Section B: Method to calculate the Multimetric Macroinvertebrate Index Flanders using the model results from individual habitat suitability models

To calculate the ecological status based on the MMIF using, both presence/absence data and data on abundance are needed. The suitability models as described in Bennetsen et al. [1] only yield results pertaining to presence/absence data. Thus, we need to provide an estimate of the abundance of the individual taxa to calculate the MMIF.

The MMIF consists of 5 individual metrics: the number of taxa, the number of sensitive taxa, the mean tolerance score, the Shannon-Wiener index; and the number of taxa from the group of Ephemeroptera, Plecoptera or Trichoptera [2]. Of these metrics, only the Shannon-Wiener index needs abundance data [2]. Gobeyn et al. [3] have shown that the sensitivity of the final MMIF score to changes in abundance data is low. Therefore, we decided to calculate the MMIF by assigning a so-called "reference abundance" to all present taxa. This number represents a count of individuals at which a taxon typically occurs in Flanders.

To this end, we defined 5 classes of abundance. We calculated the 95-percentile of the reported abundances of each taxon in Flanders. We then identified 5 abundance classes, by ranking all taxa according to their calculated percentile and identifying changepoints in this gradient. We assigned each taxon to their respective abundance class according to their 95-percentile. These abundance classes align with the typical classes that are also used during determination of biological monitoring samples [4], where larger abundances are typically noted as estimates, rather than as true count data. We then assessed the uncertainty introduced in the overall MMIF score by using these reference abundances, instead of the counts reported in the monitoring data. We replaced these reported counts by the reference abundances and calculated virtual MMIF scores for these samples. We compared these virtual scores to the scores that were reported after monitoring and calculated the number of correctly classified instances from the confusion matrix.

Reference abundance

Figure SB.1 shows the 95th percentile of the count data for each taxon. These percentiles were classified into 5 abundance classes to which a 'reference abundance' was assigned. The value of the reference abundance was based on the mean value of the 95th percentile abundances of each taxon in that class as defined in section 2.3. Most taxa were classified into classes with a lower reference abundance (Table SB.1).

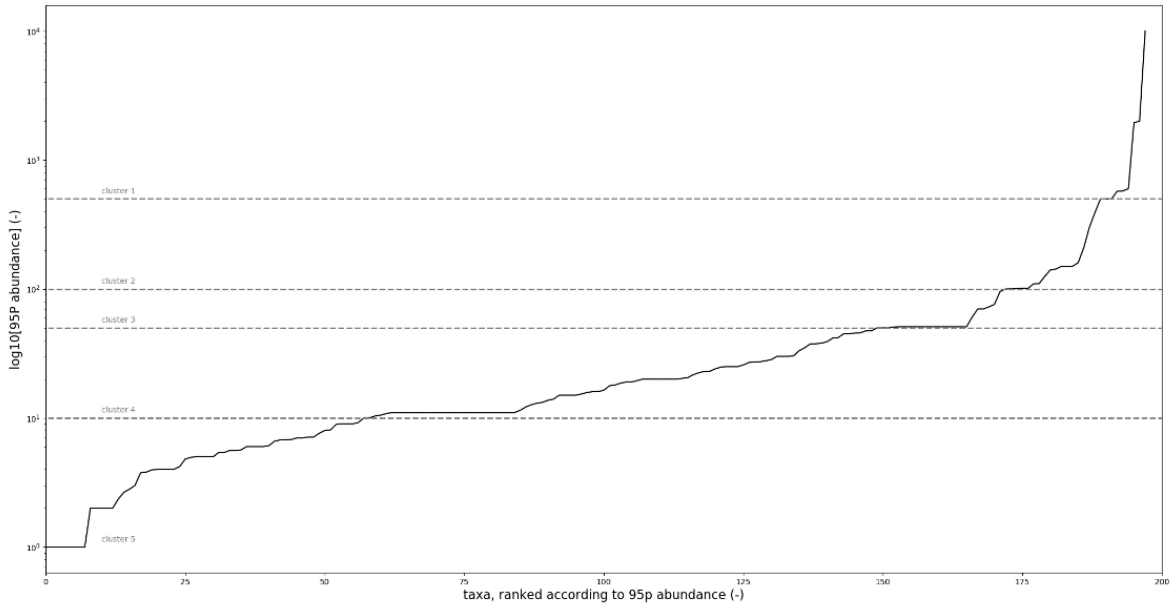

Figure SB1. Macroinvertebrate taxa in Flanders ranked according to their 95th percentile abundance value in the monitoring data. 5 abundance classes were identified and are depicted as clusters on the plot.

Table SB1. Overview of the abundance classes

Abundance Class	Rule (x = Abundance)	Number of Taxa	Mean 95th Percentile	Reference Abundance
1	500 < x	9	1911	2000
2	100 ≤ x < 500	17	155	150
3	50 ≤ x < 100	23	57	55
4	10 ≤ x < 50	92	21	20
5	1 ≤ x <10	57	5	5

The use of the reference abundance in the calculation of the MMIF score, instead of the true count data, introduces a small uncertainty in the MMIF value. 89.53% ($p<0.005$) of the samples are correctly classified. The RMSE on the MMIF value is 0.04.

The reference abundance only introduces a small uncertainty in the MMIF calculation for the design of the taxa reference lists. This was to be expected, following the sensitivity analysis as presented in Gobeyn et al. [3].

References

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