BBC

PARADISE FOR PUMAS

Visiting a place where big cats still reign supreme

Wildlife

July 2016 Volume 34 Number 8

NO-FLAP ZONE

Why New Zealand's birds gave up flying

TRACKING ADDERS

How you satellite tag a snake

ESSAY

Surprising life in an English beech wood

HUGE NEWS!

Hippos are Africa's secret superheroes

GANNETS IN THE MED?

Nesting among the sun bathers

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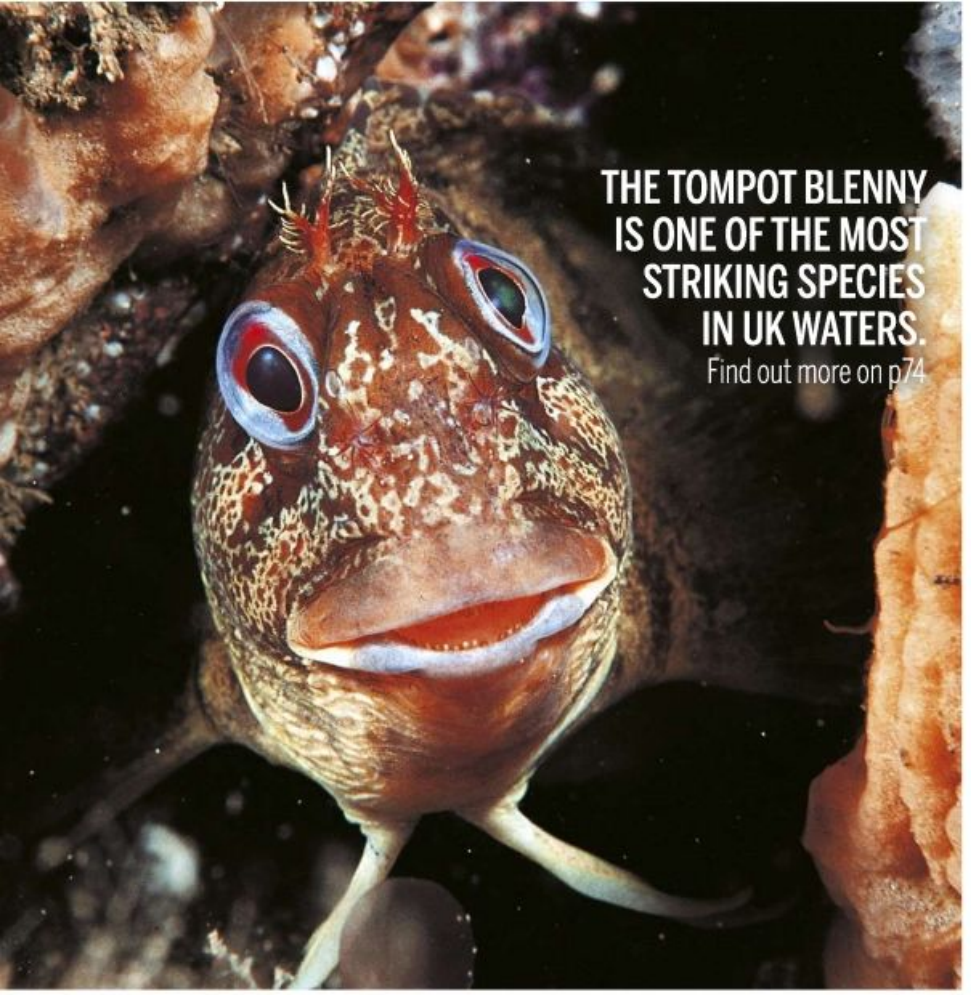

THE TOMPOT BLENNY IS ONE OF THE MOST STRIKING SPECIES IN UK WATERS.
Find out more on p74

Paul Naylor

Welcome...

Is there any creature quite so curious as the hippopotamus? They're so familiar from cartoons, children's games, even programme breaks on the BBC, and yet how much do we really know about them even if we have been lucky enough to see one in the wild, if not in a zoo? Until the copy for our article on p44 arrived, I had no idea that the models for the blimp-like ballerinas in *Fantasia* and inspiration for the famous Flanders and Swann mud-wallowing song were so important to maintaining a healthy ecosystem in their native habitat. I also wasn't aware that they had a reputation for being the most dangerous animal on the continent which, I'm glad to say, turns out to be unjustified. Now that I know more about them, the bizarre contradictions of their lifestyle and fascinating behaviour, I've promoted them to my number-one most interesting African mammal. The fact that they're probably not everyone's epitome of beauty adds to their charm.

Sheena Harvey Editor
sheena.harvey@immediate.co.uk

Contributors

MARK ELBROCH
Mark is a natural-history author and scientist for Panthera, which conserves the world's wild cats. He says, "Promoting peace among ranchers and pumas in Patagonia is a cause worthy of a lifetime." **See p20**

RICHARD FORTEY
Richard is a palaeontologist who worked at the Natural History Museum for 30 years. "The purchase of a Chiltern beech wood allowed me to free my hidden naturalist," he says. **See p30**

HANNAH JONES
Hannah runs a marine wildlife-watching firm in Penzance, Cornwall. She says, "Spotting a bowhead whale at our local beach definitely won the award for most unexpected sighting ever." **See p114**

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EDITORIAL
Tel 0117 314 7366
Email wildlifemagazine@immediate.co.uk
Post *BBC Wildlife Magazine*, Immediate Media Company, 2nd Floor, Tower House, Fairfax Street, Bristol BS1 3BN

SUBSCRIPTIONS AND BACK ISSUES
Tel 0844 844 0251/+44 1795 414500
Email wildlife@servicehelpline.co.uk
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OTHER CONTACTS
App support immediateapps@servicehelpline.co.uk
Ads Sophie Mills-Thomas 0117 314 8816; sophie.mills-thomas@immediate.co.uk
Syndication Emma Brunt 0117 314 8782; emma.brunt@immediate.co.uk

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ON THE COVER: Hippo: Wim van den Heever/naturepl.com; puma: Chris Brunskill/FLPA; gannet: Angelo Gandolfi

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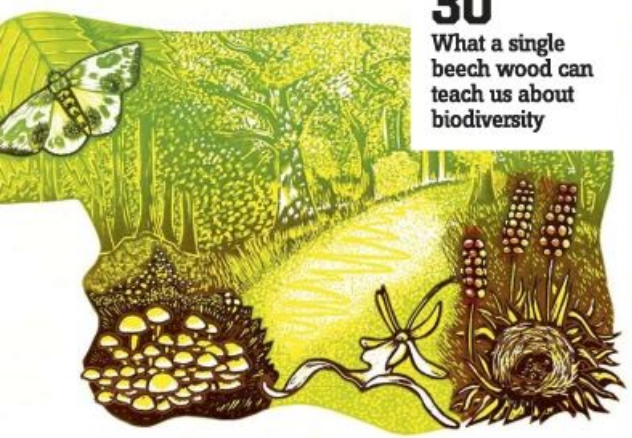

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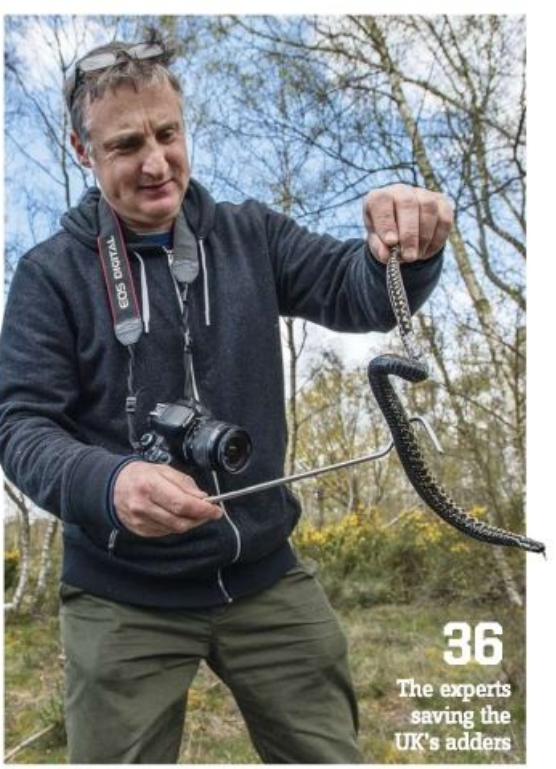

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Hippo: Will Burrard-Lucas; woodland illustration by 3BQRobin@KJA-Artists.com; tokehe: David Tipling/NPL; puma: Chris Brunskill/FLPA; adder: Sam Hobson; cuttlefish illustration by Holly Exley

BBC Wildlife

EDITORIAL
Editor Sheena Harvey
Features Editor Ben Hoare
Environment Editor James Fair
Section Editor Sarah McPherson
Production Editor Seth Burgess
Art Editor Richard Eccleston
Designer Benedict Blyth
Picture Editor Tom Gilks
Staff Writer Jo Price
Contributor Lisa Carr

ADVERTISING
Group Ad Manager Tom Drew 0117 933 8043
Ad Manager Neil Lloyd 0117 300 8276
Brand Sales Executive
Sophie Mills-Thomas 0117 314 8816
Junior Brand Sales Executive
Tara Hennell 0117 314 7357
Senior Classified Executive
Dan Granville 0117 314 7397

INSERTS
Laurence Robertson 00353 876 902208

MARKETING
Subscriptions Director Jacky Perales-Morris
Digital Marketing Manager Mark Summerton
Senior Direct Marketing Executive Corrina Persad
Press and PR Manager Carolyn Wray

LICENSING & SYNDICATION
Rights Manager Emma Brunt
0117 314 8782; emma.brunt@immediate.co.uk
Director of Licensing & Syndication
Tim Hudson

PRODUCTION
Ad Co-ordinator Sophie Loats
Ad Designer Rachel Shircore
Production Director Sarah Powell
Production Co-ordinator Lily Owens-Crossman

IMMEDIATE MEDIA COMPANY BRISTOL LTD
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WILD JULY

WHAT TO SEE » WHERE TO LOOK

Tom Mason

A male kingfisher passes a fish to his partner during courtship – females can easily be told by the orange on their lower mandible. Note that you need a licence to photograph kingfishers at or near the nest.

24 The number of years that kingfishers have bred successfully in the artificial nesting bank at RSPB Rye Meads reserve in Hertfordshire, near where this photograph was taken.

CHRIS PACKHAM'S MUST-SEE

BEHAVIOUR

RIVER STARS

Everyone, it seems, wants to see or photograph kingfishers – or write about them. In her book *Rain*, Melissa Harrison describes how one whizzing past "unzips the air above the water. A blue dart, understood only in the inarticulate half-second after it passes...", while in *Wild Kingdom* Stephen Moss points out that the species is "the James Dean of the bird world: it lives fast and dies young". Most kingfishers live no more than two years, with the record – according to BTO ringing data – being just four-and-a-half years. Iced-over watercourses make populations plummet, but the recent run of mild winters in Britain has been kind to these sparrow-sized, azure-and-orange birds.

This classic midsummer photograph by Tom Mason shows the celebrated 'fish pass' – the moment when a male kingfisher offers a minnow, bullhead or stickleback to his mate as a nuptial gift. "The pair were bonding and setting up for their second brood of the year, having already raised their first brood and fledged them successfully the month before," Tom says. "I may have lost a camera or two while taking this set of images on my local stream in Hertfordshire, but it was worth it!"

FIND OUT MORE For 10 top locations to see these widespread yet elusive birds in Britain, go to **www.discoverwildlife.com/kingfishers**

> "KINGFISHER PARENTS WORK INCREDIBLY HARD – A PAIR WITH CHICKS TO FEED MAY CATCH 115 FISH A DAY"

UK HIGHLIGHTS

The essential wildlife events to enjoy this month, compiled by **Ben Hoare**.

LITTLE TERN

LIFE'S A BEACH

One of our rarest seabirds, the little tern graces sand or shingle seashores until the end of the school summer holidays, patrolling the breaking surf to dive for fish. The species' size and yellow bill instantly catch the eye. But its handful of breeding beaches are vulnerable to disturbance, predators and sea surges – entire colonies can fail or move elsewhere. So painted models are being used to tempt terns to safer areas with wardens, electric fencing and special chick 'shelters'.

GET INVOLVED National Marine Week is 23 July – 7 August: **http://bit.ly/1rBfUNx**

OTTER

FAMILY MATTERS

There can be few more thrilling sights in British nature than a female otter with young cubs in tow. Your best chance of spotting cubs for yourself is to head to Orkney, Shetland or the Hebrides between June and September. If you're lucky, you might see a mother swimming to and fro to bring fish for her youngsters on the shore. The cubs will have started following her around at a few weeks of age, but even after six months they won't be catching many of their own fish suppers; in fact they may depend on her for a year or more.

TOP TIP Get up very early and pick a calm day, especially on a rising tide.

RAFT SPIDER

GOOD VIBRATIONS

In summer mossy pools on heaths and bogs are the hunting grounds of Britain's largest arachnid – the female has a 7cm legspan. Spreadeagled on the surface film, this cream-striped beauty waits motionless for the slightest ripple caused by its aquatic prey, including water beetles, damselflies, tadpoles and little fish. A second, much rarer species, the fen raft spider, occurs in East Anglia, East Sussex and South Wales.

FIND OUT MORE Radio 4's *Nature* covers fen raft spiders on Wednesday 13 July.

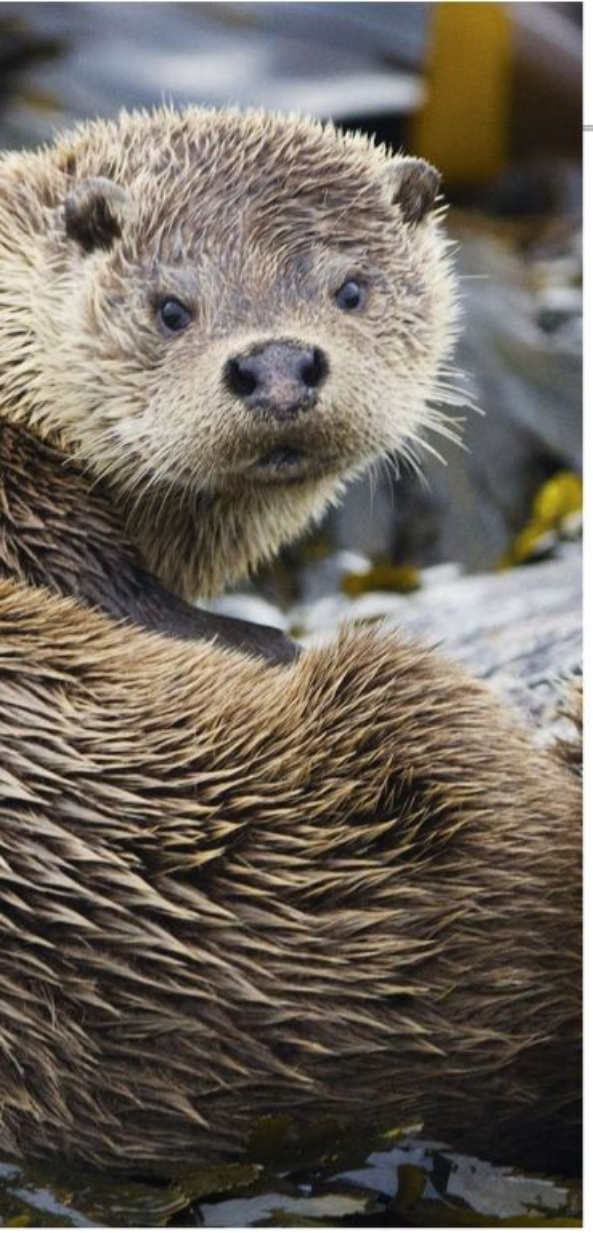
MARBLED WHITE

GRASSLAND BEAUTY

Curiously, this ravishing butterfly with the chequerboard wings is actually in the 'browns' family together with the gatekeeper and meadow brown. July is the peak month to see adults on the wing over sunny grassy places such as clifftops, chalk downland and road verges, mainly in the southern half of England, with outposts in Yorkshire and the Gower Peninsula in Wales. Adults love the nectar of thistles and knapweed, while the caterpillars munch wild grasses.

GET INVOLVED Join Butterfly Conservation's Big Butterfly Count: **www.bigbutterflycount.org**

Tern: Danny Green; otter: Jack Perks/FLPA; ant nest: Laurie Campbell; sand martins: David Tipling; marbled white: Matt Cole; spider: Alex Hyde

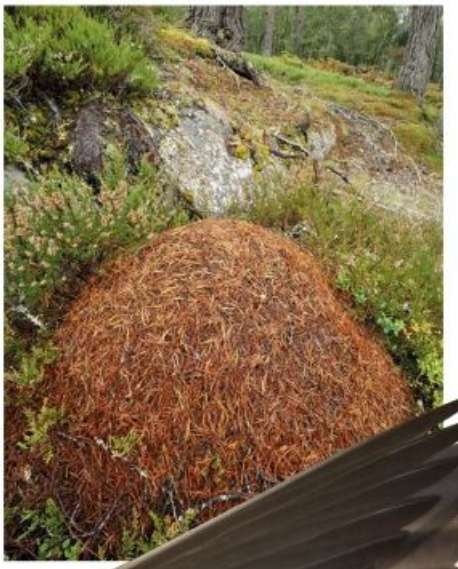


WOOD ANT

HOME SWEET HOME

They may be small, but wood ants are major ecosystem engineers. Their relentless foraging and nestbuilding recycles nutrients around the woodland, boosts soil fertility, disperses seeds and keeps populations of prey in check. Sunlit clearings and open woods suit these ants best. If you find one of their giant nests this summer, heaped from pine needles, leaf fragments and tiny twiglets, it's worth pausing to marvel at the intense activity. The worker ants defend their fortress with nasty nips and squirts of formic acid – gently proffer a twig and it may end up smelling of vinegar.

GET INVOLVED Take part in Buglife's survey of wood ant nests in Scotland: **www.buglife.org.uk/nest-quest**



SAND MARTIN

BANKING BONUSES

By July many sand martins will be incubating a second clutch of eggs. They nest colonially in soft banks beside gravel pits, lakes and river meanders, zipping back and forth low over the water and surrounding grassland to harvest the clouds of flies and midges. Chicks suffer in wet summers, but the species does well in artificial nesting banks, many with nestcams or nearby hides that offer great views. Four to visit are at Rutland Water, Attenborough Nature Reserve near Nottingham, WWT London Wetland Centre and RSPB Window on Wildlife in Belfast.

FIND OUT MORE Martin, swallow or swift? Learn with a BTO video: **www.bto.org/about-birds/bird-id**

THREE OF A KIND

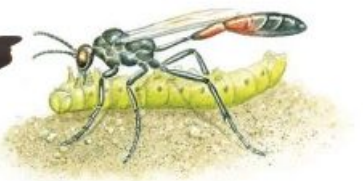
HEAVENLY HEATHS

Britain's lowland heaths come into their own on hot summer days – ablaze with blooming heather and gorse, and fizzing with insect life.

Silver-studded blue

PLEBEJUS ARGUS

Flutters low over heathery ground. Unusually for a UK butterfly, adults roost in groups. Local, mainly in south.



Sand wasp

AMMOPHILA SABULOSA

Parasitic solitary wasp. Females hunt caterpillars to stock their burrows – their grubs will feed on them.

Bell heather

ERICA CINEREA

Lurid magenta, bell-shaped flowers. Usually blooms earlier than Britain's several other heather species.

Illustrations by Felicity Rose Cole

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THE SCIENCE OF NATURE

AMY-JANE BEER'S

NATURE TABLE

Uncovering the science of seasonal treasures.

Look out for cuttlefish bones on the strandline of beaches.

18 CUTTLEFISH BONE

As Apple's Steve Jobs once said, "Simple can be harder than complex", but honing purity of form out of inherent complexity is something nature does exceptionally well. The first cuttlefish bone I saw was in a cage where it served as a calcium supplement for a bored budgie. Nothing about its pristine simplicity or dry, soft-sheen texture called to mind the colour-shifting bullet of tentacled flesh that is a cuttlefish.

Cuttlefish are cephalopod molluscs, like octopuses and squid, but unlike them have a shell – an internal one. There's another surprise when you pick up a cuttlefish bone. It looks solid yet it's airily light thanks to a structure that comprises thousands of chambers separated by thin walls of aragonite, a form of calcium carbonate that is also found in the shells of snails and mussels.

In life, the chambers of the cuttlefish bone are connected by a diffuse strand of tissue called the siphuncle. This aids the drainage of water from each chamber as it forms and supplies the gases that ultimately fill the chambers, allowing the bone to serve as a flotation device. This process is reversible – the cuttlefish can adjust the volume of fluid and gas in its shell, enabling it to lurk on the floor of the sea by day, then increase its buoyancy as darkness falls, rising into mid-water where it holds its position effortlessly.

> "CUTTLEFISH CAN ADJUST THE VOLUME OF FLUID AND GAS IN THEIR SHELL"

In many marine organisms with calcified hard parts, such as corals, snails and sea urchins, the reduced availability of carbonates caused by ocean acidification (itself a side effect of increasing atmospheric carbon dioxide) leads to the thinning of shells and skeletons. But recent research suggests that cuttlefish exposed to growing levels of dissolved carbon dioxide actually lay down denser cuttlefish bones – a reminder that the ramifications of environmental change are far from predictable.

AMY-JANE BEER is a naturalist. Her book of fun facts *Cool Nature* is out now (Pavilion, £9.99).

DID YOU KNOW?

MALE DUCKS MOULT THEIR PLUMAGE IN LATE SUMMER AND GO INCOGNITO.

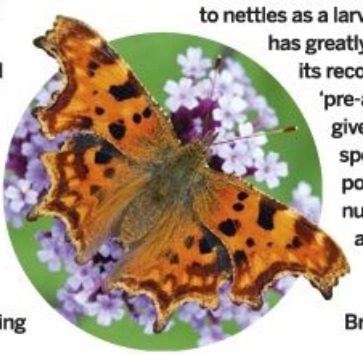
An eclipse male teal, looking much like a female.

Most species of duck moult twice a year to replace worn-out primary feathers, making them incapable of flight for a few weeks. As a defensive strategy drakes begin the summer moult by shedding their breeding finery for less conspicuous garb known as eclipse plumage, meaning they often temporarily resemble the less colourful females.

GARDENWATCH

The comma butterfly is a winner in the climate-change lottery.

Things looked bleak for this distinctive British species a century ago. Cool summers and the declining production of hops, its preferred larval foodplant, had reduced the comma's range to the far south-west of England and Wales. But the distribution of many native butterflies is shifting in response to climate warming. The comma has responded faster than others – its range has bounded north since the turn of the millennium. A timely switch to nettles as a larval foodplant has greatly enhanced its recovery. This 'pre-adaptation' gives the species a potential nursery in almost every corner of lowland Britain.



NATURE RESERVE SPOTLIGHT

GALLOWAY FOREST PARK

WHERE
Creebridge, Dumfries & Galloway, DG8 6AJ
DARK SKY RANGER
Matthew McFadzean

WHY YOU SHOULD VISIT

It is Britain's largest forest park, created in 1947 and covering 777km², and it was the first Dark Sky Park in the UK, where full views of the heavens can be had without the interference of man-made light or environmental pollution. It is a great place to see shooting stars and to observe the evening behaviour of nightjars, barn owls and tawny owls.

WHAT YOU CAN SEE

Apart from smaller mammals, there is a red deer range in the park where you can get close views of the animals from a hide and learn all about them from the rangers. Nearby there's a chance of seeing the ancient breed of British primitive goats that roam wild on the heather hillsides.

TOP SPOT

My favourites places for dark-sky observing are the Otter Pool and Stroan Loch on the Raiders Road, and Loch Riecawr on Carrick Forest Drive.

JOIN THE RANGER

In summer you can visit the red deer, go on a dusk wildlife watch and round off with seeing stars. Email equinoxboy@aol.com for more information.

Wild goats have been roaming Galloway Forest Park since the 1970s.

Wild goats: South West Images Scotland/Alamy; Matthew: Catherine McFadzean

JULY WILDLIFE EVENTS

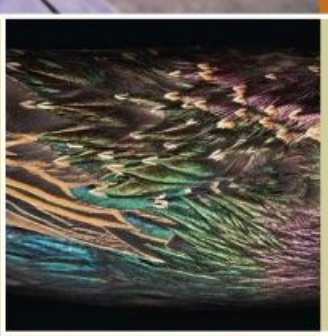
EVENT CHOICE

29-31 July

BIG WILD SLEEPOUT
Get closer to nature by camping out in your garden with your family, going on a minibeast safari or taking part in a special Big Wild Sleepout event at your local RSPB reserve. Register at the website below for a free pack of ideas to make the most of your experience.
http://bit.ly/1OSs6tt

16 July

BIG SEA SWIM
The Marine Conservation Trust is organising a fantastic charity event at 11am on Eastbourne Beach to help preserve our seas and oceans. Register at the website below to take part in a fun 1km or 3km (for experienced swimmers) swim.
http://bit.ly/1Tu6fW7



15 July -6 Nov

COLOUR AND VISION
Discover how vision first evolved and how colour in animals became the difference between life and death in this exciting exhibition at London's Natural History Museum. View more than 350 specimens. Tickets are £10.80/£5.40 for adults/children.
http://bit.ly/1VfpLtS

15 July -7 Aug

BIG BUTTERFLY COUNT
Take part in the world's biggest butterfly survey to help assess the health of our environment. Spend 15 minutes counting butterflies in your garden, nearby park or nature reserve and submit your sightings to the Butterfly Conservation Trust.
www.bigbutterflycount.org

Tents: R Thanki/RSPB; starling: NHM London; Big Sea Swim: L Roberts; peacock butterfly: T Melling/Butterfly Conservation; Phil: Chester Zoo

SPEAKERS' CORNER
PHIL BLACKBURN

WHAT Happy International Tiger Day
WHEN 3.30–4.45pm on Friday 29 July
WHERE Chester Zoo

Chester Zoo ranger Phil Blackburn and colleagues will be talking about the zoo's Critically Endangered Sumatran tigers during this drop-in session. "The illegal wildlife trade is pushing the species closer to extinction each day," he said. This talk at the Sumatran tiger enclosure is a great opportunity to celebrate the important role that these big cats have in the ecosystem on International Tiger Day and hear the latest news from the field. A range of artefacts, including a tiger skull and skins, will be used to raise awareness of the threats that they face in the wild. When bought online weekday tickets cost £21.81 for adults and £18.18 for children; weekend tickets are £23.63 and £20 respectively.

Find out more about Chester Zoo at http://bit.ly/1Y3exco

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DISCOVERIES

The latest in scientific research from all over the animal kingdom.

Written by STUART BLACKMAN

A peahen watches a peacock's display. Females have their own train, but it is much shorter and lacks eyespots.

BIRDS

PEACOCKS' POETRY IN MOTION

THE VIBRANT COLOURS OF THE MALE BIRDS' SPECTACULAR DISPLAY CONCEAL A MIRACLE OF ENGINEERING.

A peacock's display is not only about colour – it is about sound and motion too. And a collaborative study between biologists and physicists suggests that the birds' famous train feathers are built to move so as to accentuate the colours.

The team used high-speed video to analyse the motion of the rattling train. "The feathers move as standing waves, like the strings of a guitar," said Roslyn Dakin of Canada's University of British Columbia, who led the research.

Their calculations revealed that the feathers are vibrated in such a way as to create maximum movement for minimal energy expenditure, depending on their length, weight and thickness.

What's more, while the feathers are vibrating back and forth, the eyespots remain almost stationary.

That's because the feather barbs in the eyespots are locked together with tiny hooks, much like those in flight feathers, while the rest hang free and loose. This endows the eyespots with greater density and therefore inertia, which keeps them still as the train vibrates around them.

DID YOU KNOW?

Much of the sound that is produced by a peacock rattling its tail is pitched too low for human ears to hear, though peahens and rivals can sense and respond to the noise.

The result is a mesmerising effect in which the iridescent eyespots appear to hover motionless against a blurred background.

"It's neat to think about what this display must be like from the peahen's point of view," said Dakin. "Close to the ground, the peacock's 1.75m-long train would virtually fill her field of view with undulating, rattling, glittering feathers."

The team has yet to establish how the motion component of the display influences females' choices. One approach might be to manipulate the feathers so that the eyespots become more or less stationary during displays.

"We could add small weights on the shaft of the eyespot feathers to change the weight distribution along the length of the feather," Dakin told *BBC Wildlife*. "This would not affect the look of the eyespots, but it would affect how the feathers move. It would be harder to get the feathers moving with a greater amplitude or speed – we might need a robotic peacock."

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ARACHNIDS

MAKING A SHIELD OF LOVE

There are two reasons why a male nursery web spider shouldn't court a female empty-handed. If he fails to present a silk-wrapped fly, he will be rejected outright; and, according to new research, he won't have anything to defend himself with if she tries to eat him.

Female nursery webs rarely attack suitors. But when they do, the male loses everything. Unlike other cannibalistic spiders, such as black widows, females attack before mating not after it. The male doesn't even get the consolation that his body will nourish a female bearing his offspring.

Happily, the male can use the offering as a handy shield to ward off the female's fangs if she does attack.

"The male holds it in his jaws, keeping it between himself and the female," said Søren Toft of Aarhus University, Denmark. "We've seen aggressive females get their jaws caught in the gift."

The male can then turn the situation to his advantage. "Once she hits the gift, the attack stops and it turns into a mating," said Toft.

A male nursery web spider with a gift for a female.

SOURCE *Biology Letters*
LINK http://bit.ly/1P9ePHZ

Spiders: bickwinkel/Alamy; solenodon: Eladio Fernandez/NHPA/Photoshot; heath: NPL/Alamy; capuchin: Thomas Marent/Minden Pictures/FLPA; ct scan: Ariana Harrington, Florida Museum of Natural History

The rare Hispaniolan solenodon is restricted to the Dominican Republic and Haiti.

MAMMALS

REMARKABLE RELICS

Solenodons may not be the prettiest creatures around, but research shows that this obscure branch of the mammalian family tree dates from the age of the dinosaurs.

Two species of these endangered insectivores survive in the Caribbean. Unusually for mammals, they are venomous, delivering a toxic salivary cocktail through grooves in their teeth.

Solenodons have long been of interest to zoologists because they appear to have no close living relatives and have changed very little from the earliest mammal fossils.

The new genetic analysis of the Hispaniolan species reveals that the lineage split from other mammals 78 million years ago, long before the dinosaurs' extinction.

"It's just impressive it's survived this long," said Adam Brandt of the University Of Illinois at Urbana-Champaign. "It survived the asteroid, human colonisation and the rats and mice humans brought with them that wiped out the solenodon's closest relatives."

SOURCE *Mitochondrial DNA* LINK http://bit.ly/25AM3cK

The EXPLAINER

Scientific terms put into plain English for the rest of us.

ECOLOGICAL SUCCESSION

After a disturbance, such as a wildfire, a roadcutting or volcanic eruption, plants and animals recolonise in a fairly predictable sequence as each arrival modifies the habitat, making it suitable for others. A fresh lava flow, for example, may first be colonised by encrusting plants, which create a topsoil that can support herbs and grasses, then shrubs and woodland. The result is a stable 'climax community' such as oak woodland – stable, that is, until the next disturbance.

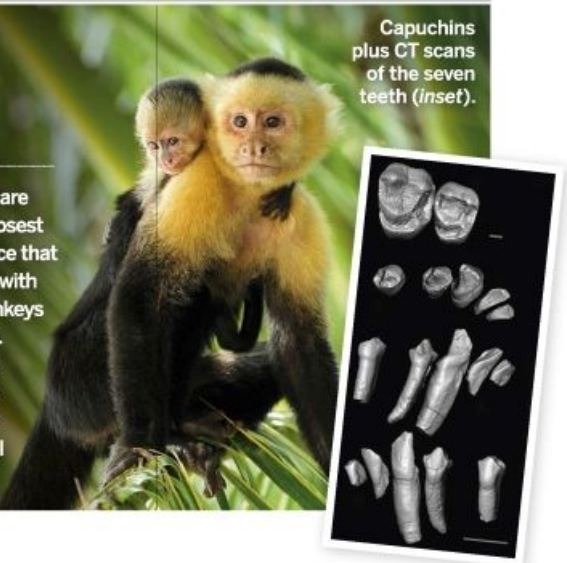
This New Forest heathland is a 'climax community'.

NEW SPECIES SPOTLIGHT

PANAMACEBUS TRANSITUS

WHAT IS IT? Known only from seven fossil teeth that are 21 million years old, *Panamacebus transitus*, whose closest living relatives are capuchins, is the first direct evidence that monkeys inhabited North America before it joined up with its southern neighbour. It remains a mystery how monkeys made the crossing or why they failed to prosper there.

WHERE IS IT? The teeth were unearthed during the expansion of the Panama Canal. *Transitus*, meaning 'transit', echoes the epic journeys made by both the monkeys' ancestors and the ships that use the canal to travel between the Atlantic and Pacific Oceans.



Capuchins plus CT scans of the seven teeth (*inset*).

SOURCE *Nature* LINK http://go.nature.com/1TbaOqn

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A brightly coloured scarlet tanager in his breeding plumage.

BIRDS

WHY RED BIRDS ARE RED

Scientists have identified the gene responsible for making the red pigments in many birds' feathers and skin – a discovery that provides a big clue for why the colour is so important in avian sexual displays.

Red pigments must be manufactured physiologically by birds, because unlike yellow ones, for example, they cannot be obtained directly from their diet.

But two separate studies – one on zebra finches, the other on a red breed of canary – have identified a single gene that codes for an enzyme that converts yellow pigments to red ones.

Intriguingly, the enzyme is also produced in large quantities in the liver, where it breaks down toxins. Producing all of that enzyme probably takes a lot of energy, and only the fittest, strongest birds are likely to be able to produce enough of it.

Miguel Carneiro of the University of Porto, Portugal, who led the canary study, said: "This might explain why variation in the intensity of red coloration appears to be an indicator of individual quality, and why red coloration of bills and feathers evolved independently so many times."

SOURCE *Current Biology*
LINKS http://bit.ly/1XV5WIM and http://bit.ly/1XV54nz

AMPHIBIANS

THE BENEFITS OF ASEXUALITY

Mole salamanders are excellent at regeneration.

Salamanders are renowned for their powers of regeneration. Some are better at it than others, though. And a new study of various species of North American mole salamander reveals an intriguing link between regenerative powers and reproductive behaviour.

While some mole salamanders reproduce sexually, others have dispensed with males entirely and reproduce asexually. When researchers compared regenerative abilities of asexual and sexual species, they found that asexual ones renewed lost tails 36 per cent faster.

The difference might help explain why the asexual species thrive despite their not reaping the genetic rewards of sexual reproduction. But what drives their regenerative prowess?

The asexual species also differ from the sexual ones in having more than the usual two copies of each chromosome – chromosome multiplication is a common cause of speciation in plants, but rare in animals. It may be that the more chromosome copies a salamander possesses, the stronger the signal from genes involved in regeneration.

SOURCE *Journal of Zoology* LINK http://bit.ly/21jy1tq

Tanager: Alan Murphy/Minden Pictures/FLPA; tiger salamander: Imagev/Photoshot; squirrel: Larry Ditto/Danita Delimont/ardea.com; plant: Ralph Clark

WILDLIFE UPDATES

FOXED FOX SQUIRRELS

Fox squirrels express frustration with their tails, according to the *Journal of Comparative Psychology*. When squirrels that have learned to open boxes to obtain nuts find a box is locked, they give a characteristic tail-flick before exploring other methods of entry.

TWISTED INSEMINATION

Wingless female strepsipterans, or twisted-winged parasites, live in the bodies of other insects, leaving just their heads protruding from their host. That might make mating with the free-flying males difficult, but an article in *Scientific Reports* reveals that a male inserts his penis into the female's neck, injecting sperm directly into her body cavity.

SNEAKY SEBA'S

Male Seba's short-tailed bats without a harem can salvage some reproductive success by nipping in to copulate with females behind dominant males' backs. Research in the *Journal of Experimental Biology* shows that these sneaky males have more athletic sperm than harem-holders, which might help compensate for their low social status.

SIX NOT OUT

A tiny population of a plant known only from a single specimen collected in 1862 has been discovered in South Africa. Mrs Barber's beauty was not seen again until 2009, but the journal *PhytoKeys* reports that extensive searches have now turned up six plants.

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CHRIS PACKHAM'S

Unsung NATURAL HISTORY heroes

Georgia Locock

Georgia's enthusiasm and passion for wildlife make her a leading light of the next generation of naturalists.

Filming this year's series of *Springwatch Unsprung* has been great. OK, our guest Deborah Meaden of *Dragons' Den* fame didn't buy into my Roadkill Bingo idea, but meeting people like Melanie and Alex, a *BBC Wildlife* Local Patch Reporter, was so reassuring. Both of them are enthusiastic and able young naturalists.

Melanie is 14 years old and collects skulls. She has quite a collection, beautifully prepared, and kindly set our quiz during the programme's first week. Thirteen-year-old Alex is a keen photographer and blogger who won the Mammal Society's Young Photographer of the Year award for a cracking shot of a brown hare. I 'discovered' the pair on Twitter, where they share their enthusiasm with loads of others – particularly, I hope, other young people.

You see, I saw bits of the young me in Melanie and

> "GEORGIA IS MY UNSUNG HERO AND A FIGUREHEAD FOR YOUNG NATURALISTS"

Alex, and I'm sure many other viewers saw reflections of their younger selves too. But rather than being isolated by their interest, as many people of my generation were, these budding ecologists are able to connect with a community of like-minded kids of a similar age using social media.

Those other nature-mad kids may not be in the same classroom, but having them there, in the ether, must be so reassuring. There is nothing worse than being marginalised as a teenager because your passion doesn't fit the norm.

And, of course, Melanie and Alex are not alone. At last year's Rutland Birdfair I had the idea of handing my 'slot' to three other young people. I gave them minimal direction but as much support as I could, and they were all utterly outstanding. Josie Hewitt spoke superbly about her ringing experiences, Connor Coombes displayed his passion and talent for wildlife photography and Georgia Locock told a packed marquee about her campaigns and how she has tried to get other teenagers into wildlife. Standing at the side of the stage watching them excel was the highlight of my year.

Georgia will be back on the Birdfair stage with me in August as she's agreed to interview me about my memoir *Fingers in the Sparkle Jar*. I think it will be refreshing for the questions to be asked by someone who is closer to the ages I recall in the book. Just a few questions, though – I have little intention of using a whole hour to talk about myself. I'm more interested in our latest campaigns and what we will be doing next to try to make things a bit better for wildlife.

Back in April Georgia organised a Peregrine Watch in Litchfield where a pair nest on the cathedral. Posters went up, the local press advertised the event, she took along some spare binoculars and about 150 people enjoyed a bit of birding, a bit of awareness and a bit of education too. And in March Georgia was at the Birders Against Wildlife Crime conference, and she has been constantly proactive in opposing the badger cull.

After her AS-level exams, Georgia spent a while at Spurn Bird Observatory in Yorkshire, where she clocked up nearly 100 bird species in five days, including ticking off a scarce icterine warbler and watching a superb male red-backed shrike being ringed... not that I'm jealous or anything! And I know all this because I read it on her excellent blog (https://georgiaswildlifewatch.com).

So this month I name Georgia Locock as my unsung hero and as a figurehead for a host of other young naturalists, campaigners and photographers who, thanks to the failings of older folk, will inherit an even bigger mess to sort out than we did. Please support them in any way you can. Sometimes the tiniest gesture kindles a confidence or a determination to succeed during what is probably the most difficult time of life.

Georgia with a barn owl chick.

Georgia Locock

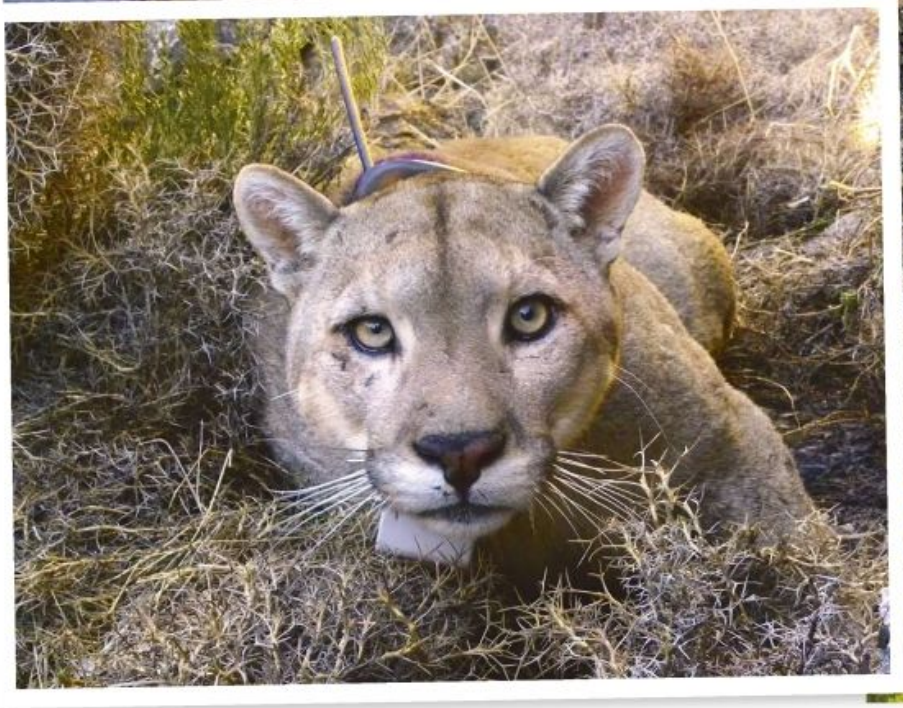
CHRIS PACKHAM
is a conservationist and presenter.
● Do you have a conservation hero? Let us know: email **wildlifeletters@immediate.co.uk**

Ken Conger

Pumas are about the same size as female leopards, and equally good at hunting.

Pumas *of* Patagonia

Patagonia's jaw-dropping scenery is perfect for pumas. This vast wilderness just wouldn't be the same without its biggest predator, says **Mark Elbroch**.



Lying on my stomach I wriggled through the warren of paths, twisting and turning where openings allowed me to approach the dogs I could not see. Our well-trained hounds were tired from following the puma down the mountain. Finally I spotted Oportus through a lattice of branches, lying comfortably in an open vault formed by arching bushes. The two hounds lay at a safe distance, barking lazily.

All was serene until someone crashed into the edge of the brush on the opposite side. They were attempting to force Oportus from the thicket, but if we'd learned anything from weeks of trying to catch pumas to fit and retrieve tracking collars, it was that noise will not drive them from cover. That was why I was crawling on knees and elbows. Well, that, and the fact that catching pumas in the vastness of Patagonia, with its scant trees and ample bushes and caves, was proving extremely frustrating. So I was trying new tactics.

Oportus, who is named after the mountain where we first captured him, suddenly rose gracefully and slithered in my direction. His sinewy form was both awe-inspiring and intimidating. Then he appeared just a couple of metres away. Fear rippled through me – at that moment it was a struggle to remember that pumas are timid creatures that avoid confrontation.

Top to bottom: a storm clears above Torres del Paine at sunrise; the study animal Oportus in his tracking collar; Andean condors have a wingspan as wide as 3.2m and the bigger male weighs up to 15kg.

PERFECT FOR PUMAS

Patagonia is nearly the end of the world, a place so far away and forgotten that high-ranking Nazis fled here to evade legal retribution after World War II. It's a breathtakingly beautiful landscape – and ideal for pumas, which I have devoted much of my career to studying. Not only are they the top predator, but meat left over from their kills helps to sustain many scavenging animals, including grey foxes and mighty Andean condors. This makes the big cat a 'keystone' species here – one whose presence supports wider biodiversity in the region.

Landscape: Thomas D Mangelsen; puma: Frans Lanting; Oportus: Mark Eibroch/Panthera; condor: Yva Momatiuk & John Eastcott/Minden/FLPA

Highly adaptable, pumas live in such diverse habitats as mountains, deserts, steppes and forests – all of which are found within Torres del Paine's 2,400km².

In the far south of Patagonia, the Andes form a border between ecosystems and countries. From these mountains west to the Pacific, Patagonia is rugged, forested and moist, inhabited by small numbers of Chilean people, Endangered huemul deer, noisy austral parakeets and reclusive, wren-like tapaculos. But this is rarely the Patagonia that people imagine, because the remainder – the vast majority in fact – is dry, open grasslands. These are inhabited by Argentinians, native guanacos (wild relatives of llamas that form large herds), southern rheas (big, flightless birds that run like emus) and Andean condors soaring on the lookout for carrion.

THE PUMA IS A 'KEYSTONE' SPECIES – ONE WHOSE PRESENCE SUPPORTS WIDER BIODIVERSITY.

Pumas thrive in this remote wilderness – some evidence even suggests that their population densities may be higher than anywhere in North America, where the cats are usually known as mountain lions or cougars. (The species ranges from Alaska south to Tierra del Fuego at the southern tip of Patagonia.) Truly this is paradise for a big-cat researcher, and I've spent countless hours here unravelling their fascinating behaviour and ecology.

LETHAL POWER

Perhaps the defining behaviour of pumas, as with other big cats, is their ability to subdue and kill prey many times their size. Their hind legs are disproportionately long, situating their haunches higher than their shoulders and providing the leaping and running power needed to catch fleet-footed prey such as guanacos or huemul deer. Their thick, muscular tails act as counterbalances while in pursuit, and can be well over 90cm long.

Pumas are stalk-and-ambush hunters, waiting undetected or moving to within striking distance of their intended target. They are patient experts of camouflage, using vegetation as short as 20cm to make their approach. Then they explode forth and grip their quarry rodeo-style, clinging tightly with sharp, protractable claws (rather than retractable ones – their natural state is to be sheathed). ▶

This female puma stalked a guanaco as it walked down a hill, then hunkered down and broke from cover too early to catch her prey.

In a flash of motion, they reach forward and hook the head of a guanaco to break its neck or expose its throat. Often they bite and sever the windpipe, quickly killing their prey by suffocation.

The second part of the species' scientific name *Puma concolor* means 'single colour', referring to the adults' uniform pelage. However, this does not mean that they're always the same shade. In Wyoming and Idaho, for example, individuals range from ochre to tawny to sepia, while in California they are pale yellow to golden brown – in both regions the animals mimic the tone of local earth or dry grass. And I distinctly recall the shock of seeing my first puma in Patagonia – he was grey like a granite boulder, the colour of rock rather than of grass or ground. He was a ghost of his northern counterparts.

Amazingly, we have also caught nearly white pumas in Patagonia. Don Arcilio Sepúlveda, who trained the hounds we use, calls them *los blancos*. They are always male; females are darker grey, often with a sepia stripe down their backs and on their faces.

Scientists generally believe that spots and stripes evolved in cats of forests and woodland, while cats of one colour evolved in open, arid environments. But after thousands of years in which puma populations have migrated between North and South America, this neat division doesn't apply to today's pumas. Hundreds of studies in North America have shown that they prefer rocky or forested terrain there, whereas in South America they flourish in more exposed, open country, whether the Patagonian steppe, Bolivia's high-altitude *antiplano* or the pampas grasslands of northern Argentina.

IN PATAGONIA PUMAS HAVE REIGNED FOR 10,000 YEARS. HERE, EXCLUDING HUMANS, THEY ARE THE GREATEST PREDATORS OF ALL.

In fact, these southerly grasslands are the only places that pumas can now stroll through open territory – the cats are harassed by wolves, bears or jaguars everywhere else in the species' huge range, so they hide. In Patagonia, on the other hand, they have reigned supreme for 10,000 years. Here, excluding humans, pumas are the greatest predators of all.

RAPTOR RIVALS

But though Patagonia lacks other large carnivores, its pumas do not lack competitors. They just have wings. During my research I was always fascinated by how pumas abandon kills in the open at sunrise to retreat to bushes, trees or steep slopes; they typically don't return to feed a second time, even when a guanaco provides so much meat. A puma that takes down a guanaco among trees may gorge on the carcass for up to nine days, while one that kills in the open has only until sunrise, regardless of when the kill was made. The reason for this apparent reticence? Raptors.

Chimango caracaras often arrive on the scene first, as soon as there is sufficient light for them to see. The larger southern caracaras turn up next, and, less commonly, white-throated caracaras and black-chested buzzard-eagles. And if the weather is windy (which it almost always is) and fair, gigantic Andean condors will also begin to circle above a carcass within several hours of sunrise.

Condors are slow and awkward on the ground, and therefore the elder, more experienced birds allow the brown-plumaged juveniles to drop down first. When

Guanaco: Joe McDonald/ gauchos: David R Frazier Photolibrary/ Alamy; caracara: Alex Hyde/imga/Nature in Stock/FLPA; puma: Thomas D Mangelsen

Patagonia's pumas come into conflict with sheep herders (*above*), while southern caracaras scavenge their hard-won prey.

HOW PUMAS HELP SCAVENGERS

Pumas can bring down big herbivores as well as smaller mammals, which in Patagonia include viscachas (a rabbit-sized rodent) and introduced European hares. But their favoured target here is the guanaco, a long-legged animal that can run at over 50kph and is the llama's wild ancestor. The guanaco and llama, together with the similar-looking vicuña and alpaca, are South American members of the camel family, rather than relatives of the gazelles or goats that they superficially resemble.

Meat left over from puma kills is a tremendous boon for Patagonia's diverse scavengers. On average, each month its pumas abandon 232kg of meat per 100km² – over three times the comparable quantity provided by wolf kills in the USA's Yellowstone National Park.

Pumas are often thought to be quite solitary, but Mark's research suggests otherwise.

the adults have confirmed that there is no danger, they too descend from the sky, usually leading to a raucous fight among 10–30 birds around the carcass. Condors can strip a 120kg guanaco well before noon – and the pumas know this, so rarely bother to return.

BOUNTY HUNTERS

For the past 150 years, pumas have had another serious competitor to contend with, too – the Patagonian sheep rancher. Merino wool and Christmas lamb are Patagonian specialities exported around the world. Ranchers bordering Torres del Paine National Park in the Magallanes region of southernmost Chile report annual losses to pumas of up to 36 per cent of their herds, which equates to over $4.6 million annually. Since federal agencies lack the resources to provide support, the ranchers kill untold hundreds of pumas every year, despite the cat being a protected species in Chile.

In Argentina, the larger portion of Patagonia, the puma's position is even more precarious. This was brought home to me on my first research trip to the country, crammed into the cab of a pick-up with several enthused ranch hands. We were in search of Arcilio, the first *el blanco* cat to be caught and collared during our puma project. We drove dusty, pebbly roads for hundreds of kilometres, paralleling the Andes and Chile to the south, but our journey had a tragic end. When we found the collar, Arcilio had been shot on a sheep ranch.

Arcilio's story is sadly typical. Unlike in Chile, the Argentine government continues to pay a bounty for puma skins across most of Argentine Patagonia, and hundreds – maybe thousands – of cats are killed. To find out more, ▶

HOW TO SEE PUMAS

- The easiest place to see pumas in the Americas is the eastern border of **Torres del Paine NP** in Chilean Patagonia. Some of the cats remain skittish, but others are used to hikers and wildlife watchers. Groups must keep to specific trails, vehicles cannot go off-road and pumas must not be approached too closely.
- Panthera and Torres del Paine authorities will be collaborating to create standards for tour operators over the next two years. Mark is currently working with South America's **SouthWild** (contact@southwild.com, www.southwild.com) to assess puma responses to tourist intrusion.

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- **Wildlife Worldwide** (01962 302086, www.wildlifeworldwide.com – the firm runs a puma tour led by photographer Nick Garbutt)

my second trip to Argentina was more clandestine. On one occasion, working undercover, I slipped through strands of barbed wire and suddenly was in a different country. I was looking for another collared puma that had disappeared, and had spotted a sheep carcass. I was horrified by what I found: five condors, several caracaras, a Patagonia skunk and a grey fox. All dead. I reached for the carcass, but luckily my colleague Cristián grabbed my arm and pulled me back. "No touch," he said. "Poison."

Ranchers in Argentina leave out carcasses soaked in strychnine, killing anything that scavenges the meat. Strychnine has been banned in the USA for more than 40 years, and in the European Union since 2006, yet it is still used routinely in this wildlife-rich wilderness. So any Patagonian pumas that steal sheep can land in trouble.

RISK AND REWARD

Oportus, the magnificent male who startled me, had a reputation as a sheep-killer. Unlike some other pumas whose ranges overlapped with ranches, he definitely partook of livestock, albeit sparingly because he knew the risks. Oportus only hunted sheep when they wandered into a labyrinth of thickets on the valley floor, in which he was invisible, or high on the mountain where signs of humans dwindled.

On five occasions, Oportus swam a full kilometre to a small island inhabited by about 40 sheep in the middle of Lago Cochrane, which is so large that it looks like an ocean when you stand on its shore. He also ate sheep quickly, and abandoned partially eaten carcasses without returning. On average, the Patagonian pumas in our study remained with sheep they had killed for only nine hours, instead of the average 41 hours for native guanacos, which is likely due to fear of people and dogs.

They say you should stand tall and make yourself appear as large as possible when shouting down a puma.

THE ENCOURAGING GROWTH OF PUMA ECOTOURISM SHOWS ONE OF THE WAYS IN WHICH WE CAN TURN THINGS AROUND.

But, when faced with Oportus at point-blank range, the best I could do in the space I had was to prop myself up on my elbows, and to raise my eyes to be closer with his. I yelled – not words, because I was too scared, just a guttural noise to let him know that I was there.

Oportus stopped mid-stride, one paw held aloft. He scrutinised me. I yelled again, and for longer to make sure he knew I was human. Still the cat did not move. I yelled a third time, my confidence building. Finally he took several slow steps backwards, then loped off in the opposite direction. I'll remember those few tense seconds for the rest of my life.

Breathing hard, I reflected on the uncertain future facing Oportus and the rest of his kind. The persecution can seem relentless; the conservation work exhausting. Yet the encouraging growth of puma ecotourism shows one of the ways in which we can turn things around. And, with luck, we will one day be able to help more ranchers co-exist with these charismatic predators that are so vital to the ecosystems of Patagonia and have prowled its peaks and plains for so long.

MARK ELBROCH *is a big-cat expert at Panthera, where he is lead scientist for its Puma Program: www.panthera.org*

Female pumas give birth in a den, usually to litters of three or four kittens. They begin to accompany their mother on hunting trips when about five months old, and stay with her until they are 18–24 months old.

FIND OUT MORE

Visit **www.panthera.org/initiative/puma-program** to find out more about the organisation's conservation work.

Thomas D Mangelsen

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BBC Wildlife

Secret life of a **BEECH WOOD**

When he bought a small wood in the Chilterns Richard Fortey dived into its rich history, and found that it encompassed everything from chair-making to Britain's rarest plant.

Though I had dreamed of having my own piece of woodland for many years, somehow there was never enough money in the bank. However, in 2011 I was suddenly solvent enough to turn that dream into reality thanks to fronting the BBC Four series *Survivors: Nature's Indestructible Creatures*, which was based on one of my books. My wife spotted a small wood for sale within walking distance of our house in Henley-on-Thames. The decision to buy was instantaneous. Walking through the stately beech trees felt almost like coming home.

The wood is the classic type for the Chiltern Hills: dominated by tall beeches, but with scattered cherry, ash, oak and wych elm, and in April awash with native bluebells, like a shimmering terrestrial sea. Our patch is part of a Site of Special Scientific Interest, so there is no question of large-scale felling, because Natural England keeps a close eye on its management and permissions are needed for almost all woodland activities. So we became guardians of what was officially termed a patch of semi-natural ancient woodland.

The word 'ancient' carries its own romance, a sense of continuity stretching back to medieval times. To our new owners' eyes the wood seemed almost eternal, leisurely seeing out many human lifetimes, in contrast to the ever-changing arable fields that cover neighbouring areas of South Oxfordshire. That romantic notion turned out to be completely wrong.

I have spent my working life – and much time unpaid thereafter – as a back-room scientist at the Natural History Museum. It did not take long for my inner scientist to wake up and start to make an inventory of all of the organisms in the wood: plants, animals and fungi. I needed help for insects, but this is when it is great to have colleagues who know all there is to be known about beetles or parasitic wasps.

The wood became a research project. Friends came down from London and pranced around with fine nets. My moth enthusiast sat up collecting on warm (and even cold) nights. All weathers would find me snuffling under logs, or collecting samples of deer poo to see what emerged. I earned strange looks from passing dog-walkers.

The experience made me realise that the natural history of the wood could not be separated from its human history. Far from being eternal, the wood had been managed for its products for centuries, and was part of the manor of Greys from the Norman Conquest until 1922. The lord of the manor might have grubbed up the wood at any time. Instead, it always earned its keep. In the medieval period it supplied the manor with construction materials and fuel. Beech was a workaday material for bowls and spoons for the serfs. The lord granted them *woodbote* – rights to gather wood for domestic use. Nothing was wasted: even roots were made into charcoal.

Later the proximity of the River Thames at Henley favoured the profitable export of beech in huge quantities to London as fuel for heating and cooking. The diarist Samuel Pepys noted in 1688: "beech woode is said to burn sooner, clearer and freer from sparkle, and to make a better coale, yet will keep fire longer than... oake". The trees would not have survived to the grand proportions that they have today, because harvesting would have been a regular business. Such cyclically managed woods encouraged a succession of fauna and flora, and a richer ecology than at present. Nature in my wood was not entirely 'natural' after all.

THE WOOD SEEMED ALMOST ETERNAL. THAT ROMANTIC NOTION TURNED OUT TO BE COMPLETELY WRONG.

The discovery of coal deposits and their ready distribution by canal as the industrial revolution gathered pace might have spelled the end for our wood. Instead the beech woods reinvented themselves in the nick of time. Already by 1726 Daniel Defoe had recorded the extensive use of beech wood in the manufacture of furniture. By the 19th century the industry had become colossal, centred on High Wycombe. 'Bodgers' turned chair legs and stretchers on primitive lathes directly from green beech in the woods. They processed the trunks in sawpits dug into the ground to allow their vast two-man saws space to function freely. The sawyer above was known as the top dog, while the poor soul underneath, who got all the sawdust in his eyes, was the underdog.

In 1873 some 19,200 chairs were ordered in High Wycombe to accommodate the bottoms of the faithful when two popular American preachers came on an evangelising tour – even nowadays such everyday chairs are available at car-boot sales for just a few pounds. The demand for beech wood was insatiable, and it must have been about this time that the modern species composition of the woods was established. Natural history was simply not on the agenda of the woodsmen.

Beechen chairs eventually fell out of fashion, or were outcompeted by cheap ▶

imports, but that was not the end for this most useful of trees. The versatile Chiltern beeches were put to work supplying millions of tent pegs for use in the field during the World Wars, and in peacetime they supplied the backs for scrubbing brushes. How are the mighty fallen: after centuries as part of the manor, the wood was now owned by the Star Brush Company. About 50 years ago even that trade dried up (plastic brushes had something to do with it), and the trees were left to grow on to their present proportions. Many are about 80 years old.

As the late, great ecologist Oliver Rackham pointed out, wood management is now at its lowest ebb. There is little demand for beech timber, and the only ready sale for these magnificent trees is once again as firewood. I began to appreciate that our 'ancient woodlands' are actually the product of many generations of management on the same site. My original notions of pristine forested countryside were mistaken: the trees themselves are probably as old as they have ever been.

Animals, plants and fungi I investigated are adapted to this beech wood regime. The iconic bluebells grow to flowering glory just before the beech canopy opens. They cram their photosynthesis into a time when light is available, and soon after setting seed they decay to a slimy pulp. Subtle sweet woodruff, lush cuckoopint and grasses such as wood melick are also 'early birds'. Evergreen holly and yew in the understorey are capable of more continuous photosynthesis, even in winter. During high summer the ground can look almost devoid of life, a brown waste of beech leaves where little light reaches the ground. It could be almost oppressive.

Except that we found a flower growing, in the semi-darkness, directly out of the ground: the yellow bird's-nest *Monotropa hypopitys*, a Red Listed rarity in our own wood! This pallid species lacks chlorophyll entirely. It was once thought to be a parasite on beech roots, but we now know it has an even more fascinating adaptation. It actually feeds from the mycorrhizal fungus that covers the roots of the beech tree. It steals what it needs from the photosynthetic work of the beech and the nutrient scavenging of the fungus. It has dispensed with leaves altogether to go straight to an elegant drooping spike of yellow flowers.

Extraordinary as it might seem, this habit has evolved more than once – and I found out that there was another species with a similar ability to flower in the darkest summer days of the beech wood. Britain's rarest plant, the ghost orchid, had been discovered elsewhere in the wood in the 1920s. So rare that it has been declared extinct, only to reappear, the inconspicuous orchid is at the top of every botanist's wish list. I crawled over the litter in the hope of being its next lucky discoverer, but it was not to be.

My own favourite organisms – the fungi – don't require

I BEGAN TO SEE THE WOOD AS A SYMPHONY COMPRISING HUNDREDS OF LINES IN DIFFERENT COMBINATIONS.

light either. In fact some of the least conspicuous species avoid it altogether and are found as simple-looking white patches on the underside of rotting logs, where they perform the vital task of returning wood to the soil. I became as familiar with these esoteric fruitings as with the conventional mushrooms that sprang up in the autumn as living proof of the association of fungi with beech roots. I smelled stinkhorns and dug up tiny truffles. I even found a fungus that had never been recorded in the wild in Britain, with one of the longest Latin names in the business: *Byssosphaeria schiedermayeriana*. It comprised a bunch of tiny black spheres, proving that the splendour of the name is inversely proportional to the modesty of the appearance. We have identified well over 300 fungal species so far.

My insect-loving friends at the Natural History Museum were lured to the wood with the promise of a cherry picker to lift them into the canopy. Nearly 180 species of beetle were flushed from their hiding places. A tiny brown beech bark beetle was 'nationally rare', and another batch of beetle species 'nationally scarce'. Craneflies joined fungus gnats on the lists, and those wasp specialists added their expertise.

As for moths, nearly as many kinds as there were beetles – some of them scarce and all of them beautiful – were attracted to the light over the course of the year. Clouded magpie moths in profusion proved that their foodplant, wych elm, was in good condition in the wood. Others needed lichens or beech or nettles. I began to understand something of the complexity of life even within an acre or two, for every recovered species had its own life narrative, its own biography. I began to see the wood as a kind of natural symphony, a complex whole comprising hundreds of individual lines that blend together in different combinations. I began to listen to the music of life.

But some of the notes were discordant. Grey squirrels from North America had long displaced the native red, and I discovered the damage they could do. In spring, when their numbers have reached a certain point, hungry squirrels gnaw off the bark of beech trees to get to the sugary rising sap beneath. They even 'ring-bark' small trees by removing a strip from the complete circumference of the trunk, thereby depriving the area above the ring of nutrients. These are the next generation of majestic beeches, but will any of them reach the stature of their parents?

The wood has seen other introductions during its long history. Muntjac deer are pretty enough creatures, but they love to nip off young shoots and flowers, and I lost one of my precious yellow bird's-nest plants to their sharp teeth. Now a new dieback disease makes me eye my ash trees uneasily. If human intervention has been a long story in the wood, maybe the latest phase of global interchange of species is on a different scale, with unpredictable consequences.

Then we found the hazel dormouse nest: a nearly perfect sphere built from woven grass and bark with a round entrance. We had another protected species in our wood, and one which even the hardest-hearted biologist would describe as cute. It was thrilling to think of these tiny mammals feeding on our bramble flowers or maybe gorging on hazelnuts from an understorey tree. I recalled that a woodsman had told me about finding one sleeping deeply on a public footpath nearby. This discovery was the perfect latest entry in our inventory of woodland life.

Biodiversity seems an abstract notion, but played out on the ground it is dramatic and surprising. The beautiful detail of natural history adds to the pleasure of the whole, just as a flourish on a flute can point up a symphony. The wood has taught me how nature in an English wood is intimately tied into human history. And that understanding nature's past may lead to constructive ways of anticipating its future.

FIND OUT MORE

Richard Fortey discussed his life and work in a 2015 episode of the World Service series *Discovery*. Catch up at **http://bbc.in/18QRZX2**

RICHARD FORTEY is a palaeontologist and author. His latest book *The Wood for the Trees: A Long View of Nature from a Small Wood* is available now (William Collins, £22).

*in*FOCUS

ROLE REVERSAL

DOTTERELS swap the usual roles of the sexes, says **Graham Appleton**.

Among birds, it's males that tend to be showier, sing most, set up and defend territories, and take the initiative during courtship. Dotterels do things differently. With these lovely little waders – relatives of the ringed plover – it is females that seize the limelight. They're also bigger and bolder than their partners, a phenomenon known as reverse sexual dimorphism.

Male dotterels, meanwhile, take care of all of the incubation, brooding and chick-protection duties, leaving the females free to head off, often to mate again with a second or even third male. Amazingly, some of these footloose females do so in another country. For example, a female may migrate from her North African wintering grounds to the Scottish Highlands to find a mate, then fly to Scandinavia to mate again.

The Eurasian dotterel is one of just two British birds – the other is the red-necked phalarope – to practise this form of gender role reversal. Coincidentally, both species are dream 'ticks' for birders in the UK, with tiny numbers visiting localised breeding ranges in northern Scotland. Since dotterels like to nest in stony, sparsely vegetated alpine or Arctic habitats, in this country only Scotland's highest plateaus – especially the Grampian massif – suit them. And herein lies the problem.

Researchers at the RSPB, University of Aberdeen and Scottish Natural Heritage are investigating a huge decline in Scotland's breeding population of dotterels, which fell by 57 per cent between 1987–88 and 2011. One possibility is that climate change and overgrazing may be fundamentally altering the exposed, mossy mountaintops where dotterels raise their young. If this tundra-like world disappears, the cold-adapted dotterels may have to retreat further north, abandoning our warming islands as a breeding species, and we'll have lost one of our most precious habitats.

● *Graham is a wader expert who formerly worked for the BTO and blogs at www.wadertales.wordpress.com. Interview by Ben Hoare.*

Mark Hamblin/2020VISION/naturepl.com

Female dotterels take the lead during courtship displays, showing off their striking white underwings.

New tracking technology has transformed what we know about adders. Helped by volunteers, Nigel Hand is fitting tiny transmitters to snakes at several study sites.

Photos by **Sam Hobson**

ON THE TRAIL OF THE adder

It may be venomous, but it's also shy and afraid of us. Now tracking studies are showing how we can protect this elusive snake, says **Nigel Hand**.

When you mention Greenham Common, most people immediately think of the protests in the 1980s against US nuclear missiles that were once kept at this former military airfield in southern England. But to me, the place conjures up happy memories of tracking adders, Britain's only native venomous reptiles. As a keen herpetologist licensed to handle these snakes in the wild, I am naturally drawn here – its gorse, bramble and scrub make it superb adder country.

So it was that on a fine April day I headed to the common with fellow adder surveyors, joined by *BBC Wildlife* photographer Sam Hobson. Our aim was to check up on the secretive snakes and, hopefully, to catch a few and attach transmitters to follow their movements. We are midway through a two-year study of the adders at Greenham and neighbouring Crookham Common, commissioned by the Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust.

Above: a basking adder displays its zigzag markings. Below: only an expert like Nigel should ever try to handle an adder.

IT'S NEVER BEEN EASY TO BE A MALE ADDER. BASKING IS A MATTER OF LIFE AND DEATH.

Traditionally, the flowering of daffodils and bluebells, appearance of frogspawn and arrival of migrant birds such as swifts are the classic signs of spring. However, for us the season is all about finding and recording adders, especially the first to emerge from their hibernacula – the underground quarters where they have spent the winter. Unfortunately, what we have seen so far in 2016 has confirmed a recent trend in Britain. These beautiful, retiring reptiles are severely threatened.

MALES UNDER PRESSURE

It's never been easy to be a male adder. In mid-February, having woken from hibernation, his priority is to spend as many hours in undisturbed basking as possible – a fitness regime none of us would mind, but for him it's a matter of life and death. Soon the snake must begin roaming, scenting out a receptive mate and guarding her in an all-consuming effort to pass on his genes.

Mate-guarding is a strenuous business that involves wrestling rivals and sending them off, so the male will need to be in peak condition. But recent mild winters

Basking adder: Paul Hobson

ADDER BITES: FACT & FICTION

FICTION! Adder bites are a big danger in the countryside. Contrary to media hype, adder bites are incredibly rare – no one in the UK has died from one for 40 years, and there were just 14 UK fatalities in 1876–1975.

FACT! If you are unlucky enough to be bitten, seek medical help. Though seldom fatal, adder bites can have nasty effects, including swelling, drowsiness, vomiting and diarrhoea, so you should always see a doctor straightaway.

FICTION! Adders are aggressive. These are very timid snakes that bite only in self-defence during attempted capture or handling or if actually stepped on. A Scottish National Heritage survey found that over 50 per cent of adder bites were to the hand, compared with 38 per cent to the feet.

FACT! Respect these snakes, and they will respect you. Always keep dogs on the lead at known or suspected adder locations, and if you're a photographer never try to edge too close.

Nigel searches a gorse thicket – it's one of the adder's favoured habitats.

Surveyors like Nigel use metal sheets (a superb solar-heated refuge) to help attract snakes.

without snow or hard frosts have seen adders basking as early as December and January. This uses up the energy and fat reserves that they will need in the breeding season.

And this is only one of the dangers the species has to face. Unlike great-crested newts, smooth snakes and sand lizards, adders have scant protection under UK law. Their habitat and hibernacula are not specifically safeguarded, so the management of these places, where it even exists, can be subject to a one-size-fits-all policy – with the adders suffering as a result.

I have monitored the adders of Herefordshire, my home county, for the past 30 years, and concerns for their numbers have been at the forefront of my work. Then in 2011 the Institute of Zoology launched an adder genetics assessment, worried that isolation brought on by the degradation and fragmentation of habitat was causing inbreeding.

My role in the study was to collect genetic samples from 16 adder sites in central and southern England, areas thought to be under the greatest pressure. The results of our research were inconclusive as far as inbreeding was concerned, but the decline in populations was startling, with many groups reduced to a handful of snakes.

A rare melanistic (black) adder at one of Nigel's study sites. Such snakes can warm up more quickly than normally coloured adders, but are easier for predators to spot.

More positively, the study showed that the most viable populations tend to be associated with large areas of contiguous habitat.

Monitoring populations isn't easy, either. You can identify individual adders by their head markings with reasonable accuracy, but need to find your snake in the first place, and the species' reclusive nature makes this method rather hit-and-miss. You have to know where to look – and cannot guarantee a sighting on each visit.

These difficulties make even more admirable the efforts of adder champions such as Tony Phelps in Dorset and Sylvia Sheldon and Chris Bradley in the Wyre Forest, Worcestershire – dedicated naturalists who have spent much of their lives monitoring local groups of snakes. Long-term studies such as Sylvia's annual census have shed light on population trends. Sadly the current prognosis for her Wyre Forest adders is poor, with numbers significantly lower than in the past – a picture replicated in many other counties.

Staffordshire is down to a couple of adder populations; Worcestershire has just two large viable sites, both threatened by human use; and Oxfordshire has only one location with a single, lonely female thought to be the last adder left in the county. And if that sounds bad,

THE BIG ADVANTAGE OF RADIO-TRACKING IS THAT YOU CAN LOCATE THE SNAKE EVEN WHEN IT IS BELOW GROUND.

Warwickshire, Nottinghamshire and Hertfordshire have no recent records at all.

In response to what can only be described as a crisis, adder researchers increasingly rely on radio-tracking, especially since improvements in technology have made both transmitters and batteries smaller. My use of this technique was inspired by a trip to the USA in 2004, during which I saw how radio-tags could be safely attached to timber rattlesnakes, including juveniles. I was sure this method could also be used for adders in the UK.

The big advantage of radio-tracking is that you can locate the snake that you are tracking on every visit, even when it is hidden below ground. There is also the possibility of finding an individual in an unexpected location, eliminating the bias that creeps in when you only search known adder habitat.

Above: once caught, an adder is held in a snug tube so that a tag can be attached without harming the snake.

Working with the Forestry Commission and Sylvia Sheldon, I set up the first adder telemetry programme in 2010 in the Wyre Forest. We tracked two adder populations, one associated with a mix of lowland heath and commercial forestry – mainly Corsican pine – and the other on a site formerly occupied by larch but now with large areas of bracken, heather and scattered silver birch.

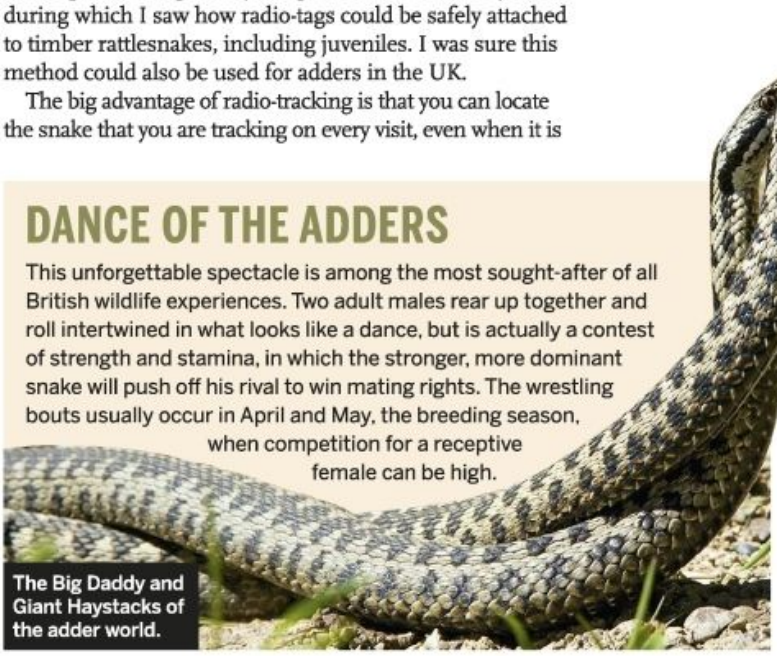
TINY TRANSMITTERS

The transmitter tags were small, weighing only 1.1g and fitted with a 12cm wire aerial. They were attached with surgical tape low down on each adder's flank, avoiding the widest point and the cloaca (the excretory and reproductive opening) so as not to impede movement or prevent the ingestion of large prey. In fact, we observed snakes in both courtship and mating, and could see noticeable prey bulges though their tags were still attached. Further telemetry projects followed: on the Malvern Hills in 2013, on a common in Herefordshire in 2015 and concluding this year on Greenham and Crookham Commons.

Adders can be tracked for approximately two months before they slough off the skin to which the radio-tags are attached. Overall, the actual tracking times have varied from 20 to 101 days, with the majority of tags lasting 40–60 days. Regular visits to record adder locations via GPS build up a map of their movements, favoured habitats and group interactions. By the end of 2015 we had tagged 43 adders.

DANCE OF THE ADDERS

This unforgettable spectacle is among the most sought-after of all British wildlife experiences. Two adult males rear up together and roll intertwined in what looks like a dance, but is actually a contest of strength and stamina, in which the stronger, more dominant snake will push off his rival to win mating rights. The wrestling bouts usually occur in April and May, the breeding season, when competition for a receptive female can be high.



The Big Daddy and Giant Haystacks of the adder world.

Dance: Andy Sands/naturepl.com (captive)

Clockwise from above: placing the adhesive that will hold a radio-tag; waiting tags, each weighing a mere 1.1g; the handling tube is calibrated to measure each adder; the team's aerial picks up the signal from a tagged snake.

One of our most significant discoveries is that male adders become 'fossorial' once breeding is over – basking infrequently, they spend up to a month under vegetation or in rodent burrows rather than ambushing prey above ground. This may be explained by the need to restore body weight lost during hibernation and breeding, which can involve going seven to eight months without a meal. Females also spend time underground but to a much lesser extent, because gravid (pregnant) snakes still need to bask. For both sexes, the damper conditions underground probably soften the skin in readiness for the next sloughing.

At three of the four study sites, tracked adders were recorded near or below bracken, a vital refuge that helps the snakes to forage and to regulate their temperature. Where bracken was lacking, gorse and bramble were favoured. This finding highlights the danger from bracken management. Cutting and removing bracken in summer does away with its understorey – the important humid 'thatch' and long grass. After extensive mechanised bracken- or scrub-cutting the ground may also be compacted, leaving nowhere for the snakes to hunt, hide or find the dampness they need.

Our tracking data has also offered fascinating new insights into adder movements. In all the projects so far, it is the male adders that roam furthest, on average 400–500m, to avoid inbreeding and maintain a viable gene pool across scattered populations. If one of them manages such a hazardous journey just once every 10 years, then there is a greater chance of a sustainable population over the long term.

But this requires suitable cover to exist. Wide expanses of overgrazed vegetation, paths and roads all form barriers to ▶

JOINED-UP LANDSCAPES WITH CORRIDORS OF ROUGH GROUND PROVIDE VITAL LINKS BETWEEN POPULATIONS.

dispersal, isolating pockets of snakes. Adders were recorded crossing unmade roads, but the telemetry revealed males reaching the extreme boundaries of their habitat, searching for a mate, then finding their way back to safer ground.

A few case studies illustrate this perfectly. On Greenham Common, one large mature male was able to cross a wide, open area by moving between linked patches of gorse and bramble before reaching the old aircraft runway, bulldozed to create a shrubby bank. But an expanse of grazed grassland stopped him going any further. Meanwhile, another pair of adders at Greenham remained within a fenced area of long grassland, because it was next to a heavily grazed area with little cover that, likewise, was a barrier to progress.

THE RIGHT KIND OF GRAZING

Commons are often grazed excessively and would benefit from 'conservation grazing' in which low numbers of livestock are used for shorter periods. You can see the difference from the example of the male adder tracked in the Wyre Forest, which travelled the longest distance we have recorded to date – almost 2km. He achieved this feat by setting out from his hibernation area on lowland heath, passing through oak woodland and reaching a distant open ride before returning. But he may have been exceptional.

Female adders roamed far less than males, the average recorded being 100–300m. Some are even less inclined to wander. One non-breeding female on the Malvern Hills stayed around the base of a small patch of gorse in an area of just 10m² from April through to September, while a breeding female in Berkshire spent the time she was tracked under a small patch of bramble growing against a boundary fence.

The experience of another female adder illustrates the hazards of moving around. She was tracked for 161m on the Malvern Hills before her signal disappeared. It was at last picked up again 861m away on the edge of a wood. Eventually the tag was located, without the snake attached, among bird droppings directly below a buzzard's nest complete with chicks. Carrion crows, magpies and pheasants will also take unwary adders.

This sort of data is vital for conservationists managing areas that contain adders, and for ecologists involved in translocations. And much needs to be done. The greatest challenge, certainly in central and southern England, is maintaining viable populations. In a 2004 study, Natural England reported that there were an estimated 1,000 adder populations across the UK, and that many of the known sites were isolated, with a third consisting of fewer than 10 adults.

In many parts of Britain urban and agricultural expansion are creating ever-more barriers to adder movement. Greater access to the countryside, for recreational activities such as mountain-biking and dog-walking, also causes disruption. And even in places that are hospitable to adders, the large-scale release of pheasants is suspected to have a devastating effect, though data on this potential threat is so far lacking.

There is no reason to lose hope, however, because our research has taught us how to fix the situation. Joined-up landscapes with corridors of rougher marginal ground and scrub will provide vital links between populations. By eavesdropping on the secret life of this iconic species, radio-telemetry gives us a scientific basis for such management. Now it is down to conservation bodies and landowners to work together to safeguard and restore the habitat in which this fabulous animal thrives.

NIGEL HAND *is an ecological surveyor and adder expert. Visit www.discoverwildlife.com to see more of Sam Hobson's adder photos.*

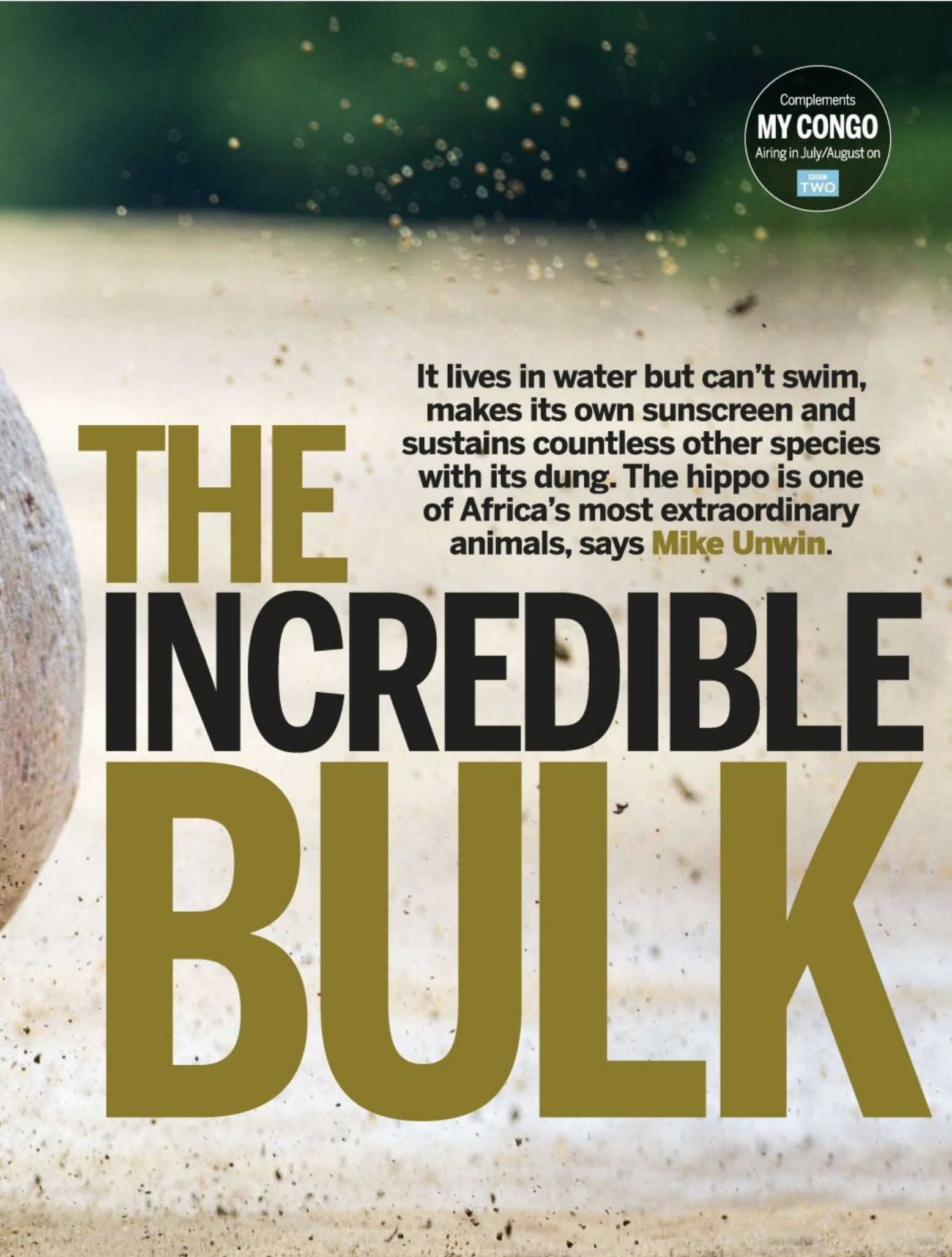
Nigel shows off a smart male adder. Males are pale yellow or greyish, with dark, crisp markings; most females are brown or reddish with dark brown markings.

GET INVOLVED

- Record your own adder sightings at **www.narrs.org.uk/adder.php**
- Watch Chris Packham's interview with adder surveyor Sylvia Sheldon for *Springwatch* in 2011: **http://bbc.in/1Uf5lcl**

Will Burrard-Lucas

A female, or cow, hippo charges in South Luangwa National Park, Zambia – she has a newborn calf on the riverbank. Hippos give birth to a single 25–45kg calf underwater (twins are rare).



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It lives in water but can't swim, makes its own sunscreen and sustains countless other species with its dung. The hippo is one of Africa's most extraordinary animals, says Mike Unwin.

THE INCREDIBLE BULK

"The hippopotamus," so the claim goes, "kills more people than any other animal in Africa." Safari guides never seem to tire of this provocative assertion, though clients who remember the tutu-clad ballerinas featured in Disney's 1940 film *Fantasia* may well wonder how such an endearingly rotund creature could ever be more lethal than a lion, for example.

Unfortunately there are few reliable statistics for human fatalities caused by wild animals in Africa. Yes, the hippopotamus – along with the lion, elephant and buffalo – accounts for a small but regular death toll, yet no figures exist with which to make meaningful comparisons across the continent. Certainly, however, no mammal claims as many victims as the Nile crocodile. And this reptile is, in turn, trumped by mosquitoes, which cause an estimated half a million deaths from malaria every year.

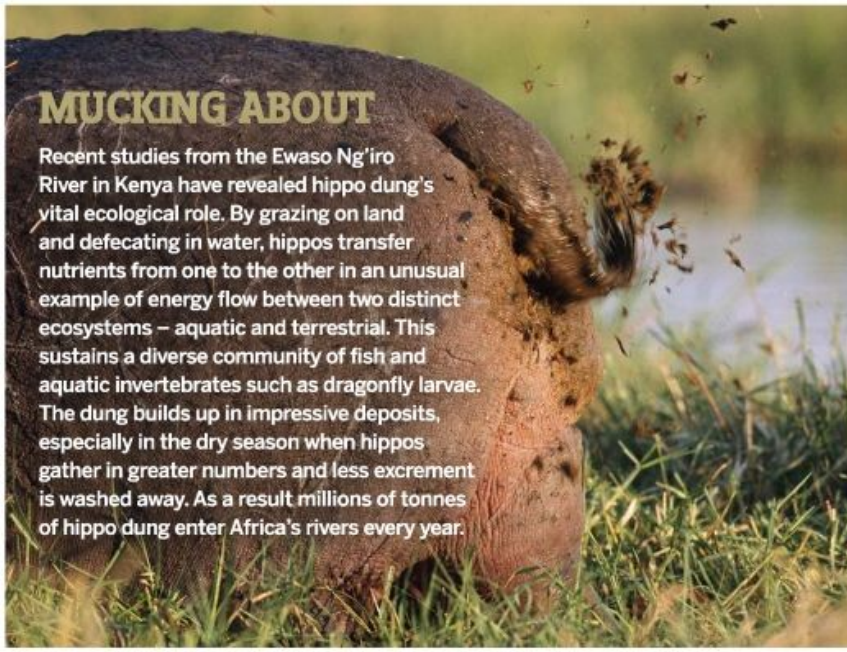
Whatever the truth, the hippo's reputation underscores the fact that we should not judge by appearances. On the one hand, this heavyweight herbivore is an animal of formidable power and – in certain circumstances – aggression. But on the other, it is a gentle creature and one of numerous paradoxes. It has the largest canines of any land mammal yet eats only grass; it spends half its life in water yet can't swim; and it walks on four legs yet is related to whales.

Zoologists will explain that the common hippopotamus is one of two species in the family Hippopotamidae, the other being the much smaller pygmy hippopotamus of West Africa. Though 'hippopotamus' derives from the Ancient Greek for 'river horse', both species are classified as even-toed ungulates so sit alongside cattle in the order Artiodactyla – rather than with horses, which belong to the odd-toed ungulates in the order Perissodactyla.

It is only since the advent of DNA sequencing that taxonomists have been able to trace the true lineage of hippos. Formerly thought to be relatives of pigs, they are now known to share a semi-aquatic ancestor with cetaceans. The latter split from other odd-toed ungulates about 60 million years ago to embrace a life at sea, and, some five million years later, hippos diverged yet again and returned to a life lived (at least partially) on terra firma.

Once there were many more species of hippo. Many of them became extinct during prehistoric times, including dwarf hippos on Cyprus, Malta and Sicily. One is thought

ONCE THOUGHT TO BE RELATIVES OF PIGS, HIPPOS ARE NOW KNOWN TO SHARE A SEMI-AQUATIC ANCESTOR WITH CETACEANS.



MUCKING ABOUT

Recent studies from the Ewaso Ng'iro River in Kenya have revealed hippo dung's vital ecological role. By grazing on land and defecating in water, hippos transfer nutrients from one to the other in an unusual example of energy flow between two distinct ecosystems – aquatic and terrestrial. This sustains a diverse community of fish and aquatic invertebrates such as dragonfly larvae. The dung builds up in impressive deposits, especially in the dry season when hippos gather in greater numbers and less excrement is washed away. As a result millions of tonnes of hippo dung enter Africa's rivers every year.

Fighting: Will Burrard-Lucas; aerial: Juan-Carlos Muñoz/Bios/Photoshot; dung: Andrew Parkinson/NPL

to have died out on Madagascar just 1,000 years ago.

Today's common hippo has evolved something of a Jekyll-and-Hyde lifestyle. By day it remains largely submerged. Indeed, it is in water that hippos socialise, defend territories, find mates and give birth. Like other ungulates, however, they must find their food on land. So every evening the animals emerge from the water, joining the likes of zebras and wildebeest in the unending search for fresh grazing.

THE BEST OF BOTH WORLDS

The twin demands of this amphibious lifestyle are apparent from a hippo's anatomy. Its massive, barrel-shaped body is that of a species whose bulk is supported by water for much of the time. Sometimes topping 2,500kg, males are the world's third-heaviest land mammal, after elephants and the two largest rhino species. Yet the hippo's short, sturdy legs allow it to wander over 10km a night for food, and can propel it at a gallop of up to 30kph.

Ironically, for a creature that spends more than half of its life in water, the hippo is not much of a swimmer. It cannot even float. By day it tends to bask in the shallows, often on a submerged sandbar, and when moving through deeper water it propels itself, astronaut-style, in a series of slow-motion bounds from the bottom.

Above left: adult males, here in the Luangwa Valley of Zambia, fight for control of groups which are typically 10–15 strong. Above: Botswana's Okavango Delta is famous for hippos – the channels they create have an enormous impact on this wetland habitat.

Other key adaptations to an aquatic existence include the positioning of eyes, ears and nostrils on the top of the hippo's skull so that it can see, hear and breathe while otherwise submerged. Like its cetacean forebears, it has also dispensed with fur – except for the tail tuft and a few facial bristles – in favour of a more hydrodynamic naked skin. This, however, leaves it vulnerable to the fierce African sun. So it has evolved a unique skin secretion that not only works as sunscreen but also provides anti-bacterial protection for wounds. This substance turns red on exposure to sunlight so is known (erroneously) as 'blood sweat'.

Hippos feed almost entirely on grass. Adults get through about 35kg a night, using their horny lips to pluck the sward. The occasional snacking on carrion witnessed in some individuals is thought to be aberrant behaviour prompted by social pressures – hippos derive no nutritional benefit from meat, so are not true omnivores.

There's no doubt that a hippo's open maw is a terrifying sight, revealing massive incisors and sabre-like canines up to 50cm long, the longest of any land mammal. Such hardware seems a little extravagant for a grass-eater. In fact these teeth serve entirely as weapons – which helps ▶

Loch Lomond Bird of Prey Centre is located in the natural woodland. With purpose built housings, it is an ideal setting for nearly 40 birds of prey and owls. The centre is home to over 20 owls, representing every native species as well as unique or unusual species from other parts of the world. See "Orla", the magnificent golden eagle and learn of our successes in rehabilitation of wild birds of prey and owls. An educational day out for all ages, and a chance to relax in wonderful surroundings.

Open daily except Christmas Day.
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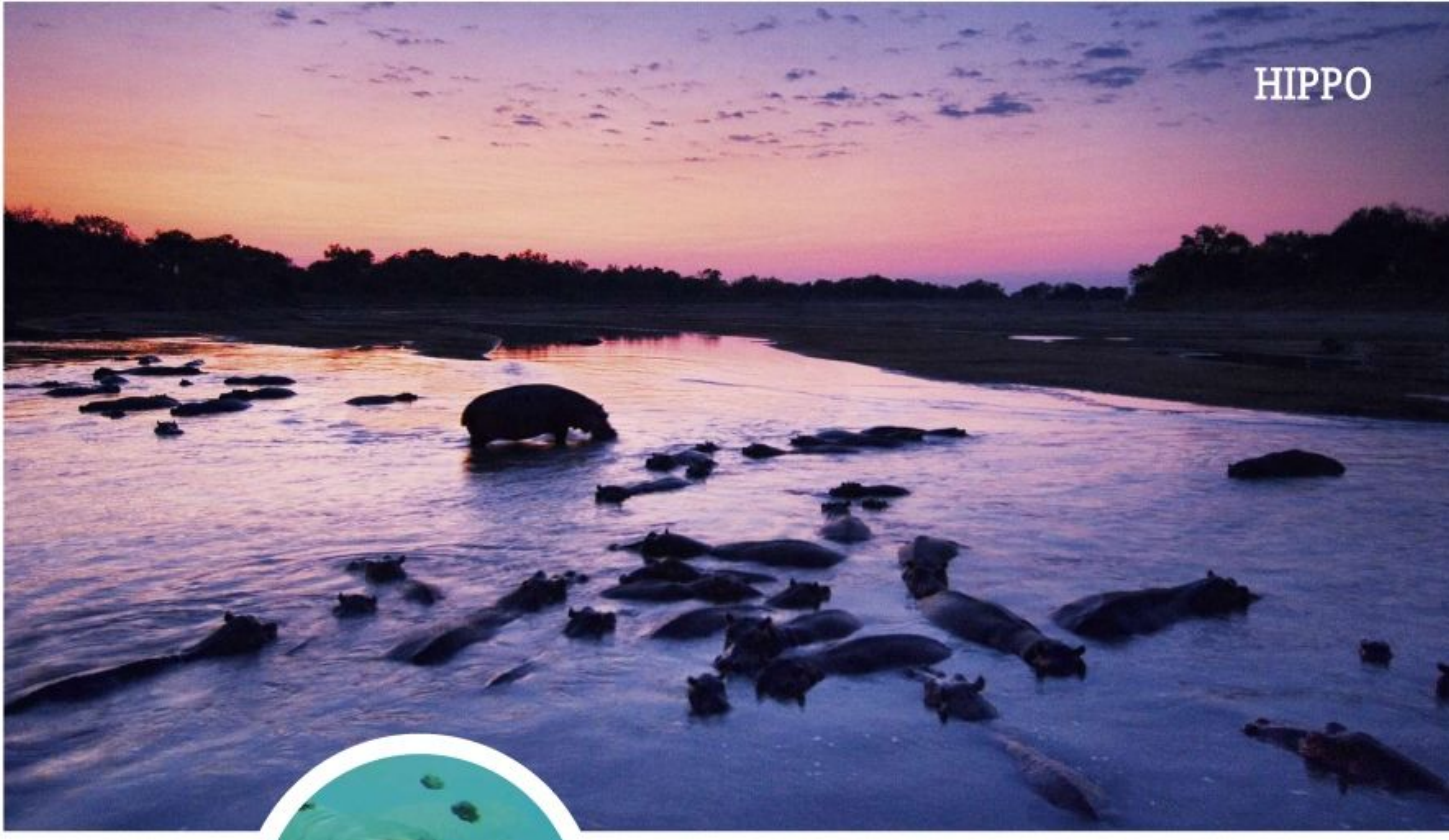


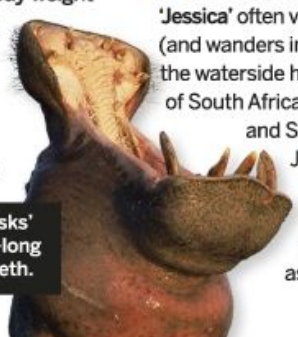
Sunrise: Frans Lanting/FLPA; underwater: Robert Pickett/Visuals Unlimited/Getty; yawn: Richard Du Toit/naturepl.com

Dawn at the Luangwa River in Zambia. Hippos typically forage at night, sleeping and socialising during the day.

7 AMAZING FACTS ABOUT HIPPOS

The Thames, as it was 125,000 years ago?

- When defecating, hippos switch their tails back and forth, scattering their droppings like a **muck-spreader**. The resulting slapping noise echoes downstream and helps proclaim territory.
- Hippos, along with other megafauna such as lions and elephants, would have been a **common sight in prehistoric Britain** – their remains have been found underneath Trafalgar Square.
- Male hippos weigh 1,600–3,200kg, and females 650–2,350kg. Despite their size they eat just **1–1.5 per cent of their body weight** every day.
- Hippos sink in water. They **run along the river bottom** instead of swimming.
- The international ban on trade in elephant ivory led to an increase of 530 per cent in the **annual export of hippo teeth** within two years. The animal's canines measure upwards of 50cm in length.
- A hippo's **stomach has four chambers** in which enzymes break down the tough cellulose in the grass that it eats. However, hippos do not chew the cud, so are not true ruminants like antelopes and cattle.
- A wild hippo named **'Jessica'** often visits (and wanders into) the waterside home of South Africa's Tonie and Shirley Joubert, who helped her out as a calf.



Hippo 'tusks' are extra-long canine teeth.

explain why hippos have earned such a bad reputation. Just the sight of them is generally enough: that gaping 'yawn', in which a hippo opens its jaws to an impressive 180 degrees, is actually a threat display.

But if a conflict escalates, the canines can inflict serious damage – as is evident from the long scars that crisscross the hide of adult males. Fights, in which two rivals lock jaws while attempting to avoid body bites, may prove fatal. Packing a force of some 1,800lb per square inch, a hippo's bite is the most powerful of all mammals: females protecting babies have even been seen to chomp an unwary crocodile in two.

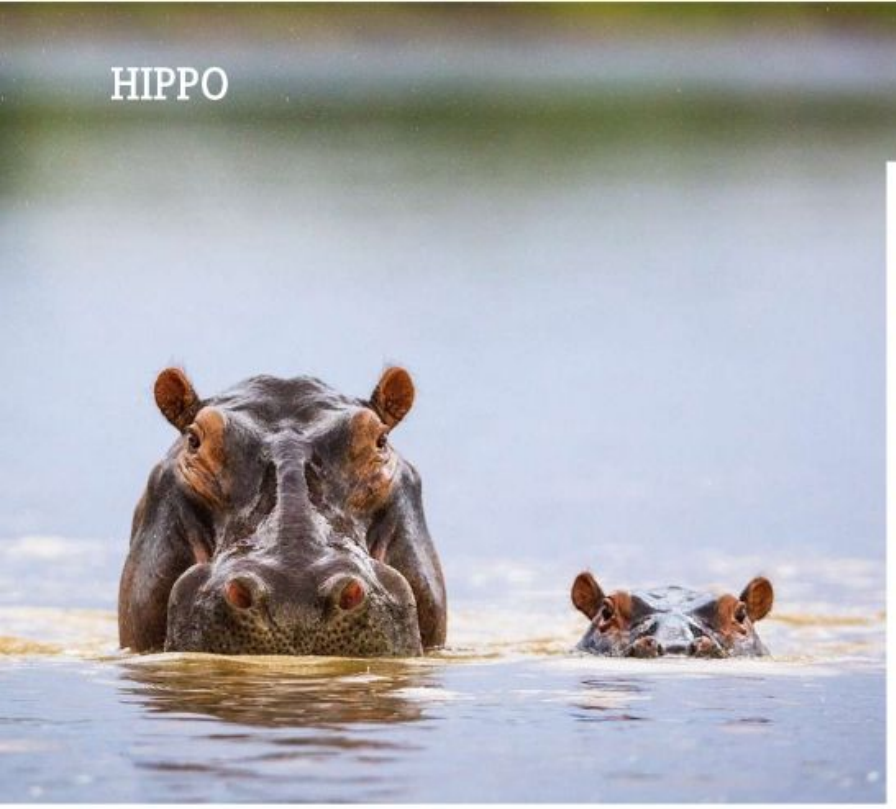
DRIVEN TO AGGRESSION

It is this territorial aggression that occasionally triggers attacks on people. Fishermen may run into the wrong animal at the wrong time, with boats attacked and capsized. Hippos deprived of natural grazing may also raid crops at night. When confronted, their first instinct is to charge back to the water, sometimes with fatal repercussions for anybody in the way. "They are evil monsters who attack us night and day," said Senegalese fisherman Moussa Bocar Gueye in May this year, after several local hippo attacks. "Because of them, we haven't been fishing. There are no more fish at the market."

Yet hippo life is not all violence – far from it. Their social groups, known as pods, usually consist of a dominant male with 10–15 females and young. Much larger groups build up during the dry season, when shrinking water sources may force pods together into herds of several hundred. But apart from these gatherings, hippos are not really that sociable. At night, they graze individually – heading out alone along time-worn trails and largely ignoring one another until they return to the water at daybreak.

Quiet waters are hippo heaven, from slow-moving rivers to lakes and estuaries, preferably with firm, gently sloping beaches for easy access. Hippos

QUIET WATERS ARE HIPPO HEAVEN, FROM SLOW-MOVING RIVERS TO LAKES AND ESTUARIES. ▶



HOW TO SEE HIPPOS

- **South Luangwa Valley NP** in Zambia has Africa's largest hippo population. Two Zambian operators visiting the area include **Robin Pope Safaris** (info@robinpopesafaris.net, www.robinpopesafaris.net) and **Shenton Safaris** (info@kaingo.com, www.kaingo.com); the latter has its own special hippo-viewing hide.
- Mass hippo gatherings occur in Tanzania during the dry season: at **Katavi NP** and the Retina Hippo Pool in **Serengeti NP**.
- Botswana's **Chobe NP** offers excellent hippo viewing from boat cruises, while the **Zambezi Valley** (especially Mana Pools NP in Zimbabwe and Lower Zambezi NP in Zambia) is *the* place for canoe safaris. **Kruger NP**, South Africa, has many hippos and is best for a DIY safari.
- Visit the hippo hides at **Wechiau Community Hippo Sanctuary** (info@ghanahippos.com, www.ghanahippos.com) from December to August.

play a significant role in shaping the surrounding landscape. Their broad trails wind through the bush, helping channel rainwater run-off into water holes – which are deepened and sealed by their wallowing. In seasonal wetlands, hippos act as hydrological engineers, bulldozing channels through swamps, diverting water flow and maintaining aquatic habitats for other wildlife.

SOUND OF THE CROWD

You don't have to notice this landscaping to realise that there are hippos around, because these animals are among the noisiest in Africa. Their telltale 'wheeze-honk' – a high whinny, followed by a series of resonant grunts – carries 5km or more. The territorial calls are given half above and half below the surface, carrying both over land and through water. One animal invariably sets off another, and the echoing chorus will elicit a response from the next pod downriver. In areas of high hippo density, such as Zambia's Luangwa Valley, a grunting chain reaction may carry for miles.

At one time the common hippopotamus ranged across Europe and North Africa, and it was present in Egypt's Lower Nile during the Roman era. Nowadays the species is confined to sub-Saharan Africa, where an estimated 125,000–150,000 survive. While some countries in East and Southern Africa still hold healthy hippo populations – notably Zambia, with an estimated 40,000 – elsewhere the species is declining sufficiently to warrant Vulnerable status.

Predictably, we are to blame. Hippos have few natural predators – only lions will tackle an adult, and generally only when it is weak or injured. Our species represents a much more serious threat, through hunting for bushmeat and ivory and by degrading, polluting and draining rivers and wetlands. The hunting has been worst in areas of political strife. In the Democratic Republic of the Congo, for instance, Virunga National Park has seen its population of 25,000–30,000 hippos (once the largest of any park in Africa) fall by an estimated 95 per cent over the past 20 years.

Earlier this year there was a plan in Zambia to cull 400 hippos annually over the next five years. Conservationists questioned its scientific basis, which Zambia's Department of National Parks and Wildlife said was to help stop the spread of anthrax among wildlife in an area of riverine forest between North and South Luangwa. After much controversy, the cull was suspended in June to allow further consultation.

Top: calves are not weaned for six months. Females shepherd their offspring closely both on land and in the water. Above: hippos congregate in the shallows in Virunga NP as villagers look on. Poaching has exacted a heavy toll on the region's hippos.

FIND OUT MORE

Learn more about Congolese wildlife in *My Congo*, airing on BBC Two in July/August and previewed on p91.

As the proposed cull illustrates, the relationship between human and hippopotamus remains ambiguous. Whether feared as an evil monster or beloved for its comedy persona, the hippo has been deeply ingrained in human culture for millennia. Indeed, it figures prominently in African creation mythology: the San people of Botswana, for example, explain how the hippo, after asking to return to the water in order to avoid sunburn, was granted permission only on condition it didn't eat all of the fish – which is why it now scatters its dung with its tail, ready for inspection.

The truth, of course, is that the hippo is an extraordinary animal uniquely evolved for its amphibious lifestyle – and critical to the ecology of the wetland environments that it helps create. Yes, it can be dangerous. But with proper conservation measures in place hippos and people can co-exist. And then this hulking herbivore will be mowing Africa's lawns, dredging its swamps and fertilising its rivers for generations to come.

MIKE UNWIN *is a nature and travel writer who has extensive experience with hippos across Africa.*

Top: Will Burrard-Lucas; virunga: Evelyn Hockstein/MCT/Getty

ADVERTISEMENT FEATURE

Get kids into WILDLIFE

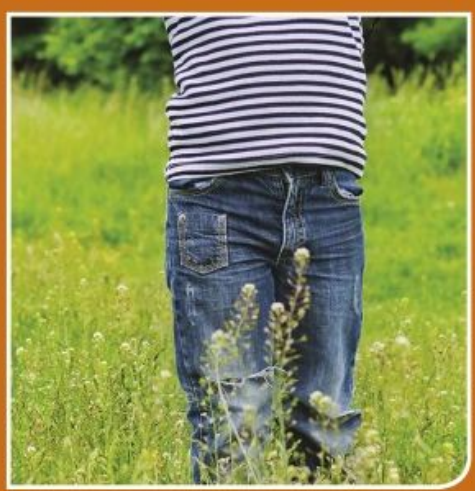
Looking for ideas of what to do with the little ones this Summer? Here are some suggestions that you can all enjoy











THE ISLE OF WIGHT RED SQUIRREL TRUST

Ryde, not just the gateway to the island but to seeing red squirrels as well

Visiting Ryde this summer holiday with the kids? Why not get them outside and help us save the red squirrels. Free guided walks taking place July to end of September, are advertised on the website below. This year we are focusing on Ryde but need lots of beady eyes to let us know of any red squirrel sightings anywhere on the Isle of Wight whether they be alive or dead. Report sightings online at: www.wightsquirrels.co.uk. Project funded by Ryde Town Council. Charity No: 1112374

www.iowredsquirreltrust.co.uk
wightsquirrels@hotmail.com

WILDWOOD

What better way to engage children and adults alike in the wonders of the natural world on our doorstep, than a visit to Wildwood near Canterbury in Kent? Become a nature detective for the day and be inspired by our stunning collection of native wildlife past and present. View our rescued brown bears from a new 'wobbly' rope bridge and see wolves, foxes, deer, badgers, owls, wild horses, lynx, beavers, wild cats, bison, squirrels, wild boar, otters and many more. Finish your day by letting your children go wild in our adventure play park featuring Kent's tallest vertical drop slide, zip wire, wild fort, twisting tube slide and tree-top towers. There is also a special area for U5s.

www.wildwoodtrust.org
info@wildwoodtrust.org

SCOTTISH SEABIRD CENTRE

Enjoy great days out at the seaside where interactive seabird adventures await you...

Located in the beautiful seaside town of North Berwick, only 30 minutes from Edinburgh, the Scottish Seabird Centre is privileged to have the world's largest colony of Northern gannets on the Bass Rock and the biggest puffin colony on the east coast of Britain on the Isle of May, right on its doorstep.

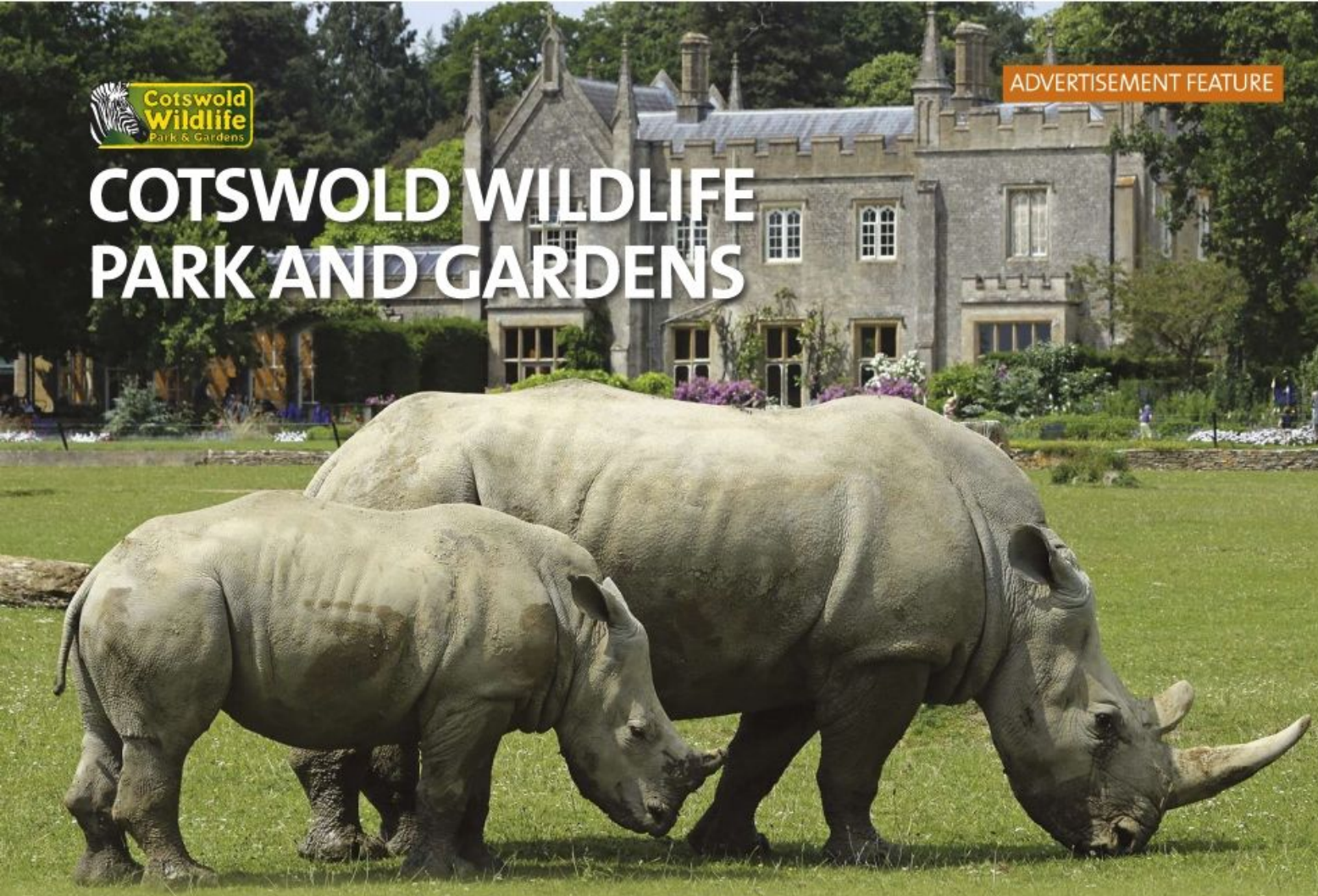
In the Discovery Centre, control the interactive live cameras located on the local islands to zoom in on the amazing wildlife without any disturbance. There's different wildlife to see throughout the seasons and at different stages of the breeding season. See puffins from April to late July, seal pups being born over the winter and gannets from February to October, with chicks then gugas on screen from early summer.

Little ones can also enjoy the soft play; fish tanks; games, puzzles and science shows; and there are family-friendly boat trips. The Seabird Café offers East Lothian's only seaside sun deck and there's a shop for wildlife treats.

01620 890202
www.seabird.org

Scottish Seabird Centre

COTSWOLD WILDLIFE PARK AND GARDENS



Come and get the kids closer to wildlife, and meet our Rhinos on the lawn

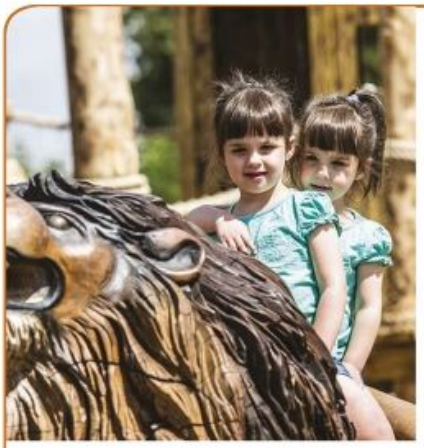
Last year saw the birth of two White Rhino calves at the Cotswold Wildlife Park and Gardens. Ian was born on 27th March, the day the Park celebrated its 45th anniversary. His birth was caught on camera by Keepers and he was born to mum Ruby in less than 10 minutes, in full view of many staff here at lunchtime, a moving experience many will never forget. Ian was named after the South African conservationist Ian Player (1925-2014) who spearheaded efforts to save the White Rhino from extinction. The Park's original Rhino pair, called Lebombo and Somtuli, arrived from Umfolozi in 1972 as a result of Ian's Rhino conservation initiatives.

Nancy had given birth to Astrid in 2013 and Keepers knew she was pregnant for a second time, but weren't expecting her to deliver a bundle of joy until later in the year. They were taken by surprise, therefore, in the early evening on 18th August when Nancy unexpectedly gave birth to John the Rhino! John the baby rhino is named in memory of Mr John Heyworth (1925-2012) who founded the Park in 1970. Rhinos were one of his favourite species at the Park and he would have loved to have seen the calves. His son Reggie, Managing Director, commented: "You wait forty years and then three come along at once! This is such a happy event for the Park, and I have to pinch myself when I see five rhinos on the lawn."

To celebrate last year's births the Cotswold Wildlife Park has made August 2016 'Rhino' month with new daily talks about the Rhinos, and Rhino Weekend 6-7th August. Both are aimed at helping raise awareness and funds for Rhino Conservation work in Africa through fun activities and competitions. The Park supports Tusk Trust and has done for many years, and we hope to generate more interest, awareness and support through this fund raising activity weekend.

"I've brought my children here for years. It's a great way to introduce them to wildlife." Bear Grylls, TV Presenter & Chief Scout.

01993 823006 | www.cotswoldwildlifepark.co.uk



Marwell Zoo

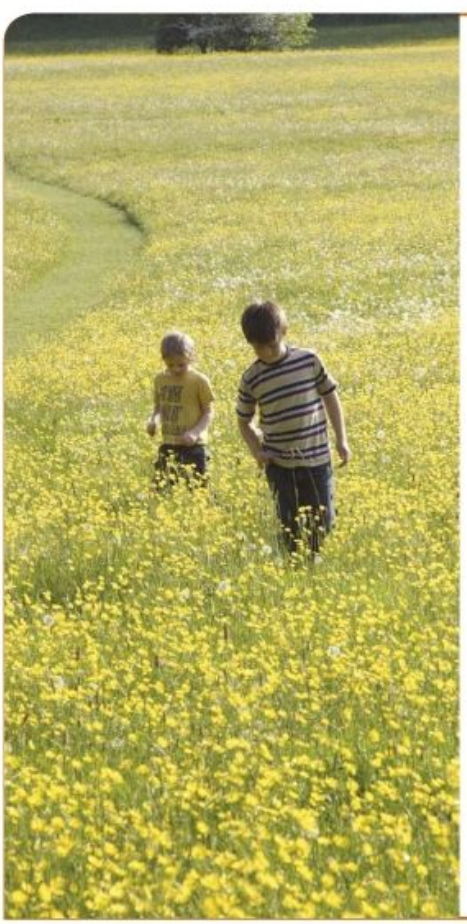
MARWELL ZOO

Explore Marwell Zoo and get closer to the wonders of the natural world.

For the first time in 12 years Marwell Zoo in Hampshire is celebrating the birth of Amur tiger cubs. Guests can watch the adorable triplets find their feet as they emerge from their den during the summer holiday. A 'zeal' of 150 Marwell's Zany Zebras will also gallop through the streets of Southampton for 10 weeks from 16 July creating a fun, family friendly sculpture trail for all to enjoy.

A miniature replica trail will be hosted at Marwell Zoo to find out fun facts about the Grevy's zebra, and support Marwell Wildlife's conservation in Northern Kenya. While at the zoo, experience the African Wilderness first hand at their newest and biggest ever exhibit – Wild Explorers! Home to white rhino, Grevy's zebra and scimitar-horned oryx. You'll enjoy a cracking view of the animals, both near and far, from the raised observation boardwalk, plus a new themed play area for little legs to run wild and practise their ranger skills.

www.marwell.org.uk



GILBERT WHITE & THE OATES COLLECTIONS

What better place to start your exploration of the natural world...

Join Gilbert White & The Oates Collections as we discover nature this summer. Our Family activities include a wide range of activities from wildlife themed arts and crafts days, to butterfly hunts in our wild meadow, pond dipping in the naturalist pond, finding out about Bats or building bird boxes. All our activities are great value for money and are the perfect way for families to explore the great outdoors together.

The Museum and home of naturalist Gilbert White and two explorers of the natural world is a great place to explore yourself with plenty to do and see for all ages. All the information about the Museum and events are on our website...

www.gilbertwhiteshouse.org.uk
info@gilbertwhiteshouse.org.uk
01420 511275

ARDNAMURCHAN MARINE CENTRE

SCHOOL IS OUT, IT'S TIME FOR WILDLIFE

Go wild in Ardnamurchan – come and see the best of Scottish Wildlife

Ardnamurchan Charters in conjunction with Carna Conservation is offering unique opportunities for guests to experience personalised encounters with both terrestrial and marine wildlife. Andy Jackson, with over 30 years of wildlife guiding will take you to explore the secrets of the secluded island of Carna and its conservation project. This includes looking for otters, exploring the meadows and scanning the skies for eagles. We also provide wildlife expeditions with our specialised partners Wild Intrigue.

With access to all the wildlife of the island, starting with otters on your doorstep to eagles soaring the summit of the island of Carna, the two cottages provide unparalleled opportunities for observing wildlife in comfort. The cottages are so secluded with perfect dark skies you might forget the outside world.

On the mainland we have specialised accommodation, Laga Lodge, for active families and groups who like to spend their days getting wet and muddy. Coming home to the luxury of underfloor heating, power showers and a laundry drying room sets you up to do it all again the next day.

We provide self-drive hire boats perfect for a family day out exploring the waters around Carna and Loch Teacuis, where one can find seals, otters and nesting terns. The 16' pioneers are also ideal as a diving platform and for underwater observation and photography of the unique reefs, a feature of the new marine protected area.

Our charter boat Laurenca makes weekly excursions to the small isles, spotting whales and dolphins on the way, along with basking sharks, porpoise, puffins and gannets. On other days Laurenca is to be found in Loch Teacuis and around Carna, visiting the seal colonies, nesting terns and shags as well as trips to the inaccessible sea eagle eyrie.

www.west-scotland-marine.com
01972 500208

ADVERTISEMENT FEATURE

KNOWSLEY SAFARI IS CALLING ALL ADVENTURERS!

Experience the North West's wildest day out with a trip to family favourite, Knowsley Safari. You can kick start your day with a tour of the 550 acre Safari Drive and get acquainted with over 700 wild animals, from baboons to camels, wildebeest to tigers, all from the comfort of your own car. The drive-through lion enclosure is a real highlight of the safari drive although for many visitors the baboons are the stars of the show. Whether up close, on the Baboon Bus or by taking the car friendly route, you'll get a great view of the monkey madness; the boisterous baboons that have become Knowsley's trademark.

An all-day destination, the fun doesn't end with the Safari Drive, on the Walkaround Area you can take a walk on the dark side through the Bat Forest – a 5* home from home for 100 Egyptian fruit bats – or marvel at the birds of prey. The 'beak to face' Birds of Prey Experience includes vulture feeding, flying displays, bird handling and even the chance to see a baby bird hatch. Anything could happen as they swoop and dive just inches above your head!

What's more you can get up close and personal at the Giraffe Tower and the Elephant Platform, watch the sea lions splash about in our sea lion display, get acquainted with the family of meerkats, or take a walk on our wild trail and spot Bruce the Moose. As well as the exotic animals who make Knowsley their home, you can also see an array of native British wildlife.

Ten species of waterfowl nest around the park's Mizzy Lake; kestrels and buzzards can be spotted in the woodland and with patience brown hares, stoats, weasels and squirrels can also be spotted. As well as all the amazing animals we also have amusement rides and play areas to keep the little ones entertained all day long!

For more information visit www.knowsleysafari.co.uk

DON'T MISS 20% OFF ONLINE DURING THE SUMMER HOLIDAYS!

AGENDA

» UNDERSTAND THE ISSUES | BE PART OF THE SOLUTION

ANALYSIS

DO EXOTIC SPECIES GET ENOUGH PROTECTION?

● YOU CAN LEGALLY KEEP BIG CATS, WOLVES AND ELEPHANTS – SEE P64

The Natural History Museum wants to increase the number of people who visit its wildlife garden, but will there be a cost to the garden's biodiversity?

The Natural History Museum/Alamy

MUSEUM HIT BY GARDEN ROW

PLANS TO REDEVELOP THE GROUNDS OF THE NATURAL HISTORY MUSEUM ARE CRITICISED BY SCIENTISTS.

The Natural History Museum's proposals to redevelop its grounds, which include making substantial changes to its garden, have come in for criticism from scientists and wildlife gardeners.

A planning application submitted to Kensington and Chelsea Borough Council in May included a proposal to build a path through the middle of the garden and to relocate two main habitats within it.

Invertebrate zoologist Dr Steve Head, co-ordinator of the Wildlife Gardening Forum, said that the plans went against the ethos of the museum. "They are going to bulldoze the garden and put in a lot of park-like features," he said. "They say it is the only way they can increase visitor numbers."

But the museum defended its plans, saying that it was proud of the garden and wanted to increase the number of people who visit it.

"The big challenge for conservation is people not engaging with nature," said Dr John Tweddle, who heads up the museum's Centre for UK Biodiversity. "About 1 per cent of our five million visitors a year go to the garden. What we're doing will increase that to 20 per cent."

Dr Ken Thompson, a plant ecologist and expert on wildlife gardening, said the garden was unique in Britain because it had a mosaic of natural habitats in an urban setting. "To do anything to it is a crime," he added.

However, a report submitted with the application predicted that the changes would increase species diversity within the garden by at least 6.6 per cent, a claim refuted by both Head and Thompson.

A field botanist at the University of Reading, Dr Jonathan Mitchley, argued that the report did not bear up to scrutiny. "It should not be considered a scientifically credible piece of work on which to base a modern planning decision," he said in an online objection.

But Tweddle said that it was rigorous science that would be peer-reviewed. "If we thought our plans would have a negative impact on biodiversity, we'd change them," he added.

James Fair

DID YOU KNOW?

Britain's rarest earthworm, *Dendrobaena pygmaea*, was discovered in the garden by the museum's worm specialist Dr Emma Sherlock.

FIND OUT MORE

You can read an extended report on our website: **www.discoverwildlife.com**

Conservationists say that up to 200 golden eagles could be culled in Norway.

NORWAY PLANS EAGLE CULL

Fears that it could lead to a similar cull in Scotland are rejected by conservationists.

The Norwegian parliament has approved a pilot project that critics say could result in a cull of more than 200 golden eagles.

The aim of the controversial trial is to reduce the population of eagles, which are claimed to kill both lambs and reindeer calves.

While Norwegian golden eagles are protected under the Bern Convention, individual birds can be shot under licence if there is sufficient evidence that they are hunting lambs.

Conservationists fear that the project is designed to make it easier to kill eagles and that it will be rolled out across other parts of the country.

"The total impact of golden eagle predation upon livestock represents less than 2 per cent of the total losses of grazing animals," said Kjetil Solbakken, director of BirdLife Norway.

"Eagles are not a major problem for Norwegian livestock farmers. Shooting golden eagles is unheard of in Europe and will place Norway in the international corner of shame."

Solbakken believes the cull is a victory for sheep and reindeer farmers who have lobbied for numbers of golden eagles to be tightly managed in the same way that many top mammalian predators are.

However, Norway's minister of climate and environment Vidar Helgesen said: "Under no circumstances will culling be allowed to an extent that threatens the Norwegian population of golden eagles. This is in accordance with our obligations under the Bern Convention."

Duncan Orr-Ewing, for RSPB Scotland, rejected suggestions that the move could lead to calls for the culling of white-tailed eagles in Scotland because of the birds' alleged impact on lambs.

"RSPB Scotland does not believe there is any justification for a cull of white-tailed eagles," he said. **Simon Birch**

DID YOU KNOW?

Norway has a stable population of 950 pairs of golden eagles.

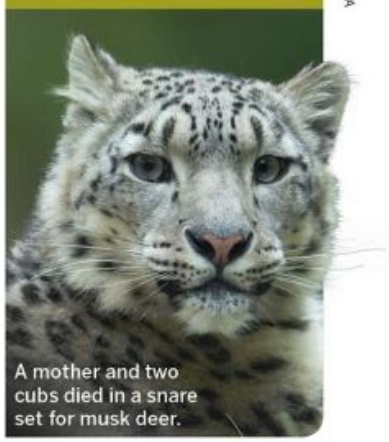
SNOW LEOPARDS SNARED

The deaths of three snow leopards – a mother and her two cubs – in a poacher's snare have highlighted the threats to the Asian big cat.

The animals were caught and died in snares in the Altai Nature Reserve in southern Russia, close to the border with Mongolia.

Dr Charudutt Mishra, of the Snow Leopard Trust, said that the illegal killing of snow leopards was not new but other threats were growing.

"Snow leopard landscapes were once considered remote, but now we are dealing with developments such as mining, roads and railroads," he said. "And these new threats – including the impact of climate change – are coming when the old ones haven't gone away."



A mother and two cubs died in a snare set for musk deer.

Eagle: Chris Wallace/Alamy; leopard Digitoto/Imageborker/FLPA

CONSERVATION briefing

GROLAR BEAR

A bear shot by a hunter on the western shore of Hudson Bay, Canada, was a grizzly–polar hybrid, according to scientists. It's believed that climate change is leading to grizzlies roaming further north and into polar bear territory, resulting in the two species interbreeding.

"WHY ARE WE ONE OF THE MINORITY OF EUROPEAN COUNTRIES IN WHICH SNARING IS STILL LEGAL?"

Actor and founder of the Born Free Foundation **Virginia McKenna** *calls for a ban on the use of snares in the UK.*

Left to right: Steven Kazlowski/NPL; Getty; WWT

Titan the turtle dove provided valuable data about the species' migration from the UK to West Africa.

TEN TAGS LIKE TITAN'S

More research into why turtle dove populations are declining is needed, say experts.

The RSPB is planning to put satellite tags on 10 more turtle doves this year as it steps up its efforts to find out why numbers are crashing so precipitously.

The signal from the one individual tagged to date – known as Titan – was lost earlier this year when the bird was known to be in Mali.

In the UK, populations have plummeted by 91 per cent since 1995, while across Europe there has been a 78 per cent decline since 1980.

While conservationists know that turtle doves are experiencing food shortages when they arrive in the UK in the spring and that this is contributing to the problems they face, less is known about the conservation issues in their wintering grounds of West Africa.

"Titan was great, but we need a bigger sample size," said Tara Proud of the RSPB's Operation Turtle Dove programme. "We have currently caught and tagged three more, and we are trying to catch more."

FIND OUT MORE
Operation Turtle Dove:
http://bit.ly/1nj5yVb

96,000 The number of kilometres flown by an Arctic tern in one year while migrating from the Farne Islands to Antarctica and back again. It's a record for any bird, beating the previous best of 90,000km – also achieved by an Arctic tern.

SPOON-BILL EGGS

Spoon-billed sandpipers have laid eggs in captivity for the first time. With only about 200 breeding pairs, the spoon-billed sandpiper is one of the world's rarest birds, so the Wildfowl & Wetlands Trust is trying to establish a captive population at its Slimbridge HQ.

My AGENDA

COMMUNITY CONSERVATIONIST

SURVEYING THE FAUNA AND FLORA OF YOUR STREET OR VILLAGE COULD GIVE YOU THE DATA NEEDED TO PROTECT IT, SAYS **JEREMY MYNOTT**.

The Shingle Street Biodiversity Survey came about because our part of Suffolk is threatened by coastal erosion, and there were various meetings about what we could do to protect our properties.

At one of these meetings I said, "Your houses aren't worth a row of beans, but if we were to do a wildlife survey, you'd find it was incredibly rich." So everyone else said, "OK, *you* do it."

I raised £12,000 from charities and grant-giving bodies. I'm a lifelong naturalist and have plenty of contacts, so I hired an ecologist to do much of the work. Some of the money also went on traps for small mammals and resources for training.

I wanted to get residents involved, so I set up local survey teams – I got 15 people in total, out of a population of 50 or 60. In the end, it was a real community effort that produced a lot of information.

Though there are disagreements about what to do, the results from this survey put us in a stronger position to negotiate for significant support for sea defences.

Anybody could do this – you could pick your garden, street or village. You would be amazed at what you'd find – we have identified 379 moth species and 26 butterflies. We get a lot of migrant birds and some vagrants.

Shingle Street is special because it is a mosaic of habitats, including shingle, saltmarsh, mudflats, farmland, saline lagoons and woodland scrub, all in an area about one mile long by half a mile wide.

FIND OUT MORE
The Shingle Street Biodiversity Survey:
http://bit.ly/1UMY2fd

A quarter of Shingle Street's residents helped with the survey.

Titan: Thomas Churchyard; Shingle Street: funkyfood London – Paul Williams/Alamy

EXPERT BRIEFING

CONSERVATION INSIGHT

GRIFFON VULTURES

A VETERINARY DRUG THAT WREAKS HAVOC ON VULTURE POPULATIONS IS PUTTING EUROPE'S SCAVENGERS AT RISK, SAYS ANTONI MARGALIDA.

During the 1990s three species of vulture – Indian, Asian white-backed and slender-billed – were virtually wiped out from the Indian subcontinent. The culprit was the veterinary non-steroidal anti-inflammatory drug diclofenac: vultures that fed on the carcasses of treated livestock died of kidney failure. This had a catastrophic effect on ecosystems. Without vultures to dispose of livestock carcasses, disease ran rampant, including rabies.

In 2013 Spain, which is home to 95 per cent of European vultures, approved the use of diclofenac. So far, no deaths related to the drug have been recorded, but then there is no official monitoring going on.

Because the drug accumulates in the soft tissues, meat-eating vultures (others eat bones or connective tissues) are most at risk. We are especially worried about the Eurasian griffon.

We estimate that diclofenac will kill 715–6,389 Spanish griffons, with the population declining by 0.9–7.7 per cent, each year. In addition, diclofenac has also been approved in Italy, which may threaten Sardinia's griffon population.

However, there is a solution. Since diclofenac was banned in India, Pakistan and Bangladesh and replaced with meloxicam, a vulture-friendly alternative that is just as effective and economical, populations are growing again.

Antoni Margalida is a postdoctoral scientist at the Universities of Lleida, Spain, and Bern, Switzerland. Interview by Stuart Blackman.

> "WITHOUT VULTURES TO DISPOSE OF CARCASSES, DISEASE RAN RAMPANT"

FIND OUT MORE
A BirdLife report on diclofenac: www.birdlife.org/datazone/sowb/casestudy/156

Ugo Mellone

Diclofenac is expected to cause problems for Europe's vultures, such as these Eurasian griffons photographed at a dead cow in eastern Spain.

FACT FILE

EURASIAN GRIFFON

GYPS FULVUS

HABITAT Expansive open areas in a wide array of environments, from mountains to semi-desert, at altitudes from sea level to 3,000m

DIET Almost exclusively carrion – mainly large mammal carcasses

THREATS Non-steroidal anti-inflammatory drugs, and collisions with the blades of wind turbines

IUCN RED LIST STATUS
LEAST CONCERN

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Mark Carwardine's AT A GLANCE...

05

TROPHY HUNTING

WHAT IS TROPHY HUNTING?

Trophy hunting is the shooting of carefully selected animals – frequently big game such as rhinos, elephants, lions, pumas and bears – under official government licence, for pleasure. The trophy is the animal (or its head, skin or any other body part) that the hunter keeps as a souvenir. It is a booming industry and is legal, albeit with restrictions on the species that can be hunted, where and when the hunting can take place, and the weapons that can be used.

IS IT THE SAME AS 'CANNED' HUNTING?

Canned hunting is trophy hunting at its most indefensible – in which the animals (particularly lions) are bred on ranches and held captive (often in appalling conditions) specifically for hunters to shoot them.

IS IT REALLY LEGAL TO KILL ENDANGERED SPECIES?

It can be. Some countries do allow a small number of endangered species to be killed in the wild by sports hunters and, with approval from the Convention on International Trade in Endangered Species (CITES), it is still possible to take the trophies home.

IS THAT WHY THE TOPIC IS SO CONTROVERSIAL?

Yes. Allowing endangered species to be killed for sport is counterintuitive. Poachers are slaughtering about 100 elephants and 3–4 rhinos every day, for example, so allowing trophy hunters to kill yet more seems absurd. Critics are also concerned about the mixed messages it sends local people: they can't hunt endangered species, but rich Westerners can.

WHAT ABOUT THE MORALITY OF TAKING ANIMAL TROPHIES?

This is another issue. A majority find it hard to sympathise with someone who pays tens or even hundreds of thousands of dollars, has everything prepared for them in advance, shoots (often incompetently) an animal at close range, and then awaits delivery of the carefully prepared trophy.

WHERE DO THE TROPHIES GO?

The USA legally imports no fewer than 126,000 animal trophies every year, and the EU some 11,000–12,000 (representing 140 species, including everything from African elephants to American black bears), not counting those trophies taken in the countries themselves.

DOES EVERYONE AGREE TROPHY HUNTING IS BAD?

No. South Africa allows trophy hunting of the 'Big Five' and many other species, for example, while Kenya has banned all trophy hunting since 1977. Even conservationists can't agree: many argue for more compassionate solutions to conservation challenges, while others believe that trophy hunting can be a good thing.

Can trophy hunting help conservation? Opinions are divided.

> "THE USA LEGALLY IMPORTS NO FEWER THAN 126,000 ANIMAL TROPHIES EVERY YEAR, AND THE EU SOME 11,000 –12,000"

HOW CAN IT BE GOOD?

While there are many examples of it being bad – the steepest declines in lion populations occur in countries with the highest hunting intensity, for instance – one apparently good example is quoted time and again. It is claimed that trophy hunting has played a role in the recovery of the southern white rhino population in South Africa. The argument goes that by allowing private landowners to conduct limited trophy hunting they have been given an incentive to keep and protect rhinos (albeit in large fenced enclosures). There is also an argument that trophy hunting revenues help conservation by filtering back into desperately poor communities.

IS THAT TRUE?

Trophy hunters do fork out large sums of money – but where it ends up is another matter. Critics argue that the hunting elite and corrupt government officials siphon off as much as 97 per cent. Besides, these are one-off payments – you can't kill the same animal twice – whereas a lion or rhino can earn money from traditional ecotourism for many years. And that, moral issues aside, is the crux of the matter.

MARK CARWARDINE is a frustrated and frank conservationist.

● Every month he demystifies some of the most important issues affecting the world's wildlife and assesses the organisations that protect it.

● The Radio 4 programme *Big Game Theory* explored trophy hunting in 2015. Listen again at **http://bbc.in/1NOHFLY**

Tom Koene/Alamy

The granting of a licence to keep wild animals focuses on whether they can escape, but should it also take account of the owner's knowledge and the animal's welfare?

R Gonzalez/Orlando Sentinel/Getty

CAPUCHINS IN MY KITCHEN

IT HAS BEEN 40 YEARS SINCE THE DANGEROUS WILD ANIMALS ACT WAS PASSED, WHICH SANCTIONED THE KEEPING OF EXOTIC SPECIES IN PRIVATE HOMES. BUT IS IT STILL FIT FOR PURPOSE IN THE 21ST CENTURY? JAMES FAIR REPORTS.

It almost reads like a cache of illegal weapons: "Bolsover Borough Council – one sidewinder, seven rattlesnakes, six cobras, one copperhead, one Taylor's cantil, two vipers."

Except it's a list of the animals licensed under the Dangerous Wild Animals Act 1976 (DWAA) and owned by private individuals – as opposed to zoos or safari parks – who live within that particular local-authority area.

In a Freedom of Information trawl of all of the councils in the UK, the Press Association (PA) found that there were nearly 40 big cats, 15 wolves and more than 300 venomous snakes legally owned under the DWAA.

Some experts have said that lions and tigers, dangerous reptiles and elephants – there is one called Valli living in a Buddhist monastery in South Wales – shouldn't be private pets and have called for changes to the act; others have pointed out that the headlines can be misleading, and most of these animals are not roaming about people's houses and gardens.

Valli, for example, has an extensive elephant house with a plunge pool, and has had the same keeper for the past 35 years.

But does the PA research suggest that there is a problem with the act, or that it's working exactly as it is supposed to?

"The DWAA was introduced when there was a trend for keeping big cats in gardens," said Ros Clubb, of the RSPCA's Wildlife Department. "You don't see that so much any more, but there are a lot of smaller mammals and venomous snakes. It's not a completely useless piece of legislation, but it could be enforced better."

One of the RSPCA's concerns, Clubb said, is that enforcement varies greatly from one council to another. "The needs of an ocelot in Lincolnshire are the

> "YOU DON'T NEED A LICENCE FOR A WHACKING GREAT PYTHON THAT COULD EASILY KILL A CHILD"

same as one in Wales, but if authorities are applying different standards, that's a problem."

There are other, arguably more fundamental, issues. For example, nobody knows how many animals are illegally kept without licences, though the level of non-compliance is believed to be "very high", according to Chris Draper, programmes manager for captive wild animals at the Born Free Foundation.

PUBLIC PROTECTION

A report written for Defra by vets belonging to the International Zoo Veterinary Group and published in 2001 said that the act had been successful in its primary purpose of "protecting the public from extremely dangerous wild animals" but that the ownership of venomous snakes was a problem.

They were easy to conceal, it said, could be easily bought and reproduce well in captivity. Raccoons and small primates were also an issue with respect to non-compliance. "The act is viewed with disdain by many animal-keeping organisations, and penalties awarded by magistrates for non-compliance have not been seen as an effective deterrent," it said.

Draper said that, much of the time, people purchased animals such as venomous snakes without licences and applied retrospectively, if at all. "You don't even need one for a constricting snake," he added. "You can get a whacking great python that could easily kill a child."

A spokesperson for the Local Government Association said that people applying for a licence to own a dangerous wild animal must have their premises inspected by their council, which will usually employ the services of an expert vet and then follow-up inspections every two years. "You have to show it's not going to escape," he said.

Not all of the animals licensed under the DWAA are held as private pets. About 2,000 wild boar, for example, are farmed, while some are owned by commercial organisations largely for the benefit of film and TV companies that need them for movies, adverts or natural-history programmes.

The company Amazing Animals has a wide range of species under the DWAA, including lions, leopards and a polar bear. The lion cubs photographed with David Attenborough for a recent cover of *Radio Times*, for example, were provided by Amazing Animals, and it does occasional live shows. Some animal-welfare groups have branded these as "Victorian", saying that they are little more than a circus act.

But Olivia Walter, of Wildlife Vets International, said that there is little wrong with Amazing Animals' approach to animal welfare.

EXERCISE AND STIMULATION

"From what I have seen," she said, "it was all positive reinforcement and animals were allowed back to their enclosure if they weren't doing what was asked. I saw two leopards asked to jump up onto a platform and walk along a rope ladder to another platform. Walking on unstable narrow branches is a normal behaviour for them in the wild, and it's more exercise and mental stimulation than they might receive in a typical zoo enclosure."

Amazing Animals has also been criticised for the size and state of its animal enclosures, but owner Jim Clubb said the firm worked to give its animals the 'Five Needs' enshrined in the Animal Welfare Act 2006.

"No enclosure can accurately replicate the range of the wild, so the intelligent animal carer needs to look towards the enrichment of the animals' lives," Clubb added. "It's not the size of the enclosure but what you put in it and how you keep the animals mentally stimulated as a whole [that's important]."

There are people who say that the keeping of many or even all wild animals in captivity is wrong, but the PA research shines a light on whether – in allowing private individuals to keep them – we should take into account their knowledge and concern for welfare when handing out licences.

For the time being, it seems, we don't – all that matters is that the animal can't get away.

DANGEROUS WILD ANIMALS ACT: WHAT'S ON THE LIST?

LICENCE REQUIRED	NO LICENCE REQUIRED
ADDER	AARDWOLF
GILA MONSTER	BAMBOO LEMUR
GOLDEN JACKAL	GREY SEAL
GREY KANGAROO	KOMODO DRAGON
RING-TAILED LEMUR	RACCOON DOG
RINGED SEAL	ROCK PYTHON
SPOTTED HYENA	SQUIRREL MONKEY
TUFTED CAPUCHIN	WOMBAT

No licence is required for a Komodo dragon.

You don't need a licence to own a constricting snake such as this boa.

Dragon: Bloomberg/Getty; boa: Carl Court/Getty

Land of flightless birds

Complements
NEW ZEALAND – EARTH'S MYTHICAL ISLANDS
Airing early August on
BBC TWO

Why fly when you can walk? This is the conclusion reached by many birds on New Zealand, from kiwis to kakapos, says **Julian Fitter**.

The world's only flightless parrot, the Critically Endangered kakapo is endemic to New Zealand.

Stephen Belcher/Minden Pictures/FLPA

New Zealand has always been known as a kingdom of birds. But it is also remarkable for how many of those birds are flightless – or used to be, because some have now died out. More types of land bird lost the power of flight in this country than anywhere else on Earth. They were able to evolve flightlessness on this island paradise because of a lack of enemies, including a total absence of predatory land mammals and snakes. And then, of course, there are also the penguins, of which New Zealand is blessed with no fewer than six species – a third of the world's total.

Captain James Cook and his party were mightily impressed by the birdsong when they arrived at Aotearoa in 1769 (the country's Maori name, meaning the 'Land of the Long White Cloud'). However, they would have been even more impressed if they had arrived 500 years earlier, when birds made up an even more dominant part of the native fauna.

The land mass that is now New Zealand broke away from the supercontinent of Gondwana some 80 million years ago and set off to the west at the rate of about 25mm a year. This breaking-away distanced it from the rest of the world before the development of mammals, so that its only inhabitants were birds, reptiles and invertebrates. While New Zealand has several marine mammals, it has only ever been home to four species of land mammal: a small mouse-like creature known only from the fossil record, and three species of bat, just two of which survive today.

Two inhabitants of the Burwood Takahē Breeding Centre. Puppets, models, hand-rearing and incubators were all once used to raise chicks, but these days the centre's 20 or so pairs of takahē rear their own.

BIRDS ON THIS ISLAND PARADISE WERE ABLE TO EVOLVE FLIGHTLESSNESS BECAUSE OF A LACK OF ENEMIES, INCLUDING PREDATORY LAND MAMMALS AND SNAKES.

This splendid isolation allowed the birds that were already there, or that found their way there before the gap became too wide, to develop with few natural predators. By the time William the Conqueror crossed the English Channel in 1066, out of the 250 or so species of native New Zealand birds, 50 were flightless. Twenty-one of these became extinct before Cook arrived seven centuries later, and a further 12 have disappeared since, due entirely to the presence of *Homo sapiens*.

But why did so many bird species in New Zealand become flightless? If you think about it, flight is only useful if it has survival benefits, and in prehistoric New Zealand the only species that preyed on birds were other birds. So rather than compete in flight with hawks and owls, many species

Top to bottom: Codfish Island is the main home of the kakapo; a plate from a volume by 19th-century naturalist Alfred Russel Wallace; kiwis (here the North Island brown) probe leaf litter and soil for food.

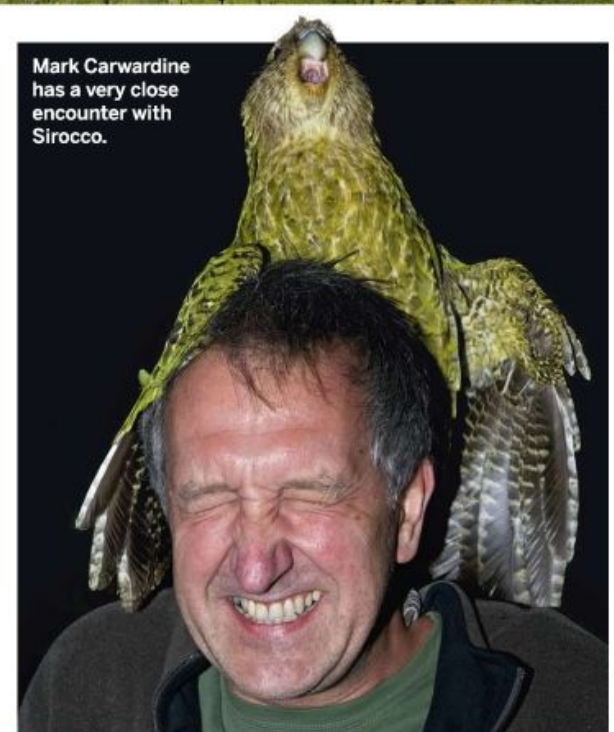
became nocturnal and flightless instead. The exceptions were the nine giant species of moa – the only known birds with no sign of vestigial wings or indication that their ancestors ever flew.

THE RISKS OF FLIGHTLESSNESS

There are two main reasons for the extinction of these flightless birds. First, many of them were good to eat and very easy to kill – indeed the nine moas, two geese and two adzebills had all gone by 1400, a mere 150–200 years after the arrival of the Maori. The second major cause was the Maori's introduction of the Polynesian dog and rat. With no mammalian predators to worry about, birds had protected themselves by being nocturnal or with camouflage; they had no defence against hunters armed with such good night vision and an acute sense of smell.

Devastation of the native avifauna accelerated with the arrival of the Europeans, who introduced a whole suite of new mammals. Not only did they bring domestic pigs and cats, black and brown rats, and Eurasian hedgehogs, weasels, stoats and ferrets, but they also brought steel, machinery and mammalian herbivores to tame the native bush and drain the wetlands, therefore ravaging the habitat of species that might just have survived the onslaught of the pests.

So we're now left with 17 species of flightless bird in New Zealand – the six penguins, and 11 land birds. Of the latter, three are found in New Zealand's sub- ▶



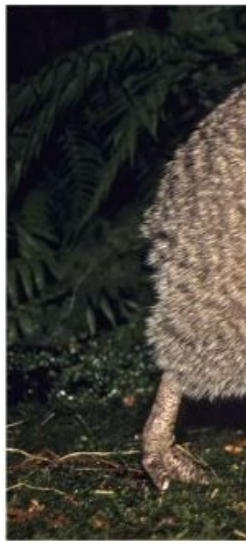
Mark Carwardine has a very close encounter with Sirocco.

TV GOLD: SIROCCO THE KAKAPO

Few wild birds have their own Facebook page or Twitter account, but then Sirocco is no ordinary parrot. For one thing, he's extremely rare – at the time of writing, there are just 159 others of his kind left. And for another, he is a global celebrity, memorably described by Stephen Fry as an "old-fashioned, big side-burned Victorian gentleman". Sirocco made headlines around the world when he attempted to mate with the head of *BBC Wildlife* columnist Mark Carwardine during the filming of BBC Two series *Last Chance to See*. Not yet 20, Sirocco probably has plenty of TV and online appearances ahead of him – his species can survive to 100 years old.

Tiaoahi: Tui De Roy/Minden/FLPA; codfish: Mark Carwardine/naturepl.com; plate: The Natural History Museum/Alamy; Sirocco: Mark Carwardine; kiwi: Life on white/Alamy

Weka are omnivorous and very productive, with females laying clutches containing two to four eggs up to four times a year.



Antarctic islands, well south of the mainland; two are so few in number that they have to be kept in special island or fenced reserves; and five are kiwis, which are also seriously endangered and subject to intensive conservation work to ensure their survival. This leaves a single species that is surviving – and in some cases thriving – on its own: the weka, which is a bit like a Eurasian corncrake or water rail on steroids.

Unfortunately, the species' success is something of a problem, because it preys on other ground-nesting birds such as waders and seabirds, as well as reptiles and invertebrates. In a normal, balanced ecosystem this would not be an issue. But when the prey species are themselves endangered, it becomes an interesting conundrum. The weka also has a reputation for being a nuisance around houses and in gardens, where it can uproot plants and steal chicken or pet food.

Weka live on North and South Island and on Stewart Island, and have been introduced successfully to a number

PEST CONTROL: HOW NEW ZEALAND BECAME A WORLD LEADER

One consequence of the extensive list of invasive animals and plants found in New Zealand is that the country has been at the forefront of pest-eradication techniques. Major pest-extermination projects across the globe – for example, efforts to remove domestic goats on the Galápagos Islands, house mice on Gough Island in the South Atlantic, and brown rats (*pictured*) on South Georgia and the Scilly Isles – have taken advantage of the country's trailblazing work. The imaginative list of control methods includes poison, trapping, fencing and even the deployment of Judas animals that enable conservationists to locate populations of species they are keen to cull (see Q&A, p100). Without these techniques, the natural world would be a poorer place.

Above: kiwis (here a North Island brown) fill a similar ecological niche to hedgehogs. Above right: the Auckland Island rail was believed extinct until it was rediscovered in 1966. Left: kiwis (here a great spotted) are the only birds with external nostrils on the end of their beak. Below: there are just 150–300 Campbell Island teal in the world.

THE COST OF THE TAKAHĒ'S SURVIVAL PALES IN COMPARISON TO THE FUNDING NEEDED TO LOOK AFTER THE KAKAPO.

of offshore islands. Sometimes they get there under their own steam – weka have been known to swim as far as 1km to reach an island. While not in immediate danger of extinction, they still need significant conservation work to ensure their long-term survival. But this need for a life-support system is far more apparent with the most colourful of all of the flightless species, the takahē.

GENTLE GIANT

Looking rather like a large blue-green football with stout red legs and a massive red bill, the South Island takahē comes across as a brute. In fact it is mostly vegetarian, using that amazing beak to eat grass, though it does opportunistically catch large insects or even small birds and lizards. The species was thought extinct until a tiny population was rediscovered in the remote Murchison Mountains of Fiordland in 1948.

Following that stunning coup, New Zealand's Department of Conservation translocated the ultra-vulnerable species to seven pest-free islands and a number of fenced mainland reserves, and launched a captive-breeding project. As a result there are now approaching 300 individuals. (The North Island takahē is extinct and known only from fossil bones and a specimen captured in 1894.)

The wild takahē population in Fiordland is gradually increasing. But the captive-breeding programme, together with maintaining 3,500 pest-control traps in one 50,000ha Fiordland reserve alone, make for a hugely expensive conservation effort. Yet if the takahē's survival costs a lot, it pales in comparison to the eye-watering funding needed to look after the kakapo.

Arguably the most charismatic member of New Zealand's avifauna, the kakapo really is odd. Not only is it the heaviest parrot in the world and the only one that can't fly, it's also nocturnal and breeds at leks, a communal courtship system that is more commonly found in waders, grouse and the pretty little manakins of Latin America. The kakapo is also the most threatened of all of New Zealand's flightless birds, and at one stage was thought to be doomed, because every known bird was male.

One factor that made the kakapo more susceptible than most to predation was its breeding cycle. A group of several males scrape out hollows from which they utter low-frequency booms to attract a female. Having mated with her chosen male, the poor bird is left to raise her young alone, so is far more susceptible to attack. Aggravating the situation is the fact that kakapos breed only when there's an abundance of fruit on rimu trees, which occurs every two to four years.

So far 2016 has been a good year for the species, with 37 chicks hatched and surviving at the end of May, increasing the population to 160. Yet this is a frighteningly small total, especially given the amount of time, money and research invested in protecting this portly parrot over the past 20 years or more.

An even larger recovery programme is aimed at the most iconic New Zealand ▶

Weka: Tom & Pam Gardner/FLPA; north island brown: Tui De Roy/Minden/FLPA; rail: www.rodmorris.co.nz; teal: Tui De Roy/naturepl.com; great spotted: Tui De Roy/naturepl.com; rat: Eureka/Alamy

Biologists check up on a captured male kakapo on Codfish Island, off New Zealand.

Tui De Roy/Minden/FLPA

birds, the kiwis. These curious creatures have, after all, given their name to the country's human inhabitants. And the conservation work has paid off, since all five species have managed to survive the onslaught of humanity and its mammalian cohorts, albeit with varying levels of success.

Kiwis look much like a shaggy-haired cross between a curlew and a chicken. They're nocturnal and feed by probing deep into the soil, and it is thought that their nostrils, which are located near the bill-tip rather than at the base, help to locate prey. The stiff 'rictal' hairs around the bottom of the bill – actually modified feathers – may also help with foraging at night.

FROM THE BIGGEST TO THE SMALLEST

The great spotted kiwi, or roroa, is the heavyweight among kiwis. It's found in the north-west of South Island, nowadays confined to upland bush and grassland areas, with a fairly stable population of 15,000 thanks to captive breeding and a major pest-control operation. By contrast, the little spotted kiwi, or kiwi pukupuku, is very much the smallest of the family – and also the most endangered, with a population of about 1,700.

That the little spotted kiwi survived at all is entirely due to the relocation in 1912 of five birds, from South Island's Jackson Bay to Kapiti Island, which lies close to the capital Wellington on North Island. Several other populations have now been established, but they suffer from a very low genetic diversity, a common problem with rare island birds.

Perhaps surprisingly, New Zealand's other flightless land birds are somewhat less demanding financially. They are the Auckland Island rail and teal and the Campbell Island teal, which as their names suggest live in the country's wild and remote sub-Antarctic islands. Again, pest control has saved these species from an untimely end – and the battle is ongoing, as demonstrated by the Million Dollar Mouse Programme, a new mice-eradication project.

All in all, the past 800 years have been pretty damning for the birds of Aotearoa, and even its species able to fly have suffered too – one, Stead's bush wren, became extinct in 1972, while the Chatham Island robin nearly followed suit in the 1980s, being saved in the nick of time by a huge amount of work and a minor miracle.

Yet the birds that are left in New Zealand are some of the most extraordinary anywhere in the world. Birdwatchers flock here in their eagerness to see these quirky products of avian evolution-in-isolation, such as the family of shaggy 'curlew-chickens' that have taken the place of the hedgehogs, anteaters or echidnas you might expect to encounter in other parts of the world. Saving these flightless marvels is expensive and it's relentless, but it's undeniably worth it.

JULIAN FITTER is a naturalist and conservationist who has written several books about New Zealand's birds.

FIND OUT MORE

The new three-part series *New Zealand – Earth's Mythical Islands* is due to air in early August. Read our preview on p90.

HOW TO SEE NEW ZEALAND'S BIRDS

- Many birds on New Zealand, from the wrybill to the rifleman, kea and blue duck, live nowhere else. Of its flightless land birds, the weka can be easily seen across North and South Islands, while the other 10 species are mostly confined to reserves or small offshore islands. New Zealand is also famous for its penguins and albatrosses.
- Two stunning offshore islands to visit are **Tiritiri Matangi** (which hosts 12 endemic birds, including the takahē and little spotted kiwi) and **Stewart Island** (home to the brown kiwi, or tokoeka).
- Tour operators include UK companies **Travelling Naturalist** (01305 267994, www.naturalist.co.uk/tours/new-zealand-natural-history) and **Naturetrek** (01962 733051, www.naturetrek.co.uk), local firm **Wrybill Birding Tours** (www.wrybill-tours.com) and South Africa's **Rockjumper** (www.rockjumperbirding.com). See **www.birdingnz.co.nz/birding-operators** for other New Zealand companies.

Look for tompot blennies around the southern and western coasts of the UK and Ireland. *Parablennius gattorugine* grows up to 20cm in length, and has a distinctive branched tentacle above each eye.

Glam rocks

You don't have to visit tropical climes to see dazzling reef fish. Meet Britain's tompot blenny – the small fish with an enormous personality.

Words and photos by **Paul Naylor**

A small fish with a punk hairdo peers out from his crevice on the reef, taking in the view of sponges and sea anemones. Bright red tentacles on his head sway gently in the swell and these, together with large, high-set eyes and thick lips, give him quite a comical appearance from our perspective.

Yet his looks belie his feisty nature. For this little tompot blenny – the species is usually under 20cm long – has defended his territory against intruders for three years now. The battles have left him scarred around the mouth, but that doesn't seem to deter the females that enter his home to lay their eggs, which he then tends with devotion until they hatch.

From his home the blenny can see other species of fish on the reef build imposing nests of pink seaweed, change colour to greet their partners or lurk with the intention of stealing his conscientiously guarded eggs. Where is this vibrant underwater world? The Mediterranean, the Caribbean or the Great Barrier Reef, perhaps? No, it's Devon in south-west England, within a stone's throw of the beach. In fact the top of a reef like this almost breaks the surface on the lowest tides, so snorkellers as well as divers can enjoy its wonderfully rich marine life.

The charismatic tompot blenny is a common species around most British and continental European coasts, mainly in water 1–12m deep, where it eats a variety of seabed invertebrates – including the anemones avoided by most predators – and grazes seaweed too. Ever since I started to dive and snorkel over the shallow rocky reefs ▶

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Clockwise from above: velvet swimming crabs prey on tompot blennies' eggs; the species shares its habitat with ballan wrasse and snakelocks anemones; a young tompot blenny; an adult male keeps both eyes on the eggs in his crevice.

near my home just outside Plymouth in 1980, I've been intrigued by the assertiveness and antics of the tompots.

Whenever I encountered a tompot on repeat visits to a particular rocky crevice, I had a hunch that it was the very same fish. Then I discovered that I could reliably identify individuals from close-up photographs showing the unique markings around their heads. It meant I could go back through my photo library to track the occupancy of individual fish in different parts of a reef over several years.

This research showed that male tompots guard the same crevice for up to three years, and can also stay in the area of reef even longer, though with moves and 'swaps' of territory during that time. The appearance of wounds around the mouth or on the fins of males coincides with these swaps, clearly a result of territorial fights. It was heartening to see one of our longest-standing reef residents – nicknamed 'Benny the Blenny' – recover well from his injuries.

Stand-offs between rival males are frequently observed, though actual attacks with the mouth are seen much more rarely. One September I was astonished to spot juvenile tompot blennies, just 2cm long and recently settled from their planktonic larval stage, battling with each other like seasoned adults.

A CREVICE FIT FOR A QUEEN

Once a male tompot has won ownership of a rocky crevice, he cleans it and – probably with the help of pheromone secretions – invites in a female. He encourages her to attach her eggs, often to the crevice ceiling as well as its floor. Female visits are quite brief so often go unwitnessed, but, sure enough, a single layer of beautiful dark purple eggs invariably appears in a male's home each April.

However, from then until June, the egg raft expands as more females visit, producing distinct patches of eggs at different stages of development. Since female tompot blennies are more mobile they are harder to track, but further study of my photographic records has shown that a female will visit several males to lay eggs in a given breeding season, and that a male will also host several females. Such polygamy is well known in members of the blenny family, but what is surprising is that a male tompot will sometimes host more than one female simultaneously – in fact I recently watched three females together with a single suitor.

I DISCOVERED THAT I COULD RELIABLY IDENTIFY INDIVIDUALS FROM THE MARKINGS AROUND THEIR HEADS.

Over the several weeks that the eggs take to develop, the male tompot's paternal duties include wiping them with cauliflower-like glands on his underside by wriggling across the egg raft. In other blenny species, the secretions of these glands have been found to contain antimicrobial compounds. Male tompots also have to be fierce guardians, because there are plenty of egg thieves about. ▶

I have seen a Connemara clingfish, which commonly live in the same crevices as tompots, sneak in to eat some eggs while the owner was distracted. Quickly realising the threat, the tompot drove the clingfish away. But the invader installed itself in a narrow part of the crevice inaccessible to the larger tompot, and waited for further chances of a snack.

Intruding crabs are also unwelcome and dealt with sharply. Though the red-eyed velvet swimming crab is notoriously aggressive, a tompot will force one from his territory by targeting its legs or rear for a rapid biting attack while keeping away from its fearsome claws.

HUNTER AND PREY

Unless a tompot blenny is unlucky enough to be caught out in the open by seals, birds, bass or cuttlefish, its other main enemies are ones shaped to enter rocky crevices. At the top of this page you can see a photo I once took of a small conger eel with a tompot blenny in its jaws; several hours later, there was just a very full-looking conger.

Some of the many fascinating interactions between tompot blennies can be tricky to interpret. In August and October, outside the breeding season, individuals (of uncertain gender) will adopt what appears to be a submissive 'belly display' posture outside the crevice of a territorial male, which usually emerges to chase them off. And I once observed a large male moving an empty whelk shell around the seabed with his head under Swanage Pier in Dorset – perhaps showing off to smaller tompots?

We still have so much to learn about this feisty species, and indeed about so many other amazing animals in British waters. This is why Marine Protected Areas, promoted by The Wildlife Trusts, Marine Conservation Society and others, are so vital. Without them we risk fatally damaging our undersea ecosystems before we have even begun to understand them.

PAUL NAYLOR *is a marine biologist and photographer. Visit www.marinephoto.co.uk to see more of his pictures.*

This tompot blenny, with red head tentacles just showing, has been unfortunate to encounter a conger eel small enough to enter its crevice home, but large enough to eat it.

FIND OUT MORE

Read Paul's book *Great British Marine Animals* (Sound Diving Publications, 3rd edn, £15.99).

FABULOUS FISH SIX OF THE TOMPOT'S NEIGHBOURS

1 CORKWING WRASSE
The male has flashy breeding colours and builds a large nest from carefully selected pieces of seaweed. Some nests are so shallow that they are exposed at low tide.

2 BLACK-FACED BLENNY
When he is actively courting, the male's yellow becomes especially vibrant. But outside the breeding season he has cryptic coloration similar to the female's (visible at bottom right).

3 TOPKNOT
This is an unusual flatfish in that it lives among rocks rather than in open sandy areas. Able to enter narrow crevices, the species may be a significant predator of young fish such as blennies.

4 LONG-SPINED SEA SCORPION
To help it ambush prey, this member of the sculpin family matches the colour of its surroundings, which can include bright pink and orange among encrusting algae and sponges.

5 GOLDSINNY WRASSE
This little wrasse nibbles parasites off other fish – the black spot on its tail stem is thought to advertise its cleaning service.

6 CONNEMARA CLINGFISH
Long and slim, this fish is superbly adapted for life in narrow crevices. Its pelvic fins are fused to form a powerful sucker with which it clings to the rocky floor or ceiling.

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BBC Wildlife READER HOLIDAY

BBC Wildlife HIGHLAND SAFARI with Nick Baker

23–28 October 2016

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Don't miss the chance to enjoy autumn in the Scottish Highlands and fantastic views of some of the best wildlife in Britain, including red deer, pine martens, golden eagles, badgers, mountain hares, red squirrels, bottlenose dolphins, ptarmigan and a host of winter wildfowl and raptors. This special five-night holiday is hosted by the *BBC Wildlife* editorial team, with naturalist and TV presenter Nick Baker joining resident guide John Poyner and his colleagues to lend their expert help to ensure that guests have the best animal encounters.

The Grant Arms, our base for the holiday, is a specialist wildlife hotel that has a long and distinguished history. At the heart of Grantown-on-Spey yet close to Anagach Woods where roe deer and red squirrels abound, and the River Spey with its otters and water birds, the hotel offers comfortable en-suite rooms, a cosy bar and a first-class restaurant serving locally sourced food.

It is also the home of the Bird Watching and Wildlife Club with its clubroom, library and lecture theatre where Nick Baker and members of the *BBC Wildlife* team will give evening talks on nature and wildlife photography. A local wildlife expert is on hand to advise on walks and the best wildlife spots if you choose to spend some time doing your own exploring.

Full details: www.discoverwildlife.com

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- Free wine with dinner
- Small-group day trips with a local guide (six people maximum)
- All transport included on the trips
- Evening talk and guided trips by Nick Baker
- Evening talks on wildlife photography and Scottish wildlife
- Dolphin-watching on the Moray Firth
- Evening trip to a pine marten hide
- Photography tips and guidance
- Trip to see the red deer rut
- Trip to the top of Cairngorm Mountain
- The holiday also includes all entry fees and free pick-up and drop-off at either Inverness Airport or Aviemore Rail Station

Not included: *travel to Grantown-on-Spey; drinks (apart from those specified above); travel insurance; other incidental expenses; gratuities*

Please note the programme schedule may change due to weather, availability and other circumstances.

BBC Wildlife

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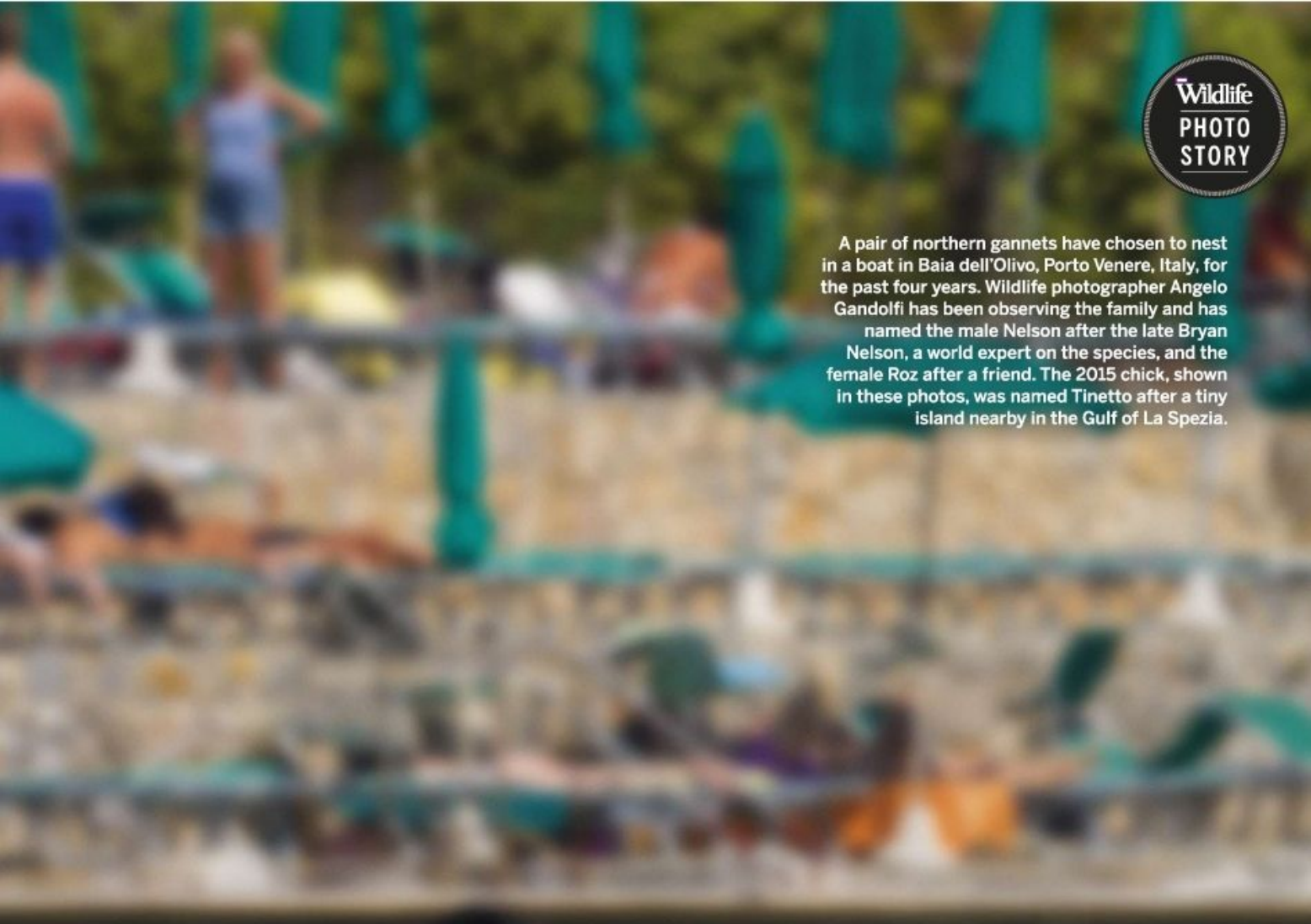
Nick Baker: Paul Carter; eagle: Cordier Sylvain/Getty



Wildlife PHOTO STORY

A pair of northern gannets have chosen to nest in a boat in Baia dell'Olivo, Porto Venere, Italy, for the past four years. Wildlife photographer Angelo Gandolfi has been observing the family and has named the male Nelson after the late Bryan Nelson, a world expert on the species, and the female Roz after a friend. The 2015 chick, shown in these photos, was named Tinetto after a tiny island nearby in the Gulf of La Spezia.

Photos by **Angelo Gandolfi**

Volare e cantare!

Gannets are meant to nest in colonies on islands and coasts, but nobody told the pair that chose a fishing boat near a popular Italian resort. **Jo Price** reports.

ABOVE Nelson returns from a fishing trip while Roz guards the nest. The parents take it in turns to incubate the egg. According to Viola Ross-Smith of the British Trust for Ornithology, in general northern gannet numbers are growing across their breeding range and traditional breeding colonies on islands and coasts are getting full. This may explain why these birds have found an alternative place to raise their chick.

LEFT Nelson and Roz bond with a greeting ceremony, which is often followed by a mutual preening session. The full gannet courtship display, including neck-biting and mock fencing, is connected to nest-site possession and never performed anywhere else. This isn't the only record of the species nesting in an unusual place – gannets have also been recorded using marinas in the French Mediterranean.

TOP Northern gannets usually breed in steep and windy locations that help them to get airborne. The elongated shape of the nearby island of Palmaria shelters the gannets in Baia dell'Olivo, but nesting at sea level has forced Roz and Nelson to alter their behaviour. To clear this motor yacht Nelson plunged into the water and paddled away before taking off.

ABOVE In the summer months Porto Venere becomes very busy with tourists, though the pair cope surprisingly well with life alongside speedboats, fishing boats, swimmers and fishermen. However, boat moorings are in short supply so some people hold a grudge against the gannets for occupying valuable space.

ABOVE Tens of thousands of adult and immature gannets overwinter in the Mediterranean Sea where they arrive between September and November and depart in February or March. This picture of an adult male was taken in January 2016 near the promontory of Portofino, Liguria, Italy. We don't yet know where Nelson and Roz go when they leave Baia dell'Olivo.

LEFT To the south of Porto Venere there are important coastal feeding areas for the gannets such as the protected marine area Secche della Meloria. The Porto Venere Regional Park and Cinque Terre National Park also conserve coastline waters. Though the Mediterranean doesn't possess prey as rich as that of the North Atlantic, the few gannets that nest here in the summer have almost no competition when they are raising their young.

Observatree
monitoring tree health

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When William Blake first penned his 1804 poem *'And did those feet in ancient time'* he conjured up visions of a nation full of lush landscapes and rolling vistas, habitats for wildlife and a source of economic growth.

Trees are vital habitats for wildlife. Over 1000 species are associated with ash trees or ash woodland (source: *Mitchell et al 2014**). They also give us clean air and water, provide food and fuel and create much-loved green spaces for people to enjoy.

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*The potential ecological impact of ash dieback in the UK. JNCC report No. 483.

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Affects: cedar
First UK recording: 2014

Oriental chestnut gall wasp
Affects: sweet chestnut
First UK recording: 2015

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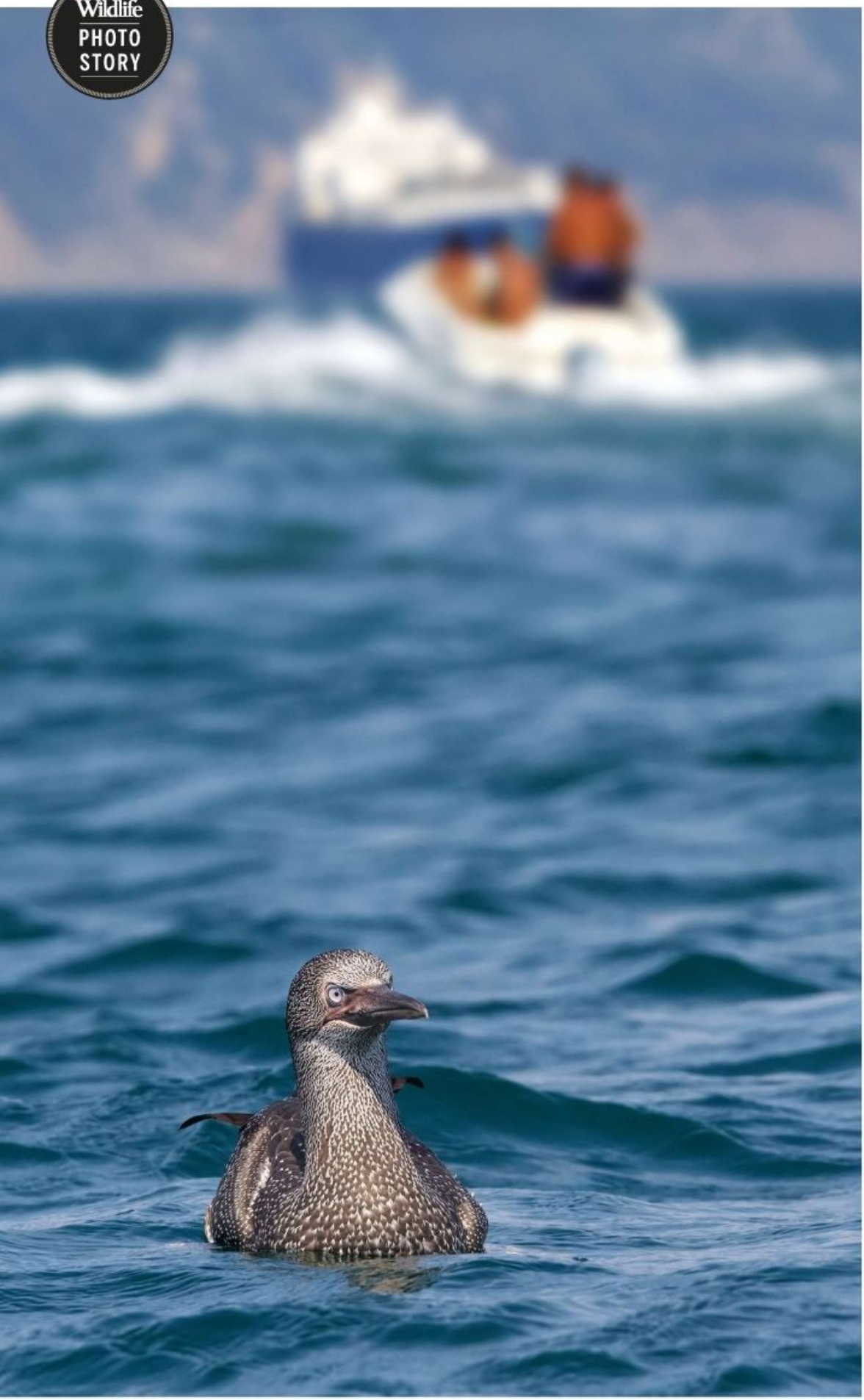

LEFT Fledgling Tinetto explores his surroundings. The larger the colony, the greater the chance of him thriving, but it is possible that a new colony can be formed by a handful of pairs. Without human help, however, Nelson and Roz would have been unable to nest successfully in the bay.

RIGHT These youngsters swam from a nearby beach when the gannets' old boat was threatened with sinking. It was fixed by local people with the approval of the Italian League for Bird Protection and Tinetto returned to it.

BELOW The young gannet will attain his full adult plumage at about five or six years old. The seabirds tolerate the presence of humans and boats in the cove as long as they do not get too close.

ABOVE Nelson tried to assist Tinetto with his early flights and continued to feed him for two weeks after he had fledged, behaviour that has never been recorded before. The youngster was the only chick to fledge at Porto Venere in 2015 at 89 days old. This year Nelson and Roz have returned to the same site – visit http://bit.ly/1O1ZKwY to follow their progress via webcam.

ANGELO GANDOLFI *has won many awards since he began his career in wildlife photography in 1977, and has a true passion for birds. Visit* ***www.discoverwildlife.com*** *for more of his photos.*

REVIEWS

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Keep an eye out this summer for a basking common lizard warming up for a day's hunting.

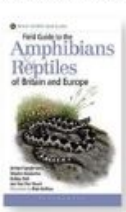
BOOK OF THE MONTH

THE PERFECT FIELD GUIDE

All you need to know about amphibians and reptiles.

Field Guide to the Amphibians and Reptiles of Britain and Europe

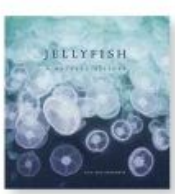
By Jeroen Speybroeck et al. Bloomsbury **£25** (out 28 July)



Spotting amphibians and reptiles can be punishing – herpetologists or 'herpers' suffer for their art. Many endure baking-hot temperatures lifting stones and turning old logs by day, before donning the waterproofs for a night spent scanning ponds and lakes by torchlight. So why do they do it? Because there is immense joy to be found in discovering and observing such charismatic and often-overlooked animals as snakes, lizards, tortoises, frogs, toads and newts.

This latest field guide to European species is the complete package for would-be herpers and interested naturalists alike, graced with eye-catching and crisp illustrations from Ilian Velikov. Every diagnostic scale pattern, dorsal groove and distinctive toe is clearly labelled. The result is a book that is eminently enjoyable to flick through, yet provides arguably the best modern account of Europe's most hidden, most ancient and most spectacular land-living vertebrates.

Jules Howard Naturalist and patron of the charity Froglife



Jellyfish: A Natural History

By Lisa-ann Gershwin

Ivy Press **£20**

Jellyfish have existed for some 600 million years, resulting in a huge diversity of life-forms that play a vital role in our oceans. Here biologist Lisa-ann Gershwin provides a tantalising introduction to these mesmerising animals, and each turn of the page offers stunning photographs, beautiful illustrations or amazing facts.

The author explores such topics as taxonomy, behaviour, anatomy and ecology, and profiles 50 notable species. She also examines our relationship with jellyfish, and their future in an ever-changing world.

Matt Doggett Marine ecologist

Beetle

By Adam Dodd

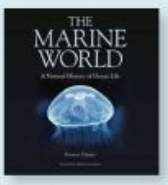
Reaktion **£12.95**

Everyone loves beetles. Despite the famine-triggering behaviour of the Colorado beetle and the grain weevil, and the real prospect of deathwatch bringing the roof down, beetles are non-threatening – they don't sting or bite. Their biology fascinated Darwin, while their beauty inspired the 16th-century painter Albrecht Dürer. During this unravelling of the human–beetle relationship, Adam Dodd is not surprised that beetles are regarded as cute. How else can we account for our fascination with sacred scarabs, the Fab Four and the best-selling saloon car?

Richard Jones Entomologist

Yellow goatfish shelter under a red tree sponge in the Caribbean.

Common lizard: R Hoddinott/NPL; goatfish: G Douwma/NPL; Thomas as goat: Tim Bowditch



The Marine World: A Natural History of Ocean Life

By Frances Dipper
Wild Nature Press **£45**

This authoritative and beautiful book tells you all about the world's seas and shorelines, and the plant and animal life they support. Clear and concise yet detailed and accurate, *The Marine World* will be enjoyed by amateur enthusiasts and marine biologists alike.

Opening chapters explain the physical forces at work – such as tides, waves and currents – and describe the many marine ecosystems.

Then the bulk of the book covers the vast array of marine organisms, from bacteria through to seaweeds, fish, mammals and birds. I was particularly interested to see human impacts on marine life considered along with how we are seeking to reduce them.

Drawings by Marc Dando and hundreds of photos ensure that the book's images are as inviting and informative as its text. Frances Dipper has produced a real pearl here.

Lindsey Chapman Presenter, BBC One's *Big Blue UK*

Falcons

By Richard Sale
HarperCollins **£35**

This is a wonderful addition (number 132 in the series) to the remarkable New Naturalist Library. In eight fact-filled chapters, the author – a physicist turned ornithologist – surveys one of the most charismatic groups of birds, the falcons. He concentrates on the four British species: the peregrine, kestrel, hobby and merlin. As well as an up-to-date review of the work of others, we get the benefit of Richard Sale's own vital research, especially in a fascinating chapter on the birds' hunting techniques.

Jonathan Elphick Ornithologist

RSPB Spotlight: Eagles

By Mike Unwin
Bloomsbury **£9.99**

White-tailed and golden eagles feature on the cover of the latest book in the RSPB Spotlight series, which aims to grab readers with accessible natural histories. As you might expect *Eagles* has copious photos illustrating all aspects of the birds' lives. There's particular emphasis on our two native species and how to see them, though the eagles of other countries feature too. Mike Unwin – a regular *BBC Wildlife* contributor (see p44) – also examines how conservation can bring *Homo sapiens* and these formidable predators together.

Brett Westwood Naturalist

MEET THE AUTHOR

Thomas Thwaites

Designer Thomas decided to take a holiday from being human by becoming a goat.

Where did you get the idea?
I was stressed out about aspects of my own life while sitting with my niece's dog. The animal was totally happy in the moment with no concerns. I thought: "You're so lucky! I wish I could be you for a bit." I went to visit a shaman and she told me I should try to become a goat. An arts award gave me the opportunity to do so.

How did you make the transformation?
I approached the project from various angles. To change my soul I tried a shamanic journey to meet my 'power animal'. For my brain I visited a neuroscientist who switched off my ability to speak using transcranial magnetic stimulation. To be able to digest grass I created an artificial rumen, while a prosthetics clinic made me some goat legs.

What were the biggest challenges?
When I visited the Swiss Alps to live with a herd for three days I struggled to go down the mountains on four legs (my arms and hands became forelegs). I also tried to cross the Alps this way, but ended up on a glacier close to the border with Italy and it was too dangerous to continue. It was much more painful to be on four legs than I imagined. Life wasn't simple, but it gave me a new perspective.

How has your experience influenced your work?
It has let me develop a methodology for exploring the overlap between the arts and the sciences. I've always been frustrated that schools tend to split these subject areas up – they're equally interesting and necessary.

> "TO BE ABLE TO DIGEST GRASS I CREATED AN ARTIFICIAL RUMEN"

Can you spot Thomas in this photo?

Do you have any plans to live like an animal again?
I've been improving my prosthetics to make them less painful, and have had invitations from goatherds since my project has been in the media. So I might go back to being an ungulate this summer.

● **GOATMAN** *is available now (Princeton Architectural Press, £14.99; www.abramsandchronicle.co.uk). Thomas discussed the book on Radio 3's* Free Thinking *in May:* **http://bbc.in/1UaZYAT**

Snares penguins are endemic to the islands of the same name, located 200km south of New Zealand.

Mark MacEwen

TV CHOICE

WILD WONDERS DOWN UNDER

Discover a remarkable land where penguins live in forests and reptiles have three eyes.

New Zealand – Earth's Mythical Islands
TV BBC Two
Due to air in early August. See *RT* for details

It's a holiday destination famed for adventure travel, breathtaking scenery and, of course, sheep. But there's far more to New Zealand – that two-island splinter of land nestled in the south-west Pacific – than kayaking canyons and grazing hills. Cut off from the rest of the world for 80 million years and one of the last large land masses on the planet to be colonised by humans, this is a place where nature has veered off on its own course.

Narrated by Sam Neill, this new three-parter tells the story of this long-lost kingdom and the captivating evolutionary oddities that call it home. "*Wild New Zealand* is a tale of unlikely heroes and extraordinary pioneers," says series producer Mark Flowers, "all of whom survive in one of the most tempestuous and volcanically active countries on Earth."

> "WILD NEW ZEALAND IS A TALE OF UNLIKELY HEROES AND EXTRAORDINARY PIONEERS"

While New Zealand's pioneers (the Snares penguins that rear their young not among icebergs, but in remote island forests; the dusky dolphins that have learned to communicate in a language of leaps; the fantail birds that have adapted to hunt over bubbly geothermal streams) are moving with the times, its heroes have remained largely unchanged since their ancestors walked with the dinosaurs. Such prehistoric peculiarities include the tuatara (a spiny, three-eyed reptile, here filmed hatching), the weta (a bizarre, tusked insect the size of a human hand) and the giant centipede (a Goliath that can exceed 16cm in length).

Naturally, no series on this island nation would be complete without a look at its raft of iconic flightless birds (see p66), of which it has more species – both living and extinct – than any other country; not forgetting, either, its human inhabitants, who include helicopter-flying sheep farmers and Maori carvers who 'fish' for wood. "We've created a new style of natural-history television that hybridises wildlife, landscapes and people, using human and animal characters to reveal the story of New Zealand in a rich, surprising and beautiful way," says Mark. "I hope it reaches out to people on many levels."

Sarah McPherson *Section editor*

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Q&A

Mark Flowers

What was the most challenging shoot?
Filming glow-worms in the forests of Fiordland, South Island. They are very light-shy, so we had to set up in pitch blackness. It was also a real technical challenge – it's easy to see the worms phosphoresce with the human eye, but such weak light is hard to capture on camera. Added to that, all of the equipment had to be ferried through virgin forest, with the wild, wet weather frequently stopping play.

Which species was the most interesting to film?
The kiwi. Males are incredibly dutiful parents – the one we filmed never let his chick out of beak range. I had no idea that a kiwi's specialised bill could serve as a toddler's reins.

How did you film the hatching tuataras?
Tuataras are very rare. Their eggs hatch in burrows up to 18 months after laying and with no warning, so the only way to film the event is to work with conservation organisations. We filmed at the Southland Museum and Art Gallery in Invercargill, one of the few places in the world to breed the species in captivity successfully. Our team in Dunedin dashed there when we got the call.

Did you use any interesting filming techniques?
GoPros really worked for our sheep-muster sequence. We put cameras in the sheepdog pods, and on, in and under the helicopter to convey how daring it is to herd sheep in this mountainous terrain.

MARK FLOWERS *is* Wild New Zealand's *series producer.*

DIGITAL HIGHLIGHT

THE LIFE OF BIRDS

An all-encompassing look at Earth's avian inhabitants.

Sir David meets a golden eagle in *The Life of Birds*.

"Birds were flying from continent to continent long before we were," says David Attenborough. "They can survive in the hottest of deserts; some can remain on the wing for years at a time; they can girdle the globe." This classic 10-part series is the ultimate natural history of the world's birds, from the mastery of flight to feeding, breeding, communication and extreme survival. At nearly 20 years old, the footage does appear dated, compared with the super-crisp, ultra-high-definition offerings of modern productions. But the stories and behaviour are no less captivating, filmed in 42 countries and presented by Sir David. Just some of the highlights include great frigate birds stealing nesting material on the wing from boobies over the Galápagos; a peregrine swooping down on its pigeon prey on the Cornish coast; dippers feeding underwater in Yellowstone; and a black heron in Africa using its wings as an unlikely sunshade while fishing.

UNCOVERING THE HIDDEN CONGO

My Congo
TV BBC Two
Due to air in July/August. See *RT*

Think of the Congo (in this case, the Republic of the Congo, not the neighbouring Democratic Republic of the Congo) and images of a desperate, war-torn country possibly come to mind. This new film for the BBC's latest *Natural World* series reveals the hidden side of this African nation – a land rich in wildlife and steeped in history. Bristol-based film-maker Vianet D'jenguet travels back to his home country, taking us from the capital, Brazzaville, north through swamp, grassland and forest to meet Congo's most charismatic species, including forest elephants and lowland gorillas. "My aim is to tell the story of how I see my country," says Vianet. "I want to change perceptions of the word 'Congo'."

Lowland gorillas star in *My Congo*.

High tea-time for the giraffes.

HAPPY BIRTHDAY LONGLEAT!

Animal Park
TV BBC One
Due to air in July. See *RT* for details

It's 50 years since the 6th Marquess of Bath decided to allow the public to motor through fields of lions at his Longleat home, turning the estate into the UK's first drive-through safari park. To celebrate, the BBC is making the 10th series of *Animal Park*, which goes behind the scenes at this famous British attraction. Presented by Kate Humble and Ben Fogle, the five episodes will reflect on the history of Longleat as well as what's going on today, with a new generation of keepers looking after more than 1,000 animals.

Sir David: Rob Cousins/naturepl.com; gorilla: Joshua Hellker/BBC; giraffes: www.longleat.co.uk

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OUR EXPERTS

JULES HOWARD is a zoologist and author, and a patron of the charity Froglife.

RICHARD JONES is a writer and entomologist with a fondness for dung beetles.

STUART BLACKMAN is a science writer who is mildly obsessed with evolution.

PHIL GATES is a naturalist who has been writing for *BBC Wildlife Magazine* since 1987.

BEN GARROD is an evolutionary biologist who specialises in both primates and skeletons.

MIKE TOMS is an author and associate director at the British Trust for Ornithology.

Conservationists are using Judas animals to remove invasive species, such as raccoon dogs in Sweden.

Mark Sisson/FLPA

Q CONSERVATION

What are Judas animals?

A Judas animals are invasive species that, like the infamous apostle, betray their own kind. Their reward, however, is not 30 pieces of silver but the safeguarding of native biodiversity. The procedure is simple: the Judas animal is caught, radio-tagged and released. Oblivious to the fact that it is now being followed, it heads off to find a mate, which is then removed. "Along with habitat loss, invasive species are a major cause of extinction," says P-A Åhlén from the Swedish Association for Hunting and Wildlife Management. "Judas animals are playing an increasingly important role in their eradication."

The technique is being used with particular success in Sweden to tackle raccoon dogs. These East Asian canids became established here (and in Finland and Germany) after being introduced to the former Soviet Union for their fur, and have been chomping their way through the country's amphibians and ground-nesting birds at such an alarming rate that the government has employed six professional hunters to cull them. But, given that the species is distributed over an area the size of the UK, the task is easier said than done.

Enter the Judas dogs. "There is no creature more suited to finding a raccoon dog than another raccoon dog," says P-A. "They are significantly reducing the population."

Other Judas animals include goats on the Galápagos Islands and Burmese pythons in the Florida Everglades.

Sarah McPherson *Section editor*

EMAIL YOUR QUESTIONS TO

wildquestions@immediate.co.uk

or post to Q&A, *BBC Wildlife Magazine*, Immediate Media Company, 2nd Floor, Tower House, Fairfax Street, Bristol BS1 3BN

The tadpole of this common frog escaped flatworm infection.

PARASITISM

Why do some frogs have five legs?

A For years individual frogs sporting five (or even six) legs were considered a mysterious and foreboding phenomenon. Particularly common in North America, such amphibians were viewed as victims of inbreeding or, worse, pesticide poisoning. But the truth, we now know, is much weirder. It's all because of flatworms.

The tiny swimming larvae of flatworms *Ribeiroia* spp. emerge from snails and infect the immature hind-parts of tadpoles, where the parasites bury themselves into the tiny buds that later become legs. Their actions have strange repercussions. The legs of these infected tadpoles either fail to develop or the developing limbs split into two branches, resulting in a single bud producing two or more legs.

And the reason that the flatworms do this is gruesome in the extreme. Deformed frogs don't fare well against predators, and are more likely to be eaten by waterbirds. When this happens the flatworms emerge from the frog in the bird's stomach and infect their new, avian host. Only within the bird can the sexual life-stage of the flatworms begin. The unfortunate frog is simply the delivery mechanism. **Jules Howard**

INVERTEBRATES

Why are so many ground beetles metallic-coloured?

A Ground beetles (family Carabidae) generally have long legs, so they can run fast above ground, and smooth, shiny bodies, so they can push easily into the soil, through grass and other herbage, under logs and stones, or into crevices. Many carabids are black, but a large number are metallic bronze, brass, copper, green, blue or gold. Intuitively this suggests a polished surface to help them glide through the root thatch, but the reflective glint also confuses predators. When the beetle runs in jerks and dashes, the sparkles create a flickering, almost stroboscopic effect, which interferes with attempts to anticipate its trajectory. **Richard Jones**

The striking green tiger beetle.

BIRDS

Do birds count the eggs in their nest?

A Most birds sense when their clutch is complete via tactile stimulation of their brood patch, the featherless area on their bellies that warms the eggs. But there is evidence that some species count their eggs by sight. American coots, for example, are rather good at spotting (and removing) eggs left sneakily in their nests by neighbours during the laying period. If the parasitic egg is a very close match to their own, however, not only do they fail to spot it, but they apparently lay one less egg of their own, suggesting that they are deciding how many eggs to lay on the basis of the total number in the nest. The theory is controversial, though – it's possible that the parasitic eggs are added once the laying period is already drawing to a close. **Stuart Blackman**

American coots lay 6–15 eggs, which are incubated for 22–27 days.

Frog: Neil Bennett/naturepl.com; beetle: Steve Hopkin/ardea.com; coot: Ivan Kuzmin/Alamy; nest: Design Pics Inc/Alamy

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Arctic–Alpine flora such as Alpine gentian are very vulnerable to climate change.

RECORD-BREAKERS

What is Britain's highest-growing plant?

A Our mountain summits are all below 1,400m and are conducive to plant growth, so species such as the tiny rock whitlowgrass *Draba norvegica*, a member of the cabbage family, can be found in rock crevices there. Species that tolerate harsh conditions at that altitude tend to form a highly specialised community and include mosses, ferns and sedges, as well as some of Britain's rarest Arctic–Alpine wildflowers, like Alpine gentian *Gentiana nivalis* and Alpine fleabane *Erigeron borealis*.

Scotland's Ben Lawers (1,200m) is famous for its mountain flora that survive prolonged sub-zero temperatures and snow cover, high winds, high rainfall, low nutrients and a short growing season. These high-altitude communities are composed of highly adapted species, such as the rare drooping saxifrage *Saxifraga cernua*, which has forsaken flowers and the uncertainty of pollination for tiny buds called bulbils that are washed away in rain and grow into new plants. **Phil Gates**

WHAT IS IT?

The Gooty tarantula in all its glory.

If ever proof were needed that spiders can be beautiful, then this is surely it. The pelages of many tarantulas sparkle iridescent blue when viewed in the right light, but none come close to this beauty.

The Gooty tarantula *Poecilotheria metallica* is named after the town in Andhra Pradesh, India, from where the first specimen was described in 1899. It has not been seen there since, though, and may have been transported to the area by train. In fact it was not seen again anywhere until 2001.

The species is known only from patches of old-growth forest in a single reserve, which the IUCN describes as "completely degraded". No wonder it is Critically Endangered. **SB**

BEHAVIOUR

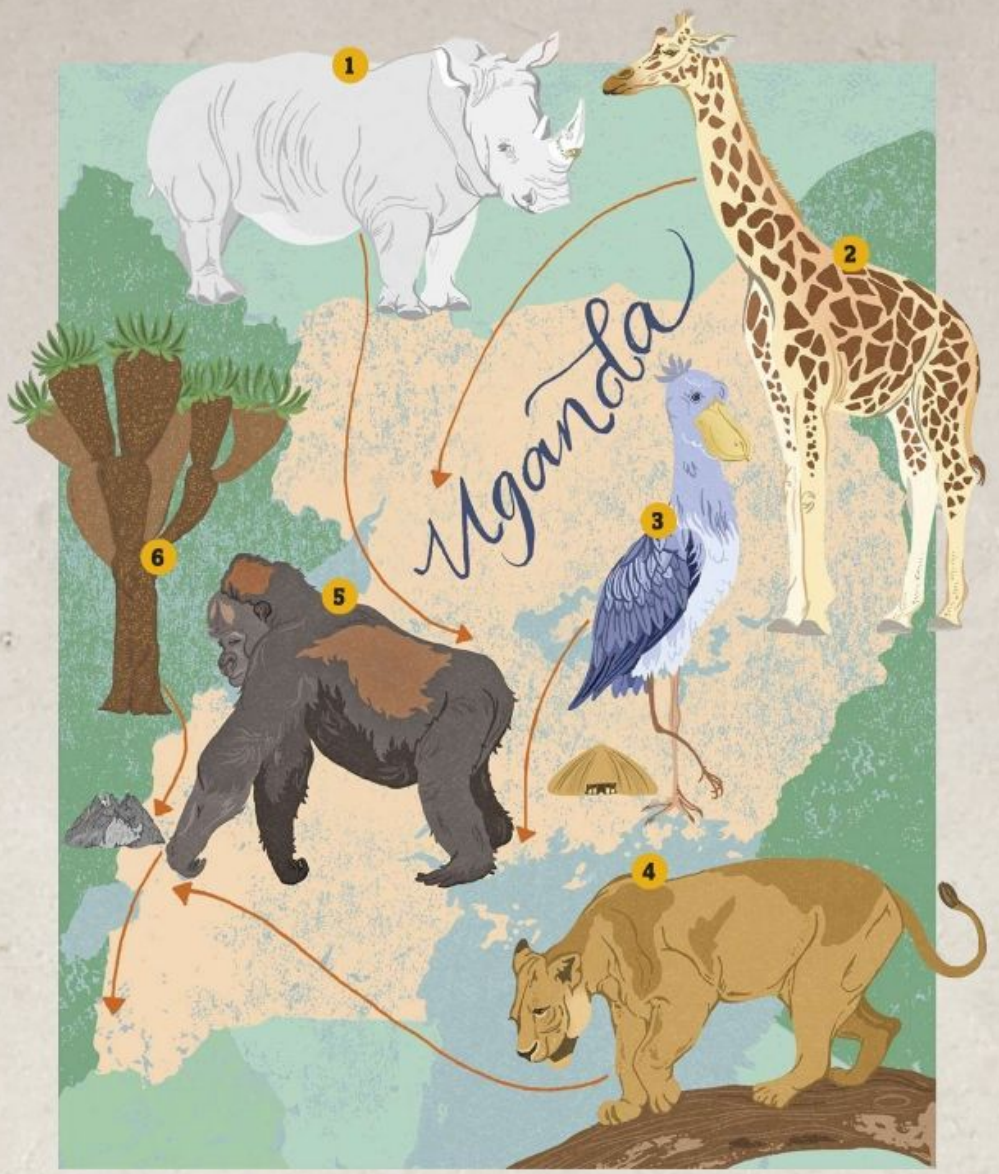
Which animals eat bone, and how do they do it?

A There are some bizarre dietary specialisms in the animal kingdom, but eating bone is still relatively unusual. Hyenas are famed for their bone-cracking jaws and ability to eat everything, bones and all, but bone only counts for a small part of their diet, while polychaete worms in the genus *Osedax* digest the fat and bone of dead whales worldwide.

The true 'bone eaters' though are the lammergeiers. These vultures have behavioural and anatomical adaptations that allow a diet of up to 90 per cent bone. Able to carry bones that weigh half as much as they do, the birds fly up using thermals and drop them from a great height, smashing them on rocks below – a skill that can take seven years to master. An extra-long intestinal tract helps the lammergeiers digest bone, as does their gastric acid, which has a pH of about 0.7, close to pure hydrochloric acid.

In addition many herbivore species, including giraffes, practise osteophagia, in which they chew bones to obtain crucial minerals that are missing from their regular plant diet, such as calcium and phosphate. **Ben Garrod**

A lammergeier picks up a bone before take-off in the Simien Mountains of Ethiopia.



WHAT CAN I SEE IN...

Uganda

Head to East Africa to see such amazing wildlife as the Endangered mountain gorilla, the wonderful white rhino, the tallest animal in the world and a truly spectacular sunflower.

1 WHITE RHINO
Ziwa Rhino Sanctuary
White rhinos were reintroduced to Ziwa in 2005 and it is still the only location in Uganda where you can see them in the wild. The 7,000ha sanctuary is home to 17 individuals.

2 ROTHSCHILD'S GIRAFFE
Murchison Falls NP
One of the rarest giraffe subspecies, Rothschild's is the tallest animal in the world and has five horns – other giraffes have two.

3 SHOEBILL
Mabamba Wetlands
With its shoe-like bill ending in a ferocious hook, this is one of the most extraordinary-looking birds in Africa, if not the world. The shoebill is frequently described as a stork, but it's probably more closely related to pelicans.

4 LION
Queen Elizabeth NP
Lions in the Ishasha sector of the park are famous for climbing and resting in trees, reputedly one of only two populations in the world that behave in such a way. Lolling about on a branch may offer the cats relief against tsetse flies or the heat.

5 MOUNTAIN GORILLA
Bwindi Impenetrable NP
Mountain – as opposed to lowland – gorillas only became known to the western world in 1902, and are one of the most sought-after animals for wildlife lovers across the planet.

6 GIANT GROUNDSEL
Rwenzori Mountains NP
Despite the prosaic name, giant groundsel is a must-see. This member of the sunflower family can grow to 20m high, creating bizarre candelabra-like structures in the process.

Illustration by Dawn Cooper; squirrel: Peter Cairns/2020VISION/NPL

VOLUNTEERING

HOW CAN I HELP...

Westmorland Red Squirrels

What does the charity do?
We work to save red squirrels from extinction in south Cumbria by controlling invasive greys. They are outcompeting our native reds for food and habitat, and spread the lethal squirrelpox virus.

How do your volunteers help?
Until a non-lethal way of controlling grey squirrels is devised, much of our work focuses on trapping and shooting. Our volunteers also manage our website and social-media accounts, file records, write blogs and newsletters, and raise funds. One member even designs knitting patterns that we sell online.

Which months are you busiest?
Trapping takes place between January and July, but we need help monitoring both reds and greys year-round. In winter volunteers also make feeders and give talks; in summer they attend shows.

Do volunteers need to have any qualifications or training?
We ensure our trappers and shooters are fully trained, qualified and insured to undertake humane squirrel control. For all other tasks you just need passion.

What have your volunteers recently achieved?
The Troutbeck Valley near Ambleside hadn't seen red squirrels for many years. Local members started a programme of grey control, raising funds through plant sales to buy camera-traps and putting up signs to spread the word. Within 12 months the reds had returned, and they have since produced young.

Bob Cartwright, Westmorland Red Squirrels
www.westmorlandredsquirrels.org.uk


Cumbria is a stronghold for red squirrels.

PHOTOGRAPHY

How to shoot purple orchids

Orchids bring to mind 19th-century plant-hunters travelling the world in search of exotic blooms. They often have highly specialised pollination systems, with some from warmer climes emitting foul smells to attract insects. Our own species are no less weird and wonderful – the bee orchid, for example, mimics the colour, shape and scent of a female bee in the hope of attracting amorous males to spread its pollen (though the UK lacks the correct bee species, so the plant self-pollinates here). Being such specialists, orchids often flower for long periods to increase their chances of pollination, giving photographers a great opportunity to capture their delicate beauty. **Sam Hobson** *Wildlife photographer*

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For more expert tips and advice on how to improve your wildlife photography, visit **www.discoverwildlife.com** where you can also enter our online photo competitions.

◀ MOODY MAGIC
The early purple peaks in May and June, but can hang on into July – though this technique is a great way to highlight the flower-spikes of any species. Choose an overcast day, slightly underexpose the background to create dramatic skies, light the foreground with a diffused off-camera flash and use a wide lens with a small aperture to increase the depth of field.

▲ GO DEEP
Long lenses are typically reserved for getting up close and isolating individual flowers. Here, however, a telephoto lens has been used to capture a beautiful display of southern marsh orchids. The foreshortening appears to pack more flowers into the frame, and the photographer has increased the depth of the image by resisting the temptation to focus on the nearest object.

▶ REMEMBER JIMI HENDRIX
You may be tempted to remove a few distracting blades of grass to get a clear view of an orchid, but this could leave the plant exposed to danger. Instead turn the surroundings to your advantage. Use a shallow depth of field to include some softly focused flower-spikes in the composition, and you could even shoot through a foreground flower to create an atmospheric purple haze.

Orchids clockwise from landscape: Alex Hyde; Ross Hoddinott; Paul Hobson/NPL
reed bunting: John Gooday/Alamy; illustration by Carlos Eulefi

Male reed buntings (*pictured*) usually sing from a reed or the top of a bush.

BIRDS

Which species is the UK's most promiscuous bird?

A Promiscuity is surprisingly common in small birds, and both sexes are known to solicit 'extra-pair' copulations – those involving individuals other than their mate. The extent of extra-pair copulation within a species can be determined by taking blood samples from chicks and extracting DNA for a paternity analysis. Though this has been done for only a small proportion of UK birds, the research so far suggests that the reed bunting may be the most promiscuous – studies have found that extra-pair males sired roughly half of all of the chicks that were reared in study nests.

Extra-pair copulation may enable males to father more chicks than would be possible if they remained monogamous. However, the benefits to females are less clear cut, though the behaviour probably increases their reproductive success too in some way, perhaps because it enables them to secure investment from more males, or because it provides genetic benefits for their offspring.

Mike Toms

RECORD-BREAKERS

What is history's biggest ever ape?

A The largest known ape is *Gigantopithecus blacki*, an extinct relative of orangutans, which stood up to 3m tall and weighed perhaps 500kg – though we can't be sure, because the species is known only from a few fossil teeth and fragments of lower jaw. The first specimen was found in 1935 among a collection of fossils in a Chinese pharmacy. Analysis of the tooth enamel suggests that the ape was exclusively vegetarian and probably limited to forest habitats, even though it was almost certainly too big to climb trees. The species is thought to have disappeared about 100,000 years ago when many forests were transformed into savannah.

An artist's impression of the ape.

YOUR FEEDBACK

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LETTER OF THE MONTH

Naturalist Chris Packham discussed his experiences of Asperger's in our May issue.

THE DIFFERENT SHADES OF THE AUTISTIC SPECTRUM

As an avid reader of your magazine who is also autistic, I was amazed to discover from reading your interview with Chris Packham that he is on the spectrum ('Packham's progress', May). It's inspiring to know that success is possible despite the intolerance we endure. However, I wanted to make some important points.

Chris described himself as being "perhaps at the more manageable end of the spectrum". It is a common misconception that because autism is a spectrum it is a gradient from 'mild' to 'severe' or 'low functioning' to 'high functioning'. This is based on outdated assumptions that those who may not talk, for example, are 'more autistic' than those who can. In fact the term spectrum simply means that autism manifests itself differently for every autistic person, all of us having a combination of varying traits, strengths and weaknesses.

Whether Chris's choice of words is a sign of internalised ableism [discrimination in favour of the more typical] or a lack of education within the autistic community, I'm not sure.

April Wakefield, Via email

BE A WINNING WRITER

The Letter of the Month wins a pair of HI-TEC Altitude Lite I waterproof boots, worth £59.99 and perfect for hiking. They are available in sizes 7–13 for men and 4–8 for women. For more information visit www.hi-tec.co.uk

Charlie Best

Heroes and zeroes

What planet is Survival International's Stephen Corry on when he criticises Kaziranga National Park for its policy of shooting poachers on sight (Agenda, May)? Many rangers put their lives on the line while protecting fantastic wildlife. They are actually doing something – while all we do is heap verbal condemnation and criticism on what poachers are doing. Rangers have been killed by poachers – that has gone largely unreported and without similar condemnation.

Les Mundy, Via email

The ivory trade

The well-researched article by James Fair about the trade in rhino horn and poaching (Agenda Analysis, June) equally applies to elephants and ivory. I first started writing about the trade in ivory in the 1970s, and for several years I have been searching for any evidence that the destruction of confiscated ivory (and rhino horn) helps conserve these species.

I have even written to the Convention on International Trade in Endangered Species, but neither the secretary, nor anyone else, has ever been able to produce any evidence that destruction has positive benefits, other than purely anecdotal along the lines of "...well it must discourage poachers".

In fact all of the evidence from other commodities suggests that destruction simply pushes the price upwards, as several commentators in the article mention.

And in the case of ivory, where there is a huge amount of perfectly legal product as well, the destruction of confiscated ivory is almost certainly in my view indirectly pushing up the demand.

John Burton, Via email

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1 SCORPION FLY in Köln, Germany, by Cristina Krippahl
2 CHIFFCHAFF in Warwickshire, UK, by Richard Pearshouse
3 RABBIT in Somerset, UK, by Carol Pike

Sacred cows

Mark Carwardine says that "palm oil production could be the most immediate threat to the greatest number of species on the planet" (At a Glance, Spring issue), but in my view there is an even bigger threat that has been expanding greatly over recent decades – livestock farming.

According to Compassion in World Farming, we rear and slaughter an estimated 60 billion farm animals worldwide every year. The Food and Agriculture Organization of the United Nations predicts that meat production will double by 2050, but already a third of the planet's land area is directly or indirectly used to farm livestock.

Much of this land is used to grow crops to feed animals, which is grossly inefficient, and yet more than one billion people do not have enough to eat themselves.

Why is it that conservationists fail to point to the biggest and most obvious threat to the Earth's biodiversity? Do they have a sacred cow?

Dom Wormell, Jersey

HS2? No thank you

I read with interest Chris Baines' article on mitigating against the environmental problems associated with HS2 ('Fast track to restoration', May). He makes a number of very good points, which would be fine if we had a government that was willing to co-operate, but given its appalling record on issues such as fracking, I think that this is unlikely.

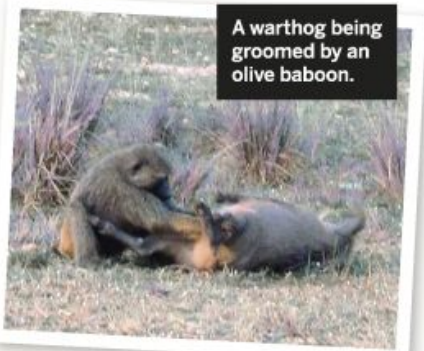
The Government has shown that it has no interest in wildlife or natural landscapes that cannot be exploited for profit. Foxes, badgers, hares, bats, newts, gulls, ravens, hen harriers and songbirds are all indiscriminately targeted in one way or another, without so much as a raised eyebrow from a Prime Minister who once said that he wanted to lead the "greenest government ever".

George Holliday, Via email

Grooming surprise

It's not just banded mongooses that groom warthogs ('Team-up is mammal milestone', Discoveries, May), as my wife Sally found out in August 2008. During a visit to Uganda's Queen Elizabeth National Park, she observed olive baboons performing the same function.

Colin Ryall, Combe St Nicholas, Somerset



A warthog being groomed by an olive baboon.

Bogged down

My family and I have enjoyed your wonderful magazine for many years. However, I was surprised at your article 'Going with the flow' (April). You stated that outside of Britain, blanket bog "occurs only in a handful of far-flung locations, such as Alaska, Chile's Tierra del Fuego, Kamchatka in Russia and southernmost New Zealand or Tasmania". Yet Ireland possesses 8 per cent of the world's blanket bogs, and is the most important country in Europe for this habitat.

Deirdre Fitzgerald, Bantry, Co. Cork, Ireland

Weedy words

The 'Three of a Kind' in your Wild section (May) was about "Weeds", but how do you define the word weed? Doesn't the term simply refer to plants that someone doesn't want to be growing in that place? To me, what you showed was just three wild plants.

Brian Hutchings, Via email

Unnatural detachment

We shouldn't be too surprised that Aesop understood animals ('The truth in fables', Spring issue). In some ways our ancestors would have had a much better understanding of nature than we do today.

For early humans, the observation of animal behaviour would have been key to their survival, whether it meant avoiding death or catching and killing animals for food. But as we started to farm, we became more detached from the natural world.

Much of our collective knowledge has thus been lost because we no longer need it to survive, but we can find small remnants in the tales passed down through the generations.

Chris Gee, Via email

● *Do you agree with this month's letter-writers? Let us know.*

GET INVOLVED!

Blogger of the Month

This month's winner is Ciara Stafford who blogs at https://stripytapir.wordpress.com. Visit **www.discoverwildlife.com** to read her blog post and find out how you can join our Local Patch Reporters project.

YOUR PHOTOS

www.discoverwildlife.com is the place to see and share wildlife photos.

PHOTO CHOICE

1 RISK-TAKER

In August I decided to paddle towards the mouth of the Bulugha River, Eastern Cape, South Africa, in a small canoe with my camera on my lap. This allowed me to get closer to nature, though the equipment was at risk of getting wet. The gamble paid off when I saw this stunning white-breasted cormorant close to the rocky shore and was able to take a few quick photos as it flew off.
Dave Kettles, East London, South Africa

2 RUN PIGGY RUN

I work as a ranger at Shamwari Game Reserve, Eastern Cape, South Africa. On my afternoon off I decided to go out tracking in a Land Cruiser and managed to locate one of our small prides. The lionesses were walking ahead out of my sight and I was slowly trailing the lion who was about 50m behind them. Suddenly a warthog came sprinting towards the male and caught him by surprise. He gave chase and luckily I photographed the action.
Sarah Moorcroft, Eastern Cape, South Africa

3 BREAKING THE ICE

I achieved this shot after spending many hours on the cold deck of an icebreaker that was travelling round Svalbard. In June at the Norwegian archipelago it is light 24 hours a day, so wildlife sightings can occur at any time. This picture of a polar bear was taken at 3am when the temperature was –10°C. I was thrilled to take advantage of the opportunity because the mammals can disappear into their surroundings alarmingly quickly.
Harry Skeggs, London, UK

4 CAUGHT IN THE ACT

I took this photo of black-necked stilts in April near Galveston, Texas. I spent an hour at Lafitte's Cove Nature Preserve looking for warblers but didn't have any luck, so decided to leave. I walked across the street from the car park to a pond where I noticed the breeding pair and took a number of shots. This picture was my favourite.
Pam Walz, Minnesota, USA

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SUBMIT YOUR PHOTOS

- Enter our Your Photos competition and your image may run in the magazine: **www.discoverwildlife.com/submit-your-photos**

5 MIRACLE OF LIFE

During an evening safari in January in Bandipur National Park, Karnataka, India, I saw a stationary spotted deer. The species usually runs away when it hears a vehicle, but this female stayed still and looked very uncomfortable. I soon realised that she was giving birth and successfully captured the incredible moment on camera.
Devarajan Karunanithi, Tamil Nadu, India

6 SEEING EYE TO EYE

Damselflies are one of my favourite creatures to photograph because they have faces that are wonderful in close-up. I visited my local patch in Bridgend with the hope of photographing the insects, but didn't see any. However, as I was heading back home in defeat I spotted this common blue resting on a blade of grass near the Llynfi River.
Geraint Radford, Swansea, Wales

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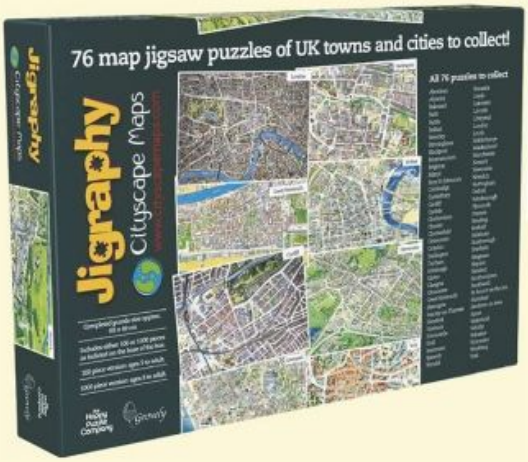

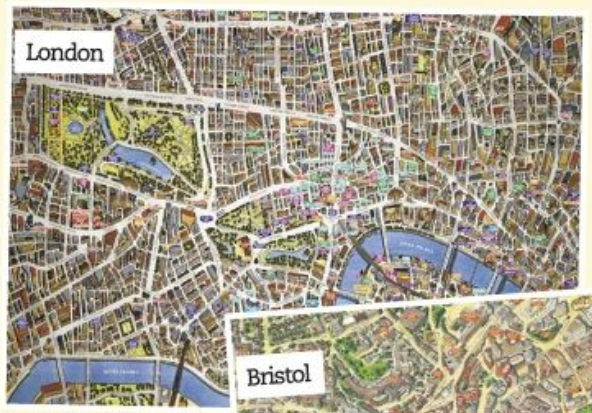

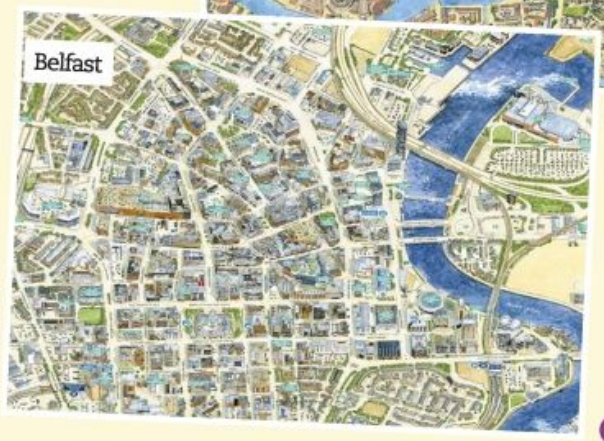

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CROSSWORD

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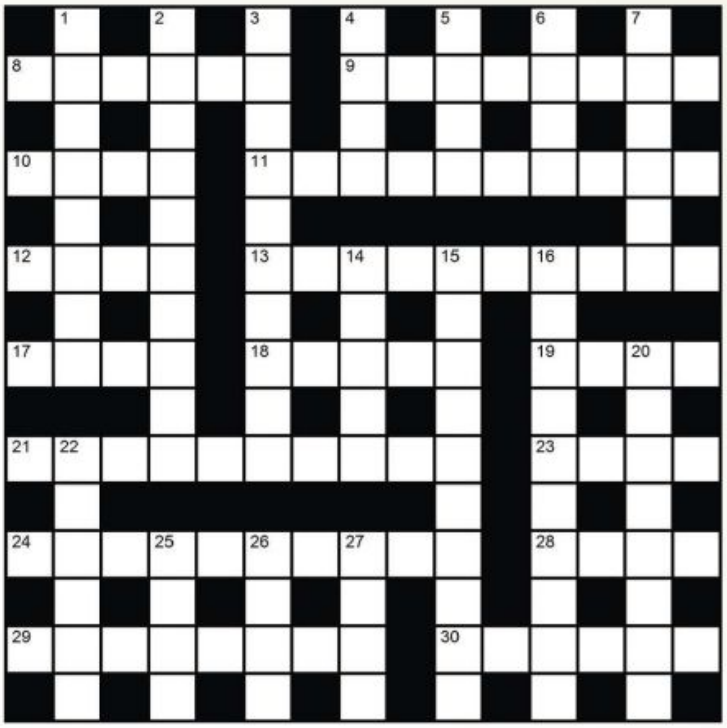
Compiled by RICHARD SMYTH



Answers in our September issue

MAY ANSWERS

Across: 7 Berries, 8 Saharan, 9 Night, 10 Uniparous, 11 Emperor, 13 Redeye, 15 Carboniferous, 19 Hornet, 20 Honesty, 23 Predation, 24 Cumin, 26 Avocets, 27 Ocelots.

Down: 1 Frog, 2 Winter, 3 Estuarine, 4 Wheatear, 5 Arboretums, 6 Aniseed, 7 Banded, 8 Sail, 12 Prairie dog, 14 Afghan fox, 16 Bee-eater, 17 Ship rat, 18 Cygnus, 21 Necked, 22 Pigs, 25 Moor.

MAY PRIZE WINNER:

Ailsa Malone Wigtownshire

ACROSS

8 Tree of the soapberry family that bears small rounded fruits with white flesh and reddish skin (6)
9 A spider or scorpion, perhaps (8)
10 Malham ___ is a wetland reserve in North Yorkshire; also a lake (4)
11 An owl, falcon or eagle (4, 2, 4)
12 See 27 Down
13 Large North American gamebird that may be greater or gunnison (4-6)
17 Gregarious small dabbling duck; males have green eyepatches and chestnut-coloured heads (4)
18 The final and fully adult stage of an insect (5)
19 ___ ants are notable for their large predatory foraging groups (4)
21 Venomous rockpool animal (3, 7)
23 The ___ monster is a lizard native to the USA and Mexico (4)
24 Small jumping insect whose nymphs cover themselves with froth known as cuckoo-spit (10)
28 River in north-east England on which the Portrack Marsh and Bowesfield Nature Reserves stand (4)
29 Plant in the mallow family with showy, trumpet-shaped flowers; native to subtropical and tropical regions throughout the world (8)
30 The ___ bird of paradise is native to the rainforests of New Guinea; males carry a two-pronged, iridescent blue shield on their breasts (6)

DOWN

1 Broadleaved deciduous tree that distributes its seeds as 'keys' (8)
2 Critically Endangered rodent related to the viscacha (10)
3 County in which most of the Peak District National Park is found (10)
4 Large bovine of South Asia, also known as the Indian bison or seladang (4)
5 The ___ shark may be longfin or shortfin; the latter is a visitor to UK waters (4)
6 The ___worm is a long-bodied clam known for boring into wood that is in seawater (4)
7 Nocturnal forest mammals of Africa and Asia that produce a musky scent (6)
14 Excrement of seabirds (5)
15 Straggling plant also known as cleavers, sticky willow and robin-run-the-hedge (10)
16 Butterflies in the family Pieridae, named for the male's brightly coloured wingtips; commonly seen in spring and summer (6-4)
20 Flowering deciduous tree or bush, notable as the preferred food of the silkworm (8)
22 Insect that has a pair of pincers on its abdomen (6)
25 The ___ hypothesis views the Earth as a self-regulating community of organisms (4)
26 Another name for the killer whale (4)
27/12 Lepidopteran that lays its eggs on willows and poplars (4, 4)

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Tales from the bush

A WILD WORLD OF RIPPING YARNS

The animal's characteristic splash guard.

This V-shaped blow also helped to clarify the mammal's identity.

The mystery species in its full glory.

WHO?

HANNAH JONES lives in Penzance in Cornwall, and with her husband Duncan runs Marine Discovery, a company that specialises in wildlife-watching sailing trips.

WHAT?

A MYSTERY MARINE MAMMAL

WHERE?

PENZANCE, CORNWALL

HANNAH REGULARLY SPOTS MAMMALS OFF THE CORNISH COAST, BUT NEVER ONE LIKE THIS SO FAR FROM HOME.

During a season we tend to record harbour porpoises, common dolphins and the odd minke whale. We sometimes get more unusual sightings, such as a dwarf sperm whale in 2011, a sei whale in 2014 and – since last summer – an increasing number of humpbacks. Bowheads, however, do not feature on the 'Possible Cornish Sightings' poster on our office wall, or even the adjacent 'Whales of the North Atlantic'.

And no wonder. Bowhead whales evolved for life in the Arctic, with huge heads that are capable of smashing though ice 0.6m thick but no dorsal fin. OK, one was spotted briefly in the Isles of Scilly in February 2015, but that was the first ever sighting in Europe below the Arctic Circle and believed to be an anomaly.

So when we were out in our catamaran and got a call from Dan Jarvis of British Divers Marine Life Rescue (BDMLR) in our Penzance office, saying that there was a whale close to the shore inside the distinctive rocks that give Long Rock Beach its name, my first thoughts were, "Is it a minke? A humpback?"

Either way, we had to act quickly. The animal could easily become stranded because the water is shallow there and the tide was dropping rapidly. In fact a pod of 30 dolphins almost got caught out in spring 2015, but local people waded into the sea to shoo them off.

Dan asked us to head over that way and check it out – the whale was thought to be a juvenile humpback, but didn't look quite right.

Approaching cautiously, in constant contact with the BDMLR team on the beach, we made out a dark shape near the shore. With us was Marijke de Boer, a marine-mammal ecologist.

"I don't think that is a humpback," she said as she peered through her binoculars. Marijke pointed to the prominent hump that acted as a 'splash guard' in front of the two blowholes, and the lack of a dorsal fin. There was only one species it could be.

I rang Dan back and gave him the news: "We think it might be a bowhead whale."

"I'm starting to think that too." He sounded worried. Though our whale was small for the species, probably a juvenile at 7–9m compared with the adult length of 12–20m, this was still the second-largest animal by mass on the planet, with a maximum weight of 80 tonnes. How could anyone move it if it did get stranded?

As the bowhead approached, its distinctive arched jawline became visible and our passengers gasped every time it surfaced. Eventually it headed out towards the long rocks and, to our relief, calmly navigated its way through the channel and back out to sea.

We tracked it from a distance for a couple of minutes, watching that broad back roll over and the characteristic V-shaped blow. And then it was gone, and we wondered. Belugas off Antrim and Northumberland, a narwhal in a Belgian river, now bowheads off Cornwall – all seen in the past year or so, and all Arctic species so very far from home.

WE HAD TO ACT QUICKLY. THE ANIMAL COULD EASILY BECOME STRANDED THERE BECAUSE THE TIDE WAS DROPPING RAPIDLY.

● Do you have a tale that you would like to share? If so, please email a synopsis of your idea to **james.fair@immediate.co.uk**

Hannah Jones x2; underwater: Kevin Aitken/WWF/cs/Alamy

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