State of Nature 2016

Foreword by Sir David Attenborough

The first *State of Nature* report that I helped to launch in 2013 revealed the severe loss of nature that has occurred in the UK since the 1960s.

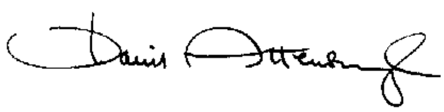
Three years on, I am pleased to see that the partnership of organisations behind that important report has grown. Thanks to the dedication and expertise of many thousands of volunteers working closely with the professionals, we are now able to document even more about the changing state of nature across our land and in our seas.

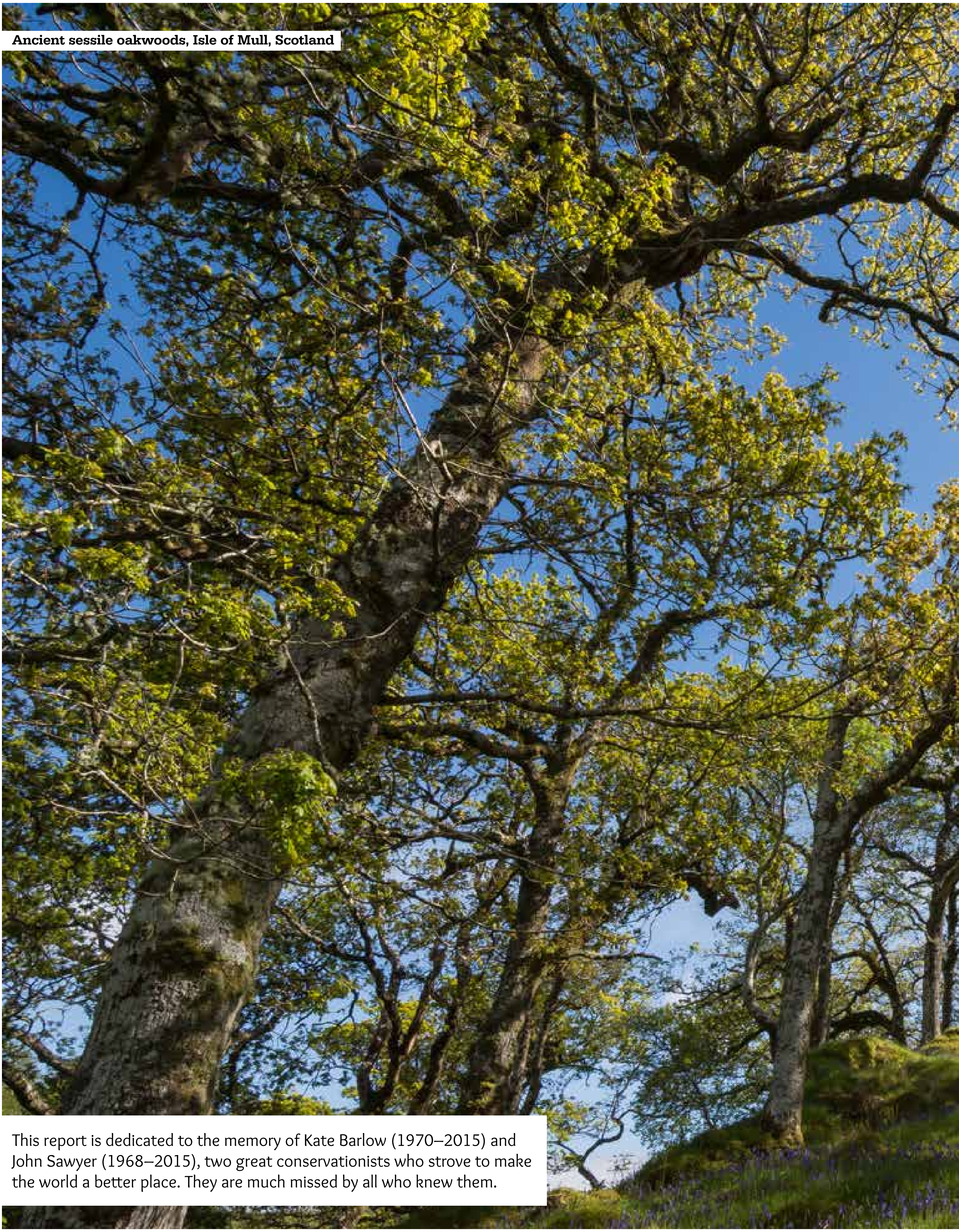
The news, however, is mixed. Escalating pressures, such as climate change and modern land management, mean that we continue to lose the precious wildlife that enriches our lives and is essential to the health and well-being of those who live in the UK, and also in its Crown Dependencies and Overseas Territories. Our wonderful nature is in serious trouble and it needs our help as never before.

But the *State of Nature 2016* report gives us cause for hope too. The rallying call issued in 2013 has been met with a myriad of exciting and innovative conservation projects. Landscapes are being restored, special places defended, and struggling species are being saved and brought back.

Such successes demonstrate that if conservationists, governments, businesses and individuals all pull together, we can provide a brighter future for nature and for people.

Helen Atkinson (Butterfly Conservation)





Ancient sessile oakwoods, Isle of Mull, Scotland

This report is dedicated to the memory of Kate Barlow (1970–2015) and John Sawyer (1968–2015), two great conservationists who strove to make the world a better place. They are much missed by all who knew them.

Sue Kennedy

Greater horseshoe bat by Dale Sutton

Contents

For guidance on how to interpret the results presented in this report, please refer to pages 72–77.

Unless otherwise stated, all photos are from RSPB Images (rspb-images.com).

This report should be cited as:
Hayhow DB, Burns F, Eaton MA, Al Fulaij N, August TA, Babey L, Bacon L, Bingham C, Boswell J, Boughey KL, Brereton T, Brookman E, Brooks DR, Bullock DJ, Burke O, Collis M, Corbet L, Cornish N, De Massimi S, Densham J, Dunn E, Elliott S, Gent T, Godber J, Hamilton S, Havery S, Hawkins S, Henney J, Holmes K, Hutchinson N, Isaac NJB, Johns D, Macadam CR, Mathews F, Nicolet P, Noble DG, Outhwaite CL, Powney GD, Richardson P, Roy DB, Sims D, Smart S, Stevenson K, Stroud RA, Walker KJ, Webb JR, Webb TJ, Wynde R and Gregory RD (2016) *State of Nature 2016*. The State of Nature partnership.

Headlines

This report pools data and expertise from more than 50 nature conservation and research organisations to give a cutting edge overview of the state of nature in the UK and in its seas, Crown Dependencies and Overseas Territories.

We present newly developed measures of change, the latest knowledge on what has driven these changes, and showcase inspiring examples of how we can work together to save nature.

Our key findings are summarised here.

- ***Between 1970 and 2013, 56% of species declined, with 40% showing strong or moderate declines. 44% of species increased, with 29% showing strong or moderate increases. Between 2002 and 2013, 53% of species declined and 47% increased. These measures were based on quantitative trends for almost 4,000 terrestrial and freshwater species in the UK.***

- ***Of the nearly 8,000 species assessed using modern Red List criteria, 15% are extinct or threatened with extinction from Great Britain.***

- ***An index of species' status, based on abundance and occupancy data, has fallen by 16% since 1970. Between 2002 and 2013, the index fell by 3%. This is based on data for 2,501 terrestrial and freshwater species in the UK.***

- ***An index describing the population trends of species of special conservation concern in the UK has fallen by 67% since 1970, and by 12% between 2002 and 2013. This is based on trend information for 213 priority species.***

- ***A new measure that assesses how intact a country's biodiversity is, suggests that the UK has lost significantly more nature over the long term than the global average. The index suggests that we are among the most nature-depleted countries in the world.***

- ***The loss of nature in the UK continues. Although many short-term trends suggest improvement, there was no statistical difference between our long and short-term measures of species' change, and no change in the proportion of species threatened with extinction.***

- *Many factors have resulted in changes to the UK's wildlife over recent decades, but policy-driven agricultural change was by far the most significant driver of declines. Climate change has had a significant impact too, although its impact has been mixed, with both beneficial and detrimental effects on species. Nevertheless, we know that climate change is one of the greatest long-term threats to nature globally.*

- *Well-planned conservation projects can turn around the fortunes of wildlife. This report gives examples of how governments, non-governmental organisations, businesses, communities and individuals have worked together to bring nature back.*

- *We have a moral obligation to save nature and this is a view shared by the millions of supporters of conservation organisations across the UK. Not only that, we must save nature for our own sake, as it provides us with essential and irreplaceable benefits that support our welfare and livelihoods.*

- *We are fortunate that the UK has thousands of dedicated and expert volunteers recording wildlife. It is largely thanks to their efforts, and the role of the organisations supporting them, that we are able to chart how our nature is faring.*

- *The UK's Overseas Territories (OTs) are of great importance for wildlife globally; over 32,000 native species have been recorded in the OTs, of which 1,557 occur nowhere else in the world. An estimated 70,000 species may remain undiscovered in the OTs.*

- *The UK has commitments to meet international environmental goals, such as those in the Convention on Biological Diversity's Aichi Targets and the United Nation's Sustainable Development Goals. However, the findings of this report suggest that we are not on course to meet the Aichi 2020 targets, and that much more action needs to be taken towards the 2030 Agenda for Sustainable Development if we are to meet the Sustainable Development Goals.*

Blickwinkel (Alamy Stock Photo)

Our key findings

Species are the building blocks of our ecosystems and we regard them as the basic measure of how nature is faring in the UK. We have updated the measures we presented in the first *State of Nature* report in 2013, and in many cases have been able to bring in new datasets and improve the underlying data measuring trends of individual species. In particular, we are now able to measure variation in trends over time for many more species, rather than just a single change over our whole study period. This means that we can detect whether the rate of change in our nature has altered in more recent years. We show trends in our species from around 1970 to 2013 (the "long term") and 2002 to 2013 (the "short term"). For guidance on how to understand the graphs presented here, as well as details of how species were assigned to our habitat categories and how our results were calculated, please turn to pages 72–77.

Trends in the abundance and occupancy of freshwater and terrestrial species

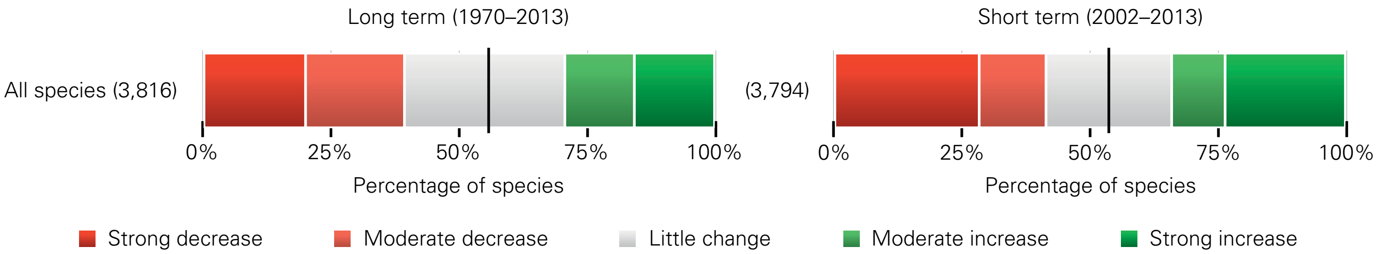


Figure 1

The percentage of species in each trend category over the long and the short term. The line in the "little change" category shows the division between declining species on the left and increasing species on the right. The values in brackets show the number of species assessed.

We have quantitative assessments of the change in population or occupancy for 3,816 terrestrial and freshwater species over the long term, and 3,794 over the short term. Over the long term, 56% of species declined and 44% increased. Among these, 40% showed strong or moderate declines, 31% showed little change, and 29% showed strong or moderate increases. Over the short term, 53% of species declined and 47% increased. Among these, 41% showed strong or moderate declines, 25% showed little change, and 34% showed strong or moderate increases.

We have fewer measures of change for our marine species, and therefore we have not presented our marine results in the same fashion. Over the long and the short term, 38% of the marine species assessed declined and 62% increased.

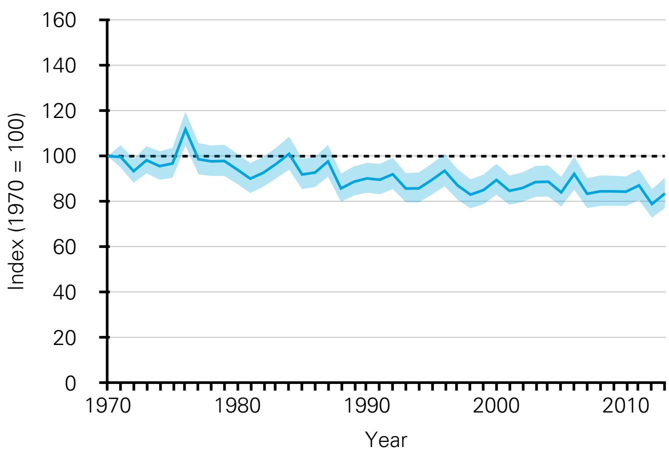


Figure 2

An index of species' status based on abundance or occupancy data for 2,501 terrestrial and freshwater species. The shaded area shows the 95% confidence intervals.

Looking in more detail, the index of change in the abundance and occupancy of terrestrial and freshwater species has fallen by 0.4% each year over our long-term period, resulting in a statistically significant decline of 16% in total. Over our short-term period, the decline was 0.18% per year, and 3% in total. There was no significant difference in the rate of change over the two periods.

Our separate measure of distributional change in vascular plants (not pictured) shows that 1,309 plants declined by an average of 11% over the long term. The short-term measure based on 515 species shows an average decline of 1%.

The index of change in the abundance of marine species has increased by 37% since 1970 (see page 45). Looking at the trends of marine species in more detail, it is apparent that one group in particular is driving this increase; when fish are excluded from the analyses, the Marine Indicator shows a decline of 14% since 1970 (see pages 45–46 for more details).

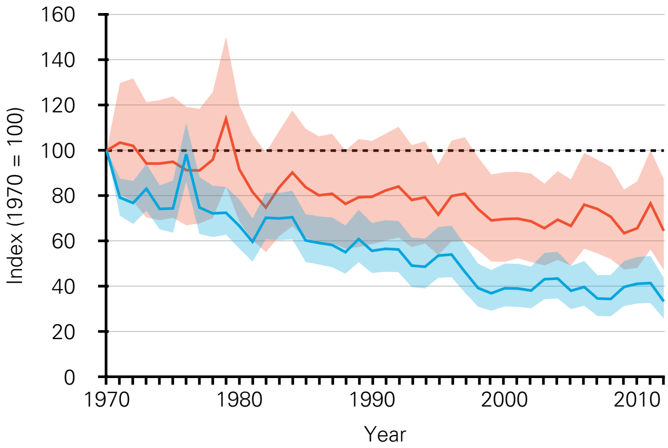


Figure 3
The UK Priority Species Indicator[1] shows the Abundance Index (blue) for 213 priority species, and the Occupancy Index (red) for 111 priority species (measured as the proportion of occupied sites). The shaded areas show the 95% confidence intervals.

The official UK Priority Species Indicator reports on the trends of the UK's highest conservation priorities. The indicator has two measures, one of abundance, the other of occupancy: since 1970 they have fallen by 67% and 35% respectively.

Over our short-term period, the indicator of abundance has fallen by 12%. Over the same short-term period the indicator of occupancy has fallen by 6%.

National Red Lists

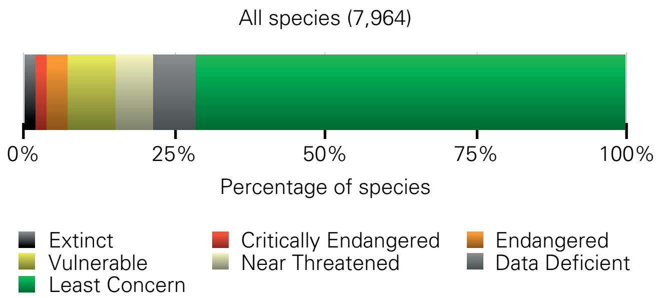


Figure 4
The percentage of species in each risk category, based on the likelihood of extinction from Great Britain. Species considered to be threatened with extinction from Great Britain are those classified as Critically Endangered, Endangered or Vulnerable in the latest International Union for Conservation of Nature (IUCN) Red List assessments.

Red Lists attempt to identify species at risk of extinction using a standardised approach that allows for comparison across species and geographic regions.

Of the 7,964 terrestrial and freshwater species that have been assessed using modern IUCN Red List criteria, 1,057 (13%) are thought to be at risk of extinction from Great Britain, and 142 (2%) are known to have gone extinct from Great Britain.

The recent *Birds of Conservation Concern 4* assessment[2], which uses different criteria from IUCN Red Lists, assessed 247 bird species. 67 species (27%) were red-listed, a substantial increase from 52 species back in 2009.

Pill woodlouse

Results in more detail

Here we delve down a little further into the headline results presented on previous pages. Our measures of the state of the UK's nature are drawn from a wide taxonomic spread of the UK's estimated 70,200 species. However, data are only available for a small proportion of these. For example, we have categorical assessments of the change in the abundance and occupancy of just 6.4% of species. There are also substantial biases and complete gaps in our knowledge; for instance, we have trends for most vertebrates, but none for fungi.

Trends in the abundance and occupancy of freshwater and terrestrial species by broad taxonomic group

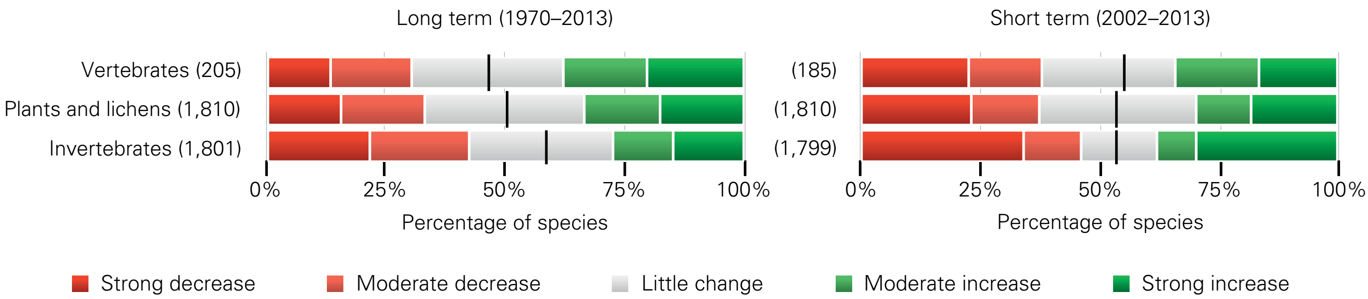


Figure 5

The percentage of species in each trend category over the long and the short term. The line in the "little change" category shows the division between declining species on the left and increasing species on the right. The values in brackets show the number of species assessed.

Over the long term, 47% of vertebrate species declined and 53% increased. Among these, 31% showed strong or moderate declines, 31% showed little change, and 38% showed strong or moderate increases. 55% of species declined and 45% increased over the short term.

50% of plant and lichen species declined and 50% increased over the long term. Among these, 33% showed strong or moderate declines, 33% showed little change, and 34% showed strong or moderate increases. Over the short term, 53% of species declined and 47% increased.

Over the long term, 59% of invertebrate species declined and 41% increased. Among these, 42% showed strong or moderate declines, 31% showed little change, and 27% showed strong or moderate increases. 54% of species declined and 46% increased over the short term.

Trends in the abundance of marine species by broad taxonomic group (see figures on page 45)

34% of marine vertebrate species declined and 66% increased over the long term. Among these, 28% showed strong or moderate declines, 14% showed little change, and 58% showed strong or moderate increases. Over the short term, 46% of species declined and 54% increased.

Over the long term, 38% of marine plant species declined and 62% increased. Among these, 6% showed strong or moderate declines, 69% showed little change, and 25% showed strong or moderate increases. 31% of species declined and 69% increased over the short term.

75% of marine invertebrate species declined and 25% increased over the long term. Among these, 38% showed strong or moderate declines, 49% showed little change, and 13% showed strong or moderate increases. Over the short term, 50% of species declined and 50% increased.

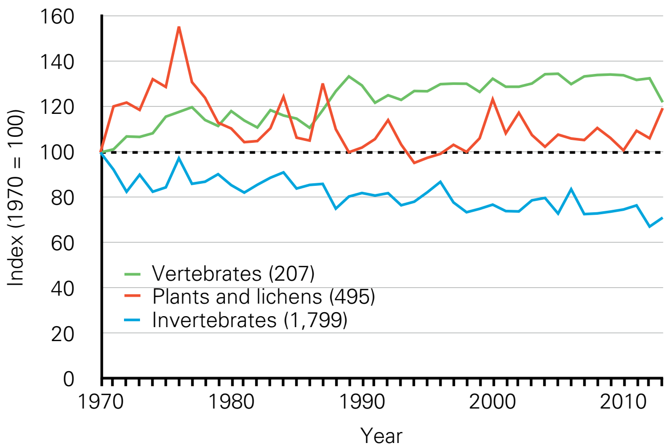


Figure 6
An index of change in the abundance and occupancy of 2,501 terrestrial and freshwater species, split into major taxonomic groups, including 207 vertebrate species (green), 495 plant and lichen species (red) and 1,799 invertebrate species (blue).

Over the long term, the index of change in the abundance and occupancy of vertebrate species increased by 18%, whereas over the short term it declined by 2%.

The index of change in the abundance and occupancy of plant and lichen species has increased by 20% over the long term, and 2% over the short term, although this is highly variable.

Over the long term, the index of change in the abundance and occupancy of invertebrate species has declined by 29%, and over the short term it has declined by 3%.

The rate of change in the short term, although marginally improved, does not show a statistically significant difference from that in the long term for any of the three groups.

National Red Lists

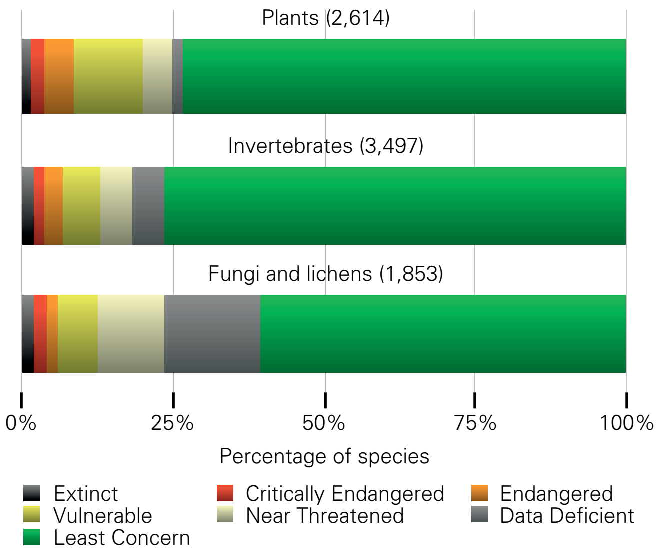


Figure 7
The percentage of species in each risk category, based on the likelihood of extinction from Great Britain, by broad taxonomic group.

Of the terrestrial and freshwater species that have been assessed using modern IUCN Red List criteria, 19% of plants, 11% of invertebrates and 11% of fungi are classified as being at risk of extinction from Great Britain.

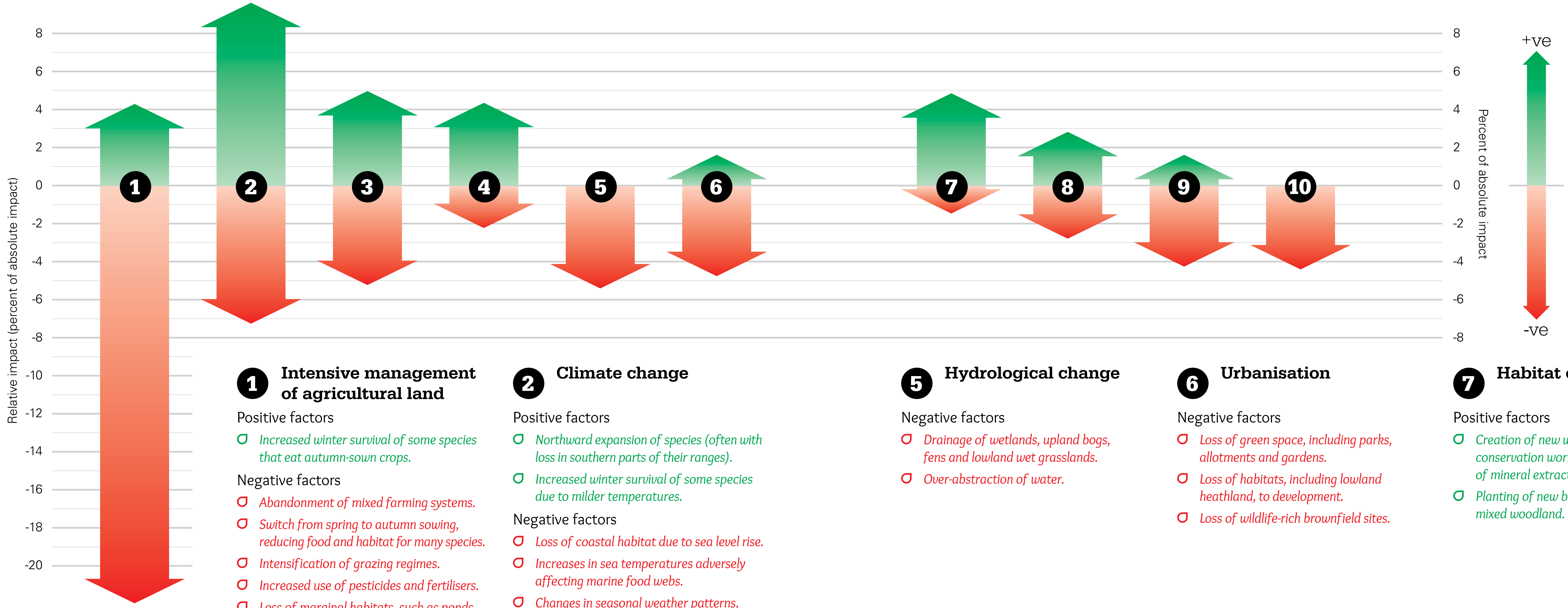
Summer lady's-tresses

Why is nature changing in the UK?

The 2013 *State of Nature* report described changes to the UK's nature over recent decades. In order to reduce the impact we are having on our wildlife, and direct our conservation response, we need to understand what caused these changes.

Following the first report, we reviewed evidence and expert knowledge explaining the long-term (c1970–2012) population trends of 400 terrestrial and freshwater species in the UK, sampled from a variety of taxonomic groups[1]. This allowed us to quantify the impact, both positive and negative, of a broad range of drivers:

- ***The intensification of agriculture has had the biggest impact on wildlife, and this has been overwhelmingly negative. Over the period of our study (c40 years), farming has changed dramatically, with new technologies boosting yields often at the expense of nature.***
- ***Climate change has also had a highly significant impact on the UK's nature, although to date there has been a more even balance between positive and negative effects. Given the UK's position relative to the rest of Europe, we have seen more species expanding their range into the UK from the south than we have seen loss of northerly species. However, as climate change progresses, the effect of increasing temperatures may not continue to be positive. In addition, novel interactions between species caused by changes to their distributions are likely to affect them in unpredictable ways.***
- ***In general, the way habitats are managed had a greater impact on wildlife than changes in the total amount of habitat. This is unsurprising, given that there have been relatively small changes in the areas occupied by different habitats during our study period, compared to substantial changes in how habitats are managed or the extent of habitat loss in the past.***
- ***Our findings were similar across the three major taxonomic groups included in the study (insects, vascular plants and vertebrates).***
- ***Of the drivers classified as conservation measures, low-intensity management of agricultural land and habitat creation have proven most beneficial for wildlife.***



1 Intensive management of agricultural land

Positive factors

- *Increased winter survival of some species that eat autumn-sown crops.*

Negative factors

- *Abandonment of mixed farming systems.*
- *Switch from spring to autumn sowing, reducing food and habitat for many species.*
- *Intensification of grazing regimes.*
- *Increased use of pesticides and fertilisers.*
- *Loss of marginal habitats, such as ponds and hedgerows.*

2 Climate change

Positive factors

- *Northward expansion of species (often with loss in southern parts of their ranges).*
- *Increased winter survival of some species due to milder temperatures.*

Negative factors

- *Loss of coastal habitat due to sea level rise.*
- *Increases in sea temperatures adversely affecting marine food webs.*
- *Changes in seasonal weather patterns, such as winter storms and wetter springs.*

3 Low-intensity management of agricultural land

Positive factors

- *Introduction of wildlife-friendly farming through agri-environment schemes.*

Negative factors

- *Abandonment and reduced grazing, leading to the loss of some habitats.*

4 Increasing management of other habitats

Positive factors

- *Conservation management, often by reinstating traditional methods.*

Negative factors

- *Increased grazing pressure.*

5 Hydrological change

Negative factors

- *Drainage of wetlands, upland bogs, fens and lowland wet grasslands.*
- *Over-abstraction of water.*

6 Urbanisation

Negative factors

- *Loss of green space, including parks, allotments and gardens.*
- *Loss of habitats, including lowland heathland, to development.*
- *Loss of wildlife-rich brownfield sites.*

7 Habitat creation

Positive factors

- *Creation of new wetlands through conservation work and as a by-product of mineral extraction.*
- *Planting of new broadleaved and mixed woodland.*

8 Increasing plantation forest area

Positive factors

- *Increased habitat area for species using coniferous plantations and woodland edges.*

Negative factors

- *Loss of the habitat that plantations replace, particularly lowland heaths and upland habitats.*

9 Decreasing forest management

Negative factors

- *Cessation of traditional management practices, such as coppicing, leading to the loss of varied age structure and open habitats within woodland.*

10 Decreasing management of other habitats

Negative factors

- *Abandonment of traditional management, including grazing, burning and cutting, which is crucial for the maintenance of habitats such as heathland and grassland.*

The figure shows the most significant drivers of change in our nature. Green arrows show positive impacts; red arrows show negative impacts. For full details and further results, see tinyurl.com/j8rxyyl

How are we helping nature in the UK?

The pressures on the UK's wildlife over recent decades (as described on pages 12–13) have been considerable, with the negative pressures outweighing the positive. This has resulted in the net loss of nature that we reported in *State of Nature* in 2013, and again in this report.

At present, conservation efforts are insufficient to put nature back where it belongs. Economic uncertainty over the last eight years has had a disproportionate impact on conservation resources; public spending on UK biodiversity has fallen by 32%, from 0.037% of GDP in 2008 to 0.025% in 2014–15[1].

That said, there are many inspiring examples of conservation action helping to turn this tide. Throughout this report we present case studies that demonstrate how conservation organisations, governments, businesses, landowners, communities and individuals have worked together to help the UK's nature.

Conservation efforts can be found at all scales – local, regional and national – across the UK, its Crown Dependencies and Overseas Territories. These efforts can loosely be placed into the categories outlined below.

Adam Cormack (The Wildlife Trusts)

Protecting the best places

The UK has a proud heritage of protecting the best sites for wildlife. Back in 1821, the first nature reserve was founded at Walton Hall in West Yorkshire, and we now have a network of sites that are protected by national and international legislation.

Nature reserves cover around 2% of the UK, and designated sites, such as Special Protection Areas, cover 10%. However, this total falls short of the global target of at least 17% of land area and 10% of marine area under protection. It is also important to note that a protected area designation does not mean that a site is safe from pressures or that it is being managed effectively.

Levels of protection vary widely across the UK's Overseas Territories, which hold globally important wildlife sites. Some are completely unprotected.


Peter Cairns

Improving habitats

Accumulated knowledge from decades of conservation experience, backed with the findings of research programmes, means that we know more about how to manage habitats for the benefit of nature than ever before.

Traditional methods, using practices such as low-intensity grazing and coppicing, are combined with new knowledge and technology to deliver specific requirements for wildlife. Developing our methods in this area is particularly relevant in light of future climate change, since habitats are likely to need to facilitate the movement of species in response to changing climatic conditions.


Andy Hay

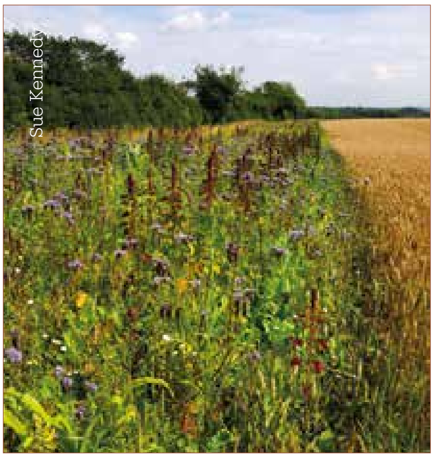
Creating new wildlife sites

After centuries of habitat destruction, the UK's nature is impoverished, with some of our special habitats reduced to scattered fragments. Conservationists have begun to master the art of recreating habitat, and restoring degraded areas, while incorporating the dynamic nature of ecosystems.

Many of these are new wetland sites, such as the Avalon Marshes in Somerset and Llanelli in Carmarthenshire, or dramatic coastal realignment schemes. Heathland, semi-natural grassland and woodland are also being restored in some areas.

However, with the changing climate, the arrival of new species and other unforeseen events, there is still more to learn and we will need to adjust our methods accordingly.

Volunteers play a vital role in conservation efforts, helping to monitor and protect the UK's wildlife


Sue Kennedy


Richard Revels


Peter Cairns

Working beyond boundaries

Conservationists have become increasingly aware of the need to work beyond the boundaries of protected areas. In his 2010 review, *Making space for nature*, Professor Sir John Lawton identified a need for more, bigger, better, and more joined up wildlife sites that function as a network and allow wildlife to move between them more easily[2]. Managing the surrounding area sympathetically – by creating corridors or stepping stones – can also help wildlife to move through the landscape.

Conservationists are increasingly collaborating with a range of landowners on large-scale projects, for example the Nene Valley Living Landscape project, which encourages the management of land in wildlife-friendly ways across landscapes.

Taking action for species

Protecting, improving, extending and connecting special places can bring great benefits for wildlife. But some of our most threatened species require a bespoke approach.

Through recovery projects we have been able to identify the exact requirements of a species, and then roll out multifaceted actions aimed at slowing declines, and stabilising, and ultimately increasing, populations of the target species.

In recent decades, this approach has given us some of our most celebrated conservation successes, such as the return from UK extinction of the large blue butterfly (pictured above) and pool frog, and the recovery of lesser horseshoe bats, red kites and bitterns.

Tackling pressures

Many of the challenges facing our wildlife, and indeed our environment as a whole, cannot be addressed with a geographical, habitat or species focus alone. For instance, tackling carbon emissions in order to limit the extent of climate change; eradicating invasive non-native species or addressing their spread; reducing air and water pollution; and achieving sustainable use of marine resources all require a society-wide response.

We often need a governmental lead, with appropriate policies and legislation, but to effect real change we all need to step up, for the good of wildlife, and also to protect the environment we rely on for healthy and happy lives.

Andrew Parkinson

Farmland

- ***Over the long term, 52% of farmland species declined and 48% increased. Over the short term, the overall picture was unchanged.***
- ***The index of change in the abundance and occupancy of farmland species has declined by 20% over the long term, and by 8% over the short term.***
- ***UK biodiversity indicators show that farmland birds have declined by 54% since 1970, and butterflies by 41% since 1976. Bats have increased by 23% since 1999.***
- ***12% of farmland species are threatened with extinction from Great Britain.***

For guidance on the results presented in this section, please turn to pages 72–77.

The state of farmland nature

Around 75% of the UK's landscape can be classed as agricultural. However, in this part of our analysis we concentrate on enclosed farmland, which covers 40% of the UK and consists of arable fields and improved and semi-improved grasslands. This enclosed farmland also includes wildlife habitats in the form of hedgerows, field margins, fallow land and other uncropped areas.

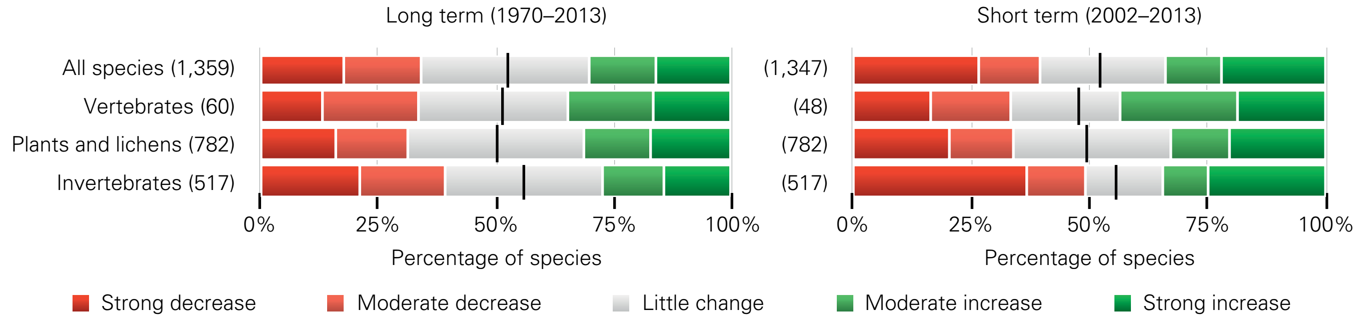


Figure 8

The percentage of species in each trend category over the long and the short term. The line in the "little change" category shows the division between declining species on the left and increasing species on the right. The values in brackets show the number of species assessed.

Looking at the long-term trends of individual farmland species, 52% declined and 48% increased. Among these, 34% showed strong or moderate declines, 36% showed little change, and 30% showed strong or moderate increases. Over the short term, the overall picture was unchanged.

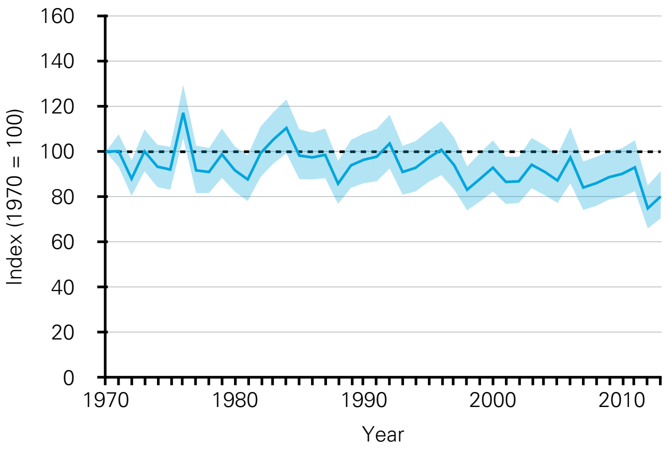


Figure 9

An index of species' status based on abundance or occupancy data for 762 farmland species.

Looking in more detail, the index of change in the abundance and occupancy of farmland species has fallen by 0.56% per year; a statistically significant drop of 20% in total, over the long term. Over our short-term period, the index declined by 0.69% per year; a statistically significant fall of 8% in total. The short-term decline is not significantly different to that from 1970 to 2002 (t= -0.77, p=0.45).

Over the long term, our separate measure of distributional change in vascular plants (not pictured) shows a decline of 7% (based on 523 species), whereas over the short term it shows a 2% increase (based on 285 species).

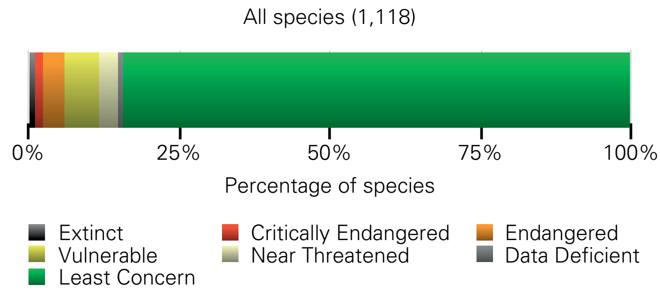


Figure 10

The percentage of species in each risk category, based on the likelihood of extinction from Great Britain.

Of the 1,118 farmland species assessed using national Red Lists, 137 (12%) were categorised as threatened. Twelve of 26 farmland breeding bird species are red-listed as birds of conservation concern in the UK[1].

The Farmland Bird Indicator[2] (not pictured) shows a decline of 54% since 1970, and although the rate has slowed in recent years, the decline continues. The same pattern can be seen in butterflies; the indicator of butterfly species of the wider countryside (not shown) has declined by 41% since 1976[2]. Since 1999, the indicator of widespread bat species (not pictured) has increased by 23%[3].

Why is farmland nature changing?

Our review of the factors driving changes to the UK's wildlife found that the **intensive management of agricultural land** had by far the largest negative impact on nature, across all habitats and species[4]. In one sense, it is no surprise that changes to our farmed environment have had more impact than any other, simply because the habitat covers so much of the UK. However, we know that government farming policies led to dramatic changes in farming practices, almost doubling wheat and milk yields since the 1970s, whilst simultaneously having wide-reaching consequences for wildlife.

This increase in agricultural productivity has been achieved through changes such as a switch from spring to autumn sowing of crops; the production of silage, rather than hay, in our pastoral farmland; and the increased use of chemicals over the long term[5]. In addition, many marginal habitats, such as hedgerows and farm ponds, have been lost, to the detriment of wildlife.

Agricultural intensification affected nearly half of the species we studied and it was responsible for nearly a quarter of the total impact on our wildlife. When examined more closely, most of the impact over our study period was due to one or more of the following:

- ***Production-driven farm practices, such as the loss of mixed systems and the change in sowing season.***
- ***Intensification of grazing regimes.***
- ***Loss of semi-natural habitats, such as hedges, ponds and field margins.***
- ***Increasing use of fertilisers.***
- ***Increasing use of pesticides and herbicides.***

Not all of this impact was negative; a number of species have benefitted, including herbivorous species that feed on crops that are now sown in autumn rather than spring.

Changes in farmland management have had the biggest impact on nature

The increased use of herbicides and other agricultural changes over many decades have caused a massive decline in corn marigolds[6–8].

The high brown fritillary is perhaps the UK's most threatened butterfly. A reduction in the appropriate grazing of bracken-dominated habitats has contributed to its decline[9,10].

The loss of farm ponds is thought to have driven a sharp decline in great crested newts[11].

Woodpigeons have prospered in recent decades, thanks to the reliable winter food provided by autumn-sown crops[12].

Case study

Environmental stewardship benefits wildlife

Clouds of finches and buntings bursting out of a field of crops and a barn owl skimming over the meadow are welcome sights to David, the owner of Sunnymead Farm, a mainly arable farm in Essex. And the good news is that these wonderful wildlife spectacles are not incompatible with a highly profitable business.

Such benefits can be achieved by careful environmental stewardship[13,14]*, such as maintaining patches of semi-natural habitat that offer food and shelter to wildlife, and reducing the use of pesticides and fertilisers wherever possible.*

These, and an array of other environmentally-friendly land management practices, are options in the agri-environment schemes offered by the governments across the UK. They can also be undertaken voluntarily by farmers for their own interests, or as part of industry-led initiatives.

It has been clearly demonstrated that such practices can enhance the breeding and foraging opportunities for birds, pollinating insects and other wildlife on a farm; the challenge is to influence wildlife populations on a national scale.

The predecessors of the current Government schemes (Countryside Stewardship in England, Glastir in Wales, the Countryside Management Scheme in Northern Ireland and the Rural Development Programme in Scotland) were first introduced in the 1980s. Thanks to continuing research on how best to combine options to benefit wildlife, the design and implementation of these schemes has altered considerably since their inception.

Currently, these schemes are jointly funded by the EU Common Agricultural Policy (CAP) and the UK Government; clearly the UK vote to leave the EU puts the future of these schemes at risk. They work via individual agreements whereby farmers receive payments based on the cost of implementing specified conservation activities and the profits foregone. Options are varied, but their aim is to conserve important ecological and historical features; to protect soils and key habitats; and to provide food and shelter for wildlife. On David's farm, he takes some measures as part of the past Entry Level Environmental Stewardship Scheme and he includes others voluntarily.

On most farms, environmental stewardship is closely tied to production. For example, sowing small areas with wild bird mixes following winter cereals, and other areas with nectar flower mixes for insects. Field margins can be diversified by incorporating 6-metre buffer strips and using winter stubbles as a tool to minimise soil erosion. These stubbles also provide a key seed resource for birds in the latter part of the winter. Managing pastures in a very low-input way results in more tussocky grass, which is good for a range of insects and birds, as well as the voles that are favoured by barn owls.

David's own sightings of a diverse array of birds suggest that these practices have been beneficial on his farm and a large body of research has demonstrated the value of environmental stewardship to farmland wildlife. Research has also highlighted that environmental stewardship is most successful when farmers are given expert advice on the delivery and placement of wildlife-friendly farming options.

There is growing evidence that many farmland birds are benefitting from key environmental stewardship options, but others continue to decline[15,16]*, and it is not yet clear whether stewardship can be delivered on a sufficiently large scale to achieve wildlife recovery nationwide. Certainly, at present, the hoped for widespread recovery of farmland wildlife is yet to be seen.*

David J Slater

Environmental stewardship can help to support farmland wildlife

Richard Revels

Lowland semi-natural grassland and heathland

- ***Over the long term, 60% of grassland and heathland species declined and 40% increased. Over the short term, 58% of species declined and 42% increased.***
- ***The index of change in the abundance and occupancy of grassland and heathland species has declined by 29% over the long term, and by 3% over the short term.***
- ***13% of grassland and heathland species are threatened with extinction from Great Britain.***

For guidance on the results presented in this section, please turn to pages 72–77.

The state of grassland and heathland nature

A distinctive and much-loved habitat, primarily found in the south of the UK, lowland heathland occurs on nutrient-poor, acidic soils of either damp peat or dry sand. The UK holds about 20% of Europe's lowland heath[1], but this is just a fraction of what once occurred; the total area in the UK has shrunk by 80% since 1800 and what remains is very fragmented. Although grassland is a widespread habitat across the UK, the vast majority has been "improved" by fertilisers, herbicides and reseeding. As a result, only 2% of grasslands now have a high diversity of species; an estimated 97% of lowland meadow was lost in England and Wales between the 1930s and 1980s[2].

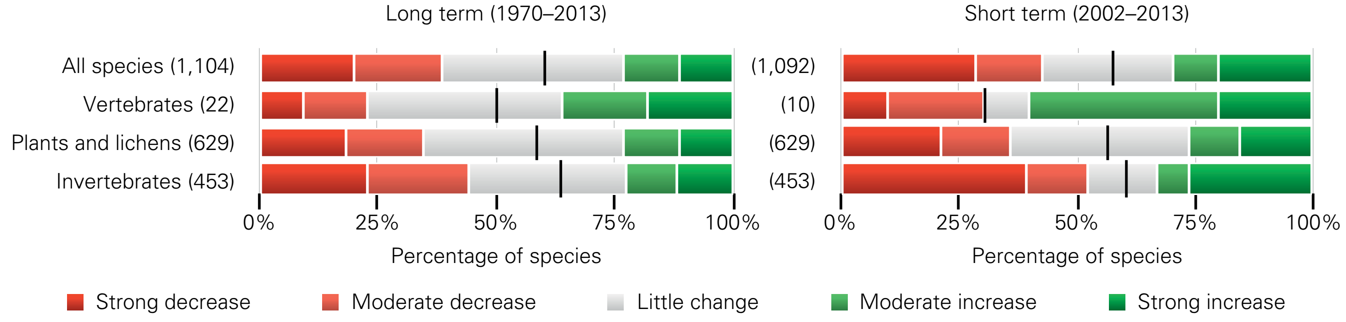


Figure 11

The percentage of species in each trend category over the long and the short term. The line in the "little change" category shows the division between declining species on the left and increasing species on the right. The values in brackets show the number of species assessed.

Looking at the long-term trends of individual species, 60% declined and 40% increased. Among these, 38% showed strong or moderate declines, 39% showed little change, and 23% showed strong or moderate increases. Over the short term, the picture was similar; 58% of species declined and 42% increased.

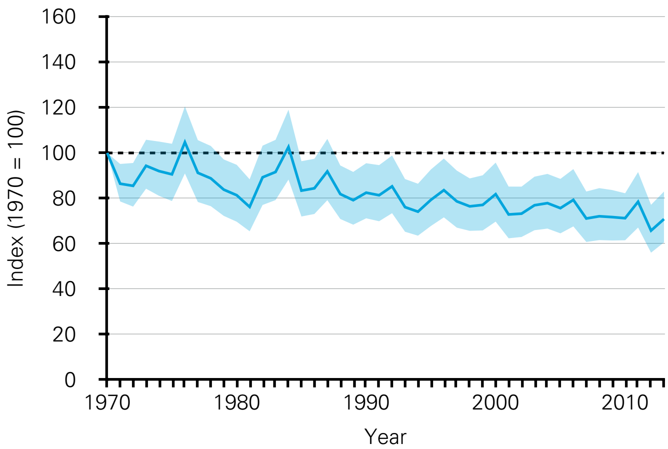


Figure 12

An index of species' status based on abundance or occupancy data for 595 grassland and heathland species.

Looking in more detail, the index of change in the abundance and occupancy of these species has fallen by 0.93% per year; a statistically significant drop of 29% in total, over the long term. Over our short-term period, the index declined by 0.28% per year; a non-significant fall of 3% in total. The short-term decline is not significantly different to that from 1970 to 2002 (t=0.18, p=0.86). Our separate measure of distributional change in vascular plants (not pictured) shows a long-term decline of 16% (based on 426 species). Over the short term there was a 10% decline (based on 192 species).

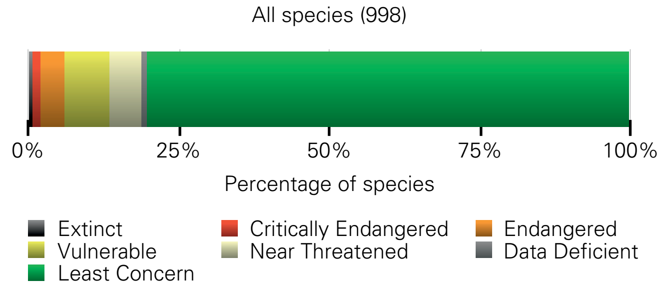


Figure 13

The percentage of species in each risk category, based on the likelihood of extinction from Great Britain.

Of the 998 lowland semi-natural grassland and heathland species assessed using national Red Lists, 131 (13%) are categorised as threatened. Two of eight grassland and heathland breeding bird species are red-listed as birds of conservation concern in the UK[3].

The total area of lowland heathland in the UK has shrunk by 80% since 1800

Why is lowland semi-natural grassland and heathland nature changing?

Historically, lowland semi-natural grassland and heathland were much more widespread than today. Although most of the dramatic losses occurred before the period of our review of the state of nature[4], the loss of heathland and the "agricultural improvement" of semi-natural grasslands has continued, albeit at reduced levels, and pressures still exist.

Our review suggested that **urbanisation** had the fifth largest negative impact on the UK's wildlife. The southern and lowland distribution of our remaining heathlands means that many are in close proximity to growing towns and cities, and their low agricultural value means they are seen as suitable for development. Most of these sites are protected as Sites of Special Scientific Interest (SSSIs), nevertheless they are also prone to degradation and disturbance through excessive and unmanaged recreational use.

Even if they are not protected and managed for the benefit of the wildlife they support, semi-natural grasslands can still survive as active farmland, provided that **low intensity agricultural management** methods are used. Low herbicide and fertiliser input and appropriate grazing regimes, which balance the needs of different species, can also help to maintain botanical diversity.

After centuries of loss, there has been a move in recent years towards **restoring heathlands**, often through the removal of non-native conifer plantations, and **restoring species-rich grasslands** through grazing and natural seeding techniques. To date, restoration is still small-scale relative to historic losses and the potential area to restore. While not always the case with lowland grassland, some key heathland plants can survive in a dormant state for many decades, so vegetation can be carefully coaxed back to life with the help of appropriate grazing.

Many areas of heathland have been lost to development

Recent heathland restoration has helped Dartford warblers. These resident insectivores also appear to be one of the species to have benefitted from climate change in the UK[5].

Sand lizards have declined since the middle of the 20th century as a result of the loss, fragmentation and degradation of heaths. However, they have been successfully reintroduced in some areas[6,7].

Although some healthy populations of grayling remain, the "improvement" of semi-natural grassland, and spread of conifer plantations on heathland, have contributed to a substantial decline[8,9].

A lack of suitable grazing regimes to maintain short grassland turf, has led to a 50% decline in the number of sites suitable for the stunning pasque flower since the mid-20th century[10,11].

Case study

Save Our Magnificent Meadows

Save Our Magnificent Meadows is the UK's largest partnership project transforming the fortunes of vanishing wild flower meadows, grasslands and their wildlife. The project is targeting almost 6,000 hectares (ha) of wild flower meadows and grasslands in nine landscapes across the UK. One of these landscapes is in Northern Ireland where the meadows and grasslands are important at a European and national scale, and are unique due to the country's biogeography, climate and culture.

Some of the special species present in Northern Ireland's meadows and grasslands include blue-eyed grass, lesser butterfly orchid, globeflower and devil's-bit scabious. These plants thrive in wet purple moor grass and rush pasture, known locally as "rough ground". The shores of Lough Erne and Lough Melvin in Fermanagh are the only known location for blue-eyed grass in the UK.

In Northern Ireland, the project is working primarily in County Fermanagh and is focusing on purple moor grass and rush pastures, which are deteriorating in extent and quality. The project is also working on lowland meadows, for which Fermanagh is one of the main strongholds in Northern Ireland.

By working with landowners, providing training and advice, and by carrying out practical conservation work, the project team will maintain 220ha of grassland, restore a further 10ha and create 5ha of new habitat.

The project is already beginning to have an impact and there is a huge community appetite for the protection and restoration of these precious remnant habitats. Everyone from teachers and pupils, to Ministers, farmers and volunteers are getting involved.

Raising awareness of meadows is a key aim of the project; a range of events, including bug hunts, moth trapping, walking festivals and National Meadows Day, have helped to spark renewed interest in a habitat that is often taken for granted.

We have lost much of this wonderful habitat, so we must do our utmost to protect these special places for nature in areas like Fermanagh, where they still exist.

*Save Our Magnificent Meadows is primarily funded by the Heritage Lottery Fund, with support from the Northern Ireland Environment Agency (NIEA). To find out more about how you can get involved in the project and what events are taking place near you, visit **magnificentmeadows.org.uk***

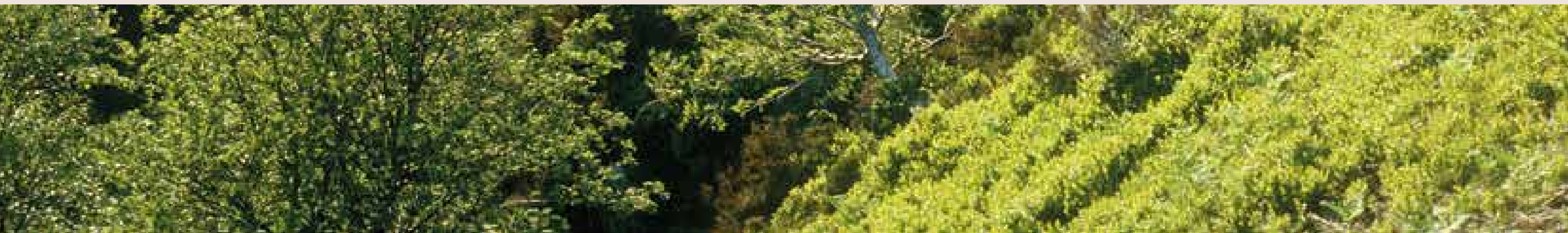
Wild flower meadows are wonderful, special places and we must do our utmost to protect them

Purple moor grass and rush pastures are characteristic of County Fermanagh

Upland

- ***Over the long term, 55% of upland species declined and 45% increased. Over the short term, 54% of species declined and 46% increased.***
- ***The index of change in the abundance and occupancy of upland species has declined by 17% over the long term, and by 4% over the short term.***
- ***15% of upland species are threatened with extinction from Great Britain.***

For guidance on the results presented in this section, please turn to pages 72–77.



The state of upland nature

The UK's uplands are often regarded as our wildest landscapes, seemingly untouched by human activity, but this is far from the case, as large areas are intensively managed. Nevertheless, they do provide the UK with some of our most dramatic landscapes and distinctive species, and cover around one-third of the land area. "Upland" does not constitute a single habitat, but instead a range of habitats that have some overlap with other definitions. However, our uplands do contain distinctive habitats, including huge tracts of dwarf-shrub heathland and internationally important areas of blanket bog. Diversity is added by mountain heaths, upland grasslands, rock outcrops, screes and botanically-rich limestone pavements.

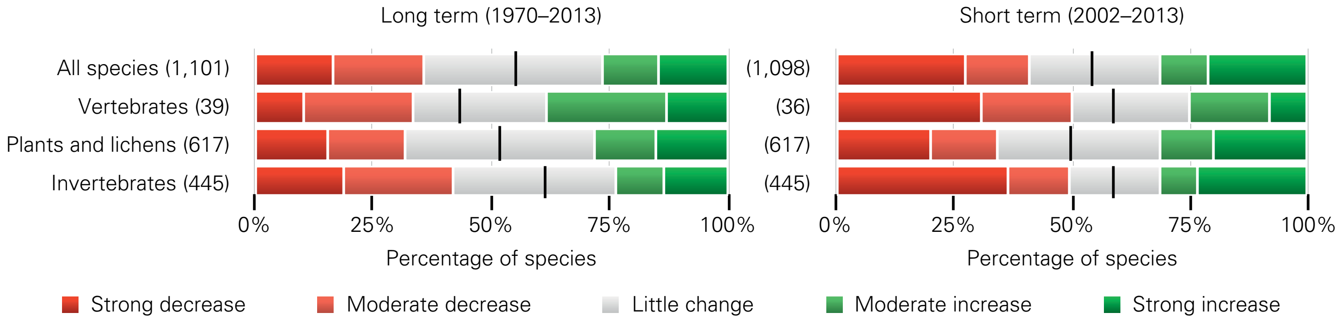


Figure 14
The percentage of species in each trend category over the long and the short term. The line in the "little change" category shows the division between declining species on the left and increasing species on the right. The values in brackets show the number of species assessed.

Looking at the long-term trends of individual upland species, 55% declined and 45% increased. Among these, 36% showed strong or moderate declines, 38% showed little change, and 26% showed strong or moderate increases. Over the short term the picture was similar; 54% of species declined and 46% increased.

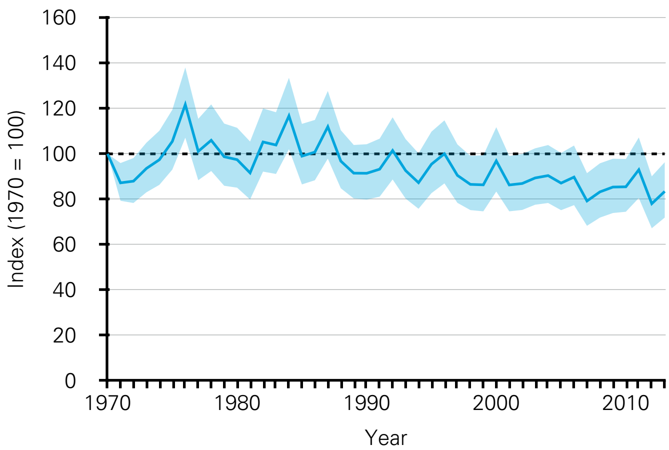


Figure 15
An index of species' status based on abundance or occupancy data for 640 upland species.

Looking in more detail, the index of change in the abundance and occupancy of upland species has fallen by 0.45% per year; a statistically significant drop of 17% in total, over the long term. Over our short-term period, the index declined by 0.35% per year; a non-significant fall of 4% in total. The short-term decline is not significantly different to that from 1970 to 2002 (t= -1.28, p=0.21).

Our separate measure of distributional change in vascular plants (not pictured) shows a decline of 8% over both the long term (based on 430 species) and the short term (based on 183 species).

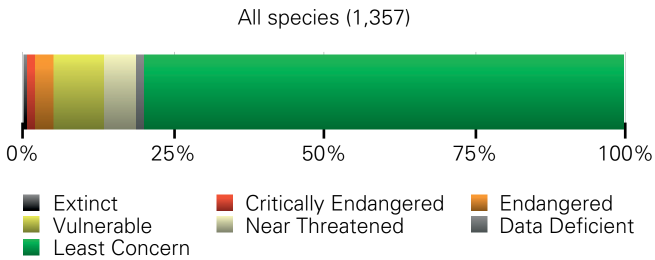


Figure 16
The percentage of species in each risk category, based on the likelihood of extinction from Great Britain.

Of the 1,357 upland species assessed using national Red Lists, 197 (15%) were categorised as threatened. Twelve of 36 upland breeding bird species are red-listed as birds of conservation concern in the UK[1].

Uplands are seen by many as wild and unspoilt, but they have been influenced by humans for millennia

Why is upland nature changing?

We know less about what is affecting upland nature than we do about many other habitats. We also have less monitoring data, particularly for non-avian species. As a result, our review of the drivers of change[2] included relatively few upland species. However, we know enough to be able to identify the major impacts on upland wildlife in recent decades.

A large proportion of the UK's uplands are **managed intensively for food production**, and are heavily grazed by sheep and deer, which converts them to grassland. This is compounded by the impacts of drainage. In large areas, uplands are also subject to frequent burning rotations as part of grouse moor management[3]. This can result in heather dominating blanket bogs and has greatly reduced the condition of internationally important upland sites.

Many of our upland species are at the southern edge of their ranges, and they may be forced to move northwards in response to **climate change**. The climate some of these species favour may also move uphill. The result would be smaller UK ranges, and in some cases – for those species already restricted to high mountain-tops or the extreme north – it could mean UK extinction.

The **expansion of forest cover** in the UK over the latter half of the last century came mainly at the expense of upland habitats. Large parts of the Scottish uplands and areas of blanket bog, such as the Flow Country, have been afforested. These coniferous plantations also have other impacts on surrounding areas, for example by providing habitat for generalist predators that prey on breeding waders.

Although progress has been made in controlling some sources of **air pollution**, increasing levels of atmospheric nitrogen mean that more nitrogen is being deposited in uplands. This artificial "fertilisation" of nutrient-poor areas, such as Scotland's mountain tops, changes vegetation composition, with effects on wildlife[4].

One-third of all burning across Britain occurs on deep peat[3]

The recent declines of the dotterel, a high-altitude specialist, may be due partly to changes in montane heaths, caused by nitrogen deposition, as well as changes on wintering grounds[5].

In some areas, overgrazing means that juniper seedlings are eaten, while in other areas, too little grazing means seedlings are shaded and can't establish, limiting the regeneration of juniper populations.

The UK population of heather moorland-loving hen harriers is extremely low, and in some areas close to extinction, due to illegal persecution associated with grouse moor management[6].

Climate change is thought to be responsible for the range contraction of the mountain ringlet butterfly: its range has shifted uphill by 150m in response to the warmer climate[7].

Case study

Restoring precious blanket bog

The Migneint-Arenig-Dduallt (Migneint) Special Area of Conservation covers 5,300 hectares (ha) of Snowdonia and makes up roughly 10% of the total area of blanket bog in Wales. Much of the Migneint's blanket bog is nationally important sub-montane heather and hare's-tail cottongrass bog, and is found within the National Trust's 8,000-ha Ysbyty Ifan Estate.

Between the 1930s and 1970s, drainage ditches were dug all over the blanket bog in an attempt to increase farming productivity. However, the anticipated gains did not materialise as the drains only had a very local effect on the water table. They also gradually became deeper and sheep got trapped in them, often dying as a result.

In addition, the ditches had a dramatic effect on peat, which is the product of dead vegetation that is unable to decompose due to the absence of oxygen in the wet, acidic conditions of the bog. The drainage ditches dried the bog surface out, exposing the peat to oxygen and allowing it to decompose. This released large quantities of carbon into water, as dissolved organic carbon, and into the atmosphere, contributing to climate change.

Through collaborative projects funded by EU LIFE and the Welsh Government's Ecosystem Resilience Fund, a huge amount of work has gone into blocking bog drainage ditches. With the support of local farmers over a period of five years, thousands of dams were built to block over 400km of ditches. At one stage, eight 12-tonne diggers were creating a series of small dams every few metres, carefully lifting vegetation to one side and replacing it once the ground had been profiled.

Ditch blocking had an instant effect – water levels rose and peat loss was slowed – and the bog is recovering well. Within three years there has been a wonderful growth of bog mosses behind the peat dams, creating the right conditions for the deposition of new peat. Not only is this good news for the blanket bog and the wildlife that lives there, it's good news for people too; healthy blanket bogs mitigate against climate change and help to alleviate flooding.

From the farmers' point of view, ditch blocking has resulted in an improvement in grazing, with more grasses, sedges and rushes becoming established. Leggy heather is also less dominant, which reduces the risk of damaging wildfires, and sheep are able to move safely through the bog without getting trapped.

Anecdotal evidence suggests that flooding of lower-lying land has declined, and water quality has also improved. One of the local farmers has reported that the river water is much clearer these days: he can now see the stones at the bottom of the river beneath the bridge in Ysbyty Ifan, something that had not been possible before.

Healthy blanket bogs mitigate against climate change and help to alleviate flooding

Drainage ditches have been blocked in the Migneint area, helping to restore the blanket bog

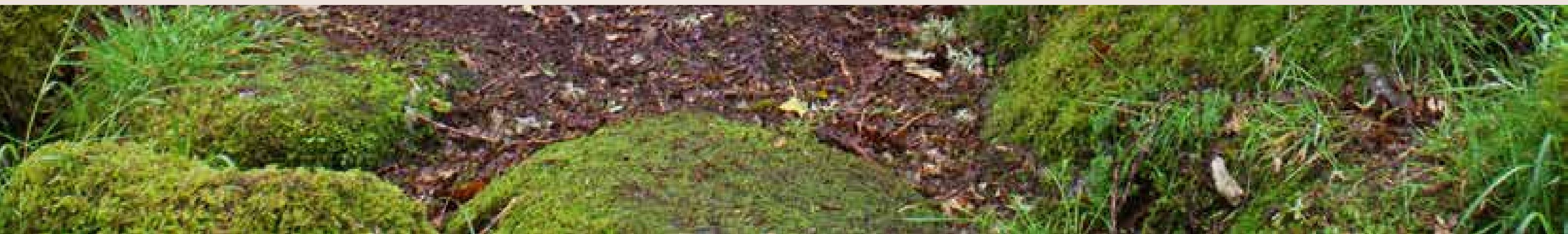
Richard Challis (Alamy Stock Photo)

Mike Read

Woodland

- ***Over the long term, 53% of woodland species declined and 47% increased. Over the short term, 51% of species declined and 49% increased.***
- ***The index of change in the abundance and occupancy of woodland species has declined by 24% over the long term, and by 7% over the short term.***
- ***The UK woodland bird indicator has declined by 20% since 1970 and the England woodland butterfly indicator by 51% since 1991.***
- ***11% of woodland species are threatened with extinction from Great Britain.***

For guidance on the results presented in this section, please turn to pages 72–77.



The state of woodland nature

Although the UK was once largely covered by trees, just 13% of its land area is now woodland, and only 1.2% is semi-natural ancient woodland, making it one of Europe's least wooded nations. Much of the UK's woodland is relatively young: at least 80% is less than 100 years old. Over the last century, large areas have been planted, and as a result, the area of woodland more than doubled in the 20th century. However, the vast majority of this new planting was with non-native coniferous trees, which bring fewer benefits to wildlife than native trees, but support an industry that produced 11 million tonnes of timber in 2014[1,2].

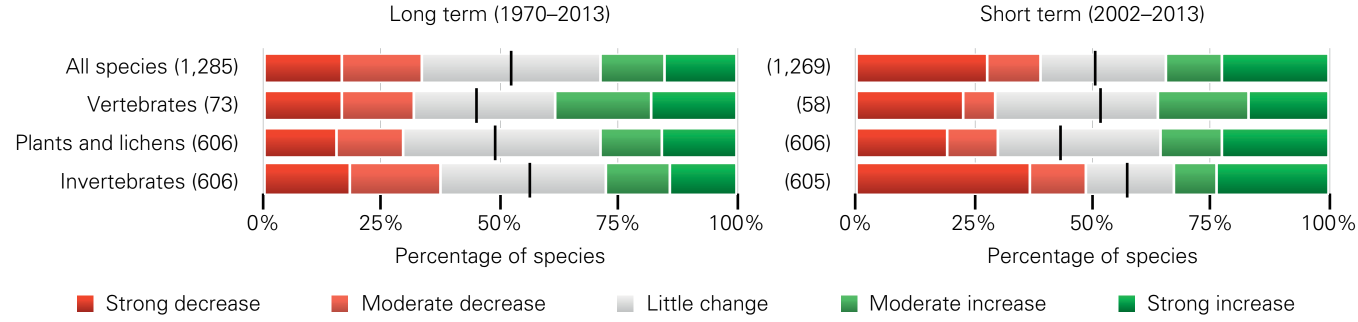


Figure 17

The percentage of species in each trend category over the long and the short term. The line in the "little change" category shows the division between declining species on the left and increasing species on the right. The values in brackets show the number of species assessed.

Looking at the long-term trends of individual woodland species, 53% declined and 47% increased. Among these, 33% showed strong or moderate declines, 38% showed little change, and 29% showed strong or moderate increases. Over the short term, the picture was similar; 51% of species declined and 49% increased.

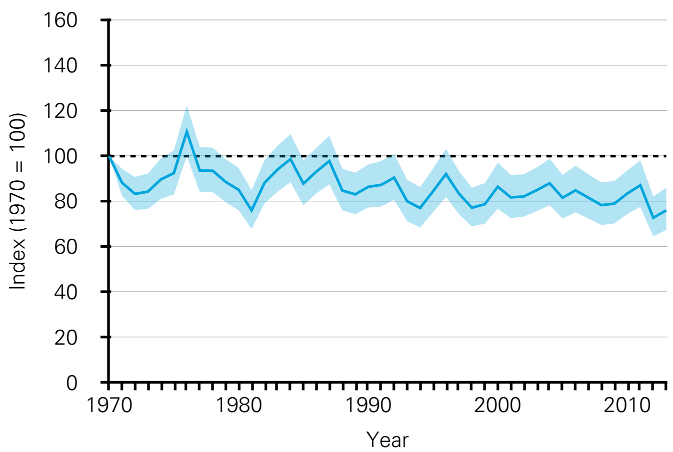


Figure 18

An index of species' status based on abundance or occupancy data for 895 woodland species.

Looking in more detail, the index of change in the abundance and occupancy of woodland species has fallen by 0.71% per year; a statistically significant drop of 24% in total, over the long term. Over our short-term period, the index declined by 0.67% per year; a significant fall of 7% in total. The short-term decline is not significantly different to that from 1970 to 2002 (t=0.57, p=0.57). Our separate measure of distributional change in vascular plants (not pictured) shows no real change over the long term (based on 365 species) and a 2% decrease over the short term (based on 199 species).

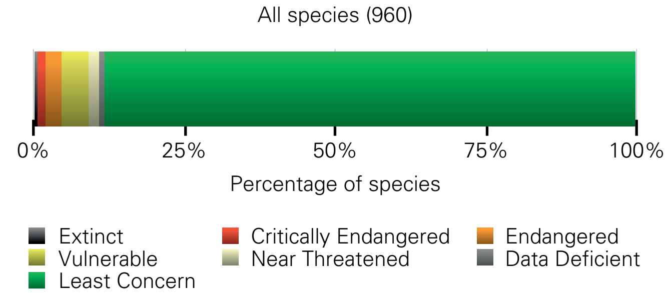


Figure 19

The percentage of species in each risk category, based on the likelihood of extinction in Great Britain.

Of the 960 woodland species assessed using national Red Lists, 102 (11%) were categorised as threatened. 16 of 49 woodland breeding bird species are red-listed as birds of conservation concern in the UK[3].

The Woodland Bird Indicator[4] (not pictured) shows a decline of 20% since 1970, although the indicator has been stable in recent years. The indicator for woodland butterflies in England (not pictured) shows a 51% decline since 1991[4].

The UK is now one of Europe's least wooded nations

Why is woodland nature changing?

It was relatively easy to pick out the major drivers of change in woodland wildlife from our UK-wide review[5]; both changes in the extent of woodland cover, and in the intensity and type of woodland management, have had substantial effects on the UK's wildlife.

The **increase in total forest cover** during our study period, through the planting of both broadleaved and coniferous forest, has had a balanced impact overall. Some non-woodland species have lost habitat to trees, while other woodland specialists have benefitted, particularly from recent planting of native woodland. However, our review also demonstrated that the management of forest is equally important, as many species favour particular management regimes.

Decreasing forest management has had a substantial negative impact on woodland species. In the middle of the 20th century, 50% of our broadleaved woodland was coppice or shrub[6], but with the abandonment of traditional management methods, such as coppicing, that figure is now below 1%.

Many woodland species rely on open woodland habitats, with access to sunlight, a varied understorey, and the mosaic of different habitats produced by the rotation of coppicing throughout a woodland. The targeted reinstatement of coppicing within nature reserves, and through grant schemes, has been successful in maintaining populations of some species, although many still suffer as a result of the limited and fragmented nature of their habitat. In addition, management often has to contend with the adverse impacts of grazing from increasing populations of both native and non-native deer.

Increases in other forest management practices have also influenced woodland wildlife. For example, a decline in the availability of standing dead wood has led to a loss of breeding and roosting sites for bats, as well as habitat for a host of specialised invertebrates.

Many woodland species rely on the conditions created by coppicing

Although the loss of heathland and moorland habitat to conifer plantations is of great concern, the goldcrest is one of the species to have benefitted from an increase in its favoured habitat[7].

The large-scale abandonment of coppicing and other traditional management techniques has had a dramatic effect on pearl-bordered fritillaries and other butterflies of open woodland[8–11].

The targeted management of woodlands, and the control of grazing from increasing deer populations, has allowed oxlips to recover in some areas[12–14].

Barbastelle bats rely on roost sites under flaking bark and in cracks in veteran trees and dead wood. The removal of dead trees in woodlands may limit the population of these dead wood specialists[15].

Case study

Using species reintroductions as a conservation tool

Some species have suffered such catastrophic declines, with local or even national extinctions, that the only remaining conservation option is targeted action to reintroduce them to their former range. There are many questions to consider before this course of action can be undertaken, not least assessing why and how a species became locally extinct in the first place, and ensuring that those threats are no longer prevalent[16–18].

The costs can be significant, so the expense must be carefully weighed against the foreseeable benefits, and any other negative impacts that may come about as part of a reintroduction programme[19]. *However, if there is little or no possibility that a species will return without intervention, then it can be really positive. Reintroductions can expand a species' range, and also reactivate beneficial land management in an area, raising awareness about conservation issues, and including the local community in a unique experience.*

From hazel dormice[20]*, sand lizards*[17]*, and large blue butterflies*[21] *to red kites and short-haired bumblebees, reintroductions of captive-bred or translocated animals have become a reliable way of restoring species across the UK. The hazel dormouse programme, run by the People's Trust for Endangered Species (PTES) and joint funded by Natural England, is an ongoing project that annually creates clusters of populations in counties from which they have become extinct. To date, dormice have been re-established at five sites, although dispersal from these to other sites has been very limited so far, and re-introductions at some other sites appear to have failed.*

Another example of a reintroduction project is that of the pine marten. This carnivore became extinct in much of England and Wales by the early 20th century, as a result of woodland clearance and persecution on game estates and farms[22]*. Scattered records have been reported over the past century, but no natural recovery has occurred*[23]*. There is reason for optimism that persecution pressures have been significantly reduced, habitat loss has been halted and there are sufficient protected areas to allow the species to survive here once again.*

Meanwhile, the Scottish population has been faring well[24,25]*, and numbers have increased sufficiently to provide a source population for a release in Wales. Consequently, The Vincent Wildlife Trust (VWT) felt that the time was right for the first native carnivore release in the UK*[26]*. Working with several partners and funders, VWT released 20 pine martens at carefully selected sites during the autumn of 2015, with plans to release a further 20 animals in 2016. The hope is that these 40 pine martens will not only create a self-sustaining population in the immediate area, but that over time their numbers will increase sufficiently to spread to other forests in Wales and across the border into England.*

Such a high-profile project will help to ensure the longevity and protection of the woodland that will become the pine martens' home. It is also hoped that boosting a native carnivore population will have wider implications for the ecosystem.

Anecdotal evidence from Ireland suggests that increasing pine marten numbers might be reducing numbers of grey squirrels, to the benefit of our native red squirrels. If bringing back the pine marten helps to restore diversity in woodland ecology, the positive outcomes of the project will be much greater than simply benefitting one iconic species.

Kevin Sawford

Reintroducing pine martens could help to restore diversity in woodland ecology

Coastal

- ***Over the long term, 58% of coastal species declined and 42% increased. Over the short term, 57% of species declined and 43% increased.***
- ***The index of change in the abundance and occupancy of coastal species has declined by 14% over the long term, and by 4% over the short term.***
- ***15% of coastal species are threatened with extinction from Great Britain.***

For guidance on the results presented in this section, please turn to pages 72–77.

The state of coastal nature

What we consider to be coastal habitat is defined by geography: more-or-less any habitat, from urban to woodland, can occur next to the sea. While much of it has a unique character, shaped by proximity to the sea, here we focus on specific coastal habitats such as sea cliffs, sand dunes, shingle ridges, and machair and intertidal areas. The intertidal areas themselves encompass a range of habitats, including saltmarshes, tidal lagoons, beaches and mudflats. Although the coastal fringe is narrow, our indented island coastline is lengthy – over 30,000km – so we have a considerable amount of some of these coastal habitats, including 70,000 hectares of sand dunes.

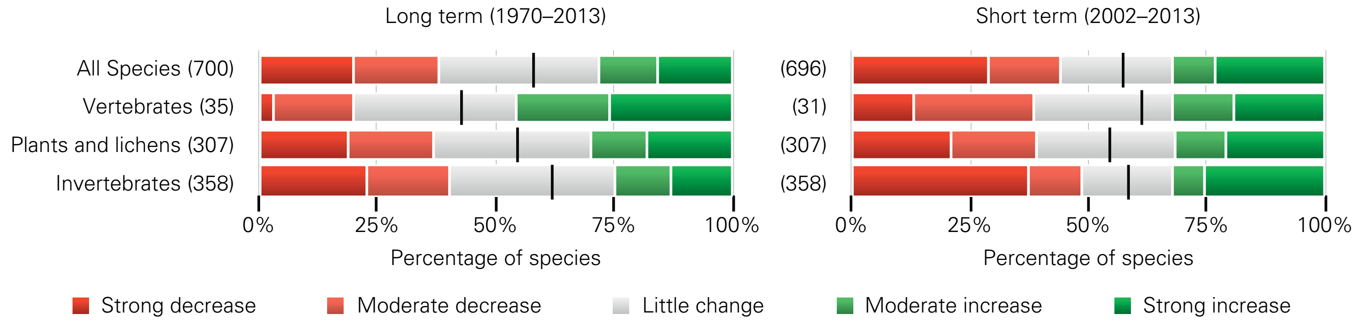


Figure 20

The percentage of species in each trend category over the long and the short term. The line in the "little change" category shows the division between declining species on the left and increasing species on the right. The values in brackets show the number of species assessed.

Looking at the long-term trends of individual coastal species, 58% declined and 42% increased. Among these, 38% showed strong or moderate declines, 34% showed little change, and 28% showed strong or moderate increases. Over the short term, the picture was similar; 57% of species declined and 43% increased.

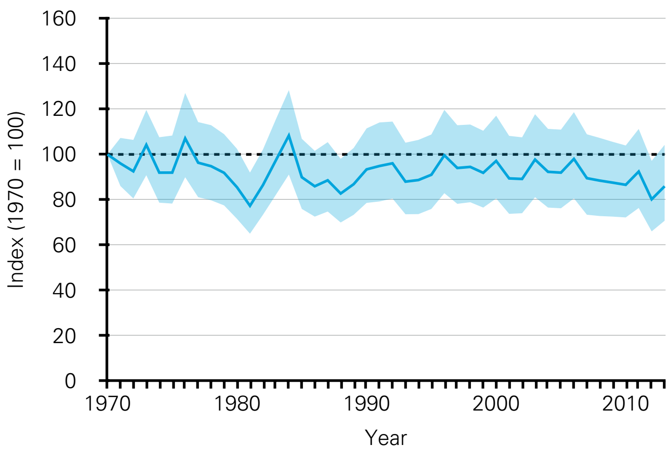


Figure 21

An index of species' status based on abundance or occupancy data for 492 coastal species.

Looking in more detail, the index of change in the abundance and occupancy of coastal species has fallen by 0.37% per year; a statistically non-significant drop of 14% in total, over the long term. Over our short-term period, the index declined by 0.31% per year; a statistically non-significant fall of 4% in total. The short-term decline is not significantly different to that from 1970 to 2002 (t=0.20, p=0.85).

Our separate measure of distributional change in vascular plants (not pictured) shows a 13% decline over both the long term (based on 177 species) and the short term (based on 52 species).

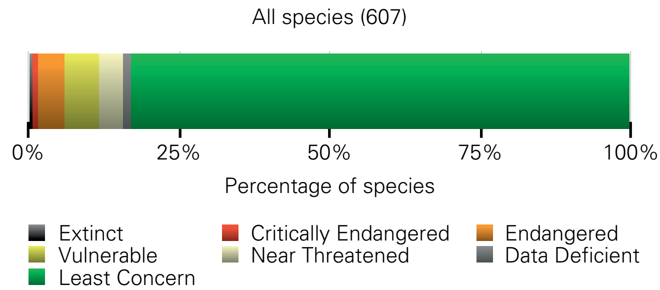


Figure 22

The percentage of species in each risk category, based on the likelihood of extinction from Great Britain.

Of the 607 coastal species assessed using national Red Lists, 93 (15%) were categorised as threatened. Eight of 31 coastal breeding bird species are red-listed as birds of conservation concern in the UK[1].

The UK's coastline is of immense value to wildlife and people; an estimated 270 million day trips are made to our coast each year[2]

Why is coastal nature changing?

Our review found that climate change was the second most significant driver of change in the UK's wildlife over recent decades[3]. While **sea level rise** caused only a relatively small part of the impact, its effects have been felt in our vulnerable coastal habitats. Saltmarshes, dune systems, soft rock cliffs and saline lagoons are vulnerable to rising seas – and are all home to specialised species.

Most pressures on our coastal fringe come not from the sea, however, but from us, in the form of **habitat loss from development** and **degradation from recreational disturbance.** The former includes the loss of dunes to golf courses and holiday resorts, and the loss of mudflats to port developments. The latter is the inevitable consequence of the attraction of the UK's coast, including its natural areas, to tourists; as a result, 10% of the UK's total tourist activity is concentrated in just 0.6% of our land area.

Many coastal habitats are reliant on natural processes and some are maintained by traditional management practices, such as grazing. Others rely on a lack of management that allows, for example, natural dune dynamics to produce the early successional habitats used by a range of rare invertebrates. The stabilisation of dunes by the creation of sea defences, as well as nutrient enrichment, reduced grazing and changes in sediment supply, can lead to the loss of these vital habitats.

Pressures on our coastal wildlife include development, disturbance by people and sea level rise

Coastal habitats are under threat from development

Danish scurvy grass is threatened by a loss of habitat as rising sea levels erode saltmarshes. Unlike some other species, it has expanded along road verges made suitably salty by gritting[4,5].

The recent decline of ringed plovers is thought to be a result of lower breeding success and the abandonment of nest sites in coastal areas that are popular with holidaymakers[6,7].

Natterjack toads are now found almost exclusively in coastal dune slacks. Multiple pressures, including a reduction in grazing leading to unsuitable vegetation, have led to a marked decline[8,9].

The erosion of saltmarsh as a result of rising sea levels threatens its specialised communities, including species such as the scarce pug moth.

Case study

Nigg Bay Coastal Realignment Project

As we have outlined opposite, climate change is a key threat to the coasts and coastal habitats of the UK. Sea level rise and the increasing frequency and intensity of storms threaten to cause flooding, as well as damage and reduce space for important coastal habitats.

Despite being under threat from the impacts of climate change, saltmarsh actually provides a nature-based solution to some of these problems. As well as being important for the biodiversity it supports, saltmarsh can store significant amounts of carbon[10] and provides an effective natural sea defence[11].

Historically, large areas of saltmarsh and other intertidal habitats have been reclaimed in the UK for agriculture and development, leaving the coasts more vulnerable to flooding and erosion. In a familiar story, over 35% of saltmarsh at Nigg Bay in Scotland was lost between 1946 and 1997, and 93 hectares (ha) of mudflats were reclaimed for development in the 1970s.

In response, the RSPB carried out a pioneering project on its nature reserve at Nigg Bay. The project aimed to recreate intertidal habitats, to address both past losses and likely future losses due to sea level rise and other effects of climate change.

The Nigg Bay project was the first example of managed coastal realignment in Scotland. In February 2003, two 20-metre breaches in the existing sea wall were created to reconnect a 25-ha field (Meddat Marsh) with the sea for the first time since the 1950s. Fortunately, the original marsh features, including the creek system, were still largely intact, allowing intertidal habitats to redevelop naturally without costly earthworks.

Within a year, several key species of saltmarsh plants and mud-dwelling invertebrates had colonised. By 2011, Meddat Marsh had been completely transformed from rush pasture to a mixture of saltmarsh and intertidal mudflats.

Negative impacts have been minimal, with very little saltmarsh lost outside the breached sea wall. In contrast, the gains across Meddat Marsh have increased the total saltmarsh in Nigg Bay by about 30%. The project has also created new saltmarsh edge habitat and intertidal mudflats, benefitting wintering waterbirds; 25 species have been recorded using the site since the sea wall was breached.

Meddat Marsh is one of the last areas in Nigg Bay to be covered by the incoming tide, and the realignment site therefore provides an extra valuable foraging opportunity for birds. During windy conditions and high spring tides, it has become a refuge for thousands of waders and wildfowl, including internationally important numbers of bar-tailed godwits.

More than 13 years on from Scotland's first ever managed realignment, it is clear that the Nigg Bay project has been a great success, with saltmarsh habitat and key marine invertebrates returning more quickly than might have been expected[12]. The realignment site has also become a key roosting and feeding area for wintering water birds and will help increase their resilience to further climate impacts.

Positive results from this, as well as more recent large-scale realignment projects at Medmerry in Sussex (2013) and the Wallasea Island Wild Coast Project in Essex (ongoing), will hopefully inspire others to repeat these successes on an even more ambitious scale.


Andy Hay

The Nigg Bay project was the first example of coastal realignment in Scotland

Freshwater and wetland

- ***Over the long term, 53% of freshwater and wetland species declined and 47% increased. Over the short term, 51% of species declined and 49% increased.***
- ***The index of change in the abundance and occupancy of freshwater and wetland species has declined by 21% over the long term, and by 4% over the short term.***
- ***13% of freshwater and wetland species are threatened with extinction from Great Britain.***

For guidance on the results presented in this section, please turn to pages 72–77.

The state of freshwater and wetland nature

Open water and wetlands cover just 3% of the UK's area, but provide many vital services to people, as well as important habitats for wildlife. The UK has over 300,000km of rivers, 200,000 hectares of lakes and half a million small ponds. Wetlands cover an even greater area, with nearly 400,000 hectares of fens, reedbeds, grazing marshes and lowland raised bogs, and nearly one million hectares of seasonally (or occasionally) inundated floodplain[1]. While these figures may seem large, they are much smaller than in the past: wetlands have been drained to claim land, principally for agriculture, for centuries.

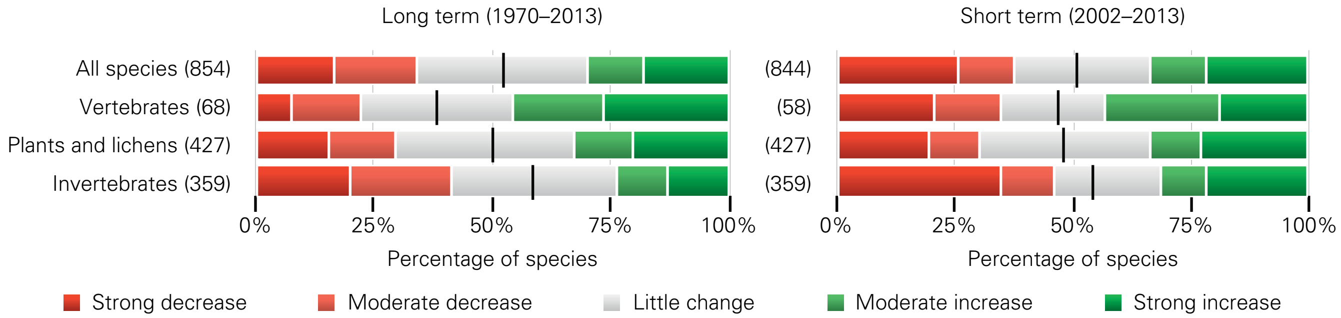


Figure 23
The percentage of species in each trend category over the long and the short term. The line in the "little change" category shows the division between declining species on the left and increasing species on the right. The values in brackets show the number of species assessed.

Looking at the long-term trends of individual freshwater species, 53% declined and 47% increased. Among these, 34% showed strong or moderate declines, 36% showed little change, and 30% showed strong or moderate increases. Over the short term, the picture was similar; 51% of species declined and 49% increased.

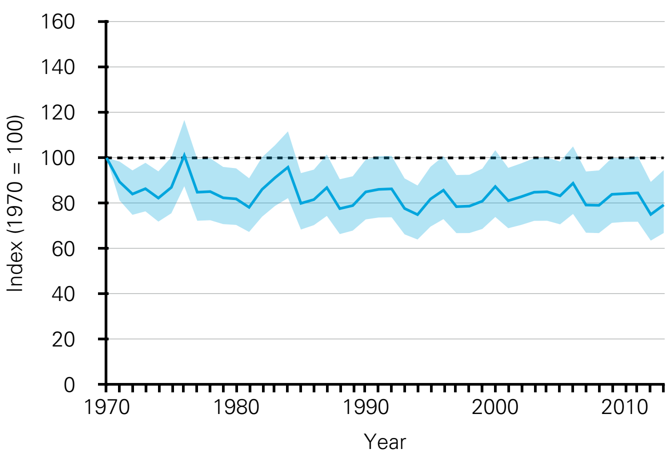


Figure 24
An index of species' status based on abundance or occupancy data for 543 freshwater and wetland species.

Looking in more detail, the index of change in the abundance and occupancy of these species has fallen by 0.59% per year; a statistically significant drop of 21% in total, over the long term. Over our short-term period, the index declined by 0.38% per year; a statistically non-significant fall of 4% in total. The short-term decline is not significantly different to that from 1970 to 2002 (t=1.88, p=0.06).

Our separate measure of distributional change in vascular plants (not pictured) shows an increase of 5% over the long term (based on 277 species) and 10% over the short term (based 91 species).

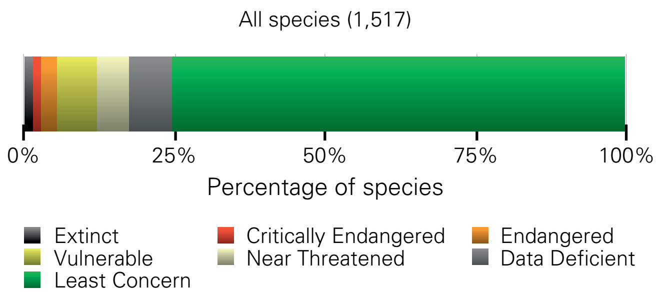


Figure 25
The percentage of species in each risk category, based on the likelihood of extinction from Great Britain.

Of the 1,517 freshwater and wetland species assessed using national Red Lists, 192 (13%) were categorised as threatened. Four of 32 freshwater and wetland breeding bird species are red-listed as birds of conservation concern in the UK[2].

The indicator of breeding waterbirds and wetland birds fell by 15% between 1975 and 2014, with the greatest loss being in birds of wet grasslands[3].

Why is freshwater and wetland nature changing?

Our review found that **hydrological change** was the fifth most significant driver of species loss across all habitats in the UK[4], and its impact is largely, though not solely, felt by freshwater and wetland species.

The majority of hydrological change can be attributed to increased water abstraction and drainage. The latter has led to the destruction of wetland habitats for centuries, with many thousands of square kilometres lost.

Although the rate of loss may have slowed in recent decades, precious habitats have been lost and the remaining wetland habitat is increasingly fragmented; many wetland species are not able to move through surrounding habitats, so dwindling populations remain on wetland "islands".

Non-native species (NNS) appear to pose a particularly serious problem in aquatic environments, in part because watercourses provide a conduit for their rapid spread[5]. Closed system water bodies are also vulnerable to local extinctions as a result of NNS invasions.

Non-native invasive plants can cause radical changes to habitats by outcompeting native species and destroying habitats for animals. Meanwhile, non-native invasive animals predate native species, outcompete others and spread diseases[6].

Habitat creation was one of the most significant drivers of positive change for the UK's wildlife, predominantly through the creation of new wetland sites. Much of this habitat creation has taken place at post-extraction mineral sites, where old quarries are converted to new wetlands, including reedbeds, marshes and open water.

Elsewhere, wet grassland restoration, such as in the Norfolk Broads and North Kent marshes, has brought back valuable areas of this massively reduced habitat.

Non-native mink predate native species, including water voles

The creation of new reedbeds across England and Wales, and the improved management of existing sites, has allowed bitterns to recover from just 11 booming males in 1997 to 156 in 2015[7,8].

Water voles have been beset by a myriad of threats, from urbanisation and predation by mink, to agricultural intensification and habitat loss due to unsympathetic waterway management[5,9,10].

The large marsh grasshopper has declined due to the loss of bogs, mires and fens through drainage, as well as the overgrazing and burning of remaining sites[11].

Small fleabane is now restricted to a few sites in the New Forest because reduced grazing by livestock has reduced the amount of short pond-margin turf on which it relies[12,13].

Case study

The Million Ponds Project

The Million Ponds Project is a national partnership initiative that aims to create a network of clean water ponds for freshwater wildlife, and reverse a century of pond loss by ensuring that the UK has over one million countryside ponds once again.

New pond schemes are designed to improve freshwater biodiversity by creating freshwater refuges and increasing landscape diversity[14], or providing new habitats for priority species, such as the pillwort plant and common toad[15].

With financial support from Biffa Award, the project directly funded the creation of 1,023 new ponds in England and Wales between 2008 and 2012. The Freshwater Habitats Trust and partners coordinated the creation of over 400 ponds for great crested newts, 47 for natterjack toads, 266 for water voles and 32 for tassel stonewort, a rare plant which is an indicator of clean water and has declined nationally as a result of agricultural intensification.

In total, 49 rare and declining pond species that are national priorities for conservation action have benefitted from this work. Many more ponds were created by partners, including at least another 600 as part of environmental stewardship schemes.

As well as creating new habitat, the project team sought to change attitudes[16] and embed pond creation in land management best practice. As a result, more than 50 factsheets were published to the online Pond Creation Toolkit and over 1,000 practitioners and enthusiasts were trained at regional workshops. A team of regional officers was also on hand to provide advice to anyone wanting to create a pond. At an average of £500 per pond, this is a cost-effective way to provide unpolluted freshwater habitats.

Pond creation has now become a widespread conservation tool to protect and enhance freshwater biodiversity in the UK, but monitoring studies are relatively scarce. To address this, the second phase of the Million Ponds Project, which began in 2013, is focusing on assessing the success of the pond creation activities to date.

Half of the ponds monitored in Wales were already of sufficient quality to achieve Priority Pond status within a few years of creation, and new populations of declining species, including pillwort and tubular water-dropwort have been found.

Monitoring also highlighted the importance of partnership working: the best schemes tend to involve technical experts and land managers working together. Armed with this new information, the third phase of the project is being developed, which will lead to the creation of many more clean water ponds for freshwater plants and animals.

Indeed, anyone can do their bit for freshwater wildlife by creating their own little pocket of clean water in their garden, and it's amazing how quickly species move in. Not only is pond creation fun and satisfying, it's a wonderful antidote to the depressing thought that we are still losing much-loved species and habitats.

*To find out more about the project and creating a pond of your own, please visit **freshwaterhabitats.org.uk/million-ponds***

Roger Key

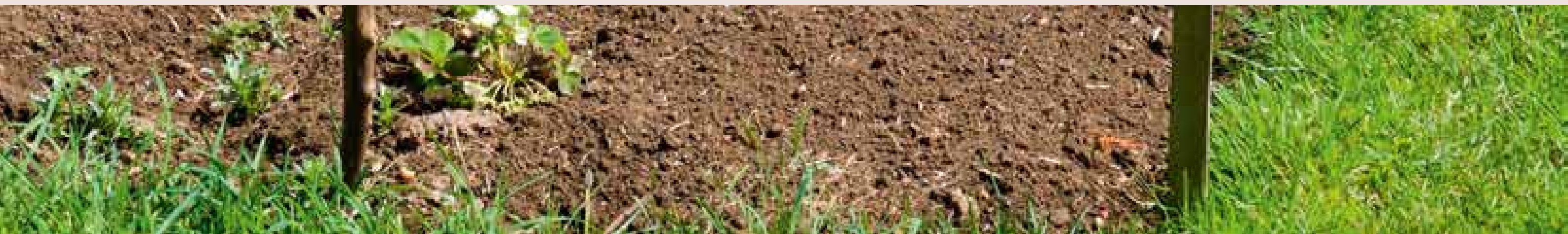
Ponds have been created specifically for the Endangered spangled diving beetle through the Million Ponds Project


incamerastock (Alamy Stock Photo)

Urban

- ***Over the long term, 47% of urban species declined and 53% increased. Over the short term, 49% of species declined and 51% increased.***
- ***The index of change in the abundance and occupancy of urban species has declined by 11% over the long term, and by 10% over the short term.***
- ***7% of urban species are threatened with extinction from Great Britain.***

For guidance on the results presented in this section, please turn to pages 72–77.



The state of urban nature

Urban areas take up just 7% of the UK's land area, but they are home to 80% of the human population. Such high densities of people mean that there is little space for nature to co-exist, and green space is often highly fragmented, restricting its value for many species[1]. Urban green spaces can vary widely in character; most consist of land managed for amenity or recreational use, including gardens, allotments, parks, playing fields, verges and street trees. However, urban areas can also contain wetlands, brownfield land and "encapsulated countryside" – portions of semi-natural habitat, such as grassland and woodland, that have been enclosed by urban expansion. All of these urban "greenspaces" can be rich in wildlife.

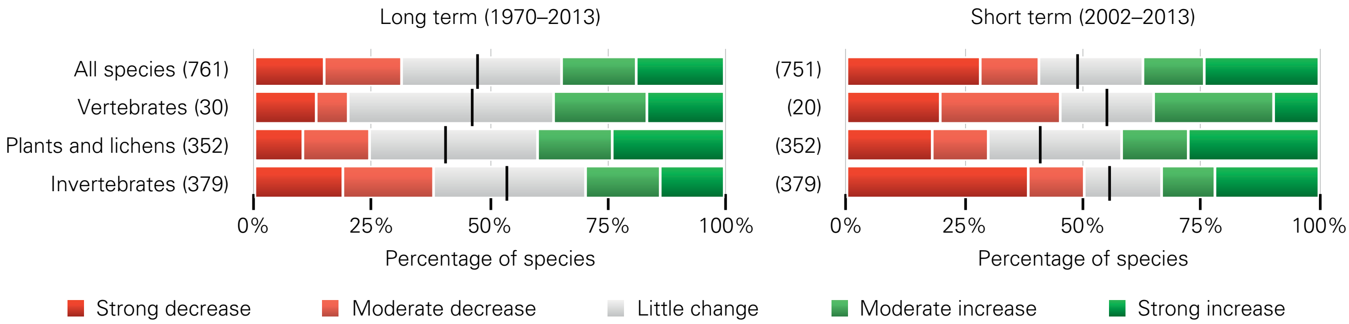


Figure 26
The percentage of species in each trend category over the long and the short term. The line in the "little change" category shows the division between declining species on the left and increasing species on the right. The values in brackets show the number of species assessed.

Looking at the long-term trends of individual urban species, 47% declined and 53% increased. Among these, 31% showed strong or moderate declines, 34% showed little change, and 35% showed strong or moderate increases. Over the short term, the picture was similar; 49% of species declined and 51% increased.

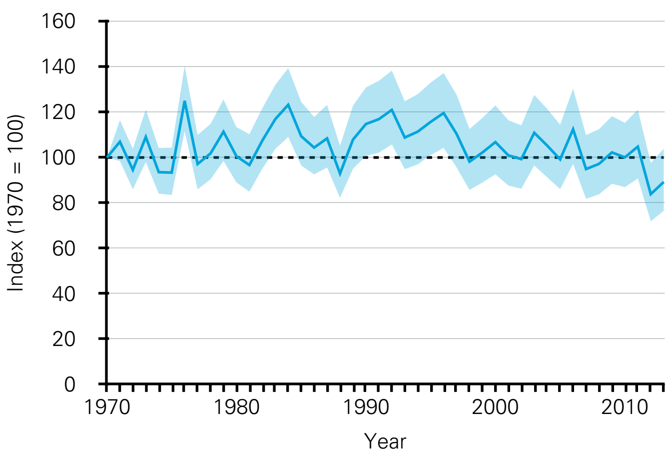


Figure 27
An index of species' status based on abundance or occupancy data for 565 urban species.

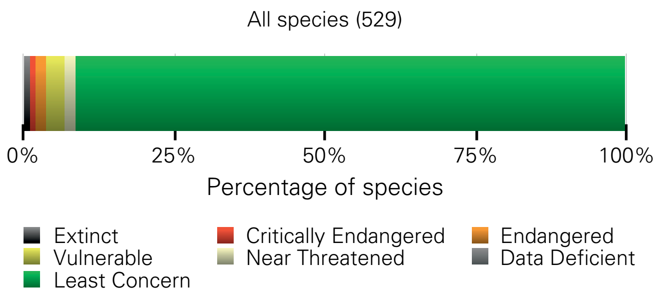


Figure 28
The percentage of species in each risk category, based on the likelihood of extinction from Great Britain.

Looking in more detail, the index of change in the abundance and occupancy of urban species has fallen by 0.27% per year; a statistically significant drop of 11% in total, over the long term. Over our short-term period, the index declined by 0.94% per year; a statistically significant fall of 10% in total. The short-term decline is significantly faster than that from 1970 to 2002 (t= -2.35, p=0.02). Our separate measure of distributional change in vascular plants (not pictured) shows a long-term increase of 17% (based on 182 species). Over the short term, there was a 9% increase (based on 108 species).

Of the 529 urban species assessed for national Red Lists, 37 (7%) were categorised as threatened. Two of six urban breeding bird species are red-listed as birds of conservation concern in the UK[2].

Urban areas take up just 7% of the UK's land, but are home to 80% of the human population; finding space for nature to co-exist is a big but achievable challenge

Why is urban nature changing?

Most urban wildlife does not actually seek out human development, but rather survives in the patches of green within urban areas. These may be parks, allotments, or simply gardens, which collectively provide a substantial area of green space; more than half of the total urban area in England is made up of green space[1]. However, most of this is not managed solely for the benefit of nature; if considered at all, the needs of wildlife are often balanced against other requirements, such as recreational space for people.

Increased **urbanisation** has led to a decline in some types of green space, such as allotments. Although the demand for gardens remains high, an increase in housing density in new developments means that garden sizes have shrunk.

Previously-developed land, commonly known as brownfield, is often targeted for development because it can reduce the need to build on greenfield sites. But this, and other types of post-industrial land, such as quarries, railways and spoil heaps, can support rich successional wildlife habitats.

In some cases, such as at Canvey Wick in Essex, they hold internationally important invertebrate populations. Development pressures within urban areas, encouraged by planning policies that restrict development on city margins, mean that many wildlife-rich brownfield sites have been lost[3].

Non-native invasive species may affect native wildlife in all habitats, but as invasive species arrive through human transportation routes, they are often first recorded, and most abundant, in urban areas[4]. While species such as grey squirrels, ring-necked parakeets and buddleia may bring a welcome sight of nature into city-dwellers' lives, they and many other non-native species have the potential to have devastating impacts on native habitats and species.

The accessibility and condition of green space within urban areas has declined

Hedgehogs have declined massively in farmland, so sensitively managed wildlife-friendly gardens have now become increasingly important for this much-loved species[5,6].

The invasive harlequin ladybird was first found in the UK in 2004 and has spread as far north as Shetland. It has caused the declines of several native ladybirds through competition and predation[7].

A combination of legislation and education has assisted the partial recovery of a number of bat species, including the soprano pipistrelle. It is illegal to kill bats or disturb their roosts[8,9].

The spectacular garden tiger moth was once common, but has suffered from the impacts of climate change; caterpillar survival is poor over mild and wet winters[10].

Case study

My Wild City

My Wild City is Avon Wildlife Trust's (AWT) campaign to re-think Bristol as a nature reserve, and was launched as part of the Bristol European Green Capital 2015 initiative. Bristol is the fastest growing city region in the UK and as the city continues to grow, so do the challenges facing wildlife within and beyond its boundaries.

My Wild City takes on these challenges, aiming to inspire people to transform Bristol into a flourishing nature reserve where wildlife can thrive. The vision is a city where whole streets get together to join up wildlife-friendly gardens, and where communities and businesses are engaged in transforming and managing their local green spaces.

AWT is delivering a range of projects that are intended to inspire a groundswell of activity, to create homes for wildlife and to care for the urban environment. These projects include the opening of a new nature reserve in the Avon Gorge (Bennett's Patch and White's Paddock); supporting four communities and the BBC to create new wildlife garden demonstration sites; and giving away over two thousand free wildlife garden starter packs.

AWT has also published a series of maps showing the best places to create habitat across Bristol, linking gardens and green spaces to form wildlife corridors.

Beyond these projects, the Trust is working with communities across the city, inspiring and enabling local people to do something amazing for wildlife in their area through a number of exciting community initiatives, including My Wild Cathedral, My Wild Park and My Wild Office.

As part of the My Wild Street project, AWT teamed up with leading UK law firm, Burges Salmon, to create a community project to bring wildlife to a typical urban street. The front gardens of 30 terraced houses on Stanley Park in Easton were turned into a haven for nature and people alike over two weeks. The Trust hope that this project will inspire other Bristolians to work with their neighbours to create their own wild streets, improving connectivity for wildlife across the inner city area.

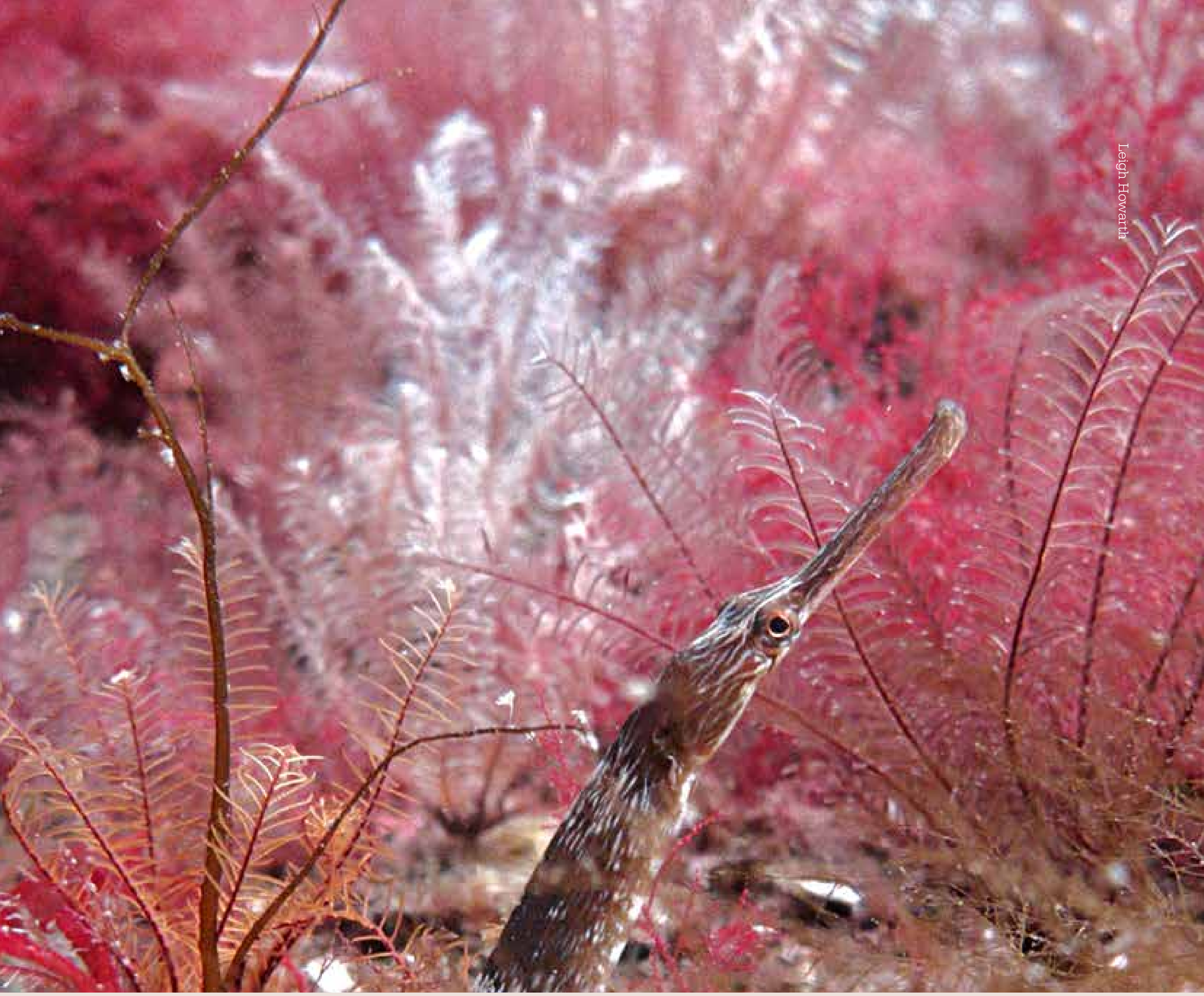
AWT is also helping to amplify people's efforts with significant media and social media activity, creating further interest and stimulating new projects. My Wild City has been an amazing success to date and will continue beyond Bristol Green Capital year.

All of the actions taken by people to help make Bristol one big nature reserve are recorded on an interactive map. The map enables people to see what others are doing and lists live projects or groups that they can join and get involved with. To find out more, please visit ***avonwildlifetrust.org.uk/mywildcityinteractivemap***

The My Wild City project aims to inspire people to transform Bristol into a flourishing nature reserve where wildlife can thrive

Nick Upton

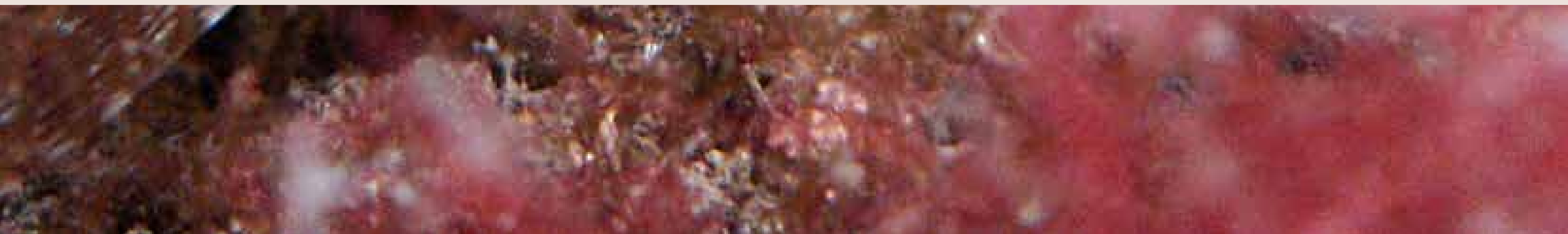
The My Wild City project encourages people to care for nature



Marine

- ***Over the long term, 38% of marine species declined and 62% increased. Over the short term, the overall picture was unchanged.***
- ***The index of change in the abundance of marine species and groups has increased by 37% over the long term, and by 9% over the short term. When fish species are excluded from the groups assessed, the index has declined by 14% since 1970, and by 5% since 2002.***

For guidance on the results presented in this section, please turn to pages 72–77.



The state of marine nature

UK waters straddle a boundary zone between warmer waters to the south and west, and colder waters to the north and east, resulting in areas of exceptional diversity and communities of European and global importance. The UK's seas cover over three-and-a-half times the area covered by land[1] (excluding the UK Overseas Territories), yet the practicalities of studying life beneath the waves mean that we know less about marine habitats and species than we do about terrestrial ones. However, since the first *State of Nature* report was published, there have been substantial efforts to improve and combine the metrics that we do have on marine species. As a result, we are now able to present trends for a number of taxonomic groups.

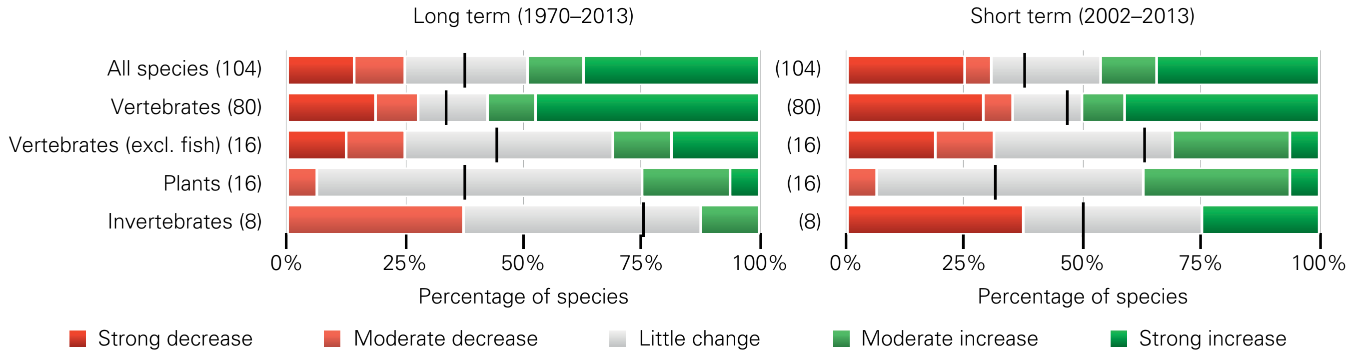


Figure 29

The percentage of species and species groups in each trend category over the long and the short term. The line in the "little change" category shows the division between declining species on the left and increasing species on the right. The values in brackets show the number of species assessed.

Looking at the long-term trends of individual marine species, 38% declined and 62% increased. Among these, 35% showed strong or moderate declines, 28% showed little change, and 37% showed strong or moderate increases. Over the short term, the overall picture was unchanged. When fish are excluded from the analysis, overall, 44% of species declined and 56% increased over the long term, but over the short term, 63% of species declined and 37% increased.

Marine fish have been influenced by commercial fishing and climate change altering the composition of marine communities, the abundance of species and the body sizes of individual fish. Over our long-term period, the populations of a large proportion of smaller-bodied fish species have increased due to warming sea temperatures, while the populations of a smaller number of larger-bodied species have declined due to fishing[2,3]. During our short-term period, improved fisheries management has allowed some commercially fished species to increase from very low baselines, while the declines of some deep sea fish have stabilised[4].

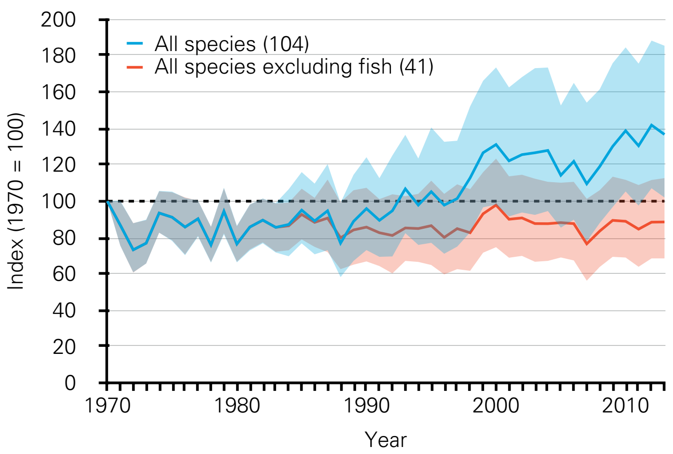


Figure 30

An index of species' status based on abundance data for 104 marine species (calculation of this marine indicator differs from the others in this report – for details see page 74).

The index of change in the abundance of marine species overall has increased by 0.61% per year, and 37% in total, over the long term. Over our short-term period, the index increased by 0.38% per year, and 9% in total. The trends are not statistically different in the long and the short term ($t=0.99$, $p=0.327$).

However, when looking at species' trends in more detail, it is apparent that one group in particular is driving this increase; when marine fish are excluded from analyses the indicator shows a decline of 14% since 1970, and of 5% since 2002.

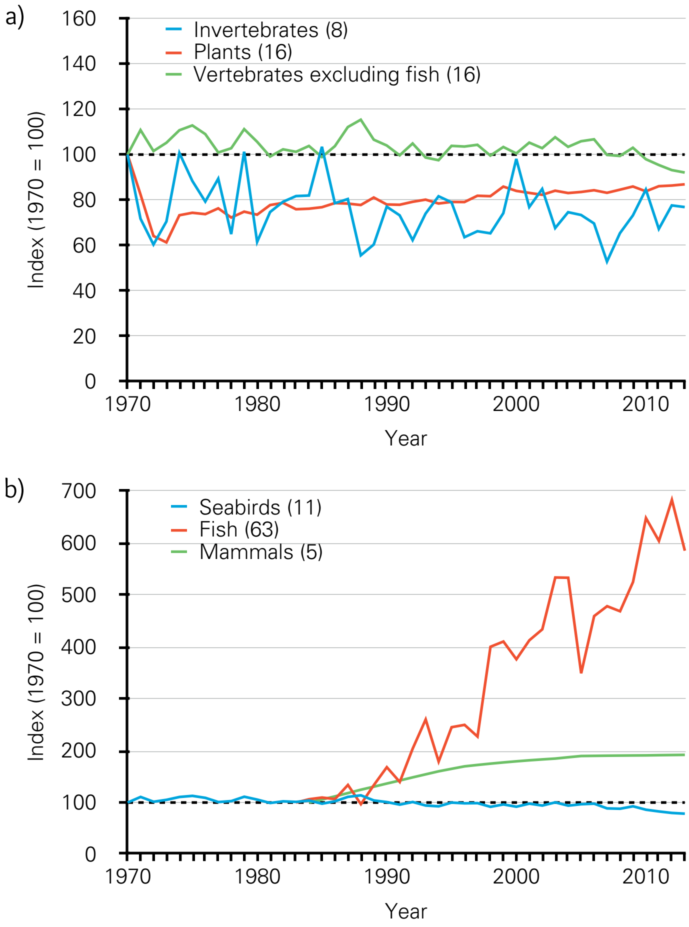


Figure 31
An index of species' status based on the abundance of a) 40 marine species by taxonomic group; and b) 79 vertebrate species, including seabirds (11), fish (63) and mammals (5).

Looking in more detail, the index of species' status for marine invertebrates (zooplankton including copepods) declined by 23% over the long term and 9% over the short term (see Figure 31a). Over the long term, the marine vertebrate index (excluding fish) decreased by 10%, while over the short term it decreased by 8%. The index for marine plants (phytoplankton and macro-algae) declined by 13% over the long term, and increased by 6% over the short term.

The strong increase in the index for fish species (485% over the long term and 35% over the short term) is apparent in Figure 31b. The seabird index has declined by 21% since 1970 and by 17% over the short term. The indicator for marine mammals has increased by 92% since 1984, but has stabilised in the short term.

The variety of marine life

The sheer variety of the UK's marine life stems from the range of habitats off our coasts. Approximately 8,500 marine species are found here[5], including 26 species of breeding seabirds and 24 regularly occurring species of marine mammals. Other important groups include benthic communities (those associated with the sea floor), commercial fish stocks, elasmobranchs (sharks and rays), estuarine fish and the building blocks of the marine food web – plankton. Although the area of deep sea in UK waters, to the north and west of Scotland, is limited, the habitats and communities to be found there – including cold water coral reefs, coral gardens and sponge-rich communities – are unique.

In recent years, our knowledge of some marine species and communities has begun to improve. For example, researchers have been working to describe and map the communities found at a seamount called Anton Dohrn, which rises to within 600m of the surface from the sea floor 2km below, and spans 45km. Four types of cold water coral reef were found at the seamount, with structure-building corals, such as *Lophelia pertusa*, creating a complex habitat matrix for a rich array of life, including pencil urchins, anemones, decapods and squat lobsters[6]. Similar surveys are being carried out at other deep-sea sites[7,8], bolstering both our knowledge of life in submarine canyons and seamounts, and our ability to protect it.

In the shallow seas mainly to the north and west of the UK, horse mussel beds stabilise the seabed and provide homes and breeding grounds for nearly 400 other species. The cliffs, rocky shores and thousands of offshore islands are of great significance to the internationally important seabird communities that use these areas to breed in huge numbers, and rely on the food supplies in the shallow seas and upwellings surrounding them.

Benthic invertebrates

In general, benthic invertebrate species (those living on, in or near the seabed) are poorly monitored, although some excellent long-term studies have been carried out in the English Channel. Over the last 100 years, the benthic invertebrate community has changed markedly with reductions in many large, conspicuous species, such as large sea urchins, starfish and molluscs. These changes happened over the same time period as significant beam trawling and scallop dredging in the area[9].

In the shorter term (from 1986 to2010), communities of benthic invertebrates have also changed in the North Sea. The distributions of 65 species have shifted towards deeper water, moving an average of 4–7km northwest each year. These changes occurred at the same time as increasing sea temperatures, but the species moved slower than increasing temperatures, meaning that they were often experiencing warmer conditions in more recent years[10].

Changes in community composition

Analyses of commercial fishery data from the English Channel over the last century have identified changes in community composition among marine fish. Species that are higher up the food web have been increasingly replaced by smaller fish and invertebrates in commercial catches, a pattern recognised in other UK waters and around the world[11].

Comparing trawler data from the early 20th century (1913 to 1922) with resurveys of the same sites in 2008/2009, revealed dramatic changes in the elasmobranchs (sharks and rays); individuals were smaller and there were declines in several of the larger, slower-growing, late-maturing species. No such change was recorded in teleost flatfish species. Some elasomobranch species were also found to be absent from the area during the re-surveys, including the formerly abundant angel shark; this supports evidence of major declines in the species in the wider English Channel region[12].

The sheer variety of the UK's marine life stems from the range of habitats off our coasts

Case study

Can we use social networks as scientific tools?

Every year, hundreds of thousands of marine images are posted on social media websites, giving a unique glimpse of the underwater world. As part of the Purple Octopus project, researchers from the Coral Reef Research Unit and the University of Essex set about analysing a small subset of these images to assess how accurately they had been identified.

They found that 93% of images are tagged correctly, making them useful as a primary source of data for conservation research. By analysing the text associated with the uploaded images, the team found it possible to map where different species live around the world, and analyse what they eat and what eats them.

Innovative approaches to combating the problems of accessing and analysing such ad-hoc, unstructured data will be required before it can be used to calculate trends such as those presented in this report. Nevertheless, this analysis by Purple Octopus shows the reliability of the wealth of potential information that is out there, and that could be accessed by using group-sourcing approaches such as this.

For more information, visit ***purpleoctopus.org***

Case study

The European Cetacean Monitoring Coalition

Since 1993, 11 research groups from Great Britain, Ireland, France, the Netherlands, and Spain – collectively known as the European Cetacean Monitoring Coalition (ECMC) – have carried out structured surveillance of top predators from ferries, to address the gap in our knowledge of how UK cetaceans (whales, dolphins and porpoises) are faring.

The groups collect broadly comparable data on cetaceans and other large marine species, such as seabirds and sharks. The data are collected by experienced volunteers, while some of the co-ordination is undertaken by paid staff. Currently, monthly sampling occurs along 31 ferry routes crossing UK waters, with a combined transect length of c11,000km per month.

The goal of the coalition is to establish a monitoring scheme that is cost-effective and policy-relevant, and that provides robust statistics on the status of cetaceans and other marine mega-vertebrates from local to European scales. Current development work includes establishing new routes; developing a combined database and associated online data portal; and devising analytical methods that account for sampling biases. It is hoped that these developments will pave the way for the data to play a vital role in improving our understanding of how the abundance and distribution of cetaceans is changing. Together with multiple partners, the ECMC also contributes to the Joint Cetacean Protocol, an even larger dataset that represents over 1 million kilometres of survey effort[13].

Dolphins can be surveyed from ferries

Why is marine nature changing?

The key drivers of change in the marine environment remain a combination of over-exploitation and climate change. Inputs of contaminants and nutrients are an additional pressure in coastal areas. Unsustainable fishing activities in the UK over the last 100 years have resulted in relatively fewer fish being caught compared with 20th century baselines, but individuals of most targeted species have also, at least until recently, been smaller and matured at a younger age[14]. The impact on fish populations is not the only result of such commercial fishing practices; bottom trawling remains the most widespread fishing activity and has a significant impact on the seafloor, damaging sensitive species in benthic communities.

Currently, it is thought that four out of the 13 fish stocks assessed are being harvested sustainably[15]; this is one more than in the early 1990s. Although this is an improvement, the majority of stocks remain at less than full reproductive capacity and/or are harvested unsustainably. The proportion of large fish in a catch is a good measure of the health of the population, and the size structure of the fish population has shown signs of recovery in the north-western region of the North Sea, at least over the short term. The Large Fish Index[16] (Figure 32) was at similar levels in 2014 in the north-western North Sea to the mid-1980s – an increase of 2.2% from a low point in 2001. This is associated with reduced exploitation and better selection of fish by key commercial fisheries. In contrast, the index remains at a low level, albeit with marked fluctuations, in the southern North Sea.

A large number of taxonomic groups and species – in particular bottom feeding fish and large-bodied copepods – have shown shifts in their distribution in UK waters alongside changes in sea temperatures. Northward movements have been considerable, with some species' distributions shifting by 10 degrees latitude since the 1950s. The majority of the most common demersal fish have shown a response to climate change, with warm-adapted species increasing in abundance and cold-adapted species decreasing[17]. Warm- and cold-adapted copepod species show a similar pattern; however there is concern that the warm-adapted species moving further into UK waters are less profitable food sources, as they are generally smaller and less abundant. They often have a different seasonality to the cold water species they are replacing, meaning there could be a mismatch in the food web.

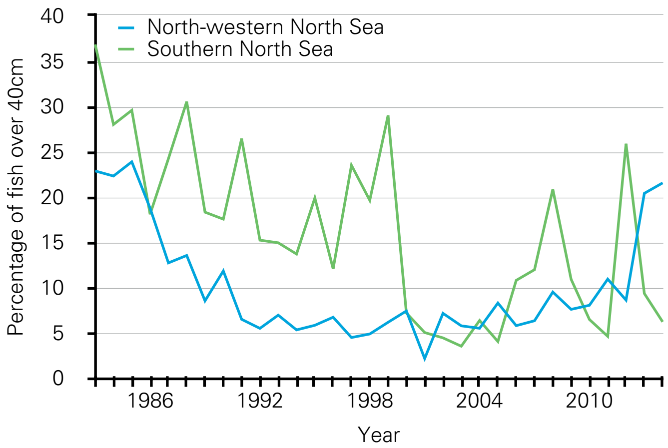


Figure 32: Large Fish Index
The proportion of large fish (equal to or larger than 40cm) by weight in the North Sea between 1983 and 2014[16].

Case study

Rat eradication on islands

The devastation caused to island ecosystems by invasive non-native species, such as the brown rat and American mink, is well documented. Fortunately, modern island restoration techniques allow us to eradicate entire populations of these invaders, reducing pressure on many of our native species.

Good ecological monitoring programmes are an essential part of this work, allowing us to assess the impacts of eradication. Three projects in the south-west of the UK have provided some excellent data in recent years, allowing us to see in detail the benefits of rodent eradication for some of our vulnerable island species.

Ramsey Island in Pembrokeshire and Lundy in the Bristol Channel have both seen dramatic changes since the removal of rats. On Ramsey Island, the number of Manx shearwaters (pictured opposite) more than quadrupled between 1998 and 2012, to almost 4,000 breeding pairs. On Lundy, Manx shearwaters have also recovered dramatically, with the number of apparently occupied sites increasing tenfold between 2001 and 2013, to almost 3,500. Puffins have also shown a strong recovery. Since the eradications, European storm petrels have started breeding on both islands for the first time since records began.

The most recent UK islands to be cleared of invasive rats are St Agnes and Gugh, in the Isles of Scilly. The monitoring work here has included plants, rabbits, shrews, invertebrates and land birds, as well as seabirds, because rats can have diverse and far reaching impacts on ecosystems. Since rat eradication was completed in late 2013, both Manx shearwaters and European storm petrels have returned to breed on the islands for the first time in living memory, an astonishingly fast recolonisation. Continued monitoring will help us follow the changing fortunes of these species, teaching us more about seabirds and the impacts of invasive predators.

On Ramsey Island, the number of Manx shearwaters more than quadrupled after invasive rats were removed

Genevieve Leaper

How are we helping marine nature?

Marine Protected Areas (MPAs) are internationally recognised as a critical tool to halt the deterioration of marine biodiversity. The UK is committed to establishing an ecologically coherent and well-managed network of MPAs in order to protect and restore marine biodiversity. This network will protect our most important marine sites, and allow marine biodiversity to recover from threats and to adapt to climate change.

The network is growing and includes sites of national importance, such as Marine Conservation Zones in England, Wales and Northern Ireland and nature conservation MPAs in Scotland. The network also contains sites of European importance, including Special Protection Areas for birds and Special Areas of Conservation for other species and habitats (see page 51).

The aim of the UK MPA network is to designate sites which together represent the full wealth of our marine diversity, and protect and restore it where necessary. The Joint Nature Conservation Committee (JNCC) is currently reviewing the network to see what further research and site designations are needed to fully achieve this aim. For example, groups such as seabirds and marine mammals can be tracked remotely while at sea. Twenty years of tracking data have been used to show how grey and harbour seals use the sea, each in a different way (see Figure 33). This means that different conservation approaches, in terms of management or protected areas, would be needed for each species. In 2016, internationally important sites were proposed for terns and harbour porpoises at sea. The next step is to see the designation of these sites, and more, using this up-to-date research.

The current network protects a range of habitats, including slow-growing maerl beds, which are formed from layers of dead maerl build-up; and seagrass meadows, which are important as a nursery ground for commercial fish and as a food source for wildfowl.

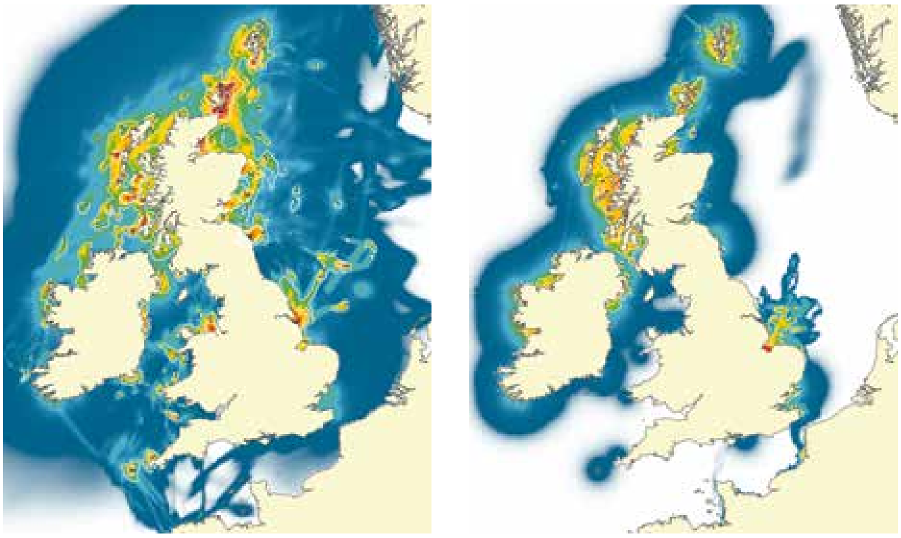
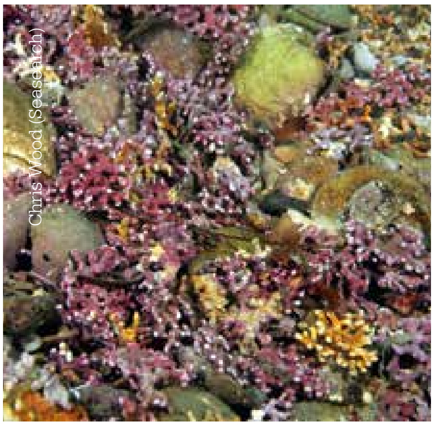


Figure 33
New analyses of grey seal (left) and harbour seal (right) tracking data illustrate how they use UK waters differently. The colours represent the predicted number of seals in each 5 x 5km grid square: yellow denotes 10–50 seals, and red over 100 seals within that grid square[18].



Large beds of rock-hard, coral-like red seaweed, known as maerl beds, provide important habitats for up to 2,000 species[19] and are an effective carbon store.

Seagrass meadows contain one of the few flowering plants that grow in the sea. These meadows help to reduce coastal erosion.

Ocean quahogs are slow-growing bivalve molluscs that can live for over 500 years. They are commercially harvested, and at risk from bottom-trawling gear; they have declined in recent years.

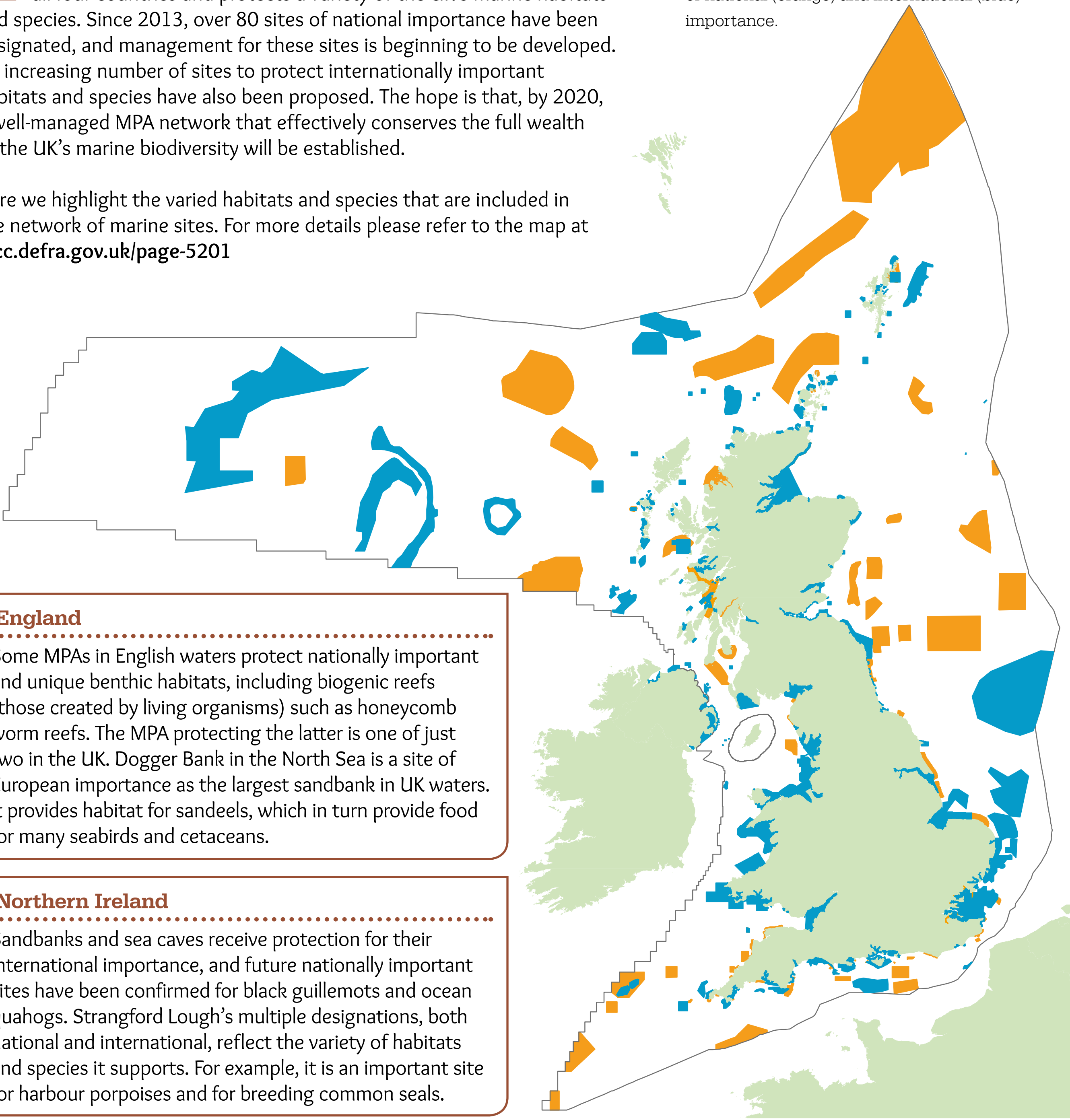
The basking shark declined historically due to overfishing. It is the second largest fish in the world and is one of the mobile species currently under-represented in the MPA network.

The Marine Protected Area network

The developing network of MPAs in UK waters, which consists of sites of national (orange) and international (blue) importance, now spans all four countries and protects a variety of the UK's marine habitats and species. Since 2013, over 80 sites of national importance have been designated, and management for these sites is beginning to be developed. An increasing number of sites to protect internationally important habitats and species have also been proposed. The hope is that, by 2020, a well-managed MPA network that effectively conserves the full wealth of the UK's marine biodiversity will be established.

Here we highlight the varied habitats and species that are included in the network of marine sites. For more details please refer to the map at **jncc.defra.gov.uk/page-5201**

Figure 34
The MPA network in the UK, showing sites of national (orange) and international (blue) importance.



England

Some MPAs in English waters protect nationally important and unique benthic habitats, including biogenic reefs (those created by living organisms) such as honeycomb worm reefs. The MPA protecting the latter is one of just two in the UK. Dogger Bank in the North Sea is a site of European importance as the largest sandbank in UK waters. It provides habitat for sandeels, which in turn provide food for many seabirds and cetaceans.

Northern Ireland

Sandbanks and sea caves receive protection for their international importance, and future nationally important sites have been confirmed for black guillemots and ocean quahogs. Strangford Lough's multiple designations, both national and international, reflect the variety of habitats and species it supports. For example, it is an important site for harbour porpoises and for breeding common seals.

Scotland

Thirty nationally important sites were designated in 2014 to protect habitats and species, including seagrass beds, sandeels and flame shell reefs. These included the North-east Faroe Shetland Channel, which at 23,682km² is the largest MPA in Europe. These sites add to internationally important sites created to safeguard bottlenose dolphins, grey and common seals, and cold-water coral reefs.

Wales

A single nationally important site in Welsh waters includes protection for sponge and algal communities. Inshore water MPAs include Cardigan Bay, a key site of international importance for bottlenose dolphins. An assessment to understand the contribution of Welsh sites to the MPA network is nearing completion, and is likely to identify some gaps, in particular in offshore habitats.

Country summaries

Since 2013, substantial effort has been made to improve our ability to report on how wildlife is faring across the countries that make up the UK. Separate reports have been produced for England, Northern Ireland, Scotland and Wales: here we give brief summaries of the details presented in those reports.

England

England holds over 80% of the UK's human population in just over half the land area, and has long benefitted from a relatively high density of enthusiastic volunteer wildlife recorders. As a result, there are robust systems for monitoring many taxonomic groups, and in some cases data stretches back decades. However, for other groups we still lack England-specific data analyses.

We collated trends in abundance within England for 1,387 terrestrial and freshwater species over the long term and 836 species over the short term. The availability of trends was strongly biased towards vascular plants (1,204 species), and so the overall pattern may not be representative of broader patterns in England.

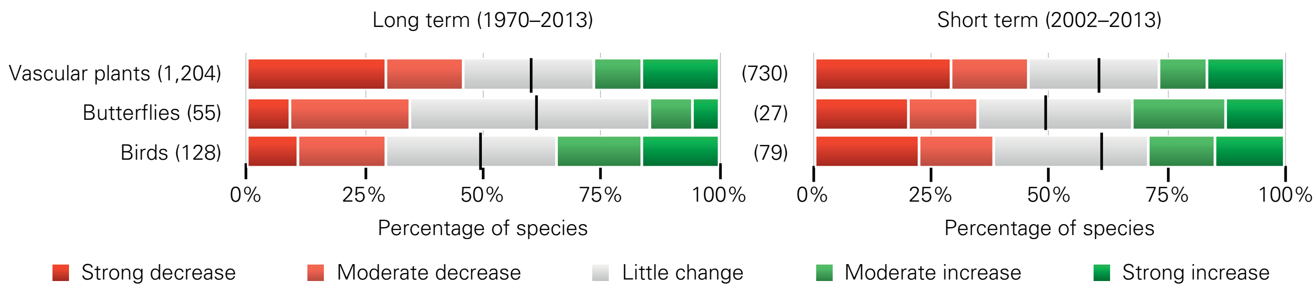


Figure 35

The percentage of species in each trend category over the long and the short term. The line in the "little change" category shows the division between declining species on the left and increasing species on the right. The values in brackets show the number of species assessed.

Over the long term, 60% of vascular plant species declined and 40% increased. Over the short term this pattern was unchanged.

62% of butterfly species declined and 38% increased over the long term, while over the short term, 50% of species declined and 50% increased.

Over the long term, 49% of bird species declined and 51% increased. Over the short term, 62% declined and 38% increased.

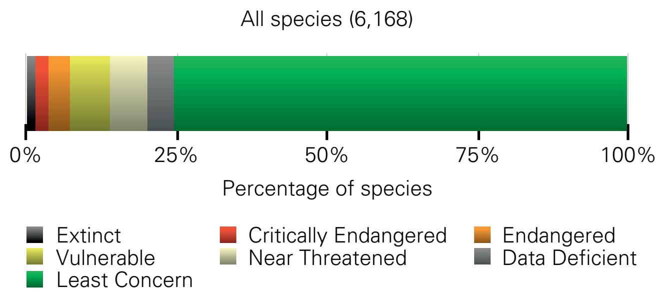


Figure 36

The percentage of species in each risk category, based on the likelihood of extinction from Great Britain.

Of the 6,168 species that have been assessed using modern IUCN Red List criteria, 728 (12%) are at risk of extinction from Great Britain. The influence of populations within England on the overall status in Great Britain varies widely between species.

When we look at the English biodiversity indicators (not shown) we can see that the Wild Bird Indicator has declined by 6% since 1970, while the indicators for birds in farmland and woodland have fallen by 56% and 23% respectively. The Farmland Butterfly Indicator has declined by 27% and the Woodland Butterfly Indicator by 51% since 1990.

Our separate *State of Nature 2016: England* report highlights the pressures affecting nature in the most densely populated and developed of the UK's four countries. It also highlights efforts to help England's species and habitats, including work to tackle invasive species, restore degraded habitats, support farmland wildlife and share our urban spaces with wildlife.

Northern Ireland

The relatively small human population of Northern Ireland means that the capacity for biodiversity recording is correspondingly low. Despite the hard work of a small number of dedicated volunteers, our knowledge of species' trends is poorer than for elsewhere in the UK.

We collated trends in abundance within Northern Ireland for 652 terrestrial and freshwater species. The availability of trends was strongly biased towards vascular plants (604 species), and so the overall pattern may not be representative of broader patterns in Northern Irish nature.

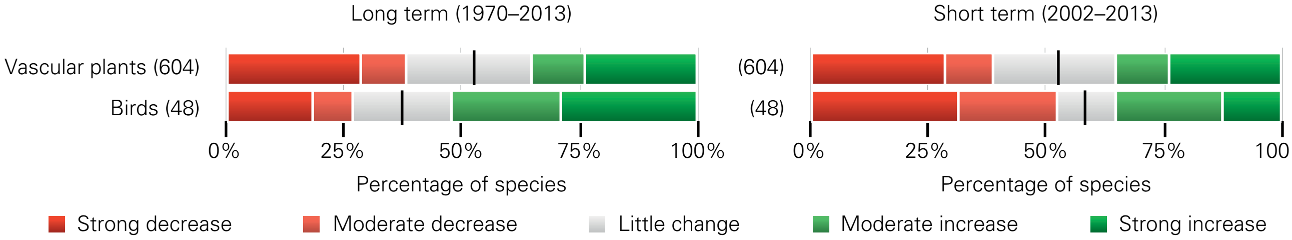


Figure 37

The percentage of species in each trend category over the long and the short term. The line in the "little change" category shows the division between declining species on the left and increasing species on the right. The values in brackets show the number of species assessed.

Over the long term, 52% of vascular plants declined, while 48% increased. This trend continued over the short term.

38% of bird species declined over the long term, while 62% increased. Over the short term, 58% of bird species declined and 42% increased.

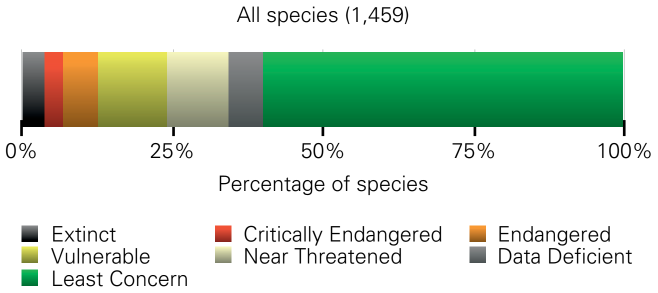


Figure 38

The percentage of species in each risk category, based on the likelihood of extinction across all of Ireland.

Red Lists are assessed across all of Ireland, incorporating data and knowledge from Northern Ireland, as well as from the Republic of Ireland. Of the 1,459 species that are known to occur in Northern Ireland and that have been assessed using modern IUCN Red List criteria, 295 (20%) are thought to be at risk of extinction from Ireland.

Our separate *State of Nature 2016: Northern Ireland* report takes a tour of the six counties of Northern Ireland, celebrating the work underway to help the country's wildlife. It showcases projects working with communities and land owners to manage habitats, making more space for wildlife such as pollinators, farmland birds and butterflies. It also highlights some of the country's most important wildlife, such as the cryptic wood white butterfly and the endangered freshwater pearl mussel. In addition, the report celebrates the contribution of the dedicated volunteers working to help red squirrels and swifts, and the efforts of the local environmental records centre to improve the evidence base supporting conservation work in the country.

Scotland

Scotland is the least densely populated of the UK's four countries, with large and remote uplands. This has hampered our understanding of changes in Scottish nature, although our knowledge has long benefitted from the efforts of dedicated and expert naturalists.

We collated trends in abundance within Scotland for 1,079 terrestrial and freshwater species (2.3% of an estimated 46,000 species[1,2]). The availability of trends was strongly biased towards vascular plants (963 species), and so the overall pattern may not be representative of broader patterns in Scottish nature.

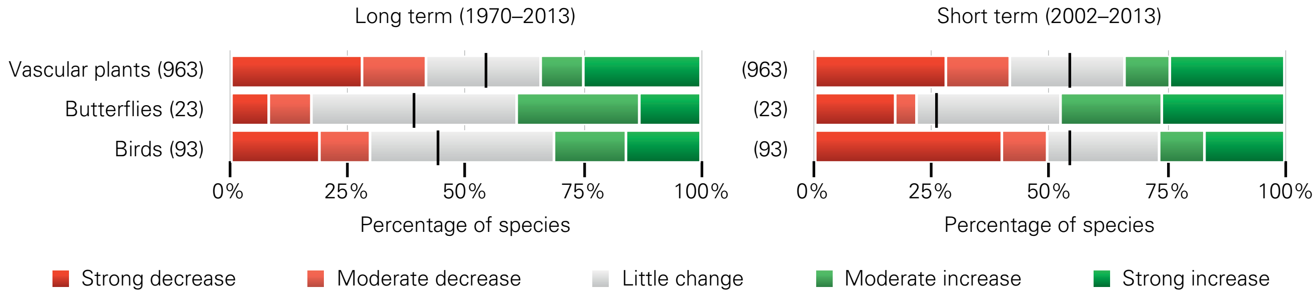


Figure 39

The percentage of species in each trend category over the long and the short term. The line in the "little change" category shows the division between declining species on the left and increasing species on the right. The values in brackets show the number of species assessed.

Over the long term, 54% of vascular plants declined and 46% increased. This pattern was unchanged over the short term.

39% of butterfly species declined and 61% increased over the long term. Over the short term, 26% declined and 74% increased.

Over the long term, 44% of bird species declined and 56% increased. Over the short term, 54% declined and 46% increased.

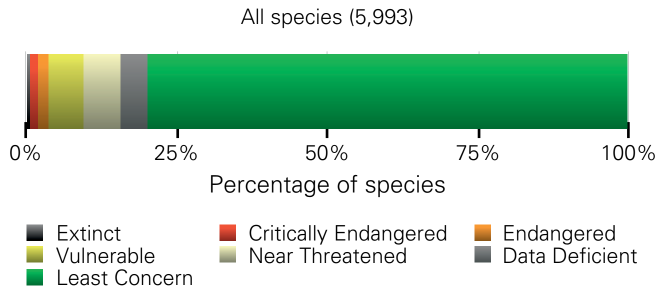


Figure 40

The percentage of species in each risk category, based on the likelihood of extinction from Great Britain.

Of the 5,993 species known to occur in Scotland that have been assessed using modern IUCN Red List criteria, 520 (9%) are thought to be at risk of extinction from Great Britain. The influence of populations within Scotland on the overall status in Great Britain varies widely between species; in some cases, Scottish trends will have relatively little influence.

The butterfly indicator for Scotland (not pictured) has increased by 41% since 1979. Generalist species of butterfly have increased by 56% and specialists have decreased by 32%. The Terrestrial Bird Indicator has shown little change since 1994, but woodland birds have increased by 63% and upland birds have decreased by 19%. The Seabird Indicator has declined steadily by 38% from its 1986 starting value.

Our separate *State of Nature 2016: Scotland* report is an assessment of the wealth of Scottish wildlife, the pressures it faces and the struggle underway to address these problems. It should also be seen as a celebration of what can be achieved and how organisations and land managers are working in partnership, often with limited funding, to achieve positive results. The projects we showcase range from those improving human lives by increasing the connection of people to nature in urban areas, to those working at an ambitious scale across Scotland's iconic wild landscapes. Throughout the report we highlight the importance of thinking, planning and working at a landscape scale, creating habitat that allows people and wildlife to live in harmony.

Wales

The capacity for monitoring wildlife in Wales is growing as the number of volunteers contributing to monitoring schemes increases. Our ability to report on the status of Welsh nature is therefore improving, although small sample sizes and short trend periods remain an issue.

We collated trends in abundance within Wales for 1,026 terrestrial and freshwater species. The availability of trends was strongly biased towards vascular plants (920 species), and so the overall pattern may not be totally representative of broader patterns in Welsh nature.

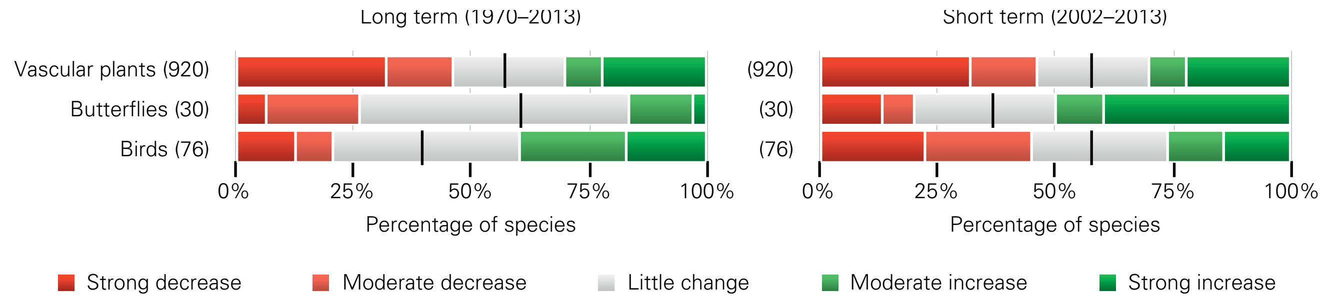


Figure 41

The percentage of species in each trend category over the long and the short term. The line in the "little change" category shows the division between declining species on the left and increasing species on the right. The values in brackets show the number of species assessed.

Over both the long and short term, 57% of vascular plant species declined and 43% increased.

60% of butterfly species declined and 40% increased over the long term, while over the short term 37% declined and 63% increased.

Over the long term, 40% of bird species declined and 60% increased. Over the short term, 58% declined and 42% increased.

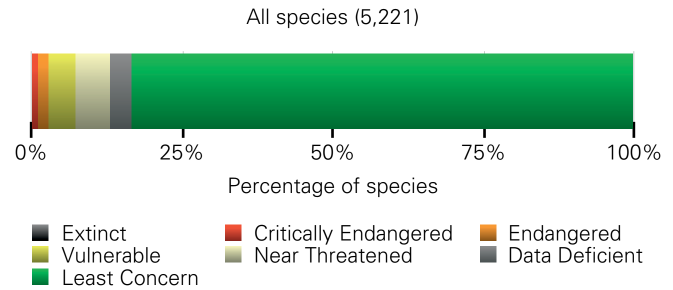


Figure 42

The percentage of species in each risk category, based on the likelihood of extinction from Great Britain.

Of the 5,221 species known to occur in Wales that have been assessed using modern IUCN Red List criteria, 354 (7%) may be at risk of extinction from Great Britain. The influence of populations within Wales on the overall status in Great Britain varies widely between species, and as Wales covers less than 10% of the UK's land area, in many cases Welsh trends will have had relatively little influence.

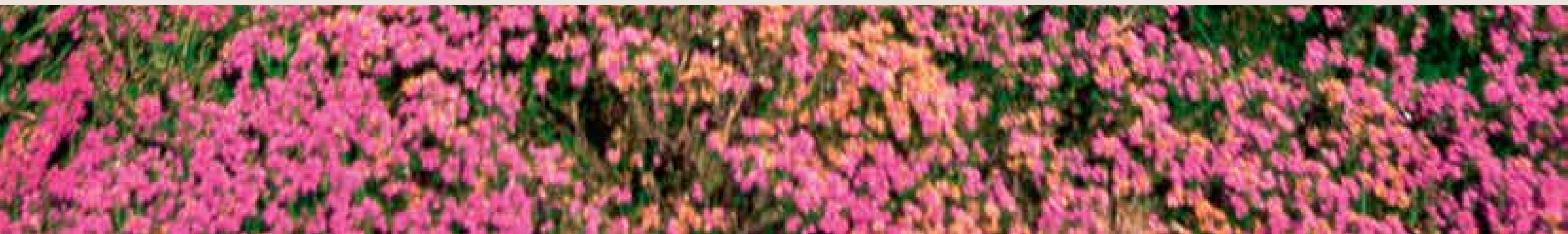
Data were available for 249 (43%) of the species identified by the Welsh Government as priorities for conservation. An analysis of the status of these species, based on data and expert opinion, showed that 33% were classified as declining or continuing to decline since 2007.

Over the long term, the index of change in the abundance of butterflies (not pictured) decreased by 31%. Over the short term it increased by 18%. Our index of change in the abundance of breeding birds (not shown) has increased by 14% since 1986, while the indicator of wintering waterbirds has increased by 3% since 1975. Over the long term, the indicator of six common bat species (not pictured) increased by 40%, compared to 25% over the short term.

Our separate *State of Nature 2016: Wales* report highlights just a few of the many conservation projects attempting to make a difference to Welsh wildlife. Examples range from projects targeting conservation priority species, such as the pine marten, to those seeking to improve habitats for wildlife at specific sites or across entire landscapes. The vital role of volunteer and community involvement in these and many other initiatives is apparent throughout the report.

Steve Vidler (Alamy Stock Photo)

UK Crown Dependencies



The UK has three Crown Dependencies: the Bailiwicks of Jersey and Guernsey, which are known as the Channel Islands, and the Isle of Man. The proximity of the Channel Islands to the Normandy coast means that they are home to a number of species not found on the UK mainland, such as the short-toed treecreeper, green lizard and French shrew. The Isle of Man lies in the Irish Sea and contains extensive moorlands surrounded by lowland farmland. As islands, the Crown Dependencies have rich marine biodiversity in their intertidal zones and offshore waters.

Jersey

At 118km^2, Jersey is the largest of the Channel Islands. It has a temperate maritime climate that sustains a mosaic of habitats ranging from coastal heath through to wooded valleys. It also has extensive intertidal and shallow marine areas. As part of its commitment to the Convention on Biological Diversity, the States of Jersey have produced a Biodiversity Strategy that identifies major issues affecting the island, and outlines policies and responsibilities for monitoring, conserving and enhancing the island's biodiversity.

Since the strategy's publication, our knowledge of Jersey's wildlife has grown; the recently opened Jersey Biodiversity Centre currently holds over 400,000 records of more than 7,000 species. In addition, the island now has an integrated monitoring strategy covering butterflies, birds, bats, amphibians, reptiles and plants that publishes results every five years in the *State of Jersey* report. Initial results suggest that sites under conservation management are in a good state of health, but that wildlife is declining in other areas, such as those dominated by agriculture or housing.

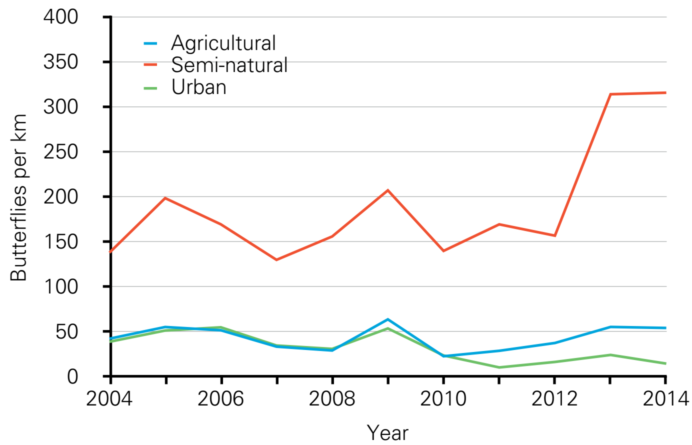


Figure 43
The average number of 36 butterfly species encountered along 41 transects. These transects are walked weekly across the land use categories in Jersey's Butterfly Monitoring Scheme.

Jersey Butterfly Monitoring Scheme (JBMS) results (Figure 43) show that Jersey's butterfly populations appear to have done better in semi-natural habitats since recording started in 2004, but badly in urban sites.

Case study

Reintroducing choughs to Jersey

Birds On The Edge (BOTE) is a collaborative project between the National Trust for Jersey, Durrell Wildlife Conservation Trust and the Department of the Environment. Since 2011, BOTE has been restoring the island's coastal cliff habitats for wildlife through a combination of traditional and modern management techniques.

In conjunction with this, Durrell have started a reintroduction programme for the chough (which became extinct in Jersey in around 1900) via a carefully managed soft-release programme. Jersey's free-living chough population now stands at 22 birds, and 2015 saw the first chough chick born naturally in the wild since their local extinction.

Case study

Studying nature under the waves

The offshore reef of Les Minquiers lies 20km south of Jersey and consists of several thousand rocks and sandbars scattered over 200km^2.

Despite being such a large and prominent natural feature, Les Minquiers is difficult to access and so had not been extensively studied. However, since 2012 a team of volunteers has been recording habitats, species and other features across the whole of the reef. They have mapped nearly 50,000 individual areas and recorded 32 different marine biotopes and more than 500 species, identifying the locations of key habitats and threatened species, such as the pink sea fan (pictured right) and sunset coral.

Pink sea fan at Les Minquiers

Bluegreen Pictures (Alamy Stock Photo)

Guernsey

The Bailiwick of Guernsey encompasses the islands of Guernsey, Alderney, Herm and Sark, as well as smaller uninhabited islands. Guernsey's coastal zone, boasting one of the largest tidal ranges in the world, has an enviable range of sea life; over 300 species of seaweed are found within the west coast Ramsar site alone. Guernsey has many natural features, including narrow country lanes and small earth-bank bordered fields; valleys and narrow water courses known as "douits"; the coastal fringe and marais (wetlands); and dune areas and rugged cliffs. These features combine to present a characteristic landscape where individual species and small fragmented habitats are key to the island's biodiversity.

However, Guernsey's biodiversity faces a number of threats, including pressures from development, agricultural intensification and disturbance. Habitat surveys on Guernsey and Herm in 1999 and 2010 quantified the loss of important habitat areas that has been occurring for the last 100 years or more, predominantly due to changes in land management practices. From this, it is possible to infer significant losses in biodiversity across the island.

A move towards intensive farming on Guernsey has led to a loss of species diversity, and there is concern that the same may be happening on Sark. Sand dune grassland on Herm has also been lost under scrub, and invasive non-native species such as the Hottentot fig are found around the cliffs on all islands, preventing smaller native species from flourishing.

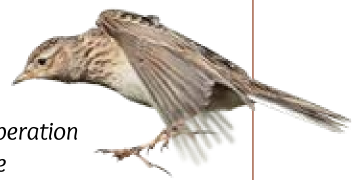
Changes in the management of coastal grassland in Guernsey have led to declines in a number of species, such as the blue-winged grasshopper, which is not found in mainland Britain.

However, it's not all bad news. A field of coastal heathland in the south of the island is now thriving thanks to effective management, having previously been home to just four heather plants. In addition, the saltmarsh in the west of the island has tripled in size as a result of offsetting work for the building of a new airport runway.

Case study

Operation Skylark

In 1952, skylarks were described as being common residents of Guernsey. However, they declined over the following decades and the last breeding pair was recorded in 2007. Skylarks are now extinct as a breeding species on the island.



Steve Round

In an effort to address the situation, the Operation Skylark initiative introduced cattle owned by a local NGO, La Société Guernesiaise, to Port Soif Common in 2015, an area of sand dune grassland that was once used by skylarks. Since traditional grazing of the site ended in the early 1990s the area has been managed by mechanical cutting on an annual basis. While effective in preventing scrub encroachment, mowing also removes the tussocks of grass and taller vegetation that provide ideal nesting sites for ground-nesting birds such as skylarks.

It is hoped that by grazing rather than mowing these sites, favourable breeding conditions can be created and skylarks encouraged to breed once more.

Case study

Monitoring Alderney's gannets

Alderney is home to an array of breeding seabirds, including two colonies of the UK's largest breeding seabird – the gannet. These birds first started breeding on the offshore rocky islet of Les Etacs in the 1940s and subsequently colonised Ortac, another offshore islet approximately 5 km north-west of Alderney.

Since the initial colonisation, the number of breeding pairs has continued to grow, matching increases across the UK. The most recent count, using aerial photography, was in 2015. It showed that since 2011, the Les Etacs colony had increased by 6%, to 5,909 pairs, and the Ortac colony by 31% to 2,777 pairs.

Gannets can fly several hundred kilometres in a single foraging trip and a new project using solar powered tags – Track a Gannet – has made it possible to get a much broader picture of how these birds use the waters surrounding the Channel Islands and further afield. The tags transmit the flight paths of the gannets to the ***teachingthroughnature.co.uk/t-a-g*** *website, which updates every time a bird comes within range of the European 3G network. This offers the most "real time" form of monitoring ever attempted on birds at sea and provides daily discoveries about the gannets' lifecycle, feeding habits, and how likely they are to interact with potential offshore wind farms and tidal turbine developments.*

Stuart Abraham (Alamy Stock Photo)

Gannets on Ortac

Isle of Man

The Isle of Man sits within the rich marine ecosystems of the Irish Sea, which include internationally important horse mussel beds and substantial areas of maerl "rocky seaweed" beds. Diverse terrestrial habitats rise from coastal heath to hill-land, with agricultural land in between. This agricultural land retains elements of traditional farming methods, including many small fields enclosed by banks. This combination of features provides exceptional habitat for birds, such as choughs and hen harriers, giving them a stronger foothold on the island than the UK mainland.

Coastal dunes, heaths and grasslands support species of special conservation interest. These include the lesser mottled grasshopper on the Langness Peninsula, which is not recorded anywhere else in the British Isles; and the scarce crimson-and-gold moth and the heath bee-fly of the Ayres, which have been recorded in just a handful of places in Britain. The Isle of Man cabbage is found in the island's dunes and also occurs on other Irish Sea coasts.

Bird population trends in the Isle of Man are available between 1998 and 2014. These trends show that 17% of the 104 birds assessed – including wrens, robins, lapwings and yellowhammers – declined over this period; whereas 33% increased, including blackbirds, chaffinches, coal tits, goldfinches and willow warblers.

Preliminary results from the Shearwater Recovery Project indicate an increase in the number of Manx shearwaters nesting at the Calf of Man, thanks to the rat eradication measures that have been in place since 2012. Between 2002 and 2014/15, the Manx Chough Census also revealed a small increase, from 150 to 160 breeding pairs.

Case study

Tackling unsustainable fishing

One of the challenges facing the Isle of Man's nature is unsustainable fishing. Among a number of fishery management measures, the Isle of Man has put in place six Marine Protected Areas (MPAs), covering approximately 2.6% of Manx territorial waters. Five Fisheries Closed Areas have been set up, primarily for the enhancement of scallop stocks. The sixth MPA is the Ramsey Marine Nature Reserve, which was set up with the primary aim of conserving horse mussel reefs, seagrass beds and maerl beds, but also for fisheries management.

The process of designating the Marine Nature Reserve demonstrates the benefits of close partnership working between the fishing industry and other stakeholders for conservation and fisheries sustainability. The longest running closed area is Port Erin, which was established in 1989. Since then, the area has shown improvements in habitat quality and complexity[1], as well as dramatic increases in scallop densities, compared to surrounding areas[2].

Crucially, after the closed area had been in place for some years, fishermen saw the benefits of it reflected in their catches from adjacent fishing grounds. Fishermen have since requested other areas to be closed or restricted.

Case study

The Ballaugh Curragh

The mosaic of wetland and peatland habitats characteristic of the Isle of Man is known locally as "curragh" and is of high biodiversity and cultural value. The Ballaugh Curragh is the first designated wetland of international importance (Ramsar site) on the Isle of Man and it supports a wide variety of birds, including the threatened corncrake. The site also boasts one of the largest winter roosts of hen harriers in Western Europe, and is famed for its orchids: in summer, thousands of spotted and greater butterfly orchids (pictured below) can be seen in the traditionally-managed hay meadows.

A scheme has been set up to help farmers and landowners to create wetlands and hay meadows around the site, preventing the area from drying out and providing habitat for many important species.

Chris Lloyd

Greater butterfly orchids thrive in the Ballaugh Curragh's hay meadows

UK Overseas Territories

- ***Over 32,000 native species have been recorded in the UK Overseas Territories (OTs) and it has been estimated there may be a further 70,000 yet to be documented.***
- ***To date, 1,557 endemic species (unique species that Britain has a responsibility for) have been found in the OTs, but only 9% of these have had their conservation status assessed.***
- ***Some 13% of the native species that have been assessed in the OTs are threatened with global extinction.***
- ***A third of the world's albatrosses and a quarter of the world's penguins are found in the OTs.***

The land and seas that the UK has responsibility for extend far beyond what we tend to think of as our country. They include areas of tropical rainforest, vast coral reefs, volcanoes, ice caps and one of the largest maritime zones in the world. These varied habitats can be found in the 14 UK Overseas Territories (OTs), which are spread across the world. Our OTs are mostly small islands, and include two World Heritage Sites of exceptional natural beauty. Their inhabitants are British nationals and the UK is responsible for helping to protect their incredible wildlife.

Globally significant biodiversity

In January 2014, the UK Environment Audit Committee urged "enhanced monitoring" and called for "a comprehensive research programme", as there are many gaps in our knowledge of wildlife in the OTs[1]. With funding from the Foreign & Commonwealth Office, the RSPB started this work by completing an ambitious stock-take of species across our OTs[2].

This project attempted to bring together all known records from the last 300 years, to document what species are known to be present. The results confirmed that the OTs could be considered the UK's natural crown jewels, yet much of their unique wildlife is little known and many species remain to be discovered.

Despite incomplete data and limited knowledge for many OTs and taxonomic groups, the high conservation value of the OTs is clear: over 32,000 native species have been recorded, of which 1,557 are endemic. It is estimated that there are a further 70,000 (including 1,800 endemics) yet to be documented.

Threatened species

The IUCN Red List provides an objective global approach for evaluating the extinction risk of plant and animal species. The Red List has a role in guiding conservation activities and focusing the conservation efforts of governments, NGOs and scientific institutions. It can also be used as a means of evaluating the success of these conservation efforts over time.

Of the native species recorded, 5,304 (17%) had undergone assessment against the IUCN Red List criteria by mid-2015. Of these, 129 were classified as Critically Endangered, 190 as Endangered and 375 as Vulnerable, meaning that 694 are currently regarded as at risk of global extinction (13% of those assessed). Of these threatened species, 111 are found nowhere else in the world. But for many of these species, which must be regarded as high conservation priorities, we lack the most basic information (distribution, population size, number of populations, population trends, threats) to be able to track their current conservation status and identify

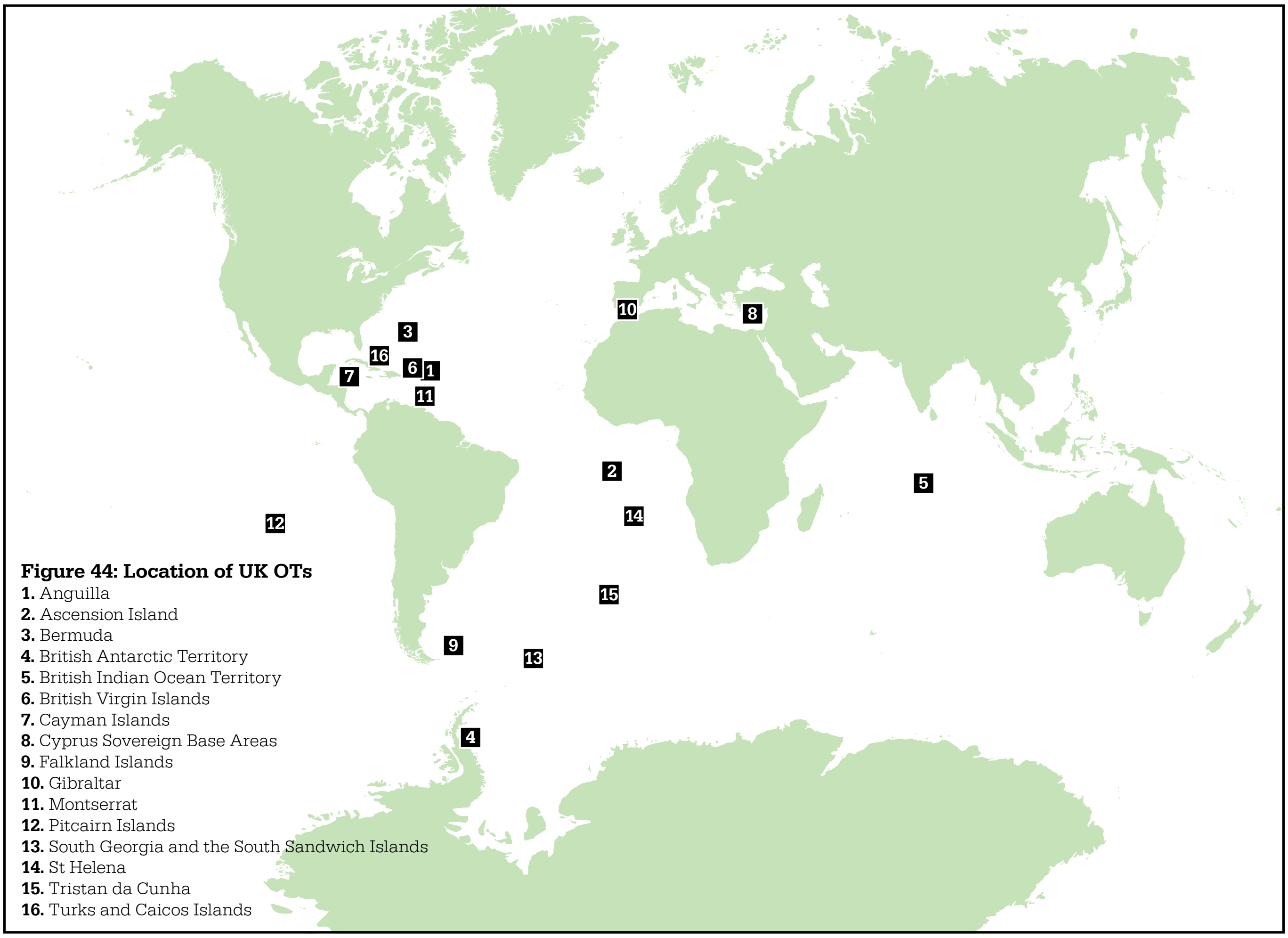


Figure 44: Location of UK OTs
1. Anguilla
2. Ascension Island
3. Bermuda
4. British Antarctic Territory
5. British Indian Ocean Territory
6. British Virgin Islands
7. Cayman Islands
8. Cyprus Sovereign Base Areas
9. Falkland Islands
10. Gibraltar
11. Montserrat
12. Pitcairn Islands
13. South Georgia and the South Sandwich Islands
14. St Helena
15. Tristan da Cunha
16. Turks and Caicos Islands

the actions required to safeguard them in the future.

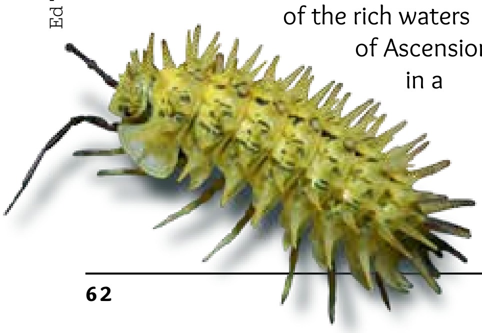
Ambitious projects are currently underway to undertake Red List assessments for the endemic invertebrates of St Helena and the endemic reptiles of the Caribbean. The project in St Helena aims to assess the Red List status of all 415 of the endemic terrestrial invertebrates on the island over the next few years. The spiky yellow woodlouse (pictured below) was one of 18 of these invertebrates assessed for the first time in 2015; only known to occur at a handful of isolated sites, this species has been listed as Critically Endangered.

Protecting marine sites

With its 14 OTs, the UK is responsible for the fifth largest area of ocean in the world – an expanse 30 times the size of the UK, measuring 6.8 million square kilometres. These waters represent possibly the most diverse marine area on Earth, occurring in the Caribbean and Mediterranean Seas, as well as the Atlantic, Pacific, Indian and Southern Oceans. They include the clearest water ever recorded, the largest coral atoll in the world and breeding grounds for endangered turtles.

The members of the Great British Oceans campaign have been calling for the creation of large-scale marine protected areas to safeguard some of the unique ecosystems. In March 2015, the UK Government responded by pledging to create the largest marine reserve in the world around the Pitcairn Islands.

Building on a manifesto pledge to create "Blue Belt" around the UK OTs, subject to local support and environmental need, the UK and Ascension Island Governments jointly announced in January 2016 that they will safeguard at least 50% of the rich waters of Ascension in a fully-protected marine reserve. This will be the largest marine reserve in the Atlantic so far.



Ed Thorpe

Protecting terrestrial sites

Important Bird Areas (IBAs) are a global network of important sites for birds, identified using internationally agreed criteria. All the OTs have IBAs, and eight new sites were identified across St Helena and Ascension Island during 2015, highlighting the importance of these islands for endemic species and internationally important congregations of seabirds. These include the entire world population of the Critically Endangered and endemic St Helena plover (locally known as the wirebird) in St Helena and 144 pairs of Ascension frigatebirds on the main island of Ascension.

Case study

Tackling non-native species in the Caribbean

Introduced mammalian predators, such as cats, rats and pigs, can have a devastating impact on native wildlife. They eat the eggs and chicks of seabirds, and the fruits and seeds of native vegetation, and they prey on reptiles and unique land birds. Pigs will also dig up and eat turtle eggs.

Introduced herbivores, such as goats, degrade the forests by destroying slow-growing hardwood trees and preventing native trees from establishing. They can also spread the seeds of non-native plants.

Between 2013 and 2015, the European Union BEST Initiative funded a project to reduce the impacts of invasive species across the five UK OTs in the Caribbean – Anguilla, the British Virgin Islands, the Cayman Islands, Montserrat and the Turks and Caicos Islands.

Activities took place in 10 Important Bird and Biodiversity Areas (IBAs), and included biosecurity monitoring on Dog Island in Anguilla following a successful rat eradication in 2001; eradicating goats from the Tobago islands in the British Virgin Islands, which support the fifth largest magnificent frigatebird colony in the Caribbean; and exploring options that will limit the spread of the invasive common iguana (pictured below) to Little Cayman and Cayman Brac in the Cayman Islands.

Collaboration, networking and the sharing of ideas between OT governments and OT- and UK-based NGOs have been key components of the project. Workshops and training courses have been particularly useful to develop best practice and allow experiences to be shared between OTs and organisations.

Serdar Yagci (istockphoto.com)


Green turtles

David Fleetham (naturepl.com)

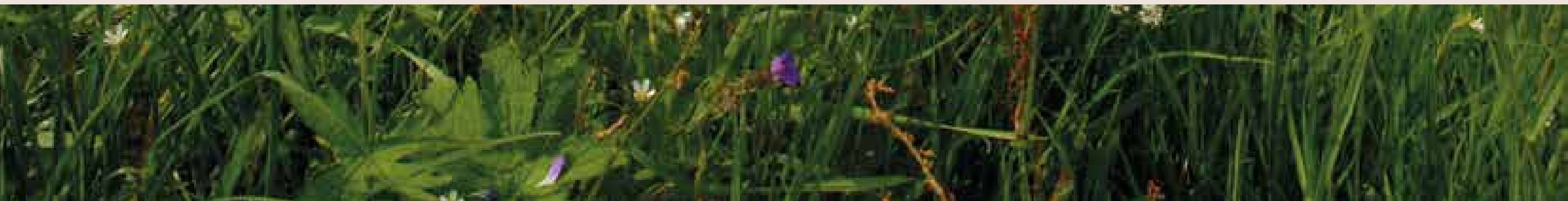
The UK is responsible for the fifth largest area of ocean in the world

Sue Kennedy

Conservation themes

In this section, we have invited guest authors to address wider conservation issues that cut across species, habitats and countries.

Firstly, we consider the conservation opportunities offered by the natural capital concept, which values the goods and services that nature provides. Then we look at the benefits of connecting children to nature, and consider how such a connection with nature can develop into engagement with citizen science, which in turn provides vital evidence to support conservation action. Finally, we set the state of nature in the UK in a global context by looking at a new and innovative way of measuring biodiversity change across the globe.



Natural capital: valuing our nature

The growing interest in natural capital was stimulated in 2011 by the Government White Paper *The Natural Choice: securing the value of nature*[1], which made a commitment to "capturing the value of nature in our nation's account", and included the establishment of a Natural Capital Committee to advise accordingly.

The first Natural Capital UK Committee (2012–2015) recommended that the UK Government develop and implement a 25-year plan to protect and improve natural capital and the benefits it provides. The present Government is now following up on this major commitment[2]. What then is natural capital, and how does it connect to species and habitat conservation?

Natural capital assets include the fresh water we use for drinking, bathing and irrigation; the air we breathe; wild species; soils and many other environmental resources that we depend on

Natural capital assets

Natural capital describes the components of nature that provide people and the economy with essential goods and services, largely for free. Natural capital assets include the fresh water we use for drinking, bathing and irrigation; the air we breathe; wild species; soils and many other environmental resources that we depend on. Just as money invested as financial capital in the bank provides interest that subsidises longer-term benefits, so investing in natural capital should secure these environmental goods and services over the longer term.

This banking analogy is easy to understand, but it can be misleading because of its focus on money, and it can lead to an assumption that natural capital is centrally concerned with monetising the value of nature. A better analogy may be the benefits that flow to individuals, and to the local and global economy, through investment in education. This is a cost, certainly, but investing in education secures vast, self-sustaining and irreplaceable benefits. Though they are hard to value, these benefits make the costs acceptable.

Natural capital is a complex concept. It includes the natural systems that sustain people and the economy on land, and in the water and air. While it is therefore anthropocentric by definition, it has to include most parts of the Earth system (living and non-living) and the environmental, ecological and evolutionary processes that sustain, restore and replenish these fundamental resources on which our civilisations rest. How does this connect to species and habitat conservation?

Conservation often aims for a state of the environment that is relatively undisturbed by people, or one that closely matches a recent benchmark, such as in this report, which looks at changes over recent decades. This translates reasonably easily to natural capital concepts. Natural capital goes broader and deeper than most conservationists would contemplate, and is more obviously utilitarian. The conservation and natural capital agendas do however intersect.

Conflicts and trade-offs

For natural capital, the contributions from nature to food, energy, clean air and water quality will be a priority, and will not always be compatible with wildlife conservation. Sometimes there will be conflicts and trade-offs, although these may be exaggerated through the sharp distinction often drawn between production and conservation landscapes. In fact, nature conservation is already underpinning some of these other essential benefits, although our efforts to document these are far from effective.

For nature conservation to easily translate into the natural capital agenda we need to ensure that it is part of the analysis at a landscape, seascape and ecosystem scale; that it is not just an output measured as counts of species and areas of habitat, but that it is evidence of functioning and resilient species and habitat assemblages. Importantly, this needs to connect to larger-scale ambitions for nature at the local, as well as regional and national, level.

A precursor to the 2011 Natural Environment White Paper was Sir John Lawton's review for Defra: *Making space for nature*[3]. This laid out some principles for a strong and well-connected natural environment that would secure wildlife sites and adapt in the face of growing challenges from climate change and other demands on our land. Prescriptions such as this will easily be embedded in the emerging natural capital discussions.

Professor Dame Georgina Mace
Professor of Biodiversity and Ecosystems, and Head of the Centre for Biodiversity and Environment Research at University College London

Jussi Puikkonen

Nick Cunard

Nature can have positive impacts on young people's education, physical health, emotional well-being, and personal and social skills

Connecting children to nature

A child's "connection to nature" describes their attitude towards nature: their deeply-held feelings of empathy for creatures; their sense of responsibility for, and oneness with, nature; and their simple enjoyment of it.

In 2010, the *Every Child Outdoors* report[1] brought together external research into the benefits of contact with nature. The key findings were that nature can have positive impacts on young people's education, physical health, emotional well-being, and personal and social skills, and that it helps them to become responsible citizens.

If children are connected with nature, they are also more likely to be interested in their environment and in taking part in nature-based activities. In other words, children who are connected to nature will enjoy it and want to save it, both now and in the future.

Until recently, there has not been a robust approach to quantifying children's connection. As a result, it has not been possible to track national baselines, nor undertake research into the relationship between connection to nature and pro-nature behaviours.

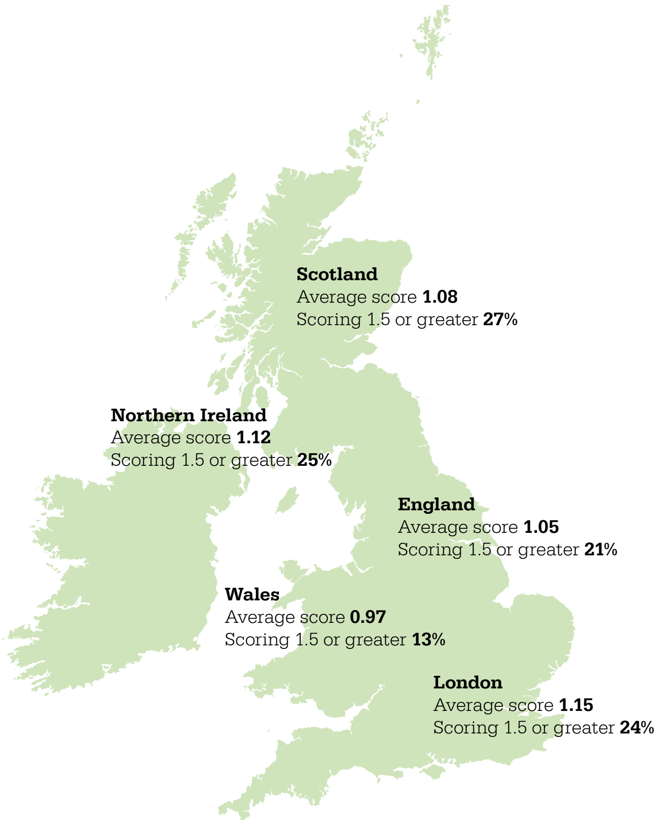


Figure 45: The Connection to Nature Index (CNI)
A CNI score of -2 to -1 indicates a lower level of connection to nature; a score of 0 indicates a neutral level of connection; and a score of 1 to 2 indicates a higher level of connection.

How connected are children?

In 2012, RSPB research supported by the University of Essex and the Calouste Gulbenkian Foundation measured UK children's connection to nature for the first time[2]. It found that only 21% of eight to 12-year-olds in the UK currently have a level of connection to nature that is considered to be a realistic and achievable target for all children.

Two recent research projects have now built on this methodology to understand children's connection to nature in more detail. The first, a study by Queen's University Belfast, involved 2,400 children aged eight to 12 years as part of the annual Kids' Life and Times questionnaire[3]. It found that "connection to nature and children's rating of their health and well-being are correlated – children who are more connected to nature rate their health and well-being as significantly higher."

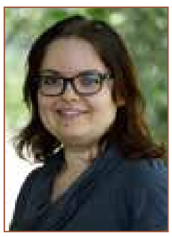
The second study, by researchers at the University of Derby, involved nearly 800 10 and 11-year-olds[4]. It found that "children who were more connected to nature had significantly higher English attainment" and that there are "strong correlations between [connection to nature] and pro-nature behaviours and pro-environmental behaviours." In addition, the study reinforced previously established national baseline levels: "those children with a connection to nature score of 1.5 or above have significantly higher health, and life satisfaction..."

How do children connect with nature?

Four principal factors have been identified that contribute to connecting children with nature: experiences of nature; knowledge about the environment; having nature near their home; and the attitudes towards nature at home.

Not surprisingly, the reasons why our children are disconnected from nature are complex and vary between individuals. As a result, there is a range of practical and policy-led solutions to increasing children's connection to nature and their participation in pro-nature lifestyles. We believe that everyone has a role to play in putting nature back into childhood, including governments, health professionals, local authorities, schools, families and, of course, organisations like those in the State of Nature partnership.

Research is currently underway to establish national baselines for both teenagers and adults in the UK; we hope to be able to report on these in the next *State of Nature* report.



Amy Batchelor
RSPB Policy Officer


Matthew Roberts (The Wildlife Trusts)

Much of our understanding of the UK's wildlife is thanks to the efforts of volunteer naturalists

Citizen science

Over 70,000 species of plants, animals and fungi are currently found in the UK[1]; a diversity of life that is both wonderful in its own right and essential to our well-being. Yet as this report and other studies[2,3] show, the UK's biodiversity is facing increasingly severe environmental and ecological pressures. Understanding how wildlife is responding to these drivers of change requires large volumes of data that are fit for purpose, and managing and protecting our natural environment requires wide societal involvement.

Much of our current understanding of the UK's wildlife derives from the phenomenal efforts and expertise of the UK's volunteer naturalists and the wider contributions of citizen scientists of all ages and from all walks of life[4].

What is citizen science?
Citizen science – which is broadly defined as the involvement of volunteers in projects that contribute to our scientific understanding – has undergone a remarkable expansion in profile and popularity during the current decade. Within the UK, it is founded on a long and illustrious history of wildlife observation by volunteer naturalists. Every year, tens of thousands of nature enthusiasts dedicate their free time to identifying and observing the UK's wildlife, and sharing the resultant data with others.

There are currently more than 200 voluntary wildlife recording initiatives across the UK, collectively generating a staggering 4.5 million wildlife observations annually[5]. Local Environmental Records Centres[6] and recording schemes[7] play a key role in supporting and managing volunteer recording. This unprecedented commitment to nature observation and environmental monitoring has created one of the largest biodiversity databases in the world, with more than 127 million observational records shared nationally via the National Biodiversity Network's Gateway[8] (as of May 2016). The majority of these have been created by volunteer naturalists.

Through partnerships between governments, NGOs and the research organisations that help to coordinate many of these wildlife recording initiatives, volunteer data from wildlife observations and more systematic surveys supports the development of trend information for over 2,700 species of UK plants and animals[5]. The data also underpins the species' status assessments that inform conservation prioritisation and legislation.

As a complement to these well-established naturalist-led activities, an increasingly diverse range of field-based and online citizen science projects have been launched by academic institutions and NGOs over the past five years. These have collectively provided opportunities for over a million people of all ages and backgrounds from across the UK to make active contributions to advancing our understanding of the state of the UK's nature and environment.

There are more than 200 voluntary wildlife recording initiatives across the UK, collectively generating a staggering 4.5 million wildlife observations annually

As a participant, it has never been easier to get involved: from helping to track the spread and impacts of non-native species, to investigating how climate change is affecting plant flowering times, "bioblitzing" a local park, or searching for microbes on school buildings. It is also becoming easier for organisations, both professional and voluntary, to develop new nature-focused citizen science projects, thanks to customisable online wildlife recording platforms, such as Indicia[9] and a growing range of downloadable "how-to" guides[10–13]. Internet platforms, smartphone technologies and social media support ever more sophisticated data collection, visualisation and analysis, and provide efficient opportunities for project promotion and feedback.

Taken collectively, there is increasing evidence that citizen science is playing a central role in recruiting and training the next generation of nature enthusiasts; communicating the beauty and relevance of the UK's wildlife to wide sectors of UK society; and catalysing positive attitudes and behaviours towards nature[14,15]. In the face of growing concerns about a decline in taxonomic expertise[16] and a disconnect from nature amongst the UK's population, this involvement in citizen science gives real cause for optimism.

A bright and exciting future
It is important that we continue to recognise and celebrate the incredible dedication, enthusiasm and expertise of the citizen scientists who are contributing so much to our shared understanding of the UK's wildlife, and that we respect the range of motivations and values that are driving this involvement. We must also thank the growing range of organisations and funders that are helping to support citizen science activity, and look forward to developing ever more rewarding collaborations. Nature-based citizen science has a bright and exciting future in the UK.

Dr John Tweddle
Head of Angela Marmont Centre for UK Biodiversity at the Natural History Museum

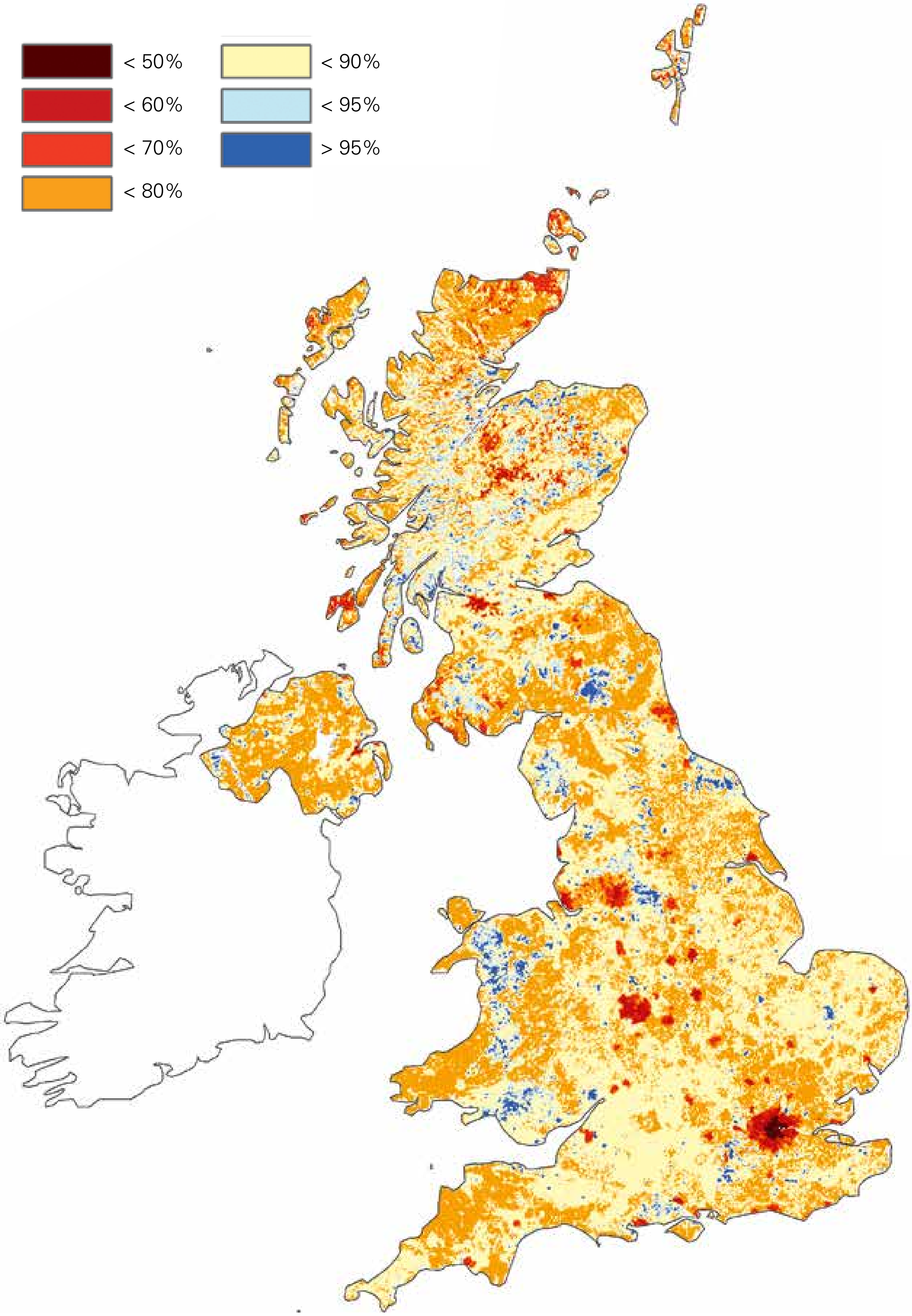


Figure 46

Map of modelled estimates of "biodiversity intactness" across the United Kingdom. The Biodiversity Intactness Index (BII) estimates, as a percentage, the average abundance of originally-present species. Areas shown in yellow, orange, red or brown have BII values below 90%, which indicates that biodiversity has fallen below a threshold beyond which ecosystems may no longer reliably meet society's needs.

A UK-wide perspective on "biodiversity intactness"

As this report shows, estimating change in the UK's wildlife is difficult. Very few datasets span more than a few decades, despite the UK being one of the most data-rich countries in the world. Furthermore, sites for which long-term data are available are seldom typical: they may have lower rates of land-use change, for example, meaning that the trends they show may depend more on where the sites are and their management, than on the true overall picture.

Lastly, most biodiversity data and indicators focus on a few well-studied types of animals and plants, and because trends often vary among groups, these might not give us a balanced picture of change.

The Biodiversity Intactness Index

The Biodiversity Intactness Index[1] (BII) attempts to overcome these problems. The BII estimates the average abundance of originally-present species, across many taxa, relative to their abundance in undisturbed habitat. It is based on biodiversity comparisons across sites, which are much commoner than comparisons over time in the UK and across the globe. Because of its advantages, the BII has even been proposed as a key indicator of whether biodiversity has fallen below a "Planetary Boundary" – a threshold beyond which ecosystems may no longer reliably meet society's needs[2].

The PREDICTS project[3], a collaboration funded by the Natural Environment Research Council (NERC), has estimated the BII globally and in every country[4]. The first step was to collate biodiversity data from many peer-reviewed surveys worldwide, each of which has surveyed multiple sites that differ in land use – the biggest driver of terrestrial biodiversity change to date – and related pressures.

The BII estimates are based on data (distinct from that used in the rest of this report) from a taxonomically-representative set of 39,123 animal, plant and fungal species across 18,659 sites. These sites cover all sorts of habitats and land uses, from protected ancient woodland to city centres[5]. We analysed these data to estimate the average effects of land use and other pressures, like human population density, on the numbers of individuals found at a site. We also estimated statistically the fraction of these that belong to originally-present species, because most regions of the world lack comprehensive faunal and floral lists.

The last step combined these models with high-resolution maps of land use[6] and other pressures in the year 2005 to map the state of the BII. Previous PREDICTS publications[4] have offered a global perspective, but here we focus on the UK and its constituent countries.

It has been proposed[2] that average BII values below 90% indicate that the Planetary Boundary for biosphere integrity has been crossed. As Figure 46 shows, most of the UK is well below this threshold: the UK's average BII is 81.0%, which is below the global average of 84.6%, and is the 29th lowest value of the 218 countries for which estimates are available. This level of decline in the UK is a matter of concern. Southern and Central England – with their widespread, intensively-managed agricultural land, urban sprawl and high population density – have, perhaps unsurprisingly, the lowest BII values (especially in London). The highest values occur mostly in areas that are remote and/or protected; we know that local biodiversity tends to be higher inside than outside protected areas worldwide[7].

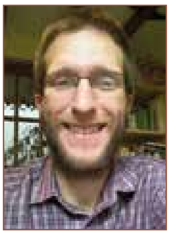
Results across the UK

Interestingly, at a national level, Northern Ireland has seen the greatest loss of biodiversity intactness (BII = 80.0%, which would place Northern Ireland 24th lowest among countries), followed by England (80.6%; 28th lowest), Scotland (81.3%; 36th lowest) and Wales (82.8%; 49th lowest – still in the bottom quarter).

Of course, any global synthesis of this kind has inevitable limitations. The map shown in Figure 46 comes from a global statistical model which assumes that pressures have the same effect everywhere. In reality, however, the wildlife on islands like the UK may be unusually sensitive to human pressures. In addition, the biodiversity value of forest is likely to be lower in the UK than in other regions, where a higher proportion of primary forest remains, but our analyses did not consider habitat configuration.

Both of these limitations mean the UK's true BII may be even lower than our estimate. A last but important caveat is that we use spatial comparisons in lieu of temporal data, an approach known as "space-for-time substitution" that is common in ecology and conservation, but which may not always be valid. The next stage for the PREDICTS project is to test the approach's validity, which will give a much better picture of the dynamics of how land-use change alters ecological assemblages.





Prof Andy Purvis ***Dr Adriana De Palma***
Department of Life Sciences, Natural History Museum

Dr Tim Newbold
Centre for Biodiversity and Environment Research, University College London

How to interpret this report

We have included this section to help you understand the different measures presented in the *State of Nature 2016* report and how they should be interpreted. For full details of the methods and how these measures were calculated, as well as caveats around interpretation, please refer to pages 74–77.

WHAT DATA HAVE WE USED?

- We present trends in abundance (2,227 species) and occupancy (1,589 species) for 3,816 native terrestrial and freshwater species across the UK.
- These trends came from a wide range of sources including national monitoring schemes and biological records.
- Details of the datasets behind our analyses, our data sources and the species they covered, are given online at **rspb.org.uk/stateofnature**

WHAT TIME PERIOD DOES THIS REPORT COVER?

- We show trends in our species from 1970 to 2013 (our long-term period) and from 2002 to 2013 (our short-term period).

WHAT ARE THE GRAPHS TELLING ME?

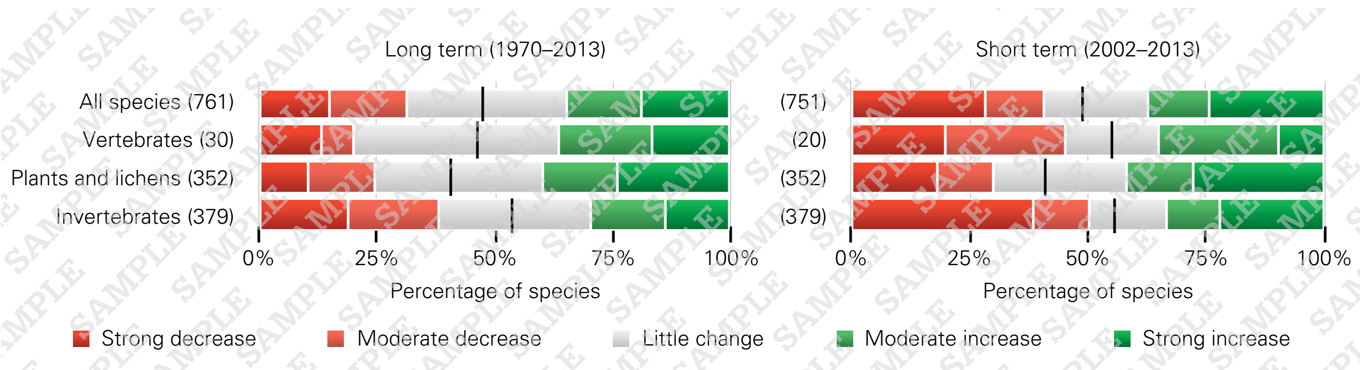
In each section of the report we present the relevant results for the country or habitat in question, to show the following:

- **Categories of change**
  The percentage of species in each trend category.
- **Change over time**
  The average change in the status of species, based on abundance and occupancy data.
- **Extinction risk**
  An assessment of Red List status for each species occurring in that country or habitat.

Please note that due to the change in species composition, and in some cases data sources, our measures are not directly comparable with those presented in the first *State of Nature* report.

Categories of change

Each species was placed into one of five trend categories based on annual percentage changes. Due to differing data availability, the species composition of the long and short-term measures varied; in general, we had data for fewer species over the short-term period.



Results reported for each figure include:

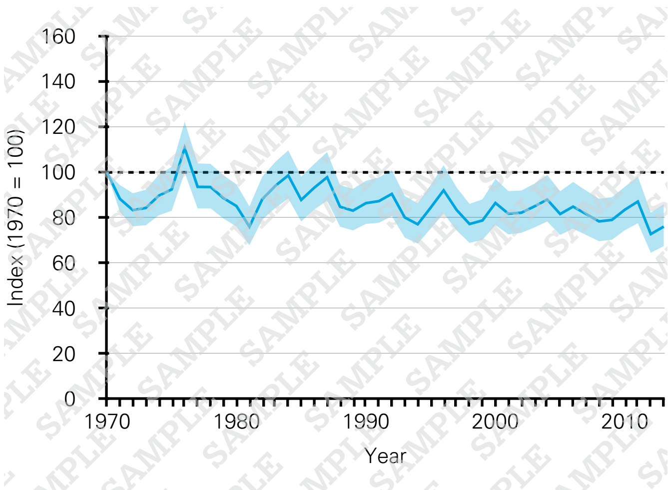
- The overall percentage of species that increased and decreased in each time period. The vertical line across the white "little change" segment of the graph shows the division between declining species on the left, and increasing species on the right (this is broadly equivalent to the metric reported for the first *State of Nature* report).
- The percentage of species that showed strong or moderate changes, and those showing little change, in each time period.

Thresholds for assigning species' trends to the five categories are given on page 75.

Change over time

These graphs combine abundance data (based on a species' population size) and occupancy data (the proportion of 1-km^2 grid cells occupied by a species) into a geometric mean indicator[1]. This relies on the assumption that proportional changes in occupancy and distribution are equivalent in creating the indicator (for more detail, see page 76).

Each graph shows the change in the status of species based on abundance and occupancy data. The shaded areas show the 95% confidence limits around the indicator line (see page 76).



Results reported for each figure include:

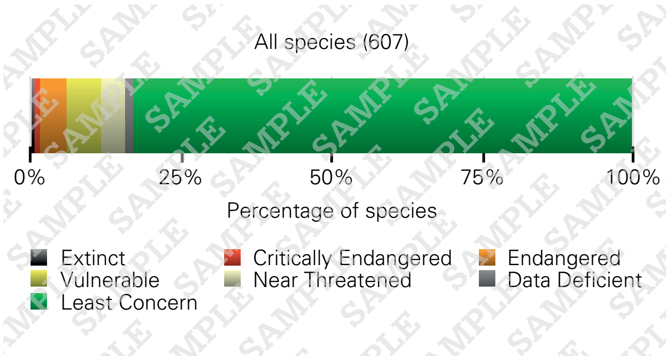
- Total percentage change in the indicator over the long term and the short term.
- Annual percentage change over the long term and the short term.
- We assessed change over the period by comparing the rate of change of the indicators between the *prior* (~1970–2002) and *recent* (2002–2013) time series, and report the test statistic (t) and the level of significance (p).

Seven-spot ladybird

Extinction risk

We summarised the Great Britain Red Lists to present the proportion of species in each threat category overall, and by different taxonomic groups. In each section we interpret existing Great Britain Red Lists, based on those species occurring in that habitat or country, with the exception of Northern Ireland, where we used all-Ireland Red List assessments.

These figures represent the ultimate threat of extinction from Great Britain. While the proportion of species listed as Least Concern is considerable, the number of species that are considered threatened with extinction from Great Britain and Ireland is worthy of note.



Results reported for each figure include:

- The overall percentage of species assessed that are regarded as threatened with extinction from Great Britain (or Ireland). This includes species that have been classified as Critically Endangered, Endangered or Vulnerable in the latest IUCN Red List assessments.

UK biodiversity indicators

Where available, trend figures from the official UK biodiversity indicators are presented to complement the *State of Nature 2016* analyses (see **jncc.defra.gov.uk/ukbi**).

The Priority Species Indicator is made up of two parts: one showing change in species' abundance and one showing change in species' distribution. All the other biodiversity indicators shown are based on species' abundance.

Methods

DATA COLLATION

We collated as many datasets as possible, describing changes in the abundance or occupancy of 3,829 native species across the UK. These came from a wide range of sources; details of the datasets behind our analyses, and the species they covered, are given online at **rspb.org.uk/stateofnature**

The species datasets included in our assessment met the following criteria:

- Two or more comparable estimates of a species' abundance or occupancy were made between 1960 and the present, with a broad geographic coverage across the species' UK range.
- Results, or at least the methodology for data collection and/or analysis, had been published.
- Start and end estimates for each species were at least 10 years apart.

Where more than one dataset was available, we gave precedence to assessments of change in abundance over occupancy, for example when both datasets were available for butterflies[1,2]. If, after this rationalisation, more than one dataset remained, precedence was given to the most robust dataset, assessed on the survey methods, sample size and time period covered. If two or more datasets were of similar quality and duration, then an average was calculated and used.

Many of these datasets are derived from structured monitoring schemes, but we also included trends based on the unstructured recording data collected by National Recording Schemes, which cover many taxonomic groups.

PROCESSING SPECIES DATA

Our aim was to examine change in overall species' status in two ways. Firstly, we categorised each species into one of five categories of change, over two time periods: our *entire long-term* period (~1970–2013) and a *recent short-term* period (2002–2013).

Secondly, we investigated how species' populations have changed through our study period by calculating annual indicators based on abundance and occupancy data. The methods used for each analysis are given on the following pages. However, some datasets required additional processing prior to these summaries being calculated. These were largely datasets of marine species and species whose population change was assessed based on unstructured biological records. Details of both these treatments are given in the next column.

Processing biological recording data

National recording schemes collect data on a vast array of taxonomic groups, from slime moulds to spiders. However, it can be difficult to use datasets of opportunistic records to assess changes over time, as recording effort varies across the UK and over time. Several statistical techniques are now available to help control these biases, and one of these – Bayesian occupancy modelling[3,4] – was used here.

These models were used to generate annual estimates of the proportion of occupied 1-km^2 grid cells for each species. Species with uncertain trends were excluded following Isaac *et al.* (2015)[5]; only species with a minimum of 20 years of reliable estimates were included.

For the species with adequate data, we estimated the overall rate of change as the difference between the first and last year. We categorised the trends by the average annual change over the range of years under consideration (short and long term).

Processing data on marine species

Marine data is often reported by sea regions, as defined by the Marine Strategy Framework Directive (MSFD); in the UK's case our waters are split into the North Sea and Celtic Sea subregions. We conducted analyses for these two seas, and then amalgamated them into UK-level results.

Fish data were received from the North Sea and Scottish West Coast International Beam Trawl Surveys and the Rockall Beam Trawl Survey. For each survey source, we used data for species that together represented 99% of the cumulative Catch Per Unit Effort (CPUE) over all length classes and areas, so we excluded rare or poorly sampled species. For each species, annually, we calculated the sum CPUE per area, using all length classes, then calculated the mean CPUE across all areas.

Rockall and Scottish West Coast data both come from within the Celtic Sea MSFD sub-region, so for the species reported within both we produced a mean trend for the Celtic Sea overall. Similarly, North Sea and Celtic Sea trends were averaged for species occurring in both, to produce UK-level indices. The start year of all data series was aligned between each survey (using data from c1983) to ensure comparability, as fishing techniques and gear change over time.

The Sir Alister Hardy Foundation for Ocean Science Continuous Plankton Recorder (CPR) dataset provided data on taxonomic groups, such as echinoderm larvae or large copepods, rather than individual species. Similarly, the Phytoplankton Colour Index gives a representation of ocean colour, which is considered a proxy of the phytoplankton biomass. This means that additional considerations are required in order to estimate an overall assessment of how marine biodiversity is changing over time, as a single trend from the CPR may encompass change in a range of individual species.

PRODUCING OUR MEASURES OF CHANGE: CATEGORICAL CHANGE BASED ON SPECIES' ABUNDANCE AND OCCUPANCY DATA

Given the differences in data sources, two approaches had to be used to classify species' trends, as described below.

Changes in species' abundance and occupancy

In order to be able to compare species' trends across methods, we calculated the average annual change over the two time periods mentioned previously – the *entire long-term* period (~1970–2013) and the *recent short-term* period (2002–2013) – although in many cases the start and/or end years did not match these years exactly. There is a time lag in the collation and reporting of biological data, so we were not able to use data more recent than 2013. In general, total change was the abundance estimate in the final year expressed as a proportion of that in the first year.

Where smoothed time series were available (details are provided at **rspb.org.uk/stateofnature**) these were used to reduce the influence of annual fluctuations. In such cases, total change was calculated using the abundance estimate of the penultimate year expressed as a proportion of abundance in the first year, as the final year of smoothed trends can be erratic[6].

Occupancy data from recording schemes, described previously as annual estimates of the proportion of occupied 1-km^2 grid cells for each species, are combined with abundance trends in these analyses. By combining these two data types in this way, we are assuming a change in occupancy at this scale is equivalent to a change in abundance.

We placed each species into one of five trend categories, defined as follows:

Strong increase
Annual change greater than or equal to +2.81%, the rate of change that would lead to population size or occupancy doubling or more over 25 years.

Moderate increase
Annual change between +1.16% and +2.81%.

Little change
Annual change between -1.14% and +1.16%.

Moderate decrease
Annual change between -2.73% and -1.14%.

Strong decrease
Annual change less than or equal to -2.73%, the rate of change that would lead to a population halving or more over 25 years.

This categorisation was based on the magnitude of change, not the statistical significance of that change. Statistical significance is determined by sample variance, which is influenced by sample size, and in relation to population change, by species' life history. This means that statistical power varies between species and between taxonomic groups. It is common practice to use the magnitude and rate of population change, rather than statistical significance, in order to categorise conservation status assessments (for example for IUCN Red Lists[7]). Thus our values are the best available estimates for each species, but we must acknowledge that many species' trend estimates are highly uncertain.

Change in the distribution of plants

For many taxonomic groups, data are not available to assess changes in abundance over time. However, data are available about their distribution. This is primarily in the form of atlases and from national and local recording schemes.

A specific index was available for vascular plants, and it was not appropriate to combine this in the same way, so results are reported separately. Two atlases of vascular plants have been produced and for each species an index – the Plant Atlas Change Index (CI) – was calculated, assessing the change in distribution between the first atlas and the second, at the scale of 10-km grid squares[8].

This index is a relative measure of change and does not tell us how much a species' distribution has changed in absolute terms, because it is expressed relative to the overall change in recording effort over time. Similar change indices are available between each pair of four Countryside Surveys (1978, 1990, 1998, 2007), allowing overall change between 1978 and 2007 to be calculated. We used Countryside Survey data for the (generally more common/widespread) species for which it was available, and otherwise used Plant Atlas data.

We placed each plant species into one of five trend categories using the definitions below. The cut-offs at ±0.5 follow Preston *et al* 2003[9].

Strong increase
Plant Atlas Change Index of 0.5 or greater.

Moderate increase
Plant Atlas Change Index of between 0.25 and 0.5.

Little change
Plant Atlas Change Index of greater than -0.25 and less than 0.25.

Moderate decrease
Plant Atlas Change Index of between -0.25 and -0.5.

Strong decrease
Plant Atlas Change Index of -0.5 or less.

Methods (cont)

PRODUCING OUR MEASURES OF CHANGE: QUANTITATIVE CHANGE

For this analysis, we need an estimate for each species per year. Most of the contributing monitoring programmes are undertaken annually, and so species' indices had values estimated for each year. In a few indices of relative abundance one or more years were missing so these values were estimated using log-linear interpolations[10]. Abundance and occupancy data are combined in this indicator in line with methods used by Van Strien *et al*[11].

Time series were not extrapolated before the first available year or after the last. Where time series ended prior to 2013, they were extended by holding the final data value constant in all subsequent years. A few time series of relative abundance contained genuine zero counts for one or more years, which were not possible to include as the composite indicator is calculated using the geometric mean. If these were at the start of the time series, that time series was only included from the year of the first positive count; if zeros occurred within a time series, 1% of the average value of the time series was added to each value in the series of that species[12].

To create composite indicators, the geometric mean was calculated from the species' time series data. Each time series was expressed as a proportion of the first year of the time series, with the first year set to 100. The methods developed to produce the UK Wild Bird Indicator[13] were used to deal with species with extremely large or small index values (which can have a disproportionate influence), and to introduce species' indices into the indicator after the start year. The period 1970 to 2013 represents the core period covered by the majority of species' time series, and so we constrained our indicators to this period.

Confidence intervals for each composite indicator were created using bootstrapping[14]; in each iteration (n=10,000) a random sample of species was selected with replication and the geometric mean calculated. To calculate trends over shorter periods within our study period, change statistics for the relevant period were calculated for each species. The geometric mean of the species' level change was calculated and 95% confidence intervals were estimated using bootstrapping.

Testing for change over the period of the indicator

Each quantitative change indicator (overall and at a UK-level) was assessed for change between two non-overlapping time periods. Each indicator was modelled using a linear model of the form: log(index)~year+year:Period, where "Period" was a binary variable specifying the non-overlapping *recent* (2002–2013) and the *prior* (~1970–2002) time series. The result at a UK-level indicated that there was no difference in the indicator between the two time periods (year:Period p=0.131), meaning there is no evidence that the rate of decline has changed over the study period.

RED LIST STATUS

At a global level, the IUCN co-ordinates the process of assessing which species are threatened with extinction, and has developed Red List assessment criteria[15] to make the process as transparent and consistent as possible.

These criteria are based on a variety of parameters, including the rate of change in species' abundance or distribution, total population size and the number of populations. How threatened a species is may vary across its range, and often regional or national Red Lists are produced, documenting which species are threatened at different spatial scales[7].

We have brought together all the national Red Lists, for either the UK or Great Britain, that have been produced using the latest guidelines from the IUCN, or non-IUCN criteria (birds)[16]. For more details of the Red Lists used, please see **rspb.org.uk/stateofnature**

We summarised these Red Lists to present the proportion of species in each threat category overall, and by different taxonomic levels. In the habitat chapters, we report only on those groups where we have habitat associations for the majority of species.

HABITAT ASSOCIATIONS

As well as measuring how the state of nature has changed overall, and looking, where possible, at individual taxonomic groups, we wished to investigate patterns across the UK's broad habitats. We therefore assigned each species for which we had trend data to one or more broad habitat categories: farmland, woodland, freshwater and wetland, upland, coastal, grassland and heathland, and urban (see table to the right). These habitat categories are similar to those used in the UK National Ecosystem Assessment[17] and the Countryside Survey[18]. As marine habitats tend to be discrete areas it was not necessary to analyse habitat associations for marine species in this way.

A range of systems has been used to classify habitat in the UK; we used the NBN Habitat Dictionary[19] to convert between them and our seven habitat types. Since many species use more than one broad habitat, they were assigned to more than one and as such are included in more than one habitat analysis.

In order to assign species to broad habitats, we attempted to use a standard approach, by extending the method of Redhead *et al.* (2015)[20]. Data from *Landcover Map 2007* was used to identify the proportion of the seven broad habitats in each 1-km square in the UK. For each species we assessed, biological recording data (from 1990–2013) were used to identify presence/absence in each square, then a binomial generalised linear model was used to investigate relationships between occurrence and habitats. Regions (100km x 100km) were used as co-variates to account for recording and distributional differences across the country. Rules were developed to generate pseudo-absence data, as well as thresholds for the number of records and the number of UK regions a species needed to be recorded in before the analysis could be run. Statistically significant slopes were taken as evidence of a relationship between a species and habitat. Where it was not possible to use the above method, we used a range of other habitat association publications to assign species to broad habitats, as we did in the first *State of Nature* report, for example Gibbons *et al.* (1993)[21] for birds. This process of selection identified the species for which raw data from across all habitats was incorporated to produce habitat specific assessments.

Freshwater and terrestrial habitats	Description
Enclosed farmland	Arable fields, improved grasslands in livestock production and associated features such as set-aside, field margins and hedgerows.
Grassland and heathland	Lowland semi-natural grasslands, lowland heath and brownfield sites such as quarries.
Upland	Mountains, upland moors and heaths, and upland extensive grazing pastures.
Coastal	Sand dunes, machair, saltmarshes, shingle, sea cliffs and coastal lagoons.
Freshwater and wetland	Lakes, rivers and ponds, fens, reedbeds and lowland raised bogs.
Urban	All environments within the confines of cities, towns and villages, including parks, gardens and buildings.
Woodland	All woodland habitats, from copse upwards, including plantation and natural woodlands and conifer as well as broadleaf. Substansive areas of scrub.

COUNTRY-LEVEL REPORTING

We do not have the same volume of information on species' trends within the UK's constituent countries as we do for the UK as a whole. As a result, although we attempted to repeat analyses, as presented in the UK report, in the separate reports for England, Northern Ireland, Scotland and Wales, in many cases this was not possible (for example, the analyses of occupancy data). Therefore, our results are strongly biased towards taxonomic groups for which more data was available (for example birds); thus we have not tried to produce results at the "all species" level given the underlying biases. For national Red Lists, we used lists of species present in England, Scotland and Wales to interpret the existing Great Britain Red Lists in a national context – this means that the status of a species outside a nation may influence the Red List results presented for that nation. In the case of Northern Ireland, we have used all-Ireland Red List assessments for species occurring in Northern Ireland, as this allowed the consideration of a broader taxonomic scope than data from Northern Ireland alone.

CAVEATS

The datasets presented in this report are a summary of the information available. However, although they cover many species, the datasets have not been selected to reflect a representative sample of UK species, either within or between taxonomic groups or habitats. This means that we should be cautious about extrapolating findings beyond the species assessed. We have put together datasets collected using different methods, measuring different aspects of species' status at a variety of spatial scales and analysed using different statistical techniques.

There are two points to note about this. Firstly, how a species has been monitored – the method, effort and extent of surveying – can influence whether the results were suitable for our analyses, and indeed the species' trend itself. Whether trends in abundance, occupancy or distribution are reported can be influential. For example, when a widespread species begins to decline, changes in abundance may be detected before changes in distribution. Conversely, increases in distribution in an already widespread species can be difficult to detect. The scale at which trends in distribution are measured can also be influential, with distribution loss at a fine spatial scale not detected if mapping is done at a coarser resolution.

Many of the monitoring schemes that produce the datasets included in this report have a wide range geographically, but may not have sufficient sampling density locally to pick up changes in localised or particularly rare species. As a result, trends for relatively few of these species are reported. Our measures of the balance of increasing and decreasing species may therefore be biased towards the more common, widespread and generalist species.

Secondly, although official guidelines are used to produce national Red Lists, there is room for variation in interpretation of these guidelines and so there are small differences in the way different authors have compiled the national Red Lists summarised here. This is particularly true in defining which species are not threatened (of Least Concern).

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For a detailed description of the data sources and the data used in this survey please visit **rspb.org.uk/stateofnature**

Partners

This report has been produced by a partnership of more than 50 organisations involved in the recording, researching and conservation of nature in the UK and its Overseas Territories.

These include a broad spectrum of recording societies with expertise on a wide range of taxonomic groups, including our best and least known wildlife; research organisations responsible for gathering and analysing data that advances our knowledge of the UK's nature; and conservation charities that take action for all elements of our wildlife and habitats.

A Focus On Nature
afocusonnature.org

A Rocha
arocha.org.uk

Amphibian and Reptile Conservation (ARC)
arc-trust.org

Association of Local Environmental Records Centres (ALERC)
alerc.org.uk

Bat Conservation Trust (BCT)
bats.org.uk

Biological Records Centre (BRC)
brc.ac.uk

Botanical Society of Britain and Ireland
bsbi.org

British Bryological Society (BBS)
britishbryologicalsociety.org.uk

British Dragonfly Society (BDS)
british-dragonflies.org.uk

British Lichen Society
britishlichensociety.org.uk

British Pteridological Society (BPS)
ebps.org.uk

British Trust for Ornithology (BTO)
bto.org

Buglife
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Bumblebee Conservation Trust
bumblebeeconservation.org

Butterfly Conservation
butterfly-conservation.org

Centre for Ecology & Hydrology (CEH)
ceh.ac.uk

Chartered Institute of Ecology and Environmental Management (CIEEM)
cieem.net

Conchological Society of Great Britain and Ireland
conchsoc.org

Durrell Wildlife Conservation Trust (Durrell)
durrell.org

Earthwatch
eu.earthwatch.org

Freshwater Habitats Trust
freshwaterhabitats.org.uk

Friends of the Earth
foe.co.uk

Froglife
froglife.org

Fungus Conservation Trust
abfg.org

iSpot
ispotnature.org

Jersey Government Department of the Environment
gov.je/Government/Departments/PlanningEnvironment

Mammal Society
mammal.org.uk

Manx BirdLife
manxbirdlife.im

Marine Biological Association (MBA)
mba.ac.uk

MARINELife
marine-life.org.uk

Marine Conservation Society
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Marine Ecosystems Research Programme
marine-ecosystems.org.uk

National Biodiversity Network (NBN)
data.nbn.org.uk

National Forum for Biological Recording
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Brick tuft fungi

Jennie Smith

The *State of Nature 2016* report is a collaboration between the UK conservation and research organisations listed below:

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Andy Hay