



Dr Nadine Stydom

Subsistence anglers from the Kowie Estuary.

## Estuarine fisheries:

Where salt water, fresh water and people meet

*Imagine two bodies of water meeting for the first time, salty sea and a freshwater river. They reach out and shake hands, creating a mix of salty and fresh water, full of nutrients and animals. Meet the estuary, formally defined as a semi-enclosed body of water which is always or sometimes connected to the sea, has a salinity (i.e. level of saltiness) somewhere between that of the sea and freshwater reaches, and has a range of characteristic plants and animals. Estuaries are incredibly diverse environments with different habitat types, and generally have high levels of primary productivity. But estuaries don't only produce a rich habitat for many fish. They also become extremely important to the livelihood of the people who live alongside their banks.*

Estuaries are incredibly diverse environments with a variety of different habitat types, and generally have high levels of primary productivity. Despite facing hugely fluctuating temperature, salinity and turbidity conditions on almost an hourly basis, estuaries make ideal homes for numerous fish species. Some fish species use estuaries as nursery areas when they are juveniles, moving out of estuaries into the marine environment as adults. These are the estuary-associated species, many of which are heavily targeted by recreational and subsistence fishers. Exploitation and overfishing have been identified as the biggest threats to

estuary-associated fishes in South Africa, with the stocks of many of the targeted species being listed as heavily overexploited or completely collapsed.

### Fish movements and acoustic telemetry

Over the past 20 years, researchers from the South African Institute for Aquatic Biodiversity (NRF-SAIAB) and Rhodes University, in collaboration with the Norwegian Institute for Nature Research (NINA) have been studying the movements of several estuary-associated species in a number of South African estuaries using acoustic



Paul Cowley

**Dr Taryn Murray with a juvenile leervis caught in the Kowie Estuary, Eastern Cape.**

telemetry. This method makes use of sound ('acoustic') to remotely record tagged animals ('telemetry'). Animals are tagged with acoustic transmitters which each have a unique identification code; on successful release, these animals then swim around and the pings released by the transmitter are recorded on acoustic receivers deployed in the sea or estuaries. Some transmitters have an expected battery life of up to 10 years. Just imagine, a fish tagged when you are 10 years old may very well still be swimming around when you turn 20!

The studied species are all readily and actively targeted by both recreational and subsistence anglers. These include the dusky kob, white steenbras, spotted grunter, leervis/garrick and Cape stumpnose. The insights into their movements have been nothing short of fascinating. Some species show extreme long-term residency (i.e. stay more or less in one place) to a single estuary (e.g. spotted grunter in the Goukou and Sundays estuaries, dusky kob in the Sundays Estuary); others seem quite happy to move between estuaries (e.g. juvenile leervis tagged in the Kowie Estuary visited at least 10 other estuaries; spotted grunter tagged in the Kariega Estuary spent 15% of their time in other estuaries); some displayed different movements depending on where they were tagged in an estuary (e.g. Cape stumpnose in the Kowie Estuary); others used



Taryn Murray

**Juvenile white steenbras caught in the temporarily open/closed Kasouga Estuary, Eastern Cape.**

estuaries quite differently depending on whether they were tagged in an estuary or the adjacent marine environment (e.g. dusky kob tagged in the Sundays Estuary and adjacent surfzone). What is also becoming increasingly evident is the extent to which large adult estuary-associated species also use estuaries. Adult white steenbras, which are supposed to be entirely marine, were recorded moving into the Great Fish Estuary on spring high tides; adult leervis have been recorded 'popping' their heads into numerous estuaries along the coastline prior to their annual migration up to KwaZulu-Natal waters; large adult dusky kob have been returning annually, like clockwork, to the Breede Estuary during a period dubbed 'Kobtober'. In addition to the incredible movement data collected, the slightly more sobering side of things has been the insights gained into the level of exploitation these species face daily. Prior to tagging, we wrap the transmitters in a luminous yellow sticker with the words 'REWARD' and contact details on them. Because all our studies entail surgically inserting the tags into the fish, when we receive a call asking what the strange thing they found inside the fish is, we know that that fish has been kept by the angler (something they are allowed to do given a valid fishing license). Recapture rates range from 5.6% for Cape stumpnose in the Kowie Estuary, to 90% for juvenile dusky kob in the Breede Estuary.



JD Filmmaker

**An adult dusky kob getting prepped for surgery in which a long-life acoustic transmitter (10-year lifespan) will be inserted into its abdominal cavity.**



Ryan Daly

**An acoustic receiver deployed in the Mtentu Estuary to monitor the movements of giant kingfish entering this estuary during the summer.**

### Enter people

Besides the important ecological role estuaries play, they are commercially valuable systems, providing a multitude of economic benefits for tourism, fisheries and recreational activities. Additionally, these systems have significant social and cultural value to many stakeholders using them. While the movement behaviour work has provided new knowledge on targeted species for improved management, these findings have had little direct influence on policy formulation. The missing link has largely been the inclusion of social, economic and ecological considerations. Over the past three years, a team of researchers from NRF-SAIAB, NINA and Nelson Mandela University have been working together with multiple stakeholders to develop guidelines for knowledge-based governance of estuarine fisheries in South Africa, ultimately aiding in the sustainable development of this sector, and improving sustainability of ecosystem services and resource utilisation.

The focal study site was Algoa Bay, Eastern Cape, specifically focusing on the functional estuaries in the bay – the Swartkops and Sundays. People from all walks of life were found to use these estuaries, including local residents from all income brackets, fishers from all sectors (commercial, recreational and subsistence), spiritual and/or religious users, and tourists (both local and international), who used these systems for (amongst others things) recreation, subsistence, cultural heritage, livelihood, and learning. These estuaries were also found to generate an income of between R 1.5 and R3 million per annum for bait collectors alone. A major finding of this research was that people's connections to these estuarine fisheries were more complicated and multidimensional than the simplified idea that fisher's make use of estuaries simply for subsistence, livelihood or recreation. It was noted that there were disparities between communities adjacent to both estuaries, which resulted in issues of exclusion and lack of access to these areas, as well as institutional and inter-community racism. While many local community members indicated keenness to be a part of local management interventions, the opportunities for this type of local stewardship were extremely limited. Local management authorities were also under-capacitated, and there was a lack of political will to support meaningful stakeholder engagement.

### A complicated affair

In addition to all these socio-ecological complexities, it is worth keeping in mind that estuaries are also amongst the most modified aquatic environments, and are

threatened by a variety of anthropogenic (human-based) activities, including infrastructure development and water abstraction which ultimately leads to habitat alternation and destruction. Throw a changing climate into the mix, which will severely impact estuary-associated species in the future because of dwindling amounts of available habitats in estuaries, and more than likely a change in water temperature too, then things get significantly more complicated.

It is difficult to argue with the success of this long-term project, particularly relating to the fish movement aspect. However, as highlighted above, it is difficult to manage a resource alone when so much more comes into play, especially when it involves people's livelihoods. South Africa actually has good legislation in place, particularly related to estuary and fisheries management, but this is often hampered by poor capacity and inefficient governance. Additionally, high levels of non-compliance or the lack of self-regulation degrade any kind of management effort.

### Managing people, not the resources

We have excellent knowledge of the movements of several important estuarine fishery species; we know roughly what the value of the estuarine fishery is; we now know that estuaries are used by a variety of different users and for so much more than merely fishing. So where to from here? In order to protect both fishes and people, more effort needs to be placed into managing the estuary itself. Having estuary-specific management plans and placing focus on estuaries that most need an intervention will already go a long way. However, in order to drive this home, champions (i.e. key people in key positions) need to be identified who can assist in prioritising and implementing these estuary management efforts. This integrated approach, which will account for connectivity, ecological and biological interactions, and socio-economic values, will be far more beneficial than the current top-down management approach (which has been mostly unsuccessful to-date). At the end of the day, successful and effective management involves not managing the resources, but rather the people.

*Article prepared by Dr Taryn Murray. Dr Taryn Murray  is an Instrument Scientist at the South African Institute for Aquatic Biodiversity in Makhanda, South Africa, working on the Acoustic Tracking Array Platform – a nationwide network of acoustic equipment monitoring the movements of acoustically tagged marine animals.*

*This work was funded by the South Africa/Norway Research Cooperation project (including SANCOOP), the South Africa/Norway joint research programme on ocean research (SANOCEAN), the South African Institute for Aquatic Biodiversity, and Norwegian Institute for Nature Research.*

Cabanga nje ukuhlangane kwezinhlobo ezimbili zamanzi, amanzi asolwandle anosawoti kanye namazi ansemfuleni ahlanzekile. Womabili lamazi akhiphe izandla axhawulane, ahlangane ekhipha inxube yamanzi anosawoti kanye nahlanzekile amasha, agcwele izakha mzimba kanye nezilwane. Nanko ke umfula osuwakhekile. Lomfula awusiyo nje indawo enhle yokuphilisa o fishi kuphela, kodwa uyindawo ebalulekile emiphakathini ehlala eduze kwemincele yawo.

*Translated by Zamantimande Kunene*

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2022-09

# Quest Volume 18 Number 3

**Academy of Science of South Africa (ASSAf)**

Academy of Science of South Africa (ASSAf)

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Academy of Science of South Africa (ASSAf) (2022) Quest: Science for South Africa, 18(3).

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