

Indicator name		Version	
NB16b: Abundance and frequency of specialist and generalist species: butterflies		July 2018	
Indicator type:	Risk/opportunity	Impact	Action
		X	
SCCAP Theme	SCCAP Objective	CCRA risk/opportunity	
Natural environment	N2: Support and healthy and diverse natural environment with the capacity to adapt	BD11: Generalist species more able to adapt than specialist species	

At a glance

- Specialist species that are adapted to specific types of habitat are likely to be more vulnerable to climate change than generalist species that thrive in varied habitats and environmental conditions.
- Butterflies are a good indicator species that can help us understand this risk.
- A combination of climate change and loss/fragmentation of habitat can lead to loss of climate space for specialist species.
- Climate change may be enabling some generalist species to expand their range northwards into Scotland; some migrant species are also becoming more abundant.

Latest Figure	Trend
Not applicable	1979–2017 Generalist species: no significant change Specialist species: no significant change

Why is this indicator important?

The 34 species of butterfly that are regularly found in Scotland include both 'generalists' that can thrive across a range of habitats and environmental conditions, and 'specialists', which are adapted to certain kinds of conditions and therefore restricted to specific types of semi-natural habitat.

It is likely that the more adaptable generalist species will cope better with a changing climate than specialists that have very specific habitat requirements.

Butterflies have rapid lifecycles and some species are highly sensitive to small changes in environmental conditions, making them good indicator species. They are easily recognisable and appreciated by the public; extensive volunteer recording and monitoring networks mean they are relatively well recorded (Fox et al, 2007). As such, they are useful indicators to represent other species and biodiversity (UKBMS, 2015).

This indicator provides a comparison of trends in abundance of specialised and generalist species of butterfly allowing these to be monitored over time. It describes trends for 24 of the 34 butterfly species that regularly occur in Scotland, at 475 sample locations.

Related Indicators:

NB16a Abundance and frequency of specialist and generalist species: snow-bed species

What is happening now?

The long-term smoothed trends for all species, generalist species and specialist species, over the period for which butterfly populations in Scotland have been recorded (1979 to 2017) are all stable.

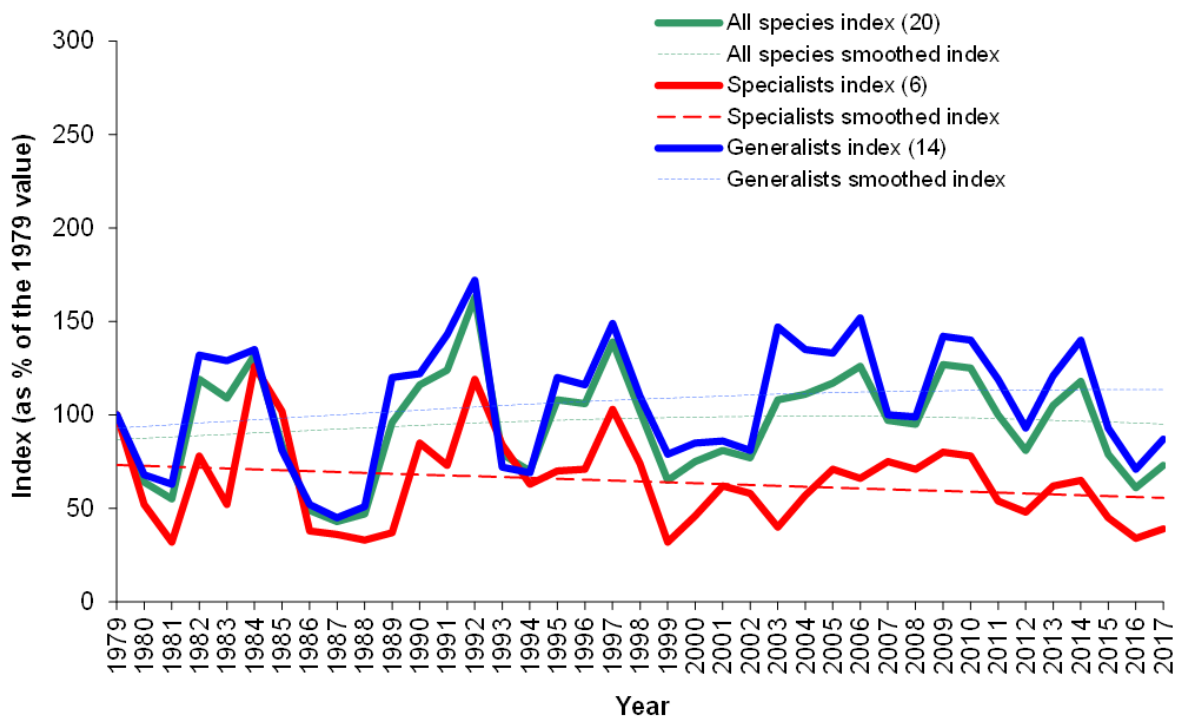


Figure 1: Scottish butterfly population trends (1979-2017)¹

Source: UKBMS for Scotland (SNH, 2018)

What has happened in the past?

See above

What is projected to happen in the future?

See 'Patterns of Change' section below

¹ A new method for calculating species indices was introduced in 2017. The indices therefore differ from those presented in the 2016 version of this indicator (see Methodology).

Patterns of change

Climate change effects on butterfly populations in the UK include the northwards expansion of species previously at their northern range limit. Also, some species previously found on south-facing slopes have started colonising north facing slopes. Some migrant species have started overwintering in the UK. However for those species at the southern limit of their range, or at the low end of their elevation range, there is a likelihood of loss of climate space in Scotland as they move northwards/to higher elevations (UKBMS, 2015).

Individual generalist species in Scotland that show significant long-term, climate-driven, increases in abundance are ringlet and orange-tip (SNH, 2018). Climate change (warming) has enabled some generalist species to increase their range and population size, with some generalist species distributed in southerly areas expanding their range to the north (Fox et al, 2007). Some migrant species, including the Red Admiral, are also increasing in abundance as a response to recent warming. Generalist species are doing better in Scotland than in England, which may reflect different effects of climate change impacts between the two countries (SNH, 2018).

Northerly distributed specialist species are expected to be negatively impacted by climate change, with predicted long term range contractions at the southern edges and lower elevations (Settele et al, 2008, cited in SNH, 2018). While there has been no overall change in Scotland's specialist butterflies since 1979, the grayling was shown a significant long-term decline, while the small pearl-bordered fritillary has increased significantly (SNH, 2018).

Interpretation of indicator trends

It is typical to see marked fluctuations in butterfly populations from year to year, largely caused by natural environmental factors, especially weather conditions. Short term comparisons are therefore not appropriate. Trends in butterfly species abundance are based on analysis of the underlying smoothed trend over a number of years (Asher et al, 2001).

Declines in butterfly populations have been linked to multiple factors: habitat loss; climate change; urban development, and increased nitrogen deposition (SNH, 2018).

Limitations

The indicator describes trends in abundance for 20 of the 34 regularly occurring butterfly species in Scotland; insufficient data is available for the remaining 14 species.

In the early years of the survey smaller numbers were surveyed therefore the data is less reliable than in recent years (UKBMS, 2015).

References

Asher, J., Warren, M., Fox, R. *et al.* 2001. *The Millennium Atlas of Butterflies in Britain and Ireland*. Oxford University Press, Oxford.

Fox, R., Warren, M.S., Asher, J., Brereton, T.M. & Roy, D.B. 2007. *The state of Britain's butterflies 2007*. Butterfly Conservation and the Centre for Ecology and Hydrology, Wareham, Dorset.

Franco, A.M.A., Hill, J.K., Kitschke, C. *et al.* 2006. Impacts of climate warming and habitat loss on extinctions at species' low-latitude range boundaries. *Global Change Biology*, 12, 1545-1553.

SNH (2018) *Scottish Biodiversity Indicator S008 'Terrestrial Insect Abundance – Butterflies'*.
<https://www.nature.scot/scotlands-indicators-terrestrial-insects>

United Kingdom Butterfly Monitoring Scheme (UKBMS) (2015) *Butterflies as indicators*.
<http://www.ukbms.org/indicators.aspx> (accessed January 2015)

Further information

Scottish Biodiversity Indicator: Terrestrial Insect Abundance - Butterflies
<https://www.nature.scot/scotlands-indicators-terrestrial-insects> [\(TBA\)](#)

UK Butterfly Monitoring Scheme: www.ukbms.org/

Acknowledgements

The information in this document comes from Scottish Natural Heritage (SNH) Scottish Biodiversity Indicator S008 'Terrestrial Insect Abundance - Butterflies' (SNH, 2018).

Appendix One: Indicator metadata and methodology

Table 1: Indicator metadata

	Metadata
Title of the indicator	Abundance and frequency of specialist and generalist species: butterflies
Indicator contact: Organisation or individual/s responsible for the indicator	Ruth Monfries (Royal Botanic Garden Edinburgh/ClimateXChange)
Indicator data source	UK Butterfly Monitoring Scheme (UKBMS)
Data link: URL for retrieving the indicator primary indicator data.	www.ukbms.org/ www.snh.gov.uk/docs/B424909.pdf

Table 2: Indicator data

	Indicator data
Temporal coverage: Start and end dates, identifying any significant data gaps.	1979 - 2017
Frequency of updates: Planned or potential updates	Annual
Spatial coverage: Maximum area for which data is available	Scotland (475 sites in 2017)
Uncertainties: Uncertainty issues arising from e.g. data collection, aggregation of data, data gaps	There is insufficient data to produce trends for 14 species out of the 34 species that regularly occur in Scotland.
Spatial resolution: Scale/unit for which data is collected	Site level resolution
Categorical resolution: Potential for disaggregation of data into categories	Per species
Data accessibility: Restrictions on usage, relevant terms & conditions	A summary of key findings is publically available on the UKBMS site. Unlicensed and free of charge.

Table 3 Contributing data sources

Contributing data sources

Data sets used to create the indicator data, the organisation responsible for them and any URLs which provide access to the data.

The multi-species index is compiled by Butterfly Conservation and the Centre for Ecology and Hydrology, using data primarily from the UK Butterfly Monitoring Scheme (UKBMS).

Table 4 Indicator methodology

Indicator methodology

The methodology used to create the indicator data

Transects (fixed-route walks) are established at each of the sites in Scotland and butterflies along this route are recorded on a weekly basis through April – September each year, provided weather conditions are suitable. Data from these weekly counts is used to produce an annual index by species and site (Rothery & Roy, 2001).

An improved Generalised Abundance Index (GAI) method was introduced in 2017 to calculate species indices. The GAI uses butterfly counts collected at 269 UKBMS sites plus 206 randomly selected 1km squares of the Wider Countryside Butterfly Survey. The GAI utilises more data than the previous method, and thus produces more representative trends for Scottish Butterflies. Results may therefore differ from previous assessments (as used in the 2016 version of this indicator).

Further information on methodology can be found in:

[Dennis, E.B., Morgan, B.J., Freeman, S.N., Brereton, T.M. and Roy, D.B. \(2016\). A generalized abundance index for seasonal invertebrates. *Biometrics*, **72**\(4\), pp.1305-1314.](#)

Scottish Biodiversity Indicator: Terrestrial Insect Abundance - Butterflies

<https://www.nature.scot/scotlands-indicators-terrestrial-insects>

http://www.ukbms.org/development_of_schemes.aspx