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Importance of compromised application of the BE-FL river macrophyte assessment system (MAFWAT) for intercalibration and harmonisation

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MOTIVE

The BE-FL ecological quality ratio (EQR) for river macrophytes, MAFWAT, uses four metrics to compare composition, structure and abundance of bed vegetation against type-specific reference expectations (Schneiders *et al.* 2004; Leyssen *et al.* 2005, 2006):

1. the relative abundance of 'type-specific taxa';
2. the relative abundance of 'disturbance indicators';
3. the ratio of observed growth forms over the expected minimum number;
4. the abundance of submerged vegetation (excl. very small and very large river types).

Each metric is conceived as an individual EQR scaled from 0 to 1, the lowest score gives the final result.

The Phase 2 intercalibration results suggest that the boundary values for status classes of R-C1 rivers used by BE-FL are somewhat too lenient compared to the assessments proposed by other member states (EC 2012). Compensation of the observed offset would require that the boundaries for high/good and good/moderate are raised from 0.8 to 0.81 and from 0.6 to 0.615, respectively (each quality class interval spans 0.2 EQR units). These minor adjustments would suffice to meet the required level of agreement, but EC (2012) also indicates that technical issues remain to be cleared regarding this matter.

These issues arise from the fact that the intercalibration database does not include the necessary information to apply the 4th metric of MAFWAT (abundance of submerged vegetation) to data from other MSs. Therefore, intercalibration considers a compromised, incomplete version of the BE-FL method with the three metrics that can be derived from the reported species-abundance data (type-specific composition, disturbance indicators and growth-form diversity). Because the lowest metric result in MAFWAT equals to the final EQR, adding the abundance metric will either have no effect or will yield a lower EQR. This makes it probable that application of the compromised BE-FL method overestimates ecological quality compared to the full method in a number of instances. In other words, compromising is likely to result in a bias that should not be compensated in harmonisation because it does not represent a real difference in objectives (as reflected by EQR values).

REQUEST

Reply to suggested boundary adjustments for BE-FL macrophyte assessment of R-C1 rivers.

COMMENTARY

1. Data

Data used to estimate the size of a possible bias are an excerpt of the VMM macrophyte database made on 8-3-2012 and include all available relevées for the Flemish river types considered by CB-GIG intercalibration, i.e. 'small brook' (Bk) and 'small brook Kempen' (BkK; Jochems *et al.,* 2002), from the years 2007 to 2011. The number of sites for each monitoring year is given in Table 1.

Table 1: Number of vegetation relevées per year and river type.

year	river type Bk	river type BkK
2007	16	55
2008	88	38
2009	162	96
2010	71	34
2011	50	49

2. Results

2.1 All sites

Assessment results are compared for 661 relevées (Figure 1). On average, the EQR decreases with 0.06 units by including the metric for submerged vegetation abundance (Table 2). This equals to 31% of a class interval. Inclusion affects the result for 33% of all cases and status is considered at least one class lower for 1/4 of the sites (Table 3).

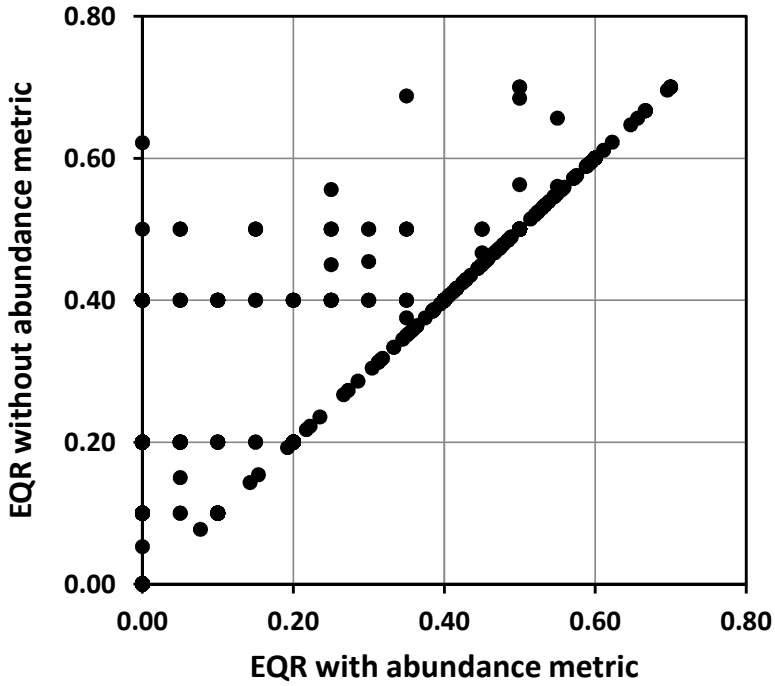

Figure 1: graphical comparison of EQR values, using 3 or 4 metrics.

Table 2: average decrease of EQR if submerged vegetation abundance is included (left column indicates compromised assessment class).

assessment	difference ± σ
all	0.062 ± 0.104 (n=661)
good	0.053 ± 0.134 (n=30)
moderate	0.055 ± 0.119 (n=290)
poor	0.102 ± 0.096 (n=185)
bad	0.029 ± 0.049 (n=152)

Table 3: number of stretches in each status class, without and with submerged vegetation abundance included and class differences.

assessment	without abundance metric	with abundance metric
good	31	25 (-6)
moderate	291	236 (-55)
poor	186	115 (-71)
bad	152	284 (+132)
minus 1 class	134 (20%)	
minus 2 classes	31 (5%)	
minus 3 classes	1 (<1%)	

2.2 Small brook (Bk)

A comparison of 387 stretches of the river type Bk shows that the EQR is lowered for 41% of all cases if the 4th metric is added (Figure 2). Overall the change in EQR amounts to 0.073, corresponding to 37% of a class interval (Table 4). Attribution to a lower status class occurs for 29% of the sites (Table 5). The reduction appears to be strongest for those of lower quality.

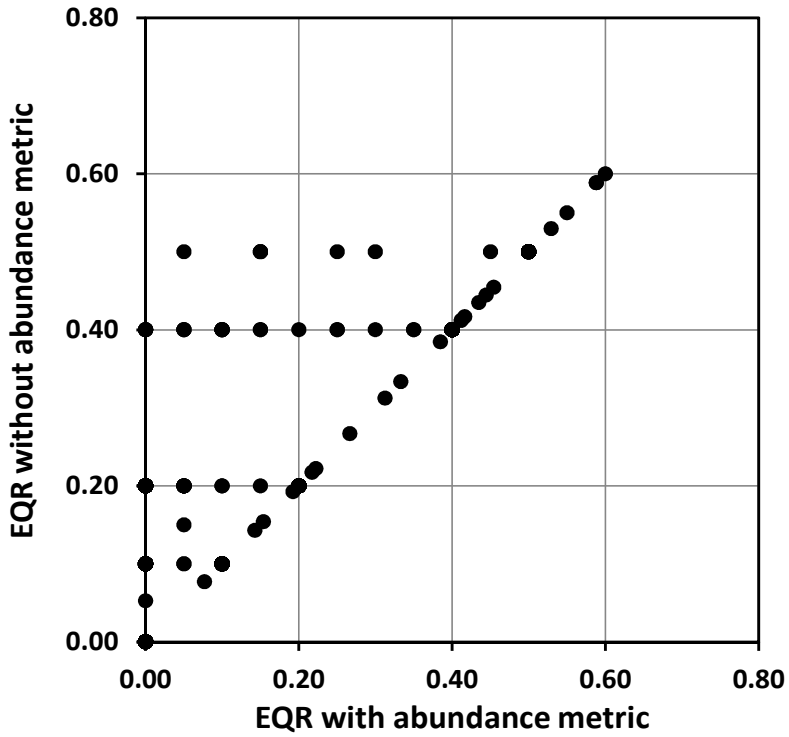

Figure 2: graphical comparison of EQR values, using 3 or 4 metrics for Bk.

Table 4: average decrease of EQR if submerged vegetation abundance is included (Bk; left column indicates compromised assessment class).

assessment	difference ± σ
all	0.073 ± 0.102 (n=387)
good	- (n=1)
moderate	0.074 ± 0.137 (n=104)
poor	0.123 ± 0.094 (n=131)
bad	0.029 ± 0.045 (n=149)

Table 5: number of stretches in each status class, without and with submerged vegetation abundance and class differences (Bk).

assessment	without abundance metric	with abundance metric
good	1	1
moderate	105	78 (-27)
poor	132	55 (-77)
bad	149	253 (+104)
minus 1 class	93 (24%)	
minus 2 classes	19 (5%)	

2.3 Small brook Kempen (BkK)

A lower EQR is obtained for 22% of the 273 comparisons by adding the classification for submerged vegetation abundance (Figure 3). On average, the EQR declines with 0.046 or 23% of a class interval (Table 6). As a result, 20% of the sites end up in a lower status class (Table 7). For the most part, classification is lowered by only one class.

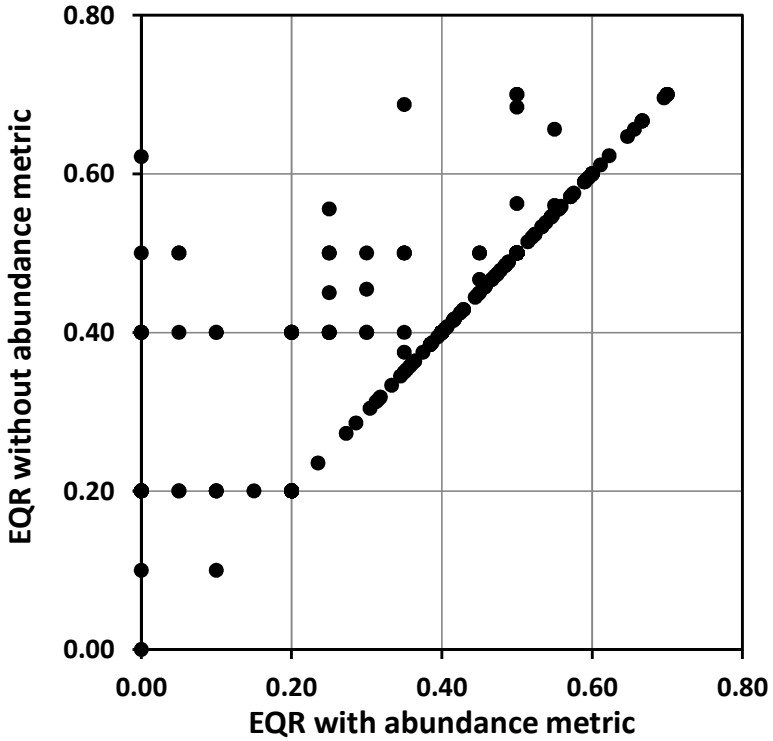

Figure 3: graphical comparison of EQR values, using 3 or 4 metrics for BkK.

Table 6: average decrease of EQR if submerged vegetation abundance is included (Bkk; left column indicates compromised assessment class).

assessment	difference ± σ
all	0.046 ± 0.105 (n=273)
good	0.055 ± 0.136 (n=30)
moderate	0.044 ± 0.107 (n=186)
poor	0.050 ± 0.081 (n=54)
bad	0.033 ± 0.058 (n=3)

Table 7: number of stretches in each status class, without and with submerged vegetation abundance and class differences (BkK).

assessment	without abundance	with abundance
good	30	24 (-6)
moderate	186	158 (-28)
poor	54	60 (-6)
bad	3	31 (+28)
minus 1 class	41 (15%)	
minus 2 classes	12 (4%)	
minus 3 classes	1 (<1%)	

CONCLUSION

The metric for submerged vegetation abundance has a sizeable effect on the macrophyte EQR obtained by the BE-FL assessment method. Results from a large sample of sites covering the entire quality qradient observed in the Flemish region, but lacking stretches of high macrophyte status and with limited representation of good status sites, indicate that overall status is overestimated by c. 1/3 of a quality class or 0.06 EQR units if the abundance of submerged vegetation is not taken into account. Such an effect occurs for both river types which have data submitted for intercalibration. This should be taken into account in evaluating the comparability of compromised BE-FL assessment results to those of other national methods. The results of the analysis presented here suggest that the bias introduced by neglecting one of the essential elements of the MAFWAT evaluation is several times larger than the apparent gap to the required level of agreement for successful intercalibration (< 0.02 EQR units). This indicates that the current, officially endorsed boundary values used by BE-FL for macrophyte assessment using MAFWAT (BVR, 2010) are sufficiently stringent and should not be raised.

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