Agentbased modelling: a methodology for simulating individual behaviour and states

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Traditional ecological models has the limitation that they are only able to simulate biological and water quality variables that can be represented as concentrations in a computational grid (euler representation), and normally the transport of mass is solved with an advection-dispersion scheme, that is based on the hydrodynamic flow.

By introducing the agentbased modelling (ABM) methodology in DHIs ecological modelling module ECO Lab, it is now possible to add individuals or particles (lagrange representation) to the classical ecological model that does not suffer from the above limitations. For each agent type included it is now possible to specify the characteristics of the agent regarding its movement and internal states. For instance a fish may have defined multiple states such as length, biomass, fitness, fat content, and its movement may be specified as something that differs from the hydrodynamic currents. Each state and movement can be specified as a function of other agents, or as a function of the agents environment: hydrodynamic variables or water quality variables included in the model. To simulate movement a number of neighbourhood functions are being developed in order to evaluate the environment surrounding each agent. These neighbourhood functions calculates for instance the oxygen gradients in a specified radius around each agent and these gradients can be applied directly in the specification in the movement behaviour of the agents.

The ABM option is not yet available in the official software release yet, but an unofficial version has been developed and applied for a few projects already. Here one application is presented focusing on migration of fish larvae in river systems in various

hydraulic and temperature scenarios.