

Ruling of the IUCN Red List Standards and Petitions Committee on the Listing of the Migratory Monarch Butterfly

27 September 2023

The IUCN Red List Standards and Petitions Committee (SPC) received a petition on the listing of Migratory Monarch Butterfly (*Danaus plexippus ssp. plexippus*) on 7 June 2023. The taxon was assessed as EN A2ab on 30 December 2021, and the assessment was published on the IUCN Red List in 2022.

The main issue raised in this petition is the appropriateness of the models used to calculate the 10-year population reduction using data on the area occupied by wintering individuals. Although the assessment period is 10 years, the assessment fitted linear and exponential models to the data from 1993 to 2020 (the last year of data available at the time of the assessment).

The use of data of longer duration than 10 years/3 generations is appropriate, but only with the correct model, i.e., a plausible model that is consistent with the underlying changes in the population and in the threats faced by the species. Regardless of the model or the length of the time series, criterion A reductions are calculated based on the last 10 years/3 generations. The use of multiple models for population projections (compliant with Guidelines) is encouraged, but each model must be plausible and must provide a fit to the data that is statistically adequate.

In this case, the exponential model can be considered plausible with the data that were available at the time of the assessment. However, based on the distribution of its residuals, the linear model cannot be considered plausible.

However, linear and exponential are not the only options; more complex models may be used depending on information about the processes that contribute to changes in population size (see section 4.5.1 of the Red List Guidelines). In this case, a break-point model, which detected a changepoint in 2014, is also plausible and was available to the assessors at the time of the assessment through Thogmartin et al. (2020; submitted March 2019). Although Thogmartin et al. (2020) concluded that there was insufficient evidence to conclude that the eastern migratory monarch population had significantly grown since winter 2014, they did detect a changepoint in 2014 (or 2013), a point at which the rate of change had increased from a decline to a much lower rate of decline, or to no decline, or to a small rate of increase. Importantly, the changepoint seems to correspond to a stabilization of herbicide use and habitat loss (Thogmartin et al. 2017), suggesting a plausible mechanism for this change in population trend.

Based on these considerations and on the information provided in the assessment, both VU and NT are plausible categories, but EN is not. In addition, the reduction is based on an index of abundance (subcriterion b) but not direct observation (subcriterion a). Thus, the listing is changed to VU A2b, with both VU and NT identified as plausible categories.

If the census for the 2023-24 winter continues the recent trend, the breakpoint model could be considered more plausible than the exponential model. In that case, the most plausible category would become NT (with criterion B2 nearly met, if not also A2). If that happens, the species can be downlisted to NT after the waiting period.

However, the listing outcome may be different if there is additional information about the trends in density. A critical assumption in the analyses that have been performed is that wintering population density is stationary (i.e., constant, or changing randomly) across years, so that area occupied by the wintering population can be used as an index of abundance. If density is declining, then abundance, and thus population size, may be declining even if the area occupied is stable or increasing. The SPC therefore encourages assessors to search for quantitative information about trends in density over time.

The SPC applauds the attempts by the two sides to reach a consensus through a workshop, and their agreement to run reassessments through a workshop process. The SPC believes the difference between the original assessment and the SPC's ruling is not necessarily due to an erroneous application of the Red List criteria, but due to a difference in levels of precaution, specifically on whether a linear model is a plausible description of population change. The IUCN criteria recommend a "precautionary but realistic" attitude to risk; implausible scenarios should not be included just because they are precautionary. The SPC notes that this may be difficult to judge in some cases, including the present case, although there is little ecological or statistical evidence on which to interpret the linear model as a 'plausible' scenario.

An additional issue: The assessors state that "For range-based and population size IUCN Red List metrics, in the case of migratory species, the focus is generally on where or when the population is smallest or most restricted (wintering data)." This is not correct. The "smallest area rule" applies only to range-based metrics. For population size metrics, the data that are most representative of the whole taxon should be used.

References

Thogmartin WE, Wiederholt R, Oberhauser K, Drum RG, Diffendorfer JE, Altizer S, et al. 2017. Monarch butterfly population decline in North America: identifying the threatening processes. Royal Society Open Science 4:170760. <https://doi.org/10.1098/rsos.170760>

Thogmartin WE, Szymanski JA, Weiser EL. 2020. Evidence for a growing population of eastern migratory monarch butterflies is currently insufficient. Frontiers in Ecology and Evolution 8. <https://doi.org/10.3389/fevo.2020.00043>