BIODIVERSITY PACK
SPECIES GUIDE

KEY SPECIES

Achieving Biodiversity 2020 objectives means taking action not just for habitats but also for the species that they support. A large number of specific actions are needed to bring about the recovery of England's most threatened wildlife, with naturally functioning wildlife habitats having a key role to play in reversing the fortunes of our declining biodiversity.

WFD AND B2020 SYNERGIES: SOME CROSSOVER

Outcome 3 of **Biodiversity 2020** requires an overall improvement in the status of our wildlife and the prevention of further human-induced extinctions of known threatened species. Success therefore requires the recovery of 943 'Species of Principal Importance' listed under Section 41 of the NERC Act and in particular of those species at risk of extinction by 2020. Achievement of this outcome is strongly linked to the protection and restoration of priority habitats under Outcomes 1 and 2, and to delivery driven by the **Water Framework Directive**. Under the directive, biological targets (such as for fish populations) will see habitat improvements delivered which benefit the targeted species, as well as many others, by improving the river ecology. The Directive also reinforces safeguards for designated wildlife sites by including water-dependent Natura 2000 sites as formal Protected Areas – these must achieve compliance with any standards and objectives for 'protected areas' established under Community legislation, which will support many priority species, Species of Conservation Concern, and more widespread species.

THE RECOVERY OF 'SECTION 41 SPECIES' IS KEY TO HALTING THE OVERALL LOSS OF ENGLAND'S BIODIVERSITY BY 2020

SPECIES CONSERVATION

The **UK Biodiversity Action Plan**, published in 1994, focused on the conservation of **priority habitats and species**. The valuable work of Biodiversity Action Plan (BAP) groups across the country helped to ensure that populations of some of our most important species were maintained and enhanced. This species-specific approach was successful in improving the fortunes of species such as the large blue butterfly, bittern and the cirl bunting.

But it is not feasible to take this approach with every declining species, meaning that we have so far been unable to halt the current decline in biodiversity – the BAP Analysis reported in 2008 saw a quarter of priority species still declining, and the State of Nature Report 2016 saw no improvement in the proportion of species threatened with extinction.

Threats such as climate change and invasive species demand that we review and change our approach to biodiversity conservation

Threats such as climate change and invasive species demand that we review and change our approach to biodiversity conservation, requiring us to go beyond protected sites and separate species and habitat action plans. The Lawton Report 'Making Space for Nature' made the case that halting (and ultimately reversing) biodiversity loss requires us to adopt integrated landscape-scale approaches that restore whole ecosystems.

Now, **Biodiversity 2020** provides the framework for that approach, setting out Government's ambition to halt the overall loss of England's biodiversity by 2020. Key to delivering this is the recovery of the 943 'Species of Principal Importance', known as **section 41 species**, listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006. The list describes species of flora and fauna considered to be of principal importance for the purpose of conserving biodiversity, and consists largely of the 'priority' species first identified under the UK BAP.

DELIVERING SPECIES CONSERVATION THROUGH HABITAT RESTORATION

Integrating the needs of England's threatened species into habitat management provides the alternative approach called for by Lawton, delivering improvements for species alongside necessary habitat works. An analysis carried out by Natural England in 2010 showed that the conservation needs of almost three quarters of the then 'priority species' could be met by managing their habitats to create the conditions that they require.

In carrying out the analysis of species' requirements a number of key habitat attributes were identified. In particular, a requirement common across most habitats was structural variation; the bare ground and variable sward heights of wet grassland, or the humid interiors and dead wood features of wet woodlands. This variation caters for the requirement, common to many plants and animals, of sheltered conditions, where patches within habitats are exposed to sunlight but sheltered from the wind. This shelter is provided in the form of localised scrub or taller vegetation, or via a landscape-scale diversity of hedgerows, woodland edge, or topographical features like river cliffs.

Species requirements in wetlands in particular were strongly associated with two further factors: water quality and hydrological processes. **High water quality** is a requirement for the majority of S41 species associated with water and it is perhaps the single most important factor for wetland biodiversity. It is also the external factor over which we can potentially have most control, via management of inputs and of the wider catchment. In particular, many priority (and other) species with restricted distributions or populations are reliant upon good water quality, and so are particularly vulnerable to the impacts of localised water quality declines; a pertinent example is that of the Glutinous snail, where a pollution event affecting a floodplain pond close to the Thames led to its England-level extinction.

Hydrological processes are an important determinant for species, although there was no one particular process that appeared more crucial than any another. Instead, their presence along a 'disturbance gradient' appears important in generating a range of broad and microhabitat types which cater for a large range of species. This ranges from undisturbed sites where the water levels are relatively high and stable (for example, bogs and fens) to sites that are seasonally inundated (floodplains) to sites that are inundated on a daily basis (saltmarsh) and are hence heavily disturbed. The importance of hydrological disturbance is demonstrated by considering species associated with ponds: Although these support many generalist species that have no particular hydrological process requirements (such as bats), a large proportion of specialist wetland species are associated with the drawdown zones around the edges of ponds and in particular bare, wet mud; indicating the importance of the variation that water level fluctuations give rise to.

HYDROLOGICAL PROCESSES ALONG A 'DISTURBANCE GRADIENT' GENERATE A VARIETY OF HABITAT TYPES; AT ONE END OF THE SPECTRUM ARE SALTMARSHES, INUNDATED ON A DAILY BASIS

To conserve species, both rare and common, we need an emphasis on increasing habitat heterogeneity in appropriate ways, between and within sites and over time

Conservationists involved with the analysis largely reported that the results concurred with their expectations, prompting the question of *why, if we generally accept that species requirements are best served through structural diversity, is the habitat management necessary for S41 species not put into practice more often?* It is likely that factors include a sometimes-unhelpful management focus on the maintenance of particular habitat features or vegetation types, which does not favour flux, or value structure, as well as issues which do not readily allow for changes in management regimes, such as resources or on-site constraints.

Wider analysis also suggests that this structural variation is important for non-S41 species too. Follow-up analysis considered invertebrates using priority habitats, and identified the same association with the features of heterogeneous habitats. This suggests that to conserve species, both rare and common, we need an **emphasis on increasing habitat heterogeneity** in appropriate ways, between and within sites and over time. **A more dynamic approach to managing habitats has the potential to provide this heterogeneity and thereby support the recovery of most species.**

Habitat Category	No. of Priority Habitats	No. of associated S41 Species
Lakes and ponds	5	97
Rivers	1	76
Wetlands	4	119

(These figures are conservative, excluding those species associated with the 'wet' features of other priority habitat types, such as heathland pools and valley mires).

A VARIED HABITAT MOSAIC PROVIDES FEEDING AND BREEDING OPPORTUNITIES FOR OTTER

It is also likely to facilitate adaptation by species to climate changes, by increasing the opportunities for them to persist within their existing habitats and, (for those more capable of dispersal), to colonise new sites. In freshwater and wetland environments **natural processes** are highly influential and generate naturally functioning habitat mosaics at a range of spatial scales, thereby providing the heterogeneity that priority species, and their less scarce compatriots, need.

The form of a mosaic will vary with scale, from the very localised – such as variation in in-channel substrates and flows, with exposed gravels, riffles, glides, deep pools and silty margins – to the landscape scale – a floodplain mosaic of ponds, lakes, rivers, streams, ditches and wetland habitats. The most diverse of these landscape-scale mosaics – landscapes that have a number of different habitats in close proximity – tend to support the most species. The scale and features that are important will vary by species, from the immediate surroundings for plants and other sedentary species, to the whole landscape for the most mobile. However in all of the broad habitat types described below, the analysis identified that **the features most important to S41 species could typically be delivered by natural ecosystem function**.

The most diverse landscape-scale mosaics – landscapes that have a number of different habitats in close proximity – tend to support the most species

Ponds and Lakes support a relatively high number of S41 lower and vascular plant, invertebrate and fish species, many of which are restricted or very restricted in their distribution, being recorded from less than fifteen 10 km squares. Around half of the species utilising lakes, and the same proportion for ponds, are found in these habitats alone. Resources such as high water quality (for starry stonewort and tubular water dropwort), seasonal fluctuation (zircon reed beetle) and open, unshaded habitat (strapwort, starfruit) are identified as being very important, particularly for the more restricted S41 species. Connectivity with other water bodies and habitats is also an important attribute for the more widespread generalist species of both habitat types, such as otter and water vole.

Critical factors, that could be delivered by the restoration of natural ecosystem function, include:

- Natural seasonal water level fluctuations leading to the formation of mud, sand or shingle drawdown zones: Factors that interrupt/alter the natural hydrology/fluctuations (for example, incompatible water level management) can be very detrimental.
- Natural water quality and nutrient status: Eutrophication, leading to high algal cover and competition, is a significant risk for many of the more restricted S41 species, which cannot tolerate such conditions.

Rivers support nearly a tenth of S41 species, either within the river channel itself, or in associated floodplain habitats/features such as river banks. Rivers are of particular importance for invertebrates (which make up nearly half of the associated species), as well as for higher and lower plants, and fish. Whilst some species are widespread, around 40 are classed as restricted/very restricted and may be confined to a single river system or just a handful of sites. Analysis again showed that high water quality was a key factor of importance, required by over 70% of species, and was linked to needs such as oxygen levels, un-silted gravel beds, and abundance of prey.

Other key factors that could be delivered by the restoration of natural ecosystem function include:

- Unobstructed river courses: A fifth of river-associated S41 species, particularly migratory fish such as salmon and lamprey species, require access to complete river systems to feed and breed. Unobstructed natural river systems also give rise to faster flows, which are crucial to a high proportion of the species which exhibited a restricted distribution, likely linked to maintaining high oxygen levels and preventing silt deposition.
- Drawdown zones: species like the southern silver stiletto-fly and shingle rove beetle rely on naturally fluctuating water levels to maintain the exposed riverine sediments on which they depend. Such species occupy drawdown zones at particular times of the year (usually spring and summer) and then require higher river levels in the autumn and winter to prevent plant succession smothering their habitats. Pulses of water or periods of low flow at other times may have detrimental effects on such species.

WETLAND MOSAICS ARE UTILISED BY A NUMBER OF S41 BIRD SPECIES

Wetlands are home to 119 Section 41 species, found across lowland fen, lowland raised bog, reedbed and coastal and floodplain grazing marsh. Many of these are wetland specialists, whilst some are also found across additional habitats. Invertebrates make up by far the greatest proportion of the wetland S41 species and, along with lower plants, form the majority of the 67 wetland species with a restricted/ very restricted distribution. Key factors vary across habitats. For example, water quality was crucial to almost all S41 species found in bogs, whilst there was no association for those of reedbeds, perhaps because many S41 species found in reedbeds are generalists also found in other terrestrial habitats, or because reedbeds themselves often persist in lower quality water, to which their species are therefore likely to be insensitive. A key attribute which was reasonably common across habitats, and could be delivered by the restoration of natural ecosystem function was:

- Open habitats: Open areas not covered by trees are important to species such as fen wood rush, stoneworts and southern damselfly. Natural processes including grazing and trampling, and seasonal or periodic inundation can limit the establishment or survival of trees and scrub which would otherwise shade out these areas.

The above snapshots illustrate **the potential for species requirements to be delivered by habitat management focused around the restoration of natural processes**, and we can infer that if this approach can meet the often very precise habitat requirements of our most threatened species, it is also likely to be able to deliver the less exacting habitat requirements of species of conservation concern and of common and widespread species too. Termed the '**mosaic approach**', the principle of integrating the requirements of species into habitat management is in line with the more integrated and large-scale approach to the conservation of biodiversity advocated by Biodiversity 2020. It considers the elements of a habitat most frequently required by the priority species that are found there – such as for lakes and ponds; high water quality, fluctuating water levels, drawdown zones – and focuses on providing these key elements. To do this requires consideration of the factors that determine or deliver these elements, such as ecological processes – disturbance and succession – and natural nutrient and hydrological regimes.

SPECIES SPECIFICS – HABITAT RESTORATION TO BENEFIT SCARCE SPECIES

Whilst there will remain a number of specific actions required to ensure the survival of particular priority species (e.g. exploitation controls, assisted dispersal where needed), a large proportion of priority species' needs can be delivered through habitat management which embraces natural ecosystem function (see examples below).

Some of these measures may need to be targeted at specific locations to ensure that priority species of restricted distribution can reach restored habitat unaided. (The factsheet 'Identifying opportunities to enhance Biodiversity' provides more information on targeting the delivery of freshwater conservation).

EUROPEAN EEL

– requires action around: physical habitat, water quality (contaminants), passage

European eels are thought to spawn in the Sargasso Sea. The larvae drift across the Atlantic in ocean currents reaching European waters as glass eel. Some remain around the coast but many actively migrate up into freshwater systems. Channels free of man-made obstructions (weirs, sluices) and water intakes (abstractions and diversions) allow the best opportunities for the species to move freely upstream, maximising the available habitat for feeding and growth. Man-made obstructions and intakes can also impede migrations of adult eel as they make their way downstream and back to sea to spawn. Natural water level regimes facilitate upstream and downstream movement, whilst unnaturally low levels (abstraction, drained watercourses) can hinder passage over both natural and man-made obstacles, preventing eels from reaching current or historic parts of their range.

Eels need good access to habitat where they can feed and grow to maturity. In some river systems physical obstructions mean the inward migrating eel cannot access sufficient habitat to sustain them. Precise habitat requirements are not well understood, meaning that natural function which promotes habitat heterogeneity is important in catering for the requirements of the species.

As a long-lived species, through their diets eels can accumulate chemicals, pesticides and heavy metals in their tissues, at levels that disrupt physiological processes such as reproduction. As well as impairing individual eel health, pollution could also therefore be having a population-level effect. Control of pollutants, delivering a more natural water quality regime, will therefore benefit the eel population.

'KICK SAMPLING' IS USED TO COLLECT THE AQUATIC LARVAE OF MAYFLIES FOR IDENTIFICATION

© Ross Hoddinott/2020VISION

YELLOW AND IRON BLUE MAYFLIES

– require action around: flows, water quality

Along with other riverflies, the specific tolerances of mayflies to changes in environmental conditions make them an effective early warning system for pollution events; the 'canaries of our rivers'. Their loss can indicate pollution by chemicals such as insecticides, as well as by organic pollutants such as sewage or slurry, since the aerobic breakdown of these pollutants utilises oxygen, depleting levels in the water. Both persistent and catastrophic pollution events are a threat to the yellow and iron blue mayflies, with natural water management regimes reducing the likelihood that pollutants will migrate quickly to the rivers, and bankside vegetation providing a buffer.

Depth of water also appears to be important for the yellow mayfly; artificial water level manipulation or excessive abstraction can therefore have a negative impact on the species.

FRESHWATER PEARL MUSSEL

– requires action around: flows, water quality, Passage of fish host species

© Linda Pitkin/2020VISION

Once widespread, recent surveys revealed most former UK populations to be virtually extinct, with very little active recruitment. Today, the pearl mussel is seriously endangered in every part of its range.

It is thought that the current lack of recruitment may be linked to increasing siltation and eutrophication of rivers, affecting oxygen availability in the substrate and leading to poor juvenile mussel survival, as well as impairing nutritional uptake by these filter-feeders (which impacts energy availability for healthy growth and reproduction). Natural bankside vegetation can help intercept inputs of sediment and nutrients, and natural flow regimes can prevent them from smothering mussel beds.

The species also relies on the presence of salmon or trout which act as host to the tiny larvae released by the female after fertilisation. These attach to fish which transport them to new habitats, so artificial barriers to migration are a concern for both fish and mussel populations.

At the stage where they leave the host fish and establish in the sediment, pearl mussels are extremely sensitive to pollutants, and require low sediment and high oxygen levels, such as those seen in a highly natural catchment. Subsequent juvenile and adult mortality are also linked to the presence of various pollutants, but at all stages low dissolved oxygen levels can be fatal, prevented by unimpacted flow conditions as well as natural water quality regimes.

Just as unusually low flows herald low oxygen levels and silt deposition, extremely high flows can wash pearl mussels from their beds or bury them in material from upstream, decimating populations. Artificial water level management, or activities within the catchment such as drainage which could deliver high volumes of water and silt, should be avoided.

THE VALUE OF NATURAL ECOSYSTEM FUNCTION IN SPECIES CONSERVATION

These and other examples demonstrate the potential of naturally functioning ecosystems to provide the breadth of features required by key species – their ecological needs. It is not surprising that the natural environmental processes which gave rise to our freshwater and wetland habitats would also create conditions which are suitable for the rare and common species associated with them. Yet our management of habitats has sometimes favoured procedure and prescription over function and flux. Allowing natural processes to become a significant and valued component of species and habitat management in the future could well be a key step in reversing the fortunes of our declining freshwater and wetland biodiversity.

REFERENCES AND FURTHER READING

- A narrative for conserving freshwater and wetland habitats in England
- Integrating priority species needs into habitat management
- The Mosaic Approach
- Actions for s41 species

CONTACT US

catchmentbasedapproach.org

@CaBAforum

info@catchmentbasedapproach.org

Edited by The Wildlife Trusts on behalf of the CaBA Biodiversity Group 2018.
Design: lonelycottage.co.uk. Header image P1: © Terry Whittaker/2020VISION.

United Nations Decade on Biodiversity