J | Hab

JBA consulting

Habitat Modelling using 1D and 2D models

Environment
Engineering
Water
Risk
Management

Why Model?

- Good habitat modelling produces empirically-derived habitat availability maps for any number of discharges
- Large stretches of river are mapped (assuming confidence in model geometry)
- If alterations are proposed to river morphology, modelling helps inform on any potential impacts on habitats (e.g. dredging, river restoration and flood defence studies)
- Modelling is useful in water resource studies to help quantify the changes in habitat availability and quality under different flow regimes

The JBA Product

JBA has developed a predictive modelling system for habitat availability at a scale relevant to the ecology through the innovative use of one dimensional (1D) cross-section sub-division tools, two dimensional (2D) flow models and LiDAR data.

Rationale

One dimensional and to a lesser extent two dimensional flood models are a ubiquitous EA product and using these models to simulate lower flows is a cost-efficient way to undertake habitat availability studies.

The interaction of water flow with river morphology is key to the development of the physical habitat. This is not a static relationship as the impact of the morphology of the river on the physical habitat available depends on flow. Using existing one and two-dimensional hydraulic models combined with a habitat model, physical habitat maps are produced for a range of discharges. Such maps show the extent, distribution and robustness of optimal habitat across the flow regime.

A Phased Approach

JHAB has the ability to use hydraulic models at a number of scales. This allows a phased approach to be utilised, recognising the strengths and weaknesses of both one and two dimensional models.

Scoping

JHab has the flexibility to re-use existing hydraulic models. The choice of hydraulic engine is open to the client. Although the 1D to grid tool currently uses ISIS, it can be adapted to use any 1D modelling package. ISIS is a widely used and well recognised software unlike the hydraulic engines used in PHABSIM. In combination with a site walkover, the model could be used to perform a scoping study. Before starting any such study, consideration will have to be given to the topographic detail contained within the 1D model.

Detailed Assessment

JHab can also be used in combination with an existing, freely available fully two dimensional model (River2D), and could be adapted for any other 2D software.

Linking the ISIS model to TUFLOW also allows floodplain habitat quality and availability to be modelled using a fully integrated habitat assessment package that may be linked to engineering and flow regime modifications.

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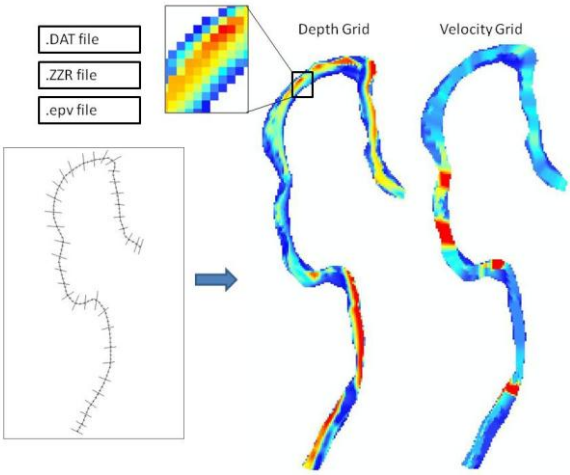
Approach

Stage 1: Converting 1D results to GRID format

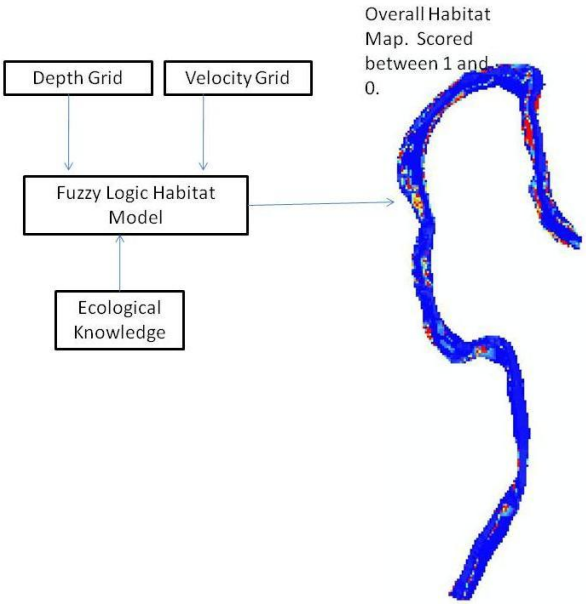


Subdivision of cross sections within ISIS allows a number of velocities to be calculated along a cross section.

A unique tool has been developed which converts one dimensional ISIS modelling results to two dimensional grids of depth and velocity. These grids can be seen as a product of the interaction of flow and river morphology.

Using this tool, grids of depth and velocity can be quickly and easily produced for a range of flows.

Stage 2: Habitat Calculations



A fuzzy logic habitat model has been developed which uses the grids of depth and velocities combined with ecological knowledge to produce maps of habitat availability and suitability.

The model does not treat depth and velocity independently (unlike PHABSIM) and the use of fuzzy membership functions rather than habitat suitability curves negates the need for the laborious data collection needed to create habitat suitability curves.

Using this tool, habitat maps can be produced for a range of flows for any species/life stage of interest. 'Crisp' habitat availability and quality numbers are also produced.

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