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The Great British Year

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Swallow and cuckoo migration



Many birds in northern temperate regions feed only on insects, which provide essential fats and proteins. In winter insects are scarce, and insect-eating birds migrate south in Autumn to warmer areas where insects are abundant. The trigger for migration is uncertain but may be reducing daylight hours, or low ambient temperatures. Two familiar migratory birds are the barn swallow and the cuckoo.

In northern Europe, swallows set off on their 9700 km journey to South Africa in late August and September. A migrating flock can include 2000–3000 birds. Ringing studies were used by the British Trust for Ornithology (BTO) to investigate the route taken by the swallows. Rings were retrieved from live captured or dead birds and showed that swallows fly over south-west France to Morocco, and then fly 2000 km across the Sahara desert. Some swallows fly along the West African coast instead.

Migrating swallows fly in daylight, using stopovers for feeding. Their flight speed is about 27–35 km per hour, and they travel about 320 km per day. Once in South Africa the swallows join other flocks and feed. Huge numbers of swallows from northern Europe feed and roost in the Lake Victoria wetland at Mount Moreland. About 3 million birds were there from October 2012 to March 2013, feeding on insects and roosting in phragmites reed beds. In late March to April the swallows leave their winter quarters in South Africa and fly northwards.

Swallows arrive in northern Europe to breed from April to May. The nest is a cup of mud mixed with vegetation, about 20 cm wide and 10 cm deep. The cup is stuck to a wall or beam about 2–5 m off the ground. Usually four to five eggs are laid and incubated by the hen bird. The eggs hatch after 14–16 days. Both parents feed the chicks about 400 times a day, so plenty of flying insects are needed. The chicks fledge about 17–24 days after hatching. Long spells of rain cause chicks to starve as very few insects fly during rain.

The Royal Society for the Protection of Birds (RSPB) and BTO estimate that there are 678 000–726 000 breeding territories of swallows in the UK. Another migratory bird,

the cuckoo, is as familiar as the swallow, but is rarely seen. It is the 'cuckoo! cuckoo!' call of the cock bird that is well known. The BTO estimates about 9600–20 000 cuckoo breeding territories in the UK. There is concern that cuckoo numbers in the UK and other European countries have declined by about 65% since the 1980s. The decline could link partly to the reducing populations of beetles and hairy caterpillars that cuckoos eat.

Cuckoos overwinter in Africa and their migratory route is being investigated using electronic satellite tags weighing just 5 g. In May 2011 the BTO tagged five British cuckoos with 5 g solar-powered satellite tags. The tags transmit data for 10 h and then stop for 48 h to recharge the battery using sunlight as the energy source.

Four tagged cuckoos from England left the UK in late June 2011, and the fifth left on 22 July. Three cuckoos flew to Italy, where they had a month stopover by the River Po. Subsequently the birds flew across the Sahara desert. The other two tagged cuckoos headed to Spain and stopped over at a site north of Madrid. The birds then flew southwards along the western edge of the Sahara via Senegal and the Gambia. All five birds reached the Congo rainforest by the end of November 2011. Just two of the cuckoos, Chris and Lyster, made it back to the UK in Spring 2012. In May 2012 five cuckoos from Scotland and Wales were also tagged.

Presumably Chris and Lyster, like other cuckoos returning to the UK, found partners for breeding. A mated hen cuckoo lays a single egg in up to 25 host nests, commonly those of dunlocks, reed warblers and meadow pipits. The cuckoo chick pushes the host's chicks and eggs out of the nest and the parents usually switch to feeding the cuckoo chick. Young cuckoos are ready to migrate to Africa by about July.

Identifying the routes, stopover sites and destinations for northern European birds undergoing their winter migrations is of crucial importance for investigating factors contributing to declining numbers of migratory birds.



Going to ground: surviving the winter



temperature drops considerably from about 38 °C to just above ambient, which may often be close to freezing.

One defining feature of true hibernation is that hibernators arouse spontaneously throughout the hibernation period, unrelated to temperature. Thus, on multiple occasions during hibernation, the metabolic rate and temperature increase to approximately normal levels, before dropping again.

There is a unique, specialised tissue that occurs in many mammals known as brown adipose tissue (BAT). Deposits of BAT are generally found on the back between the shoulder blades and close to vital internal organs. This tissue generates heat without body movements such as shivering, hence the process is known as non-shivering heat generation. For this tissue, heat generation is its main function.

Hibernators (and non-hibernators) typically build up their white adipose tissue energy reserves by spending a lot of time feeding before the onset of winter. Only a few species eat food from stored caches on temporary arousal but most do take the opportunity to excrete urine and faeces. Hibernators generally make use of burrows, nests or natural shelters such as log piles. As well as providing further insulation, these afford some protection from predators that would otherwise find them in a rather vulnerable position, in a deep hibernation sleep.

Winter is spent alone for some individuals, but many others resort to safety in numbers. Ladybirds overwinter as adults and can congregate in large numbers (up to thousands) and reptiles such as the common lizard can be found sheltering in groups. Larger British mammals such as badgers do not hibernate but may spend many days underground in particularly cold spells where the temperature in their setts can be considerably warmer than the outside environment.

The emergence from hibernation, any time between approximately February and April, coincides with increasing temperatures, longer daylight hours and also availability of food sources. It is also, for many time, to focus their attention and energies on finding mates or moving to spawning grounds.

Biologists refer to periods of decreased activity and metabolism as a state of torpor and the use of such strategies is seen across a wide range of species, including some bees, wasps, butterflies such as the peacock, as well as in amphibians and reptiles. Although the terms hibernation and torpor are often used interchangeably, torpor is distinct from the 'true' hibernation process observed in smaller mammals such as the European hedgehog, native dormouse and some bats.

Torpor saves energy and avoids challenging colder temperatures, sometimes for a temporary period of time, such as during the daylight hours for bats or throughout dark cold nights for birds. Reduced food availability throughout longer winter periods, for smaller animals, means they may also have to resort to other more complex strategies to conserve energy, for sustained periods of time. Hibernation is a much longer period in a resting state similar to deep sleep, when the metabolic rate can decrease to less than 10% of its usual value, the heart and breathing rates slow, and body



Insects and plants



The common ragwort (*Senecio jacobaea*) is notorious for being poisonous to horses but it is also a food plant for a number of insect species. The black and red cinabar moth (*Tyria jacobaeae*) can be seen flying around from May onwards into the summer and it is very visible. The caterpillars appear on ragwort and groundsel plants from July onwards and they are also brightly coloured. The bright colouring of the adults is another example of warning colouration. The food plants contain alkaloids that cause liver damage and horses seem particularly susceptible. Interestingly, the live plants are unpalatable, but the dried plants lose their unpalatability while retaining their toxicity. This is what makes their presence in bales of hay so dangerous for horses.

Female cinabar moths lay large batches of eggs and when they hatch the caterpillars can very quickly strip the host plant of all its leaves. Although there are initially large numbers of caterpillars, relatively few make it through to pupation. The caterpillars are, of course, almost free of predation, due to their warning colouration, but they are so voracious that they can exhaust their food supply before they have built up sufficient body mass to pupate. Like the orange-tip caterpillars, the cinabars may also be cannibalistic.

A number of butterflies in the UK have blue wings; the first one to appear in early spring is the holly blue (*Celastrina argiolus*) and it has an unusual selection of food plants. As the name suggests, the female preferentially lays her eggs on holly (*Ilex aquifolium*) but this is only the case for the females that emerge from the pupa in the spring. There is a second generation that emerges in the summer and these lay their eggs on ivy (*Hedera helix*). This is the only UK butterfly that is known to switch during the year between two preferred food plants.

The links between insects and food plants are often quite specific. Insect and plant have obviously evolved together. The poisonous substances from the plants do not harm the insects that eat them. These insects are unpalatable and exhibit warning colouration.

The female lays her eggs on plants that contain mustard oils, such as garlic mustard (*Alliaria petiolata*) and cuckoo flower (*Cardamine pratensis*). When the eggs hatch, the caterpillars feed on the leaves of the host plant and accumulate chemicals from the mustard oils, called glucosinolates. These persist in the butterfly tissues through the pupal stage to the adult. It is interesting that the female butterfly does not have orange tips to the wings. Both males and females are well camouflaged when at rest and it is possible that the male flies much more than the female. Being at greater risk of being eaten when flying, the flash of the orange wing tips would be easy for a predator to see and this acts as a warning.

The species of plant that the orange-tip lays its eggs on are not always very leafy and therefore the female lays a single egg. The caterpillars can be cannibalistic, eating other eggs or smaller caterpillars that they encounter, so laying a single egg makes sense. It is thought that the female might avoid a plant on which an egg has already been laid. The caterpillars themselves are at risk from parasitic flies and wasps that lay their eggs into the skin of the caterpillar.



Amphibians



Natterjack toads are rare in the UK and confined to coastal sand dune systems, coastal grazing marshes and sand heaths. Males have a rasping call which they use to attract females and which can be heard from several kilometres away. The pitch of the male's call is used by rival males to assess fighting ability.

In both frogs and toads fertilisation is external: the female extrudes her eggs into the water and the male deposits his sperm over the eggs. Frogs lay their eggs in large clumps that float in the water while toads lay eggs in long double strings that are usually wound around vegetation.

Great crested newts are the largest of the UK newts. Like smooth and palmate newts, they normally live on land but breed in ponds and pools. Males develop a characteristic large crest along their back during the breeding season. The belly is brilliantly patterned and the pattern is unique to individuals. Smooth and palmate newt males also develop a crest but it is much less obvious than that of the great crested newt.

Breeding is similar in all three species. After performing an elaborate courtship display, consisting of sending pheromones under water by tail-fanning towards the female, the male deposits a spermatophore (a small packet of sperm) from his cloaca (reproductive and excretory opening) in the path of the female. He then moves sideways in front of her and encourages her into a position where the spermatophore is picked up by her cloaca. 'Mating' is therefore achieved without direct contact between the male and female. The female lays two to 12 eggs a day (depending on the species) until 200 to 400 eggs have been laid. Each egg is laid singly on the leaf of an aquatic plant, and is wrapped carefully in the leaf. The eggs hatch after about 3 weeks and the larvae take about 12 weeks to metamorphose into juveniles. In great crested newts and smooth newts there is some evidence that the height of the male's crest affects male mating success.

Common toads return to their natal ponds year after year and large numbers may travel distances of over a kilometre to do so. At this time they are vulnerable when crossing roads and in many places in the UK special toad patrols are put in place to help them. Males usually arrive first at the breeding site and may mate several times with different females during a single breeding season. Females mate only once a season and only remain at the breeding site long enough to mate and spawn.

In some populations, males produce a 'mating call' to which females are attracted. However, in many populations, males don't call but use a tactic known as 'scramble competition' to obtain females. Males wait for females approaching the pond and then clasp them under the forearms in a grip that is known as amplexus. Males try to clasp anything that moves in their vicinity, including other male toads and even frogs. Often, more than one male will attempt to clasp a single female, resulting in a mating ball (which sometimes results in the female drowning in the centre of a ball of males). Males try and dislodge each other from the backs of females by kicking each other with their hind legs. Large males are more successful than small males at dislodging other males and so have higher mating success than small males.



What to photograph this month



January

Coastal scenes: The days are short but dramatic scenes await the hardy. Try a wide-angle lens to take in the big picture. A polarising filter can increase contrast and pick out cloud formations.



February

Bird feeders: Your house makes an ideal hide: photograph through an open window and the birds will not notice you. A telephoto lens and tripod are useful to get good close-up shots.



March

Ponds: It's amphibian breeding season so there are loads of frogs. Keep quiet, wear dull clothing and keep low down. Use a polarising filter to reduce glare from the water surface.



April

Woodland flowers: In the woods, plants are coming into bloom. Get down low and use a small tripod to keep your lens steady. Try using a piece of white card to reflect extra light onto your subject.



May

Hedge and verge flowers: Plants are bursting into flower. Catch the morning dew or try the evening; the low sun makes interesting shadows and colours are richer. A tripod helps keep the lens steady.



June

Butterflies: These insects are abundant now. Spot them early in the morning whilst they rest with wings open to warm up in the sun. If you cannot sneak up close, try a telephoto lens and a fast shutter speed.



July

Dragonflies: These magnificent insects are sluggish if the weather is a bit cool and more easily photographed. Early in the day is best before they warm up. Try using a telephoto lens to get close-up shots.



August

Reptiles: These animals are at their most active, with snakes and lizards out hunting for prey. Get out early while they are still cold, watch for them warming up in sunny spots and be careful not to disturb them.



September

Rock pools: There is a wealth of biodiversity in these tiny ecosystems. Get down close, but don't let your shadow fall across your subject. A polarising filter is useful to cut glare from the water surface.



October

Fungi: Many types of fungi send up their fruiting bodies at this time of year. Get down on your elbows to get up close. A small tripod is useful to keep the lens steady, especially as the light can be low.



November

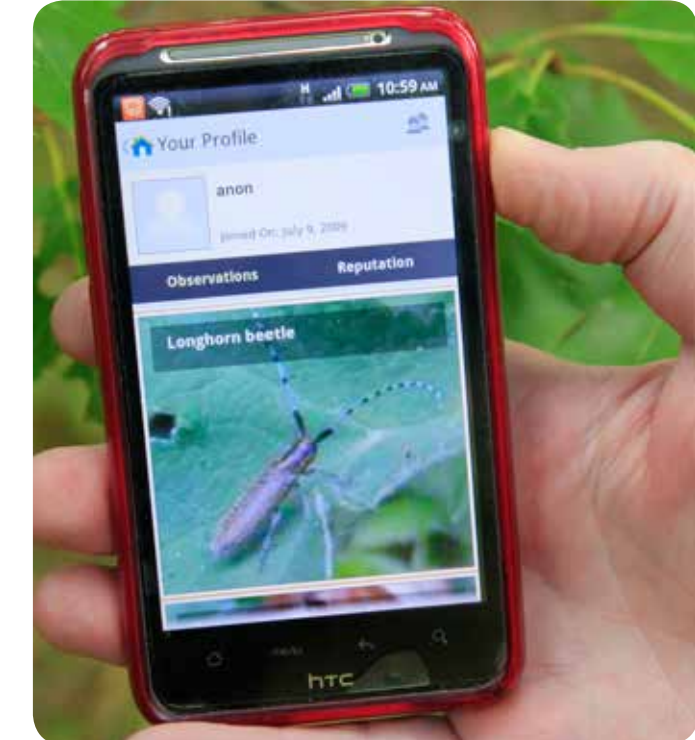
Winter berries: Berries provide a splash of colour to brighten up your photos. Use a macro lens to get really close, with a tripod for support. Sunlight reflecting off dew or rain gives an extra sparkle.



December

Winter waders: When the tide comes in birds huddle together in groups. Wrap up warm and wear dull clothing so the birds are not alarmed. A telephoto lens and tripod are essential as you won't get close.

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OpenLearn

On OpenLearn, the OU's home for free learning, you can discover more about nature and *The Great British Year*. OpenLearn will be collecting together all the seasonal observations of the organisms featured on this poster and giving you more information as the year progresses. Explore some of the data generated by observations posted to iSpot.

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