C6a Insects of the Countryside [Butterflies] – Habitat Specialists

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 26 butterfly species identified as habitat specialists. The data used reflect changes of the entire populations of species, not just of the proportion using particular habitats.
- Indices for all species are derived from the UK Butterfly Monitoring Scheme (UKBMS). The UKBMS employs standardised methods based on regular transect walks (typically weekly), augmented by timed count and larval web searches for selected species. The counts are converted into an annual index of abundance for each species using established statistical techniques.
- The indicator value for each year is calculated from a statistical model of the 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, probably generating narrower confidence intervals.
- The UKBMS draws data from all four countries of the United Kingdom, but the coverage reflects the distribution of volunteers who contribute data. There are fewer sites in Scotland and Northern Ireland, the uplands of England and Wales are less well represented and lowland semi-natural habitats are over-represented[i]. The indicator does not make a statistical correction for the location of study sites although the sites largely reflect the distribution of the specialist butterfly species within the indicator.

B. Representation

1. Given the design of the indicator and the known spatial biases, **the indicator is broadly representative of the average trend in abundance of specialist butterflies on semi-natural habitats in lowland England and Wales** [High]. The majority (26/30) of habitat specialist butterflies are included in the indicator.
2. **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[ii]** [High].

C. The trend

3. The unsmoothed indicator had a value of 39 in 2014, representing a 61% decline since 1976[iii]. The smoothed indicator declined from 65 to 36 (i.e. a 44% decline) over the same period[iv]. The vast majority of this decline occurred in the first year (1976-1977): the unsmoothed indicator had a value of 45 in 1977 and declined by just 5 percentage points from 1977-2014[iv] (a 12% decline). The 1976 data have a strong impact on the statistical interpretation of the long-term trend[v], but few sites (~30[vi]) and species (11[iv]) contributed data at this time. Thus, the evidence for the 1976-77 decline is based on a small sample size. This problem is exacerbated by the convention (common to all UK indicators) of treating the first year as a baseline known without error: the initial decline is much less pronounced when the series is centred on its long-term mean value[vii]. However, supporting data on occurrence trends shows a stable trend from 1970-1976 and a decline from 1976-1977 that echoes the abundance trend[viii], and a version of the indicator using 1995 as the baseline also showed a substantial decline[ix]. **The magnitude of decline in specialist butterflies, the confidence in that decline, are questionable** [High], and have been overstated by the design of the indicator.
4. The overall indicator masks substantial variation in the trends of species that contribute to it[x]. Half of the 26 species in the indicator declined in the long-term and 23% (6) increased. Many species experienced substantial reductions in abundance during the 1990s[xi], and nine of the 13

declining species have lost more than 50% of their initial abundance[iv]. Thus, **there is strong evidence for declines among individual species** [High]. Substantial losses among many species have been offset by large gains in a small number of increasing species (Adonis Blue, Silver-Spotted Skipper).

5. **There has been no trend in the specialist butterfly indicator since 2010** [High]. In the past five years the indicator shows no overall trend and the majority of species (23/26) showed no significant change[v].
6. The Scottish indicator of specialist butterflies declined by 42% from 1979-2014[iv]. The England-only trend closely matches the overall UK trend[iv], 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[iv]. However, **the evidence for systematic variation across the UK is limited** [Medium]: species in the Scottish indicator are a subset of those in the England indicator (There is sufficient data in Scotland for six out of 12 habitat specialist species[xii], compared with 26 for England). A formal test for variation across the UK would compare only the species common to both indicators.

D. Wider Application

7. The status of butterflies has been linked with the delivery of pollination services in ecosystems, although 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), **specialist butterflies should not be used as a primary indicator of pollination** [High].
8. Butterflies are charismatic insects that provide an important way for people to connect with nature[xv]. Habitat specialists, by virtue of their rarity, provide a good proxy for people's aesthetic enjoyment of nature (i.e. cultural ecosystem services). However, 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.
9. **The indicator does not directly measure progress towards, or achievement of, any Aichi targets** [Medium]. The Specialist butterfly indicator is used as a primary indicator of targets 7 (sustainable land management) and 12 (the extinction of threatened species)[xvi], but the relevance to both is tangential. The locations of the study sites (many are nature reserves) and specialised ecology of the species mean this indicator is largely irrelevant to the sustainable agriculture target. Moreover, although some of these species are considered at risk of extinction, these also contribute to indicator C4a, which is a more direct measure of progress towards Aichi target 12.

E. Drivers of change

10. The most significant drivers of change of the specialist butterfly index relate to the intensification of agricultural management with, in particular, intensive grazing and production-driven farm management having a strong negative impact. There is very good evidence on the impact of these drivers, which can be linked to changes in management driven by the Common Agricultural Policy. **Agricultural intensification is the most important factor in the decline in the indicator**[xvii] [High].
11. There is very good evidence that **the abandonment of traditional methods of agricultural management has had a very strong negative impact on the indicator**[xviii] [Medium], in particular the cessation of grazing regimes that maintained grassland habitats, has caused declines in species such as High Brown Fritillary.
12. **A decline in traditional woodland management methods was responsible for some of the decline in the indicator** [Medium]**,** with a strong negative impact[xix], with species such as the Duke of Burgundy suffering from the loss of coppiced woodland.

13. **Climatic change has had negligible net impact on the indicator**[xx] [Low]; species with northern distributions have contracted, whilst those with southern distributions have expanded.

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

[i] Section 2.2, notably table 2.3.
[ii] Thomas 2005. *Philos Trans R Soc Lond B Biol Sci* 360**,** 339–57
[iii] http://jncc.defra.gov.uk/page-4236
[iv] http://jncc.defra.gov.uk/docs/UKBI2015_DS_C6_Final.xlsx
[v] Sections 2.3.4 – 2.3.6, notably figure 2.6.
[vi] Section 2.2.7
[vii] Brereton *et al* (2014)
http://www.ukbms.org/docs/reports/2014/BFLY%20Ann%20Report%202014%20Nov%2016_LR.pdf
[viii] Fox *et al* (2015): http://butterfly-conservation.org/files/soukb-2015.pdf
[ix] Fox et al (2011): https://butterfly-conservation.org/files/soukb2011.pdf
[x] Section 2.1.5, table 2.1.
[xi] Fox *et al* (2006) The State of Butterflies in Britain and Ireland
[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] Section 3.4.2.1
[xvi] http://jncc.defra.gov.uk/page-6121
[xvii] Section 3.2.8, especially table 3.21 and subsection 3.2.8.1
[xviii] Section 3.2.8, especially table 3.21 and subsection 3.2.8.2
[xix] Section 3.2.8, especially table 3.21 and subsection 3.2.8.3
[xx] Section 3.2.8, especially table 3.21 and subsection 3.2.8.4