

### P3.13

## Modelling habitat suitability for twaite shad in the estuaries of Elbe and Weser (Germany)

Michael Schönung<sup>1</sup>, Joost Vanoverbeke<sup>2</sup>, Nele Wendländer<sup>1</sup>, Jens Wyrwa<sup>1</sup>, Andreas Schöl<sup>1</sup>, Carsten Viergutz<sup>1</sup>

<sup>1</sup>German Federal Institute of Hydrology, Germany. <sup>2</sup>Research Institute Nature and Forest, Havenlaan 88 bus 73, 1000 Brussel, Belgium

### Abstract

Abundances of twaite shad (*Alosa fallax*) and its larvae in the estuaries are of major importance in the evaluation of river ecosystems due to its protection under the EU's "Habitats Directive". Therefore, egg and larvae numbers of twaite shad are monitored in the estuaries of the rivers Elbe and Weser during the last decade. This study aims to model suitability for spawning and larvae growth of twaite shad within the Elbe and Weser estuaries.

Modelling was conducted for the years 2011 to 2018, whereby expert knowledge was incorporated into a rule set expressing twaite shad's ecological requirements in the estuary. These rules were combined in a fuzzy logic system and applied to modelled environmental conditions, resulting in habitat suitability scores for both spawning and larvae development. Validated environmental conditions were gained from the water quality model QSim and contained spatial and temporal distribution of both biotic and abiotic variables (such as temperature, oxygen, prey and others) within both estuaries.

The modelled suitability scores show intraannual and interannual variations along spatial gradients and indicate most suitable areas are to be found within km 580-660 (Elbe) and km 0-50 (Weser) in spring and summer time. These areas are consistent with actual spawning areas of twaite shad observed in monitoring campaigns. Model and observation data will be connected to evaluate the match-mismatch-hypothesis for fish larvae of twaite shad. Additionally, an interactive web app was written to visualise and explore model results. It provides a valuable tool to identify the causes for declining twaite shad larvae numbers and could support water management or renaturation strategies.

### Keywords

Weser, Elbe, twaite shad, fuzzy logic