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South African Network for Coastal and Oceanic Research



Differences in water temperature can create new marine species

Warm and cool water temperatures over a long stretch of coastline cause new species of marine fish to evolve without being isolated from similar types of fish nearby, according to a new international study.

The findings challenge the long held belief that new marine species can only evolve in isolated environments and provides a glimpse into the early stages of species formation in the sea.

The research also suggests that currents with different temperatures, which are known to influence the distribution of species in the sea, might also drive the evolution of new species. and Australia, led by Professor Peter Teske from the University of Johannesburg and Professor Luciano Beheregaray from Flinders University, used information from DNA to test how regional populations of a coastal species of goby are influenced by currents with different temperatures.

This goby is found along the South African coastline which is divided into temperature-defined regions, including cool-temperate, warmtemperate, subtropical and tropical.

The team discovered that while the goby's regional populations are similar, they showed differences only in the genes impacted by water temperature.

A research team from South Africa

"Each regional goby population is

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Knysna sand goby found near South African Coast. Credit: Guido Zsilavecz

already adapted to its preferred thermal habitat, and migrants that disperse into nearby regions that are too warm or too cold will not do as well as the locals," says Professor Teske.

In contrast, the remainder of the genes show no identifiable differences yet.

"Over time, the remainder of the genome will "catch up" with the temperature-selected genes, and even later, the new species will also change morphologically. Only then will they be recognisable without the help of genetic methods."

The results have important implications for the management of threatened or exploited species, and fish stocks around the world.

"When several very young species that already cannot live in each others' habitats are all treated as a



Marine currents along the Southern African coastline. Credit: Marine Research Institute, University of Cape Town .

single species, this can result in the over fishing of locally adapted stocks, or the extinction of a rare species that has been mistaken for its more abundant neighbour", says Flinders University Professor Beheregaray.

The work has been published in the scientific journal *Proceedings of the Royal Society B* and also includes marine scientists from Stellenbosch University and Dr. Jonathan Sandoval-Castillo from Flinders University.

Journal Reference:

Peter R. Teske, Jonathan Sandoval-Castillo, Tirupathi Rao Golla, Arsalan Emami-Khoyi, Mbaye Tine, Sophie von der Heyden, Luciano B. Beheregaray. Thermal selection as adriverofmarineecologicalspeciation. Proceedings of the RoyalSociety B: Biological Sciences, 2019;286(1896):20182023DOI: 10.1098/rspb.2018.2023

Source:

Phys Org. (2019, February 5). Differences in water temperature can create new marine species. Retrieved from https://phys.org/news/2019-02differences-temperature-marinespecies.html

SAIAB Embeds RRI through Summer School

By Lucky Dlamini South African Institute for Aquatic Biodiversity

The South African Institute for Aquatic Biodiversity (SAIAB) engaged the next generation of young marine scientists through hosting its second annual Summer School, from 10 to 13 December 2018 in Port Alfred. To drive the Summer School, SAIAB used two of the African Coelacanth Ecosystem Programme's (ACEP's) research platforms - the Marine Remote Imagery Platform (Mar-RIP) and the Acoustic Tracking Array Platform

(ATAP) – to action
science education and to
bring Responsible
Research and Innovation
(RRI) to life at SAIAB.

Dr Anthony Bernard and his Mar-RIP team focused on teaching the students about the baited remote underwater stereo-video (stereo-BRUV) camera systems. The students spent two days in the field, deploying stereo-BRUVS in the rock pools at Kenton on Sea. Camera systems were deployed in various rock pools and left to record for an hour. They were hoping to answer the following questions:

- Can stereo-BRUVs be used to survey intertidal rock pool fish communities?
- 2) What is the optimal deployment time for stereo-BRUVs in rock pools?
- Which bait type attracts the most fish: invertebrate bait vs fish bait and

 How does stereo-BRUV data compare to that of environmental DNA data?

Once back at the accommodation, the students calibrated cameras and then viewed the video footage to identify and count various fish species. All data was then analysed to answer these questions.

The ATAP team introduced the Summer School attendees to passive acoustic telemetry. Two days of fieldwork on the Kowie Estuary saw attendees the recover some receivers which deployed were earlier on in the year, and conduct a small range test experiment, which additional involved deploying

> receivers and sentinel tags near the mouth of the estuary. Additionally, attendees pulled a 30m seine net in order to catch some fish so that transmitter implantation could be demonstrated. Once back at the accommodation, data was downloaded from the receivers and attendees were introduced to data



The 2018 Summer School team - students and facilitators.

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analysis. The acoustic telemetry t component was facilitated by the G ATAP manager, Prof Paul Cowley, s ATAP Instrument Scientist, Dr Taryn H Murray and ATAP Instrument r

Technician, Matthew Parkinson.

A new component was added to the Summer School in 2018 environmental DNA, more commonly known as eDNA. This is a relatively new, efficient, non-invasive and easy-to-do methodology involving the collection of cells and DNA (including fish DNA) from the water column which can then be used for biodiversitv monitorina. Water collected from the same tidal pool sites used in the BRUV study were filtered and stored for later analysis. The data generated using this eDNA monitoring approach will he correlated with the BRUV monitoring conducted in the tidal pools by the students. Students were also shown how to extract DNA from fish, algae and invertebrate samples, carry out PCR and visualise their results by electrophoresis agarose ael methodologies. This part of the Summer School was facilitated by Dr Gwynneth Matcher, manager of the Aquatic Genomics Research Platform (SAIAB). Despite the extremely busy days filled with fieldwork and genetic techniques, current MSc students Godfrey Padare (telemetry research student from University of Fort Hare) and Vivienne Dames (BRUVs research student from Rhodes University) also gave oral presentations on their theses in the evenings, demonstrating how each technique can be used to answer real research questions.

In making science more receptive, interesting and more creative, the students got an opportunity to work on a mini project based on the stereo-BRUVs and acoustic telemetry research trips. On the final day they presented on the learnings and results from the mini research they conducted. This task aimed at making science more attractive to young people, increase their appetite for innovation and open up further research and innovation activities as they further their studies.

As a means of building Responsible Research and Innovation into a cohesive long-term strategy at SAIAB, the Summer School aims to attract, inspire and produce a representative generation of future marine scientists and resource managers which reflects the



The stereo-BRUVs are a custom-built innovation designed by Mar-RIP to observe fish in their natural environment. Theory was put into practice at an intertidal rocky shore at Kenton on Sea with students preparing individual stereo-BRUVs for deployment.



Summer school attendees (from left): Sandile Sithole (University of Zululand), Kaylee Nancarrow (University of the Free State) and Sifanelwe Rala (University of the Western Cape) assisting with receiver rollover.

diverse demography of South Africa. The students left inspired, informed and challenged to grow in these innovative fields of aquatic science. Overall, the 2nd annual SAIAB Summer School was extremely well received and we look forward to hosting the 3rd instalment at the end of 2019. Ø

ASCA Symposium brings together researchers working on the Agulhas current

Ву

Whitney Samuels, Jordan Van Stavel and Tamaryn Morris

South African Environmental Observation Network

On 28 November 2018, SAEON Egagasini Node hosted the first Climate Agulhas System Array (ASCA) Symposium held at the Department of Agriculture, Forestry and Fisheries (DAFF)'s Sea Point Research Aquarium in Cape Town. Students and researchers from various institutions presented research that they had undertaken through ASCA (many of which were combined with the SEAmester similarly related cruises), or projects, ranging across disciplines within marine science. The symposium provided an informal platform for guests to share their highlight activities, form work, partnerships and to discuss the future of ASCA.

What is the Agulhas System Climate Array?

The Agulhas System Climate Array consisted of: two shelf moorings



Participants of the ASCA Symposium are all smiles during a somewhat challenging group photo! Photo by Carmen Visser.

deployed at 80 m (C2) and 120 m (C3) respectively, seven tall moorings deployed from 300 to 4500 m, (Mooring A to G) and five Current-and Pressure Inverted Echo-Sounders (CPIES) to augment the tall mooring data and extend the array 300 km offshore. Instruments deployed on the array included 300 kHz, 150 kHz, and 75 kHz Acoustic Doppler Current Profilers (ADCP) from Teledyne RD Instruments, Aanderaa and Nortek single point current meters, Sea-Bird Electronics MicroCAT sensors, and the CPIES themselves.

Additionally, Conductivity, Temperature and Depth (CTD) cast surveys were undertaken at every opportunity across the ASCA transect to collect high-resolution physical and biogeochemical data across the Agulhas Current, along with phyo- and zooplankton tows for primary and secondary trophic level analysis. Recently this extended in to parasite work, micro-plastics and benthic organism profiling. Seven surveys, not all of them complete

across the ASCA transect, were undertaken between 2015 and 2018 and this provided the basis of the data presented at the conference. The majority of these additional surveys took place in conjunction with SEAmester, South Africa's floating University which has enhanced the science of ASCA as well as the technical and scientific capacity development. Additionally surveys took place with the support of the Dr Fridtjof Nansen during the first leg of its operation in the Indian Ocean in January 2018.

Why is it important to study the Agulhas Current?

The Agulhas Current is an extraordinary South African feature which has a strong impact on society given its influence on local and regional weather and climate, as well as biodiversity and fisheries. Globally, the Agulhas Current provides a key pathway of heat and salt from the Indian Ocean into the South Atlantic, which is then, transported equatorward. This distribution of heat and salt in the oceans, the Thermohaline Circulation, is what regulates our global climate.

But it is important at home too: our



A depth slice along the line of the ASCA mooring array, the coloured shading represents the velocity in m/s with reds and yellows indicating the velocity coming out of the page (southwards). Overlaid are the moorings envisaged at the start of the project. The smaller inlay image is the potential temperature, both averaged over the 3 year period of the ACT array. Figure produced by Prof. Lisa Beal of Rosentiel School of Marine and Atmospheric Science, University of Miami.

fisheries depend on it. Friction between the Agulhas Current and the continental shelf edge, which extends to about 50 km south of Port Elizabeth, draws nutrient-rich bottom waters towards the surface. Surface water usually has a few nutrients in it because tiny ocean plants, known as phytoplankton, have already absorbed them. But when the bottom water is brought closer to the surface. phytoplankton now have plenty of light and nutrients; and their blooms sustain the aquatic food web of the east coast of South Africa.

Regionally, the Agulhas Current has impacts on the mesoscale features influencing biodiversity around eastern African countries and islands. The Agulhas Current also has a strong impact on the southern Benguela and the Agulhas Return Current forms an important front to the Southern Ocean.

As climates around the world change, this piece of knowledge helps us to better understand how

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the southern Indian Ocean responds to seasonally changing winds and highlights how this response may be sped up with a warming of the ocean due to climate change.

Discussion

Subsequent the project to presentations, the floor was opened to all participants to discuss what the next chapter would be for ASCA. This allowed researchers from different institutional backgrounds, as well as visitors from the National Research Foundation and the Department of Science and

Technology and the Department of Environmental Affairs Oceans and Coasts the opportunity to discuss what ideas they had for the future of the project, along with access to resources and support in the event thereof. The much anticipated topic of access to the ASCA data and metadata were also discussed as well as integration of ASCA with adjacent mooring systems and a key concern that was raised during this discussion was whether we as the marine science community can afford not to monitor the Agulhas Current given our warming climate. These talks were positive and the



Attendees of the ASCA Symposium listening attentively to the research presentations. Photo by Carmen Visser.

ultimate goal is to continue monitoring in terms of CTD surveys twice or three times per year, with a look to redeploy moorings as funding for new instrumentation can be found.

Prizes

Students were also awarded for their contribution to ASCA research and the Symposium. Michael Hart-Davis won best poster for his entitled, "Using ocean particle trajectory modelling in applications in the Greater Agulhas System" and James Maitland for best presentation for his presentation entitled "Analysis of the first winter occupations along the Agulhas System Climate Array".

It is vital that the value of the ASCA project thus far and its contribution to reducing a knowledge gap across a variety of disciplines be recognised, as many anticipate the continuation of this project in the near future. %

By Gavin Snow

School of Animal, Plant and Environmental Sciences, University of Witwatersrand

After a two-year hiatus the School of Animal, Plant and Environmental Sciences (APES) at the University of the Witwatersrand re-established their annual Marine and Coastal Systems Fieldwork course at Rocky Bay on the KwaZulu-Natal south coast from 17 to 26 January 2019. A total of 29 predominantly 2nd year students were introduced to the marine and coastal habitats of eastern South Africa; rocky shores, sandy beaches, mangrove forests, estuaries, streams and wetlands. Biosystematics formed the basis of the course where students learned to identify organisms and put into context the behaviour, distribution and ecology of the organisms found in these diverse habitats.

The course included lectures and practical sessions on the biological classification of rocky shore biota, photography techniques, identifying and collecting frogs, estuaries, mangroves, and sandybeach environments, quantitative transect techniques, sea urchin development and reproductive strategies, freshwater biology, plastic pollution, the impact of sea level changes on coastal habitat, plankton symbiotic and and relationships. The lectures were

presented by Professors Graham Alexander and Stuart Sym, Doctors Gavin Snow, Chevonne Reynolds, Darragh Woodford and Hanlie Engelbrecht, and teaching assistant Mr Mpilo Khumalo.

Students identified organisms from a diverse range of coastal habitats; including a near-pristine stream in the Vernon Crookes Nature Reserve, mangroves in the Beachwood Mangrove Nature Reserve, Isipingo sandy beach, estuarine fish in the Mpambanyoni Estuary (Scottburgh), and frogs in a wetland near Park Rynie. The rocky shore communities of three contrasting geologies were sampled at Rocky Bay (granite), Clansthal Conservancy (Dwyka Reunion tillite) and Rocks



Students setting up their rocky shore transect at Rocky Bay.



Staff collecting intertidal specimens at Clansthal for practical demonstrations; Hanlie Engelbrecht, Chevonne Reynolds, Graham Alexander and Darragh Woodford (left to right).



A bigfin mudhopper (*Periopthalmus* argentilineatus) found at Beachwood Mangrove Reserve; one of two mudskipper species found along South Africa's subtropical east coast (photo credit: Heather Snow).

(sedimentary rock). The students used their newly gained knowledge of quantitative transect techniques to test the theory of east coast zonation on rocky shores at Rocky Bay. They were required to draw conclusions based on the transect results and present their findings. The course participants were given a guided back of the house tour of uShaka Marine World by the very capable guides. The fieldwork was concluded by examining the students on the information that they'd learned in the field and during presentations. Ø

SA's sea turtles might be refugees

Have South Africa's leatherback and loggerhead sea turtles been displaced from their optimal habitats by human activities or by changing climatic conditions?

This is the question that Professor Ronel Nel from the Department of Zoology is investigating for her Pew Fellowship, awarded for unique research that informs better management and conservation of the world's marine life and oceans. Prof Nel is one of eight scientists and conservationists selected from seven countries for 2018.

"To inform conservation planning, my research is testing the applicability of the 'refugee species' concept with regards to two sea turtle species in South Africa – the



Leatherback turtles have remained critically endangered in the region, despite being protected for 55 years.

South Western Indian Ocean leatherback (*Dermochelys coriacea*) and the loggerhead (*Caretta caretta*) nesting along the iSimangaliso coast of northern KwaZuluNatal," Prof Nel explains.

"We know from displaced migratory populations on land, also known as 'refugee species', that they may not be able to recover their population sizes when displaced to inappropriate or low-quality habitat, even in the presence of adequate



Pew Marine Fellow, Ronel Nel, will study leatherback and loggerhead turtles in South Africa to test the applicability of the "refugee species" concept to marine conservation and inform conservation planning.

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protection."

The refugee species concept is relatively new, starting in about 2012 with the European bison when it was found that their current distribution is in areas such as forests, where they were forced to retreat as a result of extensive hunting. These are in fact suboptimal foraging areas for these grassland animals. The same concept appears to apply to the Cape mountain zebra, which zoology professor Graham Kerley is researching.

Prof Nel has been researching sea turtles since 2002 as part of the iSimangaliso Turtle Monitoring Programme, which dates back 55 years. She is comparing the two turtle species' habitat use and population dynamics along the protected iSimangaliso coastline in northern KwaZulu-Natal (an area of about 180km) to test whether this concept can be applied to marine environments.

"A large proportion of the work I have done, together with Ezemvelo KZN Wildlife, is to try to understand why the turtle populations in the iSimangaliso area are not recovering," Prof Nel explains. There are currently about 70 female leatherbacks nesting per year in iSimangaliso and about 1000 loggerheads – both are modest populations. Leatherback turtles have remained critically endangered in the region, despite being protected for 55 years. South Africa only has the occasional illegal harvesting of eggs, unlike in neighbouring Mozambique or Madagascar where poaching of eggs and turtles is more rampant.

"The leatherback is far larger than the loggerhead; the shell length of the loggerhead is 80-90cm, while the leatherback is double the length at approximately 160cm. The literature says that both species can live to ± 150 years, and I have worked with a number of turtles that are ± 60 years old. Leatherbacks are very different from other sea turtles and the only one left in the family.

It is a more ancient species, and has been around for at least 100 million years, dating back to the Cretaceous era of the dinosaurs. "The low numbers for leatherbacks don't make sense; leatherbacks produce almost twice as many eggs in a season as loggerheads. Both nest in our summer between mid-October and mid-February and leatherbacks come ashore up to eight times in a season to lay 80-100 eggs at a time. while loggerheads come ashore only four times in a season. It may be that the survival of the hatchlings which emerge from early January into April, is different between the two species.

"Our long-term monitoring suggests the incubation environment is favourable so that hatching and success is very good, but what we don't know is the health and body condition of the females when they come ashore. So we are going to draw blood from a sample group to see if there is an increased amount of stress hormones in leatherbacks, which could suggest the condition in their foraging grounds is not ideal. To test this further, we will compare these blood metrics to other populations where we know the species are doing well."

Prof Nel goes on to explain that the leatherbacks' lack of recovery can partly be attributed to their evolutionarily programmed nesting habits, where they very rarely turn back once they have exited the sea

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to nest, irrespective of whether there is too much light or human presence: "The hormone cascade kicks in and there is no turning back, almost like a woman in labour. The loggerheads, by comparison are skittish, scope out the high shore from the low shore and may come out later or on a different part of the beach."

Turtles are not only threatened on the coast, however; the biggest threat offshore to leatherbacks and loggerheads is fisheries. Both species are attracted to bait or light sticks used in commercial longlining and so get hooked when they go for the bait, or they get entangled in artisanal or commercial fishing gear including coastal gill nets. The greatest "new" threat is plastic pollution.

As airbreathing marine reptiles, sea turtles are very vulnerable, because they spend most of their time in the top 20m of ocean. Plastic floats on the surface and when the turtles come up to breathe they see plastic, often blue, white or transparent in colour and accidentally swallow it, because the bits of plastic are the same colour as bluebottles and jellyfish – a main part of the sea turtle diet for the first ten years of their life, and the exclusive diet of leatherbacks.

"These threats certainly are contributing factors, but the lack of recovery needs additional research. The largest population of loggerheads in the world is off the coast of Oman, where they have 20 000 nesting females annually, and the largest population of News leatherbacks in the world is off the coast of Gabon where they have 30 000 nesting female leatherbacks annually. Both populations face the same threats as the iSimangaliso population but their numbers are staggering by comparison."

Most turtles are highly migratory, so they leave their national waters after hatching and again after nesting to go and forage in areas off other countries. This trait makes conservation of these species far more difficult as it requires international agreements and cooperation for the protection of migratory species.

Prof Nel is now trying to determine whether the iSimangaliso leatherbacks and loggerheads are unique founder populations or part of populations that were bigger in the past. "It could also be that they have become environmental refugees, forced to lay their eggs along a part of the coast that is not ideal, or it could be that the habitat into which we forced them is not nutritious enough for optimal growth and reproduction. We may need to apply for additional protected areas with better foraging habitat. These areas may be outside of South Africa's exclusive economic zone and will require international cooperation. If our sea turtles are not refugee species, it means the pressure is entirely human induced fishing pressure, plastic and other pollution, or habitat destruction."

Source:

Nelson Mandela University News. (2019, January 22). SA's sea turtles might be refugees. Retrieved from https://news.mandela.ac.za/News/S A%E2%80%99s-sea-turtles-mightbe-refugees Ø

Summer, sun, sea and ... aerosols!

By Faith February

Department of Oceanography, University of Cape Town

Imagine standing on the beach on a sunny, but windy day. Do you feel the droplets from the sea spray? Do you get the taste of salt on your skin?

Those salty, microscopic particles suspended in the water, are called sea-spray aerosols. Research around aerosols is expanding, because people are realising their impact on the climate change that everybody is talking about. Aerosols do this by absorbing and deflectina the sunlight, which determines how much warmth is exchanged with the Earth surface. Aerosols also help to form clouds and they even determine whether it rains or not! Yet we understand so little about these seemingly unimportant and practically invisible particles.



Where do they come from? How are they formed? What do they consist of? Where and how long do they stay in the air? These are all questions that still need to be answered. To try and improve our understanding of aerosols at the coast, we used particle counting equipment in Simon's Town to measure the number of particles with a specific diameter, together with weather stations measuring temperature, pressure, relative humidity, rain, wind speed and direction. When the wind is strong, we expect more salt particles created by the interaction between wind and waves to be present.

Faith February is a PhD student at the UCT Oceanography Department and studies atmospheric aerosols along South Africa's coastal region. When there is a heavy downpour of rain, we expect the number of aerosols to be less, because the rain has a wash-out effect on the particles.

What we have learned from these measurements is that the number of aerosols increases or decreases with the changes in the local weather, but that there are also changes that cannot yet be accounted for. More research should still be done to fully understand what the drivers of seasprav aerosols in the coastal areas are and what amount of aerosols is needed to have a significant impact on the sunlight that reaches Earth. So next time you go to the beach and feel the sun and sea-spray on your skin, spare a thought for the aerosols that you can't see, but have an impact on climate change! 🕫

ATAP Anecdotes: Another year, another rollover

By Taryn Murray, Matt Parkinson & Paul Cowley

South African Institute for Aquatic Biodiversity

Into 2019 we go; another year older and hopefully another year wiser. Before looking forward, it's always good to reflect on the past. What did ATAP, as a platform, achieve in 2018? For new readers, ATAP, in brief, is the Acoustic Tracking Array Platform which is a collaborative marine science platform that monitors coastal movements and migrations of tagged aquatic animals along the coastline of South Africa. The current network consists of more than 100 marine and 21 estuarine automated data-logging acoustic receivers deployed along 2 approximately 200 km of coastline, stretching from the Berg Estuary in the west to the South African/Mozambique border at Ponta Ouro in the east. Focal do monitoring sites include three large sheltered bays (False Bay, Mossel Bay and Algoa Bay) which are then additional supplemented by



The current network of receivers consists of more than 100 marine and 21 estuarine automated data-logging acoustic receivers deployed along approximately 2 200 km of coastline.

receivers deployed at several locations with safe sea-going access, as well as receivers positioned within the mouths of a number of permanently open estuaries.

A total of 172 receiver deployments were done in 2018, and data was successfully downloaded from 158 receivers that were serviced. In January 2019, the ATAP database held more than 10 million detections from more than 30 species, ranging from important fishery species such as dusky kob white and steenbras, large predatory sharks such as white sharks and bull sharks, charismatic

species such as potato bass and giant kingfish, and data-limited stingrays such as diamond rays and blue stingrays. In 2018 alone, more than 335 000 detections from 256 animals (encompassing 25 species) were recorded. More than 130 new individuals were surgically equipped with acoustic transmitters in 2018, with a lot of effort being placed on stingray species - diamond rays, blue stingrays, eagle rays and duckbill rays. Additional effort was placed on adult dusky kob in the Breede Estuary and the adjacent De Hoop Marine Protected Area (MPA) to assess connectivity between these two localities, and catface rockcod

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tagged in the Pondoland MPA to assess connectivity between the closed and adjacent open areas. An exciting project was also initiated in the Mtentu Estuary where numerous giant kingfish were tagged.

An opportunity saw the deployment of two receivers in the Berg Estuary in March 2018, along with the tagging of a handful of leervis. To date, more than 25 000 detections from five leervis have been recorded on these receivers. These receivers and transmitters are the furthest up the west coast that have been deployed and should make for interesting findings, especially since we have not recorded many fish species moving from this section of coastline further east towards the Eastern Cape and KwaZulu-Natal coastlines. On tagged individual undertook such a trip, movina approximately 1 800 km from the Berg Estuary to Durban North - all in a mere four months. This equates to movement of almost 15 km per day. Ocean boundaries are obviously of little consequence to these fish, as this individual rounded the southern tip of Africa crossing from the Atlantic into the Indian Ocean!

A number of data-deficient (Wintner 2006) diamond rays have been



tagged in recent years and are beginning to reveal aspects of their movements that were previously unknown. Thought to be a nomadic species with no clear migratory patterns (Dunlop and Mann 2013), individuals tagged with acoustic transmitters have been revealing the migratory nature of their movements. For example, one diamond ray tagged in Vleesbaai near Mossel Bay on 26 February 2016 was recorded moving into Algoa Bay (traveling ~4.9 km per day), passed Port Alfred (moving \sim 1.2 km per day), further up the east coast to Port St Johns (travel speed of ~1.4 km per day), before being detected in Mossel Bay, covering a distance of 870 km and traveling at а speed of approximately 4.5 km per day. Despite this individual only being detected 171 times on 13 different receivers along the coastline, it still provided excellent information on its movement patterns.

This year promises to be another good year for the ATAP. Not only will it be business as usual (deployments, retrievals, downloads), but we are also providing additional equipment for three African Coelacanth Ecosystem Programme (ACEP)-funded projects - a connectivity project on catface rockcod tagged in the Pondoland and St Lucia MPAs, the Canvon Connections project taking place between Sodwana Bay and Port Edward, which aims to investigate the movement of top predatory sharks in coastal areas to offshore canyons; and a project taking place in the no-take Tsitsikamma National Park MPA and an open-access area near Port Elizabeth aiming to assess fisheries induced evolution on fish physiology.

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Keep reading ATAP Anecdotes for insights into the world of acoustic telemetry in South Africa. You can also follow us on Twitter (@ATAP_ZA), Instagram (@atap_za) and Facebook (ATAP – Tracking Fish Movements).

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New study finds ecosystem changes following loss of great white sharks

A new study has documented unexpected consequences following the decline of great white sharks from an area off South Africa. The study found that the disappearance of great whites has led to the emergence of sevengill sharks, a top predator from a different habitat. A living fossil, sevengill sharks closely resemble relatives from the Jurassic period, unique for having seven gills instead of the typical five in most other sharks.

These findings are part of a longterm collaborative study between shark researcher Neil Hammerschlag from the University of Miami (UM) Rosenstiel School of Marine and Atmospheric Science, and wildlife naturalist Chris Fallows from Apex Shark Expeditions.

The research focused on the waters surrounding Seal Island in False Bay, South Africa, a site well known for its "flying" great white sharks that breach out of the water when attacking Cape fur seals. Since the year 2000, the research team has spent over 8,000 hours observing great whites from boats, during which they recorded 6,333 shark sightings, and 8,076 attacks on seals. These data revealed that for more than a decade, great white numbers were relatively stable, but in 2015 sightings began to drop off steeply.

"In 2017 and 2018, their numbers reached an all-time low, with great whites completely disappearing from our surveys for weeks and months at a time," said study lead author Neil Hammerschlag, а research associate professor at the UM Rosenstiel School and Abess Center for Ecosystem Science & Policy. "While the reasons for their decline and disappearance remains unknown, it provided a truly unique opportunity for us to see what happens to an ocean ecosystem following the loss of an apex predator."

"In 18+ years of working at Seal Island, we had never seen sevengill sharks in our surveys," said coauthor Chris Fallows. "Following the disappearance of white sharks in 2017, sevengill began to show up for the first time and have been increasing in number ever since."

During periods of great white absence in 2017 and 2018, the researchers documented 120 sevengill shark sightings and even

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witnessed an individual attacking a live seal.

In South African waters, sevengill sharks have no equal in the food web with the exception of the great white and orca whale. Historically, the only well-known aggregation site for sevengills in False Bay was located 18 km away from Seal Island within inshore kelp beds. The study suggested that the appearance of sevengill sharks at Seal Island was due to the disappearance of great whites, thereby allowing sevengills to exploit the area without risk of predation from great white sharks or competition with them for shared prey.

This 18-year study provided new insights into the diverse ways that a marine ecosystem can be altered following the loss of an apex predator.

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Source:

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https://news.miami.edu/rsmas/stori es/2019/02/new-study-findsecosystem-changes-following-lossof-great-white-sharks.html Ø



The waters surrounding Seal Island in False Bay, South Africa, are known for great white sharks breaching out the water in pursuit of seals (left image), but the recent disappearance of great whites from here has led to the emergence of another apex predator, sevengill sharks (right image) that now dominate the area. Credit: White shark image by Chris Fallows; Sevengill shark image by Neil Hammerschlag.

Cape Town's drought under the microscope

Research by oceanography student Precious Mahlalela into the cause of Cape Town's recent devastating drought has earned her the acknowledgment of having a paper published in top international scientific journal *Climate Dynamics*.

Publication of coursework MSc research in renowned scientific journals is a great achievement, particularly when it addresses such a topical and complex subject, said Professor Chris Reason of the Oceanography Department in the University of Cape Town's (UCT) Faculty of Science.

"We are happy. It's always gratifying when a student gets a paper published, especially in a leading international journal. One hopes that when they graduate, they will continue making a strong and meaningful contribution to South African research," he added.

For Mahlalela, a current PhD student, the dearth of published literature on the Western Cape's rainfall variability was the main reason she dedicated her coursework master's research project to the topic last year. The fact that the subject directly affects all Capetonians, as well as people beyond the province's borders, was a bonus.

The Mother City has been gripped by the worst drought in 100 years. While dam levels have improved, and water restrictions were reduced from level 5 to level 3 at the end of 2018, water rationing remains in place. This year Cape Town authorities will focus their efforts on recovery plans and the implementation of initiatives to help the water-scarce city bounce back after it narrowly averted the threat of Day Zero.

"At the height of the drought and panic to avoid Day Zero, the topic concerned all of us. In fact, it still does.

"There are no restrictions and limitations when it comes to who needs water, it affects everyone. Everyone also wants to understand why we find ourselves in this situation," Mahlalela explained.

First year PhD student, Precious Mahlalela, looks into the key drivers of the recent drought in the Western Cape.

The study

Investigating the Western Cape's rainfall patterns and linking them to the city's water shortage was step one, and Mahlalela's primary focus area.



Capetonians queue up at local springs during the height of water restrictions in the city, when everything was being done to avoid the prospect of Day Zero when the taps would ultimately run dry. Photo by Widad Sirkhotte, Flickr.



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She analysed station rainfall data obtained from the South African Weather Service for the period 1979 to 2017, surveying four Western Cape regions (the greater Cape Town area, the northern West Coast, the Overberg and the Garden Route) to establish different characteristics in the seasonality of the recent drought when compared to previous droughts.

In particular, and when compared to the full winter rainy season (April to September), Mahlalela's research found that the early winter drought (April to May) was severe across all regions during the 2015–2017 period.

"Drier winters result from weaker approaching cold fronts, cold fronts steered further south than average, a reduced number of fronts, or all of these factors. A large-scale climate pattern – the Southern Annular Mode (SAM) – when anomalously positive, can cause such changes in cold fronts," she said.

"It also leads to higher than average pressure over the mid-latitude South Atlantic and a weakening of the westerly wind belt that circles the Southern Ocean."

Not enough rain

Mahlalela's research revealed that, in recent decades, the early winter season recorded dry conditions. She explained that this season was associated with a weaker subtropical jet (a belt of strong upper-level westerly winds) during 2015–2017, and less moisture being transported towards the South Western Cape from the South Atlantic.

This, Mahlalela said, was one of the reasons the region received reduced



This figure shows the climatological April-May low level moisture flux (top panel), the anomalies during dry winters (middle panel) and wet winters (bottom panel). Photo Supplied.

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rainfall during recent winters.

"What happened during 2015–2017 is that both the South Atlantic Anticyclone (a high-pressure system in the subtropical South Atlantic Ocean) and the jet stream were shifted anomalously far south.

"These shifts, together with a tendency of more berg winds over the West Coast, steered the cold fronts further south than average. It resulted in far less moisture to produce rainfall over the South Western Cape, which led to a severe drought."

Mahlalela's research also pointed to grave concern about the likelihood of good autumn or early winter rains in the future.

She explained that her investigations of output from climate models used in the Fifth Assessment Report of the United Nations Intergovernmental Panel on Climate Change (IPCC) show that prolonged and severe dry periods, as experienced in Cape Town between 2015 and 2017, can be expected in future.

"Although the CMIP5 [Coupled Model Intercomparison Project Phase 5] climate models have difficulty in representing the onset of the winter rains in April in the current climate, there seems to be a clear signal of reduced winter rainfall in future, particularly in May and June."

The way forward

Plan, plan, plan, then act – that's the way forward, she said.

There's not much time left, and Mahlalela stressed that action to conserve water needs to start now, especially as the population continues to increase and the demand for water grows.

"It all comes down to proper and effective planning and management, together with responsible water usage."

Water storage and distribution should become a key focus, and not only for the Western Cape. Other Mediterranean climate-type regions such as California, Chile and southern Australia have experienced similar rainfall and water shortage challenges, along with many of South Africa's summer rainfall regions.

But it's a unified effort that requires massive collective buy-in,

Mahlalela said.

"There appears to be a climate change type of signal emerging and we need to increase our planning to become resilient. We don't have time to think, we need to act now."

Mahlalela is already working towards her next research paper, as part of her PhD, which focuses on the ongoing drought in the Eastern Cape.

Journal reference

Mahlalela, P.T., R.C. Blamey and C.J.C. Reason 2018 Mechanisms behind early winter rainfall variability in the southwestern Cape, South Africa, *Climate Dynamics*, https://doi.org/10.1007/s 00382-018-4571-y

Source:

Davids, N. (2019, January 29). Cape Town's drought under the microscope. UCT News. Retrieved from https://www.news.uct.ac.za/article/-2019-01-29-cape-towns-drought-

under-the-microscope

The robotic gliders that roam Antarctic waters

In an unprecedented study that started in December 2018 and will run until February 2020, a fleet of robotic ocean gliders will attempt to collect occupy and vital measurements from the least studied place on the planet - the frigid ice-covered waters of Antarctica. The gliders aim to measure how the icy Antarctic ocean absorbs heat, and other properties, from the atmosphere.

During winter, Antarctic sea ice expands – as an extension of the continent – over an area of the sea large enough to cover 14 South Africas. Almost all this sea ice melts away during summer, leaving a layer of fresh water on the surface of the ocean thousands of kilometres wide but only a few tens of metres deep. The fresh water is very light compared to seawater, which prevents them from mixing vertically. This changes the ocean's ability to take up heat from the atmosphere.

This study will provide key observations to help us understand how the sea ice meltwater in Antarctica grows laterally and deteriorates, thereby altering heat uptake by the ocean and impacting the climate. Bevond this, things get pretty complicated. Growth and melt of sea ice happens in response to ocean temperatures, and so - as we move towards a warmer climate - the ocean will absorb more heat. This will change the growth-and-melt behaviour of ice. The sea measurements collected by our gliders will inform researchers from UCT the Department of Oceanography, as well as their international partners, how the ocean will react to and influence a changing climate.



Autonomous underwater vehicles like this one will roam the waters of Antarctica for two years collecting information about the ocean there. Photo Louise Biddle.



Seagliders are battery-operated, self-sufficient and can send researchers a profile of the ocean every few hours. Photo Emma Bone.

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Navigating difficult waters

The waters off Antarctica are the most difficult to measure through observation. The vastness and remoteness of the Antarctic and its rapid ice growth and drift mean that the long-term observations we need can't be obtained from ships, which only go down to Antarctica for a few weeks a year.

Instead, we will send down autonomous underwater vehicles, called gliders, which are selfsufficient and give us a profile of the ocean every few hours.

The primary gliders we're using are Seagliders. Designed to be small about 1.5 metres long - and operated on battery power, they can sample the ocean for many months without human intervention. Their bullet-shaped design helps them fly through the ocean. Seagliders can profile the water column at different depths by changing their buoyancy to become heavier or lighter than seawater. They rise to the surface every six hours and 'call' us - the researchers satellite via communications, allowing US to

access their dive information and scientific data in real-time.

Understanding the Screaming Sixties

Our studv will also provide unprecedented data for us to see the impact of the hurricane-force winds that sweep through a wind belt in the southern hemisphere called the Screaming Sixties. These are the strongest winds in the world. They act in a similar way to a blender at the ocean surface by mixing fresh, surface water with the saltier water below. We are also trying to find out how these storms drive the mixing of heat from the surface down into the water column.

The project, named ROAM-MIZ Observations (Robotic and Modelling of the Marginal Ice Zone), is co-lead by Associate Professor Sebastiaan Swart at the University of Gothenburg and Dr Sarah Nicholson of the Southern Ocean Carbon and Climate Observatory, which is supported by the South African National Antarctic Programme. Swart and Nicholson both obtained their PhDs from UCT. Other collaborators from the United States, the United Kingdom and Norway make this project a global effort.

Isabelle Giddy, a UCT PhD candidate, and I, Dr Marcel du Plessis, a postdoctoral researcher at UCT, are both heavily involved in the project. We will have our eyes fixed on our computers each time a glider calls home to provide new data from half way across the world.

You too can track the latest data and locations of the gliders, which are made available to the public. Head over to the ROAM-MIZ website to view the latest data and glider whereabouts. Or follow them on Twitter at @PolarGliders and @SOCCOgliders.

Du Plessis, M. (2019, January 21). The robotic gliders that roam Antarctic waters. Retrieved from https://www.news.uct.ac.za/article/-2019-01-21-the-robotic-gliders-thatroam-antarctic-waters Ø

Environmental educators taking action

Why are children losing their connection to nature? In South Africa for example, we have the third-highest level of biodiversity in the world due to our country's unique physical features such as having two different oceans - the Indian Ocean and the Atlantic Ocean. However, environmental education is one of the most neglected topics in this country and this places a huge strain on our environment and education system. If our children, the next generation, continue to lose their connection with nature, who will fight for it? With escalating pressures on marine ecosystems caused by pollution, recreational overexploitation, activities and a rapidly changing climate, is there a sustainable future for the next generation? This has been a growing concern in all parts the world and that's of why environmental educators from all corners of South Africa are taking action to bring nature back to the classrooms.

For the past 19 years, a community of South African environmental educators who are passionate about the conservation of marine life have been gathering annually at the Marine and Coastal Educators Network (MCEN) National



Participants at the national conference of the Marine and Coastal Educators Network (MCEN), held in January 2019. MCEN is a group of SANCOR.

Conference to resolve this Sustainable enormous problem. Seas Trust's Nozi Mbongwa and Stephanie Martin attended the conference to engage with other environmental educators from different organisations. Nozi and Stephanie presented their work that aims to create a waste wise through education, generation building and skills capacity transfer. At the conference, environmental educators engaged with each other and shared resources and activities that support environmental teaching in the Curriculum and Assessment Policy Statements (CAPS).

The 19th MCEN conference took

place from the 13 – 18th January 2019 at the Garden Route National Park – Tsitsikamma and NG Youth Centrum - Hartenbos. Melaney De Morney of SANParks spoke about engaging the youth in conservation science and said, "introducing environmental education at an early age is the key to building a relationship with the environment". She also spoke about the importance of understanding biodiversity through three important elements: environmental education, research and outreach to ensure that our future scientists don't lose their connection to nature.

It was enormously useful and inspiring to see the passion that

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environmental educators share to better our country's education system. Justice Bilankulu from the Pretoria Zoo, more formally known as the National Zoological Gardens, presented his work on a case study of the education officers in a science centre environment in Pretoria. His work focused on comparing the different methodologies that environmental educators use to teach in their classrooms. He found that the majority of the educators do have the adequate information or knowledge to teach at the centres. However, they lack the resources to support teaching in their classroom.

It is quite unfortunate that these science and environment focused centres are not well supported as they provide schools with extra curricula that connects to CAPs and is more appealing to children as it is fun, simple, interactive and relatable.

We need more educators who are skills willing to share and knowledge bring better to learning education and child experiences into our classrooms. These educators have alreadv taken a stand and are taking action. They are working hard to equip this generation with tools that will sustain our resources and ecosvstems. This movement will continue to have a boundless positive outcome across South Africa's natural environments, conserving our vitally important biodiversitv and enhancing our education system.

Source:

Mongwa, N. (2019, January 23). Environmental educators taking action. Retrieved from https://sst.org.za/news/environment al-educators-taking-action/ Ø

Comments from MCEN 2019 conference participants

It was my very first time attending MCEN conference and I thoroughly enjoyed the experience. It was really great to interact with everyone and it was truly an amazing experience. Keep up the excellent work and looking forward to be at MCEN in 2020. *Kogie Govender, Science Engagement Coordinator at SAEON*

It was a wonderful learning experience. First time attendee as well. Great activities and interactions. Thank you.

Selina Maake, Education Officer at South African National Biodiversity Institute (SANBI) National Zoological Garden

Felt privileged being able to attend this year as everything about it was spectacular.

Dudu Ntombela, MPA Coordinator at WILDOCEANS

Thank you so much for every single thing that I got to do and experience. It is an honour to have attended this conference for the first time and you guys made me feel like we known each other for many years ago. Meeting wonderful and passionate people with a great sense of humour was phenomenal. What you have done to me continue doing it to others in future so that we can have more young vibrant personnel. Once again thank you all for great experience and amazing hospitality continue to shine. Mthokozisi Shoba, Educator at South African Association for Marine Biological Research (SAAMBR)

First, once again a big thanks for the opportunity you gave me to talk to your delegates yesterday. It was a big privilege and an ideal opportunity to share the work we are doing. As an observer of the proceedings, I must acknowledge the atmosphere of the conference. The enthusiasm and passion of your delegates to learn and participate really impressed me. I came home and immediately told my wife how encouraged I was by all - it was clear that you all want to make a difference in your work. Thanks for the great work you guys are doing in educating us as South Africans!

Jean Greyling, Professor and Head of Computer Science Department, Nelson Mandela University

Nozi and I want to thank you all for having us and providing us with such an enriching experience. We learnt so much and are very excited about all the amazing ideas and initiatives shared. We are very much looking forward to the next national MCEN conference, but hope to be in touch before then :)

Stephanie Martin (Head of the African Waste Academy) and Nozi Mbongwa (Head of Education) at Sustainable Seas Trust

Using systems models to promote integrated ocean management

By

Kelly Ortega-Cisneros¹, Amanda T. Lombard¹, Jai Clifford-Holmes^{1, 2}, Samantha Grusd³, Lynne Shannon³, Estee Vermeulen¹, Minke Witteveen¹

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² Rhodes University
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Marine social-ecological systems (SES) are complex and require cross-sectoral and integrated approaches to management. SES include both extractive and nonextractive human activities which have both direct and indirect impacts on ocean health, and consequently human health. Marine Spatial Planning (MSP) has emerged a sensible way to integrate as diverse ocean management strategies, but sectoral approaches to management still dominate globally, as well as in South Africa (Lombard et al. 2019). Our understanding of the impacts of, for example fishing and pollution, is growing, but the future impacts of climate change, proposed seabed



Participants at the modelling workshop in Sedgefield, January 2019. From left: Minke Witteveen, Jai Clifford-Holmes, Estee Vermeulen, Lynne Shannon, Mandy Lombard, Kelly Ortega-Cisneros, Samantha Grusd.

mining and a fast-tracked oceans economy are not well understood. Systems approaches can help us to evaluate the implications of existing and emerging threats to SES, and scenario-planning models can be helpful to decision makers trying to manage complex SES.

Environmental scientists and managers know that components of a system are interrelated and changes in one part of the system (e.g. one species) can have repercussions across the whole system. In complex SES, it is difficult predict what to the

outcomes of particular management strategies may be, and unexpected outcomes can result from the interrelated balancing or reinforcing loops within the system (Brent et al. 2017). To evaluate the effect of different management strategies and growing threats from human activities on the whole system and not only on individual components of a system, modelling approaches have been increasingly used to support integrated ocean management (e.g. Bolman et al. 2018; Fulton et al. 2014; Pinarbaşı et al. 2017).

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Approaches such as ecosystem, endto-end and system dynamics models (collectively referred to here as systems models) provide а framework to understand kev dynamic interactions, feedbacks, and direct and indirect effects within a system and therefore are well suited to advise an ecosystem approach to management (Lombard et al. in For press). instance, systems modelling can improve our understanding of the links between environmental, social and economic components of SES, and help us to make management decisions that promote desired, over undesired outcomes. This can reduce conflicts among stakeholders with different management objectives, and can test what-if scenarios, for instance, what is likely to happen if the temperature increases by 1°C or if we implement а specific management strategy?

In South Africa, systems modelling approaches have been used to increase our understanding of how systems operate and have enabled us to evaluate the different effects of environmental variables (e.q. temperature changes) and human activities (e.g. fishing) on system functioning (Ortega-Cisneros et al. 2018). Such models have been different applied to marine environments from estuaries and bays to offshore systems (e.g. Scharler and Baird, 2005; Shannon et al. 2003; 2014).

A key challenge that has emerged globally for SES modelling approaches is the integration of spatial and temporal models. Fully integrated spatial-temporal models complicated, reauire and are considerable resources to produce (e.g. Boumans et al. 2015). In South Africa, а aroup of researchers has started thinking about simpler ways to integrate their mainly spatially-explicit models (e.g. Marxan and Invest software) with mainly temporal behaviour-over-time models (e.g. Ecopath, Ecosim, Vensim and Stella software). Ecospace and Atlantis software features have that combine space and time, but the idea is to build on the strengths of existing software, and find sensible, less resource intensive ways to integrate our model inputs and outputs to promote integrated and dynamic approaches to ocean management.

In January 2019 we held a small

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workshop to familiarise ourselves with a few different modelling approaches, and to discuss 'Coupling spatial and temporal models for integrated ocean management with emphasis on an ecosystem approach to fisheries and MSP'. The aim of the workshop was to share on-going projects and develop methods to different couple our modelling approaches. The research projects discussed at the workshop included the development of system dynamics models to quantify and evaluate trade-offs between different human and environmental objectives to support MSP in Algoa Bay (as part of the Community of Practice in Marine Science in the Eastern Cape, see Dorrington et al. 2019). In addition, an end-to-end modelling approach is currently being applied to the south east coast of South Africa, from Mossel Bay to Algoa Bay, to evaluate the effects of fishing and Marine Protected Areas on the structure and functioning of this system. Finally, another project using system dynamics is а approach to identify tipping points at which boat-based whalethe watching tourism industry in the Garden Route becomes economically or ecologically unsustainable, and leverage points where management or policy interventions could move the system onto a sustainable path. The workshop was key to identifying similarities in our research questions and methods, common challenges, and opportunities to foster broader collaborations. The outputs of some of these research projects are intended to inform the drafting of area-based plans required under South Africa's new MSP legislation (MSP Bill 2017).

Overall, our research aims to advance an ecosystem approach to management of South African marine environments at the scenario and stakeholder planning engagement levels by using tools such as modelling approaches. If you are interested in this work and would like to contribute to ongoing discussions, please contact or visit us on:

AlgoaBayProject@gmail.com

www.facebook.com/AlgoaBayProject

https://algoabaydata.wixsite.com/w ebsite

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Seafood Fraud: Is your hake fake? Not if it's ecolabelled!

By Angela McQueen Marine Stewardship Council

DNA barcoding of more than 1400 Marine Stewardship Council (MSC) labelled products has shown that less than 1% were mislabelled, compared with a reported average global seafood mislabelling rate of 30 percent. These results published in the journal *Current Biology* suggests that the MSC's ecolabelling and Chain of Custody program is an effective deterrent for systematic and deliberate species substitution and fraud.

The MSC is a global not-for-profit that sets a benchmark for sustainable fishing and traceable supply chains. If fisheries and supply chain companies get certified, they can use the MSC's blue label on products in store, on fresh fish counters and on restaurant menus.

Species identification

"There is widespread concern over the vulnerability of seafood supply chains to deliberate species mislabelling and fraud. In the past,



this has included some of the most loved species that are substituted by lower value or less sustainable options, and which can seriously undermine consumer trust and efforts to maintain sustainable fisheries," said Jaco Barendse, Marine Stewardship Council and lead author on the paper.

DNA methods have been widely used to detect species mislabelling and a recent meta-analysis of 4500 seafood product tests from 51 peer-reviewed publications found an average of 30 percent were not the species stated on the label or menu. In the present study, the largest and most comprehensive assessment MSC-labelled of products, the MSC worked with laboratories of the TRACE Wildlife Forensics Network and SASA's (Science and Advice for Scottish Agriculture) Wildlife DNA Forensic unit to employ DNA barcoding to identify the species in 1402 MSCcertified fish products from 18 MSC ecolabelled fish shows mislabelling rate of less than 1%, compared to an average global rate of 30%

countries.

They found that 1389 were labelled correctly and thirteen were not. This represents a total rate of less than 1% (0.92) species mislabelling in contrast to the global average of 30%. Mislabelled products were found in fresh and frozen pre-packed products and in restaurants, mainly in western Europe, with one case in the USA. All cases of mislabelling were identified in whitefish (cods, hakes, hoki) and flatfish products.

Mislabelling or fraud?

There are many reasons that mislabelling may occur. Unintentional mislabelling can result from misidentification of species when the fish is caught, mix-ups during processing, or ambiguities in product naming, such as the use of catchall trade names such as

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`snapper' or `skate'.

Fraud, on the other hand, occurs when there is intentional substitution mainly for financial gain. This is typically when a higher value species is substituted with one of lower value. Fraud may also arise when species from unsustainable or illegal fisheries gain access to the market by passing them off as legally caught fish.

While DNA testing can identify cases of species substitution, on its own it cannot confirm whether this was fraud. To do this it is necessary to trace the product's movement back through the supply chain to identify the exact step where the issue occurred.

The MSC's Chain of Custody certification requires that every distributor, processor, and retailer trading certified seafood has a documented traceback system that maintains separation between certified and non-certified seafood, and correctly identifies MSC products at every step.

For the thirteen mislabelled products, records were obtained from each company at each step in the supply chain. Trace-backs revealed that only two mislabelled samples could be confirmed as intentional substitutions with species of non-certified origin. MSC-certified products can command higher prices and better market access than non-certified products therefore these substitutions were likely to be fraudulent. Those responsible for the substitutions had their MSC certificates suspended. There were other instances where substitutions inadvertently occurred at the point of capture or during onboard likelv processing due to misidentification between closely related, similar-looking species that co-occur in the catch. There was no discernible financial motive.

"The use of DNA tools to detect substitution in the fish supply chain is well-documented but until now has essentially revealed а depressing story. Our research flips this on its head and demonstrates how we can apply similar technology to validate the success of eco-labels in traceable, sustainable fishing," said Rob Ogden, TRACE Wildlife Forensics Network and University of Edinburgh.

Next steps

MSC certificates apply only to fish stocks and fisheries, and not entire

species. Although MSC Chain of Custody Certification requires separation of MSC and non-MSC certified products, there remains a risk for possible deliberate substitution between certified sustainable and other fish of the same species.

Francis Neat, Head of Strategic Research at the MSC said "While we can get a good indication of whether species-level substitution is taking place, using DNA barcoding and tracebacks, the future for the MSC is to invest in state-of-the-art next generation gene sequencing and isotopic and trace element profiling. This will make it possible to determine which stock a fish product came from, in addition to whether it is the species mentioned on the packaging."

Journal Reference

Barendse J., Roel, A., Longo, C., Andriessen, L., Webster, L., Ogden, R and Francis, N. 2019. DNA barcoding validates species labelling of certified seafood. *Current Biology*, 29: 198-199 https://doi.org/10.1016/j.cub.2019. 02.014 Ø

Swartkops Estuary Research Symposium – Improving estuary health for the delivery of multiple ecosystem services

By Gavin Snow^{1,2}, Janine Adams¹ and Bernadette Snow¹

¹Nelson Mandela University ²University of the Witwatersrand

On 19 March 2019 the Department of Science and Technology (DST)/ National Research Foundation (NRF) Research Chair: Shallow Water Ecosystems and the Institute for Coastal and Marine Research (CMR) at the Nelson Mandela University (NMU) co-hosted the Swartkops Estuary Research Symposium. The objective of the symposium was to discuss ongoing and planned research for input to a revised Health assessment and Estuary restoration plan for the Swartkops Estuary. The Swartkops Estuary falls within the Mzimvubu-Tsitsikamma Water Management Area and is an essential ecosystem that provides numerous ecosystem services to people living within the Nelson Mandela Bay Municipality (NMBM) and extending into Algoa Bay.

Although the estuary, which is an important nursery area for fishes, is ranked 11th in terms of its biodiversity of approximately 300 estuaries in South Africa the present ecological status is a low D (largely modified). This poor health score is largely the result of heavily modified hydrology, water quality and physical impacts that negatively impact on the biology. co-ordinate Efforts the to management of the catchment (National Water Act - Catchment Management Agencies) and the estuary (Integrated Coastal Act _ Estuary Management Management Agencies) have failed so initiatives are currently being conducted largely in isolation. Ultimately the poor management of the estuary is resulting in the unsustainable use of the estuary's resources, threatening human health and livelihoods.

To correct this situation it is essential that a co-ordinated strategy be developed, where the Swartkops River catchment, estuary and adjacent coastal waters management protocols are integrated. Determining a more accurate Ecological Reserve (a requirement of the National Water Act), with clearly defined Resource Quality Objectives (RQOs), is an important step towards achieving The RQOs this strategy. and associated Thresholds of Potential Concern (TPCs) can form the basis to developing a monitoring protocol and it is important that laws related to the abstraction and discharge of water into the river and estuary be enforced. A broad management plan can only be achieved by including all users within the catchment, the basis of Catchment Management Agencies, and the process developed using a social-ecological systems Bernadette Snow approach. Dr CMR) and NMU PhD (Director: candidate Ms Zanele Hartmann described the importance of the socio-ecological systems approach and how integrated governance is required to support the sustained use of ecosystem services, respectively. This should be aligned to the National Development Plan through the second version of the Integrated Water Resource Strategy but must also recognize the

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importance of the adjacent marine area.

A growing human population and associated developments are placing increasing demand on the limited water resource and unregulated activities are impacting on the water quality of the Swartkops River and estuary; the effects of which are exacerbated by lower river flows and a changing climate. Prof Nadine Strydom highlighted the impact that Wastewater Treatment Works (WWTW) have on water quality, which was emphasized by Mrs Jenny Rump (Zwartkops Conservancy Conservation Officer) who highlighted that 25% of the N and P in the river is from Uitenhage's Kelvin Jones WWTW and 50% from a

combination of all WWTWs. A more detailed study by Dr Daniel Lemley (NMU and SANCOR Postdoctoral Fellow) found that the WWTWs actually contributed 71% of the dissolved inorganic nitrogen and 62% of the dissolved inorganic phosphorus to the estuary. The high loads of nutrients contribute to cultural eutrophication, which have caused a shift in biotic community structures and have impacted on the ecological function of the Swartkops Estuary.

A recently published study by Adams *et al.* (2019) highlighted that the cumulative inputs of nutrients from the three WWTWs into the Swartkops River, together with the Motherwell Canal that discharges into the middle reaches of the estuary, have caused the estuary to be in a eutrophic state for a large proportion of time. The Swartkops is a permanently open estuary that used to effectively flush water from the middle and upper reaches during spring tide cycles but the consistently high loads of nutrients and reduced river flows support persistent now phytoplankton blooms. It is essential then that the discharges from these WWTWs are monitored and management interventions implemented where water quality thresholds are exceeded. Perhaps methods such as the recycling of wastewater and phosphorus mining can be used to subsidise costs, reduce nutrient loads and promote



Westward view of the Swartkops Estuary towards Port Elizabeth with the decommissioned coal power station that, together with many other developments, was built within the estuary's floodplain.



Motherwell Canal that discharges into the middle reaches of the Swartkops Estuary; note the artificial wetland to the left of the canal that was designed to treat 25% of the canal flow but is currently overloaded with 75% of flow.

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the sustainable use of water. In addition, there is a strong case for WWTWs within the NMBM to aim to attain green drop statuses. The Department of Water and Sanitation (DWS) introduced the Green Drop certification process in 2008 in an effort to progressively improve the WWTWs; operations of if implemented effectively in the NMBM then this would be a big step towards restoring the health of the Swartkops Estuary.

In addition to impacts on water quality there are other impacts that include flow obstructions, dams, recreational fishing, bait collection, boating, development within the floodplain, discharge of polluted water (e.g. conservation tanks), alien invasive species, harmful algal blooms, and salt and sand mining. There are many laws related to all of these impacts but the implementation of these laws is largely absent. The estuary has a high resilience to change because it has such a high diversity of habitats but the accumulation of these impacts is a serious threat to biotic diversity and ecosystem services. Monitoring is an essential component of any management plan and there were a number of talks that focused



Wastewater discharge from the Kelvin Jones Wastewater Treatment Plant that flows into the Swartkops River, Uitenhage.

on the use and development of different monitoring techniques. It is suspected that industries, particularly in the Markman area, discharge waste at night to avoid expensive hazardous waste removal. Ms Thandi Mmachaka (NMU PhD candidate) referred to early warning systems and automated grabs that could provide solutions to monitoring at night when security is a major concern.

Dr Lucienne Human did highlight that the South African Environmental Observation Network (SAEON –

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Elwandle Node) are monitoring and analyzing the water samples collected from the Swartkops Estuary on a quarterly basis. A limitation is that a broad suite of chemicals and metals are discharged into the river and point source discharges, such as the Motherwell and Markman canals, and it is too expensive to analyse all of these. To address this, it was suggested that a broad-scale study should he conducted to identify as many of these chemicals and metals ลร possible and then a handful be targeted based on these results. Another issue is that there is no formal data archive where data from collected research and monitoring can be consolidated and accessed; it was suggested that SAEON's data portal would be the ideal site for this.

Current research being conducted includes the movement of organic material and deposition of microplastics by Ms Kylen Brown (MSc postgraduate student, University of the Western Cape) and Dr Lorien Pichegru's research group (NMU and Sustainable Seas Trust). DNA studies are also being developed as a more efficient alternative to traditional monitoring techniques that can be expensive and time consuming. Dr Gwyneth Matcher (Rhodes University) described how pollution can create shifts in microbial and nematode assemblages and there are suitable RNA analysis techniques that can be used to monitor these changes. Prof Strydom and Dr Nikki James are leading much of the research focusing on larval fishes. In addition, Emeritus Prof Guy Bate is planning to investigate the possible uses of products of pollution as well as manipulating temperature and manganese concentrations to effect changes in microalgal group dominance; these may provide economic incentives or options that could contribute to the management of the Swartkops Estuary.

The symposium attracted many researchers and coastal managers, including representatives from the Department of Environmental Affairs: Oceans and Coasts (Cape Town) and Department of Economic Development, Environmental Affairs and Tourism. There are many challenges that were raised, the largest of which is the discharge of poorly treated water from the WWTWs within the

municipality that has severely impacted on the health of the estuary and the local economy. Many of these challenges can be addressed and the health of the Swartkops Estuary largely restored through the coordinated development and implementation of a management plan that includes the estuary, river and adjacent marine environment. It is essential that this management plan be developed using a socio-ecological systems approach so everyone who is dependent on the ecosystem services provided by the Swartkops in Estuary involved are the management of the system.

Reference

Adams JB, Pretorius L, Snow GC. 2019. Deterioration in the water quality of an urbanised estuary with recommendations for improvement. *Water SA* 45(1): 86-96. Ø

First reef biodiversity and fish surveys for Comoros Archipelago

The recent marine expedition of RV Angra Pequena into the Comoros, which was made possible by Critical Ecosystems Partnership Fund (CEPF), first visual saw the mesophotic surveys conducted in the deeper habitats (the depth between 40m and 200m) of the waters around the Archipelago. These surveys were part of a 2-year project led by WILDOCEANS and implemented in collaboration with the South African Institute for Aquatic Biodiversity (SAIAB), Coastal Oceans Research and Development in the Indian Ocean (CORDIO), the University of Comoros, Comoros Directorate of Fisheries and Nekton/ University of Oxford.

Scientists and students of the University of Comoros and Directorate of Fisheries joined the 20-day expedition aboard the 72ft research vessel. Surveys of biodiversity and fish communities were done using а Remotelv Operated Vehicle (ROV) and Stereo Baited Remote Underwater Videos (SBRUV), equipment provided by the African Coelacanth Ecosystem Programme (ACEP) part of the research platform managed by SAIAB.



Led by Chief Scientist Dr Melita Samoilys, Director of CORDIO, the team repeated shallow surveys around three islands (Anjouan, Grande Comore and Moheli) using scuba diving to compare the condition of the areas over time, and to understand the difference between the shallow habitats and the deeper habitats.

Moving from the shallow reefs to explore the biodiversity of the deeper reefs by ROV, the team found a shift from the hard corals, which depend on their relationship with photosynthesising algae, to soft corals that do not have a symbiotic relationship with light dependent organisms. The deep reefs were richly covered by various species of sponges and soft corals, including large sea fans and black corals.

In general, the conditions of the deep reef habitats at Grande Comore and Anjouan islands were good but the very low numbers of fish were striking. Fishermen who joined the team to observe the deployment of equipment and surveys in action, also expressed concern about fish numbers and declines over the past decade. In contrast to the habitats at depth, the shallow reefs on these two islands showed signs of severe degradation, most likely due to bleaching and possibly dynamite fishing. Disturbing was the huge

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amount of plastic and general trash seen on both shallow and deep reefs. A feature in Anjouan were plastic sacks used as anchors – which catch on the reefs and are left behind.

The team were very encouraged when they arrived at the marine protected area at Moheli Island to find reefs in comparatively good condition. The shallow reefs had healthy, hard corals that appear to have escaped recent bleaching events that has impacted much of the Western Indian Ocean," WILDOCEANS Executive said Director Dr Jean Harris.

"On Moheli island, fish such as grouper, were relatively abundant compared to areas outside of the MPA indicating that the marine protected area is having a positive effect in protecting these long-lived resident species from overfishing", said Director Dr Melita Samoilys.

Highlights of the expedition were engagements between the expedition team members and members of key organisations in the Comoros. A delegation from the University of Comoros, led by the Dean of Science Achmet Said, welcomed the vessel on arrival and an introductory session was held at the University to discuss the aims of the project. The local NGO UMAMA hosted a community meeting in the Sima village on Anjouan Island and AIDE hosted similar meetings on Grande Comore and Moheli Islands. attended by These were the Mayors, fishers, fishery and conservation managers and tourism The representatives. purpose of the gatherings was to discuss the purpose and approach of the project, to share the first visuals of their deep marine environment, and invite to participation by local role-players.

The project team also visited the Museum and Centre National de Documentation et de Recherche in Moroni and presented them with some samples and photographs from the surveys.

The CEPF is a joint initiative of de l'Agence Française Développement, Conservation International, the European Union, the Global Environment Facility, the Japan, Government of the MacArthur Foundation and the World Bank. A fundamental goal is to ensure civil society is engaged in biodiversity conservation. "This project is an important contribution toward the collective efforts to protect the marine biodiversity of Comoros," said Mhoumadi Soihibou, CEPF Representative in Comoros.

"Research is expensive and technically demanding requiring the involvement of а range of stakeholders. The Comoros Expedition was an example of International agencies, Regional bodies, Government agencies, NGOs and host country communities (the fisherfolk) putting their combined expertise together to undertake science to better sustainably manage the ocean," said Managing Director of SAIAB Dr Angus Paterson.

Scientists and local community members in Comoros have been empowered and equipped to continue the work after the expedition. Students from the University of Comoros have been be trained to use various pieces of equipment, including the BRUV some of which has been left with the team in Comoros to use for further research and exploration.

Source

WILDTRUST News. (2019, January 31). First reef biodiversity and fish surveys for Comoros Archipelago. Retrieved from http://wildtrust.co.za/marineconservation-impact-into-thecomoros/ Ø

STUDENT / TRAINING OPPORTUNITY	INSTITUTION	CLOSING DATE
Coastal Summer School 2019 on marine phytoplankton diversity observation	AWI	4/30/2019
28 June – 8 July 2019 Helgoland, Germany and on board the <i>RV Heincke</i>		
The training will comprise a class room module (six days) at the guest scientist		
facilities on Helgoland and a practical module (five days) on board the		
German RV Heincke in the German Bight. The Biologische Anstalt Helgoland		
(BAH) as part of the AWI is one of the oldest marine stations worldwide and		
has a strong tradition in capacity development and hosting international guest		
researchers. We are aiming for PhD students, young researchers working		
already in the field, and MSc grades.		
Course in Ocean Governance for Africa	IOI-SA, SAIMI and	5/7/2019
2 - 27 Sep 2019, Kirstenbosch Cape Town	SANBI	
This annual course is designed to contribute to building a sustainable core of		
experts on ocean governance for the continent and is intended for		
professionals, managers, educators, researchers and civil society members		
that have coastal and marine related responsibilities, functions or interests,		
preferably from or with an interest in countries within the African region.		
Limited bursaries available. The course brochure and application form are		
attached.		
L'Oréal-UNESCO PhD and Postdoctoral fellowships	L'Oréal-UNESCO	5/15/2019
The L'Oréal-UNESCO partnership has launched the first edition of the South		
African National programme to support young females scientists. A call for		
applications has opened for PhD and Postdoctoral fellowships.		
PhD Studentship	KZNSB, UJ, SU	5/18/2019
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Topic: Population bottleneck of batoids caught in the KwaZulu-Natal Sharks		
Board Bather Protection Programme, South Africa. The scientific knowledge		
produced will be crucial in providing an objective evaluation of the impact of		
shark nets and other factors on batoid population sizes. No closing date		
indicated.		
COTRA PhD Scholarship in the field of fisheries science or aquaculture at	COTRA	5/31/2019
Makerere University, Uganda. Click here for the advert and application form.		

STUDENT / TRAINING OPPORTUNITY (CONTINUED)	INSTITUTION	CLOSING DATE
PhD position at UKZN Hard corals from South Africa's shallow sub-tidal assemblages in KwaZulu- Natal are unique both in terms of their diversity and their apparent 'resilience' in the face of climate change. This presents a unique opportunity for assessing the basis of this resilience in a phylogenetic context. Candidates should have experience in genetics and evolutionary biology and a passion for marine science.	UKZN	6/1/2019
Advanced PRIMER 7 / PERMANOVA+ Workshop 24-28 June 2019, Durban Multivariate Analysis in Ecology (& other Sciences)	ORI	6/21/2019
PhD on reef ecology and population genetics A PhD opportunity is available at the NRF-SAIAB within the Genetics and Remote Imagery research platforms for a suitable candidate to investigate the potential of eDNA to collect population and community data for subtidal reef fishes occurring on photic and mesophotic reefs. No closing date indicated.	SAIAB	7/22/2019
PhD opportunity (sediment/ancient DNA) on South African and German joint project to identify changes in aquatic ecosystems over time to defines its natural variability in the past as reference condition and relates the condition of the present ecosystem to it.(No closing date indicated, open until filled).	SPACES, TRACES, DAAD	10/4/2019
Advancing Womxn Postgraduate Fellowships in Oceanography and Atmospheric Sciences at UCT These highly prestigious M.Sc. and Ph.D. fellowships for black womxn or trans students include bursary support for the duration of the degree, registration fees, relocation costs, field gear, a laptop, and participation in a leadership and mentorship programme. Applications for 2019 will be accepted until June 1, 2019 and applications for 2020 will be accepted until November 30, 2019.	UCT	11/30/2019
Global Contest to Reward Marine Science Scholars Marine-science graduate students and postdoctoral researchers interested in helping to pioneer the next generation of sustainable tuna fishing initiatives — especially to reduce bycatch and protect ocean ecosystems — are invited to submit their ideas to the first-ever International Seafood Sustainability Foundation (ISSF) Seafood Sustainability Contest. Competition judges will announce one \$45,000 Grand Prize winner and one \$10,000 Runner-Up Prize winner on February 28, 2020.	ISSF	12/31/2019

VACANCIES	ORGANISATION	LOCATION	CLOSING DATE
Marine Ecosystem Modellers	National Institute of Oceanography and Applied Geophysics (OGS)	Trieste, Italy	5/1/2019
Consulting: analyse stock structure and genetic connectivity of tuna in the Tanzanian EEZ	Deep Sea Fishing Authority	-	5/2/2019
Consulting: research oceanographic factors influencing tuna in the Tanzanian EEZ	Deep Sea Fishing Authority	-	5/2/2019
Collections Officer	SAIAB	Grahamstown	5/6/2019
Communications Manager	Marine Stewardship Council	Cape Town	5/7/2019
Senior Consultant: Ecosystem Services	Anchor Environmental Consultants	Tokai, Cape Town	5/8/2019
Monitoring, Evaluation & Learning Coordinator	Blue Ventures	Madagascar	5/10/2019
Assistant Marine Ranger	SANCCOB	Betty's Bay, Western Cape	5/17/2019
Postdoctoral Position in Seaweed Physiology and Aquaculture. Open until filled; review begins 02/19/2019.	Scripps Institution of Oceanography	La Jolla, California	5/19/2019
Postdoctoral position in Fisheries Biology/Fisheries Conservation. No closing date.	Sea Around Us / University of Western Australia	Australia	5/25/2019
Research Scientist - Marine Habitat Mapping	National Oceanography Centre	Southampton, UK	5/26/2019
SIOFA Executive Secretary	Southern Indian Ocean Fisheries Agreement	La Reunion Island	6/1/2019
Postdoctoral position on adaptive evolutionary genomics. Position open until filled.	University of Johannesburg	Gauteng	6/11/2019



Ms <u>Carol Moses</u> passed away on 17 February 2019, after a brief illness. She was deputy director and acting director of Communication Services at the Fisheries Branch of the Department of Agriculture, Forestry and Fisheries. In her youth, Carol was an anti-apartheid activist. She was a passionate communicator and enthusiastic supporter of SANCOR's Marine and Coastal and Educators Network. We extend our condolences to her family and loved ones, especially her husband, Clive Stuurman and son, Che.

Our Focus:

Science in the

Marine and Coastal Environments

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