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Session B6: The Baffle-Brush-Fishpass - A New Concept for Non-Selective Fishpasses

Reinhard Hassinger

University of Kassel, Dept. of Civil and Environmental Engineering

Werapol Bejranonda

University of Kassel, Dept. of Civil and Environmental Engineering

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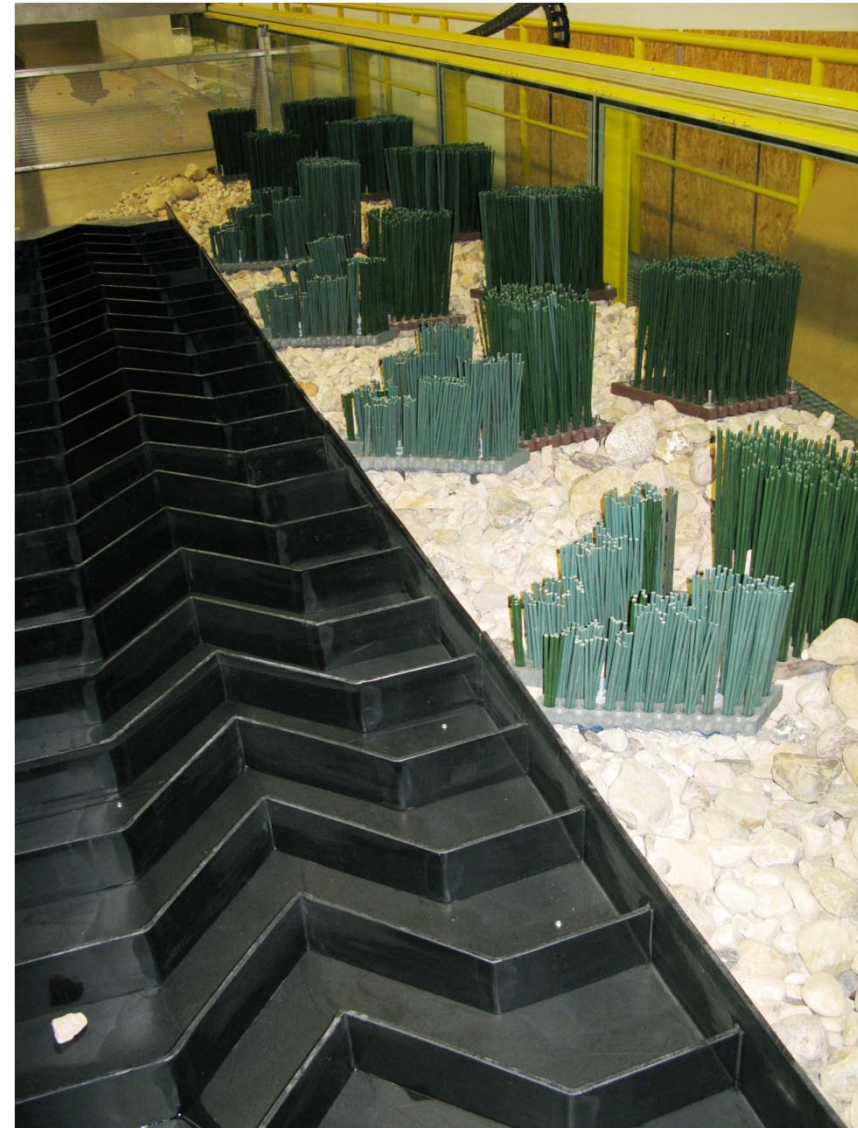
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The Baffle-Brush Fish Pass – a New Concept for Non-selective Fish Passes

Dr.-Ing. Reinhard Hassinger
Hydraulics Laboratory and
Testing Facilities
University of Kassel, Germany

- Concept/Basic idea
- Lab version of BBF
- Design Principles
- Characteristics and features



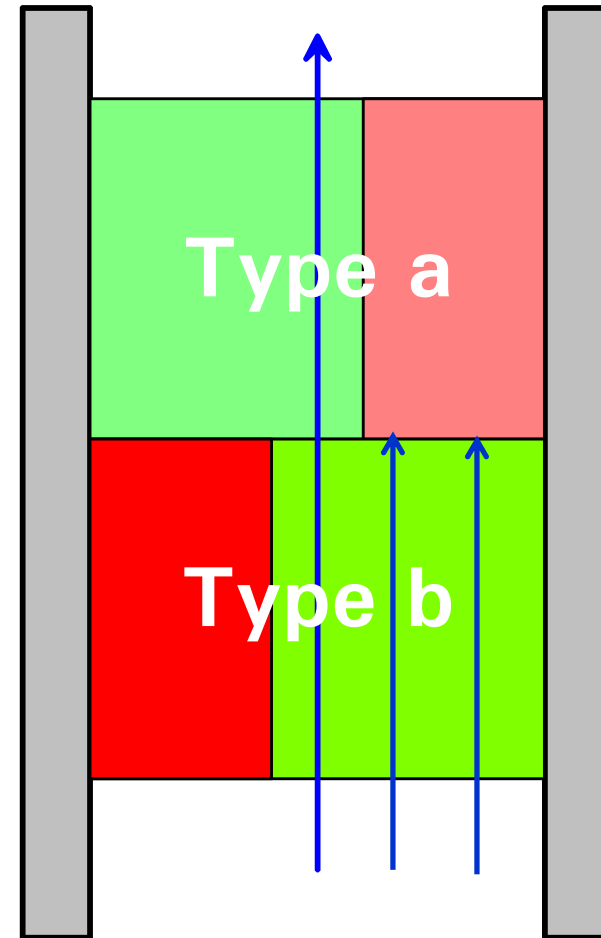
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Combining Fish Pass Types in Series

It's a common sense, that it is **not advisable** to arrange **different types** of fish passes **in series**.

Why? The **disadvantages sum** up and the **advantages are reduced** to the **intersecting set**.

The result is a **high selectivity** and a **bad performance**.



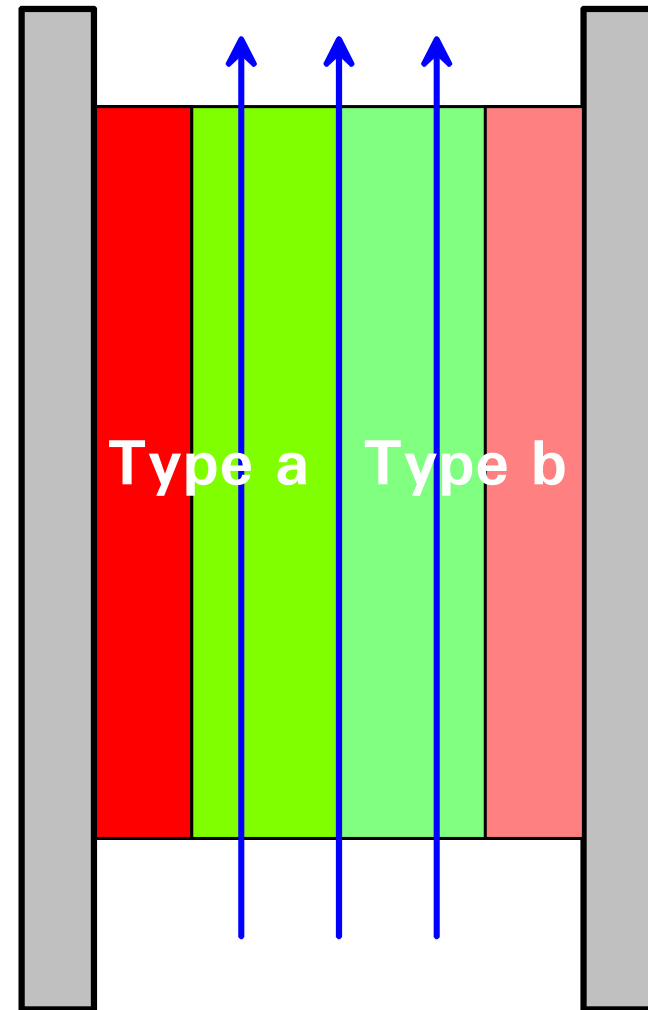
Combined Fisch Pass Types side by side (parallel)

If we do it the opposite way – i.e. arrange different fish pass types in **parallel** - we should get the opposite effect: The **advantages add** and the **disadvantages** are reduced to the **intersecting set**.

Why? The fish suffering from the disadvantages of type „a“ can **seek** for a **better corridor** in type „b“.

So, if we juxtapose different types of fish passes with extremely different hydraulic features only **few common disadvantages** are left.

The result is a **low** or almost **non-selective** fish pass.



Superactive Baffle Fish Pass (after Larinier)

If we look at the hydraulically challenging edge of the spectrum we find the superactive baffle type.

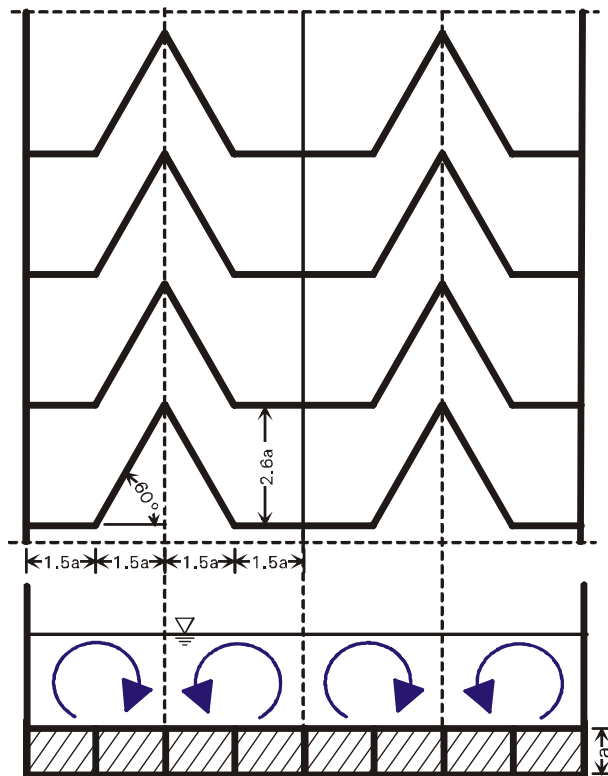
This type exposes a high efficiency in terms of hydraulic friction due to a strong turbulence generation.



Cc: ian.oates675@btinternet.com

Flow Characteristics of Superactive Baffles

- The flow field is characterized by 2 rotating vortices with a slope-parallel axis.
- The flow accelerated in the centre of the baffle unit is going down, is decelerated between the baffles and comes up with small longitudinal velocities.



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Superactive Baffle Fish Pass in Operation

- This intensive energy dissipation enables a steep slope of 10 to 15 %.
- The main advantage is strong attraction flow for salmonids.
- Many disadvantages for small and weak fish, elvers and lampreys.

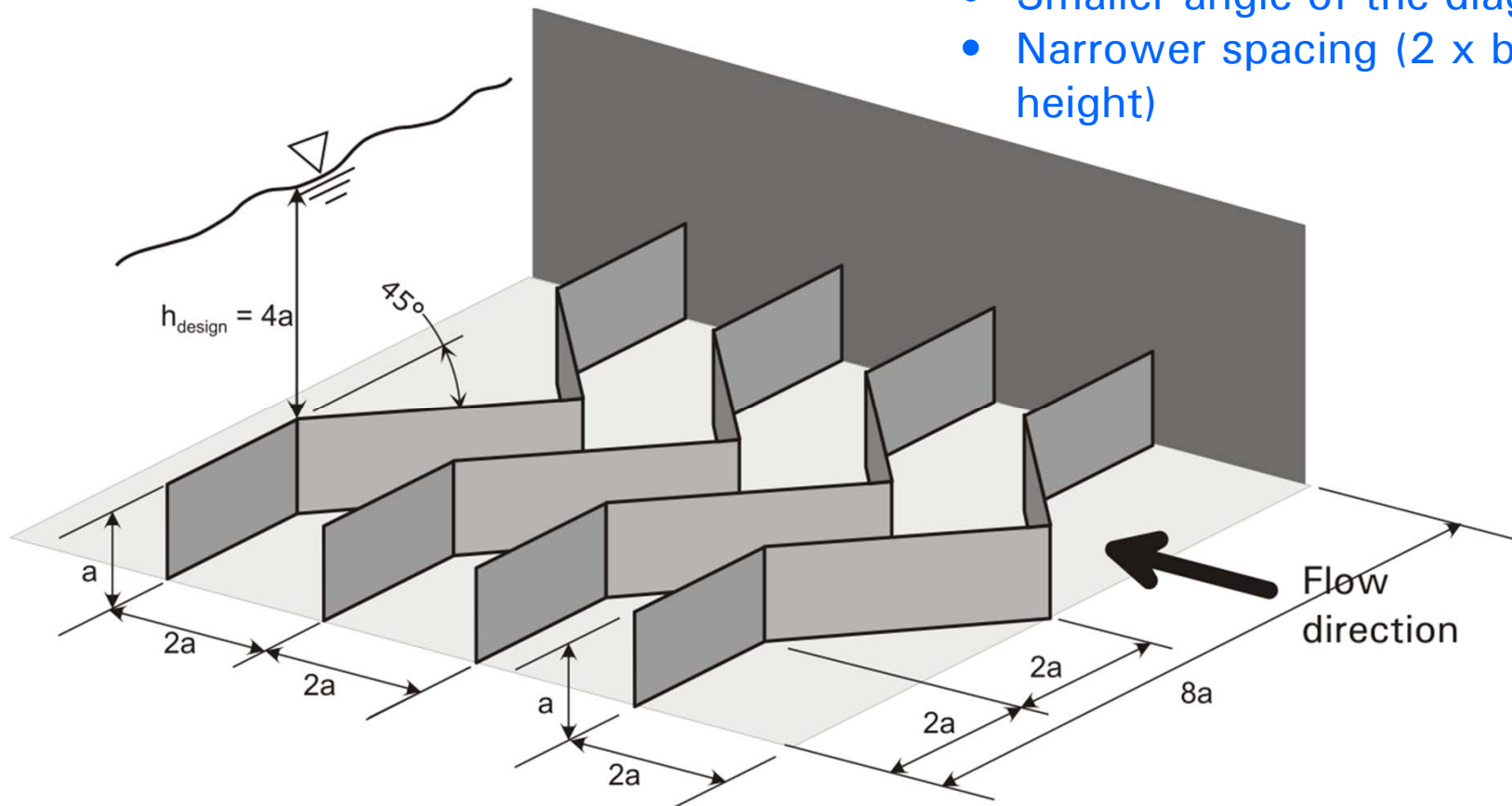


Modified Baffle Geometry

For combination with other types we have to reduce the slope and thus we modified the geometry a little bit for convenience.

Slope: 4 – 6 %

- Smaller angle of the diagonal leg
- Narrower spacing (2 x baffle height)



The Brush-type Fishway

- The other end of the spectrum is marked by the brush-type fish pass, as we have learned by several projects in Germany.
- We know, that large numbers of fish use this type.
- From a site on river Havel in Fuerstenberg north of Berlin we found 14200 fishes in less than 1 month.
- The reason is the good suitability for young, small and weak fish as well as for elvers and lampreys
- The size range of the fishes started at 4 cm and was probably down-limited by the trap mesh size.

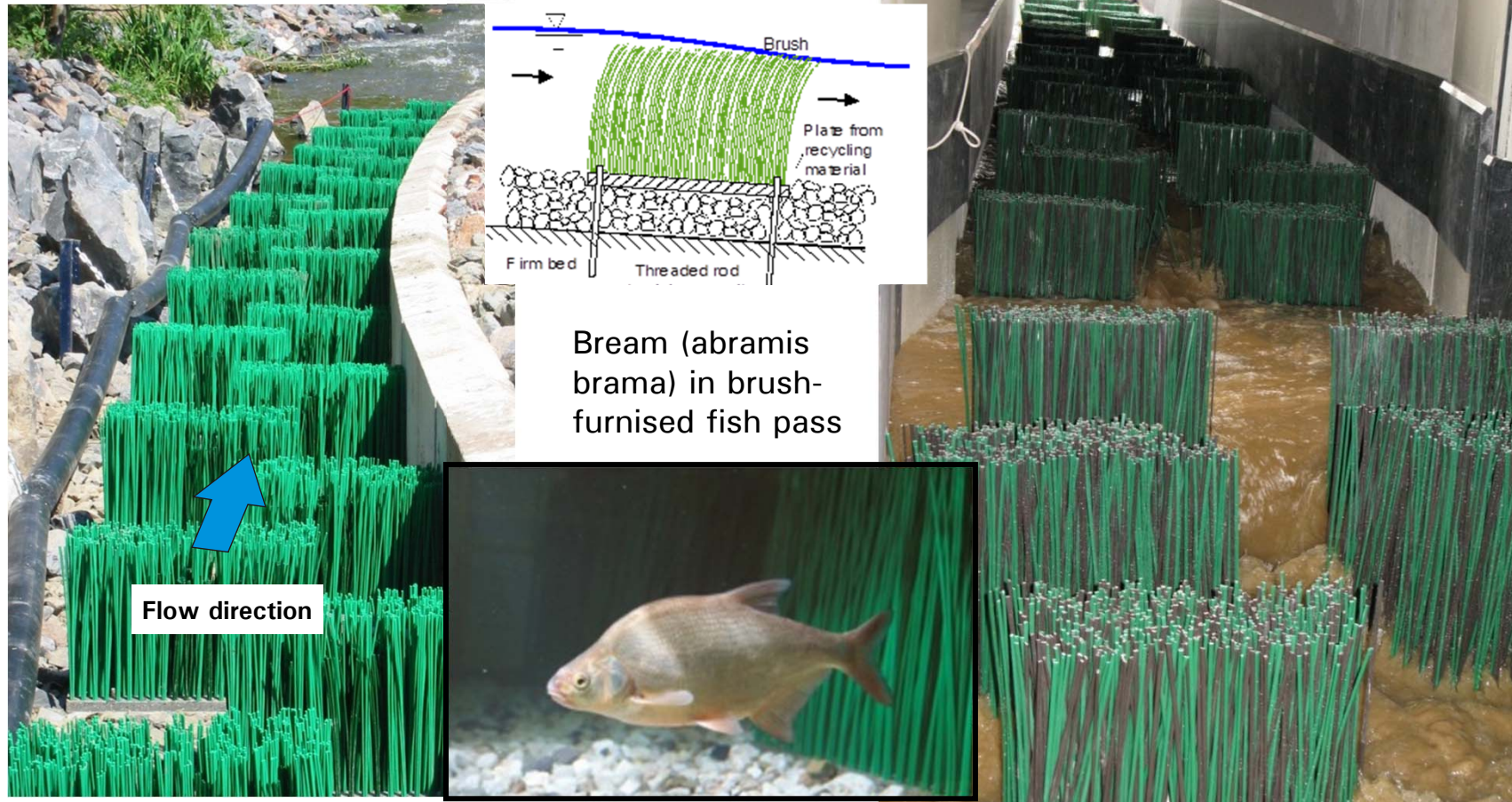
Conclusion:

The brush-type fishway should be a good partner for a combination with the baffle-type fish pass.

Brush-type Fish Pass (BFP)

Combined block ramp and brush-furnished fish pass in Hann. Muenden/river Fulda, Germany

Brush-type canoe fish pass in Fuerstenberg, river Havel, Germany



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Brush-type as Canoe-Fish-Pass

Combined block ramp and canoe-fish pass in Hann. Muenden/river Fulda, Germany



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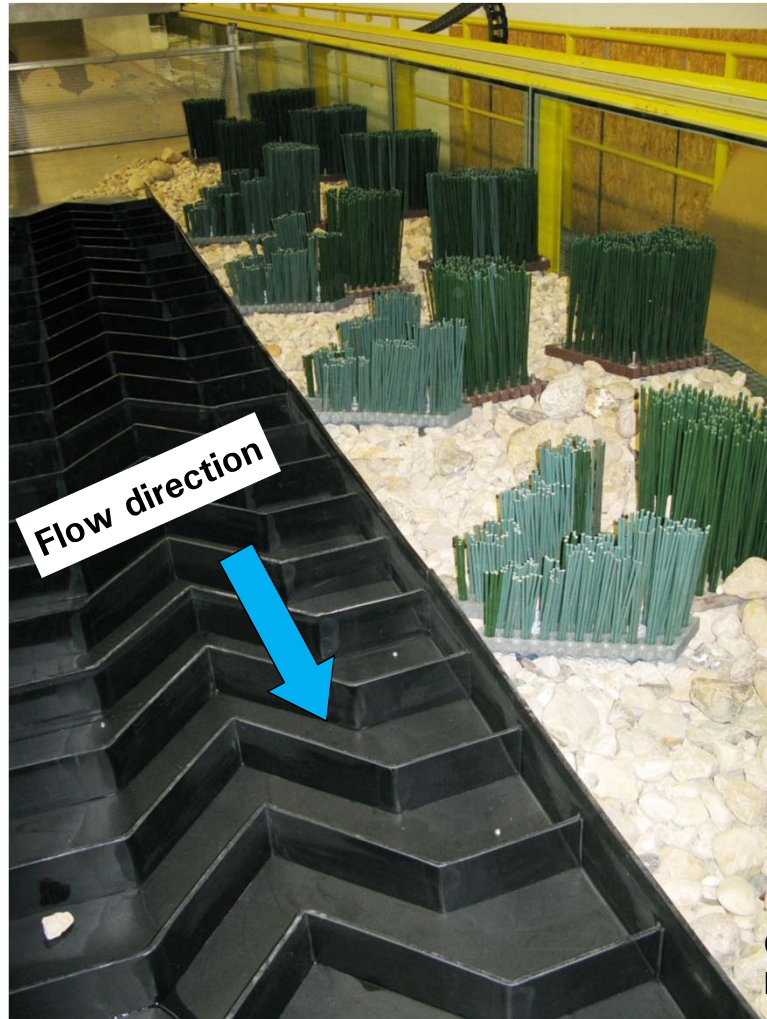
Canoe fishpass in Fuerstenberg, river Havel, Germany



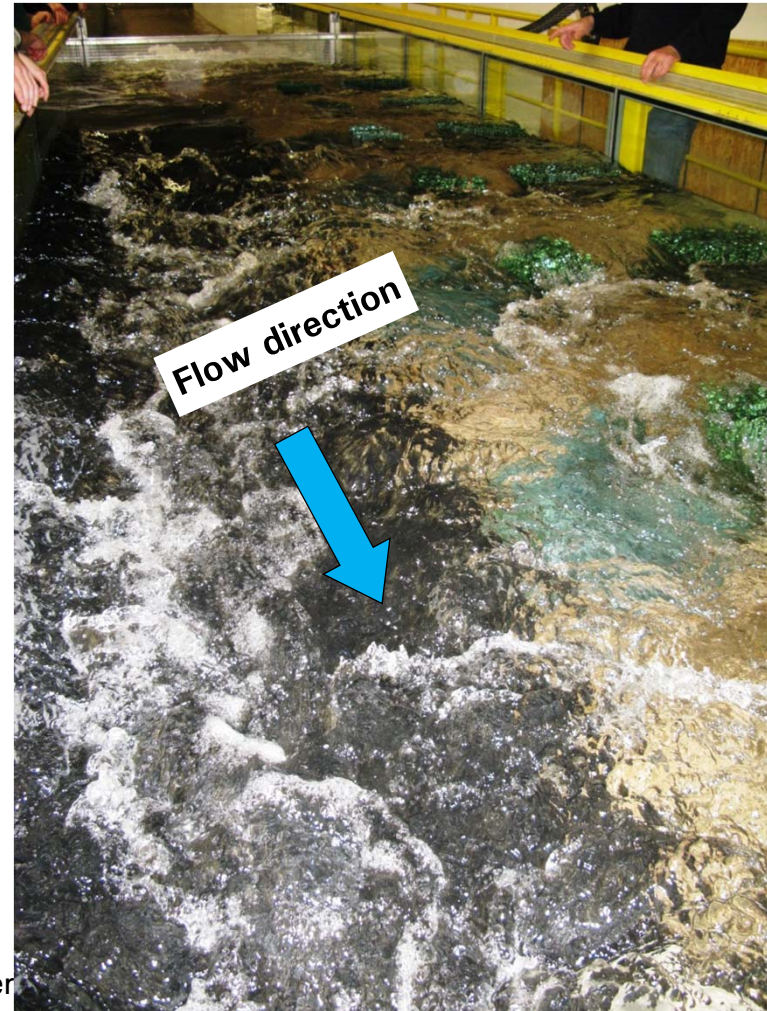
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First Laboratory Version of Baffle-Brush Fish Pass

dry



with water (depth = 36 cm)

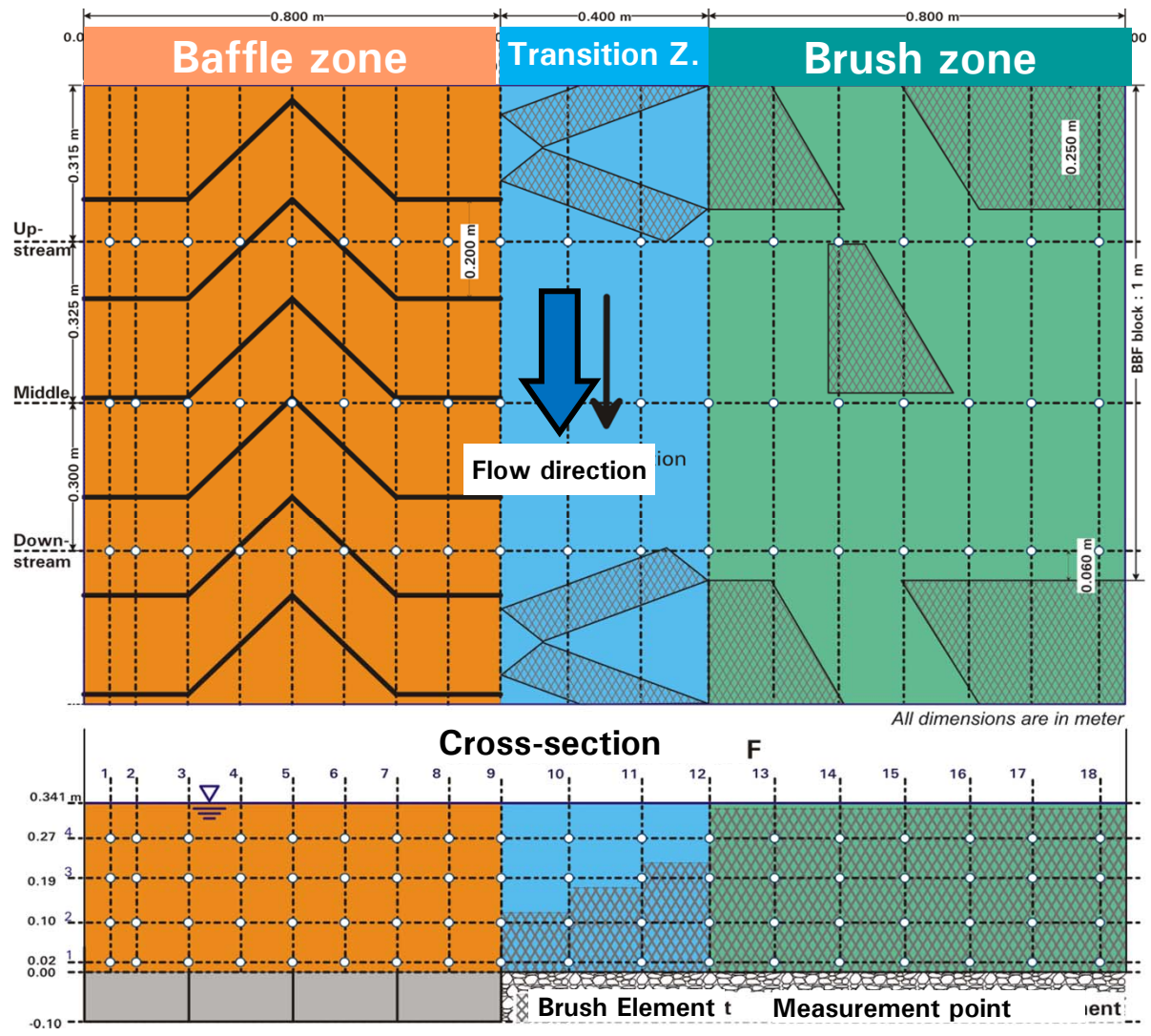


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BBF in Laboratory



Baffle-brush Fishway (BBF) in Lab



Characteristics

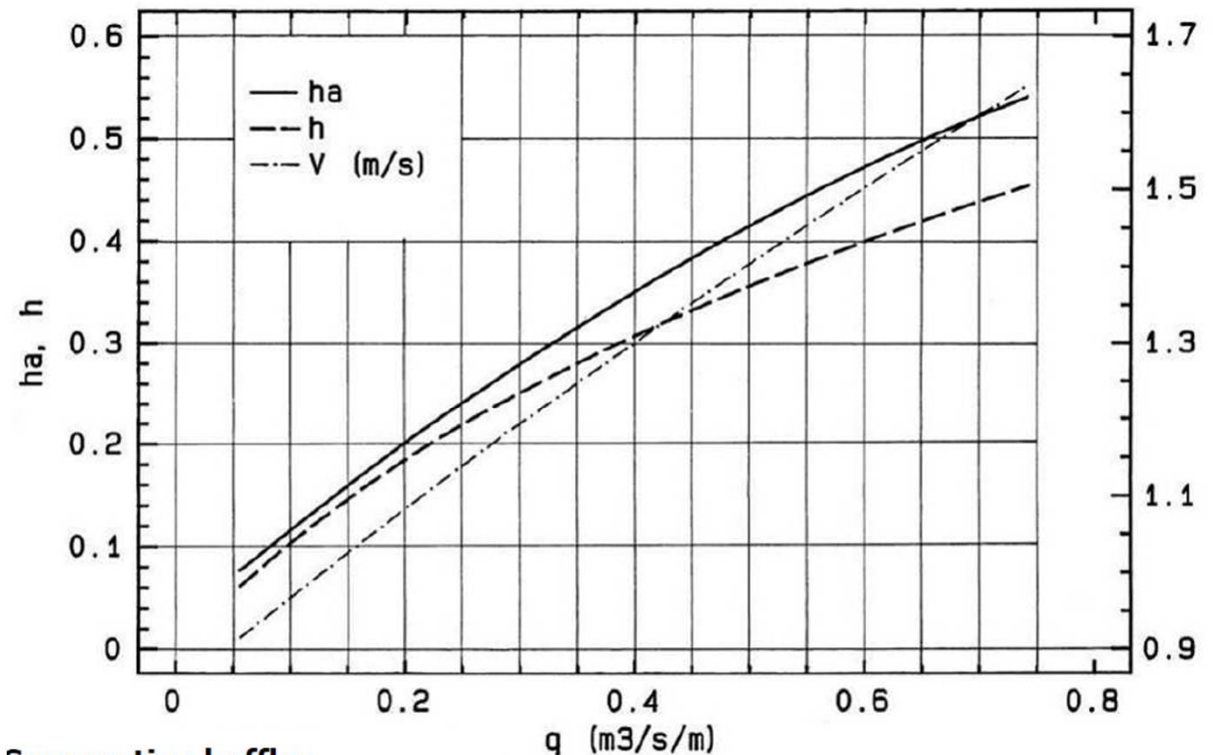
- High turbulent flow in the baffle zone
- Low-velocity flow field in the brush zone
- Transition zone with increasing bristle length

Baffle-, Brush-type and Combined Fish Passes: Ads & Cons

Type	Advantages	Disadvantages	Provides migration for
Brush-furnished Fish Pass (BFP)	<ul style="list-style-type: none"> • Natural bed material • Low velocities • Many structures • Combined use 	<ul style="list-style-type: none"> • limited space for large fish? • Weak attractive current (for salmonids) 	Weak-swimming fish, small fish, elvers, lampreys and macrozoobenthos
Superactive Baffle Fishway	<ul style="list-style-type: none"> • Attractive current for large fish • No pools needed (pools boost the cost) 	<ul style="list-style-type: none"> • Highly selective • Little migration possibilities for small and weak fish • No substrate for macrozoobenthos 	Strong and large fish (salmonids)
Baffle-brush fishway (BBF)	<ul style="list-style-type: none"> • Non-selective fishway • Several migration corridors with different hydraulic characteristics • Continuous migration corridors 	<ul style="list-style-type: none"> • Required space • High discharge (from 400 l/s) • Possibly limited function for very large catfish and carps 	Wide range of fish including elvers , lamprey and macrozoobenthos

Hydraulic Design of Baffle – Brush Fish Passes

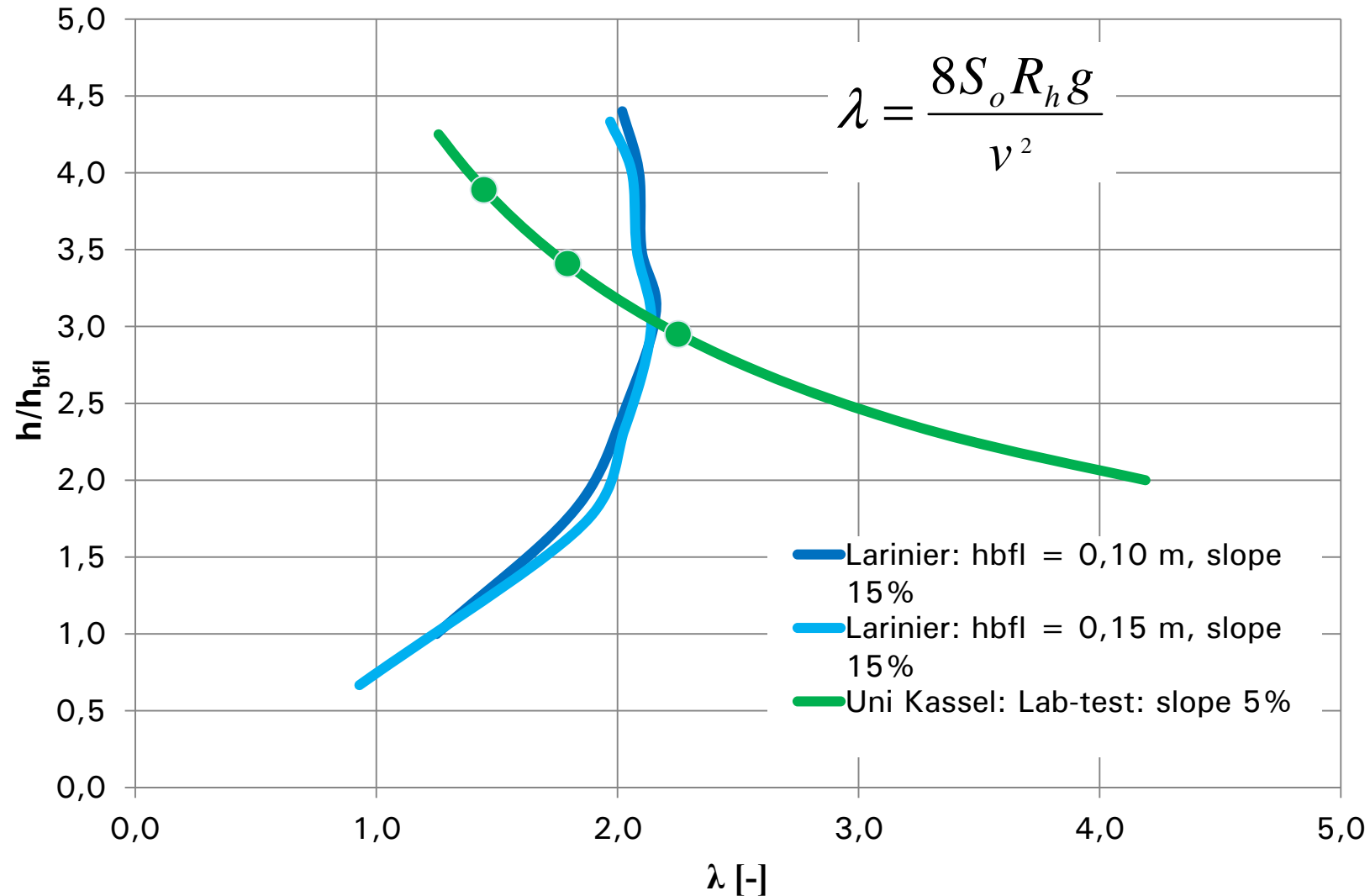
- The hydraulic design is done separately for the baffle and the brush band.
- For the design of the brush pass a spreadsheet is available on our website.
- For the baffles design information might be given in the Fish Pass Manual of the Environment Agency (excerpt from a publication of M. Larinier)



Superactive baffles
Slope = 15% a=0.10m

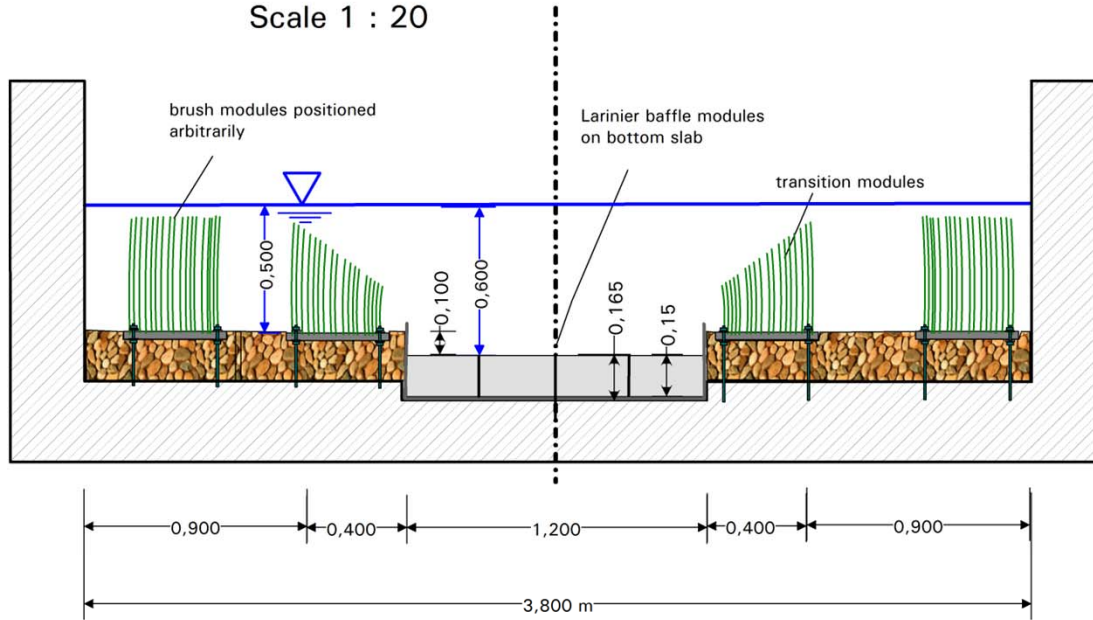
Source: Environment Agency Fish Pass Manual,
Fig. 31, p. 120

Comparison of Friction Factors for Baffle Zone Flow

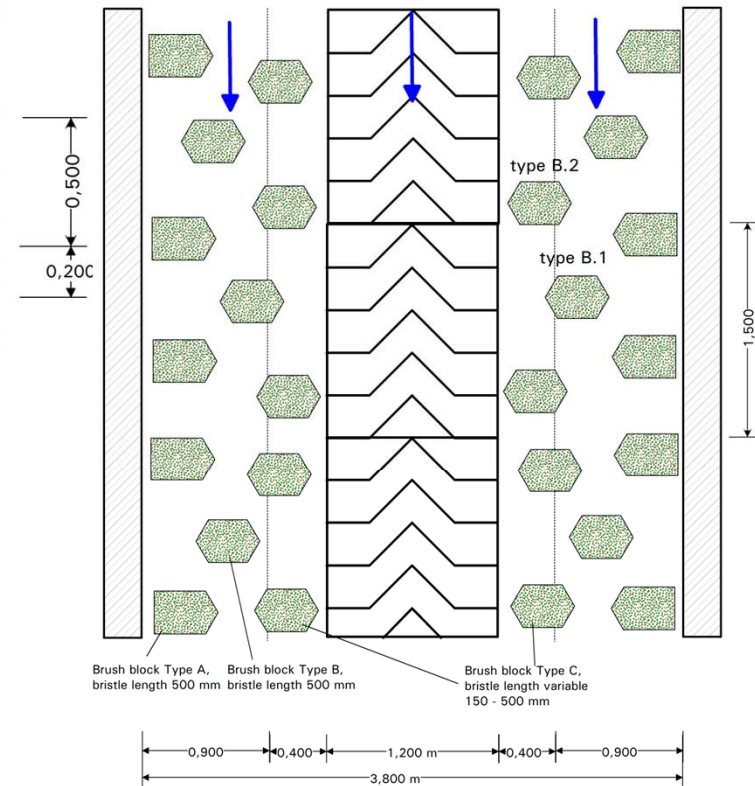


Pilot Project Sandford-on-Thames in UK

Cross Section Concrete Channel
 $b = 3800 \text{ mm}$; $Q = 1538 \text{ l/s}$
 Scale 1 : 20



Plan view Sc. 1 : 25
 $b = 3800 \text{ mm}$; $Q = 1538 \text{ l/s}$



Technical Data:

Discharge: approx. 1500 – 1600 l/s

Width: 3.80 m (0.90/0.40/1.20/0.40/0.90)

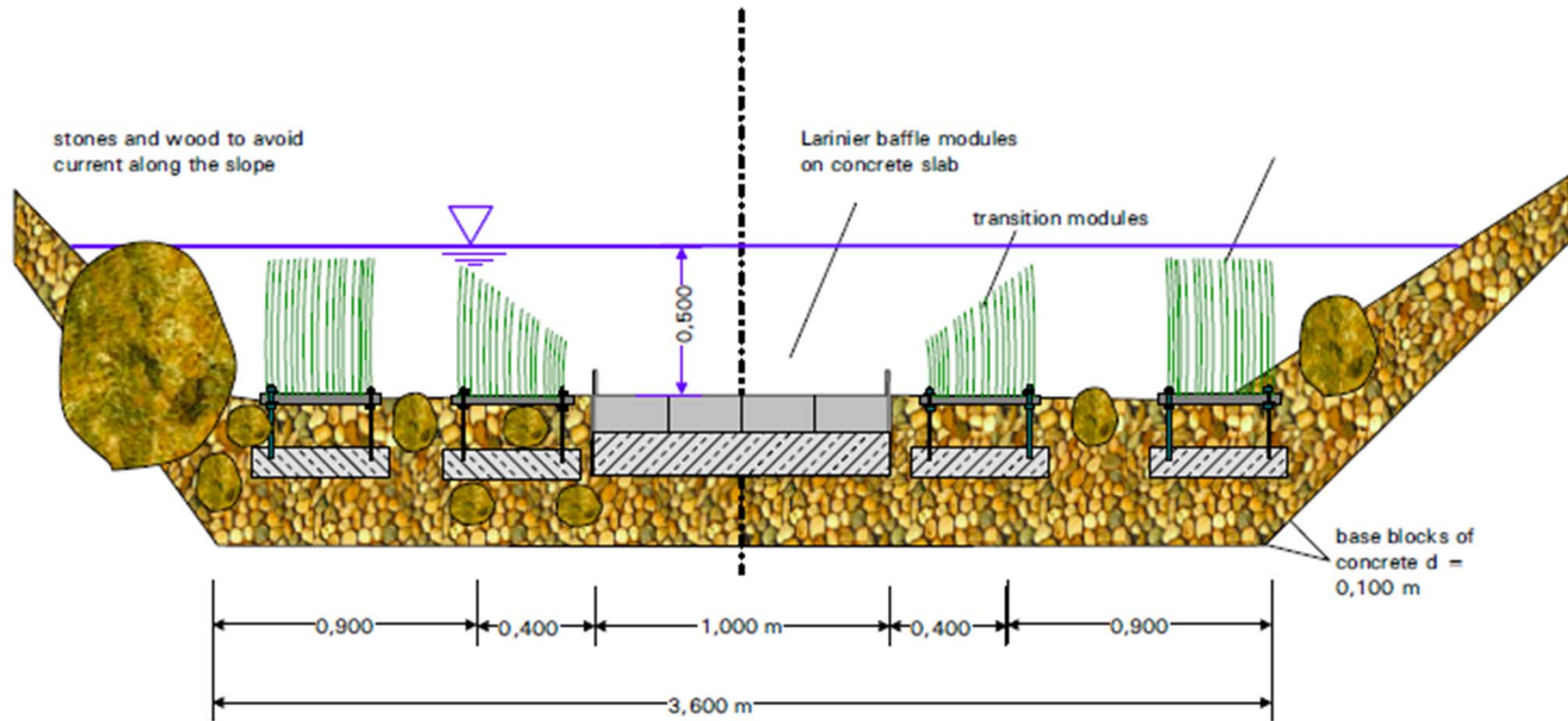
Slope: 5%

Water depth baffles: 0.60 m

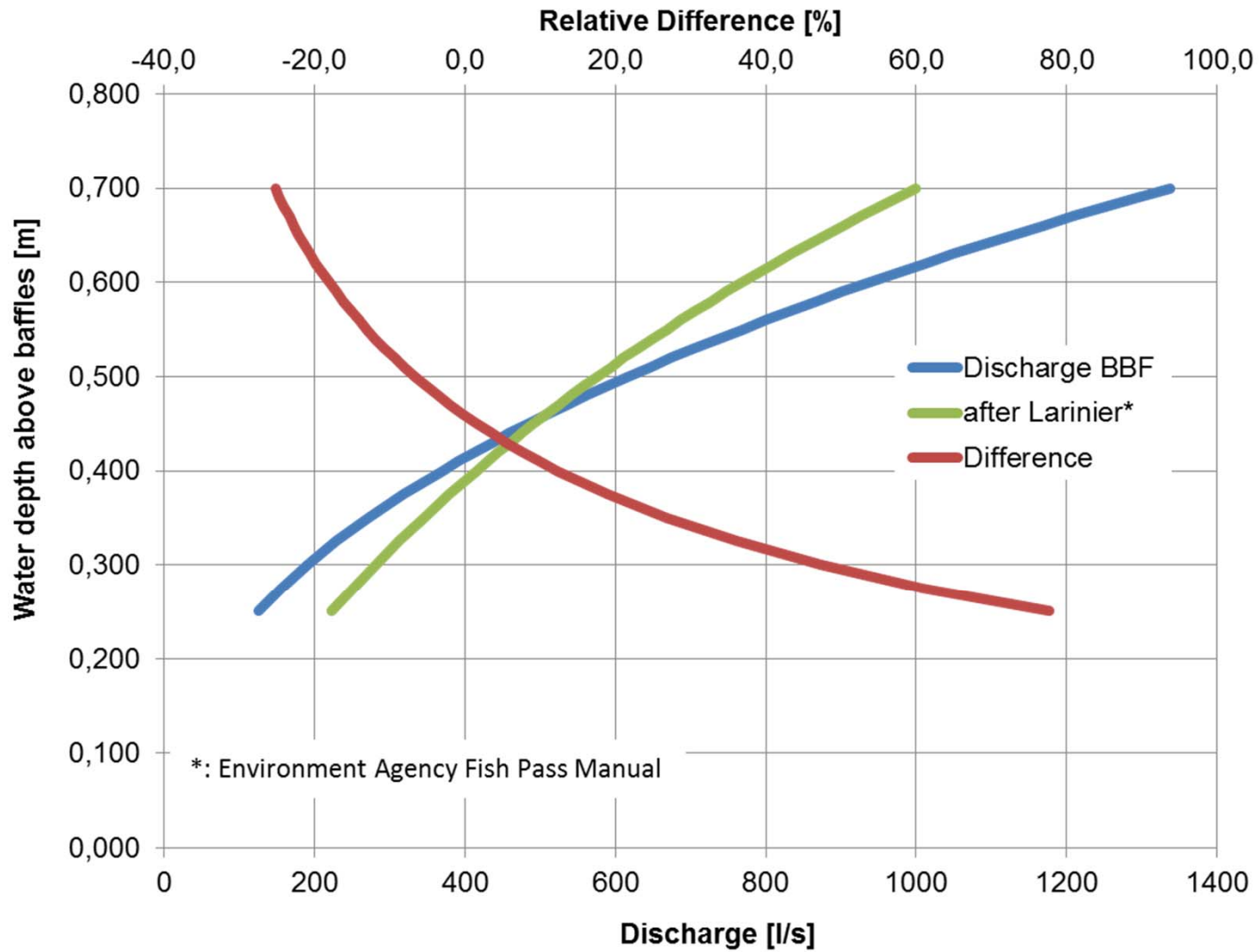
Water depth brushes: 0.50 m

Nature-like Cross-Section of Baffle-Brush Fish Pass

Cross Section Natural-type Construction
Scale 1 : 20



Fish Pass Sandford-on-Thames
 Rating Curve Baffles; Slope 5%, 1,20 m wide
 total width 3,80 m



Summary

- The Baffle-Brush-Fish Pass is a **new combination** of a modified **superactive baffle-type** and **brush-type fish pass**.
- A wide spectrum of different flow characteristics is provided by juxtaposing these types with a slope of approx. 5%.
- There are **several migration corridors** with different hydraulic conditions and they **continue** through **the complete fish** pass.
- **No obstructions** and **no narrow sections**
- The cleverness of the fish is used to seek the convenient corridors and to avoid zones not suitable for their migration preferences.
- The brush part with a gravel bed and a variety of structures is extraordinary suitable for elvers, lampreys and macroinvertebrates.

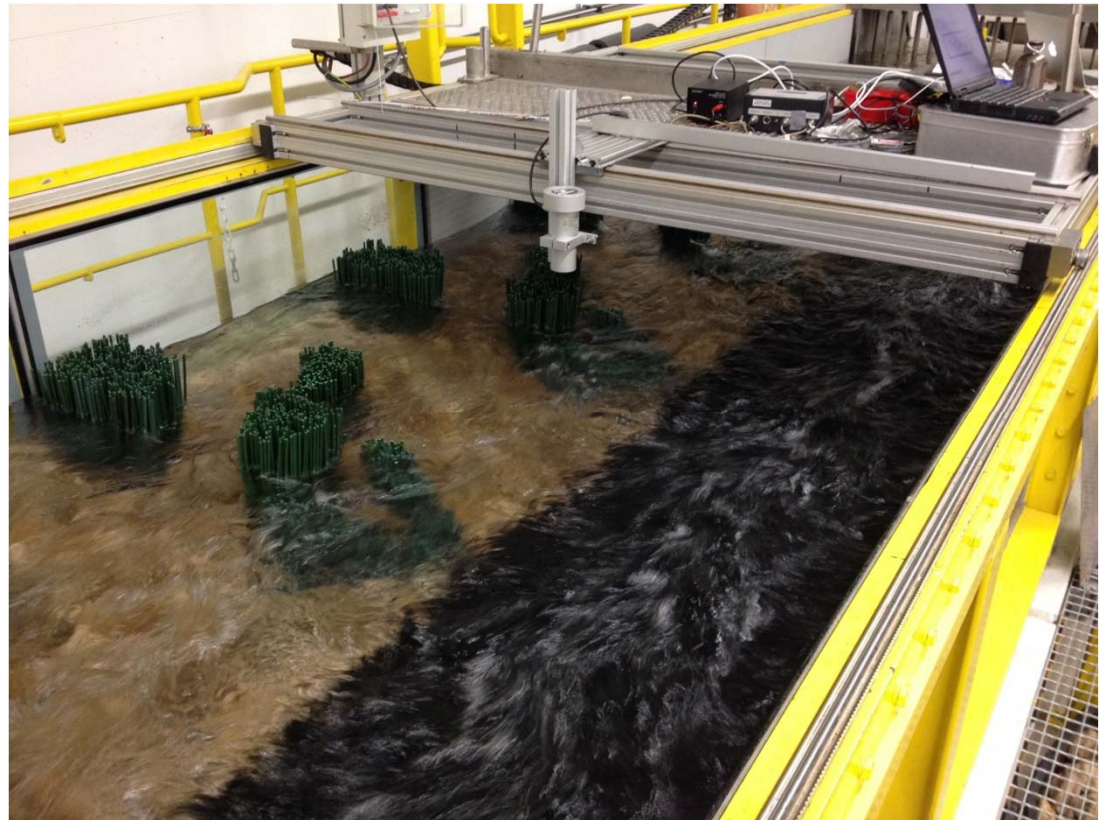
Thank you!

Author:

Dr.-Ing. Reinhard Hassinger,
University of Kassel

eMail: vpuw@uni-kassel.de

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