[Emailed statement from Laurence Gaume and Marion Desquilbet to Retraction Watch on Wednesday, January 21, 2026]

While the selection of data according to specific and consistent criteria is a necessary condition for a meta-analysis to lead to robust conclusions, it was not met in InsectChange. The problem is that the authors compiled in their database different datasets (half of the database) specifically designed to study particular, often experimentally manipulated, factors of insect changes, such as insecticide application, fires, decontamination or restoration measures, without caring of the worldwide representativeness of these habitat conditions, and most of the time without even mentioning these specific conditions. This includes experimental studies aimed at addressing questions of different nature and with control and experimental plots inadequately considered as identically and independently distributed in the statistical analysis. This also includes studies dealing with strong or not natural disturbances, e.g. human disturbances creating highly specific conditions, such as accidental introduction of an insecticide, habitat creation or site remediation, 'artificially' favouring in these cases, insect decline, insect proliferation or insect recovery, respectively. Taking into account the datasets from experimental and highly-disturbed contexts with clearly specified expected changes in the source studies, we showed that the datasets with an expected increase in insects were five times as many as the datasets with an expected decrease in insects. The over-representation of specific contexts such as habitat creation, site remediation or restoration favouring insect increase introduces the problem of the « false baseline effect » in these time series with a bias towards a below-average starting point, with a subsequent underestimation of the overall insect decline. We argue that the datasets selected by the authors to build their database are not representative of the diversity of insect living conditions around the world and that the database is biased and cannot serve to estimate insect change.

In 2020, we published a comment in *Science* on the meta-analysis https://www.science.org/doi/10.1126/science.abd8947). This comment only prompted a minimalist erratum. Our 2024 comment in the *Peer Community Journal* deals with the post-erratum version of the database. In other words, none of the issues we identified in the database is addressed in the post-erratum 2020 meta-analysis. While some of the errors that we have identified can be easily corrected using our detailed electronic appendices, the vast majority of problems we presented require a complete restructuring of the database of the meta-analysis. Indeed, in its current state, InsectChange cannot be used to estimate temporal trends in insect abundance (and/or biomass), nor to identify the factors likely to explain these trends at the local scale.

The KNB database updated in 2023, cited as the "updated" version of the InsectChange database, no longer includes data extracted from external databases concerning agricultural cover, urbanization and climate that were used with problems in the meta-analysis to study the influence on insect change of the anthropogenic factors at a local scale (see below). We did not conduct a full reanalysis of the new database. It includes many new datasets that were not

subject to our reanalysis. It still contains the problematic freshwater datasets. With regard to terrestrial datasets, we only checked for the problem of experimental sites and we can point out as an example that the database includes sites from controlled experiments in 5 studies out of the 14 initially identified with controlled experiments: in Studies 301 (experimental fires and grazing), 1396 (revegetation of a rubble dump), 1397 (artificial nesting sites), 1460 (agricultural practices) and 1516 (conservation-oriented thinning). The 2024 Nature publication (van Klink, R., Bowler, D. E., Gongalsky, K. B., Shen, M., Swengel, S. R. & Chase, J. M. 2024 Disproportionate declines of formerly abundant species underlie insect loss. Nature 628, 359-364. DOI:10.1038/s41586-023-06861-4), which dealt with terrestrial insects, was based on this database.

Moreover, the integrity of this 'updated'version is questionable due to a severe lack of transparency, as the authors did not quote our preprint that they used for corrections, nor did they detail the corrections they made, which makes it impossible to assess the extent of the remaining errors without spending days to compare the versions and check to which extent the errors and problems that we pointed were corrected. This 2023 'updated' database is also deficient due to a lack of internal consistency as there are variations between files in terms of studies included and corrections included. Some changes were made in the latest (2025) version: 3 datasets representing 11 plots were removed.

I think it is better than nothing and that *Science* should have done this as soon as our first comment on the meta-analysis was published in *Science* in 2020. I also think that a complete retraction of the article would have been warranted, especially in view of the accumulation of multiple errors and major methodological problems that we raise in our comment published in Peer Community Journal and because this meta-analysis hinders the advancement of scientific knowledge on insect decline and its drivers. It is surprising that *Science* would write this expression of concern as a warning to future users of the database, when the problems clearly call into question the results of the meta-analysis itself.

We are convinced that the database underlying the meta-analysis cannot be used to assess global insect trends or local drivers of insect changes. We found 553 errors and problems of 17 types, as well as a general issue affecting the meta-analysis, and we showed that these errors and problems bias the analysis of insect trends and their local drivers, as illustrated by the following examples, which add up to the already pointed problem of the inclusion of studies specifically designed to study particular, often experimentally manipulated, factors of insect changes.

A mathematical transformation applied to heterogeneous data invalidates global trend estimates

We point out a mathematical issue in the method used by van Klink and his co-authors to estimate the temporal slopes of insects, which distorts the results they obtained in the meta-analysis published in *Science*. Indeed, the way the authors dealt with data heterogeneity is a major problem. Metrics (abundance, biomass) are disparate, sampling methods are different and measurement units are not standardized. The log(x+1) mathematical transformation of these

heterogeneous data carried out in the meta-analysis compromises the comparison of temporal slopes between time series and the estimation of overall insect trends. It does not enable, as though specified by the authors, to work on relative and thus comparable temporal variations between datasets, and this problem alone is sufficient to invalidate the estimation of global insect trends.

The problem of non-insects in freshwater datasets calls into question the observed increase in freshwater 'insects'

The problem of non-insects in the datasets provided by the authors after their erratum published in *Science* still leads to a mis-estimation of insect trend. Many of the freshwater datasets still include non-insect invertebrates, such as invasive shells, snails, worms and crustaceans. This is the case for almost half of the freshwater datasets concerning insect abundance (number of individuals) and more than three quarters of those concerning their biomass (cumulative weight of individuals). This type of error can have a major impact on the assessment of trends: for example, a dataset from a lake in Kazakhstan shows an exponential increase in “insects” over almost a century... whereas most of these are invasive shells, reaching 95% of the biomass of the total invertebrate assemblage taken into account at the end of the period considered. In addition, a close examination of the source data enabled us to identify datasets for which it was actually possible to separate insects and non-insects. In these datasets, the biomass of insects alone often decreased, while that of entire invertebrate assemblages presented as insects increased. We were able to show that considering the entire assemblage rather than just the insects brought the estimates down, and calls into question the increase found for freshwater ‘insects’.

An inappropriate methodology rules out agriculture as a possible factor in insect decline

The contexts specific to the source studies, i.e. the factors most directly influencing insect dynamics, are often not reported in the database. Rather, the database extracts data from external databases concerning anthropogenic factors likely to influence the observed trends locally. More specifically, insect change data in InsectChange are matched via the geographical coordinates of sampling sites with other global databases describing the change of land use (agriculture, urbanisation) and climate. However, a detailed analysis shows that for two-thirds of the datasets, database matching is compromised because the sampling area is larger than the area defined as the local scale in the external database, or is not located in the right place in InsectChange. In addition, the database, which codes the world's land cover based on automated interpretation of satellite images, may confuse agricultural crops with grasslands, steppes, etc..

Thus, our exhaustive analysis shows that sites considered without croplands at local scale are indeed uncultivated, while sites considered as cultivated are generally not, or less than reported. This significant overestimation of cropland cover leads the authors of the meta-analysis to erroneously dismiss agricultural practices as a possible cause of insect decline. As a result of a doubly inappropriate methodology, the meta-analysis failed to identify the determinants of insect trends.

An accumulation of other errors

The database also contains several other errors and inconsistencies such as:

- the reversal of figures between the first and last records in a series, thus transforming a decrease into an increase,
- the preferential selection in certain studies of series where the insect trend was increasing,
- failure to correct for increased sampling effort.

Conclusion

We consider that such an accumulation of problems leads to a large-scale error in the meta-analysis and a loss of confidence in the integrity of the data presentation and thus calls for article retraction. *Science* is “kicking the can down the road” by essentially referring the problem back to the database, which is supposedly either fixed or in the process of being fixed. However, in spite of the international criticisms from a total of 65 scientists, the biased results obtained with the published meta-analysis are not being questioned and continue to be cited and influence public opinion, conveying a reassuring message on insects