Jun 19th, 2:10 PM - 2:30 PM

Evaluation of fishway design for German Federal Waterways by means of fish studies

Gerrit Fiedler  
*Federal Waterways Engineering and Research Institute*

Martin Henning  
*Federal Waterways Engineering and Research Institute*

Jennifer Wey  
*Federal Institute of Hydrology*

Cornelia Schütz  
*Federal Institute of Hydrology*

Follow this and additional works at: [http://scholarworks.umass.edu/fishpassage_conference](http://scholarworks.umass.edu/fishpassage_conference)

Fiedler, Gerrit; Henning, Martin; Wey, Jennifer; and Schütz, Cornelia, "Evaluation of fishway design for German Federal Waterways by means of fish studies" (2017). *International Conference on Engineering and Ecohydrology for Fish Passage*. 19.

[http://scholarworks.umass.edu/fishpassage_conference/2017/June19/19](http://scholarworks.umass.edu/fishpassage_conference/2017/June19/19)
Evaluation of fishway design for German Federal Waterways by means of fish studies

GERRIT FIEDLER, MARTIN HENNING
Federal Waterways Engineering and Research Institute (BAW), Karlsruhe

JENNIFER WEY, CORNELIA SCHÜTZ
Federal Institute of Hydrology (BfG), Koblenz

Fish Passage Conference, Corvallis (OR), USA, 19.06.2017
In my presentation, I want to deliver insights into:

- the designing process of pilot sites
- component optimisation by means of fish studies
- hydraulic models for attraction/auxiliary flow

brief overview of our actual work and challenges
optimisation of pilot site

IN: research question (attraction flow, position of entrance, passability)

head water
hydro electric power plant
weir
auxiliary water
out: design recommendations

attraction flow

fish pass

PILOT SITE

tail water
optimisation of pilot site

IN: research question (attraction flow, position of entrance, passability)

PILOT SITE

head water

hydro electric power plant

weir

tail water

attraction flow

auxiliary water

fish pass

OUT: design recommendations

optimisation of components by means of fish studies in a flume
Fish lab studies: fish test station

**observation area:**
- handwritten protocols
- time measurement
- cameras for fish tracks

**fish care:**
- 5 basins
- connected to isolated circulation system

**flume:**
- $Q = 1 \text{ m}^3/\text{s}$
- $W = 2.5 \text{ m}$
- $L = 60 \text{ m}$
- $D = 1.0 \text{ m}$
- isolated recirculation system
Fish lab studies: experiment set up

Experiment set up: Optimisation of the inflow of auxiliary water
Fish lab studies: experiment set up

Experiment set up for: **Optimisation of the entrance flow velocity**
optimisation of pilot site

IN: research question (attraction flow, position of entrance, passability)

PILOT SITE

head water
hydro electric power plant
auxiliary water
fish pass
weir

OUT: design recommendations

tail water
tailwater – attraction flow field
Pilot site studies: preliminary CFD studies

**CFD-studies: How to optimise attraction flow investigation**

- Calibrate with help of field measurements
- Find scenarios for attraction-flow investigation
- Interpretation of flow fields regarding swimming performance
- Scenarios should be different enough to expect a considerable effect on fish numbers

![Diagram showing attraction flow](image-url)
Pilot site studies: preliminary CFD studies

CFD-studies: How to optimise attraction flow investigation

Challenges regarding attraction flow studies:

- large range of flow rates necessary
  - Large entrance pool
- How to ensure a comparable situation between different scenarios?
optimisation of pilot site

IN: research question (attraction flow, position of entrance, passability)

Scale model of auxiliary water systems

OUT: design recommendations
Scale models of auxiliary water systems

Research question: How to discharge auxiliary water inside the entrance basin

1) energy dissipation

2) flow expansion

drop shaft in scale model

devices for flow expansion
optimisation of pilot site

Challenges for realisation of pilot sites:
- to design experiments regarding the interaction of fish and hydraulics (flow interpretation)
- to design fish studies in respect of statistic (variation studies, boundary conditions)
- CFD calibration of draft tubes-tailwater-flow fields (swirling jets)
- definition and evaluation of investigation scenarios difficult
- methods of fish counting are challenging (next talk)
- Auxiliary water discharge inside of entrance basin
- ...

IN: research question (attraction flow, position of entrance, passability)

OUT: design recommendations

We would be happy to get in contact with other researchers who have to deal with comparable problems.
Thanks!

Joint project
"ecological connectivity"

of Federal Institute of Hydrology and
Federal Waterways Engineering and Research Institute