

Interpretation

The indicator depicts the importance of the river course and banks in the studied floodplain segment for the functional and structural quality of aquatic habitats, biotic communities and species, and reflects the performance of the assessed ecosystem in terms of provisioning typical habitats of rivers and floodplains.

The quantification of habitat provision in the river is mainly based on parameters obtained from hydro-morphological (river structure) mapping and water quality assessment (in terms of chemical status according to water framework directive (WFD)). However, the procedure of the hydro-morphological (river structure) mapping and its assessment parameters may vary from (federal) state to state or does not exist at all. Accordingly, the selection of the calculation parameters for the HPI_{river} from the hydro-morphological (river structure) assessments mapping must be made according to content-related criteria.

Concerning the biological quality elements (BQE), it has to be considered that these are only recorded at the WFD monitoring sites, which are located far away from each other. Therefore, the values are strongly interpolated.

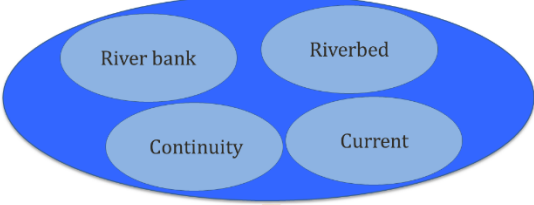
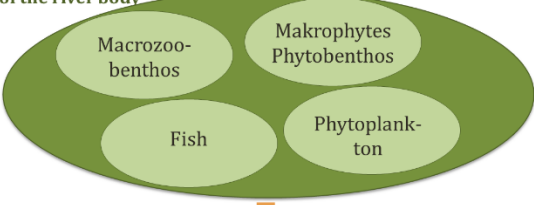
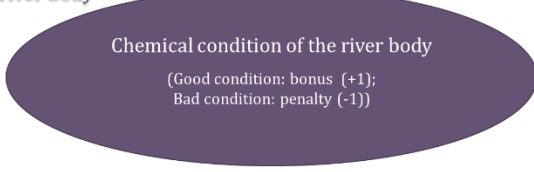

References

Förster, J., Halle, M. & Müller, A. (2017). Entwicklung eines Habitatindexes zur Beurteilung biozönotisch relevanter Gewässerstrukturen. Korrespondenz Wasserwirtschaft, 8. 466-471.

■ Original approach according to River Ecosystem Service Index (RESI) (Podschun et al., 2018)


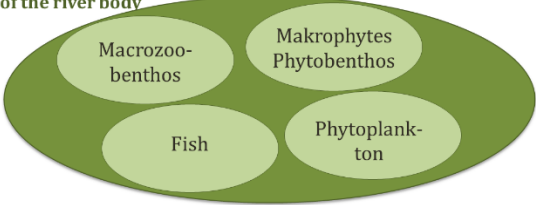
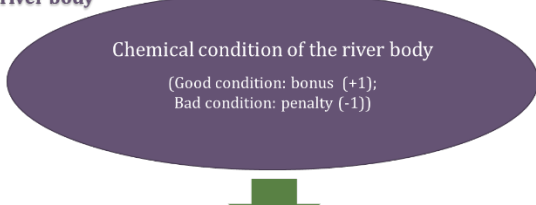

Class	Abbr.	Description		Spatial reference	
Regulating	Hab _{River}	The Habitat Index River considers the water quality as well as the functional and structural quality of biologically relevant water body structures in the river and the directly adjacent river bank.		Floodplain segment or compartment <input type="checkbox"/> former floodplain <input type="checkbox"/> active floodplain <input checked="" type="checkbox"/> river	
Variable	Abbr.	Unit	Variable description	Data basis	Comment
Riverbed	RBe	Ordinal (1-7)	Mean value of the individual parameters (EP) concerning the riverbed: usually substrate, substrate diversity, lining, structure, load	Hydro-morphological assessment (river structure quality mapping)	Might be different between countries
Current	Flow	Ordinal (1-7)	Mean value of the EP concerning the current: usually backwater, cross-banks, depth variance, current diversity	Hydro-morphological assessment	Might be different between countries
River bank	RBa	Ordinal (1-7)	Mean value of the EP concerning the bank: usually vegetation cover, pollution, embankments, shading, structure	Hydro-morphological assessment	Might be different between countries
Continuity	Con	Ordinal (1-7)	Mean value of the EP concerning the continuity: usually transverse structures, piping, culverts	Hydro-morphological assessment	Might be different between countries

Phytoplankton	PP	Ordinal (1-5)		Phytoplankton from WFD reporting	Numbers in opposite order: High: 5, Good: 4, Moderate: 3, Poor: 2, Bad: 1
Macrozoobenthos	MZB	Ordinal (1-5)		Macrozoobenthos from WFD (water framework directive)	Numbers in opposite order: High: 5, Good: 4, Moderate: 3, Poor: 2, Bad: 1
Fish	Fish	Ordinal (1-5)		Fish from WFD reporting	Numbers in opposite order: High: 5, Good: 4, Moderate: 3, Poor: 2, Bad: 1
Macrophytes/phyto-benthos	MPPB	Ordinal (1-5)		Macrophytes/phyto-benthos from WFD reporting	Numbers in opposite order: High: 5, Good: 4, Moderate: 3, Poor: 2, Bad: 1
Chemical condition of the river body (optional)	chem	Nominal (not good, good)		Chemical condition of the river body from WFD reporting	

Calculation						
Evaluation scheme			Indicator			
<div> <div> <div>Biological relevant river structure</div>  </div> <div>+</div> <div> <div>Biological species composition of the river body</div>  </div> <div>+</div> <div> <div>Chemical condition of the river body</div>  </div> <div>↓</div> <div> <div>Habitat provision river</div>  </div> </div>			<p>1. Habitat provision in the reach (in general 100m)</p> <p>a) <u>Biological relevant river structure per reach (GWS)</u></p> $HP_{river} = \frac{RBe + Flow + RBa + Con}{4}$ <p>Transfer to 5-level IDES scale; if individual variables are missing, the mean value is calculated from the remaining individual variables.</p> <p>b) <u>Biological species composition per reach (Bio)</u></p> $Bio_{river} = \frac{Fish + MZB + PP + MPPB}{4}$ <p>Calculation of the mean value from the individual parameters of the biological quality element; if there are no values, the mean value is calculated from the remaining variables.</p> <p>c) <u>Calculation of the Habitat index river for the stretch</u></p> <p>Averaging of HP_{river} and Bio_{river} flow, addition of bonus or malus (chem)</p> $Hab_{river100} = \frac{HP_{river} + Bio_{river}}{2} + chem$ <p>2. Assessment of the habitat provision river for a floodplain-compartment</p> <p>Length-weighted averaging of all $Hab_{River100}$ of a km segment, where A_i = sum of all sections contained in a floodplain segment.</p> $HPI_{river} = \frac{\sum_{i=1}^n (Hab_{river100} * A_i)}{\sum_{i=1}^n (A_i)}$			
Scaling <input type="checkbox"/> national <input checked="" type="checkbox"/> local		HPI_{river}	≥ 4.5	$< 4.5 - \geq 3.5$	$< 3.5 - \geq 2.5$	$< 2.5 - \geq 1.5$
Evaluation Class		5	4	3	2	1
Qualitative Evaluation		Very high importance for habitat provision	High importance for habitat provision	Moderate importance for habitat provision	Low importance for habitat provision	Very low importance for habitat provision

■ Adaption for Danube-wide application

Class	Abbr.	Description		Spatial reference	
Regulating	Hab _{Fluss}	The Habitat Index River should consider the water quality as well as the functional and structural quality of biologically relevant water body structures in the river and the directly adjacent river bank. Where river quality mapping is not available, biological variables can be used only.		Floodplain segment or compartment <input type="checkbox"/> former floodplain <input type="checkbox"/> active floodplain <input checked="" type="checkbox"/> river	
Variable	Abbr.	Unit	Variable description	Data basis	Comment
Phytoplankton	PP	Ordinal (1-5)	Phytoplankton from WFD reporting	WFD	Numbers in opposite order: High: 5, Good: 4, Moderate: 3, Poor: 2, Bad: 1
Macrozoobenthos	MZB	Ordinal (1-5)	Macrozoobenthos from WFD reporting	WFD	Numbers in opposite order: High: 5, Good: 4, Moderate: 3, Poor: 2, Bad: 1
Fish	Fish	Ordinal (1-5)	Fish from WFD reporting	WFD	Numbers in opposite order: High: 5, Good: 4, Moderate: 3, Poor: 2, Bad: 1
Macrophytes/phyto-benthos	MPPB	Ordinal (1-5)	Macrophytes/phyto-benthos from WFD reporting	WFD	Numbers in opposite order: High: 5, Good: 4, Moderate: 3, Poor: 2, Bad: 1
Ecological status (WFD)	ES	Ordinal (1-5)	Final evaluation of the ecological status according to the WFD		In case no single species group data (PP, MZZB, Fish, MPPB) is available, the ecological status according to WFD can be used instead
Confidence of evaluation	conf	Ordinal (1-5)	Confidence of the evaluation.		Categories were translated to Factors: High: 1, moderate: 0,7, Low: 0,3
Length of the river stretch	L	m			

Calculation						
Evaluation scheme			Indicator			
<div> <div>Biological relevant river structure</div>  <div>+</div> <div>Biological species composition of the river body</div>  <div>+</div> <div>Chemical condition of the river body</div>  <div>↓</div> <div>Habitat provision river</div>  </div>			1. Ecological status of the stretch (in general 100m) b) biological species composition per stretch (Bio) $Bio_{river} = \frac{Fish + MZB + PP + MPPB}{4}$ <p>Calculation of the mean value from the individual variables of the biological quality elements; if individual variables are missing, the mean value is calculated from the remaining variables. If all variables are missing, ES should be used instead.</p> 2. Assessment of the habitat provision river per river section <p>Length-weighted mean Length-weighted averaging of all Bio_{river} of a km segment, where L_i = sum of all sections contained in a floodplain segment</p> $HPI_{river} = \frac{\sum_{i=1}^n (Bio_{river\ i} * conf_i * L_i)}{\sum_{i=1}^n (conf_i * L_i)}$			
Scaling <input type="checkbox"/> national <input checked="" type="checkbox"/> local	HPI _{river}	≥ 4.5	< 4.5 - ≥3.5	< 3.5 - ≥2.5	< 2.5 - ≥1.5	<1.5
IDES class		5	4	3	2	1
Qualitative Evaluation		Very high importance for habitat provision	High importance for habitat provision	Moderate importance for habitat provision	Low importance for habitat provision	Very low importance for habitat provision

■ Data sources

Data set	Data type	Spatial reference	Spatial resolution	Source	Creation date	Comments
PP, MZB, Fish, MPPB, ES, conf Evaluation according to the WFD taken from the DanubeGIS	Line shape file	international/river		https://www.danube-gis.org/	2015	