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C6b Insects of the Countryside [Butterflies] – Habitat Generalists

This Evidence Statement should be read in conjunction with the *Summary of Evidence* document (Annex 3). Assertions in bold text have been assigned a confidence rating following assessment by a panel of independent experts (see main report for details).

A. Background, structure and statistical issues/biases

- This indicator describes trends in the UK abundance from 1976-2014 of 24 butterflies identified as wider countryside species (also known as habitat generalists). The data used reflect changes of the entire populations of species, not just of the proportion using particular habitats.
- Indices for all 24 species are derived from the UK Butterfly Monitoring Scheme (UKBMS) and the Wider Countryside Butterfly Survey (WCBS). Both schemes use standardised methods with replication (UKBMS is weekly transects between April and October, plus timed counts for some species; WCBS is 2 transect surveys between July and September). The counts are converted into an annual index of abundance for each species using the latest statistical techniques[i].
- The indicator value for each year is derived from a statistical model of the individual species indices. The indicator is presented in both smoothed and unsmoothed forms, but the assessment is based on the smoothed version. Uncertainty in the smoothed butterfly indicators is calculated in a way that is different from the other species indicators.

B. Representation

1. The data are drawn from all four countries of the United Kingdom, but Scotland and Northern Ireland are relatively under-represented. UKBMS sites are dominated by semi-natural habitats in lowland England, but WCBS sites are randomly located across the UK[ii]. Since 2010 the two schemes have contributed approximately equal numbers of sites, so the indicator has become gradually less biased in spatial coverage[iii]. **The indicator includes a broad range of habitats, but it is not wholly representative of the wider country** [High] because there is no statistical correction for the location of study sites.
2. **The indicator is the average trend in relative abundance of generalist butterfly species, primarily within lowland semi-natural and edge habitats (hedgerows etc.) in England and Wales** [High]. The majority (24/26) of generalist butterflies are included in the indicator.
3. **It is often stated that butterfly indicators can be used to represent trends in other insect taxa, but there is little hard evidence to support this assertion**[iv] [High].

C. The Trend

4. The unsmoothed indicator declined by 41% decline over the period 1976-2014. The smoothed indicator declined from 69 to 52 (i.e. a 25% decline) over the same period[v]. The discrepancy between the smoothed and unsmoothed lines reflects the fact that the unsmoothed index fell sharply (by 57%) from 1976-7[vi]. The unsmoothed indicator continued to fluctuate markedly during the 1970s and 1980s[vii], creating uncertainty about whether the long-term trend is negative or stable[viii]. The smoothed line has declined steadily since the mid 1990s[v], but the assessment of the overall long-term trend is "no change". Overall, **the evidence for a long-term decline in generalist butterflies is contradictory** [Medium], in part due to the practice of treating the first year as a baseline known without error**.**
5. The overall indicator masks substantial variation in the trajectory of species that contribute to it[ix]. Individual species have experienced substantial changes in abundance. Seven species declined by at least 45% and four species increased by 90% or more[x]. Thus, **there is strong evidence for declines among individual species** [Medium].
6. **There has been no trend in the generalist butterfly indicator since 2010** [High]. The indicator has declined slightly in the past five years, but not significantly, and the majority of species (21/24) showed no significant change[v].
7. The Scottish indicator of generalist butterflies increased by 23% from 1979-2014[v]. The England-only trend closely matches the overall UK trend[v], because most sites are in England (and there is no correction for the sample locations). The England and Scotland trends are broadly similar

during the 1990s, but the Scotland indicator increased during the 2000s compared with England[xi]. However, **the evidence that Scottish populations are increasing compared with England is inconclusive** [High]: there are 14 species in the Scottish indicator[xii], compared with 26 for England. A formal test for variation across the UK would compare only the species common to both countries.

D. Wider Application

8. The status of butterflies has been linked with the delivery of pollination services in ecosystems, but butterflies contribute very little to crop pollination[xiii]; whilst they are significant visitors to wild flowers[xiv], the significance for pollination is unclear because, unlike bees, their bodies are not adapted for transporting pollen grains. Since we now have a specific indicator of pollinating insects (D1c), **generalist butterflies should not be used as an indicator of pollination** [High].
9. Butterflies are charismatic insects that provide an important way for people to connect with nature (i.e. cultural ecosystem services). However, this indicator also includes two species regarded as garden pests (the large and small white, known collectively as "cabbage white"). The link between species status and cultural services is not well-established, so it remains unclear how changes in the indicator could be used as a measure of cultural ecosystem services.
10. **The indicator does not directly measure progress towards, or achievement of, any Aichi targets** [Medium]. The status of butterflies has been linked with target 5 (reducing the rate of habitat loss), target 11 (protected areas) and target 12 (the extinction of threatened species)[xv]. However, in all three cases other indicators are more directly relevant.

E. Drivers of change

11. The intensification of agricultural management - in particular, the loss of semi-natural grassland, conversion of pasture to arable farmland and the removal of hedgerows - has had a strong negative impact on the generalist butterfly indicator, although the evidence for this is comparatively weak. The negative impact of these drivers can be linked to changes driven by the Common Agricultural Policy. **Agricultural intensification contributed to the decline in the indicator**[xvi] [Medium].
12. **There is very good evidence that climatic change has had a substantial positive impact upon the generalist butterfly index**[xvii] [Medium]. Although some species have been effected negatively, more, such as the Ringlet and Comma, have benefitted and expanded their ranges northwards.
13. **An increase in nitrogenous air pollution contributed to the decline in the indicator** [Low], either through enrichment of grassland habitats or interactions with climate change resulting in local climate effects[xviii].
14. There is weak evidence that **the abandonment of traditional methods of agricultural management has had a moderate negative impact on the indicator** [Medium], in particular the cessation of grazing regimes that maintained grassland habitats, may have contributed towards caused declines in species such as the Wall[xix].

Endnotes refer to the "Technical Report – Summary of Evidence" document, unless otherwise stated

[ii] Dennis *et al* 2013. *Methods Ecol Evol* 4**,** 637–645

[ii] Section 2.2, notably table 2.3.

[iii] Section 2.2.7

[iv] Thomas 2005. *Philos Trans R Soc Lond B Biol Sci* 360**,** 339–57

[v] http://jncc.defra.gov.uk/page-4236

[vi] http://jncc.defra.gov.uk/docs/UKBI2015_DS_C6_Final.xlsx

[vii] http://jncc.defra.gov.uk/docs/UKBI2015_DS_TechBG_C6_Final.doc

[viii] Sections 2.3.4 – 2.3.6, notably figure 2.6.

[ix] Section 2.1.5, table 2.1.

[x] http://jncc.defra.gov.uk/docs/UKBI2015_DS_C6_Final.xlsx

[xi] Fox *et al* (2015): http://butterfly-conservation.org/files/soukb-2015.pdf

[xii] http://www.snh.gov.uk/docs/B424909.pdf
[xiii] Rader *et al* 2015. *Proc Natl Acad Sci* 113**,** 201517092
[xiv] Pocock *et al* 2012. *Science* 335**,** 973–7
[xv] http://jncc.defra.gov.uk/page-6121
[xvi] Section 3.2.9, especially table 3.23 and subsection 3.2.9.2
[xvii] Section 3.2.9, especially table 3.23 and subsection 3.2.9.1
[xviii] Section 3.2.9, especially table 3.23 and subsection 3.2.9.3
[xix] Section 3.2.9, especially table 3.23 and subsection 3.2.9.4