UNIVERSITY OF EXETER

Excite
School of Biosciences

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Bringing you the latest discoveries and news in biosciences

Marine Turtle Conservation in North Cyprus

by Andrea Barden and Philippa Hardman

MARINE TURTLE RESEARCH GROUP

We are students on the Conservation Biology and Ecology course at the Tremough campus in Cornwall. Each year every student on this course has the chance to apply for the Marine Turtle Conservation Project (MTCP) in North Cyprus. After volunteering on the project in our first year we were able to return the following year to volunteer again and to collect data for our third year research projects.

The MTCP, based at Alagadi since 1992, is run by volunteers who help to conserve the two species of sea turtle that come to nest annually in North Cyprus, Loggerhead turtles (*Caretta caretta*) and Green turtles (*Chelonia mydas*).

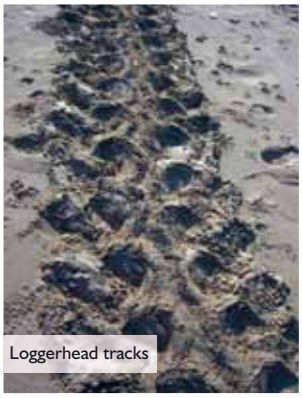
Volunteers are based at four main sites across Northern Cyprus. Each site has a leader and volunteers swap on a weekly basis to experience each base. Work involves doing night patrols of the main nesting beach which allows volunteers to work closely with the turtles. This helps to collect important data for research on these endangered species. In some cases this involves attaching satellite transmitters to the turtles, in order to track their movements around the Mediterranean.

All nests located are caged to help protect against predation from feral dogs, foxes and interference from people. Other important nesting beaches are checked by other volunteers during the day. This work involves interpreting tracks left in the sand by the turtles from the previous night, in order to analyse their behaviour and find nests that may have been laid.

Nesting season in Cyprus starts in late May and ends in early August. The incubation period of the nests is between 40-60 days giving rise to the first hatchlings around the end of July. It is estimated that only one in a thousand hatchlings will make it to adulthood. This is due to predation, by-catch and persecution from fisheries, pollution and litter. A female may lay up to five clutches in one season and up to a 100 eggs per clutch. After a nesting season a female will not return again to lay for another three to five years.

Andrea and Philippa with a nesting Green Turtle.

During hatching season the nests are excavated to ensure all the hatchlings are out of the nest. Public excavations educate tourists and locals by giving them the chance to see the hatchlings being released into the sea. The remaining unhatched eggs are analysed to see why they failed to hatch. Some hatchlings from each nest are weighed and measured for research purposes, before being released into the sea.



Loggerhead tracks

The project is run on donations from visitors to the project and volunteers help by paying £750 for their flights, food and accommodation. It is possible to help on the project for periods from six weeks to four months.

There are very few places where you can get such a valuable learning experience, whilst getting the chance to work hands-on with some of the world's most amazing and majestic endangered species. For more information about turtles visit the website *www.seaturtle.org* or for information about volunteering in Cyprus see *www.seaturtle.org/mtrg*

Left: A public release of hatchlings into the sea.
Below: This Loggerhead turtle was fitted with a satellite transmitter on 20 June 2007 at Alagadi Beach, Northern Cyprus.

Bovine Tuberculosis: a problem for all mammals

by Charlotte Cook

Bovine tuberculosis (bTB) is a disease caused by bacteria of the *Mycobacterium bovis* complex. In recent months there has been much media attention on the impacts of bTB in British agriculture and the role that the Eurasian badger plays in transmission.

Since the mid 1970s Defra has carried out a variety of badger culling strategies in attempt to reduce levels of bTB in cattle. This resulted in temporary local reductions in badger abundance, though it is widely believed that it has had no long-term impact on numbers. However, there is evidence to show that it has caused disruption in the social interactions and structure of badger populations.

In June 2007, the Government's Independent Scientific Group on bovine tuberculosis released the final report on the Randomised Badger Culling Trial (RBCT). This reported a pattern of increased bTB outbreaks in cattle on the periphery of cull areas. As a result, it is considered that culling would not be effective in the control of bTB unless a large reduction in badger populations was achieved and sustained over an indefinite period and over large tracts of land. The impacts of this level of culling are unknown but it would be a stretch of the imagination to think that it would positively affect the badger population. Aside from badgers killed directly by culling, there are concerns over the welfare of cubs orphaned by culling. During the RBCT there was a closed season from 1 February-30 April to reduce the number of cubs that starve when their mothers are killed. However, nearly 20% of cubs are born in December and January and these individuals are still vulnerable to starvation. Additionally, cubs are dependent on their mothers' milk for 3 months, therefore those born after early February (45%) will starve if their mothers are shot in early May.

bTB is not a problem exclusive to the UK cattle herd. bTB is found in wild bison and Michigan white-tailed deer in Wood Buffalo National Park, Canada. In Riding Mountain National Park, Canada, wild elk and wolves have been found to be infected with bTB. In the Kruger National Park, South Africa, bTB is increasing in prevalence and moving northwards from its introduction from cattle along the southern border of the KNP. Buffalo are a reservoir host, maintaining the disease at high prevalence (over 60% in some herds), while predators such as lions and leopards appear to be spill-over hosts. It is a concern that bTB could damage the large predators of KNP by entering the gastrointestinal tract after consumption of infected individuals. Bovine tuberculosis was found to be driving social changes within prides of lions, contributing to lower survival and breeding success. Kudu, honey badgers, warthogs, baboons, hyeanas, leopards and cheetahs have also been found to be infected with btB.

In the forthcoming years, with more research on the epidemiology of bTB, the conservational impacts of the disease and its control will become more apparent. Let us hope that wildlife populations do not suffer too badly in the meantime.

Student Profile

Tamsyn Uren-Webster

Age: **20**
Year of Study: **Third**
Subject: **BSc Biological Sciences**
A levels: **Biology, Chemistry, Physics and Geography.**

I chose to do Biological Sciences at Exeter because the range of modules offered allows you to gain a broad knowledge in the 1st year and specialise in subjects of particular interest as you progress throughout your degree.

The highlights of the course so far have been the practical work and developing my interest in interactions between animals and their surroundings, specifically the effects of environmental change including global warming and pollution. For my final year research project I am investigating how salinity affects fish behaviour and metabolism. I am keeping tanks of fish in the lab and changing the salinity of their environment. I film their behaviour looking for specific things like swimming speed and levels of aggression. I also calculate their metabolic rate by measuring the amount of oxygen they use. It takes more energy to live at higher salinities so I expect the fish to have higher metabolic rates and be generally less active.

I was awarded a Millhayes Scholarship, worth £3,000, for achieving 3 A grades at A level and at least a 2:1 for each year of my degree.

Ben South

Age: **19**
Year of Study: **Second**
Subject: **BSc Conservation Biology and Ecology**
A levels: **Biology, Art and Geography.**

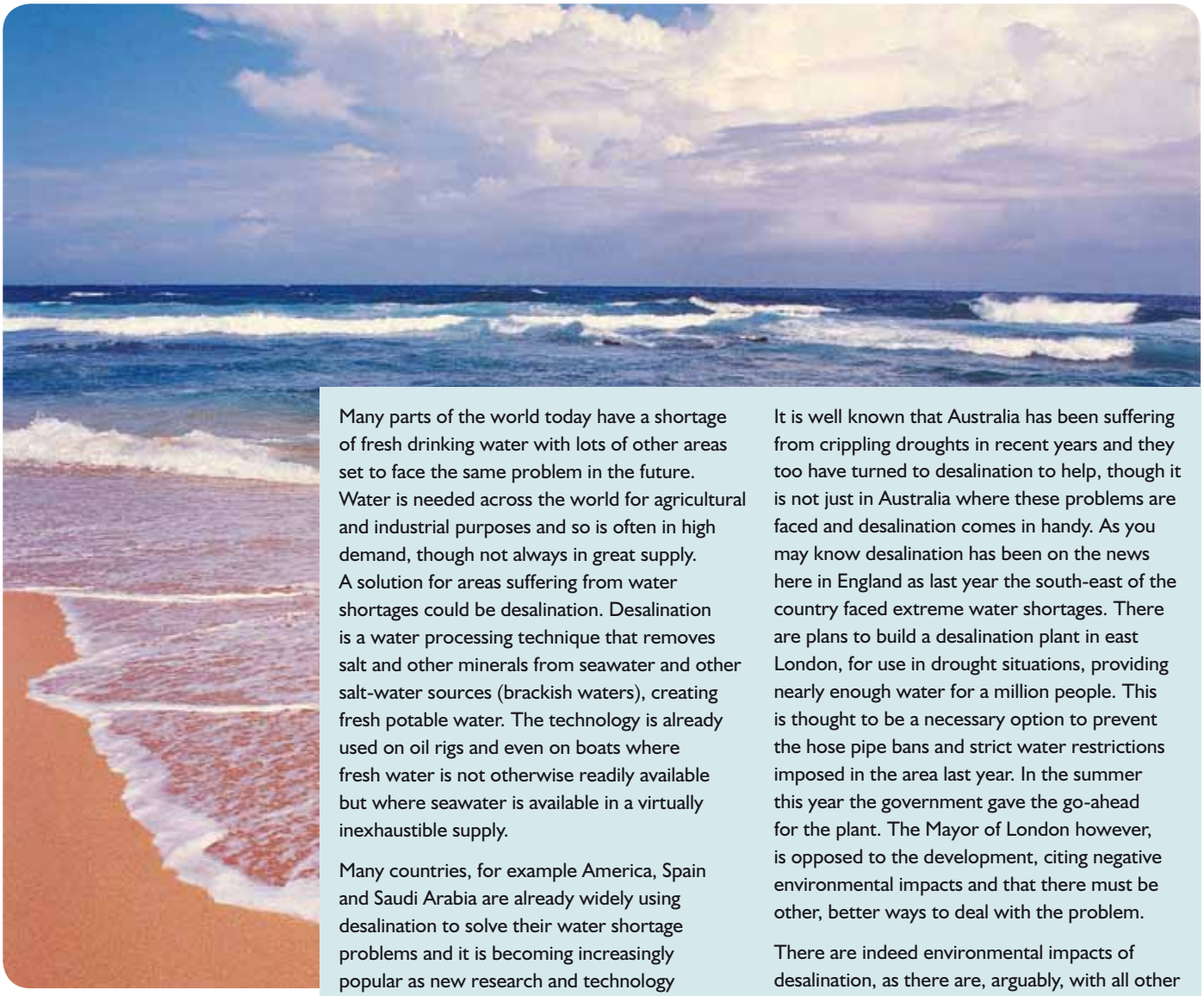
Brought up in the countryside I've always been passionate about natural history. With inspiration from various farming jobs and Sir David Attenborough I knew that conservation would be vital in the future and a good direction to further my study.

I've always been good at biology and the Conservation Biology and Ecology course at Tremough was a perfect match for my needs. It has a good combination of lecture time and field study, which I feel is essential for quality learning. In my second year, I am now looking forward to residential field courses in the Isles of Scilly in the spring and in Kenya next winter.

In addition to my studies, since coming to Tremough I have also been rowing in a pilot gig crew which is fantastic fun, allowing me to stay fit and offering social opportunities with a diverse circle.

Desalination – an end to drought?

by Charlotte Jones



Many parts of the world today have a shortage of fresh drinking water with lots of other areas set to face the same problem in the future. Water is needed across the world for agricultural and industrial purposes and so is often in high demand, though not always in great supply. A solution for areas suffering from water shortages could be desalination. Desalination is a water processing technique that removes salt and other minerals from seawater and other salt-water sources (brackish waters), creating fresh potable water. The technology is already used on oil rigs and even on boats where fresh water is not otherwise readily available but where seawater is available in a virtually inexhaustible supply.

Many countries, for example America, Spain and Saudi Arabia are already widely using desalination to solve their water shortage problems and it is becoming increasingly popular as new research and technology makes it a more economical option.

There are a number of different desalination techniques, one of the most commonly used is known as reverse osmosis (RO) which involves the use of membranes. This is an area where much research is being done and many advances are being made, as possibly the biggest unsolved problem in the use of desalination is the biofouling of these membranes, reducing efficiency and effectiveness. Biofouling can be defined as the undesirable accumulation of microorganisms, plants, algae, and animals on submerged structures. This year at Exeter I am researching the problem of membrane biofouling, particularly by sulfate-reducing-bacteria (SRB's). The work I am doing with Dr Sara Burton will lead to an increased knowledge of the microbial aspects associated with desalination.

It is well known that Australia has been suffering from crippling droughts in recent years and they too have turned to desalination to help, though it is not just in Australia where these problems are faced and desalination comes in handy. As you may know desalination has been on the news here in England as last year the south-east of the country faced extreme water shortages. There are plans to build a desalination plant in east London, for use in drought situations, providing nearly enough water for a million people. This is thought to be a necessary option to prevent the hose pipe bans and strict water restrictions imposed in the area last year. In the summer this year the government gave the go-ahead for the plant. The Mayor of London however, is opposed to the development, citing negative environmental impacts and that there must be other, better ways to deal with the problem.

There are indeed environmental impacts of desalination, as there are, arguably, with all other water purifying processes. It has been shown that possibly the greatest problem here is death of marine life sucked into the equipment at the seawater intake pipe. Another important issue is the discharge of the concentrated brine solution; pumping this back into the sea can cause the local salinity to rise creating a potentially fatal environment for many marine organisms. The environmental problems, including the energy usage of the technique are currently being actively researched and monitored, plants in Australia as well as elsewhere make use of renewable energy to minimise their environmental impact. Advancements here, as well as an increased knowledge of the major drawbacks such as membrane fouling, will ensure that desalination is the solution to the world's water crisis that we need it to be.

Studying Mountain Butterflies
to Understand Impacts of Climate Change

by Rob Wilson

From top to bottom: Apollo butterfly; Black-Veined White butterfly; Apollo caterpillar; Esper's Marbled White butterfly.

Mountains are key environments for conservation. Mountain ranges often represent "hotspots" of biodiversity, and many species only live at high altitudes. Until now, mountain habitats have survived relatively intact, avoiding the pressures of human land use that affect lowland landscapes. But climate change has become a serious threat to mountain habitats and the animals and plants that inhabit them.

Dr Robert Wilson from The School of Biosciences Centre for Ecology and Conservation, at the Cornwall Campus, has been studying the effects of climate change on mountain butterflies in Spain. The Sierra de Guadarrama mountains, just north of Madrid, are home to 120 species of butterfly (double the number found in Britain). About one third of these butterflies are mountain specialists in Spain, only flying higher than 800m above sea level. These species need cool or moist conditions to survive, and are threatened by rising temperatures.

In the Sierra de Guadarrama, average temperatures have risen by 1.3°C in the past 30 years. This might not sound serious, but it makes a big difference to the microclimates experienced by animals and plants. Temperatures are usually about 0.6°C cooler for every 100m climb, so the increase of 1.3°C means that conditions are now similar to those about 220m lower down in the 1970s. This temperature increase has important effects on butterflies. The Apollo butterfly used to be found as low down as 1000m above sea level, but temperatures at 1000m are now equivalent to those at 780m just 30 years ago. Nowadays, the lowest altitude populations of Apollo are found at 1300m, and even there they are restricted to cool, north-facing slopes.

On average, the lowest altitude populations of mountain butterfly species have shifted uphill by 210m since the 1970s. The uphill shifts seem to be caused by climate change rather than other habitat changes, because the plants that the species feed on remain present where the butterflies have disappeared. Caterpillars of the Black-Veined White feed on hawthorn, but can no longer survive the hot summers at altitudes below 900m, even though hawthorns are present.

Climbing upwards, temperature decreases quickly, so mountains allow species to track suitable climates by extending their distributions uphill. But mountains are conical, so there is never as much habitat at high altitudes, and the size of each species distribution decreases as it shifts uphill. As a result, mountain butterfly distribution sizes have decreased by one third on average since the 1970s, with species like the Apollo and Esper's Marbled White now clinging on to a few mountaintops, with a much greater risk of regional extinction.

Climate change is a serious threat to the butterflies of the Sierra de Guadarrama, but the research also shows how climate change could threaten other, perhaps lesser known animals and plants, breeding in mountain ranges all over the world. Warmer temperatures will restrict species to higher, smaller areas of habitat, threatening them with extinction. The conservation of these species depends critically on the protection of mountain habitats, and if possible the mitigation of climate change by reducing greenhouse gas emissions.

Environment in the News

by Rachael Barber

Exeter scientist urges action on coral reefs

University of Exeter School of Biosciences – Professor Pete Mumby

New research by Universities of Exeter and California Davis shows how damaged coral reefs in the Caribbean are declining until they are damaged beyond repair. A large problem a coral reef faces is becoming overrun with algae and seaweed, limiting the corals space to grow and preventing them being able to repair themselves. As the sole grazers of seaweed, Parrotfish are vital to reef survival but have suffered a reduction in numbers due to over fishing. However, by protecting them a future could be secured for the reef.

Concern grows for world's smallest bear

From BBC News 12 November 2007

The Sun bear, the world's smallest bear species has been reclassified from 'data deficient' to 'vulnerable' by World Conservation Union (IUCN). Although little is known about the biology and ecology of the Sun bear (*Helarctos malayanus*) they are thought to have suffered a 30% decrease in numbers in thirty years and are continuing to decline at this rate due to habitat loss and commercial hunting. To protect them, the IUCN cooperates with local governments, area managers, conservation groups and local people to reduce deforestation and poaching.

New insect species arrives in UK

From BBC News 8 November 2007

Nearly every tree in Britain is likely to be home to a Barkfly, and now a new species (*Atlantopsocus adustus*) has arrived on the Cornish coast from the Atlantic Islands. This new species has probably arrived on imported plants from Madeira or the Canary Islands. The successful colonisation is thought to be strongly linked to the changing of Britain's climate. The mild and humid weather means that the Barkfly is more likely to survive. This new species is unlikely to threaten the other 99 Barkfly species living in Britain.

'Designer' toxins target resistant bugs

From NewScientist.com News Service 2 November 2007

A new "designer" toxin has been invented to make more powerful pesticides and genetically modified crops. The new toxin is a modified Bt toxin, normally produced naturally by a bacteria called *Bacillus thuringiensis*. They kill specific pests, including many caterpillars, moths, and other insects, but are thought to be harmless to humans. The Bt toxins act by punching holes in the insects' gut cells, which kills them. However, it is unlikely that using this toxin could prevent other pests to boom in place of those it kills.

Seeing Red

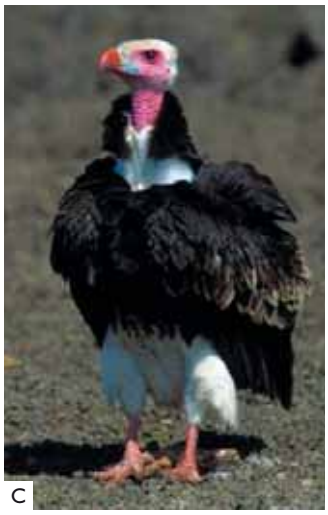
by Matthew Cole

Did you know there are over 16,000 species currently threatened with extinction of which 65 are only found in captivity? Every year The World Conservation Union produce a 'Red List of Threatened Species'; the 2007 edition indicated 41,415 species are under threat in some way.

Try to identify these seven species highlighted by the Red List… answers on the next page:

A

B



C

D

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Going Critical

'Seeing Red' The photographs on the previous page show seven endangered species:

A Yangtze River Dolphin or Baiji
Critically Endangered/Possibly Extinct

The last documented sighting of this dolphin was in 2002. Its numbers have decreased rapidly as its only habitat (the Yangtze River in China) has become overused by humans with motorised boats and fishing causing injury and death to the Baiji. It seems government intervention is too little, too late.

Photo © Mark Carwardine / NHPA / Photoshot.

B Galápagos Corals
Vulnerable/Critically Endangered

Coral has not been seen on the Red List before 2007, but climate change and the effects of El Niño have reduced the numbers of three corals, found only in the Galápagos.

Photo © P. Humann / www.fishid.com.

C African Vultures
Vulnerable/Near Threatened

Three species of African vultures have all dropped in numbers over the past few years. It is thought habitat loss, introduction of power lines and the use of insecticide-laced carcasses (to kill livestock predators) are all contributing to the vultures' dwindling population size.

Photo © Nigel J. Dennis / NHPA / Photoshot.

D Giant Panda
Endangered

Deforestation led to its decline and now it only inhabits six geographically separated regions of China. This fragmentation restricts the gene pool and limits breeding potential so numbers are struggling to climb despite reforestation programmes.

Photo © Aurora Levesley, University of Leeds.

E Western Lowland Gorilla
Critically Endangered

This gorilla's endangered status was highlighted after their population size decreased by 60% in the last 20 years. Hunting and the increasingly prevalent Ebola virus is contributing to the loss of so many gorillas.

Photo © Paul F. Brain, University of Wales, Swansea.

F Gharial
Critically Endangered

Limited to rivers in Nepal and India, only 4 breeding populations are thought to exist; net fishing and the construction of dams are thought to be the main cause for a 58% population decline over the past 10 years.

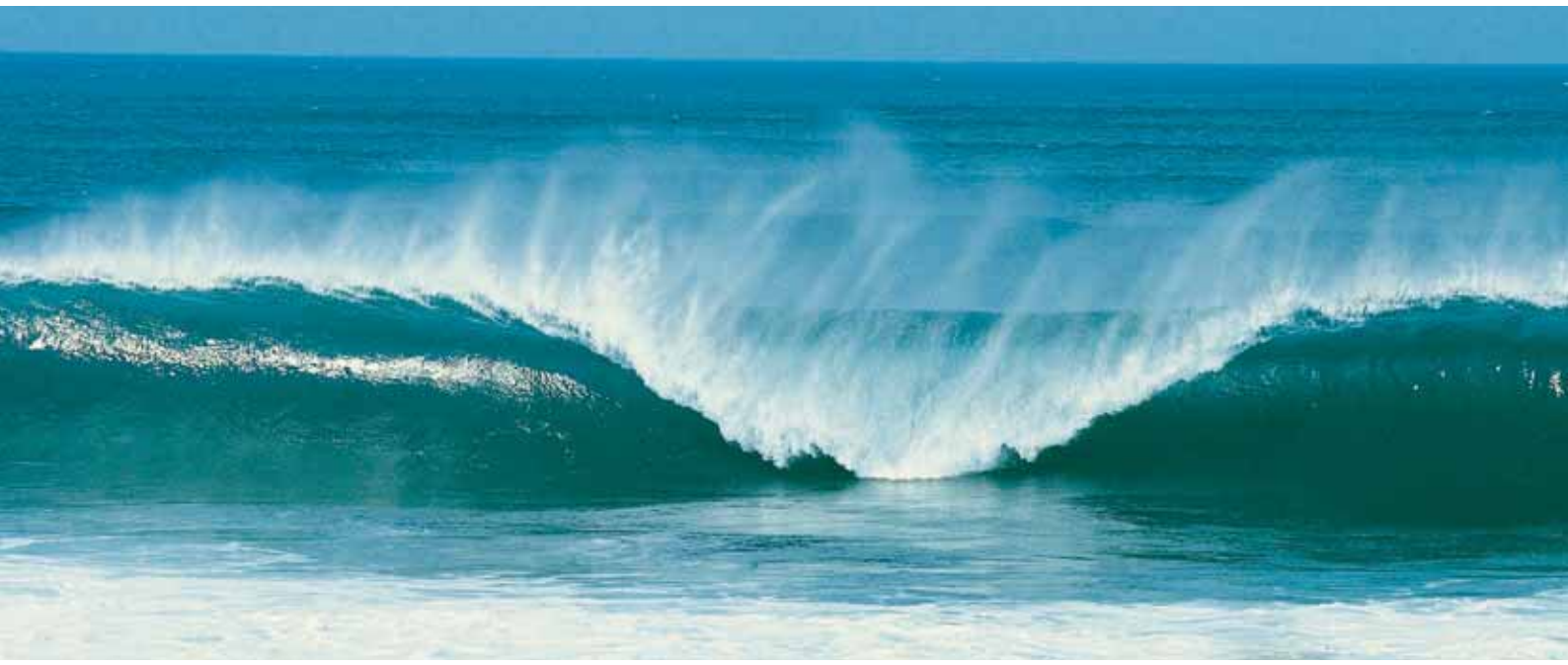
Photo © G. & H. Denzau / naturepl.com.

G Mauritius Echo Parakeet
Endangered

This parakeet, despite having an endangered status, is a success story. It has been in the red list for many years – classed as critically endangered – but its numbers are slowly increasing after prolonged, intensive and careful management by a Mauritian National Park. It is hoped similar strategies can be used worldwide to bring other species back from the brink of extinction.

Photo © Malcolm Burgess.

For more information on these and other endangered species, check out the Red List website at www.iucnredlist.org



Ocean Acidification and its effects

by Sam Fincham

One of the lesser-known problems of climate change is ocean acidification, which is the process by which the world's seas become more acidic, with disastrous consequences for marine life.

The process by which ocean acidification may occur is as follows: the greenhouse gas, carbon dioxide, diffuses into water. Carbon dioxide is a slightly acidic gas so it makes the water more acidic too. This is actually a very small change in pH; with current estimates, the largest change is likely to only be around 0.355, but it could be very significant.

Possibly the most important change will be to so-called calcifying animals. These are creatures like corals, which rely on the element calcium, the same chemical found in our bones, to form hard shells around themselves. This also includes crabs, lobsters, oysters and many other undersea invertebrates. Even a very slight change in pH can cause these animals to be unable to form these shells properly. This can already be seen in areas with coral bleaching, where the coral cannot create its normal structure and the area becomes uninhabitable, and without all the brightly coloured fish and anemones usually found in coral reefs.

The process of acidification on calcifying creatures will also create something known as a positive feedback loop as certain types of microscopic calcifying animals, known as coccolithophores, incorporate carbon dioxide into their shells. By doing this, the animals are able to store carbon dioxide, as when the animals die, they sink to the bottom of the ocean, where the carbon dioxide is said to be sequestered, or permanently stored. If coccolithophores are unable to form their calcium shells, they are unable to sequester carbon dioxide, which leads to it staying in the water, making it even harder for them to sequester it. As a result of this process, just a small change in ocean pH could quickly have a compound effect.

Another problem the carbon dioxide may cause is simply due to the chemical itself. All animals produce carbon dioxide when they respire, and remove it from their bodies, as it is toxic to them. In areas of the ocean, such as the deep sea, where oxygen is limited, this is a real problem, as rising carbon dioxide levels in the water make it even harder for fish living there to breathe. This can lead to areas of the ocean having too much carbon dioxide for marine animals, a state known as hypercapnia.

We know that ocean acidification would have devastating effects on marine biodiversity if it were to occur (although interestingly, acidic pHs are perfect for jellyfish to live in, which in turn creates its own problems, as these animals are often highly toxic) but no one is quite sure when it will happen. However, it is best to be on the safe side, and this is a further reason why we should limit our carbon dioxide output as soon as possible.

National Science and Engineering Week



National Science and Engineering Week is coming to the University of Exeter, 7 – 16 March 2008, and the School of Biosciences are hosting exciting events for years 12 and 13 at both the Streatham and Tremough Campuses.

In Exeter

6th Form Conference

Thursday 13 and Friday 14 March 2008, 1.00 - 4.00pm

This mini conference for years 12 and 13 is run over two afternoons – students may attend both days or just one. There will be talks about current research in Biosciences and posters on display illustrating some of the exciting work done within the School. Students will also have the chance to meet and chat to current undergraduates and postgraduates about studying Biosciences and about research. The conference will cover topics from across the fields of biochemistry, molecular biology, genetics, conservation and ecology.

At Tremough

'What is Science' Seminar

Wednesday 12 March 2008, 10.00am - 2.30pm

What is Science? How do we define Science? What is the purpose of Science? This engaging and thought-provoking seminar looks to answer some of these questions, as well as exploring some of the latest scientific ideas and promoting further exploration and debate of the role of Science in the physical world. This seminar runs from 10.00-11.00am and is followed by two further events; students rotate between the Ecology and Conservation seminar and the Zoological spot quiz.

Cutting-edge Research in Ecology and Conservation

An exciting seminar outlining some of the cutting-edge research carried out in the School of Biosciences, such as how genes, populations, and species change in response to natural selection or how research in the School provides new insight into the conservation of threatened species and habitats both in the UK and overseas.

Zoological Spot Quiz

A display of some of our most fascinating biological samples, parts of animals and other interesting items to handle and see how much you really know!

Email t.l.cannon@exeter.ac.uk for bookings for any of these events.

If you would like to find out about the workshops we run and other ways to get involved in Biosciences, or find further information for teachers please go to our website: www.exeter.ac.uk/biosciences or email **n.c.king@exeter.ac.uk**

If you would like to find out more about studying Biosciences at Exeter or about attending one of our open days please contact **bio-admissions@exeter.ac.uk**

Thanks must go to everyone involved with the newsletter: Rachael Barber, Andrea Barden, Matthew Cole, Charlotte Cook, Sam Fincham, Philippa Hardman, Charlotte Jones and Rob Wilson.

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