Butterflies in the United Kingdom: habitat specialists and species of the wider countryside

Technical annex – Assessing change in the UK Butterfly Indicators

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For further information on the Insects of the wider countryside (butterflies) indicator (C6) visit
https://jncc.gov.uk/our-work/ukbi-c6-insects-of-the-wider-countryside/

For further information on the UK Biodiversity Indicators visit
https://jncc.gov.uk/our-work/uk-biodiversity-indicators/

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Data capture

The primary method for capturing UK Butterfly Monitoring Scheme (UKBMS) data, including the Wider Countryside Butterfly Survey (WCBS), is through the online capture system available at www.ukbms.org/mydata. This includes site details (for example, location, habitat and management information), species counts through transect walks and other survey methods (for example, timed counts and egg/larval counts).

A proportion of data are also captured via the Transect Walker software package or via spreadsheets.

Data are processed on an annual basis. The majority of data are from surveys conducted in the previous summer, but data from previous years are also often collated. All data are processed in the same way.

Standardisation and harmonisation of the UKBMS data set

All UKBMS data are collated into a single data set to enable analysis and reporting. As of 2020, the data set comprises over 8.5 million butterfly counts. Data are standardised to conform with the UKBMS database structure, including standardised species nomenclature, data integrity checks to ensure that all mandatory information is captured, valid date and time information and accurate geographic location information.

Data verification

The UKBMS online data capture system is built using the Indicia software tools and links to the iRecord verification system (www.brc.ac.uk/irecord) to enable review of the data by experts approved by Butterfly Conservation or other National Recording Schemes (for records for non-lepidoptera). To support verification, iRecord applies automated data checks against known species distributions (for example, derived from the Butterflies for the New Millennium recording scheme) and timing of adult flight periods. Experts can use these checks and other information to confirm observations.

The UKBMS online data capture system (www.ukbms.org/mydata) also provides data summaries to enable UKBMS Branch Co-ordinators to review all transect data for their area and make corrections.

Further review and correction is undertaken by staff at Butterfly Conservation and the UK Centre for Ecology and Hydrology at the end of each field season, including the following checks that are discussed with Branch Co-ordinators and/or transect recorder:

- Counts outside of known distribution,
- Counts outside of the standard flight period for a species,
- Species newly recorded on a transect site,
- Species recorded on a transect site after being absent for more than 5 years, and
- Potential data input errors or misidentifications – all counts of specialist butterfly species are closely scrutinised and summary tables for generalist

species are reviewed for anomalies.

Transect visits which are undertaken outside the criteria for butterfly activity (for example, based on weather conditions and time of day) are flagged and excluded from the main data analyses; data is retained within the database for use in other analysis.

Data analysis

a. Classification of separate generations for bivoltine species

For bivoltine species, separate generations are identified by defining the time of year where there is a gap between generations. Classification of generations is supported by visual inspection of the seasonal pattern of counts through the season at each transect site.

b. Calculation of phenology metrics

Algorithms are applied to butterfly counts throughout the season for each species at each site to estimate phenology metrics for each year (and separately for each generation of bivoltine species). The following metrics are calculated for each site, year and species (generation):

- Number of generations,
- Date of gap between generations,
- Date of first positive count (for each generation),
- Date of last positive count (for each generation),
- Date of highest positive count (for each generation),
- Count at date of highest positive count (for each generation),
- Mean date of flight period (for each generation), as defined as the weighted date of counts (Brakefield, 1987), and
- Length of flight period (for each generation), as defined as the standard deviation of counts (Brakefield, 1987).

Long-term and decadal phenology trends are calculated for each species (and generation) at each site, where sufficient data are available, using linear regression models on the timing and duration phenology metrics.

c. Calculation of abundance indices for each species, site and year

Algorithms are applied to butterfly counts throughout the season for each species at each site to estimate a total abundance for the year (and separately for each generation of bivoltine species). This can be interpreted as the area under the flight period distribution curve. The following metrics are calculated for each site, year and species (generation):

- Number of observations, including zero counts,
- Number of positive counts,
- Sum of observed counts, and

The following metrics based on the methods described in Rothery and Roy (2001):

- Index of abundance calculated by Trapazoidal rule fitted to counts,
- The smoothing parameter used for the Generalized Additive Model (GAM) fitted to counts,
- Sum of fitted counts from GAM,
- Sum of Imputed counts (observed or GAM fitted counts),
- Sum of Imputed counts (observed or Trapazoidal estimate),
- Highest seasonal count is a GAM estimate (yes/no),
- Index of abundance estimated via a GAM (GAM Index), and
- Proportion of GAM index contributed by estimated counts versus observed counts.

Long-term and decadal abundance trends are calculated for each species at each site, where sufficient data are available, using linear regression models on the site indices.

d. Estimation of zero index for species, site, year

Zero indices are not produced by the GAM models as it only deals with counts data. Where a species is not recorded at a site in a given year there is no count (no data). This may mean that the species was not seen but could simply be because the site was not walked enough during the flight period of that species. A series of automated and manual checks were run to determine where site indices of zero are considered likely.

e. Calculation of collated indices (regional index of abundance for each year) and trends

Although alternative methods are used for specific applications, the main methods used to calculate collated indices and trends in status for individual species are as follows:

The calculation of species trends from UKBMS data is not a straightforward calculation because not all transect sites in the UKBMS data set have been recorded each year and the number of weeks with transect counts varies markedly between sites and year. A statistical model is therefore needed to produce a regional or national index of how butterfly populations have changed each year. Since 2017, a Generalized Abundance Index (GAI) method that is designed for seasonal invertebrates has been applied to the UKBMS data to calculate annual indices of abundance and assess trends. This method combines all UKBMS data including timed counts and data from the WCBS. Briefly, the method (Dennis *et al.*, 2016) adopts a two-stage approach. Firstly, all butterfly counts in a season from both traditional UKBMS transects and WCBS are used to estimate the seasonal pattern of butterfly counts for that year, either via a GAM model or other statistical model of the flight period pattern. This stage relies heavily on the traditional UKBMS transect data with good coverage throughout the season. A second stage of the model is then applied to the full set of annual counts, accounting for where the counts occur within the flight season, to then calculate annual population indices using a statistical model to account for sites and years in a comparable way described above. In common with most butterfly and bird monitoring schemes in Europe (ter Braak *et al.*, 1994), the statistical model uses log-linear Poisson regression. The national collated index is the mean (on a log scale) of the imputed and recorded site indices for each year. Long-term and decadal trends are calculated for each species at UK and country

level where sufficient data are available, using linear regression models on the collated indices.

f. Calculation of multi-species (composite) indices and trends

The UK Biodiversity Indicators use multi-species (composite) indices of abundance for different groups of butterflies, for example, wider countryside and habitat specialist species, and butterflies in different habitats, for example, farmland and woodland. Composite indices are calculated following methods developed for UK birds, derived by calculating the geometric mean index across each species assemblage.

Long time series of species abundance data such as those collected through the UKBMS and used to compile UK Butterfly Indicators cannot always be summarised adequately by linear trend lines. These long time series may show alternating periods of increase and decrease, and it can be difficult to separate patterns of genuine change from annual fluctuations. Consequently, methods that model smoothed trend lines through abundance data are becoming increasingly popular. An extension of the linear trend approach is the application of a smoothing technique that describes the pattern by assigning a trend level (= modelled abundance) to *each year* in the time series (similar to a moving average). There are several smoothing methods available such as polynomial regression, splines and Loess estimators. These models may be summarised as 'flexible trend models'. The most popular flexible trend models for the analysis of wildlife populations are GAMs and these, for example, are used to produce the UK Bird Indicators. GAMs do not however present the complete time series and do not account for serial correlation which limits their applicability to butterfly data.

Another flexible trend method from the class of structural time series analysis has been developed (Visser, 2005) and applied to European birds (Gregory *et al.*, 2007) and European butterflies (Brereton *et al.*, 2011) using TrendSpotter software (Visser, 2004). This is the approach used to describe and assess changes in the UK Butterfly Indicator updates published and updated annually from 2008 onwards. Unlike the GAM approach, the confidence interval of the trend line is not calculated by a bootstrapping method but by application of a time series analysis and the Kalman filter (Visser, 2004). This approach uses one observation per time point (for example, year or month) and therefore the uncertainty in the estimate of yearly index values (for example, confidence intervals around each year index) is modelled indirectly in the annual fluctuations. The main advantage of the TrendSpotter analysis however is the calculation of confidence intervals for the *differences* between the trend level of the last year and each of the preceding years, taking into account serial correlation which is unique for flexible trend methods. This allows short-term trends to be usefully assessed.

A statistical test is performed in TrendSpotter to compare the difference in the index in the latest year versus other years in the series. Yearly change rates and confidence intervals produced in the TrendSpotter output are used to classify the trends per year (see Appendix). The trend classification applied to the composite index (see Soldaat *et al*., 2007) is given in Table 1. This classification is not the same as that used for the individual species trends presented in the data set (increased, decreased and no change).

Table 1: Classification of composite trends on the basis of the 95% confidence intervals of the yearly change rate in TrendSpotter smoothed indices. CL = confidence limit; CI = confidence interval (see Soldaat *et al*., 2007 for explanation).

Trend class	Criteria	Description
Strong Increase	Lower CL > 1.05	*> 5% increase / year (≈ doubling in 15 years)*
Moderate Increase	1.00 < lower CL ≤ 1.05	*Increase, but unsure whether > 5% / year*
Stable	CI contains 1.00 AND lower CL ≥ 0.95 AND upper CL ≤ 1.05	*Population changes less than 5% / year*
Moderate Decrease	0.95 ≤ upper CL < 1.00	*Decrease, but unsure whether > 5% / year*
Steep Decrease	Upper CL < 0.95	*> 5% decrease / year (≈ halving in 15 years)*
Uncertain	CI contains 1.00 AND (lower CL < 0.95 OR upper CL > 1.05)	*CI too large for reliable classification*

In summary, structural time series models are essentially regression models in which the explanatory variables are functions of time and the parameters are time-varying. The Kalman filter is an efficient recursive filter that estimates the state of a dynamic system from a series of incomplete and noisy measurements. For mathematical details about structural time-series analysis and the Kalman filter please refer to Harvey (1989).

TrendSpotter is currently considered the best-available technique in the assessment of Butterfly Indicators. Regular reviews of methods to assess changes in butterfly indicators are needed; however, techniques to model trends are an active area of statistical development.

g. Methodological changes to the butterfly composite indicators in 2020

Improvements were made to the analytical techniques in 2020 to better account for the colonisation of new sites (UKBMS transects and WCBS squares). The change was to add pre-colonisation zero abundance counts for species at sites they colonised, where the site was monitoring prior to colonisation. These improvements had the greatest effect where sites had been monitored for a number of years prior to the arrival of species and/or where species were notably expanding their range. In general, the effect of these changes was most notable for expanding species whereby there was a slight reduction in their population indices for the earlier years, relative to the latter years. An example of a species where the effect of these improvements was noticeable is Silver-washed Fritillary which has spread considerably during recent decades.

This analysis improvement coincided with relatively favourable recent years for butterflies. The combination of the relative reductions in the indices of earlier years for colonising species with the relatively high indices in recent years has resulted in the indicator assessments presented from 2020 onwards differing from those presented prior to 2020 to a greater extent than would have otherwise been

expected. The difference is most noticeable for the Farmland indicator. This indicator is over a relatively short time period (since 1990) and includes relatively few species and is therefore sensitive to changes in estimated population indices for component species.

Prior to the methodological changes in 2020, the Farmland indicator assessment for the UK was categorised as “moderate decline” showing steady long-term declines. Since 2020, the indicator has been categorised as “stable”. The current farmland indicator still shows a steady decline but now this is limited to the first half of the series, with the latter half showing stabilisation. Although the changes in indicator have been emphasised by the methodological improvements, they are not dramatic alterations as the indicator was already showing signs of stabilisation and the addition of another relatively good year in 2020 would have increased this further.

These indicators are updated and published annually and can be viewed at: https://www.gov.uk/government/statistics/butterflies-in-the-wider-countryside-uk

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Appendix. Trend results for UK habitat specialist butterflies and butterflies of the wider countryside indicators, 1976 to 2020.

Habitat specialist butterflies

Year	Index	Smoothed Index (SI)	SI Lower CL.	SI Upper CL.	Yearly Change Rate (YCR)	YCR Lower CL.	YCR Upper CL.	Trend Classification
1976	100.00	57.56	50.81	64.31	0.99	0.98	1.00	MODERATE DECLINE
1977	26.18	52.81	47.34	58.27	0.99	0.99	1.00	MODERATE DECLINE
1978	42.36	48.51	43.88	53.13	0.99	0.99	1.00	MODERATE DECLINE
1979	39.17	44.84	40.68	49.00	1.00	0.99	1.00	STABLE
1980	38.73	41.90	37.95	45.86	1.00	0.99	1.00	STABLE
1981	20.42	39.76	35.87	43.65	1.00	0.99	1.00	STABLE
1982	39.90	38.42	34.53	42.30	1.00	0.99	1.00	STABLE
1983	34.99	37.69	33.81	41.57	1.00	0.99	1.01	STABLE
1984	48.87	37.42	33.54	41.29	1.00	0.99	1.01	STABLE
1985	41.02	37.39	33.52	41.26	1.00	0.99	1.01	STABLE
1986	36.64	37.54	33.68	41.39	1.00	0.99	1.01	STABLE
1987	42.36	37.81	33.98	41.65	1.00	0.99	1.01	STABLE
1988	31.92	38.17	34.35	42.00	1.00	0.99	1.01	STABLE
1989	37.41	38.61	34.79	42.43	1.00	0.99	1.01	STABLE
1990	43.25	39.06	35.25	42.87	1.00	0.99	1.01	STABLE
1991	34.67	39.44	35.63	43.24	1.00	0.99	1.00	STABLE
1992	48.53	39.71	35.90	43.51	1.00	0.99	1.00	STABLE
1993	37.67	39.78	35.98	43.59	1.00	0.99	1.00	STABLE
1994	40.64	39.67	35.87	43.48	1.00	0.99	1.01	STABLE
1995	44.98	39.36	35.55	43.16	1.00	0.99	1.01	STABLE
1996	42.46	38.83	35.02	42.63	1.00	0.99	1.01	STABLE
1997	43.45	38.14	34.34	41.95	1.00	0.99	1.01	STABLE
1998	29.99	37.39	33.58	41.19	1.00	0.99	1.01	STABLE

1999	32.28	36.71	32.90	40.51	1.00	0.99	1.01	STABLE
2000	33.81	36.17	32.36	39.97	1.00	0.99	1.01	STABLE
2001	32.96	35.79	31.99	39.60	1.00	0.99	1.01	STABLE
2002	29.79	35.58	31.77	39.38	1.00	0.99	1.01	STABLE
2003	36.81	35.49	31.69	39.30	1.00	0.99	1.01	STABLE
2004	39.63	35.45	31.64	39.25	1.00	0.99	1.02	STABLE
2005	38.28	35.36	31.56	39.17	1.00	0.99	1.02	STABLE
2006	45.19	35.20	31.39	39.01	1.00	0.99	1.02	STABLE
2007	29.38	34.96	31.14	38.77	1.01	0.99	1.02	STABLE
2008	26.06	34.73	30.91	38.56	1.01	0.99	1.02	STABLE
2009	33.42	34.57	30.73	38.41	1.01	0.99	1.03	STABLE
2010	43.75	34.41	30.56	38.27	1.01	0.98	1.03	STABLE
2011	43.25	34.21	30.34	38.08	1.01	0.98	1.03	STABLE
2012	22.86	33.99	30.11	37.87	1.01	0.98	1.04	STABLE
2013	34.04	33.89	30.01	37.77	1.02	0.98	1.04	STABLE
2014	37.50	33.92	30.04	37.80	1.02	0.98	1.05	STABLE
2015	32.36	34.09	30.20	37.99	1.02	0.98	1.06	UNCERTAIN
2016	26.49	34.47	30.51	38.43	1.02	0.98	1.06	UNCERTAIN
2017	28.97	35.08	30.91	39.24	1.02	0.97	1.07	UNCERTAIN
2018	40.55	35.87	31.24	40.51	1.02	0.97	1.08	UNCERTAIN
2019	41.50	36.75	31.25	42.24	1.02	0.97	1.08	UNCERTAIN
2020	38.90	37.63	30.84	44.42				

Butterflies of the wider countryside

Year	Index	Smoothed Index (SI)	SI Lower CL.	SI Upper CL.	Yearly Change Rate (YCR)	YCR Lower CL.	YCR Upper CL.	Trend Classification
1976	100.00	71.64	58.89	84.40	1.00	0.99	1.01	STABLE

1977	47.42	72.46	61.24	83.67	1.00	0.99	1.00	STABLE
1978	62.66	73.30	63.35	83.25	1.00	0.99	1.00	STABLE
1979	71.45	74.19	65.24	83.14	1.00	0.99	1.00	STABLE
1980	62.95	75.11	66.90	83.31	1.00	0.99	1.00	STABLE
1981	55.46	76.05	68.36	83.73	1.00	0.99	1.00	STABLE
1982	95.28	76.98	69.63	84.33	1.00	0.99	1.00	STABLE
1983	87.70	77.86	70.71	85.01	1.00	0.99	1.00	STABLE
1984	111.94	78.66	71.62	85.71	1.00	0.99	1.00	STABLE
1985	72.78	79.36	72.36	86.36	1.00	0.99	1.00	STABLE
1986	70.15	79.99	73.01	86.97	1.00	0.99	1.00	STABLE
1987	62.09	80.55	73.57	87.52	1.00	0.99	1.00	STABLE
1988	60.26	81.05	74.08	88.03	1.00	0.99	1.00	STABLE
1989	89.95	81.48	74.51	88.45	1.00	0.99	1.00	STABLE
1990	88.92	81.79	74.82	88.76	1.00	0.99	1.00	STABLE
1991	99.08	81.95	74.99	88.91	1.00	0.99	1.00	STABLE
1992	111.17	81.93	74.98	88.87	1.00	0.99	1.00	STABLE
1993	63.53	81.73	74.79	88.66	1.00	0.99	1.00	STABLE
1994	70.63	81.38	74.46	88.30	1.00	0.99	1.00	STABLE
1995	87.90	80.89	73.98	87.79	1.00	0.99	1.00	STABLE
1996	94.62	80.25	73.34	87.15	1.00	0.99	1.00	STABLE
1997	101.39	79.46	72.57	86.36	1.00	0.99	1.00	STABLE
1998	73.96	78.56	71.67	85.46	1.00	0.99	1.00	STABLE
1999	66.99	77.59	70.69	84.48	1.00	0.99	1.01	STABLE
2000	71.94	76.57	69.67	83.48	1.00	0.99	1.01	STABLE
2001	65.31	75.56	68.65	82.47	1.00	0.99	1.01	STABLE
2002	68.71	74.56	67.64	81.48	1.00	0.99	1.01	STABLE
2003	81.85	73.60	66.66	80.53	1.00	0.99	1.01	STABLE
2004	83.95	72.67	65.72	79.62	1.00	0.99	1.01	STABLE
2005	72.44	71.79	64.83	78.75	1.00	0.99	1.01	STABLE

2006	73.45	70.98	64.01	77.95	1.00	0.98	1.02	STABLE
2007	53.58	70.28	63.31	77.26	1.00	0.98	1.02	STABLE
2008	52.36	69.72	62.74	76.69	1.00	0.98	1.02	STABLE
2009	72.78	69.30	62.33	76.28	1.00	0.98	1.02	STABLE
2010	76.56	69.02	62.04	76.00	1.00	0.98	1.02	STABLE
2011	69.18	68.88	61.88	75.88	1.01	0.98	1.02	STABLE
2012	43.05	68.88	61.83	75.92	1.01	0.98	1.03	STABLE
2013	79.43	69.01	61.86	76.17	1.01	0.98	1.03	STABLE
2014	73.45	69.27	61.91	76.62	1.01	0.98	1.03	STABLE
2015	69.34	69.63	61.93	77.32	1.01	0.98	1.03	STABLE
2016	52.60	70.08	61.86	78.30	1.01	0.98	1.03	STABLE
2017	66.83	70.62	61.65	79.59	1.01	0.98	1.04	STABLE
2018	86.10	71.21	61.24	81.19	1.01	0.98	1.04	STABLE
2019	80.54	71.83	60.58	83.09	1.01	0.98	1.04	STABLE
2020	77.80	72.46	59.66	85.25				

Butterflies of the wider countryside on farmland

Year	Index	Smoothed Index (SI)	SI Lower CL.	SI Upper CL.	Yearly Change Rate (YCR)	YCR Lower CL.	YCR Upper CL.	Trend Classification
1990	100.00	110.98	96.98	124.98	1.00	0.99	1.00	STABLE
1991	122.46	110.16	97.91	122.41	1.00	0.99	1.00	STABLE
1992	127.06	109.32	98.50	120.13	1.00	0.99	1.00	STABLE
1993	78.89	108.46	98.76	118.17	1.00	0.99	1.00	STABLE
1994	91.83	107.62	98.72	116.52	1.00	0.99	1.00	STABLE
1995	107.40	106.77	98.41	115.12	1.00	0.99	1.00	STABLE
1996	121.34	105.88	97.86	113.90	1.00	0.99	1.00	STABLE
1997	136.77	104.91	97.08	112.75	1.00	0.99	1.00	STABLE
1998	103.99	103.86	96.10	111.61	1.00	0.99	1.00	STABLE

1999	94.84	102.74	95.01	110.47	1.00	0.99	1.01	STABLE
2000	102.33	101.59	93.86	109.32	1.00	0.99	1.01	STABLE
2001	93.33	100.43	92.69	108.17	1.00	0.99	1.01	STABLE
2002	92.26	99.28	91.52	107.04	1.00	0.99	1.01	STABLE
2003	113.50	98.14	90.37	105.92	1.00	0.99	1.01	STABLE
2004	111.43	97.03	89.24	104.81	1.00	0.99	1.01	STABLE
2005	99.08	95.95	88.16	103.74	1.00	0.99	1.01	STABLE
2006	98.63	94.96	87.17	102.74	1.00	0.99	1.01	STABLE
2007	72.78	94.09	86.31	101.86	1.00	0.99	1.02	STABLE
2008	68.87	93.40	85.64	101.16	1.00	0.99	1.02	STABLE
2009	97.72	92.91	85.17	100.66	1.00	0.99	1.02	STABLE
2010	100.69	92.62	84.89	100.34	1.01	0.99	1.02	STABLE
2011	91.62	92.50	84.77	100.23	1.01	0.99	1.02	STABLE
2012	58.34	92.57	84.82	100.32	1.01	0.99	1.02	STABLE
2013	108.64	92.83	84.99	100.67	1.01	0.99	1.03	STABLE
2014	102.80	93.25	85.22	101.27	1.01	0.99	1.03	STABLE
2015	95.50	93.79	85.42	102.15	1.01	0.99	1.03	STABLE
2016	71.45	94.44	85.53	103.36	1.01	0.98	1.03	STABLE
2017	90.57	95.22	85.49	104.94	1.01	0.98	1.03	STABLE
2018	110.15	96.06	85.22	106.91	1.01	0.98	1.04	STABLE
2019	110.15	96.94	84.65	109.23	1.01	0.98	1.04	STABLE
2020	102.33	97.82	83.77	111.87				

Butterflies of the wider countryside in woodland

Year	Index	Smoothed Index (SI)	SI Lower CL.	SI Upper CL.	Yearly Change Rate (YCR)	YCR Lower CL.	YCR Upper CL.	Trend Classification
1990	100.00	94.35	82.89	105.81	0.98	0.97	0.99	MODERATE DECLINE
1991	91.62	90.70	81.08	100.32	0.98	0.97	0.99	MODERATE DECLINE

1992	110.15	87.08	78.82	95.34	0.98	0.97	0.99	MODERATE DECLINE
1993	56.36	83.51	76.15	90.87	0.99	0.98	0.99	MODERATE DECLINE
1994	61.09	80.13	73.30	86.97	0.99	0.98	0.99	MODERATE DECLINE
1995	86.90	76.95	70.37	83.53	0.99	0.98	1.00	MODERATE DECLINE
1996	87.50	73.90	67.42	80.37	0.99	0.98	1.00	MODERATE DECLINE
1997	89.74	70.93	64.49	77.38	0.99	0.98	1.00	MODERATE DECLINE
1998	58.61	68.10	61.65	74.55	0.99	0.98	1.00	STABLE
1999	51.29	65.51	59.06	71.95	0.99	0.98	1.00	STABLE
2000	52.97	63.23	56.79	69.67	0.99	0.98	1.00	STABLE
2001	50.93	61.28	54.85	67.70	1.00	0.98	1.01	STABLE
2002	57.28	59.61	53.20	66.02	1.00	0.98	1.01	STABLE
2003	70.47	58.15	51.76	64.55	1.00	0.98	1.01	STABLE
2004	70.79	56.81	50.42	63.19	1.00	0.98	1.01	STABLE
2005	60.26	55.53	49.15	61.92	1.00	0.98	1.02	STABLE
2006	58.48	54.36	47.97	60.75	1.00	0.98	1.02	STABLE
2007	41.50	53.33	46.93	59.72	1.00	0.98	1.02	STABLE
2008	38.55	52.50	46.09	58.92	1.01	0.98	1.02	STABLE
2009	56.89	51.90	45.47	58.32	1.01	0.98	1.03	STABLE
2010	64.42	51.46	45.02	57.90	1.01	0.98	1.03	STABLE
2011	56.49	51.16	44.72	57.61	1.01	0.98	1.04	STABLE
2012	31.99	51.03	44.58	57.48	1.01	0.98	1.04	STABLE
2013	58.34	51.12	44.67	57.57	1.01	0.98	1.04	STABLE
2014	52.84	51.40	44.92	57.88	1.02	0.98	1.05	STABLE
2015	50.58	51.87	45.28	58.45	1.02	0.98	1.05	UNCERTAIN
2016	36.48	52.53	45.68	59.37	1.02	0.97	1.06	UNCERTAIN
2017	48.87	53.38	46.01	60.76	1.02	0.97	1.06	UNCERTAIN
2018	69.18	54.36	46.08	62.65	1.02	0.97	1.07	UNCERTAIN
2019	59.29	55.38	45.72	65.04	1.02	0.97	1.07	UNCERTAIN
2020	58.08	56.40	44.88	67.92				