

## WEIGHTED USABLE VOLUME – HABITAT MODELING THE REAL WORLD CALCULATION OF LIVEABLE SPACE

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Habitat research goes back for several decades. The importance of diversify available habitat for aquatic biota has been shown by many authors throughout the last years. In order to understand complex natural river structures and to analyze functional interactions between aquatic biota and abiotic components of the environment many methodologies were developed with the main goal to provide practical tools for river management.

Within these models normally the “Weighted Usable Area” (WUA) for aquatic organisms under specified environmental conditions are calculated. But, weighted usable area as a result of mean velocity data in verticals or transects do not describe the real world situation of velocity distributions in rivers cause of data smoothing.

Instream flow modelers are nowadays increasingly utilizing 2 D and 3 D hydrodynamic modeling approaches to assess aquatic habitat versus discharge relationships (Addley, R.C., Hardy, T.B. 2002). Out of technical increase of instrumentation, resolution and sampling strategies, new possibilities out of the use of acoustic Doppler or laser 3D profilers open new vistas within hydraulic and habitat modeling. As an example the linkage between energy intake and use, which is used in bio-energetic models, necessitates a very detailed description of the study site with a 3D velocity field.

For further development in habitat modeling, the use of WUV (Weighted Usable Volume) as a result of a special velocity distribution, which describes the real world of living space without data smoothing consequentially is a must.

The new **H**abitat **M**odelling **S**oftware (HaMoSoft) has been developed to analyse basis data (like measured velocity fields or velocity results from 3D hydraulic models, geometry, substrate and cover) with a 3D output value termed “Weighted Usable Volume” (WUV).

The great difference and step forward to existing habitat models is, that the measures or simulated velocity basis data will not be reduced to mean values in verticals or transects. The spatial velocity distribution (measured or simulated point or cell velocities) will be used with the whole information. Equivelocity contours in transects and/or horizontal layers will be calculated out of measured or simulated point/cell velocities for further use in the new habitat calculation model. The analyzed WUV describe the real world situation of living space within nature like rivers and streams (Mader 1999).

The habitat modelling tool “HaMoSoft” to analyse the real world situation of liveable space consists of the modules “Geo-statistic Data Processing Module”, “Input Data Module” and “Equi-Area /Equi-Volume Calculation Module”. The individual modules are embedded in an “Excel-Macro-Program-Code” written in “Visual Basic for Application”.

Within this 4 parametric habitat analysing software, using and combining of the parameters velocity distribution, depth, substrate and cover, the real world of habitat distribution is analysed spatially. The 1 to 4 D output matrix of usable volumes of single parameters or parameter-combinations (velocity & depth & cover & substrate) is the most important output file of the new habitat modelling software “HaMoSoft”.

Out of the combination cell by cell with species & life stage specific SI – curves the Weighted Usable Volume WUV will be calculated for each required discharge of the hydrograph.

As a final step of the calculation the real world of liveable space and its within-year fluctuation at simulated situation (natural river, reconstructed river, channel like river, minimum flow demand, ..... ) is shown by analysing different discharge situations (annual or seasonal hydrograph ) out of the hydrograph of the test site.

The sophisticated habitat modeling output is evaluated within data analyses (measured versus simulated) at the “laboratory creek”, a 1 : 1 physical scale model of the Myra River south of Vienna with a river length of 20 m, a river width of up to 4 m, water depth 0,2 – 0,8 m with controlled flow.

The new way of sophisticated habitat modeling by using HaMoSoft is a very important and useful tool of the implementation of the recent demand of the European Water Framework Directive (reestablishing good quality of rivers, monitoring strategies for regarding the effects of diverting water, minimum flow analyzes, effects of river restoration measures, deficit analyzes).

## REFERENCES

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