Waterways and Wildlife

Managing our natural environment

WILDCRU
Wildlife Conservation Research Unit

Canal & River Trust

Glandŵr Cymru
The Canal & River Trust in Wales

Ariennir yn Rhannol gan Lywodraeth Cymru
Part Funded by Welsh Government

Contents

Preface

Most people visiting our waterways, including walkers, cyclists and boaters, are attracted to the towpaths and navigations because of their beauty and tranquillity. For many, an integral part of the waterway experience is the rich diversity of wildlife encountered here, and this diversity is an essential part of a healthy waterway ecosystem. From hidden underwater wildlife to the brilliant blue of a kingfisher, and the quintessential sight and sound of dragonflies to the glimpse of a bat foraging over the water at dusk, our waterways are enjoyed for their unique and treasured biodiversity.

Many waterside habitats have become fragmented or have vanished from the countryside entirely, making waterways especially valuable habitats and much-needed corridors for wildlife. For some species, our waterways are among their last remaining strongholds and, for many others, they provide vital resources now scarce in the wider countryside. Canals are probably the most familiar waterbodies, but the Canal & River Trust also has many reservoirs, lakes and ponds, hedgerows and trees to look after. Canal hedgerows, for example, are some of our oldest waterway features and lifelines for many species, providing food, shelter and places to breed. Our many built structures, including aqueducts and bridges, play an important, but often overlooked, role as wildlife homes, especially because of their proximity to water. With the variety of waterway habitats on our estate, work is needed to maintain and enhance their biodiversity value, while at the same time ensuring that our navigations and towpaths can be enjoyed safely. It is our aim to achieve a balance that works for both people and wildlife.

We hope that anyone with an interest in canals, waterways and their wildlife will find this handbook informative and useful. Our aim is to give an insight into the wide range of habitats and wildlife that we care for, and to highlight some of the many ways in which we manage our natural environment to make a difference. The handbook has six chapters on habitats and eight chapters on wildlife groups. Each chapter summarises key information on each habitat / wildlife group, has two short feature articles on a selection of the Trust's work in this area, and concludes with a list of example management actions. The handbook is a first step in delivering a vision for the role that the natural environment of the canals of Wales can and does play within the wider landscape; the principles are applicable to all our waterways and it is our hope that we will be in the vanguard of change across and beyond Wales.

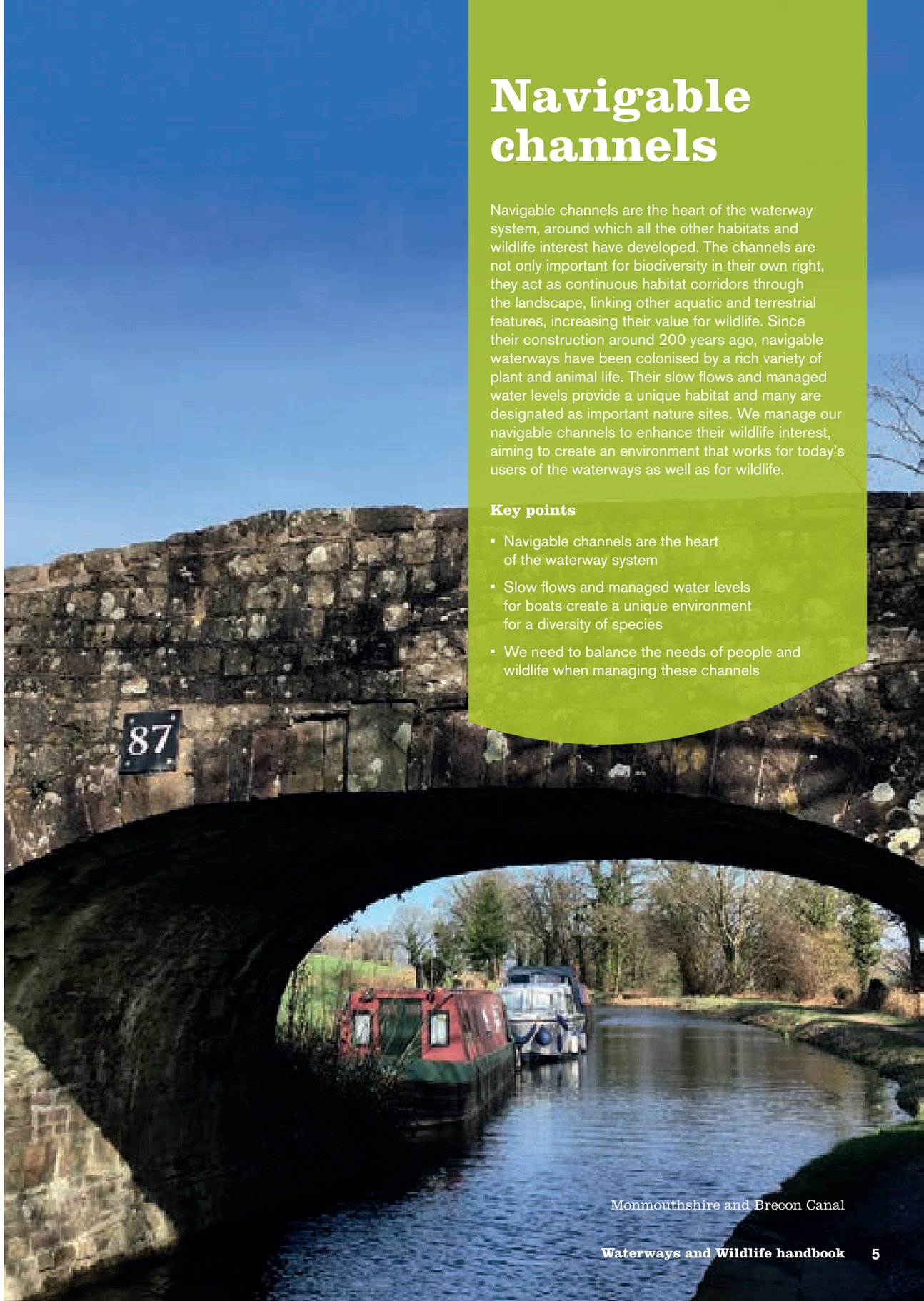
This handbook has been developed by Glandŵr Cymru (the Canal & River Trust in Wales) in collaboration with Ruth Feber at the Wildlife Conservation Research Unit (WildCRU), University of Oxford. We are grateful to the Welsh Government for funding this work, through the Green Infrastructure Capital Investment fund. We hope that this handbook will inspire and be of use to all those who own, manage, work on or simply enjoy our canals and waterways.

Navigable channels

Navigable channels are the heart of the waterway system, around which all the other habitats and wildlife interest have developed. The channels are not only important for biodiversity in their own right, they act as continuous habitat corridors through the landscape, linking other aquatic and terrestrial features, increasing their value for wildlife. Since their construction around 200 years ago, navigable waterways have been colonised by a rich variety of plant and animal life. Their slow flows and managed water levels provide a unique habitat and many are designated as important nature sites. We manage our navigable channels to enhance their wildlife interest, aiming to create an environment that works for today's users of the waterways as well as for wildlife.

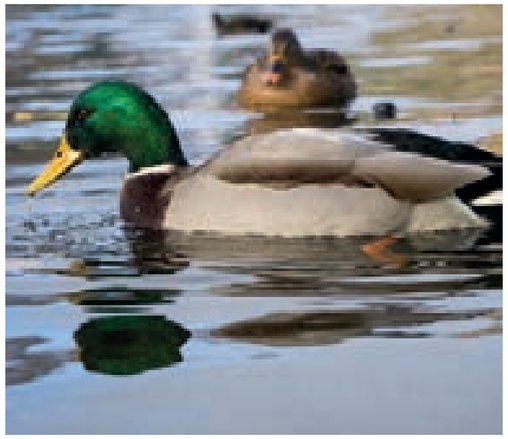
Key points

- Navigable channels are the heart of the waterway system
- Slow flows and managed water levels for boats create a unique environment for a diversity of species
- We need to balance the needs of people and wildlife when managing these channels



Monmouthshire and Brecon Canal

Common blue damselfly



Mallards

Roach are the most common fish of the waterway channels

Wildlife

Navigable waterways were originally built to move freight, but they have long had nature conservation value. With the loss of water and wetland habitats in the countryside, the value of navigable channels and their waterside habitats has increased greatly. Some channels harbour remnant populations of rare species and the importance of these sites is recognised at national or international levels. Other navigable channels may have less biodiversity value, but can still provide important habitats for wildlife, in both urban and rural areas.

The value of waterway channels for wildlife is determined by several factors, particularly water quality, boat traffic, and bank and channel structure. The richest channel biodiversity is generally found where water quality is high, boat traffic is low, and where banks and channels are natural rather than highly modified structures with hard, steel sheet piled, or wholly concrete, banks. Natural and engineered soft banks support a rich abundance of aquatic plants, providing habitat for many species of invertebrates and fish, and, in turn, animals higher up the food chain, such as otters and kingfishers. Some hold important populations of scarce plants, insects and molluscs.

The deeper central areas of the channel are generally poorer in invertebrate diversity compared to the shallow margins. In the margins there are more plants that provide shelter, and dragonflies, water beetles, water bugs and snails can be found here. Generally, the more species-rich and abundant the vegetation, the richer the community of invertebrates. All channels support populations of fish, dominated by coarse fish such as carp, perch and roach. Some waterways provide an important habitat for eels, who like plenty of muddy sediment in which to scavenge for their prey and hide, down in the depths of the channel.

Being highly connected, the waterway channel is easily colonised not only by native species, which is desirable, but non-native ones too. These invaders can be very difficult to control. Plants such as floating pennywort form thick mats of vegetation across the channel, shading out light for species below. A notorious invertebrate invader is the American signal crayfish, which has out-competed our native white-clawed crayfish. Invasive fish, too, can upset the ecological balance – zander, for example, is prevalent in turbid channels and is a voracious predator.

Channel management

Active management of waterway channels and adjoining vegetation, like trees, is needed not only to keep them navigable and safe for people, but also to maintain their wildlife value. Because of slow flows and controlled water levels, open water would eventually be lost to encroaching vegetation, so regular weed cutting or dredging of channels is carried out. Dredging removes silt and sediment accumulations, including polluted ones. A range of pollutants, from industrial spillages, boat fuel spills and bilge water, to sewage effluents and diffuse agricultural pollutants, can end up in the water. Pollutants are harmful to aquatic life and lead to loss of biodiversity; tackling pollution is an important part of our work.

Dredging and weed cutting cause disruption in the short term, but most communities recover and the habitat is kept suitable for early successional species that would otherwise be crowded out. These include important species such as the floating water plantain on the Montgomery Canal, which cannot compete with more robust species. Whenever channel management is carried out, care is taken to leave the banks, and a specified minimum band of reed fringe alongside it, as undisturbed as possible.

For wildlife of the navigable channel, boat traffic can cause problems. This is particularly true for submerged plant species, which can be damaged by boats, while delicate bankside plants and animals can be affected by waves and boat wash. If there is a lot of sediment and algae in the water it can smother not only water plants, but also invertebrates and fish eggs within the channel. In general, less boat use is associated with higher biodiversity but, nonetheless, channels with heavy boat traffic still support species that are tolerant of disturbance.

Tree fallen across the channel blocking the navigation, in need of removal

Our specialised fisheries contractor removing the non-native invasive zander

Dredging to remove sediment from the channel

Volunteer marking up a surface water drain with the Yellow Fish logo

Making a difference: 1

Only rain down the drain!

Good water quality is vital for waterway wildlife. For example, drains with contaminated surface water, misconnected pipes from toilets or dishwashers and improper use of industrial site drainage all have a negative impact on water quality. Very often, people are unaware that the water from their drains and any pollutants in that water, such as soaps, fuels and paints, end up in our waterways.

The Canal & River Trust have adopted the Yellow Fish initiative in which we and our volunteers work with local businesses, identifying the surface water drains that lead to our waterways. These drains are marked with a Yellow Fish logo. Once they have been identified with a Yellow Fish, this will hopefully encourage local businesses to protect them from pollution by only allowing rainwater down their drains: "Only rain down the drain!"

In recent years, we have run a national project where trained volunteers survey and map some of the drains and pipes going into our canals. Using this survey data, we have identified hotspots of unlicensed discharges that could be having a negative impact on water quality. All discharges into the waterways need to have a licence and, as part of that process, must have an environmental assessment.

Highlights

- Good water quality is needed to support a variety of wildlife and plants
- We work with local businesses to highlight what they discharge into our waterway
- We initiated a national survey with volunteers, to identify drains and pipes connecting to our waterways

Discharge into a waterway

Azolla starting to invade the channel next to the bank

Making a difference: 2

Weevil army eats canal menace

Canals are the super slow-ways of our beautiful blue and green nation, but they are vulnerable to invasions from non-native species that take advantage of the connections across the landscape. One such species is the North American water fern *Azolla filiculoides*. Like many invasive water plants, *Azolla* is a garden escapee sold for use in ponds, but once let loose it causes havoc for wildlife. *Azolla* is a voracious grower and can multiply rapidly, covering the surface of a waterway with thick mats. These reduce light and oxygen in the water, killing fish and other wildlife, and can also cause problems for passing boats. As the weather gets warm in the summer there is often a rapid acceleration in the growth of the plant, but we have a team of trained assassins on hand to take charge of the situation.

When *Azolla* is spotted in the canal, an army of its native predator, 2mm-long weevils *Stenopelmus rufinasus*, are released into the water, and they soon get to work munching their way through it. Individually, the weevils consume only a relatively small amount of *Azolla*. However, they breed quickly to produce very large populations which, as a community, will feed extensively. In a matter of weeks, the weevils are capable of clearing large patches of the invader, yet they cause no damage to our native flora and fauna. We have used this natural method of plant control across our network of canals in recent years with encouraging results.

Highlights

- Like many invasive water plants, *Azolla* is a garden escapee sold for use in ponds, but once let loose it causes havoc for wildlife
- The plant can create dense mats across the surface of the water blocking out the light for submerged waterway life and obstructing the navigation
- Once released, weevils make light work of the water fern as they breed quickly and are fast to spread, without causing damage to other native species

Volunteer releasing weevils into the water

Examples of what we do:

Improvement of connectivity of water courses and habitat. Can include enhancing fish passage (where practical and possible).

Actions to reduce phosphorous in our waters. For example, we aim to prevent or reduce high levels of phosphorus entering our waterways from adjoining farm land or sewage treatment works by working with partners and stakeholders. These include organisations such as regulators, water companies, fishing clubs and landowners.

Localised management of problem invasive non-native animal species. This can include dealing with invasive non-native shellfish, such as the American signal crayfish or zebra mussel, removal of the non-native fish zander and measures to reduce spread of tiny aquatic creatures like non-native invasive shrimp.

Improvements to reduce blue-green and other algal blooms in the water.

Dealing with polluting discharges and drains in to our waterways.

Control of invasive non-native aquatic plant species, such as floating pennywort and water fern.

Creation and management of 'in channel' aquatic plant reserves, including installation of 'silt curtains' or other on-line 'linear plant margins', using suspended or staked geotextile to locally improve water quality and reduce habitat disturbance.

Dredging to remove silt, thereby reducing the amount of sediment in the water that will otherwise get stirred up by water flows, passing boats and other activities (resuspension). Suspended sediment can have an impact by covering and smothering water plants, river gravels and aquatic invertebrates.

Litter picking and removal of waste left in our waterways. Can include fly-tipped white goods, builders' debris, car tyres, shopping trolleys and vegetation waste.

Waterway banks and grasslands

We need to provide safe, solid, level banks for walking and cycling and for boats to moor against, especially at recreational honeypot sites like wharfs, moorings, bridges and locks. Beyond these high-use areas, there are many miles of grassy waterway banks, where land and water meet and a rich diversity of wildlife can be found. Flowering plants vary from wetland to meadow species and attract many insects, including pollinators foraging for nectar. Lush vegetation provides nesting and feeding places for birds such as coots and moorhens, and soft, vegetated banks are especially important for water voles. Towpath verges, cuttings and embankments provide grassy habitats that will be used by reptiles, amphibians and small mammals. Banks and grasslands can provide a wonderful green corridor alongside waterways, enabling wildlife to move through the landscape.

Key points

- We need to balance both recreational and wildlife needs when managing waterway banks
- Waterway banks, where land and water meet, can have a rich diversity of flora and fauna
- Waterway banks provide green wildlife corridors through the landscape

Rich in diversity, a waterway bank with purple loosestrife

Boats moored along a mature, natural bank

Water vole © Mark Baker

Tufted vetch and meadowsweet can be found on waterway banks and grasslands
© Rob Wolton / Hedgelink

Waterway banks

Many waterside habitats have vanished from the countryside, making waterway banks especially precious for wildlife. Species normally associated with ponds and wetlands will make their home here, particularly where the vegetation is lush and diverse. The combination of water, tall fringing emergent plants, and transition to plants favouring drier land higher up the bank creates a rich and diverse habitat for invertebrates, amphibians, reptiles, mammals and birds.

Dense vegetation, comprising a rich mix of species, is particularly important for water voles. This much-loved but severely declining animal feeds on tall grasses, sedges and rushes, and makes its home in waterside burrows in the bank. Bankside management has to take into account recreational and engineering needs, as well as wildlife conservation but, wherever possible, we use vole-friendly bank protection methods. These incorporate soft banks and vegetation, rather than hard vertical systems, to encourage water vole populations along our waterways.

Vegetated banks are also used by waterway birds for nesting. Coots and moorhens build nests hidden in the marginal rushes and reeds, while mute swans build larger, more open nests. Often the offside bank is used for nesting, where there is less disturbance.

Towpaths and verges

Towpaths, generally no longer needed for towing, can be managed to enhance their biodiversity as green corridors of grassy, flower-rich habitat. Towpath verges on the water's edge can be particularly important for wet meadow plants, such as gypsywort, skullcap and bedstraws, and, on the hedgerow side, dry meadow plants such as cow parsley or red campion often thrive. Some towpath verges have rarer plants including species of orchid.

Flowery towpaths will be visited by a whole range of pollinators, including bees and butterflies, especially if the verges are sheltered by hedgerows. Larger animals such as grass snakes can be found basking on warm, sunny verges, while amphibians will use the taller vegetation for cover from predators, and as rich hunting grounds. Even the humble nettle is important, as a foodplant for small tortoiseshell and peacock butterfly caterpillars. We aim to manage our towpath verges to maximise their wildlife value where possible. Simple changes, such as reducing the frequency of mowing, or not mowing the whole width of vegetation, can be compromises that work well, both for people that use the canals, and wildlife.

Cuttings and embankments

Cuttings and embankments are part of the structure of many waterways. The habitats on their slopes vary and can include rock exposures, grassland, woodland and scrub. Some of our sites have features of particular geological or wildlife interest which has resulted in their designation as special sites for conservation. Where the embankments are grassy they can have a variety of wildflowers, including species of unimproved grassland, such as cowslips.

Grassy embankments can have many small mammals, attracting the attention of barn owls. Barn owls have declined in numbers on farmland, but grassy embankments such as those along canals have become particularly important, where barn owls can sometimes be glimpsed, silently hunting for their prey at dusk.

One of the larger animals found along our waterways is the badger, and the slopes of cuttings and embankments in particular, can be ideal for sett construction. Often the setts can be found where woodland meets grassland: woodland providing cover and shelter, while grassland provides their main food source – earthworms. When badgers make their setts in canal embankments this can cause structural and leakage problems. Because of this risk, we monitor all badger setts on our embankments.

The spiny caterpillars of peacock butterflies feed only on nettle plants © Ruth Feber

Pollinators benefit from flowery verges and embankments © Rosalind Shaw

Barn owls can sometimes be seen hunting over grassy embankments

Mowing the grass

Making a difference: 3

Keeping trim

The way that we mow the grass alongside our waterbodies depends on the type of towpath: we consider the canal's character, surface type, structure, width, type of edging, location and level of use. Cutting through the vegetation to the water's edge at particular points can allow anglers access, and provide boaters with safe, informal moorings.

Safety comes first, but we need to balance this with the needs of wildlife. Towpaths provide important corridors for many species. In 2017, a great crested newt was unexpectedly found taking shelter under a discarded bag during the autumn grass cut on the Gloucester and Sharpness canal. The mowing regime for this area was changed to cut narrower widths, less frequently, to provide the newts with a safe area to hunt for their insect prey. Relaxing the mowing regime also allowed common spotted orchids to flourish from dormant seed stock, previously unknowingly suppressed by the regular mowing.

Leaving the grass longer under hedgerows is of great benefit to many creatures, including reptiles and small mammals like hedgehogs. Where we own larger areas of grass, we employ the specialist skills of grazing cattle which provide a more varied landscape, ideal for wildlife such as rare grasshopper warblers, in contrast to lawn-mowers, which create flat, characterless environments.

Highlights

- Towpaths need to be mown so that they can be enjoyed by everyone
- There is a careful balance between accessibility and wildlife, as canals provide a corridor for a range of species
- Mowing regimes can be managed in a way which benefits specific species

Cattle can be used to graze larger areas of grassland, which creates good wildlife habitat

This concrete canal has the same habitat as traditional earth built canals; deep earth banks, lush reed fringes, trees, hedgerows and grass verges

Making a difference: 4

There could be concrete lurking below

When you visit some of our waterways you would never guess that you are looking at a concrete canal. During their construction around 200 years ago, several of our canals were built on unstable hillsides or with embankments made up of leakage-prone material. For some of these canals, although not the environmentally preferred option, the only solution to prevent ongoing structural problems is to incorporate concrete into the channel lining. In recent years, several of these new concrete canals have been specifically built with the needs of wildlife in mind.

Our ecologists and engineers work together to design and build concrete navigations that are structurally sound, whilst incorporating habitats like deep earth banks, trees, hedgerows, grass verges and reed fringes. Before draining, in preparation for construction work, a specialist fish rescue is undertaken. Typically fish are moved to adjoining canal sections. If there are protected species, such as great crested newts or bats, it is necessary to plan ahead to provide for them. Once the new channel is completed, previously recovered soil (containing the local plant seedbase), reeds and other plants can be replaced. If planned well, a new waterproof and stable canal can successfully be rebuilt in this way. Concrete canals can provide super habitat and lush reed fringes for wildlife, including threatened burrowing creatures like water voles.

Highlights

- Our canals are artificial structures, largely built by hand during the 17th and 18th centuries
- Some canals are located on hillsides and are made of material that is prone to leakage and instability
- Although not favoured environmentally, a concrete canal can be built accomodating the needs of wildlife, incorporating habitats like grass verges, water vole friendly banks and reed fringes

Canal relining underway on the Monmouthshire and Brecon Canal

Examples of what we do:

Protect and improve growing conditions for protected and special plant species. This can include fencing of banks that would otherwise be trampled by cattle, and vegetation management to increase ground flora cover.

Planting or seeding to increase the local, native species diversity. We aim to select native seed mixtures in preference to non-native species. This may also reduce the grass cutting frequency as most native grasses are typically slower-growing.

Reducing intensity of grassland cutting. We can change the timing, increase the cutting height and reduce the frequency of cutting, so that native plants can flower, set seed and spread, all of which will also benefit pollinators.

On species rich grassland we can organise animal grazing (if practical) or localised cut and rake and removal of cuttings. This helps to improve growing conditions for special native plants. Cut and rake is often carried out by volunteers.

Creation and restoration of natural canal banks. This includes introduction and improvement of reed fringes, with native local plant species, and rebuilding of good bankside habitat.

Where possible and practical, we use natural green bank repair techniques in preference to hard edging such as steel sheet piling and wholly concrete edging when undertaking leak stopping, channel relining works and similar.

Management of dominant terrestrial non-native plant species. Control of these species may be needed when they threaten native plant communities.

Litter picking and removal of waste left on our land and waterways. This can include fly tipped white goods, builders' debris, car tyres, shopping trolleys, vegetation waste and other material.

Hedgerows

Canal hedgerows are some of our oldest waterway habitats, and part of the living landscape of the waterway corridor. More than that, they are lifelines for many wildlife species, providing food, shelter and places to breed. A rich diversity of plants, birds, mammals, pollinators and other insects can be found in hedgerows or at their base. Hedgerows can also act as corridors, joining up other habitats such as woodlands and grassland, and helping species to move through the landscape. Many hedgerows have been lost from the wider countryside over the last half century, making our hedgerow resource more valuable than ever.

Key points

- Canal hedgerows are a vital habitat, for a whole range of species
- Hedgerows can act as habitat corridors through the landscape
- Hedgerows need managing to keep them in the best condition

Hedgerow blossom

The gatekeeper butterfly is commonly seen along hedgerows © Saxifraga / Jan van der Straaten

Common whitethroat

Around thirty bird species will use hedgerows for nesting

Hedgerow wildlife

Canal hedgerows were frequently planted by the original canal companies in the 18th century, to protect the towpath from cattle and other livestock, making them some of the oldest established habitats on our waterways. We have over 600 miles of hedgerows to look after, and they form part of a vital green corridor along most of our canals, providing cover, shelter and food for many wildlife species.

Historically, the quick-growing and thorny hawthorn was used for most canal hedgerows, because it made a good stock-proof hedge. Since then, other shrubs have been planted or have colonised the hedge. Hawthorn is still one of the most common species in our hedgerows, along with ash, blackthorn, elder and hazel. Hedge base vegetation contributes to the hedgerow habitat, with plants such as cow parsley and hedge garlic, as well as tussocky grasses, roots and woody stumps, all providing resources for wildlife.

Pollinators are part of the abundant insect fauna that make use of hedgerows. Blackthorn blossom in the spring provides a vital early source of nectar for bumblebees and butterflies emerging from hibernation, while ivy blossom in the autumn helps them build up reserves for winter. Butterflies are a common sight along hedgerows. The gatekeeper butterfly is also known as the hedge brown, because of its habit of patrolling hedgerows, the adults feeding on flowers such as bramble, while its caterpillars feed on grasses at the hedge base.

Birds are the most frequently seen (and heard) wildlife of the hedgerows. A largely different suite of birds is associated with hedgerows, compared to our water habitats. Birds such as blackbirds and robins will nest and feed in hedgerows, while dunnocks and whitethroats will use taller shrubs as song-posts to announce their territories.

At least 30 bird species nest in hedgerows; some, such as bullfinches, favour taller hedges with trees, others, such as yellowhammers, prefer low hedges. Grassy hedge bottoms provide nesting material and insect larvae for chicks to feed on. In winter, hedgerows can be feeding and roosting sites for resident birds and winter visitors, such as fieldfares and redwings, especially if hedgerows are left to flower and fruit.

Mammals are seen far less often than birds, but hedgehogs, bank voles and shrews are just some of the species that will nest and feed in or along hedgerows. Well connected, larger hedgerows are used by dormice, while bats will use them as foraging and commuting routes. Hedgerows are valuable for amphibians and reptiles too. Grass snakes and slow worms will find places to hibernate at the base of hedgerows, while toads will hunt there for their invertebrate prey.

One of the most important aspects of our hedgerows is their role as green corridors through the landscape, connecting up patches of woodland or grassland, and helping wildlife to move and disperse. The proximity of hedgerows to waterways adds to the value of the corridor, increasing the diversity of habitats within it and helping a wider range of wildlife species.

The endearing hazel dormouse needs mature, well-connected hedgerows. This agile climber is mainly nocturnal; it will sleep during the day, using cavities in trees and branches

Hedgerow management

Hedgerows need to be managed to keep them in good condition, as well as preventing them from growing over the towpath. Without management, hedges can become gappy or turn into a line of trees if left to grow. The structure can become thin, especially at the base. Old hedges can be rejuvenated through traditional methods such as coppicing and laying, while cutting hedges rotationally keeps them healthy and vigorous. Where hedges cannot be rejuvenated, or where they have been lost, new hedges can be planted. Hedgerow work requires planning, to avoid any disturbance to nesting birds or bat roosts.

Planting up a gappy hedgerow

Hedge-laying on Monmouthshire and Brecon Canal

Making a difference: 5

Helping hedgerows

The encouragement of traditional techniques, such as coppicing and hedge-laying, improves the health of hedgerows, and planting up gaps and replacing lost hedgerows helps retain these important connections within the landscape. The People's Postcode Lottery have helped to fund hedgerow maintenance across the canal network which, so far, has improved almost 20 km of hedgerow, trained 188 volunteers to traditionally lay hedgerows and involved nearly 1,000 volunteers.

Many of our hedges have gaps, or are disconnected. Hedges traditionally would have been boundary markers and stock proof, but current management often means that the bottom becomes open and gaps can appear. When hedges are laid, the older wood forms a barrier at the base of the hedge, whilst the cuts encourage new fresh growth to grow up towards the light, which will thicken the hedge. Laying a hedge also encourages the hedge to flower and set berries. When undertaking hedge-laying, it is important to plant new species within the hedge, to diversify the typical hawthorn dominant hedges. These can include species such as blackthorn, field maple, alder, spindle, crab apple, wild rose, wild privet and hazel.

Hedges also benefit from the inclusion of tree species every 30 - 50m that can be left to grow out and become landscape markers. The inclusion of orchard trees at regular intervals has huge gains for wildlife and people.

Highlights

- Hedgerows are historical and important corridors, that a wide range of species depend upon
- Hedges alongside waterways can become gappy with age and are often species-poor
- Traditional management techniques, such as hedge-laying and gapping up, are the best way to manage hedgerows to benefit wildlife

Volunteers undertaking hedge management works

Glow worm

Making a difference: 6

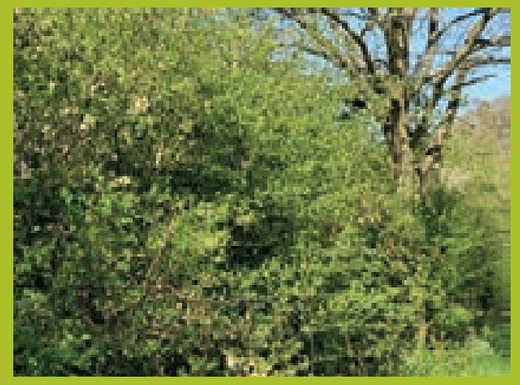
Glowing in the hedges

Waterways and railways are often bordered by continuous hedgerows. Where the grass is left to grow tall alongside the hedges, an almost magical creature can occasionally be found. Taking a stroll on a warm summer's evening, small green lights may be seen around the bottom of the hedges. The lights belong to the female glow worm, a beetle, which will climb to the top of the tallest blades and shine, like a landing strip at an airport, to help the flying males locate it. Glow worms can first be seen glowing in late May and continue until early September, but as the female cannot eat, she will only live for about two weeks. She will need to conserve energy and so is reliant on tall grass in a small area, which she can climb up every single night until a male spots her.

Once she has been mated with, she will turn off her light and lay her eggs in the dead wood and undergrowth under the hedge, and then, as with many insects, she will die. The eggs hatch out into larvae and spend a year, or even two, living amongst the roots of the hedge, feeding on snails which they seem to paralyse before sucking out their insides. As the larvae transform into adults after two or three years, it is thought that there may be separate populations inhabiting a single site. There is some evidence to suggest that artificial lights can affect the ability of males to find females and that the males may be attracted to the artificial lights, hampering their efforts to find females.

Highlights

- Leaving a strip of tall grass alongside hedges between May and September gives female glow worms a better chance of being spotted
- Dead wood and brash stacked neatly in the bases of hedges provide the glow worm larvae with places to hide and hunt their snail prey
- Dark waterway corridors enable the females' lights to be the brightest things in the landscape



Hedgerows and tall hedge base vegetation will encourage glow worms © Ruth Feber

Examples of what we do:

Laying of hedgerows. This extends their life and improves the structure for the benefit of wildlife. It also helps keep the hedges stock-proof.

Coppicing of hedgerows. This can benefit particular species and will improve and extend the life of over-mature or over-flailed hedgerows, reviving them.

Gap-planting. This improves the density, quality and connectivity of the hedgerow.

New hedgerow planting. We plant hedgerows to help extend and connect this linear habitat along our waterways, improving connections within the wider landscape.

Diversity planting of hedgerow and associated climbers and ground flora.

Planting and maintenance of hedgerow trees within hedgerows.

Control of terrestrial invasive non-native plant species. Some species, such as Japanese knotweed, threaten the hedgerow habitat and need to be controlled.

'Dead hedging' and construction of wood stacks. This helps invertebrates and other wildlife, and re-uses the cuttings when hedgerow or tree management is undertaken.

Trees, woodland and scrub

We have around one million trees growing along our waterways and they support a rich diversity of wildlife, from mosses and lichens, to invertebrates, bats and birds. They also influence waterway bank and channel species, creating conditions for shade-tolerant bankside plants, and shelter and breeding habitat for fish. Our trees, woodland and scrub need to be managed to balance the needs of wildlife, our waterway structures, and people.

Key points

- Trees, woodland and scrub are all valuable for our waterway biodiversity
- They provide shelter and food for birds, bats and invertebrates, and shade for fish
- Management helps maximise their benefits for wildlife and protects the waterway environment

Orchids and bluebells along a wooded stretch of the Monmouthshire and Brecon Canal

Goat willow can often be found by canals and rivers
© Peter Roworth / Natural England

Some of our trees are very old: pollarding can keep them at a manageable size

As well as habitat for wildlife, trees add interest and beauty to the water's edge

Trees

Trees are an important part of waterway ecology. Each tree, by providing habitats for other plants and animals, has its own unique biodiversity community. Historically, some trees were planted along waterways by the original canal companies and engineers to serve as distance markers, while others were planted as windbreaks, to help stabilise banks, or as sources of timber. Many of our waterway trees have simply grown naturally from seeds, many dropped by passing animals. Willows and alders can be found on waterway banks, hawthorn, oak and ash in the hedgerows, and fruit trees near canal settlements or lock-keepers, cottages.

Alders are one of the most common trees along the waterway. They have fibrous roots that can help bind banks together and prevent erosion, as well as providing shade and shelter for fish, birds and other wildlife. On our artificial canals, trees need to be managed. Once fully mature, they can damage embankments and create leakage through banks, rather than protect them. Many waterway willows and alders, and sometimes other trees, have been coppiced or pollarded over many years, to keep them at a manageable size. These old trees are a characteristic feature of our waterways, and are home to many species - they are used by nesting birds, a large number of invertebrates, as well as other plants and lichens.

Sometimes trees self-seed in the wrong places, leading to damage on structures such as bridges and embankments, and dead, dying or diseased trees may pose a danger if they fall. We regularly survey our trees; pollarding, reducing, coppicing, felling and planting as necessary, to maintain their high biodiversity value while protecting waterway structures and people.

Woodland and scrub

Woodlands often grow in narrow blocks or ribbons alongside canal and river navigations. At the water's edge there might typically be alders or willows, with trees of drier conditions, such as beech, oak, birch or hazel, on the slopes behind. Sometimes waterways cut through large woodlands that pre-date the canal by hundreds of years.

Ancient woodlands such as these have rich communities of species, including mosses, lichens, other plants and invertebrates, which do not occur in younger woodlands. Ancient woodland flora, such as bluebells or primroses, may extend to the towpath or the water's edge.

Strips of woodland, and larger woodland areas that are next to waterways, will be especially valuable for bats, and the moths and other insects on which they feed. Woodlands provide habitats for species that would not normally find suitable conditions along waterways, increasing our overall biodiversity.

Scrub adds more variety, offering different habitats to woodland. Scrub is a vegetation stage intermediate between open ground and woodland. Influenced by soil type and location, common scrub species are hawthorn, blackthorn, elder or bramble. Scrub that has developed on embankments or on towpath banks can be very diverse, and valuable for a range of birds, small mammals and insects, especially in sunny situations. Scrub can provide nectar, pollen, fruits, seeds and shelter, and support a host of wildlife species. It will establish and develop naturally if left to do so, eventually turning into woodland. Management is required to keep the right balance for the safety of our customers, and the integrity of waterway structures, as well as habitat diversity.

Flora such as ramsons (wild garlic) and bluebells can be found where ancient woodland meets water
© Rob Wolton / Hedgelink

A hawthorn laden with berries will sustain birds and small mammals through the winter months
© Rob Wolton / Hedgelink

View from Monmouthshire and Brecon canal

Making a difference: 7

Coppicing, planting and vibrant views

During 2016/17, funding from Welsh Government gave the Trust the opportunity to deliver a unique project to reinvigorate the waterway corridor along the Monmouthshire and Brecon Canal for the benefit of its communities and wildlife. The aim of the project was the large scale transformation of canalside habitat using traditional countryside management techniques and planting.

Volunteers from the Llangattock Community Woodland Group, Canal & River Trust contractors and others restored hazel coppice, planted flora and undertook hedgerow management along the canal. Each of these activities was selected specifically to deliver improvements for pollinators (including bees and butterflies), dormice and also farmland birds and other wildlife. Over 350 forty-year-old hazel stools were coppiced, extending the life of these characteristic shrubs, thereby improving habitat for local wildlife. The branches and brash that were generated were used to create deadwood stacks and woodpiles for creatures such as insects and hedgehogs. Planting included 1,200 woodland and hedgerow plants, such as honeysuckle, dog rose, sallow and blackthorn and more than 22,500 canal bank plants including sedges, rushes and flowering plants. The work also revealed many stunning vistas of the surrounding landscape, giving people vibrant panoramic views across the Brecon Beacons from the towpath and canal.

Highlights

- Traditional countryside management techniques, if used well, can extend the life of trees and plants and create better habitat for wildlife
- Much of this work could not be undertaken without the help of our volunteers
- Our waterways are excellent wildlife corridors, ribbons of water skirted by trees, hedgerows and scrub

Hedgerow management

Trees growing along our waterways provide valuable habitat and create beautiful places for people to enjoy

Making a difference: 8

Can’t see the wood for the trees

There are hundreds of thousands of trees growing alongside the Canal & River Trust’s waterways and these provide valuable wildlife habitats and beautiful places for people to relax. However, the trees must be managed carefully to make sure they don’t damage the canals with their roots or fall across the water and block the navigation. As trees grow larger, their branches can also become a problem for boats negotiating the water. It is necessary to trim back the branches of the trees growing on the offside of the canals to prevent them excessively overhanging the canal, whilst ensuring that we retain precious habitat for sheltering juvenile fish, and keep perches for kingfishers to hunt from.

Weeping willow trees can be particularly difficult as their drooping branches become heavy with leaves and reach out into the water. Often, weeping willows are planted alongside locks as they make a beautiful feature. This can later become a problem for boats entering or leaving locks. In situations like this, it is always preferable to keep the tree and instead, by crown lifting the branches, raise the growth structure of the tree. It can look rather harsh immediately after cutting but once the next season’s growth has come through, the willow will soon be weeping again.

Highlights

- We need to manage trees to balance needs of people, our structures and the wildlife
- Trees such as weeping willows can sometimes grow to obstruct the navigation
- Where possible, we retain trees and manage by selective cutting

A weeping willow on a lockside in need of crown lifting

Examples of what we do:

Aim to conserve veteran, mature and valuable trees. These trees host diverse communities of species.

Re-pollarding of previously pollarded trees.

Creation of, and allowance for, standing dead-wood and monoliths (safety permitting).

Coppicing for the benefit of certain hedge and tree species.

Planting to increase species diversity and connectivity between woodland and trees in the wider landscape.

Tailored vegetation management. We aim to increase ground flora cover, understorey and canopy diversity.

Leave fallen or felled dead-wood in situ (safety and local practicalities permitting).

Management of dominant terrestrial non-native plant species. This is important where such species threaten our native trees and shrubs.

Construction of brash and timber stacks. These benefit invertebrates and other wildlife such as hedgehogs.

Built structures

Our many built structures play an important, but often overlooked, role as wildlife habitats. Aqueducts, bridges, tunnels, and locks, as well as cottages, warehouses and other buildings, have become integral parts of the landscape of our waterways, and contribute much to their biodiversity. In general, it is the older structures, built of stone and with lime mortar, that have the greatest value. A wealth of life unfurls from the nooks and crannies, making the most of the damp conditions and shaded areas under bridges and in tunnels. Because of their proximity to water, our structures often support unusually diverse communities.

Key points

- Built structures on our waterways provide habitat for a range of terrestrial and aquatic species
- Bats are probably the most well-known users of our tunnels, aqueducts and other buildings
- We take care to protect and enhance these valuable habitats for wildlife

Brynich Aqueduct carries the Monmouthshire and Brecon Canal over the River Usk

Bridges, tunnels and aqueducts have crevices that provide roosting places for bats, and waterways provide excellent foraging habitat

Grey wagtails will nest in suitable wall crevices
© Mark Baker

Ivy-leaved toadflax

Homes for wildlife

Built structures support a very diverse range of animals and plants. Bats are probably the most well-known animals that use our structures. They can sometimes be seen clustered in tunnel roofs or under aqueducts, but are usually well hidden, squeezing into tiny crevices. Some structures are simply used as day roosts, but larger voids within or behind retaining structures are used for hibernating, or as nursery roosts. In the winter, bats need moist, cool places to hibernate and canal tunnels can be ideal. Canal structures are particularly important for bats, because of their association with water, which helps provide rich insect foraging grounds on which bats depend.

Lichens are probably the oldest species to live on our structures. Growing as slowly as one millimetre a year, mosaics of lichens on towpath walls and buildings are part of our waterway heritage and would take many decades to re-create. Wildlife will also make use of large waterway buildings, such as warehouses. If buildings have eaves, they may be used by nesting house martins, while roof and wall crevices may house the nests of other birds such as wagtails.

Old walls have wall ferns and mosses growing on them, themselves creating sheltered micro-habitats that will be used by invertebrates. Hart's tongue fern is commonly seen - an evergreen glossy plant that has long narrow pointed fronds. Hart was historically another name for a deer, and the plant was named for its resemblance to a deer's tongue. Another familiar sight is ivy-leaved toadflax, introduced to our shores in the 17th century, thought to have been brought over with imported marble slabs from Italy. It is now widespread across Britain, bringing a welcome sprinkling of colour along our canal walls, with its delicate lilac flowers, which look like tiny snapdragons, and trailing green leaves. Plants such as these rarely cause structural damage and so can be retained, but larger woody plants may need to be removed, as they will damage the structure and ultimately reduce its biodiversity value.

Invertebrates associated with built structures vary according to the construction and aspect. In tunnels, the dominant species will usually be the cave spider, with its distinctive webs covering every tiny crevice. On walls in the open, there are many more species. One of the most common on sunny walls is the zebra spider which catches its prey by jumping on it, rather than using a web.

Wet structures

Wet or submerged built structures are home to a number of aquatic organisms. Lock walls have a range of plants, liverworts and lichens, creating habitat niches for other species. Mussels, for example, are widespread along our canal walls. However, some species can be a problem. The zebra mussel is a tenacious species that is not native to this country. This stripy mussel competes for space with native species and impedes the smooth running of canal gates and sluices.

Freshwater sponges are one of the more unusual and interesting aquatic organisms to exploit canal structures. They are colonies of microscopic animals and among the simplest forms of animal life. Their colour varies – sometimes they are tinged green, where they are associated with algae, others are creamy white. Sponges can be seen growing on lock sides and on masonry in bridge holes, where they filter water for tiny aquatic organisms. They can grow quite large - up to 500mm. Around 16 freshwater species may be found in Britain, but rather little is known of their ecology and distribution.

Repair and maintenance work on our built structures needs to minimise disturbance to wildlife. For example, work may be timed so it does not disturb hibernating bats. In the spring, nesting birds can affect the work that can be done in or on buildings. With careful planning, it is usually possible to find solutions.

Lock walls have flowering plants, ferns, liverworts and lichens that like wet conditions. Some of these plants are rare or scarce

Beige, grey and brown circle-shaped fresh water sponges growing on an old lock gate, looking a little like underwater lichens

Boats sharing locks saves water

Making a difference: 9

Harnessing the power of the sun to move water

Every time a boat passes through a lock, thousands of litres of water are used, and water also evaporates from the canals during warm weather. The water levels need to be regularly topped up, otherwise boats would run aground and wildlife would struggle. Supplies of water come from a network of reservoirs, rivers and streams, as well as being pumped from underground. Pumping stations at key locations allow water to be pumped back up lock flights, to where it is needed. Pumps on the Caen Hill lock flight in Devizes move around 3,300 mega litres of water, from the bottom to the top each year. To offset the environmental impact of running the pumps, solar panels have been installed near the pumping station at the bottom of the flight, generating renewable energy from the sun to move the water.

Most of our lock gates are made from oak and, over time, they will need replacing. The Trust has worked with H.M. Prison Service and Fresh Start New Beginnings, a charity that works to reduce re-offending, on a trial to recycle old lock gates. Fifteen old lock gates from the Montgomery Canal were dismantled, removing steelwork, and turned into picnic benches, bird boxes, bat boxes and posts. Our old lock gates have even been used to create bridges and sculptures at Glastonbury Festival.

Highlights

- Careful water management is important, to make sure that the canals do not run dry
- Renewable energy from solar panels can help fulfil these energy demands
- The wood from lock gates can be re-used for a range of products

Solar panels help power the pumps to move water to the top of the Caen Hill Flight

Yellow corydalis by the Monmouthshire and Brecon Canal

Making a difference: 10

At home in locks, aqueducts and bridges

The Monmouthshire and Brecon Canal has a vast and diverse array of limestone structures, ranging from bridges, aqueducts, locks and their approach walls, not forgetting a large number of dry stone walls and even a tunnel! These structures are particularly good for species like yellow corydalis, wall-rue and ivy-leaved toadflax, as well as a number of fern species. Also, due to the clean unpolluted air along the canal, these historic structures are covered in a diverse collection of lichens. Many of these same species can be found on the walls, such as at lock approaches and the wingwalls of bridges and aqueducts. Where the environment becomes damper, due to constant spray from lock gates or paddles, the flora change, giving way to mosses and liverworts. Liverworts are the simplest of all plants, having no roots, but rhizoids (little hairs) instead. Like mosses, they are found in very moist areas, so many lock side locations are ideal.

As part of the Trust's annual vegetation maintenance along the Monmouthshire and Brecon Canal, damaging woody vegetation, such as bramble, saplings and ivy, is removed. However, our contractors are instructed to leave specific species of wall flora. Rooted into nooks and crannies in the mortar these do not do any damage, instead, adding colour and interest to our soft estate.

Highlights

- Limestone structures, such as locks and bridges, provide specialised habitats for wildlife
- Many species of wildlife spend their whole life cycle on limestone structures
- The Trust actively protects the growth of special wall flora, ensuring it is not harmed as part of the annual clearance of vegetation from structures

Rusty back fern

Examples of what we do:

Protect and create opportunities for roosting bats. These may be in structures such as bridges, locks and aqueducts as well as buildings, and may include the installation of bat bricks or boxes. Existing crevices suitable for use by bats to be kept, and new crevices incorporated, where possible.

Provide opportunities for nesting birds, invertebrates, reptiles, amphibians and other creatures within structures and buildings (as practical). This may include installation of bird boxes and incorporation of crevices suitable for use by nesting birds, reptiles and amphibians.

Keep valuable non-woody wall flora, lower plants such as lichens, ferns and fresh water sponges growing on structures such as locks and aqueducts, where possible. Sometimes removal is needed for repointing, for operational reasons or to protect the integrity of a heritage structure. Woody plants and other vegetation that will damage structures and buildings, are normally removed.

Other waters

Canals are probably the most familiar of our waterbodies, but we also have over a hundred reservoirs, and many lakes and ponds, that we look after. These 'open water' habitats provide a very different type of environment for wildlife. Our reservoirs are often over two hundred years old and many are now designated as Wildlife Sites at local, national and international level, often because of their importance for water birds. We also care for fast-flowing feeders and streams that supply our canals, and which are home to a different suite of species. Together, these other waters provide a rich variety of wildlife habitats.

Key points

- Waters other than canals that we look after include reservoirs, lakes, ponds, feeders and streams
- These habitats support a great variety of plant and animal species
- Many of our reservoirs are of national or international importance for wildlife

Former gravel pit, now a superb lake for wildlife, especially water birds and waders

Volunteer from a local bird conservation club ringing a little ringed plover chick

Great crested grebe nesting on one of our reservoirs

Reed beds can be found around reservoirs and former gravel pits

Reservoirs, lakes and ponds

The standing open water and associated habitats of reservoirs, which may include wet woodland, reedbed and marsh, support a great diversity of wildlife. Overwintering wildfowl are particularly characteristic of many of our reservoirs. Wildfowl arrive in autumn, mostly from north-eastern Europe, and make use of the food and shelter provided by the reservoirs during the winter, before leaving for their breeding grounds in the spring. Pochard, tufted duck and teal are regular visitors to reservoirs, and other birds that can be seen include the beautiful great crested and little grebes, shoveler, as well as the more familiar coots and moorhens.

Former gravel pits, restored as lakes, can be wonderful places to see water birds and waders. Their artificial gravel beaches can make perfect nesting sites for little ringed plovers.

Reedbeds – extensive stands of common or thatching reed – are an especially important habitat that can be found in the undisturbed margins of reservoirs and ponds. Because they appear uniform, reedbeds can give the impression of being poor for wildlife. But in fact, they harbour a wealth of biodiversity, including many bird, invertebrate and mammal species. The most characteristic birds of reedbeds are reed and sedge warblers which will nest here, as will herons, who take advantage of the shallow, clear water in which to fish. Reedbeds are also home to some nationally rare or threatened species.

Reservoir and pond margins can also support a range of wetland plants such as lesser pond-sedge, water forget-me-not, branched bur-reed, flowering rush and lesser reedmace, and insect communities including uncommon wetland beetles. A key feature around some of our larger water bodies is the ‘draw-down zone’. As water is used to supply the navigation throughout the summer, large areas of mud are exposed. This unusual habitat supports some rare species of plants and invertebrates that are particularly suited to this environment.

Though most of our reservoirs have good water quality, some can suffer from nutrient enrichment (eutrophication) which leads to a reduction in biodiversity value. One of the symptoms of a nutrient problem is a ‘bloom’ of blue-green algae, which can produce a toxic scum. Eutrophication is usually caused by pollutants and agricultural run-off. Other factors, including intensive fisheries and feeding bread to water birds, can exacerbate the problem.

Feeders and streams

Our waterway network includes not only slow-moving channels and open water reservoir habitats, but also a variety of rivers, feeders and streams. The wildlife habitats provided by canal feeder streams are very different to those of navigation canals. Feeders tend to be narrow, shallow and fast-flowing, and can have a stony bed. But, being man-made, feeders are more uniform than most natural streams, with engineered banks and controlled flows. They support a different range of species to the other water bodies. For example, starwort has a root system that enables the plant to withstand fast flows. Its masses of small star shaped green leaves on very delicate stems are a familiar sight in many feeders.

The insect life of feeders is also different. Mayflies are regularly seen along feeder streams in early summer. Their larvae have adapted to fast-flowing water, often living under stones on the bed. Other faster-flow species include flatworms, freshwater limpets and stone-cased caddisfly larvae

Some species are thought to have originally colonised canals via feeders. The rare floating water plantain *Luronium natans* is one such example, thought to have colonised the Montgomery Canal via the River Dee feeder of the Llangollen Canal over 150 years ago.

Feeder streams provide different habitats for wildlife

It can be necessary to protect our feeders, waterways and other waters by removing builders’ waste and fly tipped white goods, car tyres, shopping trolleys and vegetation waste

Fish bypass around Dog Head Stakes weir

Making a difference: 11

From stakes and stones to fish bypass

If you walk the towpath at the beautiful intersection between the Kennet and Avon Canal and River Kennet SSSI at Newbury, you will see a weir on the offside. This weir, called Dog Head Stakes, was built 200 years ago, and as its name suggests, it used to be made up of a row of stakes and removable hazel hurdles. Whenever water levels were getting too low, canal workers would wade in the river to fix the hurdles to the stakes. During high flows, these would be removed to prevent flooding.

Years ago these stakes and hurdles were replaced with stone, to avoid the treacherous fixing and removing of hurdles. Recently we had to substitute the stone, which was getting washed away during high flows, with a row of steel sheet piles. This steel weir was carefully designed to create the right water level for navigation and the river SSSI, while ensuring that migrating fish can pass over it during higher flows.

To give fish an alternative route around the weir, especially during lower flows, we created a 50-metre-long fish bypass, by excavating a channel into the gravel bank on the bend with the river. Advised by the Environment Agency, we created the right flow conditions and created meanders and pools. The bypass is a great link for young fish and fish species that prefer slower flowing water.

Highlights

- Sometimes we need to find innovative solutions to look after our customers, as well as our wildlife
- Weirs are necessary to help us maintain water levels for boats and to release surplus rain water to avoid flooding
- Several of our waterways connect to and join with rivers, both of which are important habitat for fish

Digging the fish bypass

Volunteers clearing willow out of a pond

Making a difference: 12

Creating ponds for wildlife and volunteers

Our waterway wildlife can really benefit from ponds. Ponds offer refuges for rare and threatened plants, water beetles, and amphibians such as frogs and newts, which are more likely to be predated by fish in our navigations.

At some of our sites we have excavated a series of ponds. These range in size, depth and shape, allowing for the varying requirements of species, seasonal changes and animals with different life cycles. We typically aim to use the local, natural, water-retaining soils and water table to establish these ponds. When choosing a site for a pond we also look at the surrounding environment. Many of the animals which use ponds need scrub, grass, woodland and other terrestrial habitats.

Ponds are a great resource for volunteers to work on, for training people, and to showcase how to identify and protect pond wildlife. At Fens Pools (a Special Area of Conservation), we now have over 30 years of amphibian monitoring data, in part through working with other organisations. Water quality, invertebrate and invasive species data are collected. Monitoring the whole pond ecosystem creates a greater understanding of species, requirements, and allows volunteers to gain a range of skills. Long term monitoring can highlight where pond management needs to be adapted, for example, to address issues like invasive species or deal with species declines.

Highlights

- New ponds using local soils and the natural water table can offer instant rewards, with species colonising within weeks
- Creating groups of new ponds can offer refuges for species such as the great crested newt
- Ponds can be a great resource for volunteers, children and others to learn about aquatic wildlife

Monitoring ponds for great crested newts

Examples of what we do:

Delivery of water quality improvements. We do this by working in partnership with other organisations such as regulators, fishing clubs and landowners. Measures include working with catchment groups to reduce run-off of phosphorus, sediment or soil from adjoining farmland into ponds, rivers or streams, through creation or management of reed beds.

Improvement of associated habitats. This includes a whole range of actions such as management of off-line ponds, creating better fish passage, and removing excess tree cover on navigated river channels to provide more light for aquatic plants. Some actions are targeted for particular species conservation, such as vegetation clearance from gravel beach habitat around a quarry for nesting little ringed plovers.

Dealing with polluting discharges and drains.

Desilting of valuable ponds. This helps to avoid their loss as a consequence of drying out, or colonisation by dense scrub and grasses.

Actions to reduce "blanket weed" or other algal blooms in the water.

Control and management of invasive non-native aquatic plant species. These include species such as floating pennywort, Australian swamp stonecrop and water fern.

Localised management of problem invasive non-native animal species. A particularly notable problem species is the American signal crayfish.

Litter picking and removal of waste left on our land and water bodies. This can include removal of fly tipped white goods, builders' debris, car tyres, shopping trolleys and vegetation waste.

Water plants

From the scalloped leaves of the curled pondweed, to the delicate flowers of the rare floating water plantain and the spikes of emergent arrowhead and branched bur-reed, water plants can be found in all our waterways. The richest water plant communities flourish in canals with the clearest and least disturbed water, some canals being national strongholds for rare or declining species. Water plants that can survive in tougher environments are important for supporting a range of aquatic life. Sometimes non-native water plants invade the waterways, causing major problems for people and wildlife. Conservation, and sometimes control, of water plants are major considerations in our management of the waterways.

Key points

- Canals can support rich communities of water plants, including rare and declining species
- Water plants are important for supporting a range of other wildlife
- Non-native water plants often need to be controlled to maintain navigation and protect native wildlife

Floating water plantain *Luronium natans* (Hans Dekker, Saxifraga Foundation)

Water plants on the Monmouthshire and Brecon Canal

Tubular water dropwort *Oenanthe fistulosa*

Emperor dragonfly on emergent vegetation (Willem Jan Hoeffnagel / Saxifraga Foundation)

Diversity of water plants

Water plants are an integral part of the biodiversity of canals, upon which much of the biological community of the waterway depends. For some water plant species, which have suffered from the effects of pollution and habitat loss, canals may be among their few remaining strongholds. Their slow flows and managed water levels provide a unique habitat that has become vital for conserving their populations.

The greatest variety of water plants is usually found in canals which have fewer boats, and where water is clear and undisturbed. Some waterways are designated as Sites of Special Scientific Interest (SSSIs), or even have international wildlife status, because of their plant communities. Two of the most important, and rare, water plants that are found in our waterways are the floating water plantain and the grass-wrack pondweed. The tubular water dropwort is another conservation priority. For special plants such as these, work is undertaken to protect populations and provide the conditions they need, such as managing shade levels and competing species, and maintaining water quality.

In canals with regular boat traffic, the variety of water plants tends to be more limited. In navigations with large quantities of common water plant species, like fennel-leaved pondweed, it may be necessary to cut aquatic plants to avoid them tangling and blocking boat propellers. In busy canals, boats can affect plants through direct damage and because of currents and waves from boat wash. More boat movements lead to increased turbidity, reducing the light for life below the water. In busy channels, water plants may be limited to tough species, such as broad-leaved pondweeds, which can be found at the margins. The emergent plants of the margins in these situations, are often dominated by reed sweet-grass.

Emergent and submerged plants growing at the edges of both undisturbed and busy waterways provide important habitats for a range of other wildlife and can help protect wildlife from the effects of boat wash. Water plants provide important habitat for aquatic insects, such as dragonflies and water beetles, and cover for nesting coots and moorhens, and juvenile stages of fish.

Invasive species

The connectedness of the waterway system is, on the one hand, a beneficial feature that helps desirable wildlife to colonise, disperse and thrive. At the same time, though, it provides a ready means for non-native invasive species to spread. The waterway network is home to a number of invasive water plant species, which cause a variety of problems. Invasive plant species compete with native plant species for light, space and nutrients. They spread over the water, shading out life beneath and reducing the waterway value for invertebrates, fish and birds. Sometimes they make the channel almost impassable for navigation.

Once established, these plants are hugely expensive and challenging to control, and eradication is often impossible. Floating pennywort *Hydrocotyle ranunculoides*, for example, was introduced to the UK in the 1980s. This fleshy-stemmed plant uses its roots to weave a floating mat of lush foliage. It grows very rapidly in late summer – up to 20cm per day – and is responsible for swamping waterways, crowding out native plants and taking oxygen from fish and insects. Added to this, it can grow from tiny fragments, making its removal difficult and expensive. Similarly, Australian swamp stonecrop *Crassula helmsii*, introduced in the 1970s, thrives in waterway habitats, from deep canals and reservoirs to damp ground. It forms a dense mat over the water's surface, that blocks out light and oxygen, killing aquatic species beneath it. Another species of non-native plant, water fern *Azolla filiculoides*, forms mats of vegetation so dense that they pose a hazard by appearing solid. It is entirely free-floating and so the mats can cover any depth of water.

Invasive water fern *Azolla filiculoides*

Mat of invasive Australian swamp stonecrop *Crassula helmsii*

Horse drawn boats have little impact on special water plants compared to motorised craft

Making a difference: 13

Conserving floating water plantain

The Montgomery Canal contains probably the world's biggest population of floating water plantain *Luronium natans*. The canal was closed to navigation in the 1940s but, by 1970, there was an enthusiastic campaign to restore it. As part of this restoration, it was recognised that conserving the wildlife of the canal, particularly *Luronium*, was essential. 'On-line' and 'off-line' nature reserves have been created to provide a protected environment for the plants, allowing them to thrive. Due to the sensitive nature of the Montgomery Canal, voluntary speed limits are in place along particularly sensitive lengths, as boat passage can damage the plants. We have even trialled use of a horse-drawn trip boat on one section of canal. It has far less impact than a motorised boat and this return to a historic mode of transport really draws the crowds!

We also help these rare plants in other ways. Removing tree shade and leaf litter, and dredging reedmace beds, removes competing plant growth and allows more light to reach the canal bed. Working with organisations such as Chester Zoo and the local Wildlife Trusts, we have collected *Luronium* plants from areas of abundance, transplanted them to a protected environment and allowed them to multiply. The plants have then been returned in greater numbers, to both new and existing locations, to boost the canal and reservoir populations.

Highlights

- Floating water plantain is a nationally scarce species, which can be found in Wales and our north, west and midland waterways
- 'On-line' and 'off-line' reserves can provide the plants with sheltered, undisturbed habitats
- The plants can be propagated in controlled environments away from the waterway and then translocated to suitable sites, as new populations or to boost existing numbers

Volunteers sifting through aquatic plants looking for *Luronium natans*

An 'on-line' aquatic plant reserve along the banks of one of our waterways

Making a difference: 14

Special water plant reserves

Some native aquatic plants are particularly sensitive to sediment build-up and disturbance from boats. On several of our waterways, we are working with partner organisations to protect and improve conditions for these water plants. Special refuges are constructed within the canal, called 'on-line reserves'. Here, we stake Nicospan geotextile in place, creating a permeable wall one metre or more from the canal edge, in the water. This forms a barrier to silt and improves water clarity behind it, allowing sensitive plants to thrive.

As part of the restoration of the Montgomery Canal, nature reserves have been created, known as 'off-line reserves'. These are linked to, but separate from, the channel of the canal. The reserve at Brithdir Locks, near Welshpool, is typical. A proportion of the flow from the bye-wash of the lock is diverted into a series of ponds created on adjacent land. In some locations, there are desirable species of plant close by and, here, natural colonisation of the reserves will take place. On other sections, species like floating water plantain *Luronium natans* and grass-wrack pondweed *Potamogeton compressus* have been introduced through planting. Like the canal, these reserves are artificial structures that require regular maintenance to help the special plants to thrive and keep more aggressive vegetation at bay.

Highlights

- Canals support a variety of water plants, some of which require good water clarity and little disturbance by boats
- We are helping these plants, by installing 'on-line' and 'off-line' reserves
- These reserves need regular maintenance, to help the special plants to thrive

Nicospan 'on-line' reserve on the Ashby SSSI, protecting water plants during the annual Shackerstone Family Festival

Examples of what we do:

Control of invasive non-native aquatic plant species such as floating pennywort, Australian swamp stonecrop and water fern.

Protection of rare water plant populations and their habitat. An important example is floating water-plantain *Luronium natans*.

Locally manage non-native animal species. This can include managing fish such as carp which, when occurring in large numbers in a particularly sensitive location, can impact water plant numbers and diversity.

Improve water quality. We work with partners and stakeholders including regulators, water companies, fishing clubs, landowners and others to prevent or reduce phosphorus entering our waterways, from adjoining farm land and sewage treatment works.

Dealing with polluting discharges and drains in to our waterways.

Creation and management of 'in-channel' aquatic plant reserves and, where relevant, making connections with other plant populations. For example, we install 'silt curtains' using suspended or staked geotextiles to locally improve water quality and reduce disturbance.

Actions to reduce blue-green and other algal blooms in the water.

Dredging to remove silt. This reduces the amount of sediment in the water that will otherwise get stirred up by water flows, passing boats and other activities (resuspension). Suspended sediment can impact aquatic plants, by covering or smothering them and by reducing light levels in the water.

Planting to extend, connect and fill gaps in habitat. For example, we plant aquatic vegetation and create reed beds or reed islands, to enhance marginal reed fringes.

Aquatic invertebrates

Perhaps the most diverse wildlife group found in our waterway system is the aquatic invertebrates. From tiny limpets and impressive swan mussels, to endangered white-clawed crayfish and brilliantly coloured dragonflies, invertebrates come in all shapes and sizes and are an integral part of the waterway ecosystem. Most aquatic invertebrates are found in the margins of the waterways, especially when these are well vegetated. These areas provide the best food and shelter, and are least disturbed by boats. Invertebrates are vital in the food chain, feeding on smaller aquatic organisms and themselves being preyed upon by fish, birds and mammals, making them an even more valuable part of our waterway wildlife.

Key points

- A great diversity of aquatic invertebrates inhabits our waterways
- Invertebrates play a vital role in the waterway food chain
- Management of habitats to conserve and enhance aquatic invertebrate communities is an important part of our work

Broad-bodied chaser © Saxifraga / Willem Jan Hoeffnagel

Zebra mussels on wall of drained lock during lock gate replacement work

The non-native American signal crayfish is an invasive species of our waterways

Species diversity

An impressive array of aquatic invertebrates can be found in our waterway system. Species range from those that are highly sensitive to pollution, silt, and disturbance by boats, to tougher species that are widespread on the waterways. Some non-native species can cause problems for the waterway ecosystem and need to be controlled. Other native species are priorities for conservation. Waterway management must take all these needs into consideration.

Molluscs

The waterway network has a diversity of molluscs including water-snails, winkles, mussels, tiny cockles and limpets. One of the biggest molluscs of our waterways is the swan mussel. They live in the muddy sediment at the bottom of the canal, filtering the water for tiny particles of food. Swan mussels are sensitive to canal maintenance, such as de-watering and dredging. If stranded they may die, but they will move into a central pool if this can be left for them. The non-native zebra mussel is less welcome in our waterways. They can have a detrimental effect on native swan mussels, and can drastically alter the ecology of the waters in which they live.

Crayfish

Crayfish are not fish, but crustaceans, a type of invertebrate. The white-clawed crayfish is the UK's only native crayfish, but has been declining rapidly since the 1970s and is now a protected species. This secretive creature looks like a miniature lobster but is rarely seen, having a liking for reedy fringes and underwater crevices in walls in which to shelter. The other crayfish species found in our waterways are not native to this country, the most widespread of which is the American signal crayfish. This aggressive species breeds faster than our native crayfish and damages banks with its burrowing. It also carries a fungal disease called 'crayfish plague', which is harmful to our native species.

Beetles, backswimmers and boatmen

Some of the most visible of the aquatic invertebrates are the ones that live on or just under the water surface. Black whirligig beetles are a common sight, skimming rapidly over the water surface, preying on other small invertebrates on the water. There are many species of aquatic beetle in our waterways, including some very rare ones. Also well-known are water boatmen – water bugs, some of which swim on their fronts, and others on their backs which, to avoid confusion are now known as backswimmers. Backswimmers are carnivorous, eating tadpoles, insects and even small fish, while water boatmen are vegetarians.

Lesser water boatman
© Saxifraga/Kees Marijnissen

Dragonflies and damselflies

Some of the most familiar and beautiful aquatic invertebrates are damselflies and dragonflies, a typical sight on a warm summer's day by the water. Damselflies are the more delicate of the two, thinner and with wings that fold over their backs when at rest and feeding mainly on mosquitoes, midges and other insects. The dragonfly is a voracious hunter, both underwater in its aquatic larval stage, when it will even take small fish, to its peak as a flying adult when it feeds on other invertebrates. The reed fringes of many of our waterways provide excellent breeding sites and hunting grounds for these insects.

Our maintenance programme involves the creation and improvement of canal banks with aquatic invertebrates such as dragonflies in mind. In the past, any work on canal banks would have involved steel sheet piles. Today, with our greater emphasis on habitat creation, an increasing proportion of this engineering work involves the creation and restoration of soft banks using coir rolls, staked geotextile or hazel faggots. This allows the growth of reed fringes, ideal habitats for many invertebrates. The roots of these plants protect the bank from erosion.

Banded demoiselle, a gracious type of damselfly
© Saxifraga / Ab H Baas

Aquatic plants are important for aquatic invertebrates, such as these mating large red damselflies

Aerial view showing a silt curtain. You can see the difference in the water quality either side of the curtain. The dark areas are clear water. The brown water contains much more suspended sediment

Making a difference: 15

Silt curtains for dragonflies

Water quality for wildlife in our canals can be improved with the use of 'silt curtains'. A silt curtain is like a giant sieve, made from a flexible material. It is weighed down to the canal bottom with chains and has floats to support it at the water's surface. The silt curtain acts as a barrier to boats, and slows down the movement of the water. When sediment and silt get stirred up into the water column by boats, it will tend to resettle around the margins of the water bodies, smothering plants and affecting the aquatic invertebrates that live there.

Silt curtains prevent the stirred up sediment from reaching the marginal habitat and are particularly good for some species, like the common hawker dragonfly, which prefer cleaner water. Dragonflies can spend from one to five years living under water. When they are ready to transform into adults, they will climb up a tall piece of vegetation and free themselves from their larval exoskeleton. After their fragile wings have hardened, they take flight for the first time and find food or mate. The difference that silt curtains can make can be seen in the increase in biodiversity and is clearly visible from above.

Highlights

- Silt curtains prevent silt from collecting in areas where it can become a problem
- Silt curtains provide a barrier to boat movements
- Aquatic invertebrates will thrive in water bodies with good water quality

Silt curtain rolled out, ready for installation

Dipping platform being used by a school group

Making a difference: 16

Dipping in the shallows

Beneath the water's surface, down in the depths of the waterway, there is an entire world of aquatic invertebrates waiting to be discovered. Across our waterways, we have designed and built a variety of dipping platforms, to be used by visiting school groups and public alike. The dipping platforms act like a jetty, allowing people to safely reach out into the water with nets to see what they can catch. The best pickings can be had from amongst the vegetation along the edges, as this is where the majority of the water-residing invertebrates, or 'minibeasts', can be found. Some gentle sweeping with the net amongst the rushes and reeds, and the occasional deeper dip down to the mud at the bottom, should yield good results.

Certain species are less tolerant of cloudy water and will only be found if the water is clean and clear, like alderfly larvae. Catching the animals and bringing them to the surface allows them to be seen properly. Many of the minibeasts look quite alien and unusual: water scorpions, caddisflies and dragonfly larvae, in particular, giving people a glimpse into a rarely viewed ecosystem.

Highlights

- Dipping platforms provide an opportunity for people to discover more about life below the water's surface
- The platforms allow safe access for catching aquatic invertebrates
- Often, people will not have seen many of these species before

Water scorpion

Examples of what we do:

Protection of aquatic invertebrate populations and their habitats. These include, for example, native white-clawed crayfish, dragonflies, native mussels and special water beetles.

Localised management and control of problem invasive non-native animal species. This can include dealing with invasive non-native shellfish, such as the American signal crayfish or zebra mussel, and removal of the non-native fish zander, during fish rescues undertaken to facilitate canal maintenance and repairs.

Actions to reduce phosphorous in our waters. For example, we aim to prevent or reduce high levels of phosphorus entering our waterways from adjoining farm land or sewage treatment works by working with partners and stakeholders. These include organisations such as regulators, water companies, fishing clubs and landowners.

Improvements to reduce blue-green and other algal blooms in the water.

Dealing with polluting discharges and drains in to our waterways.

Control of invasive non-native aquatic plant species, such floating pennywort and water fern.

Creation and management of 'in channel' aquatic plant reserves, including installation of 'silt curtains' or other on-line 'linear plant margins', using suspended or staked geotextile to locally improve water quality and reduce disturbance. These areas can also be very beneficial for aquatic invertebrates.

Improvement of connectivity and habitat. This includes, for example, diversity planting within existing reed fringe and banks with native local species, planting of aquatic vegetation and installation of reed beds or reed islands. All of these improvements also create better water quality.

Creation and restoration of natural canal banks. This can include the introduction and rebuilding of good bankside habitat with soft soil banks and reed fringes or repair of stone waterway walls with crevices suitable for our native crayfish as well as aquatic invertebrates.

Dredging to remove silt, thereby reducing the amount of sediment in the water that will otherwise get stirred up by water flows, passing boats and other activities (resuspension). Suspended sediment can have an impact by covering and smothering aquatic invertebrates and the habitats they depend on, including the river gravels and aquatic plants.

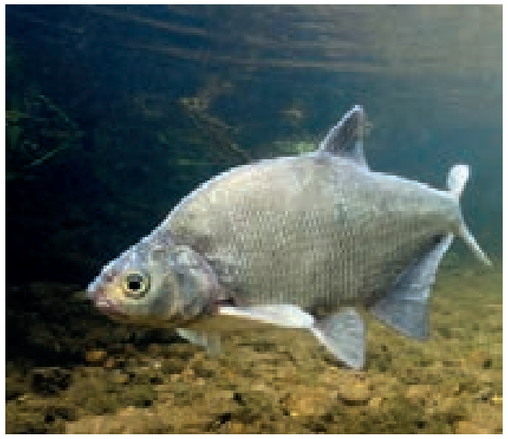
Fish

Submerged in our network of waterways is a huge variety of fish, a major part of our waterway biodiversity. Both rural and urban canals support coarse fish populations, including bream, perch, roach and tench. The greatest variety of species is found where there are vegetated margins and some waterside trees. Less common fish, such as bullhead, spined loach, sticklebacks and eels, can also occur in our waterways. Some canals and rivers have thriving salmonid populations, including trout and salmon. The waters of the quieter side arms and undisturbed channels have a different type of fishery, including species such as dace, rudd and barbel. We undertake a range of activities to manage and protect our fish populations and their habitats.

Key points

- Our urban and rural waterways have a large and varied fishery
- A range of habitat improvements are undertaken to benefit fish populations
- These include habitat enhancements, dredging, control of invasive non-native species, and protection of rare species

Pike



Bream

Perch

European eels can be found in our waterways

Fish in our waterways

Navigated canals have a characteristic coarse fishery of species able to live in sediment-rich water, dominated by roach, gudgeon, bream, rudd, tench and perch. As well as species more generally prized by anglers, our waterways have many other fish species. Some, like minnows or sticklebacks, are well known but less common. Others are rare, or even protected, adding to the fishery's biodiversity value. Such special species include allis and twaite shad, spined loach and lampreys. These only occur in certain waterways and are often limited to lengths with particular conditions, such as rivers, estuaries and combined river and canal channel. Bullheads are another threatened species; these small fish are largely found in cleaner, stony waters and around the brickwork at canal locks.

One of the most fascinating fish in our waterways is the endangered European eel. Eels have an extraordinary life cycle, spawned as larvae in the Sargasso Sea near Bermuda, before travelling with the Gulf Stream to Europe, developing into tiny transparent elvers known as glass eels. When they reach coastal areas, they migrate up rivers and streams. However, their migration into the upstream waters where they mature has many obstacles. Weirs make it difficult for the elvers to complete their journey unless we install special passes to allow them to pass unhindered. Eels prefer dark waters with plenty of silt and mud at the bottom; large eels up to 9lb have been caught in lock chambers, during lock repair works on our canals. At between 8 and 18 years, the mature eels then head back across the Atlantic Ocean to the Sargasso Sea to spawn. They can live to be 100 years old.

Some non-native fish can affect the biodiversity of our waterways. A notable example is the zander. Introduced into some midland canals in the 1970s, the zander, native to continental Europe, is now expanding its range rapidly. A predator of small and medium sized fish, zander are particularly well adapted to muddy waters and navigated canals. In turbid canals, many of the native fish populations where zander have been illegally introduced have suffered greatly from the aggressive feeding of this top predator. It is still not clear whether natural fish populations of species such as gudgeon will ever fully recover here. Electro-fishing and seine-netting operations to remove zander are expensive and labour intensive, and have only been partially successful in controlling this invader.

Fishery management

A number of factors impact fish populations in our waterways. Fish can suffer from the effects of pollution incidents, and other changes to their habitat. For example, too much sediment can smother fish eggs and gravel in spawning grounds and reduce light levels, leading to loss of aquatic plants. Non-native plants quickly spread, shading out submerged plants and lowering the habitat quality for fish and other aquatic life, while non-native fish can over-graze vegetation, disturb the waterway bed, and cause predator-prey imbalances. On some waterways, weirs may limit the ability of fish to move freely within the system.

We undertake a range of management actions to help avoid or counteract these impacts, for example, dredging to remove silt, providing fish passes so upstream migration can occur, controlling invasive non-native species, and rescuing fish from pollution incidents. Many general habitat improvements also help fish – vegetated margins in channels and soft waterway banks help provide breeding and spawning habitat, and overhanging vegetation provides shelter for adult fish. Fish rescues, undertaken when canals are drained for maintenance work, are another part of fishery management. Where rare species occur, special management may be needed and planned for.

The non-native zander causes problems for native fish populations

Diverse bankside with overhanging and aquatic vegetation provides good habitat for fish

Fish rescue in preparation for canal maintenance activities

Newly installed eel tiles on a weir. Once completed, water will run down these tiles so that eels can wriggle their way up © Environment Agency

Making a difference: 17

Eel passes and floating islands

Many different fish live in our waterways and there are a number of ways we help them to thrive. One of our special fish is the eel. Both youngsters (elvers) and mature eels are found in the muddy bottoms of our rivers and canals, where they scavenge for food by night, preying on dead and dying animals, fish and invertebrates. Navigation and water control structures, such as locks and weirs, can cause obstructions to migrating eels. In recent years, we have begun installing eel passes at several of these obstruction points. Each eel pass needs to be site specific and may have a different design. They can vary from narrow steel tubes with a bed of bristles, up which the eels can wriggle, to bespoke eel tiles. These look a little like the two-dozen chicken egg trays, with knobs through which the eels can weave their way up.

We give our fish a helping hand in other ways too. For example, to help reduce algal blooms and provide food and cover for fish, we have installed floating reed rafts on some of our reservoirs. The root balls on these floating rafts dangle in the water, encouraging the growth of zooplankton, which provide a handy source of food for fish. The rafts also provide safe havens from predators, and shade on hot, sunny days.

Highlights

- Fish and eels thrive in our rural and urban waterways
- Eels travel over 5,000 km to reach our waterways, where we aim to facilitate their migration by the installation of eel and fish passes
- Floating reed islands provide great habitat and food sources for fish and help reduce algal blooms

Environmental scientist and ecologist surveying floating raft for active birds' nests before volunteers re-plant it with native reeds. The raft helps to reduce the algal blooms you can see in the water surrounding it

Wetsuit-cladded workers temporarily stunning healthy fish to capture and move them to clean water on the same canal

Making a difference: 18

Protecting fish from pollution

Water pollution is a significant issue we deal with on a regular basis. Pollution can range from minor oily sheens to large, industrial incidents, all of which can impact on water quality and wildlife. When a pollution incident is reported, we try to stop the pollution from spreading by using booms. Depending on the severity, we can also close the navigation until the pollution has been removed. Polluting chemicals are cleaned up using absorbent pads or by pumping the dirty water into a tanker for disposal. For large scale incidents, we work with Natural Resources Wales or the Environment Agency. They can help the fish by dosing the waterway with hydrogen peroxide, which temporarily increases the oxygen in the water.

If a pollution incident is serious, fish can, and do, die. In these situations, we call out our highly specialised fish rescue contractor. They remove any live fish, usually by electrofishing. Electrofishing involves lowering the water levels and, as workers wade through the water in wetsuits, a low electric current is applied to the water ahead of them. The gentle electric current does not harm the fish, but temporarily stuns them, making fish less likely to be damaged when collected by net and moved to nearby clean water. The contractor will also remove dead fish from the water as soon as possible.

Highlights

- Water pollution is an issue that we deal with on a regular basis
- We use a variety of methods to clean up pollution
- Fish rescues move fish out of harm's way, usually by a process known as 'electrofishing'

Environment Agency aerating the canal after a pollution incident, to save the fish

Examples of what we do:

Protection of fish such as eels and bullhead as well as their habitat.

Improve connectivity between water courses and enhancing fish passage and habitat (where practical and possible).

Localised management and control of problem invasive non-native animal species. This can include dealing with invasive non-native shellfish, such as the American signal crayfish and removal of the non-native fish zander during fish rescues.

Improving water quality and reducing phosphorus levels in our waterways. For example, we aim to prevent or reduce high levels of phosphorus entering our waterways, from adjoining farm land or sewage treatment works, by working with partners and stakeholders. These include organisations such as regulators, water companies, fishing clubs and landowners.

Control of invasive non-native aquatic plant species, such floating pennywort and water fern.

Creation and management of 'in-channel' aquatic reserves and reed fringe habitat, including installation of 'silt curtains' or other 'on-line' reserves, using suspended or staked geotextile to locally improve water quality and reduce disturbance, enhancement of marginal reed fringes, planting of aquatic vegetation and creation of reed beds or reed islands. These areas make ideal fish feeding areas, shelter and nurseries for fish fry.

Creation and restoration of natural canal banks. This can include the introduction and rebuilding of good bankside habitat, with soft soil banks and stone waterway walls (with crevices suitable for invertebrates, fish fry and native crayfish).

Measures to reduce blue-green and other algal blooms in the water. Algal blooms can remove oxygen from the water, especially overnight, reducing the amount of air available for fish.

Dealing with polluting discharges and drains into our waterways.

Dredging to remove silt. This reduces the amount of sediment in the water that will otherwise get stirred up by water flows, passing boats and other activities (resuspension). Suspended sediment can impact fish by clogging their gills, covering and smothering their habitat, river gravels and fish eggs and by reducing light levels in the water.

Amphibians and reptiles

The combination of land and water on our networks can provide perfect habitats for amphibians and reptiles. Although we usually associate our native frogs, toads and newts with water, in fact they are all terrestrial for large parts of the year, and use the waterways mainly during the breeding season. Reptiles, such as grass snakes, will hunt in or near water and need connected habitats to prevent their populations becoming isolated. Amphibians and reptiles are iconic creatures that are suffering population declines, due to the loss of ponds and other habitats in the countryside. Both groups benefit from our waterway corridors and the habitats they provide.

Key points

- Amphibians and reptiles make extensive use of our waterway networks
- Good quality terrestrial, as well as aquatic, habitats are important for these species
- Waterways can act as habitat corridors, enabling reptiles and amphibians to move and disperse

Common frog

Great crested newt © Saxifraga / Kees Marijnissen

Amphibians

Seven species of amphibian are native to Britain (smooth newt, palmate newt, great crested newt, common frog, pool frog, common toad and natterjack toad), but urbanisation and loss of habitat have reduced the areas available for these animals. Our ponds, lakes and canals can provide important places for these species to live and breed. Of the seven species, the common frog, common toad and smooth and palmate newts are most commonly associated with our waterways. However, because the newts are nocturnally active, hiding under stones or logs during the day, they are rarely seen. Out of the three newts, the great-crested newt is the largest and rarest. It has particular habitat requirements that are not common along our waterways, but can be found in some of our waterway ponds.

The best-known amphibians of our waterways are the common frog and the common toad. Both breed in the waterway margins, and are most successful in quiet side waters, wides or ponds where there are no fish. Waterways with shallow margins, soft bank protection and adjoining hedgerows are ideal for them. Within the water, a mixture of submerged, floating and marginal plants gives them, their eggs (spawn) and tadpoles some protection from fish. On land, rough grassland, hedgerows and scrub provide good habitat for the adults to forage for their invertebrate food, and hibernate. The most obvious signs of these species can be during the breeding season, when their spawn can be spotted in the water: frogspawn in clumps and toadspawn in strings.

Newts have a similar life cycle to frogs and toads, hibernating through the winter months and returning to breeding ponds in the spring. Like other amphibians, they are terrestrial for parts of the year and use ponds and other waters mainly during the breeding season. Newts are carnivorous and will eat anything they can catch, from worms and water snails to other invertebrates and insects, so habitat management that encourages a diversity of invertebrates will also help newts.

Clumps of frogspawn

Common toads need both terrestrial and aquatic habitats © Saxifraga / Jan Nijendijk

Reptiles

Of the six reptiles that are found in Britain (sand lizard, common lizard, slow worm, smooth snake, grass snake and adder), the species most likely to be encountered on our waterways is the grey-green grass snake. This placid, sun-loving creature is shy by nature, and enjoys basking on grassy banks on warm summer days. Grass snakes are equally happy on land and in water, and can sometimes be seen swimming across the canal or sunning themselves on towpaths. Their favoured prey are amphibians and fish, so the waterways and their adjacent habitats provide plentiful food.

The other reptile most likely to be seen is the slow worm. Neither a snake nor a worm, the slow worm is in fact a lizard, and the most common reptile in Britain. All reptiles need external warmth to raise their body temperatures and become active. Sheltered, relatively open habitats with diverse vegetation will provide slow worms with different places to take cover or bask, depending on the weather conditions. Where there are edges of rough grass, slow worms and common lizards can be found basking and feasting on insects; they also take advantage of built structures as sun traps. Reptiles hibernate during the winter, either singly or communally. They will usually choose sites such as old animal burrows, rotted tree stumps or under fallen logs. Their hibernation sites need to be free from flooding and in warm, often south-facing, locations.

Reptiles do not disperse very far, so all their habitat requirements must be met in relatively small areas. The linear nature of our waterways can act as excellent habitat corridors for these sensitive animals, linking populations and helping them to colonise new sites. Managing the hedgerows, grassy banks and towpaths sympathetically, for example, leaving patches of scrub and not mowing all of the vegetation too often, will help these species to thrive.

Grass snakes are good swimmers © Saxifraga / Bart Vastenhouw

Common lizards can be found basking in sunny corners

Patches of scrub along our waterways are perfect reptile habitat

Grass snake on a tree over the water

Making a difference: 19

Graceful grass snakes

Grass snakes living on the banks of our canals take advantage of the amphibians using the waterways, including toads; grass snakes are one of the few predators able to tackle the toxins in the toad's skin. In hot weather, it is not unusual to see grass snakes swimming in the waterbody, probably hunting for frogs on the move, but in the height of summer they may also swim in order to cool down.

Altering the grass mowing regime to allow a wide waterway fringe greatly benefits the shy grass snake, and its favourite prey item, the common frog. Sometimes grass snakes can turn up in surprising locations; coir rolls, used in soft bank protection, left in a yard for a while, can soon become a refuge for grass snakes to hide in. When we undertake vegetation works along the waterways, we often leave piles of cut branches and brash on the bank, as a habitat pile. These stacks of vegetation will provide a home for a variety of insects, and small mammals, such as field mice and bank voles. This, in turn, produces a rich bounty for the hunting grass snake.

Highlights

- Wide waterway grassy fringes benefit grass snakes and their prey
- Timber and hedge cuttings left in purposeful mounds provide refuge for amphibians, and sometimes egg laying sites for grass snakes
- Improving habitats for amphibians will benefit the reptiles which prey on them

Grass snake breeding pile built by volunteers

Smooth newts in a newt trap, temporarily captured during the survey

Making a difference: 20

A fishy problem

Food webs in our waterways can be complicated, and sometimes we need to intervene to get the balance of predators and prey right, and give some species a helping hand. Toad tadpoles are distasteful to fish, and the adults will actively seek out habitats with fish living in them. However, other species of amphibians in our waterways will do their best to stay out of the way of fish to avoid being eaten. The smooth newt, for example, particularly likes weedy margins, where its tadpoles can hide away from fish. Common frog tadpoles are consumed by many predators including fish, and are also essential prey items for the endangered great crested newt.

One of the most beneficial enhancements for amphibians is to dig new ponds planted with plenty of native, marginal plants, and try to keep fish out. During the restoration of the Montgomery Canal, a population of rare great crested newts was found near Crickheath. By creating a series of ponds adjacent to the canal, we are safeguarding the population from the presence of fish. The ponds also provide habitat for a diverse range of invertebrates, themselves prey for the amphibians.

Highlights

- Some waterway species need a helping hand to escape from their natural predators
- This can involve creating special habitats for them
- By creating ponds without fish, we can give rare great crested newts a better chance of survival

Ponds being constructed on the Montgomery Canal to create new great crested newt breeding habitat, once the vegetation is well established

Examples of what we do:

Protection of amphibian and reptile populations and their habitat. These include the great crested newt, slow worm and common lizard.

Improve connectivity of the linear aquatic habitat. This can be done through, for example, creation and maintenance of 'in channel' aquatic plant reserves, enhancement of marginal reed fringes, planting of aquatic vegetation and installation of reed islands.

Control of invasive non-native aquatic plant species such as floating pennywort and water fern, which can outcompete native plant species and create too much shade in the water.

Delivery of water quality improvements. Measures include the creation and management of reed beds, dealing with polluting discharges and drains in to our waterways and working with catchment groups to reduce run-off of phosphorus, sediment or soil from adjoining farmland into ponds, rivers or streams.

Localised management of invasive non-native animal species. This includes removal of the non-native fish zander during fish rescues which are undertaken to facilitate canal maintenance and repairs. It also includes the regulation of fish stocking, where amphibians such as great crested newt are present in ponds and other water bodies.

Adapting the intensity of grass cutting on canal banks and waterway verges. We can increase the cutting height, reduce the frequency or not cut at all (where possible and practical). We can apply changes to timing and reduce the speed of grass cutting, to avoid harm to amphibians and reptiles.

Keep rough grassland/scrub areas and manage hedgerows, to extend their life and improve the structure for the benefit of wildlife.

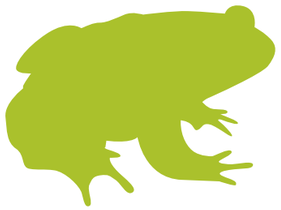
Reconnecting terrestrial habitats by planting new hedgerows and filling in gaps with new planting.

Constructing wood stacks or 'habitat piles' and 'dead hedging'. We aim to re-use the cuttings when hedgerows or trees are managed, to create new habitats as refuges for invertebrates, reptiles and small mammals.

Provide opportunities for reptiles and amphibians in built structures, such as bridges and locks, by incorporating suitable crevices.

Leave fallen or felled dead-wood in situ (safety and local practicalities permitting).

Manage dominant terrestrial non-native plant species, such as Japanese knotweed.



Pollinators

The sight and sound of bumblebees droning from flower to flower and the fluttering of brightly coloured butterflies are quintessential to a summer's day. Yet they are not only lovely to see and hear alongside our waterways– these, and other insects such as hoverflies, honeybees and moths, are also performing vital work as pollinators of our wildflowers and fruits, vegetables and crops. Sadly, many pollinators are in trouble, largely due to the loss of flowery habitats and the use of pesticides on farmland. The waterway network, with its flower-rich towpaths, verges and embankments, hedges, grassland and scrub can provide excellent foraging habitat, as well as places to nest and breed, and will help a whole range of nectar-feeding insects.

Key points

- Pollinators benefit from flower-rich habitats next to canals and other waterways
- Other habitats, such as hedgerows and tussocky grass, provide much-needed shelter and places to breed and overwinter
- By managing these habitats in the right way, we help these vitally important yet declining insects

Bumblebee

Tussocky grasses and gnarled tree bases can provide nesting places for bumblebees

Beetles such as this rose chafer are lesser known pollinators

Pollinator requirements

Pollinators are vital both for native plant communities and for the productivity of many agricultural crops. Wild pollinating insects in Britain include bumblebees, hoverflies, various other flies, moths, butterflies and beetles, yet many of these are declining. Insect pollination in the UK is one of the 'ecosystem services' that biodiversity provides, thought to be worth more than £400 million each year to the economy. We provide as many flower-rich habitats alongside our waterways as possible, to help encourage and support populations of our precious pollinators.

The UK has 25 species of bumblebee and around 59 species of butterfly. These are dwarfed by the number of moth species, at around 2,500! Sadly, pollinators such as bumblebees, butterflies and moths have struggled in recent years. Wider countryside species have fared especially badly, and it is generally agreed that loss of wildflowers in the landscape has been a major factor. Other causes, such as pesticide use, are also implicated.

Pollinating insects have interesting and varied life cycles, but what they need above all are flowers. Bumblebees, for example, drink nectar and eat pollen - nothing else. Their lifecycle begins in spring, when a queen that has overwintered will emerge, feed on nectar to restore her energy, choose a nest site (which may be a hole in the ground or in tussocky grass) and lay eggs. She collects pollen and nectar from flowers to feed her first brood of larvae, which develop into adult bees and look after the next brood.

Butterflies and moths also need flowers as sources of nectar. They have complex life cycles, with egg, caterpillar, pupa, and adult stages. Some butterflies live as adults for only a few days or weeks, while other species live for many months and hibernate over the winter. As well as flowers for nectar, butterflies and moths must find the right foodplants for their caterpillars, with different species requiring different foodplants. A mix of native wildflowers, hedgerow shrubs and trees will help meet their needs.

Managing habitats for pollinators

Our waterways have a range of valuable habitats for pollinators. They include flowery verges, hedgerows with flowering shrubs such as hawthorn and, of course, waterside flowering plants such as water-mint and meadowsweet. Leaving verges and banks uncut during the summer will allow plants to flower, providing nectar and pollen.

Encouraging a diversity of plants is important, since pollinators have different requirements. For example, bumblebee species tend to feed on a variety of flowers, with long-tongued and short-tongued bumblebees generally feeding on deep or shallow flowers respectively. Because pollinators are on the wing at different times throughout the spring and summer, it is important to have a succession of flowering plants through the season. Self-heal, primrose and lady's smock are just a few spring favourites, summer nectar sources include clovers, knapweeds, marjoram and thistles, while bramble and ivy are important sources of nectar for the later flying insects.

A diversity of plants will also benefit other pollinators, such as butterflies and moths, which need caterpillar foodplants as well as nectar sources. Tussocky hedgerow bases, old wood, and grassy banks are valuable habitats and may all be used as nesting places by bumblebees. Sheltered habitats are especially important for pollinators, so keeping hedgerows, scrub and sunny woodland edges in good condition and letting shrubs and trees flower, will help provide ideal conditions.

Encouraging pollinating insects leads to plentiful orchard fruit

Species-rich grasslands next to waterways will attract a diversity of pollinators. This grassland has bee orchids, where part of the flower resembles a bumblebee!

Flowering ivy in hedgerows provides much-needed nectar in late summer

Insect hotel

Making a difference: 21

Building a hotel for pollinators

Bees, ladybirds and butterflies can now experience five-star luxury accommodation, thanks to the new insect hotels that we have installed at various locations across the waterways, with the help of our volunteers. Insect hotels are a fantastic way to recycle many materials that may have otherwise been thrown away, and are really easy to assemble. They are built using a sturdy base of wooden pallets, placed one on top of another, to create a tall stack. Each of the 'floors' between the layers of pallets is then filled with anything that creates a safe refuge for the insects to take shelter in. We have used broken bricks, snapped bamboo canes, small rocks, bark chippings, and dead leaves and branches, to mimic the habitats that the insects naturally use. Many of the building components have been donated to us from builder's merchants and garden centres, who would otherwise have sent them to landfill.

The insect hotels provide a safe, stable shelter from the cold weather in winter, and their nooks and crannies provide a variety of places to hide from predators or hunt for prey. A healthy insect population is essential for the health of the wider wildlife population, playing a crucial role in everything from pollination of wildflowers, to food for birds and small mammals.

Highlights

- Insect hotels are a great way to reuse materials instead of throwing them away
- Insect hotels can be built by people of all ages and abilities
- A wide range of insects will take advantage of the shelter provided by an insect hotel

Volunteers building an insect hotel

Volunteers pruning mature orchard trees

Making a difference: 22

Pears, plums and pollinators

Orchards are a traditional feature of Britain's landscape and their presence across our waterways has been steadily declining. The Green Valleys community group teamed up with us, by planting a new fruit orchard on the Monmouthshire and Brecon Canal, near Brecon. The team planted a range of local varieties of fruit trees, which will benefit the local community as they pick the fruit and reconnect with their food.

Each spring, the trees will produce blossom, providing a rich nectar resource for a range of insect pollinators, from hoverflies to bees and wasps. There are hundreds of different species of bees, including solitary bees, like the leaf-cutter bee, which will nest in dead wood, and bumblebees who build nests in hedge banks, and all are important pollinators. Cockchafers are another important pollinator, as they lay their eggs in dead timber in orchards. As the trees mature, they will also provide shelter for other wildlife such as birds and bats, and fallen fruit will help sustain larger animals, such as badgers, through the winter.

Highlights

- Traditional orchards are a historical feature of the landscape, but are in decline
- The blossoms and fruit provide a vital food source to pollinators and other insects
- Mature orchards support a diverse range of species

Working with Green Valleys community project to plant fruit trees in a new orchard near Brecon

Examples of what we do:

Planting or seeding to increase the local, native species diversity. We aim to select native seed mixtures in preference to non-native species.

Reducing intensity of grassland cutting. We can change the timing, increase the cutting height and reduce the frequency of cutting, so that native plants can flower, set seed and spread, all of which will benefit pollinators.

Localised cut and rake and removal of cuttings on species rich grassland. This helps to improve growing conditions for special native plants. It is often carried out by volunteers.

Creation and restoration of natural canal banks. This includes introduction and improvement of reed fringes, with native local plant species, and rebuilding of good bankside habitat.

Laying of hedgerows to extend their life and improve the structure. Many pollinators will benefit from hedgerow nectar, and bumblebees will nest in tussocky hedge bases.

New hedgerow planting to extend or connect the linear habitat.

Provide opportunities for pollinators in and near structures and buildings. Some pollinators will use crevices and 'insect hotels' for nesting.

Conservation of veteran, mature and valuable trees. These can provide important sources of pollen, especially in spring.

Vegetation management to increase ground flora cover, understorey and canopy diversity. All management to increase habitat diversity will help pollinators and other insects.

Management of dominant terrestrial non-native plant species. Control of these species may be needed when they threaten native plant communities.

'Dead hedging' and construction of wood stacks. This is done by re-using the cuttings when hedgerow or tree management is undertaken and invertebrates, including pollinators, will benefit.

Water voles and otters

Water voles and otters are the most iconic of our waterway mammals and both can thrive on our network of rivers and canals. The shy and beautiful otter is one of conservation's success stories: brought back from the brink after decades of decline due to toxic pesticide-laced waterways, otter numbers are at a healthy level once again. Water voles have not been so fortunate. Loss of lush bankside habitat and the arrival of the predatory American mink have caused huge declines in the populations of these endearing animals and water voles are now a treasured sight along our waterways. Wherever possible we incorporate vole-friendly soft banks in our works, to increase the habitat available to this much-loved waterway creature.

Key points

- Both of these charismatic waterway mammals can thrive on our network of canals and rivers
- Our water vole conservation efforts focus on improving bankside habitats
- Water voles are a treasured sight along our waterways

Water vole © Mark Baker

Water vole exploring newly installed bank restoration with coir rolls © Mark Baker Education Vision

Water voles need lush bankside vegetation. Here, water vole droppings can be seen on the canalside rocks

Raising awareness of the declining water vole through information boards

Water voles

Immortalised as Ratty in The Wind in the Willows, the furry water vole is an endearing waterway character. Not to be confused with rats, the water vole is one of our most endangered species. The familiar sighting and 'plop' noise as they hit the water have declined greatly on many waterways. Water voles burrow into steep canal or riverside banks using their large, orange front teeth, to form a complicated system of underground tunnels and nesting chambers. On canals these tunnel networks do not usually extend more than two metres away from the water's edge. Water vole presence is indicated by closely grazed 'lawn' areas which can be seen around the burrow entrances. They leave latrines - piles of tic-tac shaped brown droppings - on features like rocks and tree roots, and below tussocky sedges, to mark the boundaries of their territories.

Water voles spend most of their time within two metres of their burrows and tend to occur in areas rich in dense vegetation. This affords the voles some protection from the searching eyes of their predators - mainly American mink, which have contributed to the water vole's decline. Slow-flowing, deep water such as canals, lakes and streams suit the voles, which do not have the webbed feet of most water-dwelling animals and swim with characteristic slow, doggy-paddle style swimming strokes.

We have been working to highlight the water vole's decline and boost populations for a number of years. Where possible, vole-friendly coir rolls are installed and planted along the banks of canals. The rolls protect against erosion and at the same time provide food and shelter for the animals. Hazel faggots and floating islands are planted with water-loving vegetation that is ideal for the voles to feed and nest in. By expanding their habitats and enhancing their food sources, we hope to help reverse the fortunes of this declining animal.

Otters

Over recent years, national affection and dedicated conservation efforts have helped reverse the fortunes of the otter. With its long, streamlined body, webbed toes and waterproof fur, this ultimate waterway animal thrives in clean lakes, streams, rivers and canals, as well as coastal areas and offshore islands. Otters are an indicator species – because they are at the top of the food chain, they give a good picture of the health of the general waterway environment. Despite being largely shy, nocturnal creatures, daylight sightings of otters are on the rise, as their numbers increase.

Otters prefer relatively undisturbed watercourses, with frequent dense vegetation or wooded areas which are used for resting and as breeding holts. Canals alongside rivers are ideal, as there are often quiet scrubby or wooded areas between the watercourses. Otter territories can be vast, covering up to 40 km of watercourses, with the size of their home ranges depending on the availability of food and shelter. Much of the otter's diet comprises fish (amphibians, crayfish and small mammals are also taken), so good fish stocks will help otters. Conservation effort continues to focus on encouraging natural recovery of populations through improving and extending areas of suitable waterway habitat.

Otter eating fish © Saxifraga / Mark Zekhuis

Coir rolls ready for installation, used to rebuild reed fringes. These provide habitat for fish and therefore otters

Lush species-rich reed fringe after bank restoration

Making a difference: 23

Banks fit for water voles

The work we do to protect our water voles and manage their bankside homes is more important than ever. For example, we help water voles on our waterways by adapting the grass cutting regime where we can, giving them much needed cover and food to survive the harsh winter months. Our ecologists and engineers have also developed a variety of techniques that fix different bank erosion and leakage problems, whilst protecting and repairing deteriorating water vole habitat. For instance, we have pioneered a technique to repair failing canal banks, using a geotextile fabric called Nicospan. This is installed on posts below the waterline to rebuild and protect the bank, leaving water voles and other wildlife such as amphibians with access to their natural habitats, both above and below water.

Recent years have seen an increase in major flooding events. High water levels on rivers can wash away water vole burrows and reed fringes, and the sheer force of water can displace voles, leaving them vulnerable to predation or further environmental stress. The amazing engineering of our canals, though, often means that water levels fluctuate far less than some of our other waterways and rivers. This feature of canals can be really important for helping create a relatively stable environment during winter floods, and providing a safe space for water voles to carry on their business along vegetated banks.

Highlights

- Creating and protecting habitat for water voles along waterways is a major part of our work
- Our ecologists and engineers have developed designs for canal repairs that include water vole friendly banks and reed fringes
- Canals can provide more stable water levels than rivers during flooding events, helping water voles survive

Ecologist working with Canal & River Trust construction team to install below water level Nicospan

Otter spraint

Making a difference: 24

Otters on our waterways

Otters rely on healthy ecosystems and clean water, which can be threatened by pollution and habitat loss. The Canal & River Trust has been working hard to improve water quality by dealing with misconnected drains, polluting discharges and by cleaning up pollution incidents when they happen. We have also been installing reed fringes and marginal habitats through some of our hard-engineered landscapes. These increase areas for fish spawning and fish nurseries, and also improve feeding opportunities, cover and habitat for otters. The green edges also help to hold and break down any pollutants.

The Trust works to alleviate some of the other threats faced by otters. To help avoid the need for otters to cross bridges and busy roads, specially designed otter ledges allow them to cross beneath the road. When we are consulted on new developments we often request ledges and also ask that dark corridors are protected through the sensitive application of lighting. Another threat to otters is the illegal use of crayfish traps on our waterways, which can sometimes result in the trapping of otters, which sadly drown. The recovery of otters has created concern among some angling and fishing communities, who are worried that otters are competing for the fish. In these circumstances, we can provide practical advice on how they can protect their fisheries.

Highlights

- We help otters by protecting and rehabilitating water quality, to restore the aquatic ecosystem
- We remove barriers to otters, such as roads, by providing ledges.
- We work with angling and fishing communities to provide advice on otters

Otter taking shelter in a canal bypass-weir

Examples of what we do:

Protection of existing water vole and otter populations and their habitat.

Creation and restoration of natural canal banks. Can include improvement and rebuilding of soft banks, re-planting bankside habitat and fencing of cattle-poached banks.

Incorporate soft (soil bank) and green (reed fringe and grassy bank) repairs and bank designs. We do this where appropriate and possible, rather than always using hard edging such as steel piles and concrete. This work can be done when we undertake leak stopping, channel relining and similar works.

Localised management of problem invasive non-native animal species in partnership with stakeholders. This can include American mink.

Control of invasive non-native aquatic plant species, such as floating pennywort and water fern.

Improving water quality. For example, prevention or reduction of high phosphorus entering our waterways from adjoining farm land or sewage treatment works, by working in partnership with other organisations such as regulators, water companies, fishing clubs and landowners.

Creation and management of 'in channel' aquatic plant reserves. This can include installation of 'silt curtains' or other 'on-line' water plant reserves using suspended or staked geotextile.

Improvement of habitat connectivity. We do this through extending and connecting linear marginal reed fringe habitat, along both sides or at least one side of our canals and waterways.

Dealing with polluting discharges and drains in to our waterways.

Adapting timing and intensity of grass cutting of canal banks and waterway verges. Where we have water voles, we aim to leave vegetation for cover throughout the winter. We increase the cutting height, reduce the frequency of cutting or sometimes not cut at all (where possible and practical).

Changes to other vegetation management, including scrub management. Where possible, we aim to enhance habitat, food and cover, especially during the breeding season and throughout the winter.

Planting or seeding to increase the local, native species diversity.

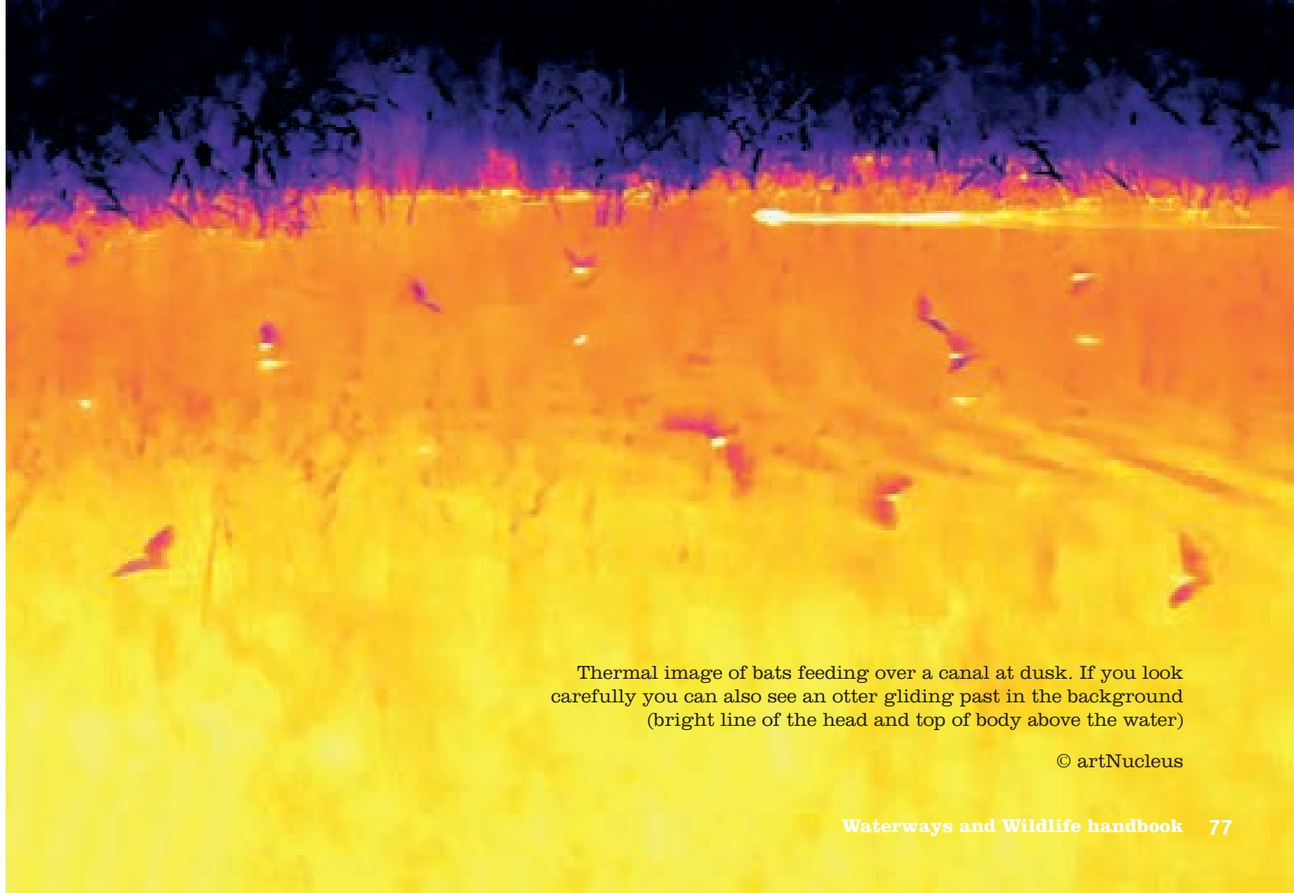
Control of terrestrial invasive non-native plant species.

Bats

Because they fly at night, bats are not seen as often as other waterway wildlife, but waterways are important for many bat species. Channels and open waters and their adjoining trees, pastures and woodlands attract a wealth of insects on which bats feed, while built structures, such as bridges and tunnels, are exploited by bats as safe places to roost and hibernate. Conservation efforts involve the protection of summer roost sites and winter hibernation sites, and the management of habitats where bats forage and commute. Our network of waterways is known to support important colonies of these social and intelligent creatures, many of which nationally are in decline.

Key points

- Many bat species are declining nationally
- Waterways can provide plentiful insects for bats to feed on, and roosting and hibernation sites in trees and built structures
- Protecting and maintaining habitats for bats is a vital part of our conservation work



Thermal image of bats feeding over a canal at dusk. If you look carefully you can also see an otter gliding past in the background (bright line of the head and top of body above the water)

Tree-lined waterway corridors are wonderful for bats

Soprano pipistrelle bat © Jim Mullholland

Tall hedgerows and treelines attract moths, one of the main foods of bats. This swallowtail moth feeds on a range of hedgerow shrubs © Rob Wolton / Hedgelink

Waterway corridors

At least 17 species of bat breed in the UK and all have become more scarce in the last 100 years, so protecting bats and their waterway habitats is crucial. The main requirements of bats are good nocturnal foraging areas and safe and undisturbed places to roost during the day and hibernate over winter. Canals and other inland waterways combine open water, hedgerows, woodlands and treelines and adjoining pastures, providing a plentiful source of the insects that bats feed on. Built structures such as waterside bridges, aqueducts, culverts, walls, buildings and tunnels are used as safe places to roost, nursery sites and hibernating sites.

Freshwater is important for all bat species. Bats drink from open water surfaces and many bat species feed on insects as they emerge from their aquatic larval stages, such as caddis flies, crane flies, midges and mosquitoes. Daubenton's bats are particularly associated with waterways, using their large feet to catch insects from the waters' surface and using nearby bridges and other structures as roosts. A varied habitat structure in the vicinity of open water will help bat populations by supporting insects, such as moths, on which they feed. Grassy margins, scrub, overhanging vegetation, aquatic plants and bankside vegetation provide excellent conditions for insects and foraging bats. Woodland that is adjacent to water is particularly valuable, as bats will be using the trees as roosts, and visiting the water to feed.

Waterways are also important because they act as corridors through the landscape, connecting foraging or roosting habitats such as other waterbodies and woodland. Linear habitats such as hedgerows and treelines next to watercourses are especially valuable for bats. Many bat species will follow landscape features that provide shelter from wind for both the bats and their insect prey, as well as cover from predators such as raptors and owls. Treelines and tall hedgerows may also be particularly important during the breeding season, when female bats return from foraging areas to their nurseries frequently throughout the night.

Roosting and hibernating

As well as feeding grounds for bats, waterways can provide a range of roosting and hibernating opportunities. Bats are most active during March to October and, during these summer months, they need safe places to roost during the day. Mature trees next to the waterway, especially oak, ash, beech and willow, have numerous cracks and crevices that will be used by bats as summer roost sites. However, smaller, younger and non-native trees can also present potential roosting features for bats and should not be overlooked. Because natural roosts like these have become scarcer, built structures have become increasingly important. Almost every waterway structure can be used, but tunnels, bridges and the underside of aqueducts are particular favourites. One of the clues that bats are around is the presence of small droppings under bridges and aqueducts. Similar in size to mouse droppings, they are characteristically dry and crumbly. Bats may travel several kilometres from their day roosts (in tunnels, bridges, or trees) each night to feed.

Bats are seldom seen in the winter. They generally select undisturbed, cool places in which to hibernate. Larger structures, where internal temperatures can remain relatively constant, are often used as hibernating sites and bats can be found hibernating in some of our tunnels. We create roosting and hibernating habitat using various special modifications to our structures, such as 'bat-bricks' in bridges, tunnels and aqueducts and 'bat grilles' which allow bats to access lock huts, lime kilns and pillboxes whilst preventing disturbance from human visitors. All bat roosts are protected by law, and disturbance to bat colonies during maintenance work on built waterway structures is kept to a minimum, by phasing works to seasons when bats are absent.

Roosting Daubenton's bats

Bat brick

Bat grille on lock hut allowing bats through but stopping disturbance from people

Roosting lesser horseshoe bat © Daniel Hargreaves

Making a difference: 25

Bats in lime kilns

One of the smallest bat species in the UK, the lesser horseshoe bat, is also one of the nation's rarest. In 2013, the Trust, with funding from The Vincent Wildlife Trust's Y Bannau – Bro'r Ystlum/Our Beacon for Bats Project (funded by the Brecon Beacons Trust and Heritage Lottery Fund), adapted one of the recently restored 19th-century lime kilns on the side of the Monmouthshire and Brecon Canal, at Brecon, to attract rare lesser horseshoe bats.

The Monmouthshire and Brecon Canal is an important foraging and commuting route for bats. The lesser horseshoe bat had been recorded in a number of rural buildings locally, but too often these buildings were being used or were threatened with development. Lime kilns played a vital role in Wales' industrial history, being used in the 1800s to produce lime mortar for agricultural use and the construction trade. In this project, the lime kiln was specially adapted with an insulated door to trap cold air, providing a safe and secure place for the bats to spend the winter hibernation and where they could not be disturbed. Regular monitoring of the site indicated that this purpose-built roost was occupied within weeks of construction. It has been used ever since on a regular basis, by up to 7 lesser horseshoes and one soprano pipistrelle.

Highlights

- Lesser horseshoe bats are one of the nation's rarest species
- Rural buildings that are used by bats are often threatened by development.
- The specially adapted lime kiln provides a secure place for winter hibernation for bats

The specialist team during the conversion of the Brecon Lime Kiln

Natterer's bat

Making a difference: 26

Bat box monitoring with volunteers

Over the last century, many traditional roosting sites on the edges of our waterways and in nearby woodland have been destroyed. Bat boxes provide bats with a safe place to hibernate and have their babies, known as pups. The use of bat boxes is a way of helping conserve bats. It can also be an effective survey technique for detecting bats, as well as an educational resource for the public.

The Canal & River Trust has successfully been running a small number of bat box monitoring schemes for ten years, with each scheme having between 30 and 130 bat boxes per site. We use Woodcrete bat boxes as these have a slightly higher success rate, afford better protection against squirrels and woodpeckers, and are more durable. Bat boxes are clustered in groups of ten, and tend to be more successful when placed along the edges of footpaths and near water.

Bat boxes can be monitored as a training event, creating a unique opportunity for people to learn more about bats, under the supervision of a licenced bat worker. They are an ideal way to see bats up close and help people training towards their bat licence. They also provide valuable data about the species of bats using the boxes and whether they are using the boxes as roosts, for mating or for raising young.

Highlights

- A number of bat species, including the rare Bechstein's bat, benefit from bat boxes
- Bat boxes offer an accessible resource for people to learn about bats and their conservation
- We are increasing our understanding of how and why bats use artificial bat boxes

Ecologist putting up a bat box, together with volunteers

Examples of what we do:

Protection of bats and their habitats. Bat species found on our waterways include pipistrelle, Daubenton's and lesser and greater horseshoe bat. All bats are protected by law.

Protect and create opportunities for bat roosts in structures such as bridges, locks and aqueducts, as well as buildings. This can include installation of bat bricks or bat boxes and incorporating crevices suitable for use by bats, particularly Daubenton's bats.

Improvement and connection of corridor habitats. These include reed fringes, hedgerows, woodland, grassland and scrub.

Adapt intensity of grass cutting of canal banks and waterway verges. We can do this by increasing the cutting height, reducing the frequency of cutting, or not cutting at all (where possible and practical).

Hedgerow management that extends hedgerow life and improves structure and connectivity. Hedge-laying and coppicing are traditional hedgerow management skills that help achieve this.

New hedgerow planting to extend or connect the linear habitat to the wider landscape. This will help improve habitat corridors for bats to forage.

Planting and maintenance of hedgerow trees within hedgerows. These can provide opportunities for roosting and encourage insects for bats to feed on.

Conservation of veteran, mature and valuable trees. These trees provide many opportunities for bats to roost.

Creation of, and allowance for, standing dead-wood and monoliths (safety permitting).

Construction of brash and timber stacks for the benefit of invertebrates, which bats will feed on.

Birds

Waterway birds are among the most visible and much-loved wildlife of the waterway network. Swans, ducks, moorhens and coots are easy to spot from the towpath. But there are many other birds along the waterways that make use of the great variety of habitats, from reed-fringes, grasslands and hedgerows, to patches of woodlands and scrub. Many of our reservoirs are important overwintering wildfowl sites and our built structures are often used for nesting. Overall, the waterways provide a home for a great diversity of resident, breeding and overwintering bird species.

Key points

- Our waterways support a rich diversity of birds
- Canals, reservoirs, hedgerows and buildings can all provide places to nest and feed
- We manage our habitats to increase their bird diversity, and some bird species are helped by special projects

Duck family

Moorhens are a familiar sight on our waterways

Grey heron

Tufted duck

Water birds

Mallards and mute swans are among the most familiar and loved birds on our waterways, common in both rural and urban areas, and happy to share their surroundings with people and boats. Other regularly seen species are moorhen and coot which occupy similar habitats, preferring shallow, still or slow-moving water including reservoirs, canals, ponds and lakes. They often breed in vegetation on the offside banks of canals, or in quiet side-waters. An unmistakable bird of our waterways is the grey heron, posing gracefully as it waits patiently for an unsuspecting fish to swim within reach of its dagger-like bill, or stalking the shallows, searching for food. Grey herons typically breed in woodland areas that are close to water, building their nests, called heronries, in the tops of trees. Another unmistakeable bird along our waterways is the kingfisher, often heard before they are seen, a high pitched whistle preceding the flash of brilliant blue as it takes flight from its waterside perch.

As well as birds that are resident all year round, our waterways attract a range of migrant species which visit only seasonally, either during winter to find shelter, or during summer to breed here. Waders are particularly easy to see during migration. When on passage, waders can end up anywhere where there are muddy margins, such as canals, rivers and reservoirs. For example, common sandpipers can be seen on river and canal banks, with their characteristic bobbing movements as they move to hunt for food. Redshanks can also be spotted on rivers and canals, identifiable by their bright red legs.

Many of our reservoirs are very important sites for wildfowl and a range of resident and migrant species can be seen including little and great crested grebes, pochard, tufted duck and common tern.

Other birds

Birds are not only attracted to our canals, rivers and reservoirs. Alongside the waterways, hedgerows, verges, woodland and scrub on cuttings and embankments will provide a diversity of nesting sites. Waterway edges will be used for drinking and feeding, as well as rich sources of food. Tussocky grasses and wildflower-rich areas will encourage pollinators and many other insects, particularly important in spring, when they are often the main food item for growing chicks. Our network of hedgerows can provide vital havens for species such as the yellowhammer, declining in the wider countryside due to intensive farming practices.

We also have larger birds: kestrels, barn owls, buzzards and sparrowhawks may be seen alongside waterways with wooded or scrubby margins, while migrants that can be seen during the summer include redstarts, whinchats and spotted flycatchers. Reed fringes and reedbeds are hugely valuable habitats for birds, with reed buntings and reed and sedge warblers among the species that regularly make their homes there.

Our built structures, too, provide homes for birds. Swallows and house martins will make use of eaves or roof voids on our buildings for their nests, while the distinctive black-and-white dipper will nest under the arches of bridges and aqueducts. All birds and their nests, whether on land or water, are protected through the breeding season, so any management works need to be timed to avoid disturbing nesting birds.

Waterways attract a great variety of birds. Their precise requirements all differ, but essentially they need food throughout the year and places to nest and raise their young. We help by managing our habitats in ways that enhance their flora and fauna, which will have benefits for all our birds. Individual species can be helped through special projects, such as the installation of barn owl boxes and nesting rafts for terns.

Yellowhammers are declining in the wider countryside. Our hedgerows provide valuable habitat for them

Reed warbler

Eaves and roof voids can make good nesting places

Grey wagtail © Stephen Shutt

Making a difference: 27

Nesting boxes for dippers and wagtails

Dippers and grey wagtails are frequently found on the fast flowing streams and rivers passing under the Monmouthshire and Brecon Canal, although they are rarely seen on the canal above. For those who take the time to stop on their journey and peer over one of our many aqueducts, these beautiful birds provide a great spectacle while foraging around the rocks below for invertebrates.

The Trust is providing some much needed nesting habitat that will help secure the future of these birds, so iconic of fast flowing streams. To this end, eleven dipper boxes have been installed under the Monmouthshire and Brecon Canal's aqueducts, with help from our volunteer ecologists. Of these, five were already being used at the start of the 2017 nesting season, only twelve months after installation. Grey wagtails often nest on operational lock gates which can make for a very vulnerable situation for the birds. As a result, boxes are being provided as alternative safe nesting places on all appropriate lock gates along the canal, the first being sited at Llangyndr.

Highlights

- Dippers and grey wagtails are frequently found on the fast flowing streams and rivers
- Dipper boxes installed on and under the Trust's structures provide this iconic bird with secure nesting habitat
- Grey wagtails often nest on operational lock gates; we provide them with secure alternatives

Volunteers installing a dipper box on an aqueduct on the Monmouthshire and Brecon Canal

Mute swan

Making a difference: 28

Protective parents and a flash of blue

One of the most iconic canal birds is the graceful mute swan, also depicted on our Canal & River Trust logo. During spring and summer, many swans nest alongside our waterways, giving people a unique 'bird's eye view' of these lovely cygnet families. Swans tend to pair up for life and go back to the same nesting site year after year, painstakingly spending 2 or 3 weeks building their nest from scratch. They lay 3 to 10 eggs, which take around two weeks to hatch. Swans can be quite protective of their nests, eggs and downy youngsters. To make sure canal visitors are aware, we can put up signs on towpaths near active swan nests.

Another fantastic waterway bird seen when out and about on our waterways is the orange fronted, luminescent blue kingfisher. Despite kingfishers being fairly common along our waterways, spotting one can be incredibly difficult. One of the responsibilities of the Trust is to cut back branches of trees alongside our navigations so that boats can pass freely and safely. When doing this we aim to take care to leave kingfisher perches, so that these colourful protected birds can continue to use these fishing spots when on the lookout for small fish and aquatic insects to eat.

Highlights

- Mute swans and kingfishers are much loved birds of our waterways
- Informing people about protective nesting mute swans in public places is part of our work
- We try to protect kingfisher perches during our waterway maintenance

Kingfisher

Examples of what we do:

Protection of birds and their habitats.

Improvement of reed fringe and aquatic habitat. We do this through, for example, creation and maintenance of 'in channel' aquatic plant reserves, enhancement of marginal reed fringes, planting of aquatic vegetation and creation of reed beds or reed islands. These are valuable areas for birds.

Measures to reduce blue-green and other algal blooms in the water. These will result in better water clarity, benefitting birds that hunt by sight.

Planting or seeding to increase the local, native species diversity for food, shelter and nesting.

Improvement of water quality by dealing with polluting discharges and drains in to our waterways.

Adapting intensity of grass cutting of canal banks and waterway verges. By increasing the cutting height, reducing the frequency or not cutting at all (where possible and practical) we can provide improved habitat for protected bird species and nesting birds in general.

Control of dominant invasive non-native terrestrial plant species to provide a more diverse habitat.

Localised management of problem invasive non-native animal species. This can include species that predate on eggs and chicks, such as American mink, and can involve partnership working.

Laying of hedgerows to extend their life and improve the structure for the benefit of wildlife including nesting birds.

New hedgerow planting to extend and connect habitats.

Planting and maintenance of hedgerow trees within hedgerows.

'Dead hedging' and construction of wood stacks. We do this to provide habitat for invertebrates and other wildlife when hedgerow or tree maintenance is undertaken.

Retaining and creating opportunities for nesting birds in structures and buildings. This includes fixing of nest boxes to posts, bridges, trees, locks and buildings (as appropriate and practical).

Conservation of veteran, mature and valuable trees will add to the available nesting and feeding habitat.

Creation of, and allowance for, standing dead-wood and monoliths (safety permitting).

Management of vegetation to benefit specific bird species. This includes, for example, clearing of vegetation from gravel beach habitat around a quarry lake site for nesting little ringed plovers.

Thomas Telford aqueduct carrying the Llangollen canal across the Ceiriog valley.

This handbook has been developed by Glandŵr Cymru (the Canal & River Trust in Wales) in collaboration with Ruth Feber at the Wildlife Conservation Research Unit (WildCRU), University of Oxford. With special thanks to the Canal & River Trust's Environment team, especially Oda Dijksterhuis and colleagues including Laura Mullholland and Robert Coles. We are grateful to the Welsh Government for funding this work, through the Green Infrastructure Capital Investment fund. Several of the examples used in this document, illustrating how we make a difference, could not have been achieved without the enthusiasm and commitment of our dedicated volunteers.

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Cover Image: Kingfisher