

Adaptive Management of Barriers in European Rivers



AMBER



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Aim - apply adaptive management to the operation of dams and barriers in European rivers to achieve a more efficient restoration of stream connectivity, and address impacts caused by river fragmentation

- H2020 funded project
- 20 partners - hydropower businesses, rivers authorities, non-governmental organisations, universities and the European Joint Research Centre
- 11 countries - Poland, Italy, Germany, UK, Ireland, Netherlands, Spain, France, Switzerland, Denmark and Sweden
- Stakeholder involvement
- Citizen science



Main outputs

- European Barrier Atlas
- Citizen science application
- Ecological and habitat data
- eDNA tool development data
- Ecosystem Service and Socio-economic data
- Organisms' responses to conditions at barriers
- Case Study data – removal/mitigation/installation
- Book and decision support tool



Ability of organisms to cope with barrier and pass hydrodynamics



Fish passes and barrier specifications – use knowledge of target species' swimming abilities

A few species relatively well-studied (e.g. salmonids) but:

- Many other taxa poorly understood
- Especially 'weak swimmers'
- Invertebrates – e.g. crayfish
- Invasive species
- Even salmonids often show poor passage rates
- Energetic costs of passage unknown

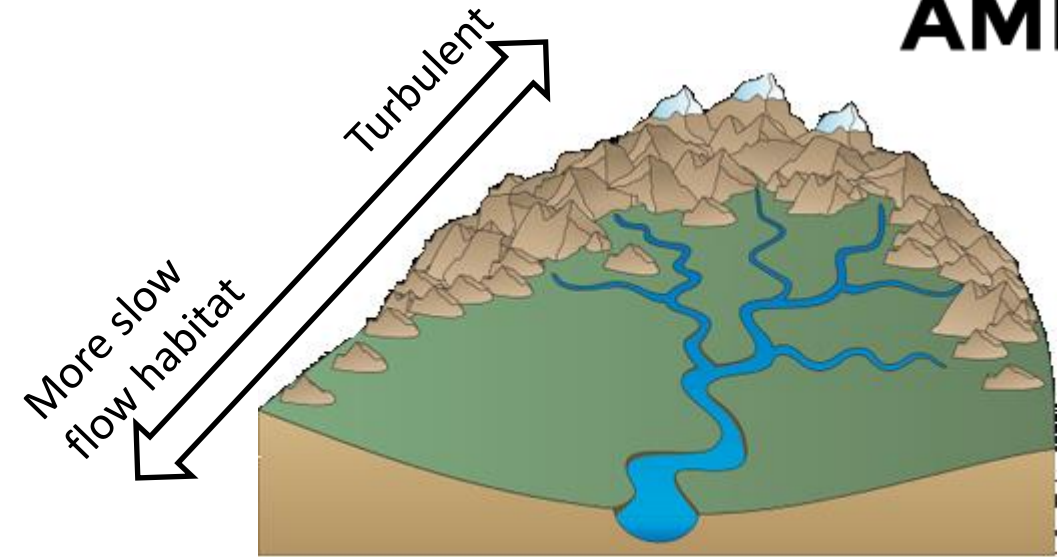


Ability of organisms to cope with barrier and pass hydrodynamics

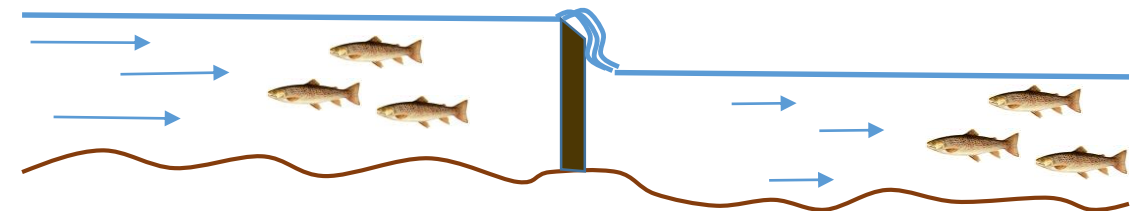


Intraspecific variation poorly understood – one size fits all. Ignores variation:

- Inter-population variation – upstream/downstream, barrier effects
- Individual - size, sex, morphology
- Temperature variation – seasonal differences, climate change
- Turbulence and substrate



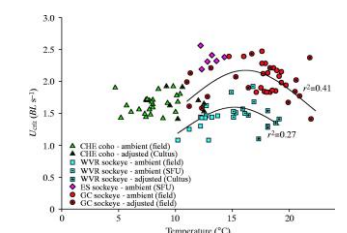
Selective effects of barriers



Variation with size/sex/morphology etc



Temperature effects



Study species

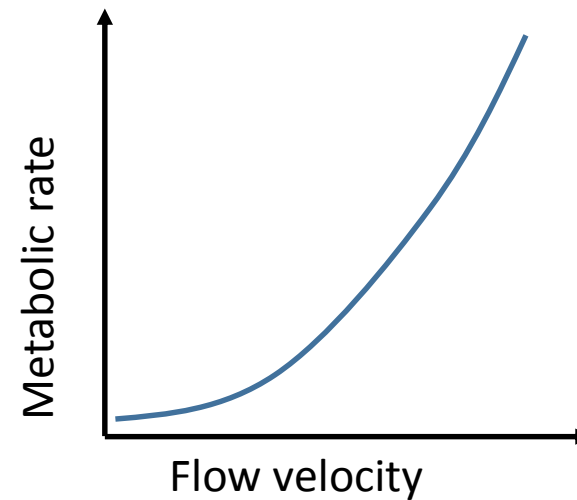
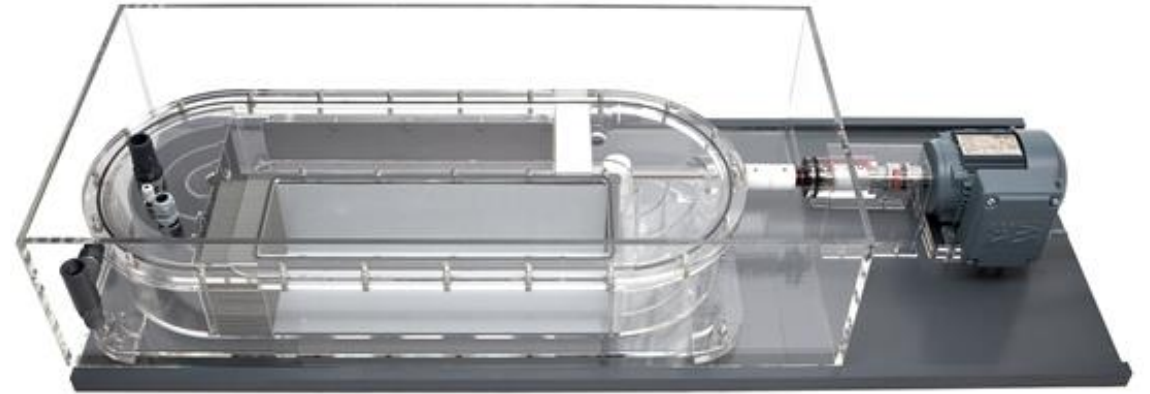


- Focus on 'weak swimmers'
- Less-studied species
- Invasive species
- Control - brown trout



Swimming ability/energetics

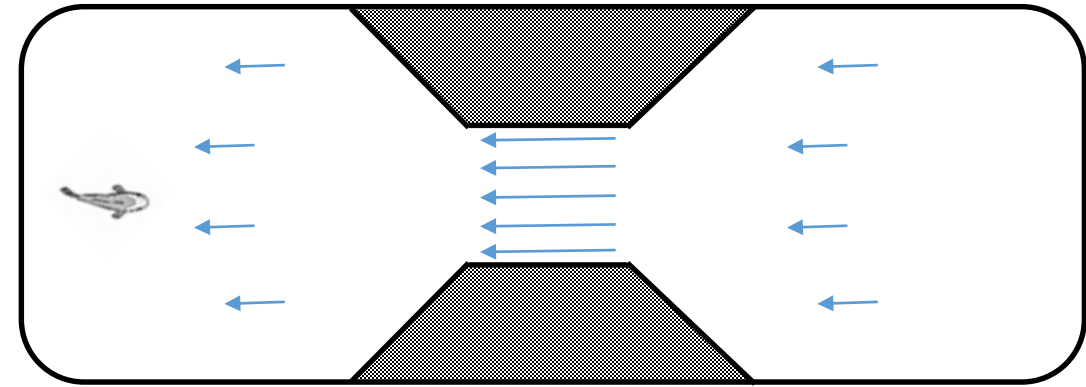
- Critical swimming ability
- Baseline metabolic rate
- Active metabolic rate
- Interspecific variation
- Individual variation
- Population variation
- Temperature effects
- Effect of turbulence on swimming/metabolism



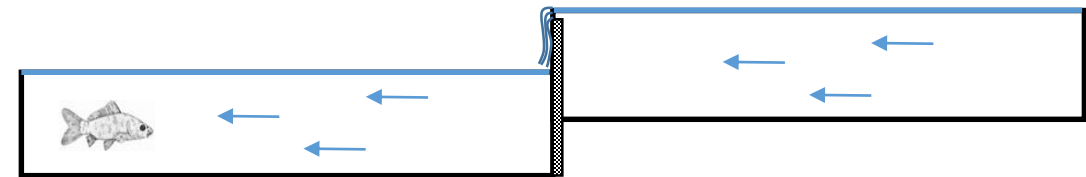
Voluntary swimming behaviour

- Debate over applicability of 'forced swimming' data
- Fish can display different swimming ability when behaviour is voluntary
- Stream channel mesocosms
 - Velocity barriers
 - Vertical barriers – crump weirs, overshot weirs, etc
 - Effect of substrate

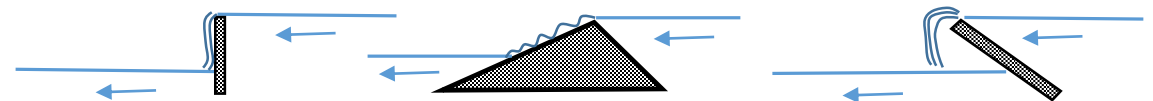
Velocity barriers



Vertical barriers



Vertical barriers

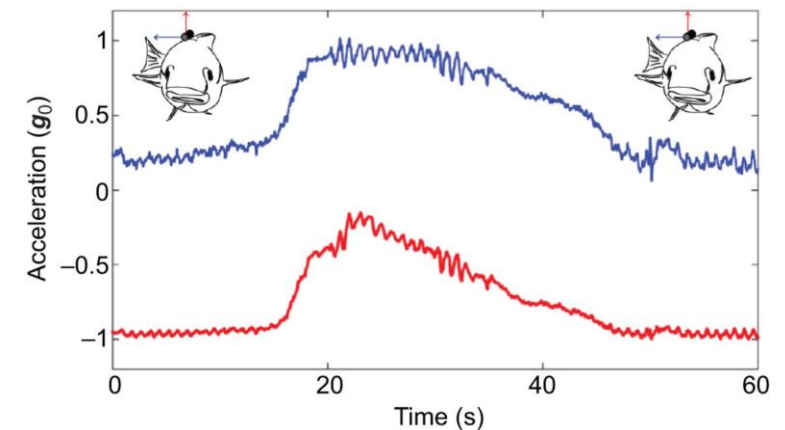
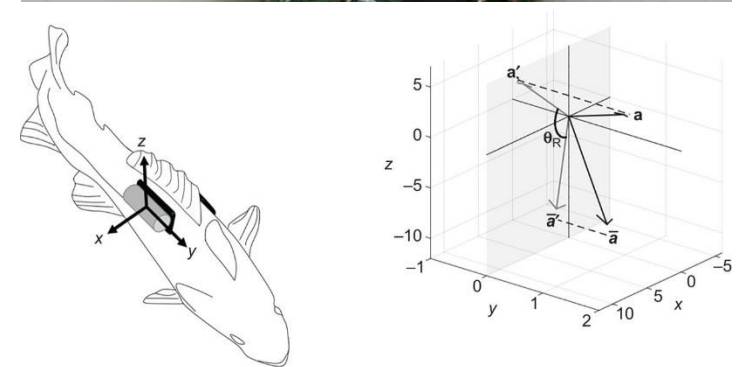


Tagging



Assess behavioural response to barriers

- Accelerometer tags
- Monitor activity levels
- Swimming speeds
- Response to turbulence
- Behavioural changes with temperature and substrate type



Outputs

- Broader knowledge base for designing barriers and mitigating impacts
- Data to feed into Agent Based Model to predict how barrier removal/mitigation may affect species distributions
- Contribute to decision support tool
- Published in articles and book
- Data will be open access





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Thank you!

- <http://amber.international/>
- Barrier app – coming January 2018
- Keep an eye out for book and decision support tool
- Collaboration/feedback/input welcome!



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