Universität Stuttgart, Germany
WAREM (Water Resources Engineering and Management)
Master of Science Program

MASTER'S THESIS (December 2003 - June 2004)

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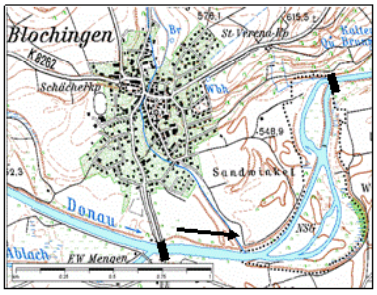
Mesohabitat Modelling for Fish: Application and Comparison of Different Approaches

Overview

Within the field of ecohydraulics, habitat modelling is a useful tool for designing and assessing river restoration programs, fishery enhancement, and environmental flow assessment. At present, most fluvial fish habitat modelling occurs on a microscale, with a maximum extent of several hundred metres. The cost of such methods becomes unfeasible at the management scale, which may require considering several kilometres of river for a given project. Research is being conducted internationally on effective methods for upscaling present modelling techniques to an intermediate "meso" scale.

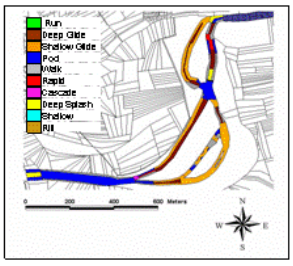
Purpose

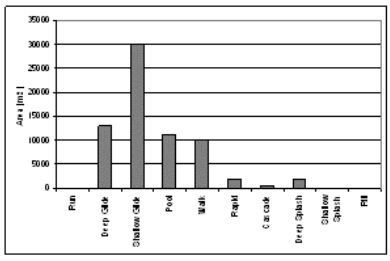
The purpose of this Master's thesis was to aid in further development of the MesoCASiMiR method at the Universität Stuttgart by testing and comparing 4 mesohabitat mapping methods being developed for different applications within different research groups: Meso-Scale Habitat Classification Method in Norway, Rapid Habitat Mapping in England, MesoCASiMiR in Germany, and MesoHABSIM in the USA. The methods were compared based on ease of application, time required, amount of detail provided, and subjectivity.



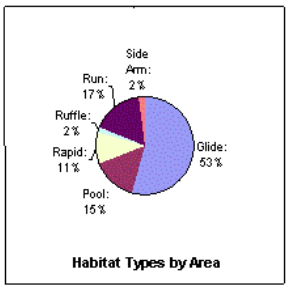
Procedure

Two Case Studies were performed. The first involved mapping 8.5 km of the River Eyach with all 4 methods. The second case study on the Upper Danube was composed of several parts. The first was a 2 km long wadeable section that included the Renaturated "Blochinger Sandwinkel" (see above map). The second was composed of two sections (2 and 2.8 km long, respectively) which were too deep to be waded and in which all observations were made by estimation. The third portion of this case study involved mapping a wadeable and an unwadeable section each (4.5 and 7.1 km respectively) with only MesoCASiMiR in order to aid in developing specific recommendations.

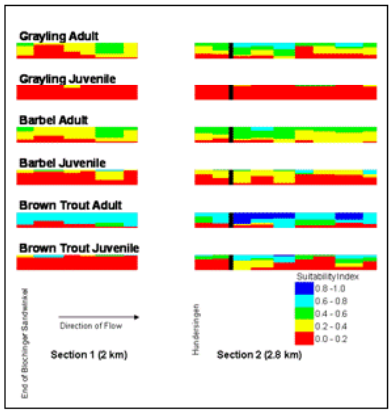




The Meso-Scale Classification - Norway method uses a decision tree to aid users in classifying river habitats during mapping. It was the quickest of the four methods, and was straightforward in it's application. It provides little detail, however.

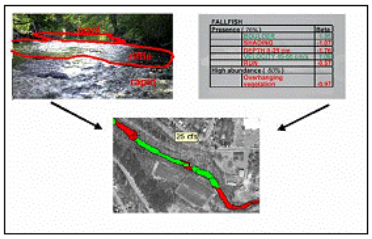


Rapid Habitat Mapping - PHABSIM was specifically designed as a quick method to get an overview of the river habitats in order to make better decisions for selecting representative locations for further microscale modelling. It was never intended as a stand alone method. It sacrifices detail and objectivity for speed and ease of application.



Data collected from the MesoCASiMiR mapping method is imputted directly into a mesoscale model. The goal of the developers is to create a compromise between quick reconnaisance methods and detailed microscale models. It was in the mid-range for all comparison categories, including the time requirement and subjectivity.

The MesoHABSIM model will not be available until summer 2004 (figure to the right reproduced from http://www.neihp.org) This method sacrificed speed and ease of application for the sake of accuracy and detail. It was the slowest and most difficult of the methods by a wide margin, but requires no additional microscale modelling to supplement it's precise results



Conclusions

The results indicated that all methods had strong and weak areas based on these criteria, depending upon their original design purpose.

Each of the mapping techniques is still in development and could benefit from a greater examination of the strengths of the other methods. MesoCASiMiR specifically could benefit from improved visualization, such as with the Norwegian method, and improved substrate classes, such as with MesoHABSIM. Ways of reducing subjectivity within the method must also be researched further. Its ease of application could be improved by adjustments to the various parameter classes.