Dr Mark Eaton

RSPB

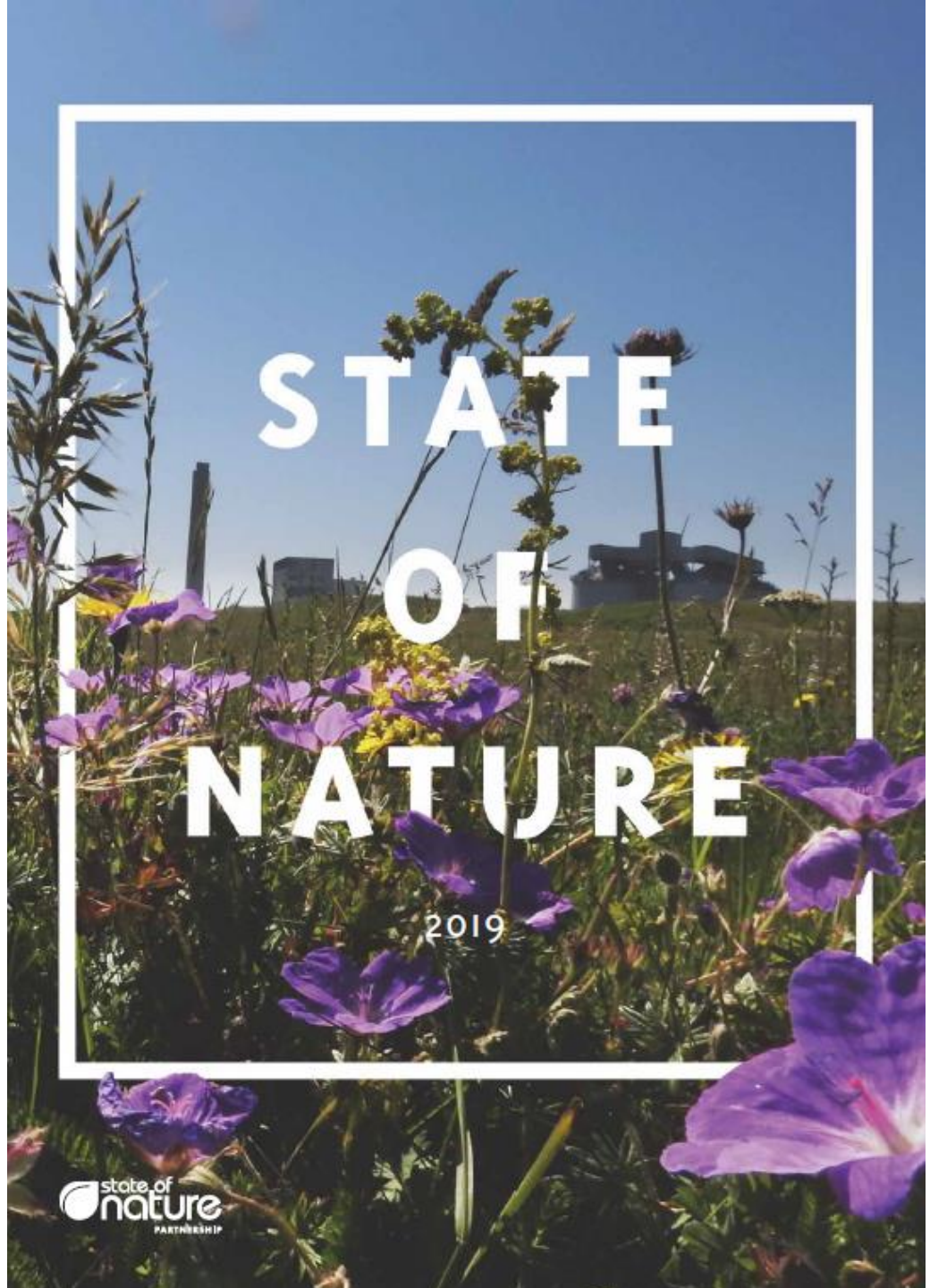
@Mark_A_Eaton

Scottish Biodiversity Science conference

18th Nov 2019

The aims of State of Nature reports

To support the work of the nature conservation sector in the UK and UKOTs by providing an agreed evidence base of the state of wildlife, together with contextual information on the pressures it is facing, and the impact of conservation responses, which will serve as a valuable tool to help the sector inform key decisions. In addition, to enable the nature conservation sector to be seen to be working cooperatively to save nature.


STATE
OF
NATURE
2019
state of nature
PARTNERSHIP


STATE
OF
NATURE
2019
state of nature
PARTNERSHIP
SCOTLAND

state of nature PARTNERSHIP

The *State of Nature 2019* report is a collaboration between the conservation and research organisations listed below:

www.nbn.org.uk/stateofnature2019

This report should be cited as: Walton P, Eaton M, Stanbury A, Hayhow D, Brand A, Brooks S, Collin S, Duncan C, Dundas C, Foster S, Hawley J, Kinninmonth A, Leatham S, Nagy-Vlaltu A, Whyte A, Williams S and Wormald K (2019). *The State of Nature Scotland 2019*. The State of Nature partnership.

STATE OF NATURE

2019

state of nature PARTNERSHIP

SCOTLAND

THE HEADLINES

In this report we have drawn on the best available data on Scotland's biodiversity, produced by partnerships between conservation non-governmental organisations (NGOs), research institutes, UK and national governments, and thousands of dedicated volunteers. We have focused on the trends in species as the key evidence of how nature is faring.

The collection of systematic data on species' trends often does not fully cover timescales relevant to ecological changes. Widescale data collection only began 20–50 years ago. The results should be interpreted in that context and viewed against a backdrop of profound historic human influences on nature in Scotland. Scotland makes a very significant contribution to UK biodiversity; it has a high proportion of the UK's upland habitats, including its most mountainous terrain, and has species found nowhere else in the UK. Some of Scotland's species, such as the White-script Lichen and Scottish Primrose, are found nowhere else in the world. Historic deforestation, intensified livestock grazing since the 18th century, widespread sporting management since the 19th century and large-scale commercial forestry during the 20th century have all had significant effects on upland wildlife.

Photo: Drew Buckley

Our data show that the abundance and distribution of Scotland's species has on average declined over recent decades and most measures indicate this decline has continued in the most recent decade. There has been no let-up in the net loss of nature in Scotland.

Photo: Kevin Sawford

24%

decline in average species' abundance.

Our indicator of average species' abundance of 352 terrestrial and freshwater species has fallen by 24% since 1994. There has been very little change in the rate of decline in the last 10 years.

14%

decline in average species' distribution.

Our indicator of average species' distribution, covering 2,970 terrestrial and freshwater species over a broad range of taxonomic groups, has fallen by 14% since 1970, and is 2% lower than in 2005.

49%

of species have decreased in abundance.

Of the species showing either strong or moderate changes in numbers, 49% have decreased and 28% have increased. Likewise more species have decreased in distribution (33%) than increased (20%) since 1970.

62%

of species show strong changes.

Our wildlife is undergoing rapid change, the proportion of species defined as showing strong changes in abundance, either increasing or decreasing, rose from 45% since 1994 to 62% over the last 10 years.

11%

of species are threatened.

Of the 6,413 species found in Scotland that have been assessed using Regional Red List criteria, 11% have been classified as threatened with extinction from Great Britain.

38%

decline in the Scottish breeding seabird indicator between 1986 and 2016.

However, the abundance indicators for fish species, both pelagic and demersal, show some signs of recovery from deep historic lows in the Celtic and North Seas.

Though some pressures on nature,

notably freshwater pollution, have reduced in recent decades, the pressures that have caused the net loss of biodiversity continue collectively to have a negative effect.

- Agricultural productivity, linked to the intensification of land management and the decline in farmland nature, is still increasing, although some farmers have adopted wildlife-friendly farming techniques.
- Average temperatures in Scotland have increased by nearly 1°C, with widespread impacts on nature evident already.
- Legislation has driven marked reductions in emissions of some harmful pollutants, although negative impacts remain.
- The need for more homes in response to changing human population demographics means that thousands of hectares (ha) of habitat including farmland, woodland and wetland are built on every year, although woodland cover has increased and new wetland habitat has been created.

Photo: Oliver Smart

This report showcases just a few of the exciting conservation initiatives,

involving thousands of people, intended to help nature flourish across Scotland, delivered through partnerships of individuals, landowners, NGOs and government.

Photo: Andrew Parkinson

The impacts of fishing and climate change

on species' abundance and distribution are evident throughout Scottish seas. At the base of the food web, plankton communities have changed in response to warming seas. While fish stocks are showing signs of recovery, the impacts of unsustainable fishing persist. The ramifications of other pressures on the marine environment, such as noise and plastic pollution, are of concern but remain less clear.

Photo: Peter Cairns

Scotland has a long history of love for, and fascination with, our natural heritage.

Thanks to this, thousands of volunteers collect data on our wildlife every year. Without their dedication this report would not be possible; we thank them all.

#STATEOFNATURE

THE HEADLINES

In this report we have drawn on the best available data on Scotland's biodiversity, produced by partnerships between conservation non-governmental organisations (NGOs), research institutes, UK and national governments, and thousands of dedicated volunteers. We have focused on the trends in species as the key evidence of how nature is faring.

The collection of systematic data on species' trends often does not fully cover timescales relevant to ecological changes. Widescale data collection only began 20–50 years ago. The results should be interpreted in that context and viewed against a backdrop of profound historic human influences on nature in Scotland. Scotland makes a very significant contribution to UK biodiversity; it has a high proportion of the UK's upland habitats, including its most mountainous terrain, and has species found nowhere else in the UK. Some of Scotland's species, such as the White-script Lichen and Scottish Primrose, are found nowhere else in the world. Historic deforestation, intensified livestock grazing since the 18th century, widespread sporting management since the 19th century and large-scale commercial forestry during the 20th century have all had significant effects on upland wildlife.

Photo: Drew Buckley

Our data show that the abundance and distribution of Scotland's species has on average declined over recent decades and most measures indicate this decline has continued in the most recent decade. There has been no let-up in the net loss of nature in Scotland.

Photo: Kevin Sawford

24%

decline in average species' abundance.

Our indicator of average species' abundance of 352 terrestrial and freshwater species has fallen by 24% since 1994. There has been very little change in the rate of decline in the last 10 years.

14%

decline in average species' distribution.

Our indicator of average species' distribution, covering 2,970 terrestrial and freshwater species over a broad range of taxonomic groups, has fallen by 14% since 1970, and is 2% lower than in 2005.

49%

of species have decreased in abundance.

Of the species showing either strong or moderate changes in numbers, 49% have decreased and 28% have increased. Likewise more species have decreased in distribution (33%) than increased (20%) since 1970.

62%

of species show strong changes.

Our wildlife is undergoing rapid change, the proportion of species defined as showing strong changes in abundance, either increasing or decreasing, rose from 45% since 1994 to 62% over the last 10 years.

11%

of species are threatened.

Of the 6,413 species found in Scotland that have been assessed using Regional Red List criteria, 11% have been classified as threatened with extinction from Great Britain.

38%

decline in the Scottish breeding seabird indicator between 1986 and 2016.

However, the abundance indicators for fish species, both pelagic and demersal, show some signs of recovery from deep historic lows in the Celtic and North Seas.

Though some pressures on nature,

notably freshwater pollution, have reduced in recent decades, the pressures that have caused the net loss of biodiversity continue collectively to have a negative effect.

- Agricultural productivity, linked to the intensification of land management and the decline in farmland nature, is still increasing, although some farmers have adopted wildlife-friendly farming techniques.
- Average temperatures in Scotland have increased by nearly 1°C, with widespread impacts on nature evident already.
- Legislation has driven marked reductions in emissions of some harmful pollutants, although negative impacts remain.
- The need for more homes in response to changing human population demographics means that thousands of hectares (ha) of habitat including farmland, woodland and wetland are built on every year, although woodland cover has increased and new wetland habitat has been created.

Photo: Oliver Smart

This report showcases just a few of the exciting conservation initiatives,

involving thousands of people, intended to help nature flourish across Scotland, delivered through partnerships of individuals, landowners, NGOs and government.

Photo: Andrew Parkinson

The impacts of fishing and climate change

on species' abundance and distribution are evident throughout Scottish seas. At the base of the food web, plankton communities have changed in response to warming seas. While fish stocks are showing signs of recovery, the impacts of unsustainable fishing persist. The ramifications of other pressures on the marine environment, such as noise and plastic pollution, are of concern but remain less clear.

Photo: Peter Cairns

Scotland has a long history of love for, and fascination with, our natural heritage.

Thanks to this, thousands of volunteers collect data on our wildlife every year. Without their dedication this report would not be possible; we thank them all.

#STATEOFNATURE

HISTORICAL CHANGE IN BIODIVERSITY

This report focuses on changes in biodiversity and the drivers of these changes, taking 1970 as baseline year. We must remember, however, that people have been shaping landscape and wildlife for millennia. This historic context is important in framing more recent changes that we can accurately measure. This is a selection of indicative milestones, trends, pressures and changes, from various sources – some broad and major, others quite specific. The list is not comprehensive. It is, rather, a brief illustration of the multiple historical perspectives on people and nature in Scotland.

	PRE-1800	1800 TO 1900	1900 TO 1950	1950 TO 1980	1980 TO 2000	POST-2000
TRENDS AND MILESTONES	• Woodland cover peaks c5,000 years ago across most of Scotland. Unique native pinewood and broadleaved ecological communities develop. • Peatlands develop post-glaciation to cover c20% of Scotland.	• Early 19th century: diverse multispecies fisheries sustained in coastal waters. • Corncrakes and other farmland wildlife common and widespread across Scottish landscapes.	• Forest cover begins to increase – but much of it is non-native monocultures.	• Loss of native woodland slows as conservation designations and woodland grants are established. • Ospreys return as Scottish breeders in **1954**. • Northern Gannet populations grow, with the world's largest colonies in Scotland.	• Corncrake population begins to recover from **1991**. • Red Kite and White-tailed Sea Eagle reintroductions succeed in re-establishing them as breeders in Scotland. • Peatland restoration work expands.	• Populations of wintering geese increase significantly (except of the declining Greenland White-fronted Goose). • **2016** – Scottish Government announce that Beavers, released in **2009**, are to remain in Scotland – the first time that a mammal has been reintroduced in the UK.
PEOPLE AND NATURE	• Cultural significance of Scottish wildlife evident in art and literature from Neolithic through to Scottish Enlightenment.	• Origins of environmental movement accelerated by the extinction of the Great Auk. • **1822** – Dalmarnock Bridge protests win access to countryside for Glasgow people.	• Modern Scottish conservation movement emerges post-WWII, with growing government commitment and voluntary sector, underpinned by science base. • Oil in Navigable Waters Act **1922** reduces chronic marine oil pollution.	• National wildlife protection legislation emerges. • First National Nature Reserve in **1951** at Beinn Eighe. • National Parks designated in England and Wales from **1951** – but not Scotland. • Scottish Wildlife Trust formed **1964**.	• Fiscal incentives for forestry on blanket bogs ended, late **1980s**. • Sandeel fishery closures, with industry cooperation, in response to wildlife trends, Shetland and Forth. • SNH formed in **1992** – one of the most enduring public wildlife agencies.	• CBD's 2020 targets set in **2010**. In **2017** Scotland meets seven out of 20, compared with a global average of four, is making progress on 12 and submitted the world's first Aichi assessment. • MPAs and Natura sites designated in Scottish waters. • Loch Lomond and The Trossachs, and the Cairngorms, designated as National Parks in **2002** and **2003** respectively.
PRESSURES	• Woodland clearance from c5,000 years ago. Felling accelerates for timber, tanning and charcoal in the 17th/18th centuries; most woodland is lost.	• River and air pollution in the Central Belt intensify with industrial revolution. • **1880s** – steam trawlers meant a rapid increase in fishing effort. • Draining of wetlands and peatlands intensifies. • Loss of mixed farming as large-scale sheep operations develop.	• Urbanisation seen as the key issue for biodiversity, rather than broader land and sea-use patterns. • To ensure national timber self-sufficiency, Forestry Commission establishes post-WWI – Scotland is the principal location for commercial planting.	• Following WWII food shortages, and following joining of the EU Common Agricultural Policy in **1973**, farming methods intensify with wildlife losses. • Use of DDT and other organo-chlorines becomes widespread from **1950**, affecting wildlife, especially songbirds and predators. • Commercial forestry expands onto important wildlife habitats – native woodlands and peatlands.	• Overgrazing and non-native Rhododendron impacts drive key Atlantic woodland sites into unfavourable status.	• Water surface temperatures increase in rivers, lochs and seas – projected to increase further. • Invasive species – new non-natives continue to establish. Species established in the south spread north. Climate change increases establishment probability.
TRENDS AND MILESTONES	• The Wolf becomes extinct in Scotland, probably in the late 17th century.	• The Great Auk goes extinct – last Scottish breeding in **1813**, globally extinct by **1844**. • Intensification and industrialisation of marine fisheries lead to major landing declines in second half of 19th century, into 20th.	• Last Scottish White-tailed Sea Eagle killed in **1914**. • Between **1903** and **1928** at least 6,028 Fin Whales were hunted in Scottish waters. • Svalbard-breeding Solway Barnacle Geese hit a low post-WWII of less than 300 individuals through hunting and disturbance.	• Overfishing led North Sea Herring stocks to decline by over 99% between the **1960s** and mid-70s. • Post-war farmland wildlife declines proceed across much of western Europe. • The endemic Scottish Manx shearwater flea *Ceratophyllus fionnus* was last recorded in the **1970s**.	• Breeding failures and prey fish availability issues become evident for Northern Isles seabirds. • Black Grouse declines, especially in south of Scottish range. • Farmland wildlife declines continue, including Great Yellow Bumblebee and Corn Bunting.	• The Loch Lomond Capercaillie population goes extinct, meaning significant range contraction. • Curlew numbers have fallen by 48% since **1995**.

THE HEADLINES

In this report we have drawn on the best available data on Scotland's biodiversity, produced by partnerships between conservation non-governmental organisations (NGOs), research institutes, UK and national governments, and thousands of dedicated volunteers. We have focused on the trends in species as the key evidence of how nature is faring.

The collection of systematic data on species' trends often does not fully cover timescales relevant to ecological changes. Widescale data collection only began 20–50 years ago. The results should be interpreted in that context and viewed against a backdrop of profound historic human influences on nature in Scotland. Scotland makes a very significant contribution to UK biodiversity; it has a high proportion of the UK's upland habitats, including its most mountainous terrain, and has species found nowhere else in the UK. Some of Scotland's species, such as the White-script Lichen and Scottish Primrose, are found nowhere else in the world. Historic deforestation, intensified livestock grazing since the 18th century, widespread sporting management since the 19th century and large-scale commercial forestry during the 20th century have all had significant effects on upland wildlife.

Photo: Drew Buckley

Our data show that the abundance and distribution of Scotland's species has on average declined over recent decades and most measures indicate this decline has continued in the most recent decade. There has been no let-up in the net loss of nature in Scotland.

Photo: [illegible] Sawford

24%

decline in average species' abundance.

Our indicator of average species' abundance of 352 terrestrial and freshwater species has fallen by 24% since 1994. There has been very little change in the rate of decline in the last 10 years.

14%

decline in average species' distribution.

Our indicator of average species' distribution, covering 2,970 terrestrial and freshwater species over a broad range of taxonomic groups, has fallen by 14% since 1970, and is 2% lower than in 2005.

49%

of species have decreased in abundance.

Of the species showing either strong or moderate changes in numbers, 49% have decreased and 28% have increased. Likewise more species have decreased in distribution (33%) than increased (20%) since 1970.

62%

of species show strong changes.

Our wildlife is undergoing rapid change, the proportion of species defined as showing strong changes in abundance, either increasing or decreasing, rose from 45% since 1994 to 62% over the last 10 years.

11%

of species are threatened.

Of the 6,413 species found in Scotland that have been assessed using Regional Red List criteria, 11% have been classified as threatened with extinction from Great Britain.

38%

decline in the Scottish breeding seabird indicator between 1986 and 2016.

However, the abundance indicators for fish species, both pelagic and demersal, show some signs of recovery from deep historic lows in the Celtic and North Seas.

Though some pressures on nature,

notably freshwater pollution, have reduced in recent decades, the pressures that have caused the net loss of biodiversity continue collectively to have a negative effect.

- Agricultural productivity, linked to the intensification of land management and the decline in farmland nature, is still increasing, although some farmers have adopted wildlife-friendly farming techniques.
- Average temperatures in Scotland have increased by nearly 1°C, with widespread impacts on nature evident already.
- Legislation has driven marked reductions in emissions of some harmful pollutants, although negative impacts remain.
- The need for more homes in response to changing human population demographics means that thousands of hectares (ha) of habitat including farmland, woodland and wetland are built on every year, although woodland cover has increased and new wetland habitat has been created.

Photo: Oliver Smart

This report showcases just a few of the exciting conservation initiatives,

involving thousands of people, intended to help nature flourish across Scotland, delivered through partnerships of individuals, landowners, NGOs and government.

Photo: Andrew Parkinson

The impacts of fishing and climate change

on species' abundance and distribution are evident throughout Scottish seas. At the base of the food web, plankton communities have changed in response to warming seas. While fish stocks are showing signs of recovery, the impacts of unsustainable fishing persist. The ramifications of other pressures on the marine environment, such as noise and plastic pollution, are of concern but remain less clear.

Photo: Peter Cairns

Scotland has a long history of love for, and fascination with, our natural heritage.

Thanks to this, thousands of volunteers collect data on our wildlife every year. Without their dedication this report would not be possible; we thank them all.

#STATEOFNATURE

KEY FINDINGS

We are able to present trends in status for more species than ever before in *State of Nature 2019*. This is due to new datasets becoming available and the development of analytical tools which enable a much broader range of taxonomic groups to be represented.

Using multispecies indicators, our goal is to communicate a clear, objective assessment of the state of biodiversity in Scotland. The metrics we present show how measures of average species' status have changed over time as well as showing the variation in trends between species.

For full methods see *State of Nature 2019* at www.nbn.org.uk/stateofnature2019.

Our species' status metrics make use of two broad types of data:

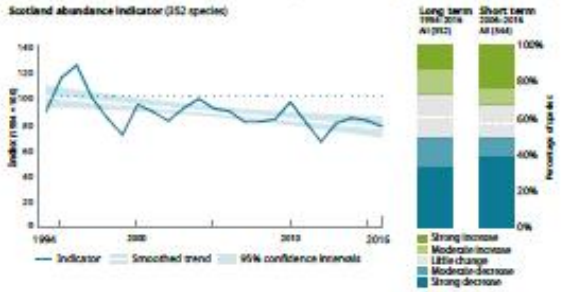
Abundance data from a number of well-established monitoring schemes in Scotland and the UK encompassing 352 species (birds, mammals, butterflies and moths). Many of these species are popular to record, and are relatively easy to identify and to observe, making it possible to count individuals to get a measure of relative abundance. Our abundance metrics report the average change in relative abundance across these species.

Occupancy data from large-scale biological records datasets from which we can now calculate trends for 2,970 species across a wider range of taxonomic groups (including mammals, vascular plants, lichens, bryophytes and a number of invertebrate groups). These trends measure the change in the proportion of occupied sites in Scotland, so our metrics effectively report the average change in distribution for these species.

We focus on measuring change over two periods: from 1994 through to 2016 for abundance data and from 1970 to 2015 for occupancy data. Our short-term period covers the final 10 years of these time series, telling us how Scotland's nature is doing now.

Photo: Laurie Campbell

SCOTLAND-SPECIFIC COMBINED ABUNDANCE INDICATOR BASED ON TRENDS OF MOTHS (175 SPECIES), BIRDS (143 SPECIES), BUTTERFLIES (25 SPECIES) AND MAMMALS (9 SPECIES)



The abundance indicator for 352 terrestrial and freshwater species, for which Scotland-specific trends are available, shows a statistically significant decline in average abundance of 24% (95% confidence intervals (CI) -33% to -15%) between 1994 and 2016. Over this long-term period the smoothed indicator fell by 1.2% per year. Over our short-term period, the decline was a statistically non-significant 12%, a rate of 1.3% per year. There was no significant difference in the rate of change between the long and the short term.

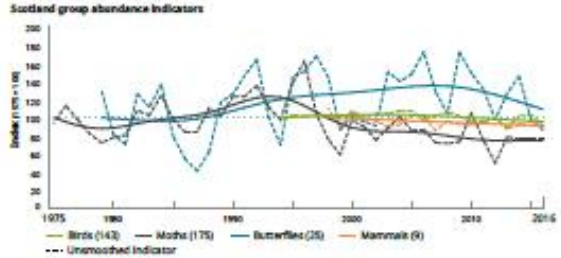
The white line with shading shows the smoothed trend and associated 95% CI, the blue line shows the underlying unsmoothed indicator. The bar chart shows the percentage of species within the indicator that have increased, decreased (moderately or strongly) or shown little change in abundance. Within multispecies indicators like these there is substantial variation between individual species' trends. To examine this, we have allocated species into trend categories based on the magnitude of population change, over the long- and the short-term periods.

- Over the long term, 49% of species showed strong or moderate declines and 28% showed strong or moderate increases; 24% showed little change.
- Over the short term, 48% of species showed strong or moderate declines and 33% showed strong or moderate increases; 18% showed little change.
- Over the long term, 45% of species showed a strong change in abundance (either increase or decrease). Over the short term this rose to 62% of species.

Using a different, binary categorisation:

- Over the long term, 60% of species showed negative trends and 40% showed positive trends; over the short term, 56% of species showed negative trends and 44% showed positive trends.

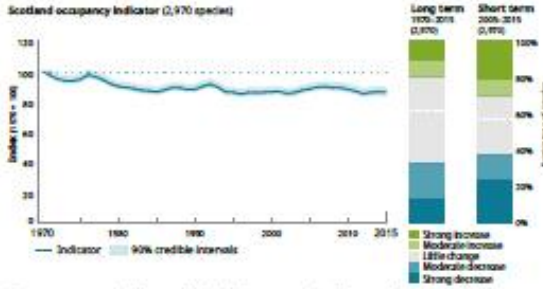
TRENDS IN ABUNDANCE FOR BIRDS, MOTHS, BUTTERFLIES AND MAMMALS



Based on smoothed trends:

- The abundance indicator for 175 moth species starts in 1975 and shows a statistically significant decline in average abundance of 25% (CI -49% to -1%). Over the short term, the indicator was 10% lower in 2016 compared to 2006.
- The abundance indicator for 143 bird species starts in 1994 and has been broadly stable since, with a statistically non-significant decline in average abundance of 4% (CI -9% to 0%). The indicator was 7% lower in 2016 compared to 2006.
- The abundance indicator for 25 butterfly species starts in 1979 and shows a slight but statistically non-significant increase in average abundance of 9% (CI -27% to +45%). The indicator was 19% lower in 2016 compared to 2006.
- The abundance indicator for nine mammal species starts in 1998 and overall shows a statistically significant decline in average abundance of 9% (CI -14% to -4%). The indicator was 5% lower in 2016 compared to 2006.

CHANGE IN SPECIES' DISTRIBUTION IN SCOTLAND



The occupancy indicator for 2,970 terrestrial and freshwater species shows a decline in average distribution of 14% between 1970 and 2015, and 2% between 2005 and 2015. Because species tend to decline in abundance before they disappear from a site, declines could reflect more severe underlying abundance declines.

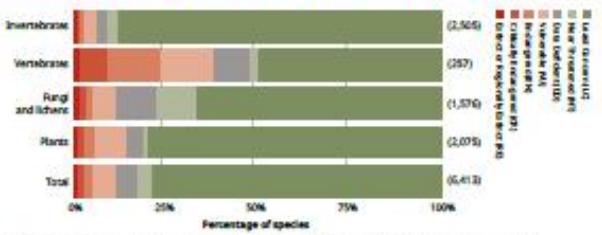
To examine the variation in species' distribution trends, we allocated trends into categories based on the magnitude of distribution change.

- Over the long term, 33% of species showed strong or moderate declines and 20% showed strong or moderate increases; 47% showed little change.
- Over the short term, 37% of species showed strong or moderate declines and 30% showed strong or moderate increases; 33% showed little change.
- Over the long term, 23% of species showed a strong change in distribution (either increase or decrease). Over the short term this rose to 45% of species.

Using a different, binary categorisation:

- Over the long term, 62% of species showed negative trends and 38% showed positive trends in distribution; over the short term, 57% of species showed negative trends and 43% showed positive trends.

NATIONAL RED LIST ASSESSMENT BY TAXONOMIC GROUPS



Of the 6,413 species found in Scotland that have been assessed against the International Union for Conservation of Nature (IUCN) Regional Red List Criteria, 642 (11%) of the extant species, for which sufficient data are available, are formally classified as threatened (Critically Endangered, Endangered or Vulnerable) and therefore at risk of extinction from Great Britain (the scale at which assessments are made). The bars show the percentage of assessed species, by broad taxonomic group and overall, which fall into each of the IUCN Red List categories.

Of the extant terrestrial and freshwater species found in Scotland, assessed using modern IUCN Regional Red List criteria, 265 plants (13%), 153 fungi and lichens (11%), 92 vertebrates (37%) and 132 invertebrates (5%) are classified as being at risk of extinction from Great Britain.

Burns, Eaton et al. (2018) Ecological Indicators, 94: 226-236

24%

decline in average species' abundance.

Our indicator of average species' abundance of 352 terrestrial and freshwater species has fallen by 24% since 1994. There has been very little change in the rate of decline in the last 10 years.

14%

decline in average species' distribution.

Our indicator of average species' distribution, covering 2,970 terrestrial and freshwater species over a broad range of taxonomic groups, has fallen by 14% since 1970, and is 2% lower than in 2005.

49%

of species have decreased in abundance.

Of the species showing either strong or moderate changes in numbers, 49% have decreased and 28% have increased. Likewise more species have decreased in distribution (33%) than increased (20%) since 1970.

62%

of species show strong changes.

Our wildlife is undergoing rapid change, the proportion of species defined as showing strong changes in abundance, either increasing or decreasing, rose from 45% since 1994 to 62% over the last 10 years.

11%

of species are threatened.

Of the 6,413 species found in Scotland that have been assessed using Regional Red List criteria, 11% have been classified as threatened with extinction from Great Britain.

38%

decline in the Scottish breeding seabird indicator between 1986 and 2016.

However, the abundance indicators for fish species, both pelagic and demersal, show some signs of recovery from deep historic lows in the Celtic and North Seas.

24%

decline in average species' abundance.

Our indicator of average species' abundance of 352 terrestrial and freshwater species has fallen by 24% since 1994. There has been very little change in the rate of decline in the last 10 years.

14%

decline in average species' distribution.

Our indicator of average species' distribution, covering 2,970 terrestrial and freshwater species over a broad range of taxonomic groups, has fallen by 14% since 1970, and is 2% lower than in 2005.

49%

of species have decreased in abundance.

Of the species showing either strong or moderate changes in numbers, 49% have decreased and 28% have increased. Likewise more species have decreased in distribution (33%) than increased (20%) since 1970.

62%

of species show strong changes.

Our wildlife is undergoing rapid change, the proportion of species defined as showing strong changes in abundance, either increasing or decreasing, rose from 45% since 1994 to 62% over the last 10 years.

11%

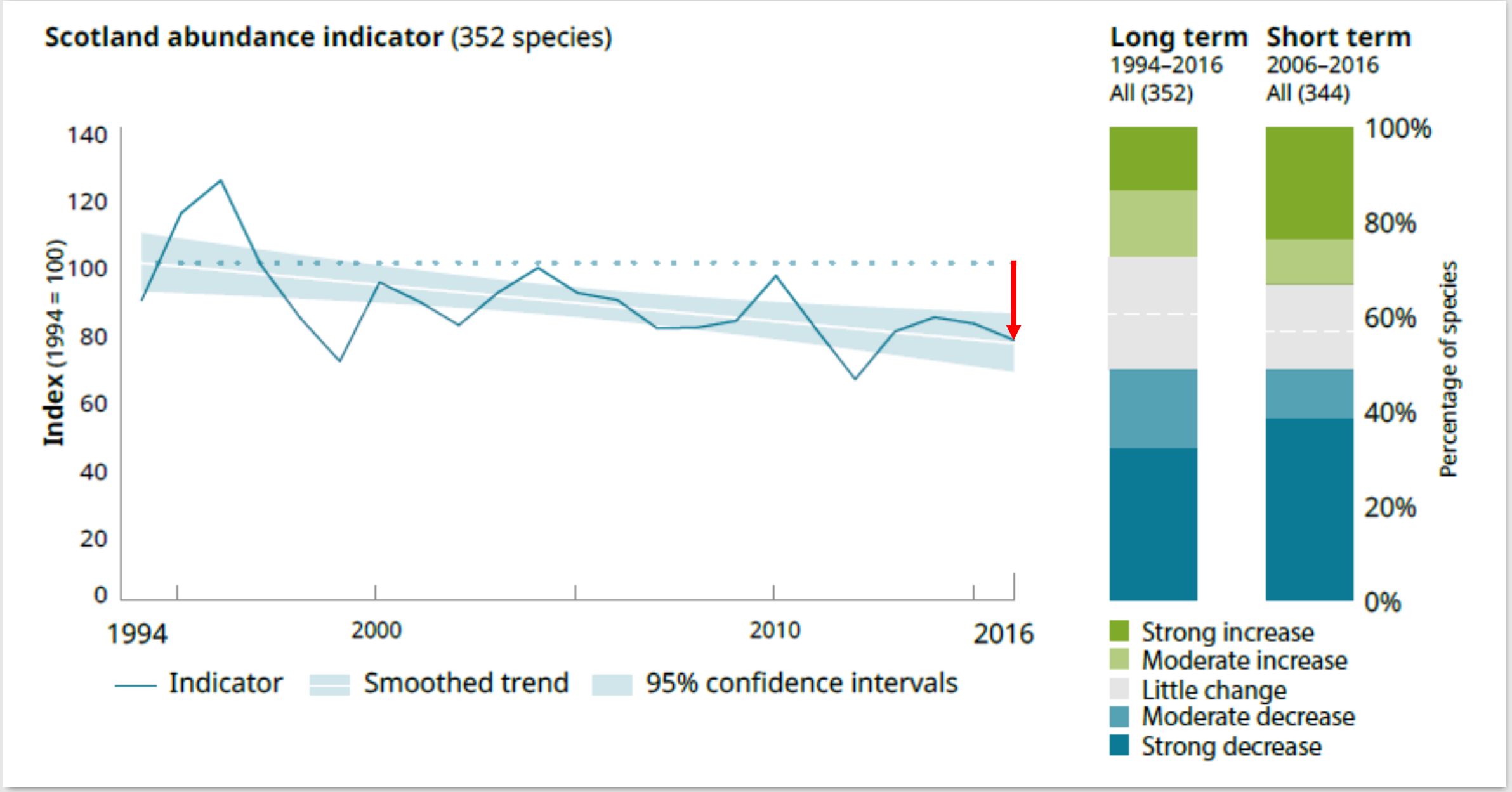
of species are threatened.

Of the 6,413 species found in Scotland that have been assessed using Regional Red List criteria, 11% have been classified as threatened with extinction from Great Britain.

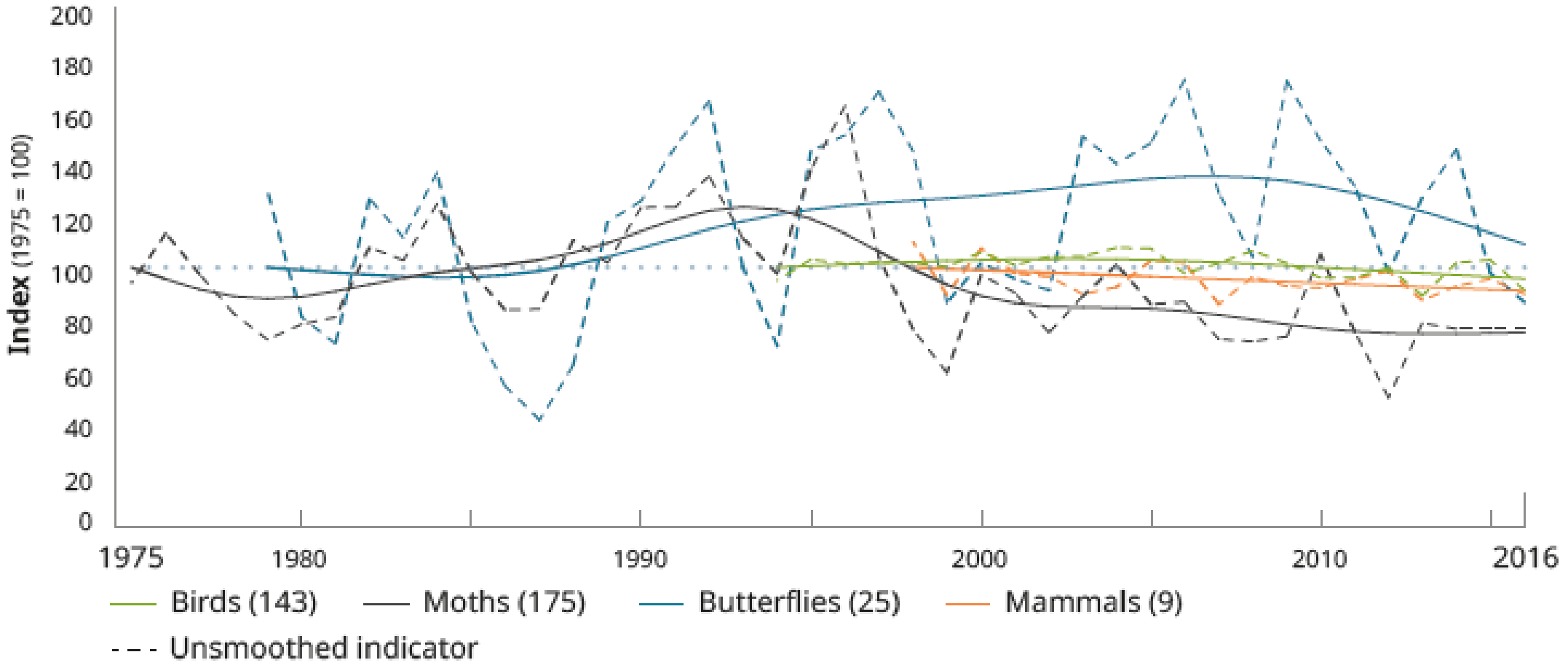
38%

decline in the Scottish breeding seabird indicator between 1986 and 2016.

However, the abundance indicators for fish species, both pelagic and demersal, show some signs of recovery from deep historic lows in the Celtic and North Seas.


Scotland abundance indicator (352 species)
Index (1994 = 100)
140
120
100
80
60
40
20
0
1994
2000
2010
2016
Indicator
Smoothed trend
95% confidence intervals
Long term
1994–2016
All (352)
Short term
2006–2016
All (344)
100%
80%
60%
40%
20%
0%
Percentage of species
Strong increase
Moderate increase
Little change
Moderate decrease
Strong decrease

Scotland group abundance indicators



24%

decline in average species' abundance.

Our indicator of average species' abundance of 352 terrestrial and freshwater species has fallen by 24% since 1994. There has been very little change in the rate of decline in the last 10 years.

14%

decline in average species distribution.

Our indicator of average species' distribution, covering 2,970 terrestrial and freshwater species over a broad range of taxonomic groups, has fallen by 14% since 1970, and is 2% lower than in 2005.

49%

of species have decreased in abundance.

Of the species showing either strong or moderate changes in numbers, 49% have decreased and 28% have increased. Likewise more species have decreased in distribution (33%) than increased (20%) since 1970.

62%

of species show strong changes.

Our wildlife is undergoing rapid change, the proportion of species defined as showing strong changes in abundance, either increasing or decreasing, rose from 45% since 1994 to 62% over the last 10 years.

11%

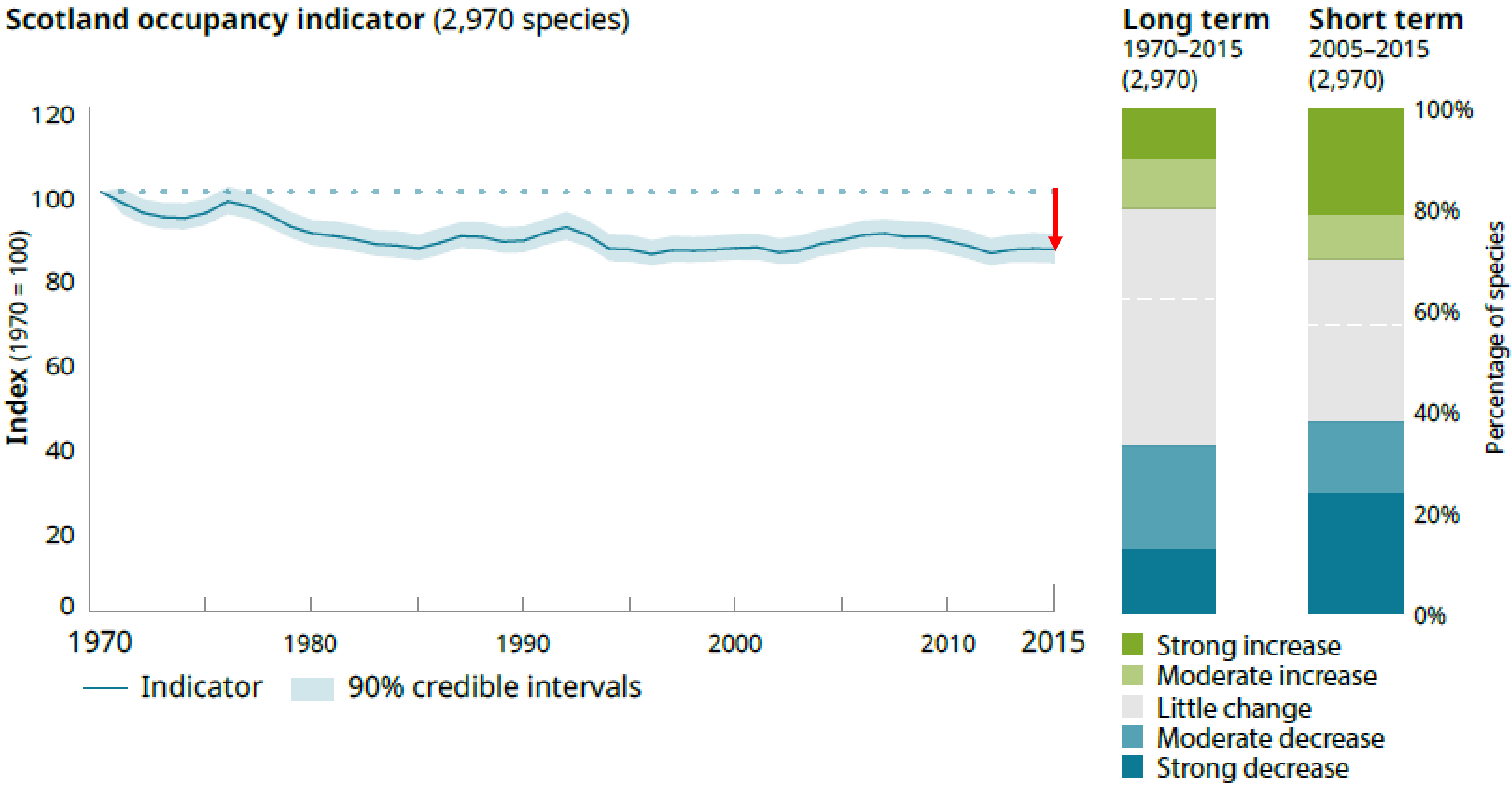
of species are threatened.

Of the 6,413 species found in Scotland that have been assessed using Regional Red List criteria, 11% have been classified as threatened with extinction from Great Britain.

38%

decline in the Scottish breeding seabird indicator between 1986 and 2016.

However, the abundance indicators for fish species, both pelagic and demersal, show some signs of recovery from deep historic lows in the Celtic and North Seas.


Scotland occupancy indicator (2,970 species)
Index (1970 = 100)
120
100
80
60
40
20
0
1970
1980
1990
2000
2010
2015
Indicator
90% credible intervals
Long term
1970–2015
(2,970)
Short term
2005–2015
(2,970)
100%
80%
60%
40%
20%
0%
Percentage of species
Strong increase
Moderate increase
Little change
Moderate decrease
Strong decrease

24%

decline in average species' abundance.

Our indicator of average species' abundance of 352 terrestrial and freshwater species has fallen by 24% since 1994. There has been very little change in the rate of decline in the last 10 years.

14%

decline in average species' distribution.

Our indicator of average species' distribution, covering 2,970 terrestrial and freshwater species over a broad range of taxonomic groups, has fallen by 14% since 1970, and is 2% lower than in 2005.

49%

of species have decreased in abundance.

Of the species showing either strong or moderate changes in numbers, 49% have decreased and 28% have increased. Likewise more species have decreased in distribution (33%) than increased (20%) since 1970.

62%

of species show strong changes.

Our wildlife is undergoing rapid change, the proportion of species defined as showing strong changes in abundance, either increasing or decreasing, rose from 45% since 1994 to 62% over the last 10 years.

11%

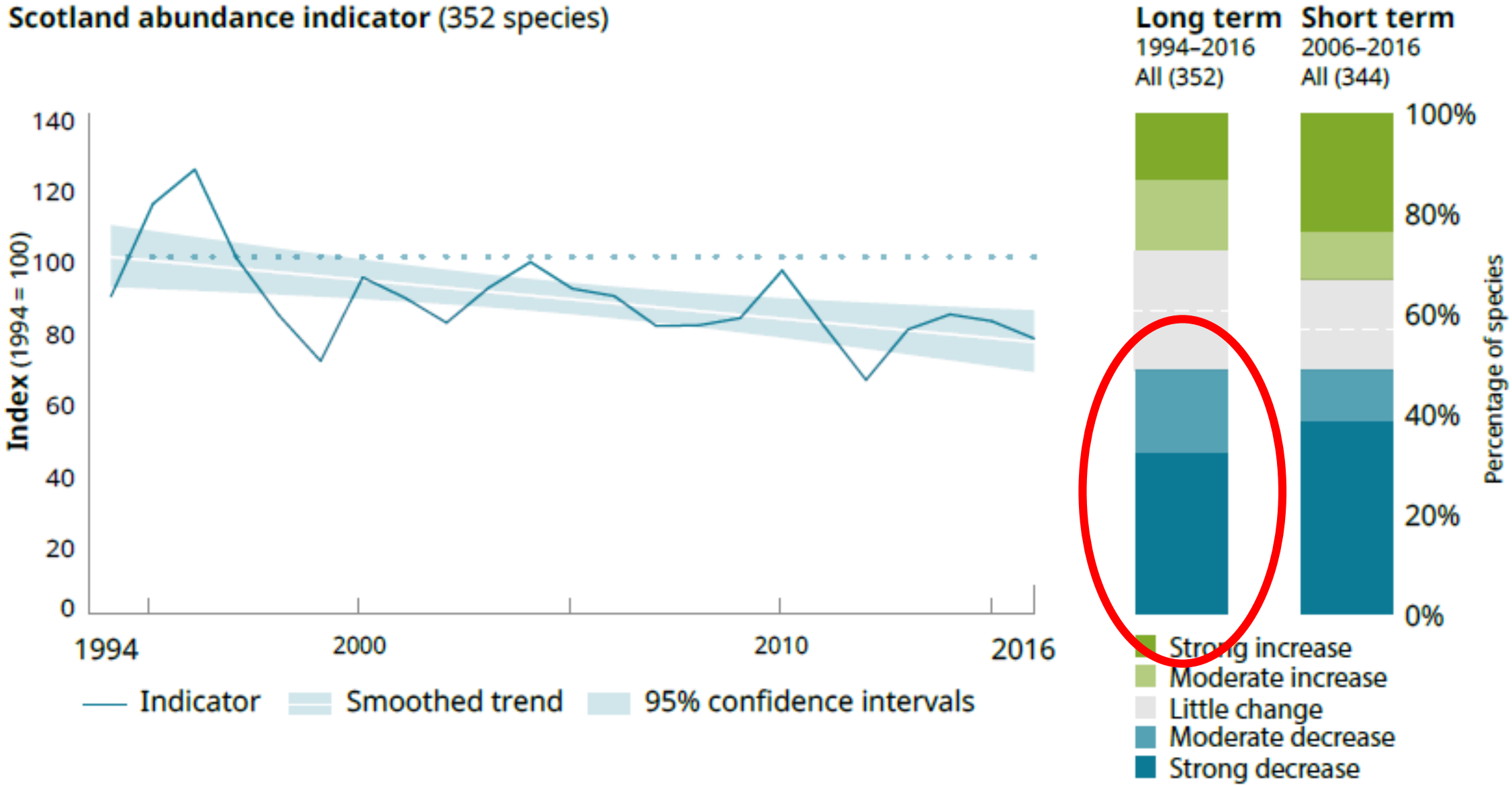
of species are threatened.

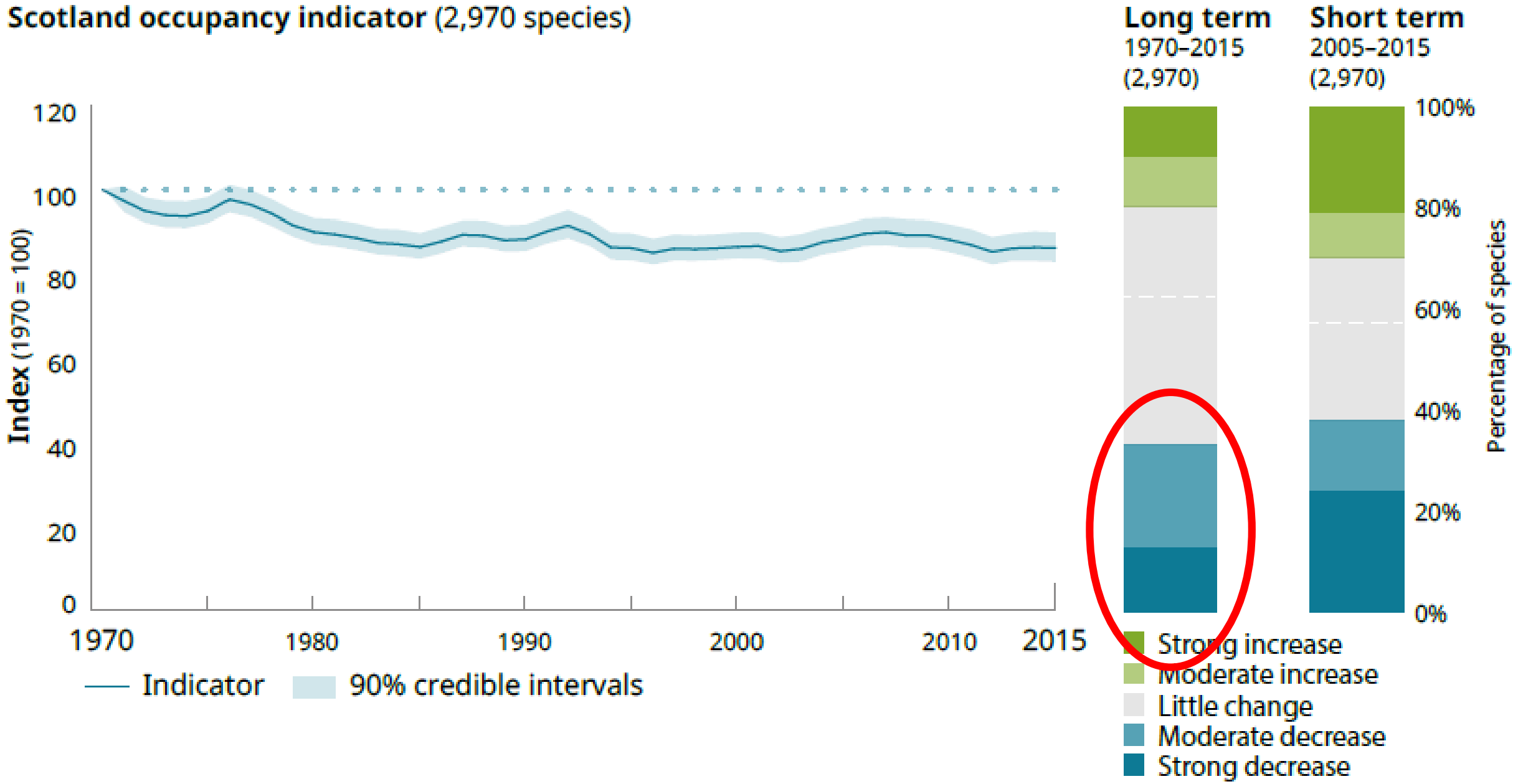
Of the 6,413 species found in Scotland that have been assessed using Regional Red List criteria, 11% have been classified as threatened with extinction from Great Britain.

38%

decline in the Scottish breeding seabird indicator between 1986 and 2016.

However, the abundance indicators for fish species, both pelagic and demersal, show some signs of recovery from deep historic lows in the Celtic and North Seas.


Scotland abundance indicator (352 species)
Index (1994 = 100)
140
120
100
80
60
40
20
0
1994
2000
2010
2016
Indicator
Smoothed trend
95% confidence intervals
Long term
1994–2016
All (352)
Short term
2006–2016
All (344)
100%
80%
60%
40%
20%
0%
Percentage of species
Strong increase
Moderate increase
Little change
Moderate decrease
Strong decrease


Scotland occupancy indicator (2,970 species)
Index (1970 = 100)
120
100
80
60
40
20
0
1970
1980
1990
2000
2010
2015
Indicator
90% credible intervals
Long term
1970–2015
(2,970)
Short term
2005–2015
(2,970)
100%
80%
60%
40%
20%
0%
Percentage of species
Strong increase
Moderate increase
Little change
Moderate decrease
Strong decrease

24%

decline in average species' abundance.

Our indicator of average species' abundance of 352 terrestrial and freshwater species has fallen by 24% since 1994. There has been very little change in the rate of decline in the last 10 years.

14%

decline in average species' distribution.

Our indicator of average species' distribution, covering 2,970 terrestrial and freshwater species over a broad range of taxonomic groups, has fallen by 14% since 1970, and is 2% lower than in 2005.

49%

of species have decreased in abundance.

Of the species showing either strong or moderate changes in numbers, 49% have decreased and 28% have increased. Likewise more species have decreased in distribution (33%) than increased (20%) since 1970.

62%

of species show strong changes.

Our wildlife is undergoing rapid change, the proportion of species defined as showing strong changes in abundance, either increasing or decreasing, rose from 45% since 1994 to 62% over the last 10 years.

11%

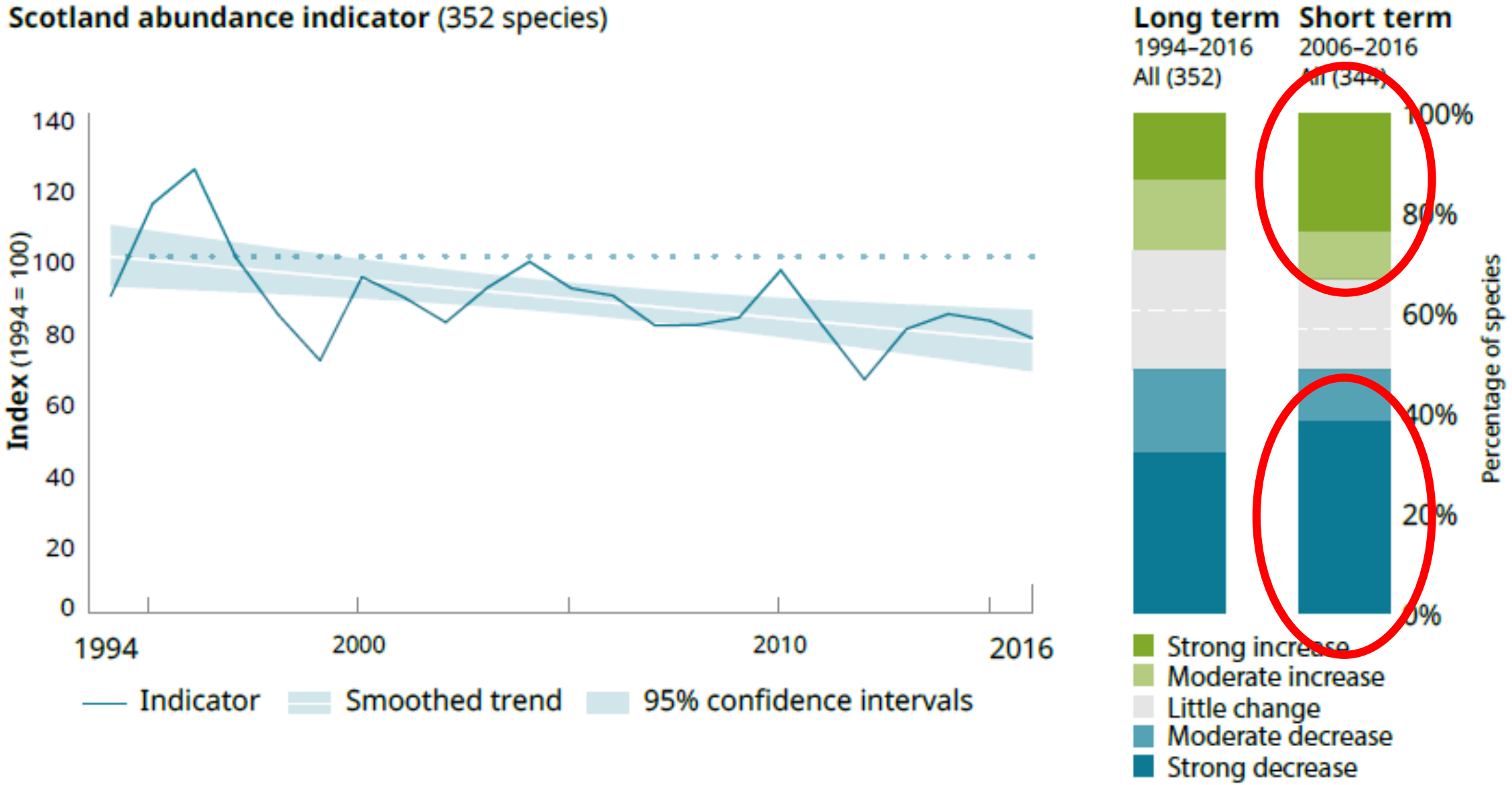
of species are threatened.

Of the 6,413 species found in Scotland that have been assessed using Regional Red List criteria, 11% have been classified as threatened with extinction from Great Britain.

38%

decline in the Scottish breeding seabird indicator between 1986 and 2016.

However, the abundance indicators for fish species, both pelagic and demersal, show some signs of recovery from deep historic lows in the Celtic and North Seas.


Scotland abundance indicator (352 species)
Index (1994 = 100)
140
120
100
80
60
40
20
0
1994
2000
2010
2016
Indicator
Smoothed trend
95% confidence intervals
Long term
1994–2016
All (352)
Short term
2006–2016
All (344)
100%
80%
60%
40%
20%
0%
Percentage of species
Strong increase
Moderate increase
Little change
Moderate decrease
Strong decrease

24%

decline in average species' abundance.

Our indicator of average species' abundance of 352 terrestrial and freshwater species has fallen by 24% since 1994. There has been very little change in the rate of decline in the last 10 years.

14%

decline in average species' distribution.

Our indicator of average species' distribution, covering 2,970 terrestrial and freshwater species over a broad range of taxonomic groups, has fallen by 14% since 1970, and is 2% lower than in 2005.

49%

of species have decreased in abundance.

Of the species showing either strong or moderate changes in numbers, 49% have decreased and 28% have increased. Likewise more species have decreased in distribution (33%) than increased (20%) since 1970.

62%

of species show strong changes.

Our wildlife is undergoing rapid change, the proportion of species defined as showing strong changes in abundance, either increasing or decreasing, rose from 45% since 1994 to 62% over the last 10 years.

11%

of species are threatened.

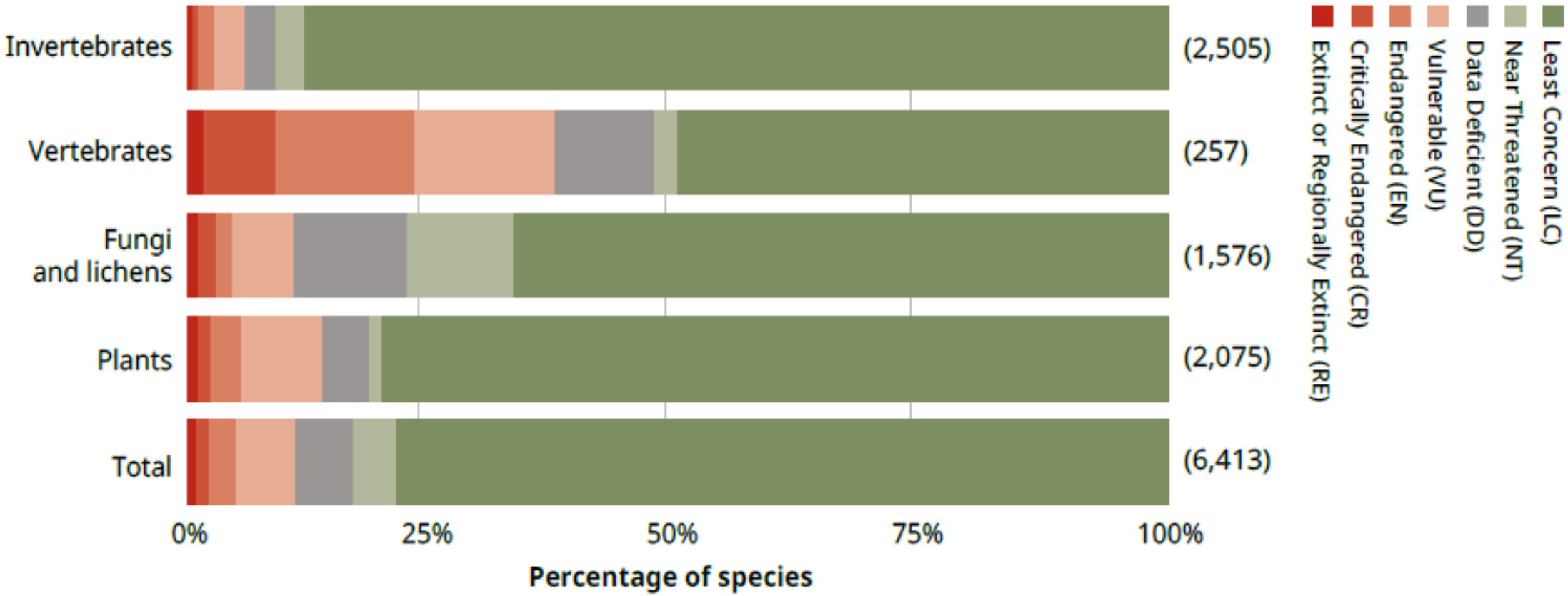
Of the 6,413 species found in Scotland that have been assessed using Regional Red List criteria, 11% have been classified as threatened with extinction from Great Britain.

38%

decline in the Scottish breeding seabird indicator between 1986 and 2016.

However, the abundance indicators for fish species, both pelagic and demersal, show some signs of recovery from deep historic lows in the Celtic and North Seas.

NATIONAL RED LIST ASSESSMENT BY TAXONOMIC GROUPS



24%

decline in average species' abundance.

Our indicator of average species' abundance of 352 terrestrial and freshwater species has fallen by 24% since 1994. There has been very little change in the rate of decline in the last 10 years.

14%

decline in average species' distribution.

Our indicator of average species' distribution, covering 2,970 terrestrial and freshwater species over a broad range of taxonomic groups, has fallen by 14% since 1970, and is 2% lower than in 2005.

49%

of species have decreased in abundance.

Of the species showing either strong or moderate changes in numbers, 49% have decreased and 28% have increased. Likewise more species have decreased in distribution (33%) than increased (20%) since 1970.

62%

of species show strong changes.

Our wildlife is undergoing rapid change, the proportion of species defined as showing strong changes in abundance, either increasing or decreasing, rose from 45% since 1994 to 62% over the last 10 years.

11%

of species are threatened.

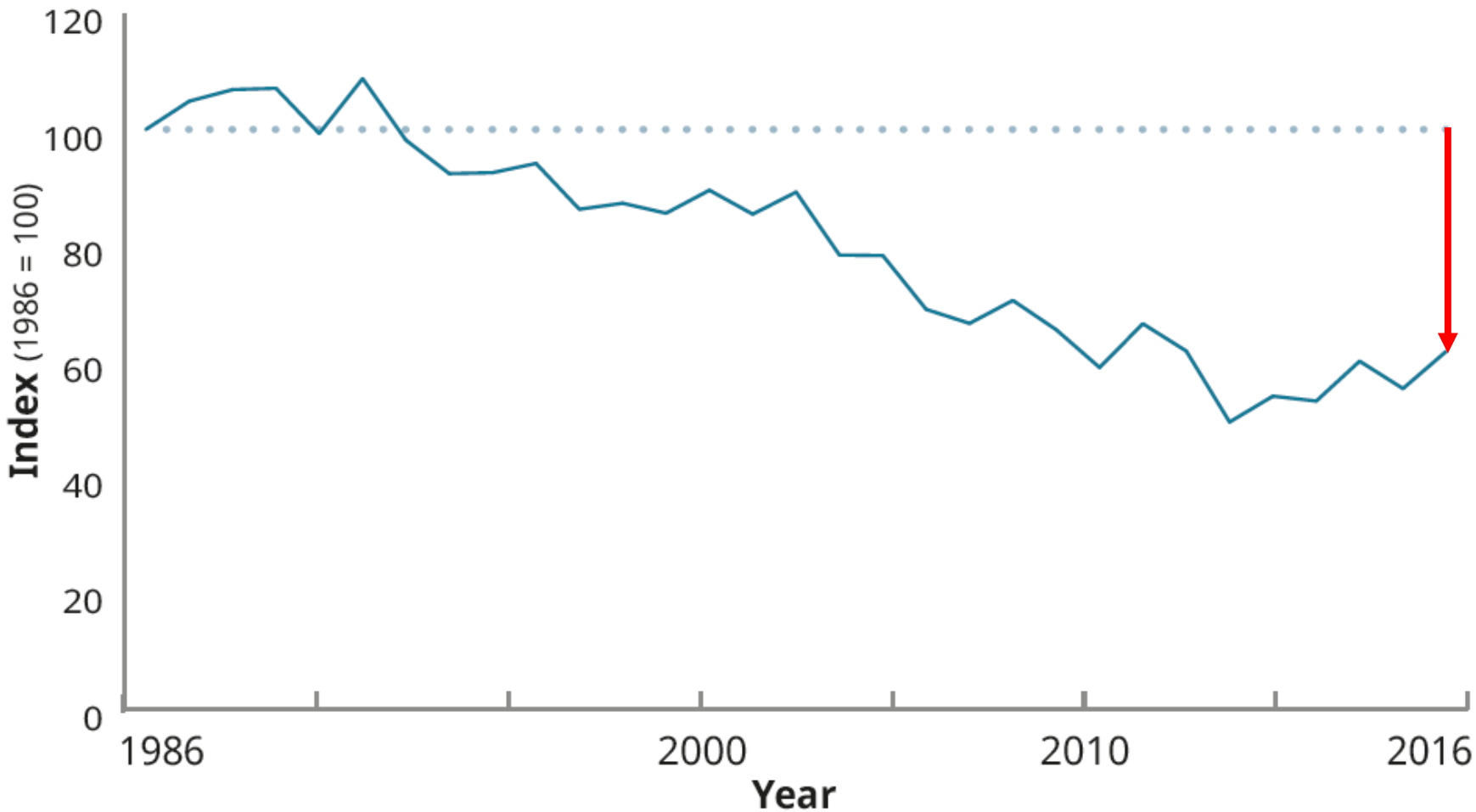
Of the 6,413 species found in Scotland that have been assessed using Regional Red List criteria, 11% have been classified as threatened with extinction from Great Britain.

38%

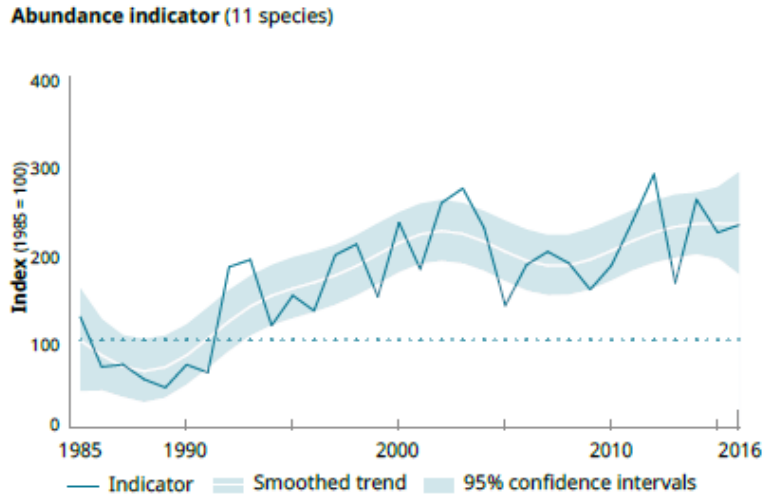
decline in the Scottish breeding seabird indicator between 1986 and 2016.

However, the abundance indicators for fish species, both pelagic and demersal, show some signs of recovery from deep historic lows in the Celtic and North Seas.

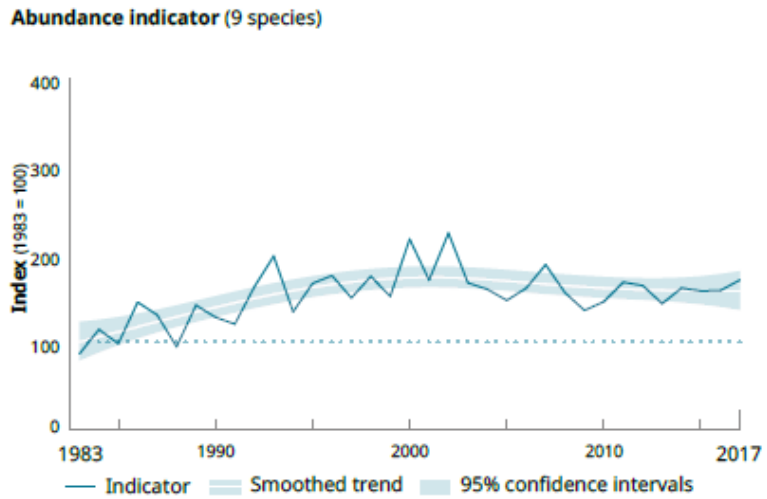
Abundance indicator (12 species)



Change in average species' abundance – Celtic Seas demersal fish



Change in average species' abundance – Greater North Sea demersal fish



THE HEADLINES

In this report we have drawn on the best available data on Scotland's biodiversity, produced by partnerships between conservation non-governmental organisations (NGOs), research institutes, UK and national governments, and thousands of dedicated volunteers. We have focused on the trends in species as the key evidence of how nature is faring.

The collection of systematic data on species' trends often does not fully cover timescales relevant to ecological changes. Widescale data collection only began 20–50 years ago. The results should be interpreted in that context and viewed against a backdrop of profound historic human influences on nature in Scotland. Scotland makes a very significant contribution to UK biodiversity; it has a high proportion of the UK's upland habitats, including its most mountainous terrain, and has species found nowhere else in the UK. Some of Scotland's species, such as the White-script Lichen and Scottish Primrose, are found nowhere else in the world. Historic deforestation, intensified livestock grazing since the 18th century, widespread sporting management since the 19th century and large-scale commercial forestry during the 20th century have all had significant effects on upland wildlife.

Photo: Drew Buckley

Our data show that the abundance and distribution of Scotland's species has on average declined over recent decades and most measures indicate this decline has continued in the most recent decade. There has been no let-up in the net loss of nature in Scotland.

Photo: Kevin Sawford

24%
decline in average species' abundance.
Our indicator of average species' abundance of 352 terrestrial and freshwater species has fallen by 24% since 1994. There has been very little change in the rate of decline in the last 10 years.

14%
decline in average species' distribution.
Our indicator of average species' distribution, covering 2,970 terrestrial and freshwater species over a broad range of taxonomic groups, has fallen by 14% since 1970, and is 2% lower than in 2005.

49%
of species have decreased in abundance.
Of the species showing either strong or moderate changes in numbers, 49% have decreased and 28% have increased. Likewise more species have decreased in distribution (33%) than increased (20%) since 1970.

62%
of species show strong changes.
Our wildlife is undergoing rapid change, the proportion of species defined as showing strong changes in abundance, either increasing or decreasing, rose from 45% since 1994 to 62% over the last 10 years.

11%
of species are threatened.
Of the 6,413 species found in Scotland that have been assessed using Regional Red List criteria, 11% have been classified as threatened with extinction from Great Britain.

38%
decline in the Scottish breeding seabird indicator between 1986 and 2016.
However, the abundance indicators for fish species, both pelagic and demersal, show some signs of recovery from deep historic lows in the Celtic and North Seas.

Though some pressures on nature,
notably freshwater pollution, have reduced in recent decades, the pressures that have caused the net loss of biodiversity continue collectively to have a negative effect.

- Agricultural productivity, linked to the intensification of land management and the decline in farmland nature, is still increasing, although some farmers have adopted wildlife-friendly farming techniques.
- Average temperatures in Scotland have increased by nearly 1°C, with widespread impacts on nature evident already.
- Legislation has driven marked reductions in emissions of some harmful pollutants, although negative impacts remain.
- The need for more homes in response to changing human population demographics means that thousands of hectares (ha) of habitat including farmland, woodland and wetland are built on every year, although woodland cover has increased and new wetland habitat has been created.

Photo: Oliver Smart

This report showcases just a few of the exciting conservation initiatives,
involving thousands of people, intended to help nature flourish across Scotland, delivered through partnerships of individuals, landowners, NGOs and government.

Photo: Andrew Parkinson

The impacts of fishing and climate change
on species' abundance and distribution are evident throughout Scottish seas. At the base of the food web, plankton communities have changed in response to warming seas. While fish stocks are showing signs of recovery, the impacts of unsustainable fishing persist. The ramifications of other pressures on the marine environment, such as noise and plastic pollution, are of concern but remain less clear.

Photo: Peter Cairns

Scotland has a long history of love for, and fascination with, our natural heritage.
Thanks to this, thousands of volunteers collect data on our wildlife every year. Without their dedication this report would not be possible; we thank them all.

#STATEOFNATURE

INVASIVE AND NON-NATIVE SPECIES

Invasive non-native species (INNS) are a major driver of biodiversity loss globally[1]. Impacts include predation, competition, hybridisation, novel disease and pathogen transfer, and habitat degradation. The effects in Scotland broadly reflect the international and wider UK situation: significant and intensifying impacts on many native taxa, especially in the most vulnerable environments – islands, freshwater bodies and native woodlands[2].

The available indicators show an increasing spread of 190 established INNS across terrestrial, freshwater and marine environments in Great Britain during the last six decades – with northwards shift a common pattern[3]. They also show no reduction in the establishment rate of new non-native species. With evidence that climate change and INNS will impact biodiversity in a negative synergy, it is evident that despite recent progress in policy and legislation, the impact and threat from INNS is intensifying significantly in Scotland.

ERADICATION OF INNS ON ISLANDS

The Shiant Isles are one of the most important breeding colonies for seabirds in Europe. Historical evidence indicates that current populations are greatly reduced through the presence of non-native Black Rats, thought to have arrived from an 18th century shipwreck, which predate upon seabird eggs and chicks[4]. Some previous breeders, like Manx Shearwaters, have been wiped out on the islands.

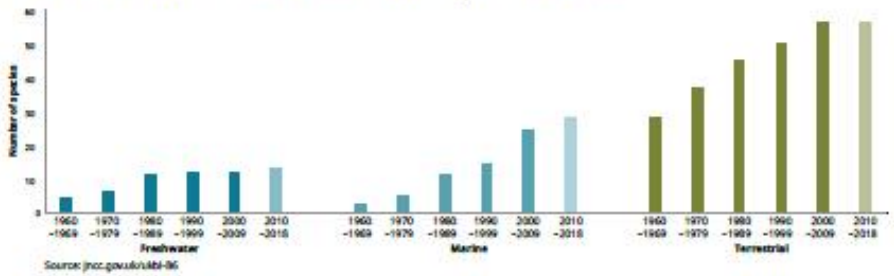
A rat eradication and biosecurity project took place during winter 2015–2016, led by RSPB Scotland and funded by the EU LIFE fund and SNH, with the support of the Nicolson family, custodians of the islands. Wildlife Management International Limited ran operations, using rodenticide contained in bait stations set across the Shiant Isles and taking more than four months to complete.

In March 2018 the Shiants were declared officially free of rats. Manx Shearwaters and Storm Petrels were encouraged to nest using call playback, and in 2017 calling Storm Petrels were recorded on the islands for the first time. Seabirds and other wildlife on the islands are being monitored to determine responses, and a comprehensive biosecurity plan is being implemented to prevent reinvasion of mammal predators[5].

RHODODENDRON

Rhododendron ponticum was introduced to Scotland via the horticulture trade; since then, it has thrived in the mild, wet conditions of the west of Scotland and has spread across much of the available habitat. If left untreated it eliminates vegetation, outcompetes native tree and shrub regeneration and has significant impacts on other woodland species groups such as mosses and lichens. It is a major cause of unfavourable site condition on designated sites, including more than half of those designated under the EU Habitats Directive for Western acidic oak woodland – the "Celtic Rainforest", for which Scotland has significant international responsibilities[6]. Rhododendron is also a key host and reservoir for fungus-like *Phytophthora* tree pathogens[7]. Several large-scale control projects have tackled the issue in Scotland, but success rates have been poor, with reinvasion of previously cleared areas. Key past weaknesses have been failure to eradicate at the whole-population scale, and failure to implement legacy biosecurity arrangements post-eradication. A national approach has been developed to highlight priority areas and guide implementation of control[8].

UK Biodiversity Indicator: Number of new INNS established in or along 10% or more of Great Britain's land area or coastline, 1960 to 2018 (final columns in each habitat refer to nine years rather than 10)



Source: jncc.gov.uk/ukbi-B6

UPLAND MANAGEMENT

Uplands cover about half of Scotland's area (estimates vary from 44% to 85% depending on the definition used[1]), encompassing a variety of habitats and reflecting the country's diverse geology, climate and relief. Blanket bog and upland heath are globally rare habitats but are found in relative abundance here. Scotland has 60% of the UK's internationally important peatlands, which have a key role in carbon capture and sequestration[2,3].

Land use for farming, forestry, sporting estates and recreation continues to influence land management and condition of upland habitats.

- Agriculture has a significant influence, through grazing, drainage and application of nutrients. In the north and west, crofting exerts a significant influence on the landscape; in the last decade there has been a decline in livestock grazing in some areas and undergrazing is a pressure. In many other areas, overgrazing from high deer and livestock densities is a principal pressure on habitats, altering vegetation and preventing tree regeneration[4].
- In the 20th century, large areas of upland were planted with non-native plantation forestry; more recently some expansion of native woodland, following major historic losses, has occurred[5].
- Grouse moor management exerts a powerful influence over land in upland areas[6]. Inappropriate muirburn, including on deep peat, can damage vegetation and soil, leading to nitrogen deposition and release of carbon[7]. Differing management objectives still lead to significant conflicts in the uplands[8,9], and the illegal persecution of birds of prey continues to have a major impact on species' distribution[10].
- Some sensitive habitats have also been damaged by windfarms and hill tracks, although this is mitigated, to some degree, through planning processes. Following widespread historic degradation of peatland habitats, major efforts have been made in recent decades to protect and restore blanket bog habitats, with significant positive progress in the Flows of Caithness and Sutherland, the Western Isles and elsewhere[11]. Integrating land use for multiple benefits and managing conflicts in the uplands remains one of Scotland's biggest challenges.

MAR LODGE ESTATE NATIONAL NATURE RESERVE

In 2017 the Mar Lodge Estate, owned by the National Trust for Scotland, became the UK's largest National Nature Reserve, at 29,000ha[12].

The landscape is internationally significant for its sense of wildness, scale and diversity. The montane plateau is among the most significant areas of wild land in the British Isles, and part of the Cairngorm Mountains National Scenic Area and Cairngorms Wild Land Area. The estate encompasses four of the five highest summits in the British Isles and holds a total of 15 Munros. The Cairngorms are home to Britain's largest area of arctic-alpine flora and snowbed communities.

Caledonian pinewood today covers around 2,350ha of Mar Lodge Estate. Collaboration with neighbouring estates led to a plan to cull deer and erect a fence, which has resulted in the successful regeneration of over 800ha of pinewood since 1995. Birch and montane scrub is also recovering across large areas. These habitats are important for Red Squirrel, Black Grouse, Capercaillie, Scottish Crossbill, Parrot Crossbill, wood ants, other invertebrates and fungi. Some of the Scots Pines provide the second longest native pine chronology in Scotland, stretching back to 1477.

Moorlands cover the majority of the estate and provide essential habitat for Hen Harriers and Red Grouse. Burning is no longer used to manage the moorland, acknowledging the risk this poses to the woodland, people and the carbon which is locked up in the peat soils.

Mar Lodge has a rich cultural as well as natural history, including its development as a sporting estate in the 19th century. Deerstalking, walked-up grouse shooting and Salmon fishing still happens on the estate but nature conservation and public access is its primary purpose now.

Photo: Tim Hunt

Round-leaved Sundew

WOODLAND

Despite Scotland being the most wooded of the UK countries, with around 19% woodland cover, it remains one of the most heavily deforested countries in Europe, with woodland cover well below the current European average of 37%[1,2].

Just under a quarter (311,000ha) of Scotland's woodland is considered native[3]. This includes globally important areas of Atlantic rainforest, including Oak and Hazel woodland, and Caledonian pine forest – widely recognised as being of very high value to biodiversity, but fragmented and restricted in range[3]. The remaining three-quarters (1.4 million ha) is mainly commercial forestry plantation dominated by conifers, which benefit a smaller range of largely generalist species.

Photo: Mike Read (rspb-images.com)

Woodlands in Scotland face pressure from fragmentation, browsing and grazing, INNS and new pests and pathogens[4,5]. Climate change will interact with these drivers, increasing the frequency of drought, flood and extreme weather events, leading to changes in distribution and altered competitive relationships between species. Challenges facing woodland and woodland managers are exemplified by the percentage of woodland features on protected sites in favourable or recovering condition, which dropped from 68.1% in 2017 to 65.2% in 2019[6]. Overgrazing and INNS (principally *Rhododendron ponticum*) were the most frequent pressures recorded at sites in unfavourable condition, though undergrazing can also present problems for some plants and lichen assemblages, due to increased shade[7]. Evidence suggests that many specialist lichen species have continued to decline in abundance as well as distribution because of negative habitat pressures[8]. Despite the many pressures, some woodland species have fared well in Scotland in recent years: the Woodland Bird Index increased by 69% between 1994 and 2017, with 19 of the 23 monitored species increasing over the period[9].

REVIVING AND RE-CREATING NATIVE WOODLAND

Over the course of 15 years, Borders Forest Trust has acquired – through volunteer fundraising, grants from charitable trusts and public subscription – 3,100ha of the Southern Uplands across Dumfriesshire and the Scottish Borders, collectively known as The Wild Heart of Southern Scotland project[10].

Upland ecosystems have been substantially affected by long-term patterns of grazing, but wildlife-sensitive management and considered tree planting is now restoring the area. Over the course of the project nearly a million trees and shrubs have been planted, including new woodlands, wood pasture and riparian buffer strips. Nature is beginning to return to the restored landscape and a recent scientific study found that the number of woodland bird species recorded regularly had risen from two in 2008 to 14 in 2015.

This project has demonstrated that planting trees and shrubs, even at high altitudes and in severe conditions, is a perfectly achievable approach to restoring ecologically damaged and degraded marginal upland areas and provides a template that could be copied across the country.

Photo: David Woodfall (rspb-images.com)

LANDSCAPE SCALE RESTORATION

Cairngorms Connect is an ambitious multi-partner project with a 200-year vision to enhance habitats, species and ecological processes across a vast area within the Cairngorms National Park[11]. Covering 600 square kilometres, including ancient Caledonian pine forest and montane willow communities, the biggest land restoration project in Britain will allow forests to expand, naturalise rivers and restore huge tracts of peatland. Work on this project is currently in its infancy but milestones have been set for actions, monitoring, research, publicity and demonstration.

POLLUTION

Pollution – from plastic waste and chemicals in our soils, waters and air to the noise and light from cities and transport – threatens the environment and the species that inhabit it, not to mention our own health and well-being. From nutrient enrichment on mountain tops to the plastic litter in our seas, there are few places in Scotland left uncompromised by the by-products of modern human life. There has been marked progress, particularly since the 1990s, but the legacy of over 200 years of industrial development still remains, and we face challenges from new forms of pollution too.

Photo: Ernie Janes (rspb-images.com)

Air pollution and nutrient enrichment affect biodiversity and ecosystem services, harm human health and contribute to climate change. Widespread changes have been recorded to sensitive ecosystems in Scotland, with farming, transport, energy and industry being the key pollution sources.

Levels of the principal air pollutants have all declined in Scotland since 1990, and all but ammonia are at levels below 40% of their 1990 value[1]. Most semi-natural habitats, and over two-thirds of our wildflowers (such as Harebell and Betony), require low levels of nitrogen[2]. Eutrophication, acidification and toxification of ecosystems have been shown to drive declines in the presence, abundance and health of sensitive species of plants, lichens and other fungi[8]. Further up the food chain, the moth species whose larvae depend on low nutrient-adapted plants declined strongly between 1970 and 2010[4]. Even in montane regions, far from the sources of air pollution, excess nitrogen is deposited in the rain, altering plant communities and ecological functioning[8]. While reactive nitrogen (NOx) levels have fallen to around 30% of their 1990 value, the reduction in ammonia has been relatively small, with no significant change since 2007. Many pollutants have long-term impacts so the influence on many sensitive habitats remains considerable. New threats have arisen with the introduction of novel agrochemical and pharmaceutical products, and plastic pollution is increasingly recognised as causing harm to natural systems.

Diffuse pollution has been reduced in Scotland, particularly since the 1990s, but still represents a significant risk to freshwaters[8]. Agriculture and forestry are the main contributors of diffuse pollution, with nutrient and pesticide run-off, soil erosion through cultivation and poaching by animals close to watercourses adding individually small, but cumulatively large, pollution loads. Further diffuse pollution arises from contaminated drainage from roads and urban areas, along with deposition of acid pollutants from the air. In 2018, 12% of lochs and 20% of rivers and canals were in "poor" or "bad" condition, according to Water Framework Directive assessments[3]. These were primarily associated with intensively managed farmland.

MOSS SPECIES PROVIDE TELLTALE SIGNS OF POLLUTION AND CLIMATE CHANGE

Revealing evidence that points towards an increase in temperature and reducing nitrogen levels in Scotland has been discovered by analysing data from species records of mosses and liverwort (bryophytes). Scientists from the James Hutton Institute and SNH have collaborated on a project which shows bryophytes can be used to assess the health of our ecosystems[8]. The newly developed indicator, which links bryophyte records in the National Biodiversity Network to information on the habitat preferences of different species, provides good evidence of how mosses and liverwort have reacted to changes in pollutants[9]. The indicator draws together over half a million records going back to 1960. Most of these records were made by volunteers from the British Bryological Society.

The indicator breaks down information into 10 catchment-based Scottish regions and the data indicated a peak in the 1990s, with sensitive species then starting to increase. Most records are from semi-natural habitats, so it appears that bryophyte records largely reflect changes in atmospheric nitrogen pollution and it is heartening to see some signs of recovery from pollution. There is evidence for a similar pattern at a UK level for bryophytes and lichens, although this must be set against the decline in abundance as well as distribution for specialist lichen species because of negative habitat pressures[10].

SCOTLAND

Scotland holds some of the most diverse landscapes in the UK. From the remote montane habitats of the UK's highest peaks and the extensive expanses of blanket bog and upland heath to the West Atlantic oakwoods, Caledonian pine forests, lochs, coasts and seas, Scotland supports a wide variety of wildlife. The landscapes hold species found nowhere else in the UK, including the Wild Cat, Capercaillie and the endemic Scottish Primrose, Northern February Red Stonefly and Scottish Crossbill[1].

The marine environment is a critical component of Scotland's natural history. The area within 12 nautical miles of the coast is greater than its total land area[1]. The deep seas around Scotland host the UK's only underwater mountains, known as seamounts. Scotland is also recognised as being of international importance for its breeding seabird colonies[2] and marine mammals[1].

KEY FINDINGS

24%
decline in the average species' abundance.
Our indicator of average species' abundance in Scotland of 352 terrestrial and freshwater species has fallen by 24% since 1994. Moths show significant declines in abundance, while the indicators for birds and butterflies have remained broadly stable over time.

14%
decline in average species' distribution.
Our indicator of average species' distribution in Scotland, covering 2,970 terrestrial and freshwater species over a broad range of taxonomic groups, has fallen by 14% since 1970, and is 2% lower than in 2005.

49%
of species have decreased in abundance.
More species have shown strong or moderate decreases in abundance (49%) than increases (28%) since 1994, likewise more species have decreased in distribution (33%) than increased (20%) since 1970.

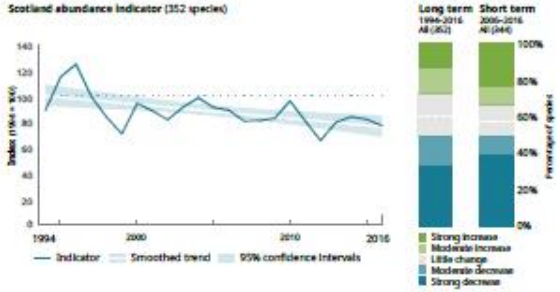
62%
of species show strong changes.
Scotland's wildlife is undergoing rapid change; the proportion of species defined as showing strong changes in abundance, either increasing or decreasing, rose from 45% over the long term to 62% over the short term.

11%
of species are threatened.
Of 6,413 species in Scotland that have been assessed using IUCN Regional Red List criteria, 11% have been classified as threatened with extinction from Great Britain.

Photo: Mark Hamblin (rspb-images.com)

SCOTLAND-SPECIFIC COMBINED ABUNDANCE INDICATOR BASED ON TRENDS OF MOTHS (175 SPECIES), BIRDS (143 SPECIES), BUTTERFLIES (25 SPECIES) AND MAMMALS (9 SPECIES)

Due to poor taxonomic representation before the mid-1990s, the abundance indicator was created from 1994 onwards. It is not appropriate to compare between countries, as data from different taxonomic groups have been used.



The abundance indicator for 352 terrestrial and freshwater species, for which Scotland-specific trends are available, shows a statistically significant decline in average abundance of 24% (95% CI -33% to -15%) between 1994 and 2016. Over this long-term period the smoothed indicator fell by 1.2% per year. Over our short-term period, the decline was a statistically non-significant 12%, a rate of 1.3% per year. There was no significant difference in the rate of change between the long and the short term.

The white line with shading shows the smoothed trend and associated 95% CI, the blue line shows the underlying unsmoothed indicator. The bar chart shows the percentage of species within the indicator that have increased, decreased (moderately or strongly) or shown little change in abundance.

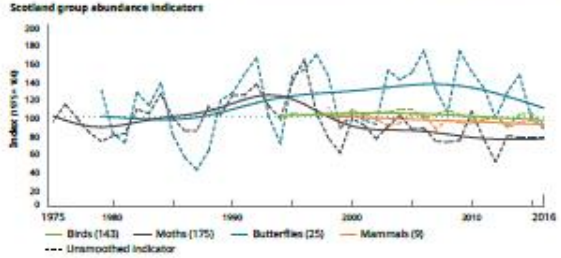
Within multispecies indicators like these there is substantial variation between individual species' trends. To examine this, we have allocated species into trend categories based on the magnitude of population change, over the long- and the short-term periods.

- Over the long term, 49% of species showed strong or moderate declines and 28% showed strong or moderate increases; 24% showed little change.
- Over the short term, 48% of species showed strong or moderate declines and 33% showed strong or moderate increases; 18% showed little change.
- Over the long term, 45% of species showed a strong change in abundance (either increase or decrease). Over the short term this rose to 62% of species.

Using a different, binary categorisation of species with positive and negative trends:

- Over the long term, 60% of species showed negative trends and 40% showed positive trends; over the short term, 56% of species showed negative trends and 44% showed positive trends.

SCOTLAND-SPECIFIC TRENDS IN ABUNDANCE FOR BIRDS, MOTHS, BUTTERFLIES AND MAMMALS



Based on smoothed trends created using Scotland-specific data:

- The abundance indicator for 175 moth species starts in 1975 and overall shows a statistically significant decline in average abundance of 25% (CI -49% to -1%). Over the short term, the indicator was 10% lower in 2016 compared to 2006.
- The abundance indicator for 143 bird species starts in 1994 and has been broadly stable with a statistically non-significant decline in average abundance of 4% (CI -9% to 0%). Over the short term, the indicator was 7% lower in 2016 compared to 2006.
- The abundance indicator for 25 butterfly species has been broadly stable since 1979, with a statistically non-significant increase in average abundance of 9% (CI -27% to +45%). Over the short term, the indicator was 19% lower in 2016 compared to 2006.
- The abundance indicator for nine mammal species starts in 1998 and overall shows a statistically significant decline in average abundance of 9% (CI -14% to -4%). Over the short term, the indicator was 5% lower in 2016 compared to 2006.

THE
A S

The *St*
partn
70 p
con
ins
na
h
a

nd
pecies
, declined
ades and
s suggest
ntinues.
n no let-up
s of nature

and ma

KEY FINDINGS

Of the 6,413 species found in Scotland that have been assessed using the IUCN Regional Red List criteria, and for which sufficient data were available, 642 (11%) are currently threatened with extinction from Great Britain (Scotland-specific assessments are not available).

The abundance indicator for 352 terrestrial and freshwater species for which Scotland-specific trends are available shows a significant decline in average abundance of 24% since 1970, and 12% over the past 10 years.

Within this indicator, the proportions of species increasing and decreasing since 1994 are similar, but over the past 10 years more species have decreased (46%) than increased (39%), with 15% showing little change. Scotland's wildlife is undergoing rapid change in abundance; the proportion of species defined as showing strong changes in abundance – either increases or decreases – rose from 45% over the long term to 62% over the past 10 years.

Our indicator of average species' distribution has fallen by 14% since 1970. This indicator includes data on 2,970 terrestrial and freshwater species over a much broader range of taxonomic groups, including invertebrates and plants. Because species tend to decline in abundance before they disappear from a site, this change could reflect more severe underlying abundance declines that we are currently unable to quantify.

Within this indicator, more species have decreased than increased. Since 1970, 33% of species have decreased and 20% have increased in distribution, with 47% showing little change. Over the past 10 years, 37% of species have decreased and 30% have increased in distribution, with 33% showing little change. Scotland's wildlife is undergoing rapid change in distribution; the proportion of species defined as showing strong changes in distribution – either increases or decreases – rose from 23% over the long term to 45% over the past 10 years.

Within the marine environment, the abundance indicators for fish species show signs of recovery from deep historic lows in the Celtic and North Seas; however, the Scottish breeding seabird indicator shows a 38% decline since 1986.

HEADLINES

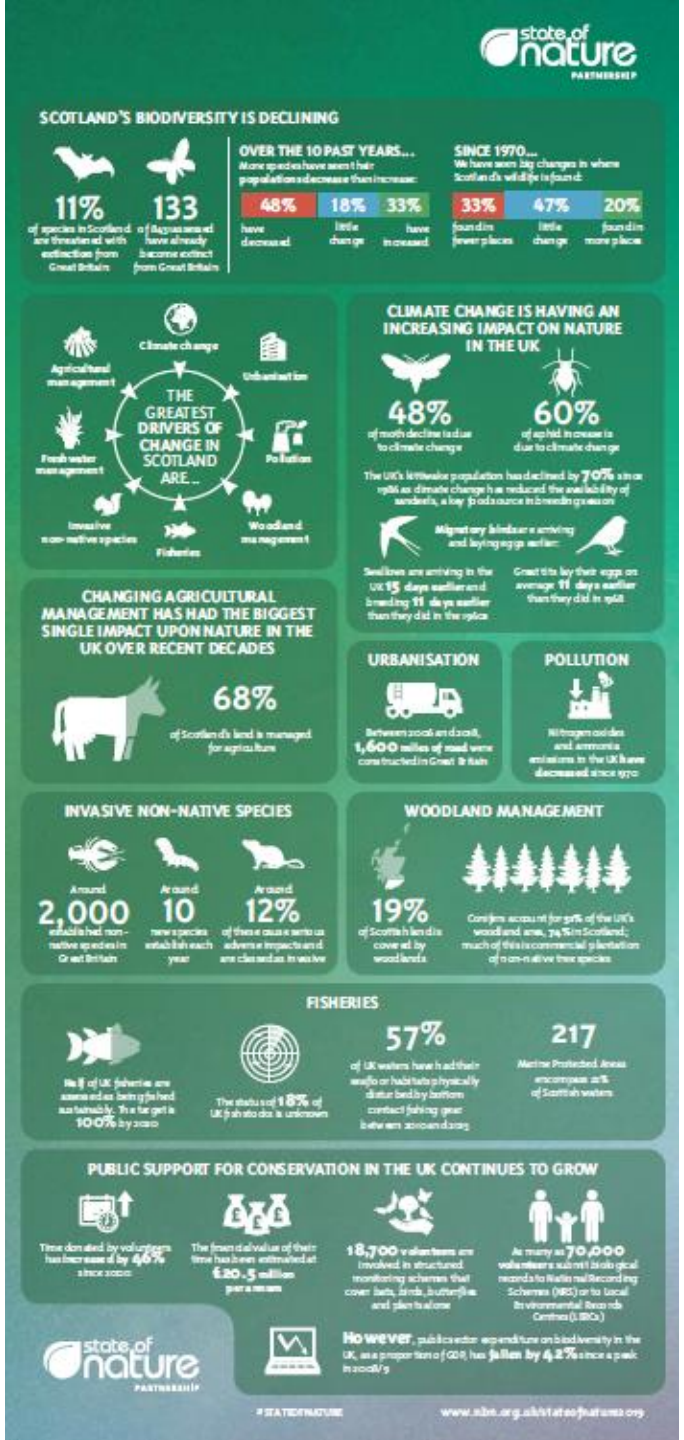
Prior to the 1970 baseline used by the *State of Nature 2019*, we know there was widespread loss and degradation of habitats across Scotland, dating back many centuries, from which the country's wildlife has not recovered.

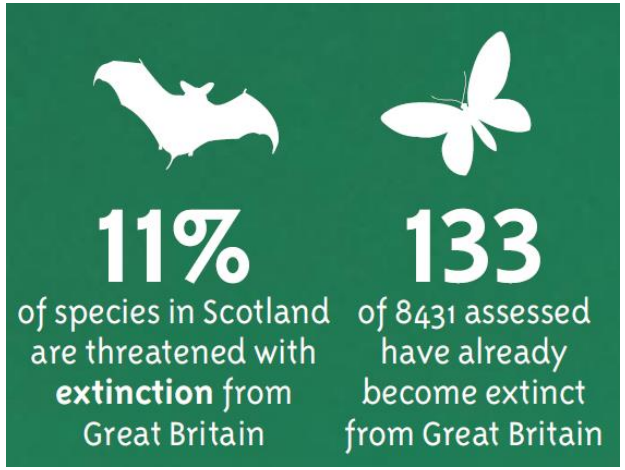
While pressure on Scotland's special landscapes has resulted in both losses and gains for biodiversity since 1970, the measures of both average abundance and average distribution in the *State of Nature Scotland 2019* report show that Scotland's wildlife has declined substantially in recent decades. The rate of change in Scotland's species appears to be increasing: our statistics indicate that over the last decade nearly two-thirds of the species for which we have data have shown strong changes in abundance, and nearly half have shown strong changes in distribution.

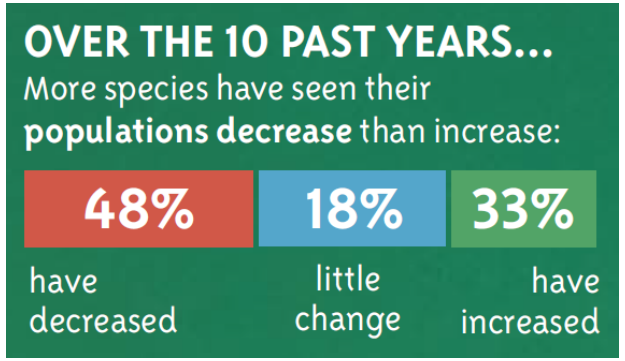
Pressures upon wildlife come from many sources, including agricultural management, urbanisation, pollution, hydrological change, woodland management and invasive non-native species. Climate change is driving widespread changes in the abundance, distribution and ecology of Scotland's wildlife, and will continue to do so for decades or even centuries to come.

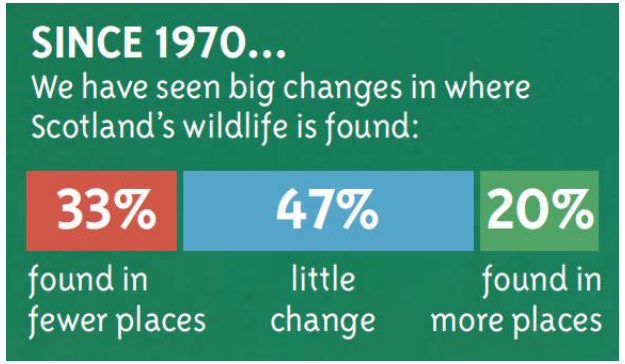
Scotland's extensive seas are also subject to a range of pressures. Progress has been made on improving water quality, contaminants and eutrophication (excess nutrients) in coastal waters and some fish stocks are showing signs of recovery. Other pressures, such as those associated with climate change and ocean acidification, are still challenging and there is evidence of change in open sea habitats and plankton communities.

The *State of Nature 2019* report showcases just a few of the exciting conservation initiatives intended to help nature flourish across Scotland, delivered through partnerships of individuals, landowners, NGOs and government.


state of nature
PARTNERSHIP
SCOTLAND'S BIODIVERSITY IS DECLINING
11%
of species in Scotland are threatened with extinction from Great Britain
133
of 8431 assessed have already become extinct from Great Britain
OVER THE 10 PAST YEARS...
More species have seen their population decrease than increase:
48%
have decreased
18%
little change
33%
have increased
SINCE 1970...
We have seen big changes in where Scotland's wildlife is found:
33%
found in fewer places
47%
little change
20%
found in more places
THE GREATEST DRIVERS OF CHANGE IN SCOTLAND ARE...
Climate change
Urbanisation
Pollution
Woodland management
Fisheries
Invasive non-native species
Freshwater management
Agricultural management
CLIMATE CHANGE IS HAVING AN INCREASING IMPACT ON NATURE IN THE UK
48%
of moth decline is due to climate change
60%
of aphid increase is due to climate change
The UK's kittiwake population has declined by 70% since 1986 as climate change has reduced the availability of sandeels, a key food source in breeding season
Migratory birds are arriving and laying eggs earlier:
Swallows are arriving in the UK 15 days earlier and breeding 11 days earlier than they did in the 1960s
Great tits lay their eggs on average 11 days earlier than they did in 1968
CHANGING AGRICULTURAL MANAGEMENT HAS HAD THE BIGGEST SINGLE IMPACT UPON NATURE IN THE UK OVER RECENT DECADES
68%
of Scotland's land is managed for agriculture
URBANISATION
Between 2006 and 2018, 1,600 miles of road were constructed in Great Britain
POLLUTION
Nitrogen oxides and ammonia emissions in the UK have decreased since 1970
INVASIVE NON-NATIVE SPECIES
Around 2,000 established non-native species in Great Britain
Around 10 new species establish each year
Around 12% of these cause serious adverse impacts and are classed as invasive
WOODLAND MANAGEMENT
19%
of Scottish land is covered by woodlands
Conifers account for 51% of the UK's woodland area, 74% in Scotland; much of this is commercial plantation of non-native tree species
FISHERIES
Just 1 of UK fisheries are assessed as being fished sustainably. The target is 100% by 2020
The status of 18% of UK fish stocks is unknown
57%
of UK waters have had their seafloor habitats physically disturbed by bottom contact fishing gear between 2010 and 2015
217
Marine Protected Areas encompass 20% of Scottish waters
PUBLIC SUPPORT FOR CONSERVATION IN THE UK CONTINUES TO GROW
Time donated by volunteers has increased by 46% since 2000
The financial value of their time has been estimated at £20.5 million per annum
18,700 volunteers are involved in structured monitoring schemes that cover bats, birds, butterflies and plants alone
As many as 70,000 volunteers submit biological records to National Recording Schemes (NRS) or to Local Environmental Records Centres (LERCs)
However, public sector expenditure on biodiversity in the UK, as a proportion of GDP, has fallen by 4.2% since a peak in 2008/9
state of nature
PARTNERSHIP
#STATEOFNATURE
www.nbn.org.uk/stateofnature2019


11%
of species in Scotland are threatened with extinction from Great Britain
133
of 8431 assessed have already become extinct from Great Britain

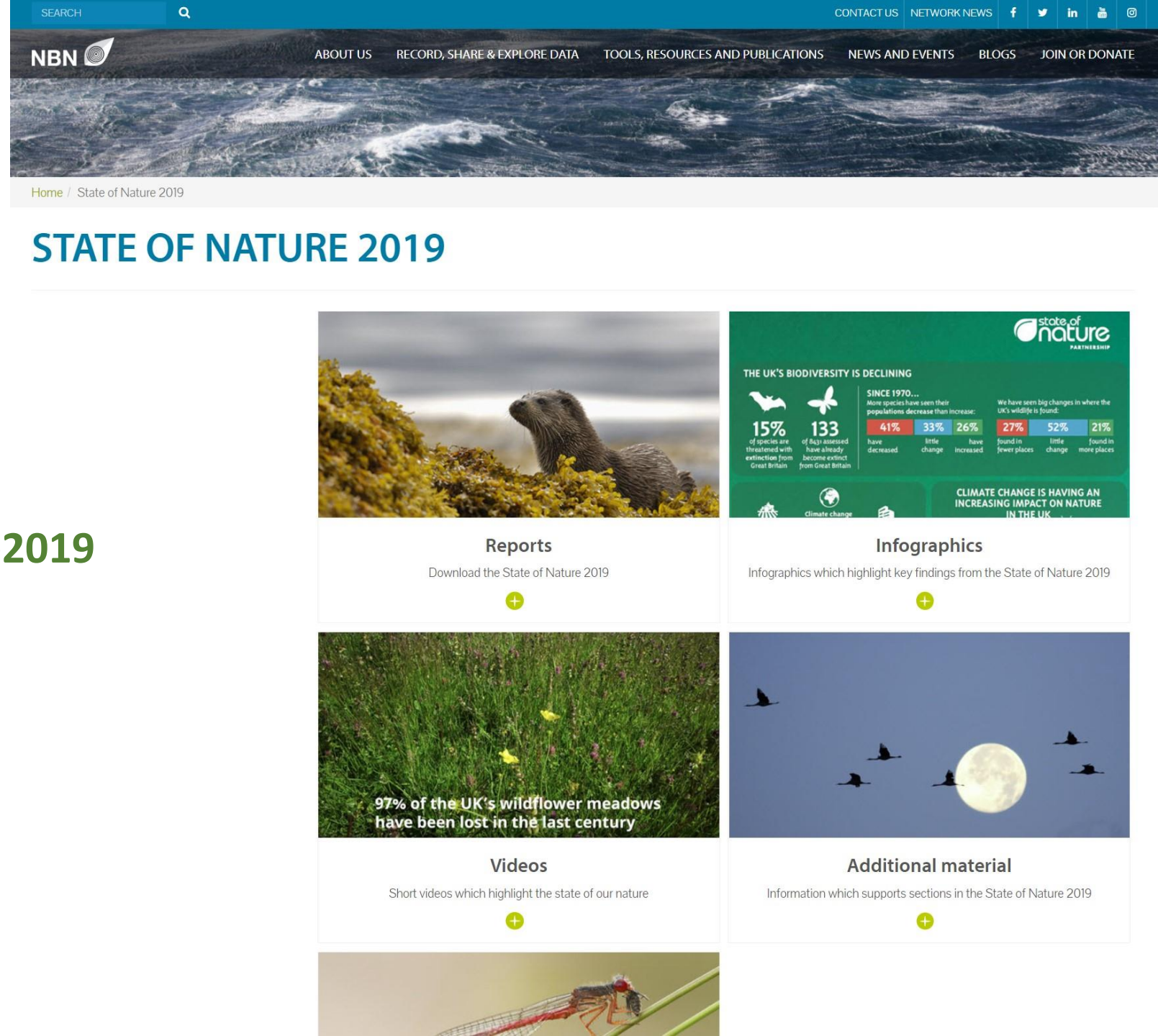

OVER THE 10 PAST YEARS...
More species have seen their populations decrease than increase:
48%
have decreased
18%
little change
33%
have increased


SINCE 1970...
We have seen big changes in where Scotland's wildlife is found:
33%
found in fewer places
47%
little change
20%
found in more places


#STATEOFNATURE
352 TERRESTRIAL AND FRESHWATER SPECIES ASSESSED IN SCOTLAND HAVE DECLINED BY 12% IN JUST 10 YEARS.
state of nature
PARTNERSHIP

All content available at

www.nbn.org.uk/stateofnature2019




Thanks to the many contributors to SoN Scotland, the 63 partner organisations, and all those who provide data…
…and you for listening