

# Effects of hydro power plants on river fish



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- 23.000 hydro power installations in European Union\*  
(based on 630.000 km total river length - one per 27 km)
- 7.400 of them in Germany



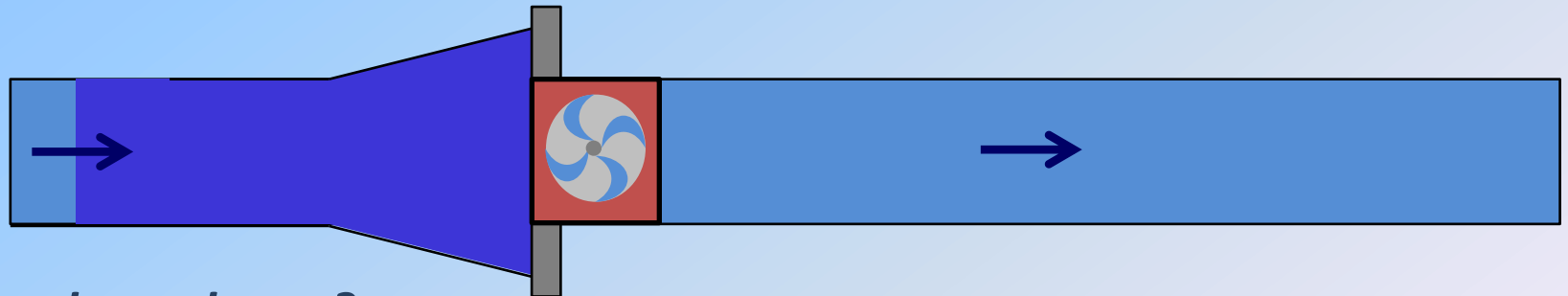
Hydro power installations are generally associated with  
river transformations

# ▶ “Local” effects of hydro power plants

## 1. DAMMING - BACKWATER



“Lake-like” conditions



*What do we know?*

Backwater proportion  $< \frac{1}{4}$  -  $\frac{1}{3}$  precondition for good ecological status

*Solution*

Limiting backwater proportion

# ▶ “Local” effects of hydro power plants

## 2. DOWNSTREAM REACH

Water from “lake-like”  
backwater



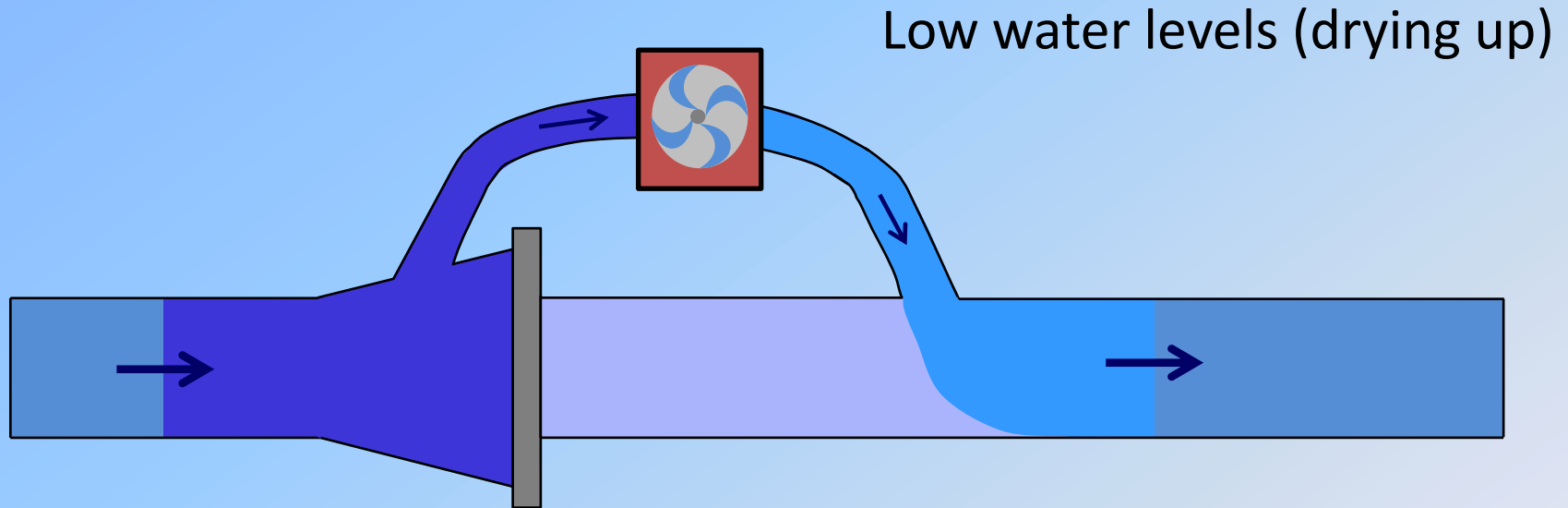
*What do we know?*

Unnatural physical and chemical conditions of the water

*Solution*

Limiting backwater proportion

### 3. WATER ABSTRACTION - DIVERTED REACH



*What do we know?*

Minimum water requirement can be modelled site specifically



*Solution*

Adapting water discharge to ecological demands

## ▶ “Local” effects of hydro power plants

Local effects cause a  
reduction of the habitat area for the native river  
community!

## 1. DOWNSTREAM REACH - HYDRO PEAKING



Habitat conditions:

- Extreme discharge- / water level fluctuations
- Unstable habitat area

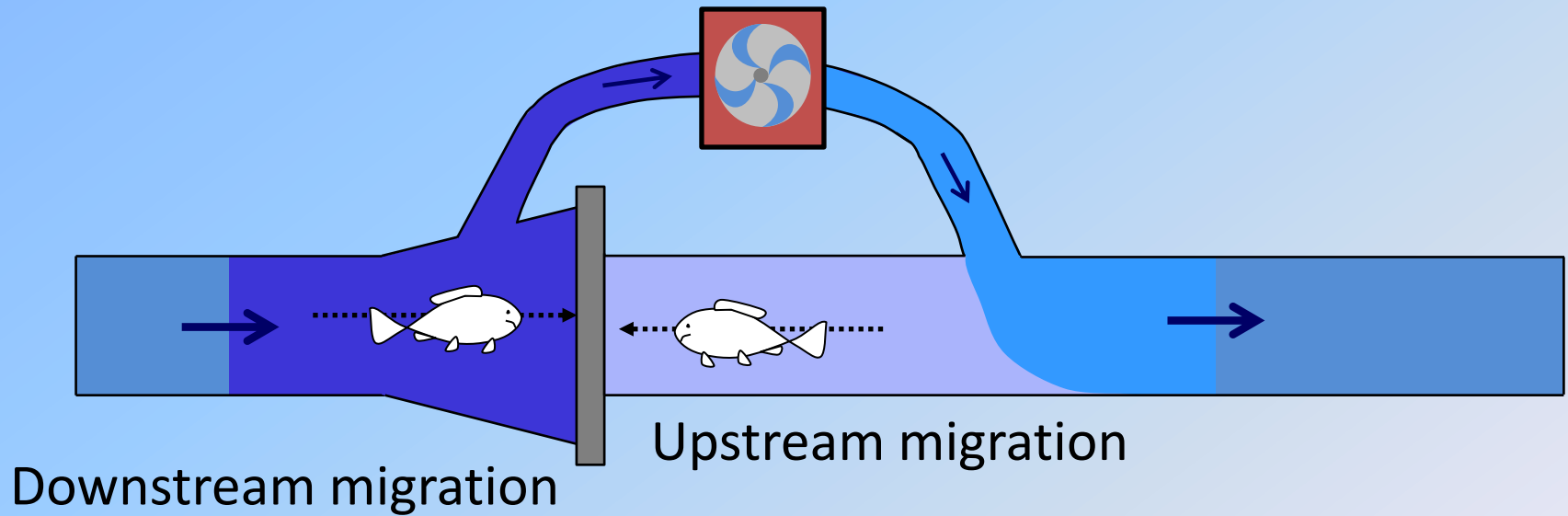
***What do we know?***

High mortality  
(esp. juveniles)

***Solution***

Termination/?

## 2. BARRIER – BLOCKING OF FISH MIGRATION



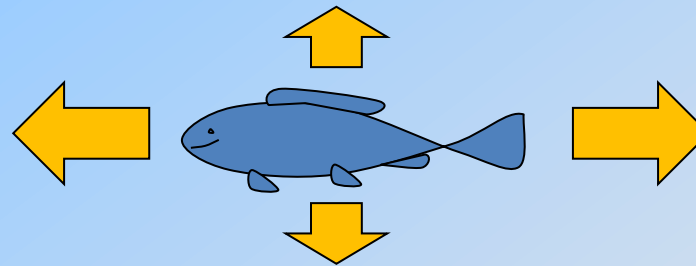


## 2. BARRIER – BLOCKING OF FISH MIGRATION

Different habitats during live cycle



Migration distance:  
10 km (Bullhead)

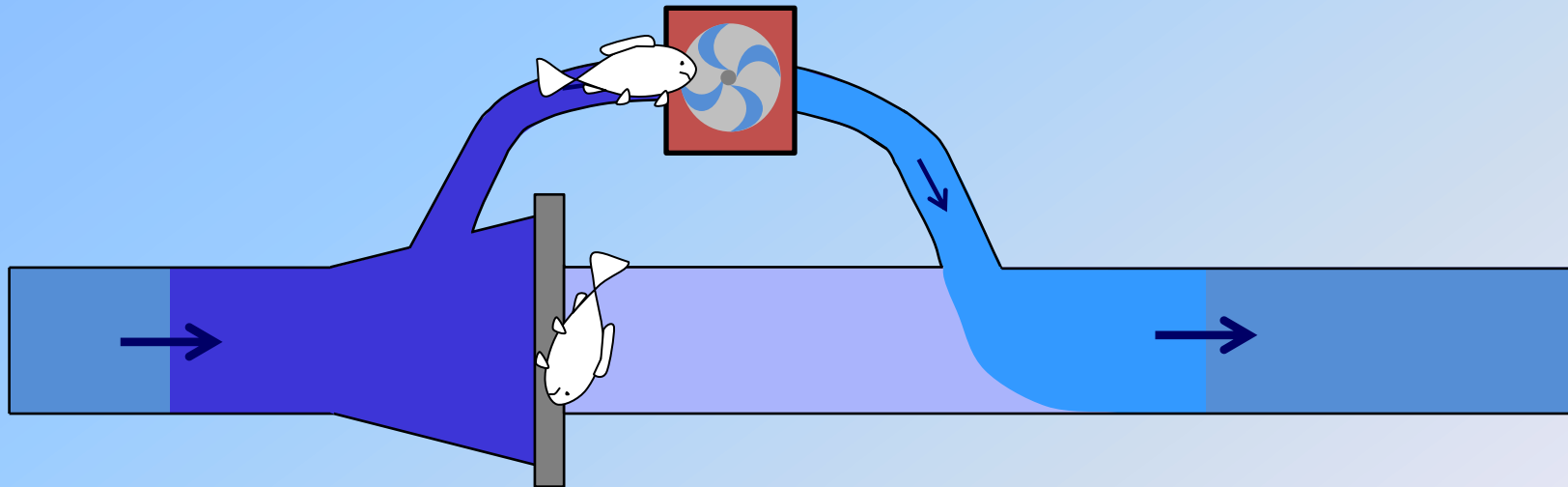


920 km (Salmon)



6000 km (Eel)

### 3. INJURIES / MORTALITY



Downstream migration

### 3. INJURIES / MORTALITY

*What do we know?*

Mortality rate\*

Kaplan-turbine:  
11 - 97 % Eels <sup>1</sup>

1 based on 71 datasets (EBEL 2013)

**Overview of typical corridor components and associated characteristic causes of injury to fish**

Cause of injuries		Pressure fluctuation	Collision	Contact pressure at obstacle	Electric field	Predation
Corridor component						
	Falls of water	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Subsurface outlet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Obstacles, baffles	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Screens, physical barriers	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Electric fish barrier	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Rotating devices (turbines, pumps)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

The causes of injury to fish associated with specific corridor components are determined by the local hydraulic and physical conditions

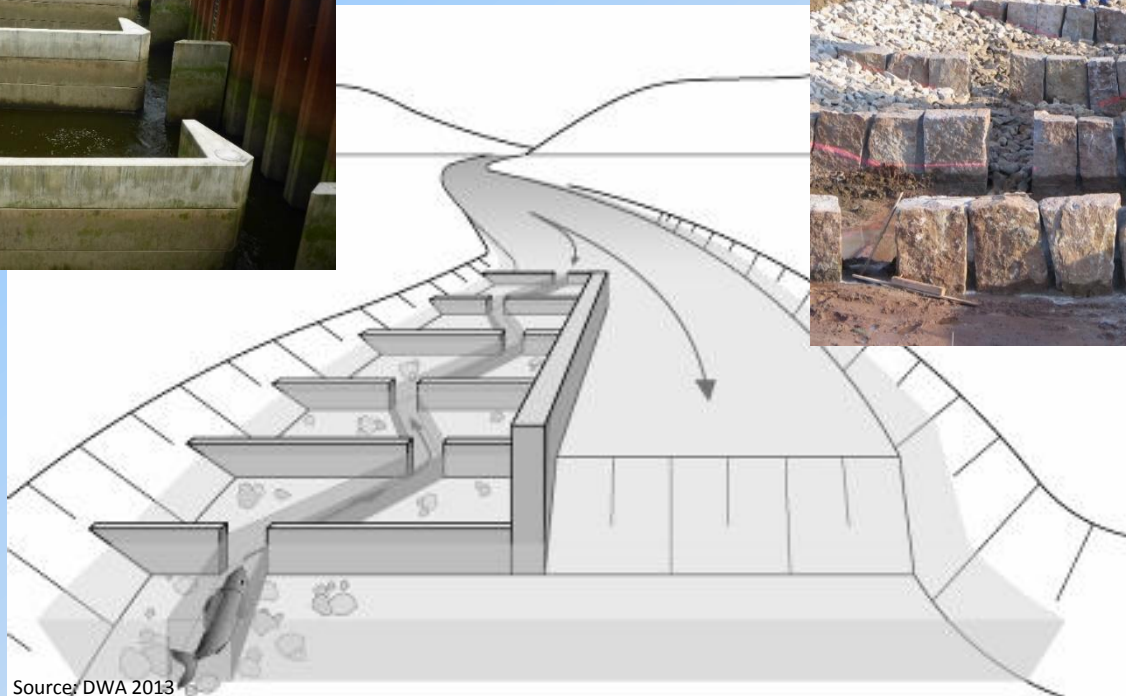
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## 1. SOLUTIONS UPSTREAM MIGRATION

Technical devices to connect downstream to upstream reach for migrating fish



- Fish pass



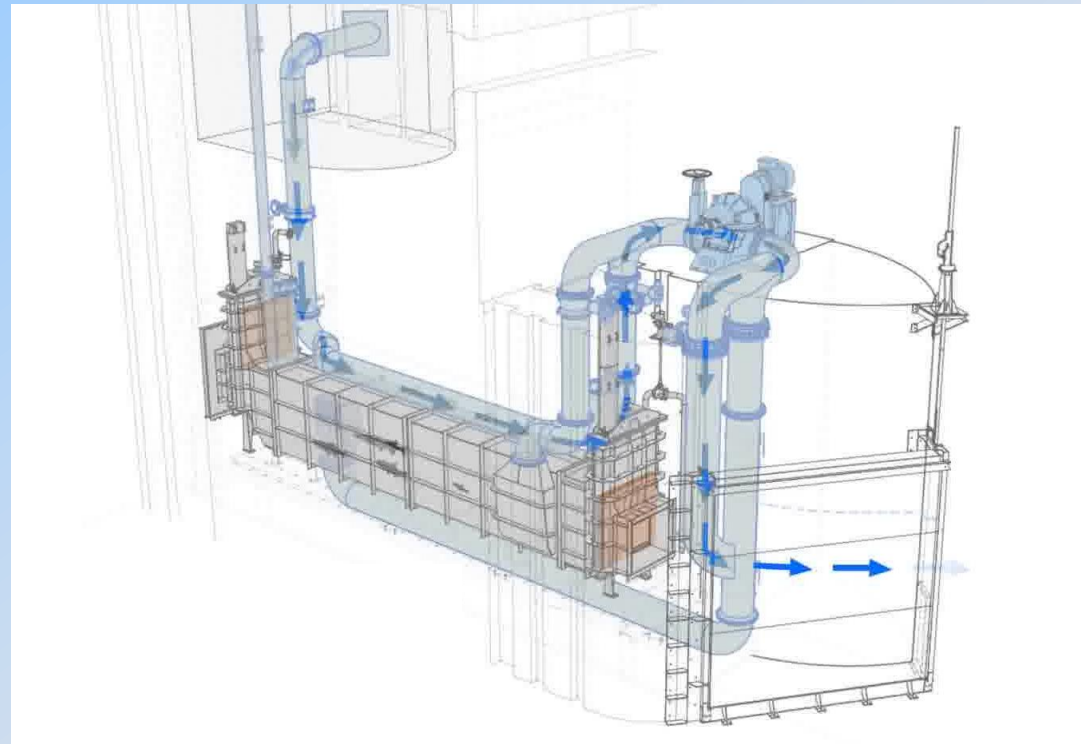
## 1. SOLUTIONS UPSTREAM MIGRATION

### *What we don't know?*

- Spatial requirements of shoals
- How to guide fish in to fish pass entrance in large rivers
- Efficient technical solutions for high dams

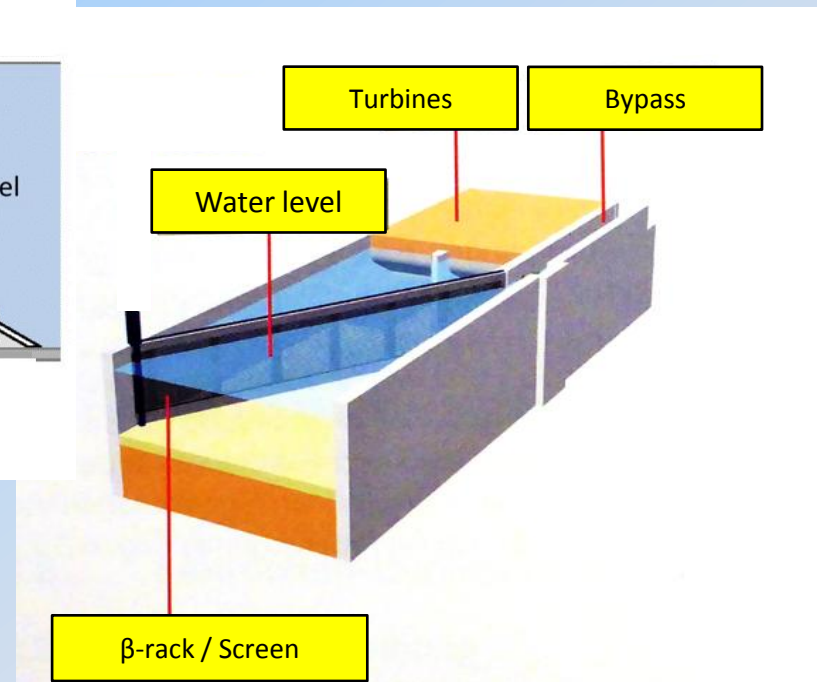
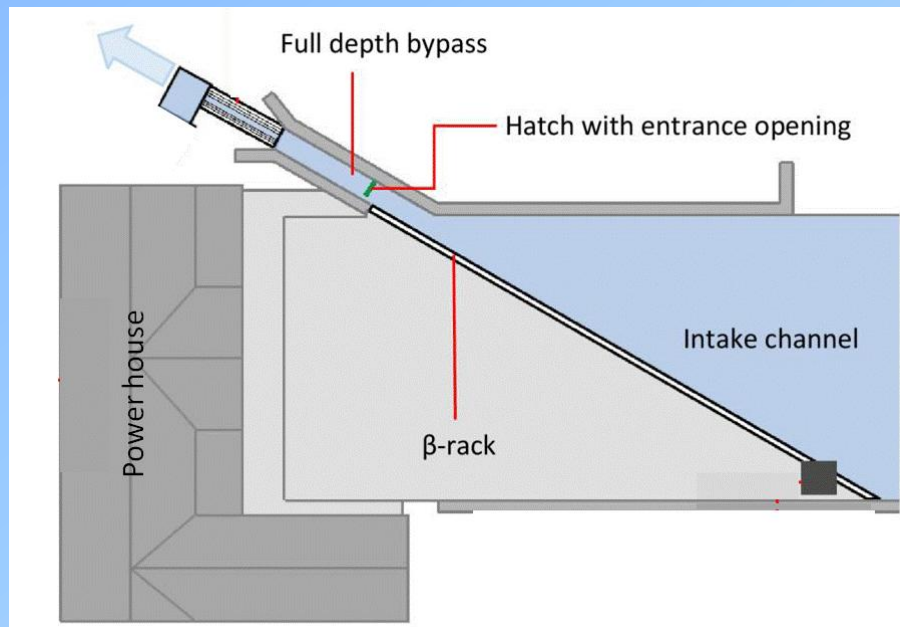


Fish locks  
Fish lifts



## 2. SOLUTIONS DOWNSTREAM MIGRATION

- Mechanical barriers / Fish screens



- Behaviour barriers
- Mortality reducing turbines
- Turbine management (Switch off)

## 2. SOLUTIONS DOWNSTREAM MIGRATION

### *What we don't know?*

- Guidance in large rivers
- How to protect fish < 10 cm body length
- Bypass design



→ Hydro power plants

1. Reduce the habitat area for the native river organisms
2. Hamper the fish migration
3. Cause injuries and mortality of fish
4. Damming – main reason for the absence of native species with long migration distances in most European rivers

→ Solutions for the reduction of negative effects exist

**But**

will never compensate them completely!





*Thanks for your attention!*

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