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Session D4: Hybrid Model Approach for Designing Fish Ways - Example Fish Lift System at Baldeney/Ruhr and Fish Way at Geesthacht /Elbe

Frank Seidel

KIT - Institute for Water and River Basin Management

Peter Oberle

KIT - Institute for Water and River Basin Management

Mark Musall

KIT - Institute for Water and River Basin Management

Phillip Schultz

KIT - Institute for Water and River Basin Management

Thomas Grafmüller

KIT - Institute for Water and River Basin Management

See next page for additional authors

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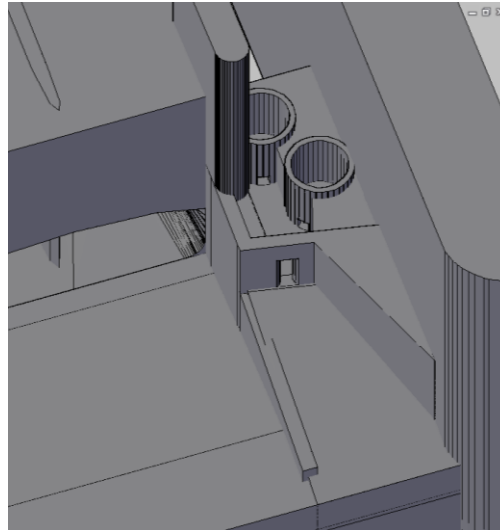
Presenter Information

Frank Seidel, Peter Oberle, Mark Musall, Phillip Schultz, Thomas Grafmüller, and Franz Nestmann

Hybrid model approach for designing fish ways - example fish lift system at Baldeney/Ruhr and fish way at Geesthacht /Elbe

F. Seidel, P. Oberle, M. Musall, P. Schultz, T. Grafmüller, F. Nestmann
Fishpassage 2015, Groningen

Institut für Wasser und Gewässerentwicklung – Bereich Wasserwirtschaft und Kulturtechnik –
Prof. Dr.-Ing. Dr. h.c. mult. Franz Nestmann

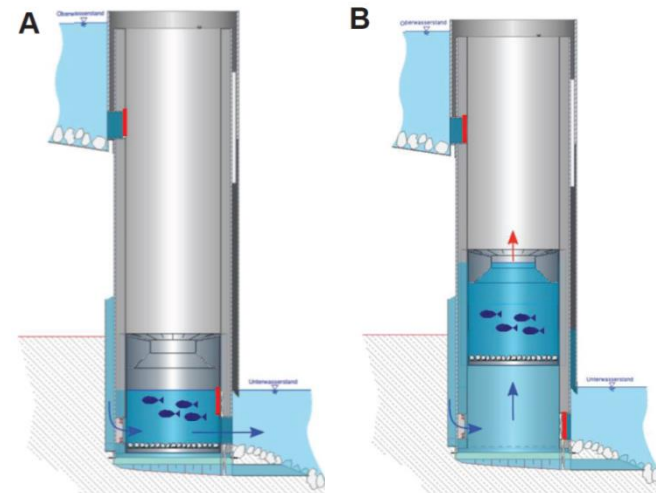


Passability: Design and design criteria

Manuals, engineer standards



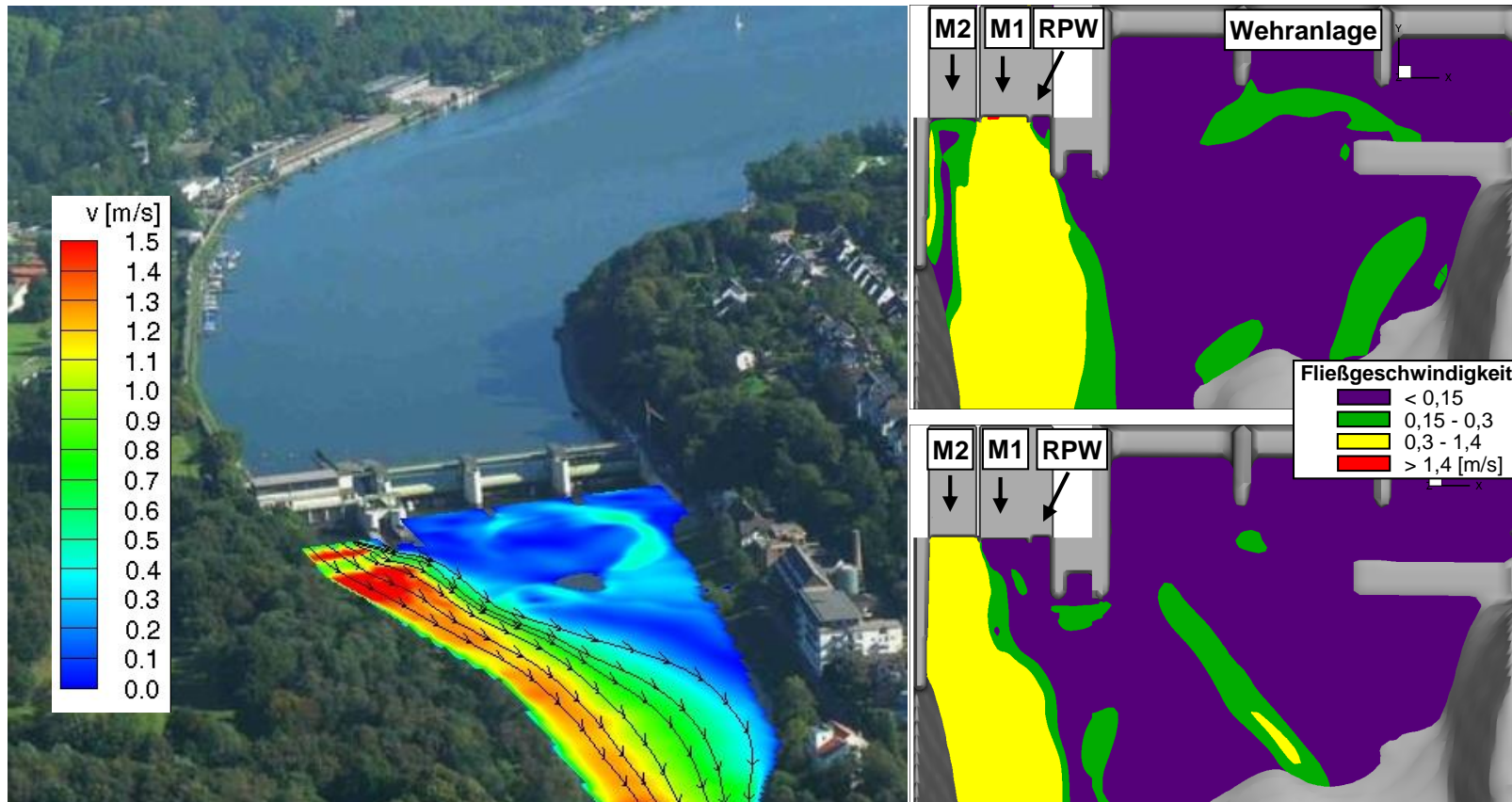
Special design, e.g. Fisch Lift



How can we ensure the functionality of new and innovative systems and fish ways in the design phase?

Case study 1: Baldeney

- 3D-hydrodynamic numerical model for evaluating the attractiveness



Velocities: hydraulic colour scheme,
Flow 3D, RANS

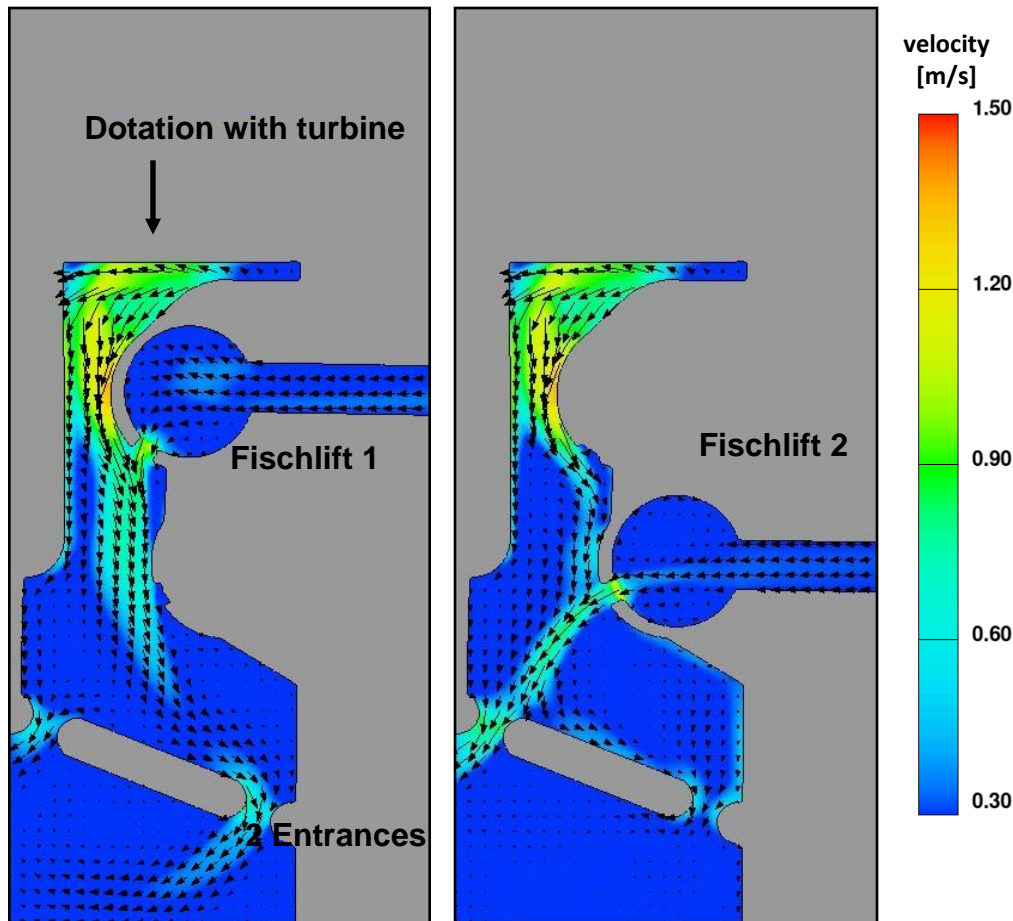
Velocities: ethydraulic colour
scheme



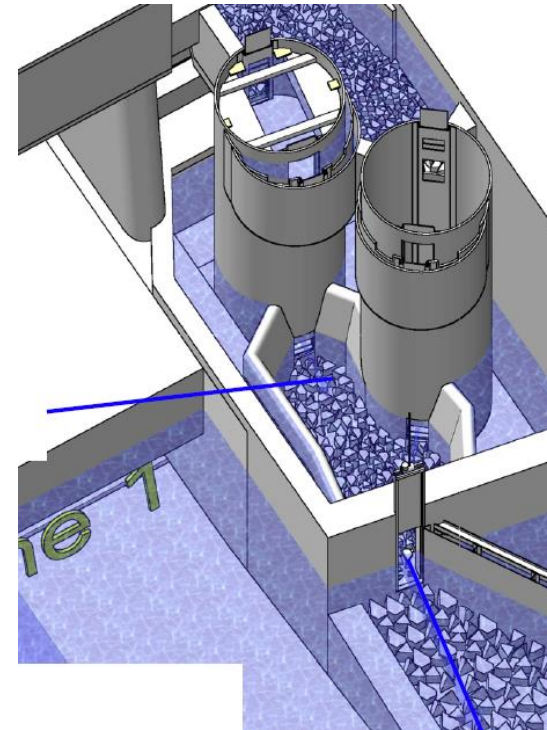
numerical

Example: Prechamber design

3D-hydrodynamic numerical model



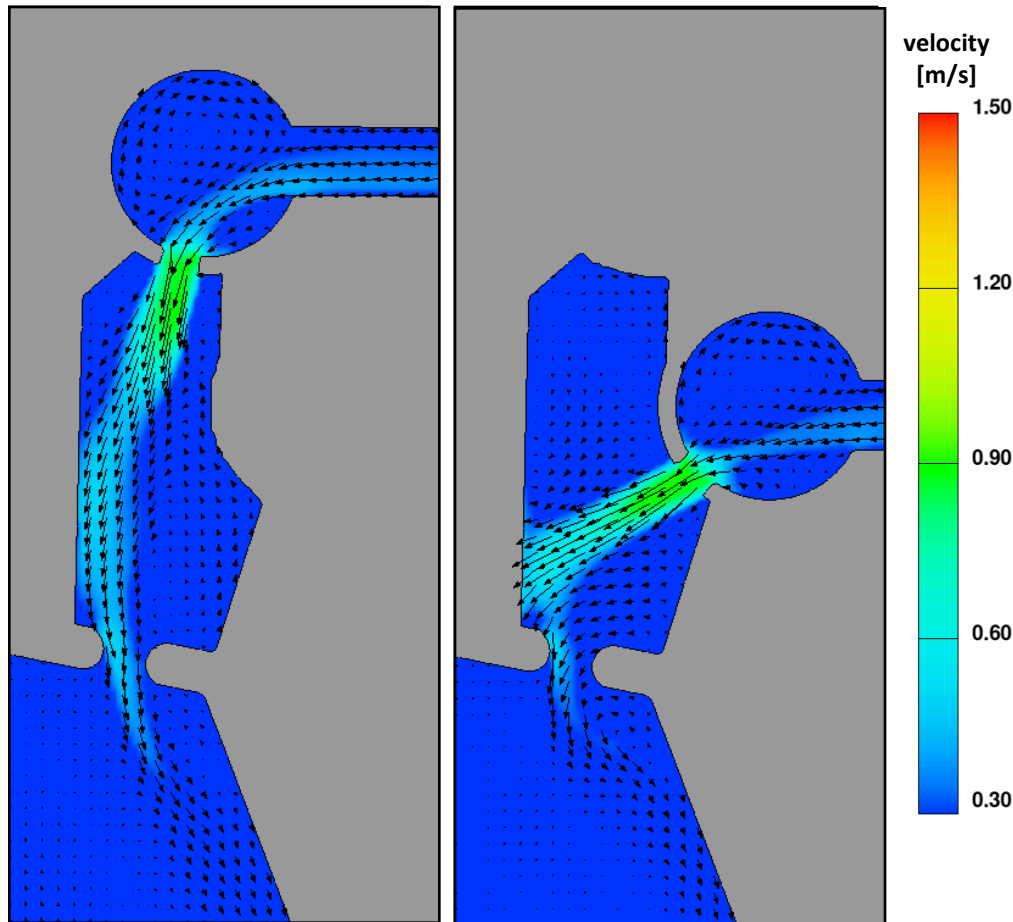
> 50 simulations



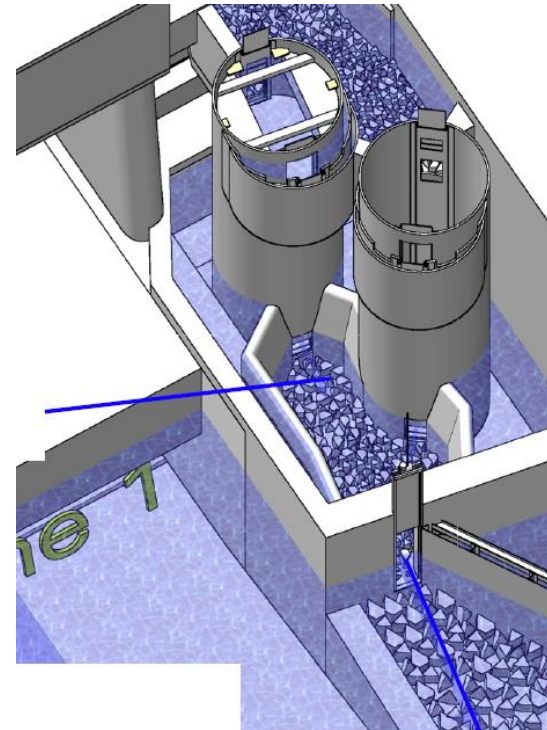
numerical

Example: Prechamber design

■ 3D-hydrodynamic numerical model



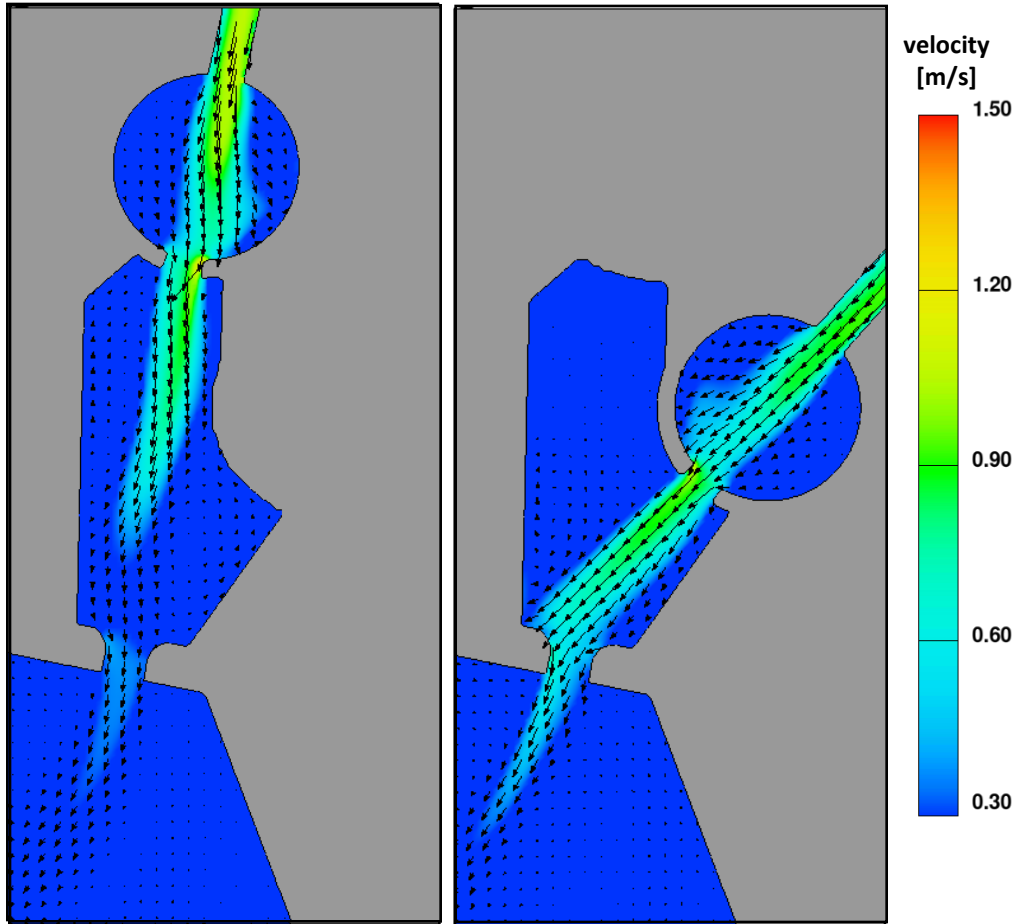
> 50 simulations



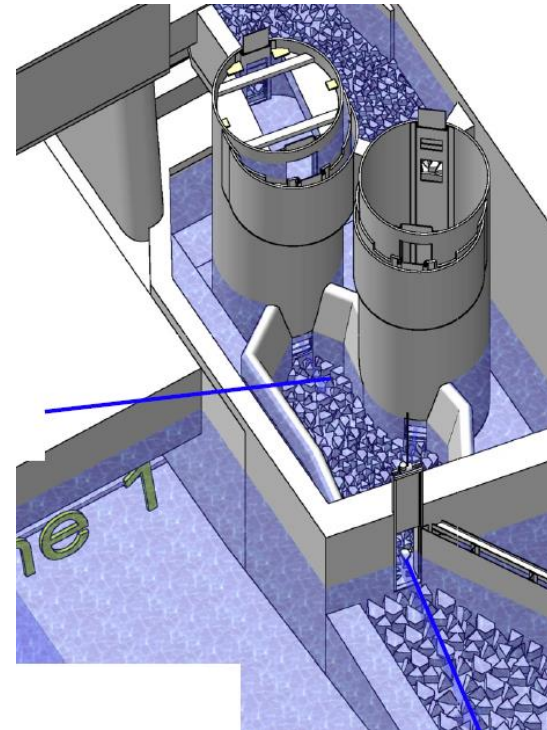
numerical

Example: Prechamber design

3D-hydrodynamic numerical model



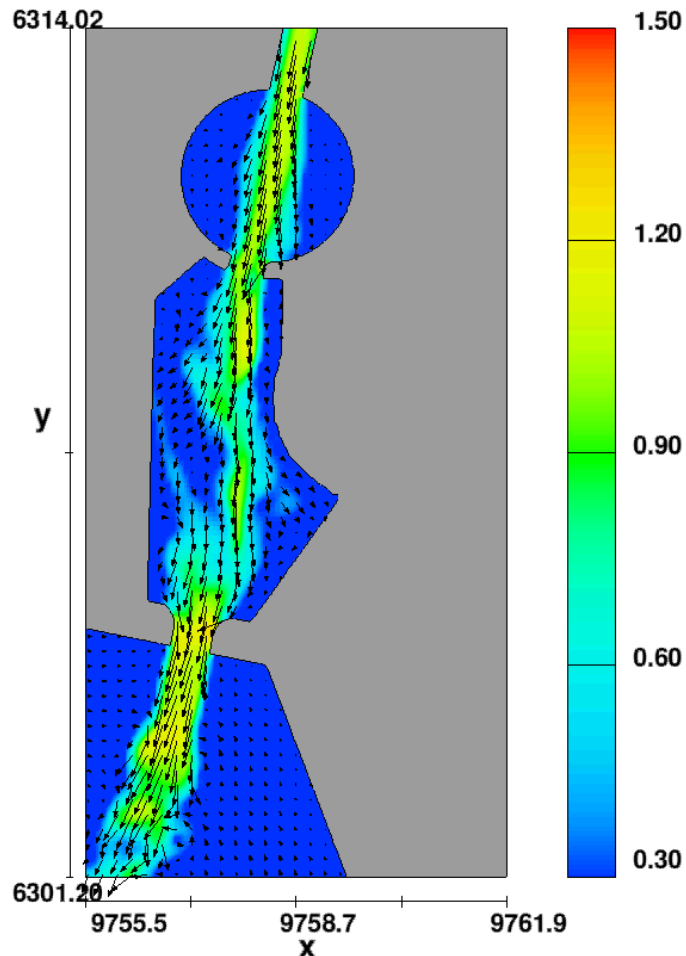
> 50 simulations



numerical

Example: Prechamber design

3D- numerical model, LES



Physical model, scale 1:3

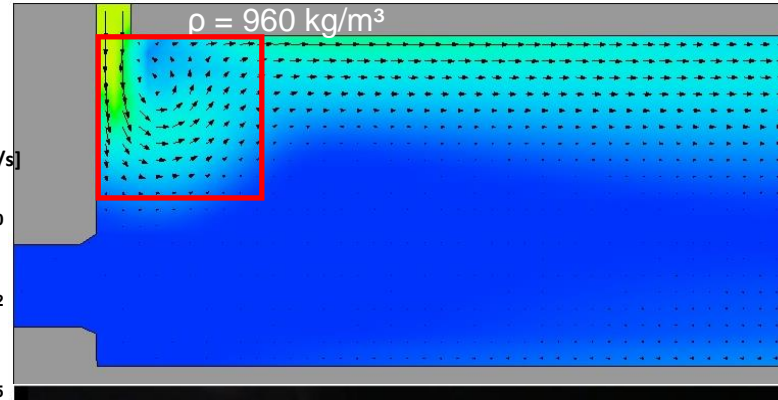
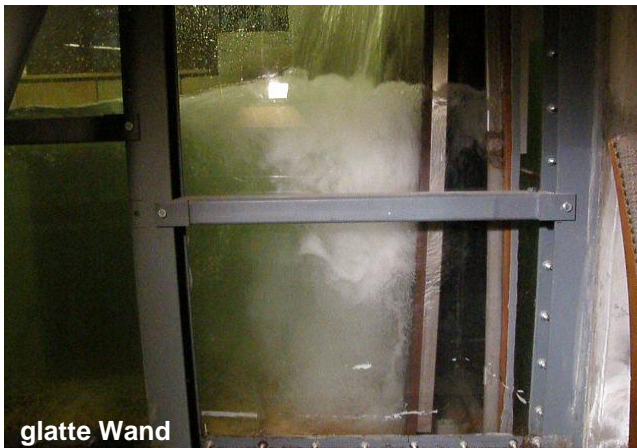
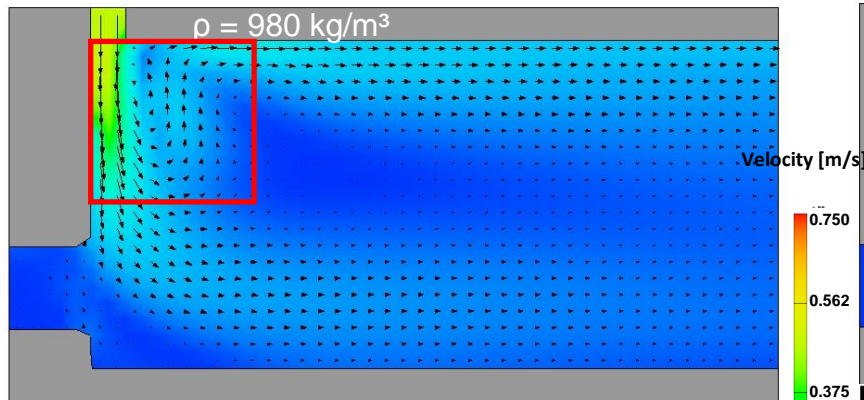


numerical

physical

Example: Prechamber design, additional dotation

- 3D- numerical model and physical model scale 1:1,7



numerical

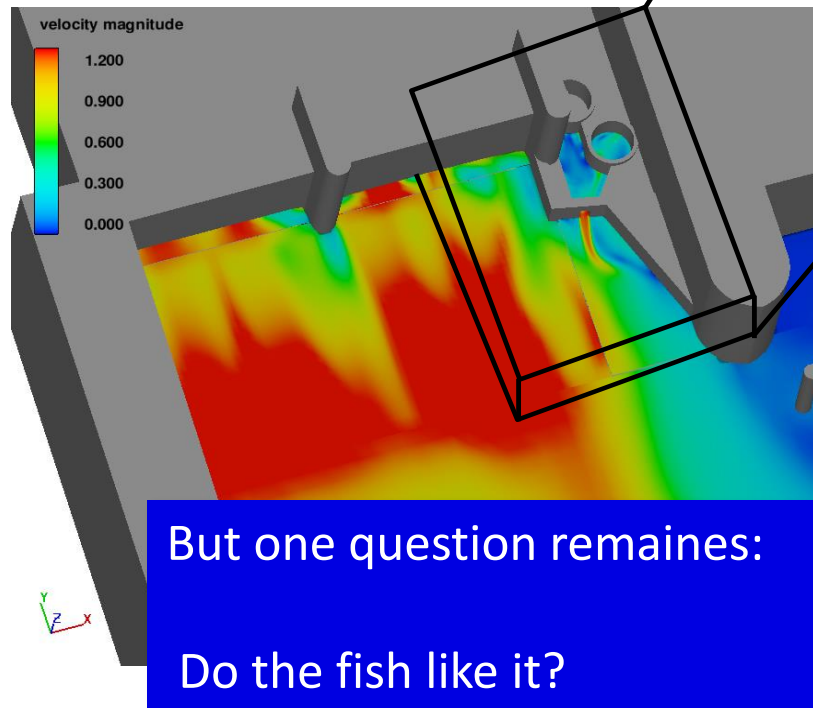
physical

ethohyd.

Additional ethohydraulic test for the dotation, scale 1 : 1,7

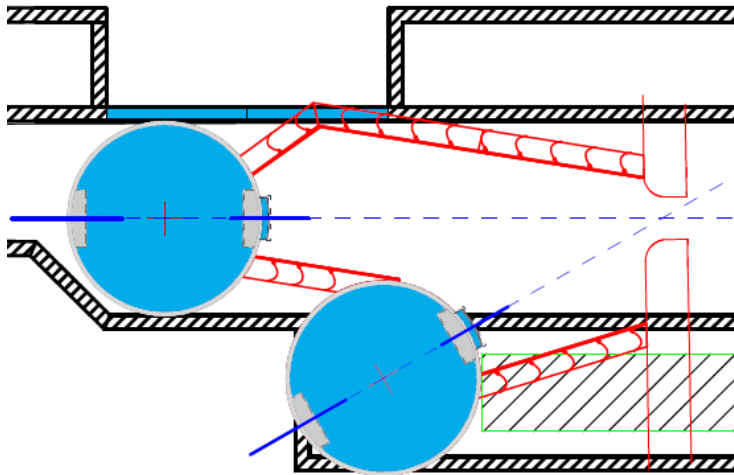
Result of the model study

- Based on the results of the physical and numerical models the hydraulic situation, the attractiveness and the passability of the fish-lift was evaluated positive!



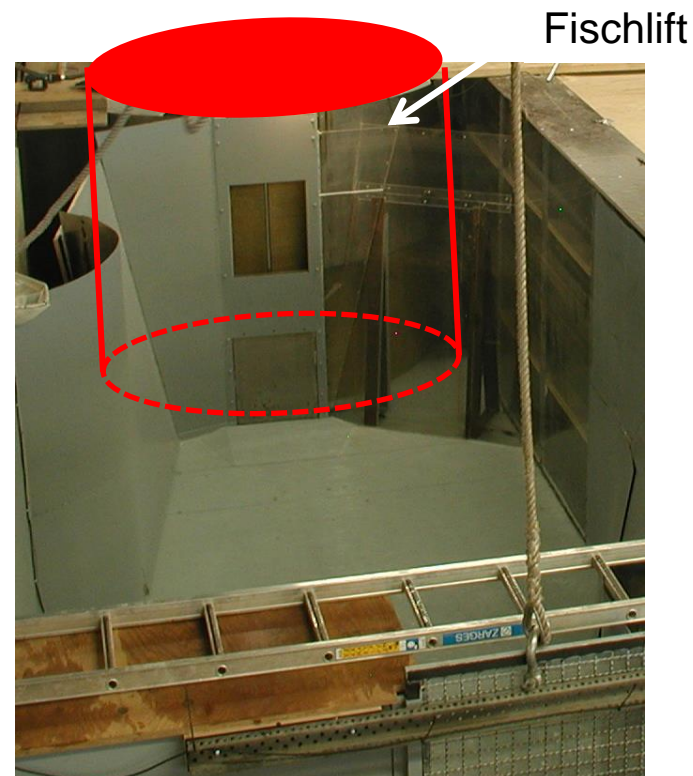
Let's ask the fish: Ethohydraulic test

■ Setup scale 1:1



■ Ethohydraulic flume at KIT

- Length: 20 m
- Width: 2,7 m
- Depth: 2,0 m



ethohyd.

Ethohydraulic test



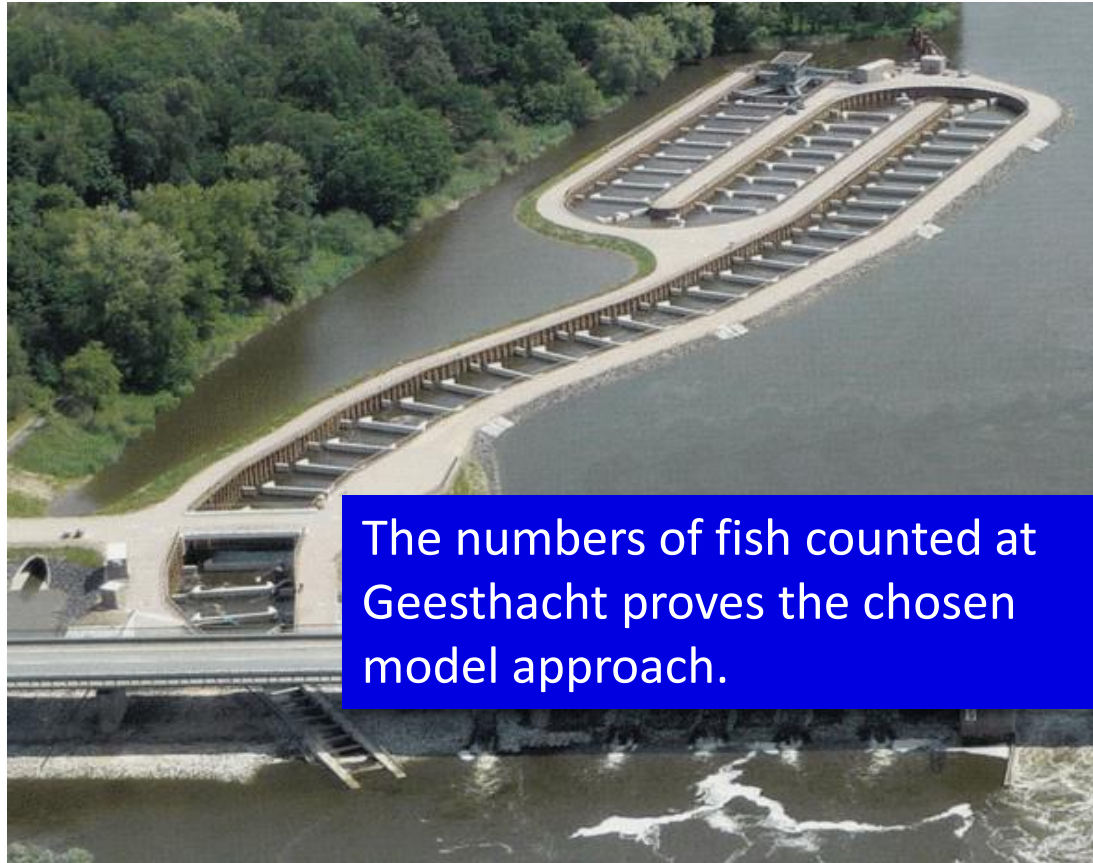
<i>Art</i>	<i>Einstieg</i>	<i>Ausstieg</i>
Aal (inkl. Steigal)	+	+
Barbe	+	+
Barsch	+	+
Brassen	+	+
Döbel	+	+
Elritze	+	+
Forelle (Bach-/Seeforellen)	+	+
Gründling	+	+
Hasel	+	+
Hecht	+	+
Karpfen	+	+
Quappe	+	+
Rotaugen	+	+
Ukelei	+	+
Zander	+	+
Anzahl Versuche	35	40

- > 800 individuals from 15 fish species
- > 80 setups

In addition to the model study, the functionality of the fish lift was proven within the ethohydraulic test.

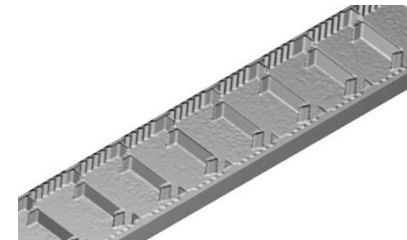
- 2015: Test for downstream passage
- 2016: Construction

Case Study 2: Fischway Weir Geesthacht



The numbers of fish counted at Geesthacht proves the chosen model approach.

- Study at KIT: 2008-2009
- Construction 2010

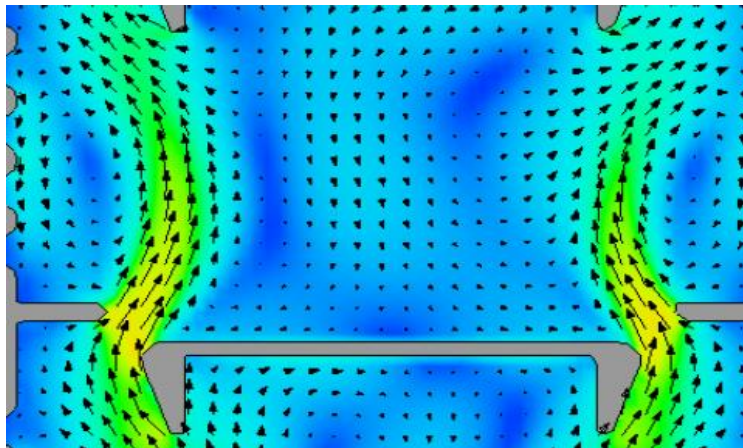
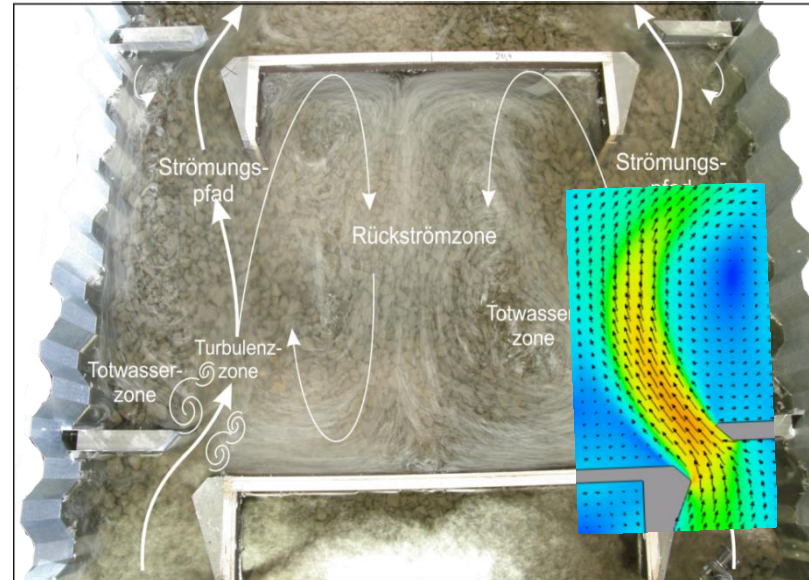


numerical

physical

ethohyd.

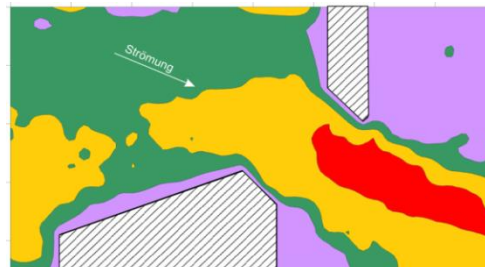
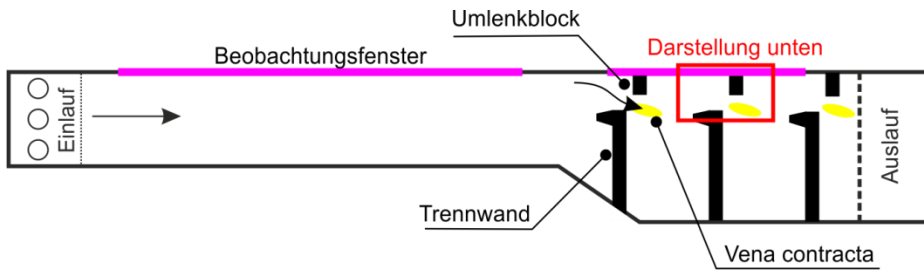
Flow field of the fish way Geesthacht



numerical

physical

Example: Ethohydraulic test for the slot passage



ethohyd.

Conclusions

- Today, it is possible to utilize available tools in the planning phase to increase the quality of fish passages.
- This is of particular importance for special designs and non-standard solutions.
- We can extract way more than just the mean velocity out of the numerical and physical models, therefore we need to know more about the interaction between the fish and the hydraulics and fish-relevant hydraulic parameters e.g. turbulence, eddy size etc.
- Ethohydraulics is a good way to support engineerical problems and to learn more about the interaction between the flow field and fish behavior.

