

ISSUE 5
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Exclusively
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THE ZOOLOGIST

INSIDE:
Avian malaria
Thinking SMART
Dangerous waters



Scimitar-horned oryx (*Oryx dammah*)



Tim Wachter, Senior Conservation Biologist, ZSL

SAHARA DESERT WELCOMES BACK ICONIC ANTELOPE

**Scimitar-horned oryx thriving
in their former home**

SCIMITAR-HORNED oryx were declared Extinct in the Wild in the 1990s, but their path to extinction began decades earlier. Already dwindling in population as human activity expanded into their habitat throughout the 20th century, the war between Chad and Libya in the 1970s – taking place in prime oryx habitat – was the last nail in their coffin.

Since 2012, ZSL has been involved in a project led by the Government of Chad and the Environment Agency of Abu Dhabi to restore this iconic antelope to its natural habitat. Seven years on there are very real signs of success. “There are now more than 150 oryx living in the wild again in Chad, with a third of those born in the wild,” says Tim Wachter, ZSL’s lead on the project.

Collaboration has been key to the project’s achievements. Organised by the Sahara Conservation Fund, the opening meeting in 2012 brought together Chadian government officials, local figureheads and representatives from a range of national and international agencies – everyone from ministers to local livestock owners.

After playing a major part in identifying the reintroduction site, ZSL’s role is to monitor the progress of the released oryx and train Chadian colleagues to monitor them. The team works closely with colleagues at the Smithsonian Conservation Biology Institute who manage the technical side of satellite tracking. “Almost all of the released oryx are fitted with satellite collars and we use the data to keep track of them,” says Tim. “The goal is to see each animal every week. Once found, we record oryx body condition, group sizes, food choices, courtship and calving.

“Oryx females are able to have a calf every nine months, and by observing how frequently they give birth – as well as the calf mortality rate – we can build a picture of the habitat’s suitability and the project’s overall success.”

Extinct for at least 30 years, information about scimitar-horned oryx behaviour in the wild is limited, so the team are having to learn as they go and take lessons from other oryx species. Tim studied wild beisa oryx in Kenya and, through ZSL, reintroduced Arabian oryx to Saudi Arabia – this experience is proving invaluable.

The project has not been without its hurdles though – after excellent results in 2016 and 2017, mid-2018 saw a higher than average mortality rate among a newly released group of animals. “Last year turned out to be the wettest year so far,” says Tim. “The rains attracted enormous numbers of biting flies to the soft-release pens, putting the animals under huge stress during an already sensitive time for them – when they’re getting used to life in the wild, a new community of animals and wild food.

“It has been a hard but important lesson for us to learn,” says Tim. This year the release will be delayed until the cooler, drier period in mid-September when food is still abundant and flies are less of an issue. The objective is to continue releases until 500 scimitar-horned oryx are living the wild, and then monitor their progress. With success on the horizon for the oryx in Chad, the project team are exploring the possibility of further reintroductions of other species – notably ostriches and the addax. The ultimate aim is to restore the ecosystem to its former diversity. **TZ**



Prof Ken Norris, Director of Science, ZSL

DEAR FELLOWS

THE Institute of Zoology was formed in 1977 and from 1988 onwards received a grant from the UK Government to support its science. For most of the ensuing period the grant was provided by the Higher Education Funding Council for England (HEFCE). In April 2018, responsibility for our funding and wider support passed to Research England.

The Institute is an integral part of the higher education sector, but in a distinctive context – we are part of a conservation charity rather than a university. We recently celebrated the 30-year anniversary of this support. Over that period, the Institute has

received more than £60m in funding, which is by far the largest amount and longest continuous period of external support for ZSL's work. What have we achieved over the last 30 years?

The Institute developed the science that underpins the IUCN Red List, the approach now used to assess extinction risk in wildlife and conservation progress globally. We pioneered the Living Planet Index (LPI), a measure of global wildlife health, which is used in a wide range of global policy forums, including the Convention of Biological Diversity. We played a major role in the discovery of the disease that was (and still is) causing the global decline in amphibian populations. It has transformed the way the community views the role of disease in conservation, highlighted the pathways through which wildlife diseases move around the World, and provided the evidence-base for global and continental policy interventions.

Our science underpins some of the most successful endangered species recovery programmes in the world, and hence an understanding of what works and can be applied elsewhere. We have been highly innovative in public engagement with science. Soapbox Science was developed by the Institute and is a novel public outreach platform to bring scientists and the public together. Its activities are global – 30 events were held in 2018 across three continents.

The Institute of Zoology is a small but key node in global networks – we currently work with nearly 300 external organisations across 70 countries. Global conservation problems require global science! We are uniquely placed to deliver, and we do. **TZ**

AVERTING AVIAN MALARIA

Famous finches face threat of disease

OFTEN credited as the inspiration for Darwin's theory of evolution by natural selection, the finches of the Galápagos Islands may now be under threat from avian malaria – and ZSL is at the forefront of the race to prevent it.

"While their role in Darwin's work has been questioned, Galápagos finches provide the perfect example of his theory in action," says Liam Fitzpatrick, PhD researcher at ZSL's Institute of Zoology. "The 15 species have evolved through the process of adaptive radiation, whereby a group of closely related species rapidly diversify to occupy different niches in the environment."

The finches are an important part of life on the archipelago, adapted to live in a wide range of habitats – from the arid lowlands to the humid highlands – and utilise a variety of food sources (even the blood of other birds, in the case of the vampire ground finch, found on Darwin and Wolf islands). Sadly, says Liam, that may now be at risk.

"*Plasmodium*, the group of parasites that cause avian malaria, are found in bird species on every continent," says Liam. "In fact, of the 23 bird orders identified and tested around the world, *Plasmodium* have been found in 20. And, for most of these bird species, they have no ill effects."

However, when a parasite is moved outside of its historic range and infects an animal that hasn't encountered it before, the effects can be devastating. Mosquito species *Culex quinquefasciatus*, a known carrier of *Plasmodium* parasites, was accidentally introduced to the

Galápagos in 1985 and scientists are concerned it could have the same disastrous consequences as in Hawaii the century before. "The same mosquito species was accidentally introduced to Hawaii in the 1800s," says Liam, "causing the establishment of avian malaria on the island, the extinction of at least nine native bird species and a continued impact on Hawaiian bird species to this day."

Working closely with the Galápagos Biosecurity Agency and Galápagos National Park, ZSL has undertaken a two-pronged approach to understanding the threat avian malaria poses on these unique isles. "The Galápagos already has one bird-biting mosquito species, *Aedes taeniorhynchus*, that has been present there for at least 200,000 years, so we're testing to see if it can transmit the avian malaria parasite," says Liam. "If the results indicate it can, there's a chance that the endemic birds have been exposed to the parasite before and developed some immunity to cope with the infection."

In another aspect of the study, the team is examining the populations of the two mosquito species across Santa Cruz and Isabela, two of the larger islands in the archipelago, to identify environmental factors that impact their distribution and abundance. "We could then create a distribution map across Galápagos and identify bird populations that are at highest risk of infection," says Liam. The hope is that this would then lead to targeted screening of birds and, if required, a mosquito control programme. **TZ**



Small ground-finch (*Geospiza fuliginosa*)

DIARY DATES

10 May 9:30am-4pm

Establishing a career in conservation science: A ZSL/BES early career event
Mappin Pavilion, ZSL London Zoo

14 May 4:45pm

How to make the most of your library:
An introduction to ZSL Library & Archives

Street-smart animals: Incorporating cognitive behaviour into conservation efforts
ZSL London Zoo

15 May 6pm

Gala: Safari in the City, hosted by Chris Packham
ZSL London Zoo

11 June 6:30pm

Stamford Raffles Lecture
Huxley Lecture Theatre, ZSL London Zoo

9 July 4:45pm

Art works and archives: An introduction to our special collections
ZSL Library, ZSL London Zoo

Find out more at zsl.org/whats-on



Black rhino (*Diceros bicornis*)

THINKING SMART

Why data are vital to conservation management

WITH the illegal wildlife trade increasingly organised and well-armed, protected area management is a demanding task. Data management system SMART (Spatial Monitoring and Reporting Tool), developed by ZSL and eight other partners, is one method our conservationists are using to turn the tide.

“SMART harnesses data collected by a GPS app on the ranger’s smartphone or tablet,” says Clarine Kigoli, ZSL Data Analyst and SMART specialist. “It collects data as the ranger moves through the landscape and allows them to log anything they see – animal movements, habitat changes or signs of poaching. Over time, the area manager can use this information to build up a picture of hot spots for illegal activity – areas that need more protection efforts.”

Observations are recorded on the app using an image selection system, hurdling language barriers and allowing for easy uptake from rangers. This simplicity is at the heart of SMART’s success, says Zeke Davidson, ZSL’s Country Director for Kenya. “SMART means that we can turn experiential knowledge – the intimate understanding people have of their environment and wildlife from having grown up and lived in an area for generations – into digital information.”

It also allows conservationists to react in real time. “If a ranger records a poached animal

carcass it can immediately raise a red flag at a control centre,” says Zeke. “Our rangers have gone from a single man in a uniform to having the technical and law enforcement capacity of the whole protected area at their fingertips.”

SMART also has implications for how conservation projects are funded, says Zeke. “The same data can be translated seamlessly into reports for funders,” says Zeke. “Funders can clearly track how effectively we’re protecting wildlife, making it easier for them to justify supporting us in the long term. If we’re successful, the number of miles a ranger has to cover between sightings of a given species will go down as they become more plentiful.”

Now on its fifth iteration, Clarine believes the system’s strength lies in collaboration. “SMART is already being used by 600 NGOs in 50 countries,” says Clarine. “Backed by nine of the world’s largest conservation NGOs, open source and free to download, it’s constantly being developed and adapted to suit new environments.”

Zeke and Clarine are working to make SMART *the* tool for conservation across Kenya, where 16 NGOs and the Kenya Wildlife Service are already using it. The future for SMART is massive; once uptake is ubiquitous, conservationists can build country- and region-wide pictures of wildlife crime hotspots and channel resources to combat it. **TZ**

VENEZUELA’S UNDERWATER ARCHITECTS

Preserving the Caribbean’s ocean giants

RISING ocean temperature, water acidity and increasing pollution are developing into a perfect storm. Without time to recover, coral reefs could be lost, along with the organisms that rely on them for shelter. Ana Yranzo Duque, Segré EDGE Fellow, is on a mission to ensure the survival of two species of coral in the Caribbean.

“*Orbicella faveolata* and *O. annularis* are the very bedrock of reefs in the Caribbean,” says Ana. “They form huge colonies, providing vital homes for reef-dwelling fish and invertebrates, ultimately benefitting the entire ocean ecosystem.”

The *Orbicella* has proved a resilient genus, showing signs of recovery after recent extinction events, and Ana hopes it can adapt to the changing climate. Nevertheless, environmental pressures and a slow growth rate has seen the genus decline rapidly across the Caribbean, with *O. faveolata* and *O. annularis* both classified as Endangered by the International Union for Conservation of Nature (IUCN) Red List.

Ana began diving at 16 years old, just a few months before a die off struck the reefs of Venezuela’s Morrocoy National Park in 1996. “When I began diving it was like discovering a new world, and to see such loss in so short a time frame

was shocking. I wanted to do everything I could to protect it.” Two decades on, Ana is leading a project to understand the situation facing *Orbicella* corals in Morrocoy National Park, Venezuela.

“I was surprised to see as many *Orbicella* colonies as I did,” says Ana, “although overall biodiversity is still much lower since the die off.” She will continue monitoring until 2020 to ascertain the abundance and sizes of the corals, as well the temperature, pH and identify any diseases.

Meanwhile, pollution is a growing issue, and engaging the root of this is vital to the corals’ survival. Venezuela’s population has doubled since the 1980s, placing the country’s natural resources under greater strain, and local communities still lack adequate water treatment facilities – meaning agricultural and household chemicals often end up in the sea.

Ana is working to mobilise the local community. “The hotels and marinas all rely on the tourists who come to experience the coral reefs, as I first did. It’s in their interest to guard the national park.” The campaign includes working with local business owners, government officials and visiting tourists in the hope that, collectively, Venezuela’s reefs can be saved. **TZ**



Orbicella annularis (below) supports a *Millepora* fire coral

SAVANNAH SATELLITES

Analysing Africa's grasslands from above

TECHNOLOGY offers increasingly novel ways to monitor the activities of wildlife and the health of their habitats. Conservationists are no longer reliant on first-hand observations and, from developing new ways to track marine animals (see page 6) to employing technology to measure the success of reintroductions (see page 7), we are constantly exploring the ways that technology can inform our work. In another such project, Henrike Schulte to Bühne, PhD student at ZSL's Institute of Zoology, is trialling how satellite imagery can inform conservation in Benin, West Africa.

"West Africa doesn't receive the conservation attention or funding of its eastern or southern counterparts," says Henrike, citing the likes of Kenya as one of the countries where the attention of conservationists has historically focussed. "With fewer boots on the ground and remoter locations, satellite data can give us important insights into the health of the region."

By analysing freely available satellite imagery published by NASA (National Aeronautics and Space Administration) and ESA (European Space Agency), Henrike's aim is to understand how environmental drivers – particularly rainfall and agriculture – affect biodiversity. "The region is seeing rapid land use and demographic change similar to that experienced in the UK during the Industrial Revolution," says Henrike. "It also supports some of Africa's most iconic creatures – lions, giraffes, elephants – so it's crucial we understand how they could be affected before it's too late."

Benin, home of Pendjari National Park – the basis for Henrike's research – was one of many West African countries hit by severe drought in the 1970s and 80s, prompting massive agricultural upheaval and political unrest, and is expected to experience rapid climate change in the future. "In such a climatically volatile area, the consequences of climate and land use change on the habitats of wildlife could be profound."

Henrike is also concerned with the spill over effect of agriculture into the unconverted, wild savannah. "People are likely to use the land close to their homes to graze livestock, collect firewood or pick plants for medicinal reasons," says Henrike. "As cropland expands, new areas of unconverted savannah experience increased pressure. It's important to find out how the removal of water or biomass could interact with changes in rainfall, such as making it harder for vegetation to recover after an especially tough drought."

Savannahs and grasslands cover around 40% of Earth's ice-free surface and, as well as supporting many of the world's most well-known megafauna, they are vital for human life too. "Their soils are also an important carbon sink, and support the livelihoods of millions of people," says Henrike. Ultimately, Henrike hopes that her work will provide conservation managers with the information they need to keep savannah systems resilient to climate change. **TZ**



Killer whale (*Orcinus orca*)

DANGEROUS WATERS

Toxic chemicals put marine mammals at risk

THE announcement of a coming 'killer whale apocalypse' – the crash of 10 of the world's 19 killer whale populations in the next 30 to 50 years – by ZSL and its collaborators in *Science* in 2018 received global news coverage. Behind the decline: the insidious spread of polychlorinated biphenyls (PCBs) throughout the world's oceans, a highly-toxic chemical banned across Europe in 1987 because of its danger to humans. Sadly, governments have been slow to act.

"Despite the crisis, there's still a global problem with compliance," says Paul Jepson, co-author of the paper and specialist wildlife veterinarian at ZSL's Institute of Zoology. "Meanwhile, PCBs continue to leak into our waters from landfills, having a dramatic effect on the reproduction and immune system of killer whales."

The UK Cetacean Strandings Investigation Programme (CSIP), headed by Paul, has one of the largest collections of cetacean PCB data in the world and the data give a clear indication of the continued problem PCBs present. "We saw an immediate drop in PCB levels after the EU ban, but within a decade the concentration of the pollutant in European waters stabilised at a level still dangerous to marine life," says Paul.

"As much as 1,300 milligrams per kilogram (mg/kg) of PCBs have been found in killer whale blubber. To put that in context, studies show that as little as 10-20 milligrams can have an adverse effect on mammals." Killer whales are particularly at risk from PCBs because of their long life-spans, allowing them to accumulate huge levels of PCBs through their prey which they pass on to their young during pregnancy and lactation.

The species was once very widely distributed globally, but there is considerable uncertainty about the current population trends for many populations. The killer whale is still categorised as Data Deficient by the IUCN Red List and there is further scientific debate about whether the killer whale should

constitute one or more species. "We're largely limited to studying the coastal populations that don't move as far," says Paul. "Conservationists have even employed sniffer dogs to locate killer whale faeces to analyse for health assessments and pregnancy when it floats to the surface."

However, perhaps a proxy could provide some clues to their health. Rosie Williams, PhD researcher at the Institute is using harbour porpoises to fill in the gaps. "Harbour porpoise carcasses collected by CSIP, a dataset that stretches back to 1990, tell us that the concentration of PCBs has spread over time from the west coast of the UK, where the chemical was traditionally produced, to Scotland," says Rosie. "Other researchers have even found PCBs in the Arctic, suggesting atmospheric transport of the pollutant."

Harbour porpoises are numerous throughout the UK, and a key prey species of killer whales, allowing Rosie to draw hypothesis about what effect PCBs might be having further up the food chain. Sadly, Rosie fears this may be about to change. "Harbour porpoises are under increasing pressure themselves, and are often victims of bycatch – accidental capture by fishers. We're also seeing a correlation between the higher levels of PCBs in porpoises that have died of infectious disease, suggesting it is having an impact on their immune system."

This relationship between PCBs and bycatch is key to Rosie's research. Lulu the killer whale, one of just nine killer whales making up the last pod remaining in UK waters, made headlines in 2016 when she died after becoming entangled in fishing nets. "Killer whale bycatch is a rare event," says Paul, "they're so intelligent they normally avoid nets." It's thought the dangerously high levels of PCBs found in Lulu's blubber contributed to a brain infection and, ultimately, her death.

"What's clear is that our oceans are under enormous stress and PCBs are creating a perfect storm for marine mammals," says Rosie. **TZ**



Velvet spider (*Loureedia colleni*)

WEB AIDS ILLEGAL TRADE

Tarantula trafficking is big business

WHEN it comes to the illegal wildlife trade, large mammals tend to hog the headlines. The £17 billion industry is defined in terms of ivory, rhino horn, pangolin scales and tiger skins – not invertebrates. Sergio Henriques, PhD researcher at ZSL's Institute of Zoology and Chair of the IUCN's Spider and Scorpion specialist group, hopes to change that.

"Trade in tarantulas is growing, fuelled by hobbyists willing to pay thousands of pounds for the rarest, most colourful species," says Sergio. He also believes that social media has a role to play, allowing the rapid communication between buyers and sellers online. "It's remarkable how quickly the illegal trade capitalises on these animals. Species appear in the trade within weeks of being described as new to science."

Two weeks after describing species *Loureedia colleni* (pictured) in December 2018, a new member of the velvet spider family found in Spain, Sergio was personally contacted by collectors trying to obtain coordinates. Meanwhile the Critically Endangered peacock tarantula, or 'gooti sapphire', is feared extinct in its natural range of northeast India, thanks to the appeal of its unique purple and yellow colouring.

"Many countries ban or limit the export of tarantulas but far too many are making it through

the net," says Sergio, who has worked on a guide for rangers and customs staff to use to identify key species. "Tarantulas are especially vulnerable to poaching because, like elephants, they are long lived and only reproduce infrequently. Some reach 30 years old."

Very little is currently known about the state of the world's tarantula populations. So far only 39 species of tarantula have been assessed by the IUCN, with 16 of these listed as threatened, out of the 900 species already described by science. Tarantulas make up just 0.5% of the world's total spider species – the most diverse order of predators on the planet. Sadly, their diversity comes at a cost, says Sergio. "They're highly specialised, with species often found in just one small pocket on the planet. This means they are highly susceptible to climate change and habitat loss."

Sergio is now working to build a better picture of the global threats facing spiders. "Through a sampled approach we have selected 200 spider species worldwide. Their assessment against the IUCN's Red List criteria should give us a glimpse into how spiders are faring globally."

Once a species is assessed, the information can be used to direct resources more efficiently, to reinforce proposals for protected areas, start reforestation initiatives or, in the case of tarantulas, strengthen protective measures against their trade. **TZ**

ENORI & THE NATIVE OYSTER NETWORK

ZSL provides pearls of wisdom for oyster conservation

NATIVE oyster beds are now the most threatened marine habitat in Europe, with fewer than 5% remaining compared to historic levels. The list of threats facing the UK's native oysters is long, with overfishing to supply human consumption at the top, but pollution and infection from parasites are also issues. Tackling this head on is the Essex Native Oyster Restoration Initiative (ENORI), chaired by ZSL.

A collaboration between oyster cultivators, government, conservationists and academia, ENORI aims to replenish native oyster beds in Essex and ultimately contribute to self-sustaining native oyster populations in the UK, sustainable oyster fishing and increased biodiversity.

ENORI operates in the UK's only marine conservation zone (MCZ) designated for oyster recovery, encompassing the Blackwater, Crouch, Roach & Colne estuary. 'Cultch' (empty oyster and other bivalve shells), are physically deployed on the seabed within a 2km² restoration zone by boat. Empty shells, deposited on the sea bed, provide the perfect material for 'spat' (oyster larvae) to settle on.

To obtain these shells, ENORI works with local oyster fishers to collect empty oyster shells, and used oyster shells are even being collected from London's Borough Market. This year ENORI will also be translocating mature native oysters from other sites into this restoration zone because

the UK's native oyster species, *Ostrea edulis*, is at particular risk of extinction, down to its poor recruitment and a slow growth rate.

ENORI is also now part of a wider web of 16 oyster restoration projects, native oyster fisheries and cooperatives across the UK and Ireland, forming the formidable Native Oyster Network. Looking ahead, the Native Oyster Network, newly formed by ZSL and collaborators, is keen to build more connections with oyster fishers and even seafood restaurants to establish shell collection and recycling initiatives nationwide. Three more MCZ's have also been proposed that contain native oysterbeds, including one in Falmouth.

"The significance of oyster beds is vastly underappreciated," says Alison Debney, ZSL's Programme Manager for Estuaries and Wetlands. "We want to revolutionise the way oysters are perceived, using ENORI and the Native Oyster Network to communicate their value to a wider audience. It might be a surprise to some that oyster beds offer coastline protection against tidal erosion, support a wealth of marine life by providing robust nurseries for juvenile fish and drastically improve their surrounding water quality: it's thought that a single oyster can sift through an astonishing 200 litres of water a day."

ENORI is carrying out ongoing research into oyster growth, survival and reproductive success to make sure our conservation impact

is maximised. Although there is a long way to go before self-sustaining populations of oysters are achieved in UK waters, the rapid expansion of ZSL's ENORI project, and resultant formation of the Native Oyster Network, certainly provides reassurance for the future of native oyster beds across the UK. **TZ**



The UK's native oyster (*Ostrea edulis*)



Hawksbill sea turtle (*Eretmochelys imbricata*)

UNCOVERING PLASTIC

ZSL launches project to understand plastic's effect on Indian Ocean's turtles

PLASTIC has floated to the top of the marine conservation agenda, riding a wave of popular interest driven by programmes like Blue Planet, but scientists are still working to uncover the true effects of the pollutant. A recent study of the UK's marine mammals by the University of Exeter and Plymouth Marine Laboratory, using samples collected by ZSL, found microplastics in all 50 animals examined – but cautioned that further research is needed to understand the effects of microplastics on animal health.

Thanks to funding from DEFRA (Department of Environment, Food and Rural Affairs), ZSL has undertaken a new project to identify the problems plastic pollution poses to sea turtles in the remote British Indian Overseas Territory (BIOT), which includes the Chagos Archipelago.

"Sea turtles are incredibly long-lived animals, with some individuals estimated to reach 100 years old, and face huge challenges across their lifetimes," says Rachel Jones, Project Manager for ZSL. "If females are lucky enough to reach sexual maturity at around 25 years old, they then embark on a journey of thousands of miles across the Indian Ocean to the beach where they hatched to lay their own clutches of eggs. This hazardous mission puts them in the firing line of a number of threats, from fishing nets and pollution to their natural predators, such as sharks."

Turtles are one of a number of reptiles whose sex is determined by the temperature of their nest during incubation, and several studies have shown

that global warming is contributing to drastically skewed ratios all around the world, with some populations having as many as 90% female hatchlings. ZSL's scientists, alongside collaborators from Swansea University, will be examining whether plastic pollution could be playing a role in the temperature of nests or impacting the turtles' ability to dig nests.

"Plastic is very good at conducting heat, and enough small pieces in the sand could be affecting the temperature of the turtle's nests," says Rachel. "We have also seen plastic debris on beaches interfering in turtles' ability to dig nest pits and the tiny hatchlings' attempts to reach the sea."

The Chagos Archipelago is a key habitat for turtle species like the Critically Endangered hawksbill turtle and Endangered green turtle, the latter of which are still recovering slowly from historic hunting by humans. Researchers will be inserting sensors into nests to monitor sand temperature change, as well as conducting post-mortems on turtles to examine the effect of plastics on their digestion.

The project will also see ZSL's sustainability campaign, #OneLess, which aims to reduce consumption of single-use plastic water bottles in the UK, rolled out across Diego Garcia, in the Chagos Archipelago. The campaign on the island will look at ways to reduce, reuse and recycle plastic bottles entering the islands, helping the US and UK Military based there to devise a long-term waste management plan. [TZ](#)

WORLD FIRST FOR RARE FISH

Technology could throw light on elusive fish

UNTIL now, angelshark monitoring has relied upon first-hand observations by conservationists, divers and fishers. For the first time, technology will help conservationists understand where angelsharks go when they leave shallow waters.

"So little is known about the angelshark, like where they go when they leave the coast," says Joanna Barker, ZSL conservationist and Co-Founder of the Angel Shark Project. "They are the world's second most threatened family of shark, so it's vital we understand how they use the ocean and how to protect them."

Joanna drafted in David Jacoby, Postdoctoral Research Associate at ZSL's Institute of Zoology, who's experience using acoustic telemetry to track hammerheads, reef sharks and rays proved invaluable. "The angelshark is an ambush predator, waiting for fish to swim over the top of them before striking, so it was vital any tag we developed didn't affect their ability to hunt," says David. "It's also illegal to catch angelsharks, so we needed to be able to tag them under water."

Alongside conservation tech developers

Arribada Initiative and Angel Shark Project partners, the team used 3D printing to produce a new tag attachment that fits onto the angelshark's dorsal fin. "A team of three divers are required to fit the tag, but doing it underwater allows us to minimise stress to the shark," says David. "The mechanism also takes a DNA sample which, in time, will help us build a picture of the genetic diversity of the remaining populations of this species."

After rigorous ethical review, the tags are now being trialled in Las Graciosa Marine Reserve, off the coast of northern Lanzarote – one of the last strongholds of the Critically Endangered angelshark (*Squatina squatina*). Twenty four individuals have been fitted with tags and seven receivers installed around the area to record the animals' movements. The data will be collected in November 2019 for analysis.

"The Canary Islands act as a unique stronghold for angelsharks," says Joanna. "This work will significantly improve our understanding of angelshark habitat use in the archipelago."

Visit angelsharknetwork.com/canaryislands to find out more about the project. [TZ](#)



Angelshark (*Squatina squatina*) © Michael Sealey

SCIENTISTS TRACK TWEETS TO SAVE RARE NEW ZEALAND BIRD

Hihi calls help ZSL scientists understand reintroduction success



Hihi (*Notiomystis cincta*)

HOW do you monitor a species you've reintroduced when it's very rare, not much larger than a European robin and prefers the most pristine, dense and remote forest of New Zealand?

ZSL's scientists might have the answer. By placing listening devices throughout the reintroduction area in New Zealand's Rotokare Scenic Reserve, scientists were able to eavesdrop on the hihi (*Notiomystis cincta*) and understand where the birds were without having to risk disturbing them.

"There are so many difficulties when it comes to trying to monitor the success of a reintroduction," says scientist Oliver Metcalf. "Radio tags and field teams are expensive and can change the behaviour of the birds, potentially influencing the outcomes of any reintroduction. This technology bypasses all of those things – the acoustic monitoring devices we used were simple to put up, have a longer battery life than a human, and they don't influence the birds' behavior." Oliver, now PhD candidate at Manchester Metropolitan University, helped develop the technology during his masters at ZSL's Institute of Zoology and Imperial College London.

The team created a bespoke algorithm to identify when recordings contained hihi calls and used dynamic occupancy modelling to detect

changes in the bird's pattern of occurrence in order to estimate habitat preference.

"Hihi are an absolutely essential part of the forest ecosystem" said Dr John Ewen, Senior Research Fellow at ZSL's Institute of Zoology. "They play a crucial role in pollinating indigenous plant species and they are an important indicator of forest health."

"Reintroduction is considered the most effective conservation action we can take to save the hihi in New Zealand, but as with other reintroduction programmes for other species around the world, we've found it can be challenging to accurately monitor their success."

"Using acoustic recording units has enabled us to gain a true understanding of how they settled post-reintroduction. It has really exciting implications for the reintroduction programmes of many other difficult-to-monitor endangered species globally."

The hihi is unique to the northern regions of New Zealand, but was decimated by non-native mammal species brought to New Zealand by humans – an all too familiar story for islands around the world. Since 2004, ZSL has been working to reintroduce the hihi back into their native habitat. Through the help of local nature reserves like Rotokare Scenic Nature Reserve in the Taranaki region, North Island, ZSL has been able to provide new homes for the birds. [TZ](#)

VULTURES FALL PREY TO CATTLE DRUG

Reversing the collapse of Asia's Gyps vultures

SHORTHAND for greedy or unscrupulous, the vulture's maligned position in English vocabulary belies a vital role in the ecosystem and, importantly for humans, the dynamics of zoonotic diseases.

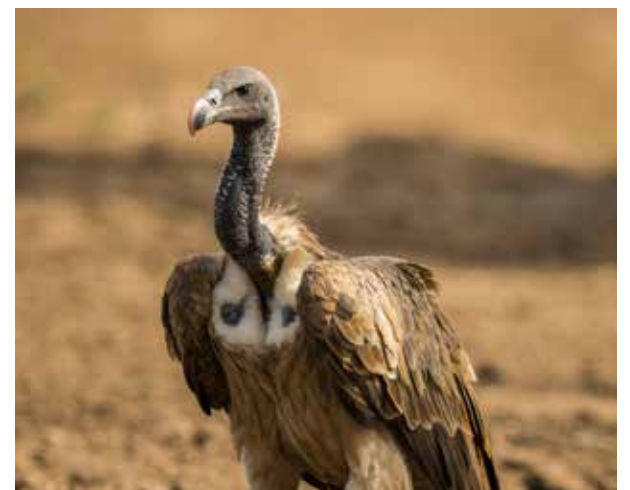
The vulture's exceptionally corrosive stomach acid allows it to safely digest carcasses infected with potentially lethal bacteria, removing those bacteria from the environment. That role was found to be in danger when it was discovered in the 1990s that vulture populations, once numbering in the millions, had collapsed across Asia. The Indian sub-continent was hardest hit, with populations decreasing in some countries by 97% over the course of 15 years and one species, the white-rumped vulture, estimated to have declined by as much as 99.9%. And, as vulture numbers fell, feral dogs numbers grew, feeding on the carcasses vultures traditionally clean, leading to an increase of rabies cases among humans across Asia.

The cause of the decline, diclofenac – a non-steroidal anti-inflammatory drug not dissimilar to painkillers found in products treating muscular aches in humans – was discovered in 2003 by a team of scientists including members of ZSL's Institute of Zoology. "Diclofenac was used widely across Asia to treat muscular discomfort and other inflammatory conditions in cattle," says ZSL's Assistant Director of Wildlife Health, Nic

Masters. "Easily digested by many mammals, the drug proves toxic for scavenging birds, leading to kidney failure and death." India's livestock population was estimated to exceed 400 million in the 1980s and, in a country where cows are considered holy and largely not consumed by humans, the drug led to disaster for the birds relied upon to dispose of rotting carcasses.

Diclofenac has since been banned for veterinary use across India, Nepal and Pakistan – although use is still occurring in rural communities, says Nic – and ZSL is part of the project to restore their numbers across the subcontinent. "We're focusing on three species of *Gyps* vulture, the hardest hit by the drug. Nepal began its reintroduction programme in 2017, and India's is due to start this year," says Nic. "So far we've released 17 birds in Nepal, all with GPS tags that give us updates on the birds' health and whereabouts in real time."

"Myself and other colleagues from ZSL's veterinary team have supported the health of these birds, providing guidance on the conservation breeding programme, pre-release health checks and health monitoring once they've been released." The project is a truly collaborative one, led by RSPB alongside a number of Asian conservation organisations, and takes a multi-disciplinary approach. As well as zoo breeding



Long billed vulture (*Gyps indicus*)

and reintroductions, the project involves tours of pharmacies and farmers across key areas to change perceptions of diclofenac and promote the safe alternative – meloxicam – and the development of vulture safe zones.

"Twenty years ago we feared the *Gyps* vulture would go extinct," says Nic. "Thankfully, through a conservation breeding programme and pressure from scientists to ban the drug, we're finally seeing their trajectory towards extinction change. It's been an incredible project to be a part of and a massive conservation success story." [TZ](#)



Dr David Curnick, Research Fellow,
Institute of Zoology, ZSL

SCIENTISTS' CORNER

Q&A with David Curnick

DR David Curnick is a Research Fellow specialising in marine ecosystems. A member of the IUCN's Mangrove Specialist Group, which ZSL hosts, he is a key proponent of their conservation and importance for global ecology.

TZ: *What makes mangrove forests so important?*

DC: Mangrove forests line coasts and estuaries throughout the tropics, from Indonesia and the Philippines to the Caribbean. They're built to withstand harsh ocean weather, regular flooding and a high salt content – all of which makes them crucial for both animals and humans.

Their elaborate root systems absorb wave energy and promote sediment accumulation, which both stabilises coastlines and traps carbon. It's also the perfect environment for young fish and sharks to grow, away from larger predators, before venturing into the open ocean or coral reefs. In fact, it has been shown that coral reef fish biomass can be twice as high when mangroves and seagrasses are present.

This also has a massive bearing on our way of life. In the same way that they provide a wonderful nursery habitat for marine creatures, they also do an incredible job of protecting us from tsunamis and storm surges and capturing carbon that would otherwise find its way into the atmosphere. Just one hectare of mangrove forest can store 1,000 tonnes of carbon and it's estimated that over half of the world's tropical coastal fisheries rely on mangroves – a value in the billions of pounds globally.

With global fish stocks at breaking point and extreme weather events set to increase as climate change continues to intensify – often hitting the very poorest coastal communities, where mangroves are found – their protection is paramount.

TZ: *Despite their importance, it is estimated that a third of mangrove forest has been lost globally since the 1980s. Why are they at such risk?*

DC: Put simply, mangroves have a brand problem. Coral reefs grab the headlines, but the value of mangroves is often overlooked – as we're seeing in the Maldives. Despite recommendations from social and environmental experts against it, the Maldivian Government fast-tracked the development of a new airport on the Kulhudhuffushi atoll in 2017, destroying the largest black mangrove forest in the country.

Mangroves sit in highly-sought after coastal real-estate, often falling victim to coastal development, tourism or aquaculture. It's a short-term view that needs to be rectified by both conservationists and governments and we need to model the protection of mangrove forests based on the ecosystem services they provide. Governments should recognise the vital role mangroves play in achieving the targets set out by the Convention of Biological Diversity and the Sustainable Development Goals.

TZ: *What does the future of mangrove conservation hold?*

DC: There is still hope for mangroves. In the Philippines, for example, a nation of island communities, the government have recognised their importance and outlawed their removal. The recent super-typhoon Haiyan (locally known as Yolanda) highlighted the vital role mangroves play as nature's bioshields for the Philippines' coastal communities.

ZSL is working with the government there to replant coastlines and estuaries, where over half of historic mangrove forests were lost, and we've integrated mangrove forests into six marine protected areas in Panay and Bohol. We also run a mangrove rehabilitation course every year, which has seen over a thousand participants from various institutions and organisations. If other nations can follow this example we have a chance at protecting the important role mangroves play in the global ecosystem. **TZ**

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to get your feedback.

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to send us your suggestions.



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