specimens of Cape Galaxias, and, even more surprisingly, we also collected two specimens of the Cape kurper, another larger fish species that Dr Cambray has been studying intensively for many years.

This discovery of the Cape kurper is what really got me excited, for, as far as I am aware, the species has not been reported from the Liesbeeck River since Dr Keppel Barnard wrote about it in 1943 – over 60 years ago. So here, in a tiny refuge in the heart of posh Cape Town, we found two indigenous species hanging on by a thin thread – and with that tenacity we have a better chance to understand what such isolation and reduction in population size might actually mean in terms of the impact on genetic diversity. The sheer surprise that any fish species might survive under such stressed circumstances for so long is utterly remarkable. At once the value and importance of small sanctuary streams for threatened species speaks for itself.

At present there is only one species each of Cape galaxias and Cape kurper recognized. However, recent genetic studies carried out through the University of Pretoria have shown that both the Cape galaxias and the Cape kurper are in reality more complex entities, with several species involved. Thus it is probable that the forms (species) found in the Newlands stream are actually much more restricted and threatened than we currently accept. They may therefore be species deserving of considerably greater conservation attention than either has yet been given. The new Biodiversity Act in South Africa is about to become law and focuses, among other things, on threatened species and on invasive alien organisms. The Act will bring a new organization into being – the South African National Biodiversity Institute to oversee the implementation of the Act. The new SANBI will be derived from the National Botanical Institute (NBI) under which Kirstenbosch Garden is part. For freshwater fishes, the new SANBI may have a problem to solve right on their doorstep, so to speak.

***Sandelia* sp.**

Letters to Ichthos & SAIAB Scientists

Lee-Ann Fargher, SAIAB:
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Hi
I am not sure if you will be able to identify this for me. I was diving in Pemba (Northern Mozambique) amongst thousands of jellyfish, when this unusual jelly swam past me. The photo was taken with a 1:3 macro lens, to give an indication of size.
Regards, Paul Mullon
Marketing Director
Metrofile (Pty) Ltd

**

Dear Mr Mullon,
I know very little about jellyfish so I sent your photo to my friend Dr Bella Galil in Israel.
She replied as follows:
' the handsome jellyfish is *Mastigias papua* (lagoon jelly or spotted jelly), but I would use *Mastigias* sp. as there are probably several species hiding under that name. It usually swims near the surface (symbiotic algae need the light), in lagoons and near shore. Known to occur off east Africa' - Phil Heemstra (P.Heemstra@ru.ac.za)

**

Hi Phillip
Many thanks for this. As an old Rhodian (1980-1984), I am thrilled to see you guys still leading the field.
Regards Paul Mullon

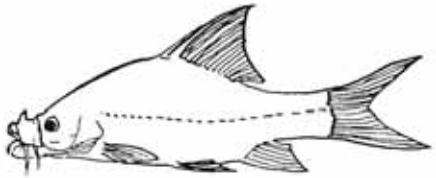
A Story from a friend in Holland! J Loscher

Have you heard of the Klaas Witkampvissies ?
To tell you how the Klaas Witkampfish got his name I have to take you way back. It was in the year 1938 or 1939 when I was a boy of 6 or 7 years old. In those days just before the great war there were few jobs and little money. My father, who was an engineer aboard a steamship, was lucky to have found a job ashore. But he loved the sea and did not like living on the land.
On Sunday mornings after we had breakfast, I always asked him about the life aboard ship and the adventures he experienced. And yes, being a sailor he had plenty stories to tell me. Whether or not they were all true, I cannot say, after all he was a sailor. My mother called them jokingly, the 'Sundaymorningtales'. One of the stories I remember well goes as follows:

In his cabin, aboard ship, he had three large aquaria made of iron with only a front window of glass and a small opening on the top, to prevent splashing and spilling of water. That left him very little space to live in. But it was cosy by the light of those fish tanks.
When they were in foreign harbours and he could leave ship, he contacted local fisherman and went fishing with them in their little fishing boats made of hollowed trees.
He gathered those fishes for friends in Amsterdam, who were a professor of ichthyology and his students. One time during a big storm they had to seek shelter in a very small port somewhere in Africa. After the storm had died down he, of course, went fishing in the river delta with some newly made fisherman friends to gather fishes for his aquaria. This time in this river delta in Africa he did catch a dozen shiny little fishes he had never seen before. They were friendly little fishes and did not disturb the other fishes in the aquarium.
The sailors, who visited my father after work in his cabin, admired his fishes, drank lemonade and talked about home, their wives and girlfriends. They were impressed by the looks of the new fishes, so different from the other fishes, with their very high foreheads and shape of a silver guilder, which was a Dutch coin. After work there was little to do, so the fishes were very popular and everybody came to look at them. Everybody except the captain and the first mate. The captain did not come because he was the captain, and the first mate, Mister Klaas Witkamp, did not come because he was a man who spent all of his spare time reading books, wearing large round reading glasses.

One day however, quite unexpectedly, the captain entered the crowded cabin, looked at the fish tank and with a loud voice he uttered "I'll be darned, Klaas Witkampvissies!" And yes, everybody saw it, these fishes looked very much like Mister Witkamp, they had the same round eyes and the very high forehead. Everybody agreed. Since that day, whenever we see strange fishes, we do not know the name of, we call them Klaas Witkampvissies. Maybe, just maybe, their real name was *Barbus mariae*, or rhinofish, that lives in Kenya.
A fish good for angling and eating, a pity, because it is rather slow breeding and it may take more then 12 years to double a population.

Greetings from Amsterdam Holland, Aquarianer



Barbus mariae

Surveys of the Upper Zambezi River system

Denis Tweddle, Research Associate of SAIAB: D.Tweddle@ru.ac.za

Exploring the Upper Zambezi River has long been a dream for the freshwater ichthyologists in SAIAB. The Zambezi is an enormous river system bounded to the north by the even larger Congo system and to the south by smaller southern African rivers. For those of us interested in the distribution and relationships of fish species throughout central and southern Africa, the opportunity presented to us to go and explore the Upper Zambezi was a dream come true.

Five countries, Zambia, Angola, Namibia, Botswana and Zimbabwe, share access to the natural resources of the Upper Zambezi River. The Upper Zambezi is defined as the river from its source in Zambia very close to the Democratic Republic of Congo border down to Victoria Falls. Below the falls the river has several major differences in fish fauna and is classified as the Middle Zambezi. The African Wildlife Foundation (AWF) is assisting the four countries that meet on the river at the tip of the Caprivi Strip to coordinate management of the natural resources in that area in an initiative appropriately called the Four Corners Project. The fifth country sharing the river, Angola, is not yet in a position to join the programme as it has other urgent priorities.

The fish component of the project has two aims. The first sub-component is coordination of fisheries research and monitoring with harmonisation of methodology. The responsibility for coordinating and managing the second sub-component, an assessment of the biodiversity in the system, has been given to SAIAB.

A 2 kg specimen of nembwe, *Serranochromis robustus jallae*, caught on a spinner

When the river level was at its lowest. Our first, largely exploratory survey was conducted over four weeks in October/November 2002 at the end of the dry season.

Together with Ben van der Waal, professor at the University of Venda and a long time associate of SAIAB, we drove north through Botswana and Northern Zimbabwe to Victoria Falls, where AWF has its main office. There we met up with Paul Skelton, Managing Director of SAIAB, who flew up to join us there. After meeting with our AWF colleagues, we headed west through Botswana and the Caprivi Strip in Namibia into Zambia, where the tarmac road ended and our bush driving adventures began. The "road" from the border at Katima Mulilo up the western bank of the Zambezi to Senanga at the southern tip of the Barotse Floodplain is as clearly marked on the map as the tar roads negotiated earlier. The similarity ends there. The 200 km stretch took seven hours to cover and we were grateful for the high ground clearance of our bakkie, while the trailer, with its lower ground clearance, was light enough to drag through deeply-rutted sand on its axle.

About 40 km before we reached Senanga we had to cross the Zambezi on a pontoon ferry at Kalingola. This was the first of four river crossings during our survey at that point.

In Senanga we began a round of meetings with senior government officers that seemed never-ending as we were itching to get on to the river and start catching fish. Going through the formalities, however, has long-term benefits to the programme as everyone in the area will know what we are up to, when it comes to our future visits. From Senanga we travelled north to Mongu, this time on a pot-holed tar road.

Our goal during this first part of the survey was to get as far north as possible and sample on the way back south to Victoria Falls. We had one week in the field, after which we were going to spend a week at Victoria Falls holding a workshop on sampling and identification of fishes for participants from the Four Corners countries. We would then return to the Barotse Floodplain for two more weeks sampling before returning south. We had expected to reach the source of the river north of Mwinilunga, but it soon became clear that we would not be able to reach our goal in the time available. From Mongu, we needed to travel to Lukulu.

Leaving Mongu at mid-day after the inevitable round of government meetings, we

Getting ready to cross the Kabompo River

forded a river on to the floodplain and drove slowly north on sandy tracks, using four-wheel drive and rarely getting above second gear. At dusk we were still well short of Lukulu and camped on the riverbank. This was a wonderful choice of campsite, because when we got up in the morning we realised we were camped at an eddy in the river that looked very fishy. I set up my spinning rod before breakfast and cast out a small Mepps spinner. Four casts later I had landed four three-spot bream, *Oreochromis andersonii*, between 1.8 and 2.6 kg in weight, and I caught six in total before we packed up camp and headed north again. From Lukulu we travelled to Kabompo, which is an administrative town situated on the Kabompo River, a large tributary of the Zambezi. *En route* we crossed the Kabompo River on another ferry, operated by hand-pulling the boat across on a wire cable stretched between the banks. Each ferryman ingeniously used a club-like piece of wood, into which was cut a deep groove that fitted over the cable and gripped it when held at an angle. Starting in the bows of the boat, each ferryman would grip the cable and walk backwards to the stern, then release the cable and start again from the bows. The boat could thus be hauled across without the ferrymen developing large callouses on their hands.

From Kabompo, we were at last able to start sampling. A small stream, the Maninga River, yielded many small and very interesting

species, including an undescribed small spotted barb. We then drove north alongside a large open dambo (a swampy stream course created by impeded drainage). Realising we would not reach Mwinilunga, we stopped to sample the swamp and then headed back south. The swamp was fascinating. We stopped where an elderly woman had cleared some of the vegetation and fished in the pool she had created using an open basket. We inspected her catch and then fished ourselves with dipnets. We caught most of the species she had but had to resort to bartering with her, using eggs we had intended to eat for supper, to obtain specimens of the fishes she had caught that we were unable to catch. On leaving the water, both Ben and I discovered our legs were covered in blood, oozing from very small wounds. We realised we had been feasted on by leaches, which inject anti-coagulant into the bite marks they create, and it was several hours before our wounds stopped bleeding.

Fish were surprisingly scarce in the Kabompo River itself and in future visits we intended to examine this river in other areas to try to determine the reason for the fish scarcity. It was certainly not due to heavy fishing activity.

Having failed to reach Mwinilunga, solely because of the state of the road, we headed back south and reviewed our proposed future sampling programme. To sample the northern tributaries effectively as well as the main floodplain, we realised we needed to include several days travelling time as well as enough time to sample the extremely diverse habitats we found on the trip. We therefore had to change our plans to include two 6-7 week trips, instead of three shorter ones.

Encircling a grounded mat of vegetation on a sandbank, a very productive fishing method.

On the trip south we sampled a number of different habitats, one of the most interesting of which turned out to be the rocky rapids below Sioma Falls on the main river. Here we caught four specimens of the unusual broadhead catfish *Clariallabes platyprosopos* which has an unusual flattened head and bulging cheeks. The specimens came from deep under boulders at the edge of the rapids.

Back in Victoria Falls, Paul left us to return to Grahamstown, but we were joined by Roger Bills, the Curator of Freshwater Fishes at SAIAB, who led the fish identification workshop. During the week we demonstrated the use of various fish sampling techniques on the river above the falls in the Zambezi National Park (with parks permission) and caught a wide variety of interesting fishes, including tiny juvenile tigerfish, *Hydrocynus vittatus*, less than 2 cm long. The adult tigers we caught were very lean and had obviously recently spawned. In contrast, tigers caught further north on the floodplain were in much better condition, which seems to indicate that tigerfish do not breed at the same time throughout their range. The Victoria Falls area had unusual heavy rain a few weeks before, so this may have proved a trigger to spawning. Apart from the fish, we also caught a 2 m crocodile, which tangled its teeth in our gillnets and unfortunately drowned.

At the end of the week we headed west and then north back up to Senanga. We were accompanied on this part of the survey by two other vehicles, from the Namibian and Botswanan government fisheries departments. For the next two weeks staff from all four countries joined us in the sampling programme.

We set up camp on a lagoon north of Senanga town and started our sampling programme on the main river and lagoons, using an inflatable boat and gillnets belonging to the Namibian Fisheries team. We also sampled smaller streams and drying lagoons. The number of fish species encountered rose rapidly and we observed lots of fishing activity, including some ingenious methods. Fishing in drying pools is very much a social activity and we were lucky to observe organised basket fishing parties.

Keeping a wary eye on the crocs

After five days in Senanga, we headed north to Mongu, sampling en route. One of the small streams crossing the road yielded one of our most exciting finds. Wielding a D-shaped dipnet in marginal vegetation, Ben caught several specimens of *Neolebias lozii*, all about 2 cm long and thus one of the smallest fish species in the world. This fish was only discovered recently and was described in 1993. It is related to the Congo species. We preserved some tissue samples for genetic analysis in future to determine the species' relationships.

After a night camping in hotel grounds in Mongu, we headed across the floodplain, past the Litunga's (the king of Barotseland) dry season palace at Lealui, to the main river near the Kalabo ferry crossing. Here we set up camp under a large thorn tree, temporarily driving off numerous roosting openbill storks, unfortunately unavoidable as the tree was the only patch of shade for miles around. We recruited local villagers to clear the undergrowth and particularly the thorns, the latter an essential task as we were sleeping on airbeds during the expedition.

Our sampling in this area yielded several species we had not seen up to that point. Some cichlid specimens need further careful examination to identify them and ascertain whether we have discovered a new species. A very productive sampling method was to go to extensive shallow sandbanks where clumps of floating vegetation had grounded and encircle the vegetation with a small, fine-meshed seine. By removing the vegetation from the net we eventually ended up with the fish that had been sheltering in the vegetation

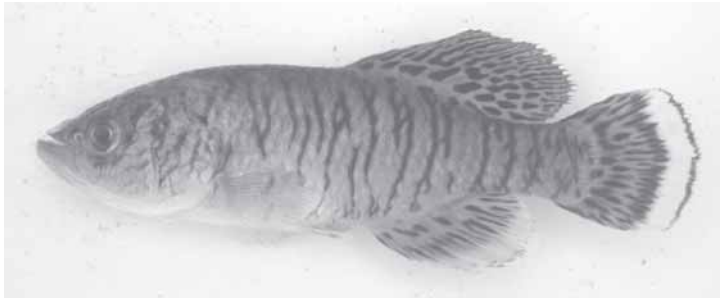
roots trapped in the net. The bulk of these were squeakers (*Synodontis* sp.), but this also proved our most successful method to trap various mormyrids, including *Hippopotamyrus ansorgii*, which had previously eluded us. Needless to say, while wandering around out on the sandbanks we had to keep a very wary eye open for crocodiles.

After several days at Mongu, our colleagues from Botswana and Namibia left to return home, while we spent a further day inland investigating forest lakes we had noted on the maps. These lakes are fascinating. The one that we sampled was several kilometers across but we could see no open water. The entire lake was covered by floating grasses. At the margins, in an area cleared by villagers to draw water, we fished with a D-net and caught the small, swamp-loving barb *Barbus brevidorsalis*, and the local villagers showed us snake catfish, *Clarias theodorae* and the blackspot climbing perch *Microctenopoma intermedium* which they had caught in baskets. The brief look at these lakes marked the end of this first phase of the project. From Mongu we headed south to Victoria Falls to brief AWF on our expedition, and from there it was back home to Grahamstown, dropping Ben off in Louis Trichardt on the way.

Fish trap and reed fence

The second survey took place at the peak of the flood in May 2003, and the river was very different. Prof. Ben van der Waal and SAIAB's collection technician, Punky Yose both accompanied me on this survey. We left Grahamstown on the 7th April to make the long drive up to Zambia. In Kasane, Botswana, we visited the AWF project headquarters, where we met Ernest Tshuma from the Natural History Museum of Bulawayo. Ernest is the technician who looks after the museum's superb fish collection from southern central Africa and SAIAB has had close ties with the museum for many years. We had invited Ernest to join us on the expedition to gain first-hand knowledge of the Upper Zambezi fish fauna and to learn more about our sampling technique, and we were delighted he was able to join us.

We first sampled several sites on the Chobe River at Kasane. The river here was functioning as a channel for the Zambezi floodwaters. The river was very high and we fished over flooded grass and bushes. We had company at one site in the form of a crocodile that lay basking on rocks while Ben fished with a D-net. We kept a wary eye in case the crocodile became interested in us.



***Nothobranchius* sp.**

From Kasane we drove into the Caprivi Strip and targeted two isolated pans known to Ben from his work in the area many years before. These pans are the home of the fascinating Caprivi killifish, *Nothobranchius* sp., which has still to be described. This fish is an annual species that lives for only a few months during the rains. It rapidly matures and lays its eggs in the mud. The pan dries out and the eggs lie dormant until the pan floods in the next rainy season. The eggs hatch and the life cycle is repeated. The first site yielded numerous large predatory insects and amphibians and apparently no fish. On sorting the catch later in Grahamstown, however, I discovered we had caught a tiny juvenile fish, still with its yolk sac. The second pan yielded a good catch of the stunningly beautiful killifish. The pan is in a woodland and is relatively undisturbed and well-vegetated, apart from a small cattle drinking area. The dirt road in the area has been rebuilt further away from the pan than previously and thus the fish population appears to be safe for the immediate future.

We camped at Mutemwa Lodge, a fishing lodge run by ex-Springbok rugby player Gavin Johnstone, and explored the river in the area more thoroughly than we had time for on the previous visit. The river level was still rising and this created a variety of new habitats as the river overflowed into low-lying depressions inland. It was fascinating to observe the wide variety of fishes that utilised the overflowing waters. One of the lodge staff built a reed fence with a fish trap across the overflow channel in about 15 cm of water. During the night it caught large cichlids that must have been swimming on their sides in the shallow water to get through into the pans behind. This illustrates the remarkable ability of fishes to colonise new habitats as they become available. Our sampling in the stream yielded a very diverse catch of over 20 species.

We visited Sioma Falls, but in the enormous volume of water we were unable to sample effectively and caught nothing. The high river level meant that the road between the ferry across the Zambezi and Senanga was washed away, and thus we had to make a major detour to get to the Barotse floodplain, retracing our route back through the Caprivi Strip and through northern Zimbabwe back into

Punky Yose on the Zambezi River

Zambia. We took the opportunity to sample the river in the Zambezi National Park, just above Victoria Falls, repeating the sample sites from the first survey.

Our route took us up to Lusaka before heading west on the long drive to Mongu. We crossed numerous small streams that we earmarked for future attention. At one of these we saw many women with fishing baskets and we stopped to watch them in action. They were intercepting an upstream migration of small, colourful *Barbus* species, probably on a breeding migration, and we bought samples of all the species. At the bridge there were four small meshed gillnets, one behind the other and all completely blocking the river. This shows how important fish are in the local subsistence economy in Zambia, even in areas far away from recognised fishery areas.

We arrived in Mongu, which is on raised ground at the edge of the Barotse floodplain, giving us a raised viewpoint over the plain. The change since our first survey was dramatic. In October, we looked out over a seemingly endless dry grassy plain. Now we looked out over an equally endless sheet of water, covered with patches of floating grass. We set out by boat in the late afternoon to camp on the main riverbank in the middle of the floodplain, having been informed that there were patches of raised land above the water level where we could camp. We arrived in the main river 1½ hours later at dusk to find no land in sight and thus nowhere to spend the night. Travelling downstream, we discovered the Kalabo ferry, abandoned for the duration of the flood, tied up to electricity pylons. Here we pitched our tents on the metal mesh deck and spent two very uncomfortable nights. Although the rainy season was over, everything was saturated with dew and our lights attracted swarms of insects, which covered everything on deck.

Fishing was very difficult on the floodplain because of the depth and strong currents, and because the fish were widely dispersed in the vast expanse of water. Our catches were very low and therefore we cut short our stay and headed back to dry land to explore streams and marshes around the periphery of the floodplain. Between Mongu and Senanga we concentrated on the Kataba River, where we had caught the tiny species *Neolebias lozii* on the first survey. We again found the species at the same spot by the main road bridge, but other sites in the river system and the large shallow swamp that forms the river's headwaters failed to yield any more specimens.

From our new base at Senanga we explored the floodplain. As at Mongu, the fish were widely dispersed and difficult to catch, but we did succeed in catching a variety of species where flooded villages created a diversity of shallow habitats.

Our most successful sampling took place along the flooded road south from Senanga. The road formed a partial barrier to the floodwaters pouring out over the submerged river banks into the floodplain beyond, creating numerous rapids and riffles. The road surface itself proved to be an excellent sampling site for those species that live in fast flowing streams over sandy/gravely beds, e.g. the barred minnow, *Opsaridium zambezense*.

Sampling along the flooded road south from Senanga

Small species, particularly small barbs, proved to be abundant around the edges of torrents flowing through culverts and many women took advantage of these concentrations to harvest the small species with bed mosquito nets. Glancing casually at the catch from these mosquito nets, the first reaction was to be horrified at the very small fish being caught. There were, however, negligible amounts of juveniles of large species in their catches. The women were exploiting very small species that are prolific breeders and abundant in pools and streams throughout the floodplain. The women's families would benefit greatly from their endeavours.

After several days sampling around Senanga, we set off for the long trek back to Grahamstown, initially heading in the opposite direction north to Mongu then due east to Lusaka. On this stretch we sampled the streams we had earmarked earlier. The Luampa River was most interesting, yielding over 20 species, one of which was a different species of the tiny catfish *Zaireichthys*. These tiny fishes normally live just buried in sandbanks in flowing water. The common species for the area was found on a small sandy patch, but just to the side we collected a more robust, darker brown species in vegetation streaming in the current. This species needs further study.

We camped on the bank of the river after our sampling and while enjoying our breakfast we had a visit from a large group of people from a passing truck. Word had spread that we were looking for a mythical creature with a human head and fish's body. Mermaids are apparently not limited to ocean folklore. Our visitors departed very disappointed after seeing our jars of tiny fishes.

Travelling back south, we dropped off Ernest in Bulawayo and spent a day in his museum checking through the Upper Zambezi collection to compare with our catches. We left Ben at Louis Trichardt and Punky and I eventually returned to Grahamstown.

The second survey showed that the flood cycle has an enormous impact not only on fish distribution, but also on the lifestyle of the human inhabitants of the floodplain. At high water, all the villages on the floodplain were flooded and almost the entire population had moved to dry land on the periphery. Nevertheless, the villages were not entirely abandoned. Some of the huts, although completely surrounded by water, still had floors a few cm above the water, and their owners continued to live there, with their belongings, such as live chickens, on the thatched roof or on raised platforms alongside. We even saw a maize granary built on poles standing in water but still full of the family's maize store.

The fish were very widely dispersed, but the fishermen, both male and female, adapted to the changes by fishing areas around the periphery of the floodplain where they could intercept breeding migrations of fish, particularly the smaller species.

Education Bus tour to the Western Cape

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Learners from Louterwater Primary with their playdough fish.

Celebrating Ten Years of Democracy - bus visit to Krakeelriver Primary

The Communications Division of the South African Institute for Aquatic Biodiversity in Grahamstown has returned from its most recent education bus tour. The outreach bus, called the Fantastic Fish Tank, traveled around part of the Eastern and Southern Cape from the 24 – 28 May 2004, stopping in small towns along the route so as to reach learners and educators. The aim was to take the 'fish tank' to those schools that have no means to visit the Institute, promoting an interest and awareness in science by communicating knowledge of fishes and aquatic environments. The Methodist Education Initiative donated the Toyota Coaster bus to SAIAB. Sponsorship to refurbish and equip the bus was received from the South African Agency for Science and Technology (SAASTA) and the Shuttleworth Foundation (TSF). This outreach programme was initiated a year ago when the education officer, scientists, science communicator, and other staff members of the Communication Division traveled to previously disadvantaged schools in rural areas around the Eastern Cape.

For the recent tour, the Eastern Cape and Western Cape Departments of Education, South African National Parks in Knysna and the Wilderness National Park in George assisted in selecting and contacting the visited schools in Uitenhage, Knysna, Wilderness, Misgund and Joubertina. Schools in George and Sedgefield, which contacted the Institute requesting a visit but could not be accommodated due to time constraints, were given educators' packs. These consisted of a Coast Care Fact File, educational and career pamphlets, activity sheets, a set of posters and other educational material.

The theme of the activities during the school visits was based on the adaptations fish have to survive in an aquatic environment. The programme included a power point presentation with colourful images of 'weird and wonderful fish'. This was followed by a hands-on display of fish from the Institute's National Fish Collection. Learners found this fascinating, as many had never even been to the sea, let alone seen the strange types of fish in the display. The presentation was followed by an opportunity for the learners to create their own creature from colorful playdough. They were asked to name their creature and write down why it had the adaptations they had given it, encouraging them to think about the lesson. A microscope was also set up to familiarize learners with the equipment, while looking at the gills and breathing organs of the threatened Eastern Cape rocky. Posters on Biodiversity, Fishes of the Eastern Cape Province, Coelacanths, Fossils and Careers were displayed. Educators each received educators' packs.

SAIAB's communication and education staff interacted with about 840 Grade 7-8 pupils and their educators.

The teachers commented that the activities and presentations complemented the syllabus (as many were busy teaching vertebrates) and that they had learned so much. They were very pleased to receive the teaching aids as they felt these would be helpful for current and future learners. The learners were happy that SAIAB had made an effort to bring science, education and fun to their schools!

Charles de Vos presenting 'Weird & Wonderful Creatures' to learnersfrom Joubertina Primary

Learning to use a microscope - Chris Nissen Primary, Knysna

ICEFISH Cruise encourages schools to participate

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An international research cruise, dubbed the *ICEFISH Cruise*, is presently underway in our Southern Oceans. The cruise has been organised through the North Eastern University in Boston, USA, with a number of countries being involved. The South African Institute for Aquatic Biodiversity (SAIAB) in Grahamstown, will represent South Africa. Dr Eric Anderson (with an interest in deep sea fishes) and Lukhanyiso Vumazonke (with an interest in marine shrimps) of SAIAB joined the research vessel at Punta Arenas (southern Chile). After a stop in the Falkland Islands, the cruise track continues to South Georgia Islands, South Sandwich Islands, Bouvet Islands, Tristan da Cunha, and ends in Cape Town on 17 July 2004.

The goal of the *ICEFISH Cruise* is to study the systematics and biology of Sub-Antarctic fishes that are related to the species of Antarctica. In addition, researchers on board the Research Vessel Nathaniel B. Palmer will obtain fish specimens and digital images for use in a second edition of the classic book, "Fishes of the Southern Ocean." They also hope to discover some new species!

The *ICEFISH Cruise* web site is http://www.icefish.neu.edu

Daily reports are being posted on the site, as well as photos of life on board the Research Vessel Nathaniel B. Palmer.

The organisers are using the ICEFISH site to encourage contact between school children around the world, fostering communication between schools in the US, UK, Germany, France, New Zealand, and South Africa. A number of schools are "participating" in the cruise via contact with the scientists and through use of educational materials posted to their web site. There are school curricula developed for the K-12 levels, ie from kindergarten through high school, college, and beyond. Among the activities during the cruise (17 May - 17 July), various investigators will be responding by email to student questions and comments. A group of Grade 10 and 11 learners from Victoria Girls High School in Grahamstown have joined the programme, communicating with the scientists on board and following the voyage of the Research Vessel Nathaniel B. Palmer.

Lukhanyiso Vumazonke of the South African Institute for Aquatic Biodiversity holds a skate that was collected near the Falkland Islands

Note: Copies of the book *Fishes of the Southern Ocean*, by Ofer Gon and Phil Heemstra are still available through SAIAB at R180.00 ($ 50.00). Please call Phumeza Mpambani at 046 603 5838 or email her on P.Mpambani@ru.ac.za.

Tiger reef-eel found at Aliwal Shoal: Fishwatch report

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Underwater photographer, Kobus Landsberg, recently photographed a tiger reef-eel, (a.k.a. leopard moray), *Scuticaria tigrina* (Lesson, 1829), at Aliwal Shoal. This is a new distribution record, as it was previously known south to Sodwana Bay. *Scuticaria tigrina* (formerly known as *Uropterygius tigrinus* in Smiths' Sea Fishes) is widely distributed from the islands of the eastern Pacific to Africa. It has been reported in the Western Indian Ocean from South Africa, Tanzania, Mozambique, Oman and Mauritius. The tiger reef-eel is an uncommon nocturnal species that is rarely seen. Kobus came across the Aliwal specimen at 15 m in a fairly strong north-south current. He said " It was swimming in the open and was not afraid of us at all".

Underwater picture of tiger reef-eel

Morays of the genus *Scuticaria* have a short rudimentary tail restricted to the tail tip. The upper and lower jaws are approximately equal, with the eye about midway between the snout tip and the corner of the mouth (rictus). If the anus is visible it is found well past the mid-length of the body. *Scuticaria* also have small, sharp teeth.

The moray eel most likely to be confused with the tiger reef-eel is the large-spotted snake moray, *Uropterygius polyspilus,* which has a strikingly similar colour pattern. The two are readily distinguished with specimens in hand by the anus of *S. tigrinus* being more than two-thirds the total length from the snout and by it having the inner row of teeth extending only about halfway back in the jaw. *U. polyspilus* has its anus about mid total length and has larger and fewer teeth, with the inner row reaching nearly as far back as the outer row. If only the head is visible the eye of the tiger reef-eel is over or in front of the length of the mouth; the large-spotted snake moray has an eye over the rear half of the mouth length.

Tiger reef-eels are pale cream to yellowish brown with large, irregular, well spaced, dark brown spots; the snout and jaws have small dark spots. They are reported to attain 140 cm.

Marjorie Courtenay-Latimer: A tribute

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Professor JLB Smith dedicated his book, "*Old Fourlegs*" to:

"*Miss M. Courtenay-Latimer one of South Africa's most able women*".

And indeed he should have. Had it not been for the Herculean efforts of Marjorie Courtenay-Latimer to save what she could, of the first living coelacanth known to science, "*Old Fourlegs*" would never have been written, and the remarkable achievements of Professor Smith would not have had their shining star to carry him to the great heights and stature he enjoyed in the scientific fraternity and beyond.

Marjorie deserved all the credit that came her way and a great deal more. And yet her relationship with the coelacanth and the way in which history treated her was a mixture of joy and pain. For all of her life after her remarkable discovery in 1938, she revelled in the kind attentions that the fame of the discovery had brought her, but this joy was always clouded by memories of the struggle she had to save what she could of the first coelacanth against overwhelming odds and the cruel hurt of not saving its internal organs. JLB Smith on the telephone, in his letters to her and in his books and papers kept harping on the tragic loss of the internal organs. Even before Prof Smith had seen the coelacanth he was desperate about the loss. In his letter to Marjorie Courtenay-Latimer of 9th January 1939, written from Knysna in response to communications and the now famous illustration of the fish by Marjorie, he wrote:

> *Dear Miss Latimer,*
> *Your fish is occasioning me much worry and sleepless nights. It is most aggravating being so far away. I cannot help but mourn that the soft parts of the fish were not preserved even had they been almost putrid. I am sorry to say that I think their loss represents one of the greatest tragedies of zoology, since I am more than ever convinced that your fish is a more primitive form than has yet been discovered.*

Later the press acclaimed the discovery of the coelacanth to be the "*Greatest Zoological Find of the Century",* but she lived constantly with the depressing counter balance of the loss of the inner soft parts being, as Smith wrote, "*one of the greatest tragedies of zoology*".

The see-saw continued. JLB Smith was a fair man and acknowledged very readily and with great compassion that Marjorie had achieved marvels in managing to preserve so much of this large fish given the circumstances of East London, immediately before Christmas in 1938. In honour of this, he named the fish *Latimeria chalumnae*. What a tremendous honour to have what is perhaps the world's most famous and curious fish genus named after her. To all who knew the circumstances in which she had struggled to preserve the fish and to large measure won, the honour was well deserved and totally appropriate. The holotype of *Latimeria chalumnae* is proudly mounted in the East London museum reminding all of her great fortitude, insight and persistence. Yet, in an article published in the *London Illustrated News*, Dr E I White of the British Museum protested the use of the name *Latimeria*, scathingly criticising Marjorie for not preserving the soft parts. Prof. Smith swung to Marjorie's defence and strongly criticised Dr White and reiterated to the naive that what Miss Latimer had accomplished against such huge odds was commendable and unquestionably deserved the honour. But how unfortunate to have the honour diminished so undeservedly in the press.

Marjorie at the African Coelacanth Ecosystem Conference in East London

So Marjorie was delighted by the accolades, including her Honorary Doctorate from Rhodes University, but always, the joy was tempered by the regret. As it turns out, so much is now known about the internal organs of the coelacanth that the loss of those organs does not constitute a loss at all to science. The only loss was really to JLB Smith, who was deprived of the opportunity to study and describe the organs in 1939, but which he did later in the early 1950s. This temporary setback gnawed at Marjorie all her life and though logically she accepted that science had recovered, her emotional scars of 1938 and 1939 would not go away. She always spoke warmly of the most beautiful blue fish that she had found, but at other times she said with a greater degree of emotion and conviction than many realized, that she should have pushed this odd fish overboard and enjoyed the Christmas of 1938. Almost certainly, deep down she did not mean that, but what a pity that none of us could heal those scars.

Although we did inform her of the new discoveries of coelacanths in Chaka canyon in April and early May this year, perhaps Marjorie Courtenay-Latimer's last official role with the coelacanth was when she gave the Keynote Speech at the official reception of the African Coelacanth Ecosystem Conference at the East London Museum on 28 October 2003. She began her speech to a hushed and admiring audience by saying, "*Well here I am*!" rather like the coelacanth had done to her 65 years earlier. She went on to inform us that she was born prematurely on 24 February 1907 in East London and placed in a shoebox. She was schooled at the Convent of Holy Cross where her biology teacher, Sister Camillar, had a particular interest in fossil fish, and once, when Marjorie was not listening, Sister Camillar asked, "*You, little Latimer, what is a fossil fish?".* But as Marjorie told us in the speech, *"You, Miss Latimer, did not know*" and so it was a case of "*You, little Latimer, write out 25 lines describing fossil fishes".* Had it not been for this punishment and the memory it ingrained in the agile brain of Marjorie, the 1938 coelacanth might have been thrown away.....I doubt it, Marjorie was too intelligent and dedicated to have done so, but it does show that at nearly 97 years of age, Marjorie's sense of humour remained delightful and she was still generously giving credit to others.

She explained to us how she sorted through the catch on the trawler *Nerine* on the fateful day of 23 December 1938, and then saw a *"mauvy-blue fish, with white fleckings, and iridescent colours all over. But what was it? Sister Camillar flashed into my mind—a fossil fish has limb-like fins! And rugose scales. A FOSSIL FISH, I thought? Oh No, this was ALIVE.....it had just been caught.*

She went on to describe in detail the manner in which she struggled to preserve the fish and how she had tried unsuccessfully to contact Prof. JLB Smith. And then the excitement of Prof Smith when he saw the fish and said *"it IS a coelacanth… a living fossil!!" "Lass", this fish will be on the lips of every scientist in the world!"* How true that was!

Marjorie served the East London Museum and South Africa with great distinction, was innovative, enterprising and accomplished amazing results in science, developed remarkable museum displays and collections. All of this was achieved through utter dedication and very hard work with exceedingly limited financial resources. Financial resources are always too limited in small museums, even famous museums, and the perpetual battle for funding resulted in a decision by the Board of

the East London Museum to sell the coelacanth specimen for 5000 pounds to Britain. Marjorie was instructed to prepare the holotype for transport and execute the transaction. She expressed such fury at the short-sighted decision and was so adamant in her refusal that the terrified Board members reversed their decision. The coelacanth remains to continue to give the East London Museum its unique, tangible special place in history. From now onwards it will also serve as reminder of the epic discovery and a monument to a wonderful woman.

For us at SAIAB and especially those on the African Coelacanth Ecosystem Programme, Marjorie held a very special place. She was the living link between the first discovery of coelacanths in South Africa in 1938 and the second discovery in 2000, which led to the launch of the programme. Somehow it was really important to us to share our work with Marjorie and include her in what we were doing, the new discoveries and ideas. We phoned her from the ship, from the ports and from our laboratories and saw her in East London. It seemed imperative to report to her, as though none of our work was worthwhile unless it received her final stamp of approval? Or maybe it was that she was so enthusiastic and warm in her support that the reward of gaining her approval was what we were seeking? No matter what the reason, an element of the fun of the project has been lost and there will be emptiness. But what is certain is that we shall fight, as she did, to conserve coelacanths, to develop sustainability and to build capacity around her memory.

Small & large mouths

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Over the last few years there has been a development of interest in fishing for indigenous freshwater fishes. In South Africa this has primarily been focused on the nine 'yellowfishes'. One of the conservation concerns arising from the exploitation of yellowfish is that there is a possibility that people will move fish within and across catchments. If this happens it may result in the genetic homogenisation of stocks or cross-breeding of different species as has occurred with trout in Europe and USA.

Above: A juvenile largemouth yellowfish (*L. kimberleyensis*) from Aliwal North.

Left: Nick Jones at the Aliwal North weir on the Orange River.

A programme was started to examine genetic and morphological variation initially within the Orange-Vaal yellowfishes. There are two species, the large and small mouth yellowfish *Labeobarbus kimberleyensis* and *L. aeneus* respectively. This project has been going on for a couple of years and the final samples were needed from around Aliwal North and below Augrabies Falls. Nick Jones and I were asked to help with the field collections and then to do a morphological analysis of the same specimens.

We were a little apprehensive about the task as we had never collected or seen live largemouth yellowfish which are listed as scarce in Skelton (2001). We also had limited time at each of the sites (three days) and a shopping list of 30 fish of each species at each site. Of course, before leaving we examined specimens in the SAIAB collection carefully and discussed distinguishing features with Prof Paul Skelton. We also talked with Nature Conservation Officers Pierre De Villiers (Free State) and Abie Abrahams (Northern Cape) to pin-point good collection sites.

The first site we sampled was the weir just above the Aliwal North bridge. The Orange River here is very very muddy and not the most pleasant place to sample. We started off using a small 3m seine net and immediately caught both species of yellowfish! We took these back to our hotel room (which itself became muddier as time went on) and put them in our bath whilst we gradually worked though them taking samples. We needed to get muscle and liver tissues which we froze in liquid Nitrogen. We mostly caught juveniles to small adults (5-25cm TL) and almost all were from the margins of the river and in slow-flowing side channels. In the main stream we caught very large mud-suckers *Labeo capensis* and *L. umbratus* and the occasional sharptooth catfish (*Clarias gariepinus*). The most obvious differences between the two species of yellowfish are the mouth position (terminal in largemouths and inferior in smallmouths) and colouration (silver in largemouths, olive to yellow in smallmouths). We didn't at any stage see intermediates or what people have referred to as hybrids.

After Aliwal North we drove to Upington and then on to Pofadder. Temperatures went up by about 10 degrees and the landscape changed from lush karoo to stony desert. The lower Orange sites we had chosen were below Augrabies gorge where the river widens and there are more varied and extensive river habitats. We based ourselves at Pofadder and sampled initially at Onseepkans but had limited success there. On day two and remaining days we fished at Pella drift, another 50km downstream. The seine net proved ineffective due to the rocky substrate and the faster flow of the river, so we resorted to gill netting and angling overnight. The secret weapon for smallmouth yellows was mealies soaked in aniseed essence which was introduced to us by Mark Staak from the Aggenys angling club. Armed with this bait we collected all our smallmouth yellows in a frenzied couple of hours on day two. The largemouths yellows were much more scarce and we collected these gradually with gill nets in the long deep runs and pools. We did not reach our target of 30 largemouths and probably needed either another fleet of gill nets or another two to three days sampling.

Above: Smallmouth yellowfish (*L. aeneus*) from Pella drift.
Right: Nick Jones with a largemouth yellowfish (*L. kimberleyensis*) caught in gill nets at Pella drift.

Well, we attained most of our targets, and given the low abundance of *L. kimberleyensis* in the lower Orange, 22 of the targeted 32 should be considered acceptable. We also got to see the lower Orange endemic *Barbus hospes*, which contrary to popular opinion seems very abundant, but only after dark. In all the collecting trip was an enjoyable success.

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