View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by Hydraulic Engineering Repository

HENRY

Hydraulic Engineering Repository

Ein Service der Bundesanstalt für Wasserbau

Conference Paper, Published Version

Washburn, Emma; Hateley, Jon

Guidance for asessing the efficiency and related metrics of fish passage solutions using telemetry

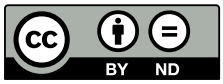
Verfügbar unter/Available at: https://hdl.handle.net/20.500.11970/106438

Vorgeschlagene Zitierweise/Suggested citation:
Washburn, Emma; Hateley, Jon (2019): Guidance for asessing the efficiency and related metrics of fish passage solutions using telemetry. In: Bundesanstalt für Gewässerkunde (Hg.): Standardisierung von Fischaufstiegsanlagen – Notwendigkeit, Möglichkeiten und Grenzen. 6. Kolloquium zur Herstellung der ökologischen Durchgängigkeit der Bundeswasserstraßen am 6./7. Juni 2018 in Koblenz - BfG-Veranstaltungen 1/2019. Koblenz: Bundesanstalt für Gewässerkunde. S. 54-59.

Standardnutzungsbedingungen/Terms of Use:

Die Dokumente in HENRY stehen unter der Creative Commons Lizenz CC BY 4.0, sofern keine abweichenden Nutzungsbedingungen getroffen wurden. Damit ist sowohl die kommerzielle Nutzung als auch das Teilen, die Weiterbearbeitung und Speicherung erlaubt. Das Verwenden und das Bearbeiten stehen unter der Bedingung der Namensnennung. Im Einzelfall kann eine restriktivere Lizenz gelten; dann gelten abweichend von den obigen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Documents in HENRY are made available under the Creative Commons License CC BY 4.0, if no other license is applicable. Under CC BY 4.0 commercial use and sharing, remixing, transforming, and building upon the material of the work is permitted. In some cases a different, more restrictive license may apply; if applicable the terms of the restrictive license will be binding.



Guidance for asessing the efficiency and related metrics of fish passage solutions using telemetry

Emma Washburn and Jon Hateley

1 Introduction

I'm lucky to have been involved in the development of a European standard for assessing the efficiency of fish passes using telemetry. This work has been very much a group effort with experts from 14 different countries involved (Figure 1) and my colleague, Jon Hateley, as co-lead.

Figure 1:
Experts from 14 different countries have been involved in the drafting of the standard.

It all started with a casual request from my boss at the time; "Emma, can you look at all our research and see what we know about fish passes and what we still need to find out?"
I thought it sounded simple. It wasn't….

2 Background and Objectives

Standards ensure **Functionality**: The fish passes in Figure 2 have been built on flow gauging weirs to ISO standards which provide fish pass design specifications to ensure that the river flow measurements won't be affected.

As well as functionality, standards also ensure **Comparability**. Monitoring work such as sampling of lakes for the Water Framework Directive (Directive 2000/60/EC) needs to produce results that are comparable across different water bodies. There are already four fisheries monitoring standards that fulfil this requirement: hydroacoustic monitoring, electric fishing, gill netting and one overarching standard that describes how to select the correct method for a particular situation.

Figure 2: A Larinier fish pass on a flow gauging weir (left) built to ISO 26906:2009 and Low Cost Baffles (right) designed to ISO/AWI TR 19234

Back to that casual request: A brief systematic review of UK and European fish pass monitoring studies revealed inconsistencies and irregularities between and within studies, making comparison impossible. The studies used different efficiency definitions and, even when the same definition was used, its meaning differed between studies. In addition, there were lots of variables in the studies, such as capture location and release site, all of which could affect efficiency estimates. These were all dealt with in different ways, further complicating the issue. Finally, the supplementary data collected e. g. fish pass parameters, river flow information, that helps with the interpretation of results also differed between studies. All of this variation and limited data made it difficult to compare how well the different fish pass designs were working.

As a result of the review we realized that there was a need to standardise on the definitions used, as well as the methods, so that we all speak the same 'fish pass monitoring' language. Rather than limit the work to our own organisation, we decided to develop a CEN standard for monitoring the efficiency of fish passage solutions which could be used across Europe. Publication of the standard will increase the relevance and transferability of results from costly fish pass monitoring studies, maximising the benefit across Europe. Ultimately the benefits will be improved fish passage solutions, increased river connectivity and restored environments for inland fish species (Figure 3) as well as improved compliance towards Water Framework objectives. This is not the only piece of the jigsaw; for example, laboratory based studies will also feed into this, but obtaining comparable field data is an important step. This project is supported by the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC).

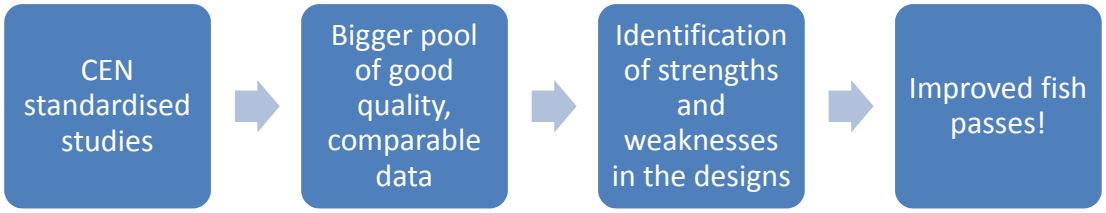


Figure 3: A fish pass monitoring standard should contribute to improvements in fish pass designs

3 The Process

It takes considerable time and effort to produce a CEN standard (Figures 4 & 5).

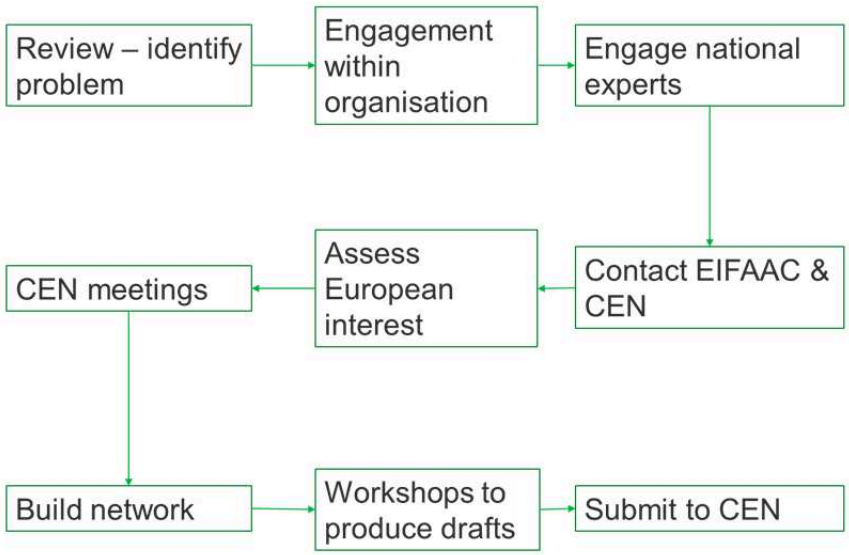


Figure 4: The groundwork required before the official process began.

We spent a lot of time talking to people, presenting the idea and gauging the level of interest (Figure 4) before the official process started (Figure 5). Workshops were used to produce the first and second drafts of the standard. Our tactics were to lock people in a dark room for 2 days and not let them out until the drafts had been completed! The final draft has just been out for consultation. Once the comments have been incorporated and accepted then there will be a vote to either accept or reject the standard. If it is accepted then it should be published later this year or in early 2019.

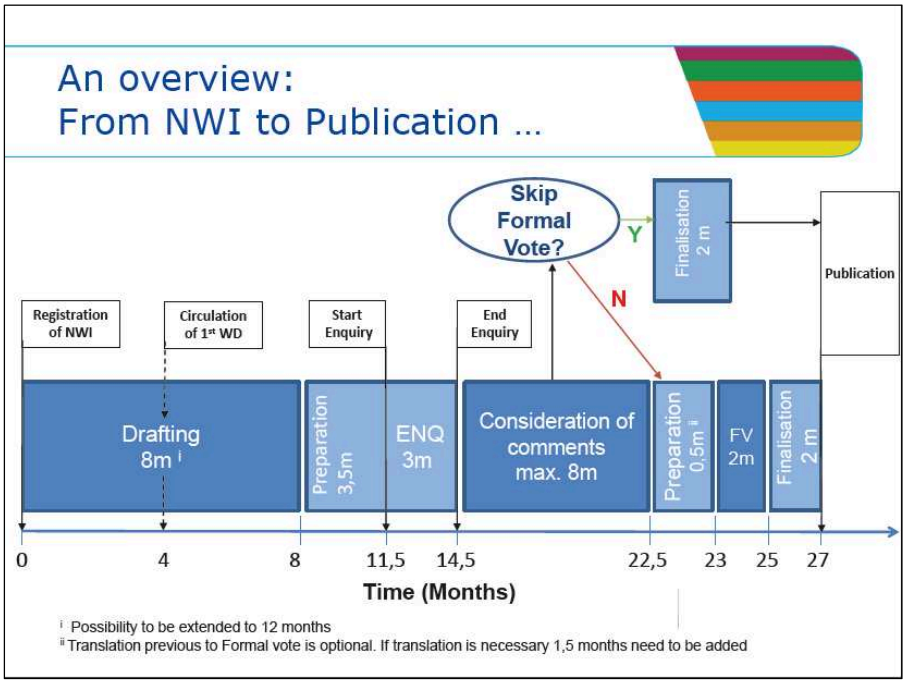


Figure 5: The CEN process and timeline for production of a standard

4 Content of the Draft Standard

The scope defines what is in the standard:
This European Standard specifies standardised methods for assessing the efficiency and related metrics of fish passage solutions using telemetry techniques that allow individual fish approaching an impediment to be monitored.
It covers studies using fish that have been electronically tagged with acoustic, passive integrated transponder or radio tags in order to provide a variety of defined passage efficiency metrics and includes both upstream and downstream passage of fish.

Each of these telemetry techniques involves the electronic tagging of individual fish and positioning of receiver units to track individual fish as they approach and pass (or fail to pass) an impediment, allowing an measure of the proportion of fish that are able to use the fish pass. The positioning of receiver units as described in the standard allows relevant aspects of fish pass efficiency (attraction, passage, overall) to be assessed, depending on the specific aims and objectives of the study.

Methods for assessing fish pass effectiveness (assessment or count of the number and type of fish successfully negotiating the fish pass), which are not covered by this standard, include; trapping, video, acoustic cameras, direct observation/online surveillance, physiological telemetry (e. g. EMG (electromyogram), accelerometry and heart rate), eDNA (environmental Deoxyribonucleic Acid), Catch Per Unit Effort (CPUE) and flume studies. These methods do not provide information on the numbers of fish approaching the impediment that are available to pass, therefore the failure rate cannot be assessed. Some aspects of efficiency (passage efficiency) can be also gathered by other methods (capture-mark-recapture [CMR], traps in combination with electric-fishing) in certain situations, mainly in smaller rivers. However, these other methods are not covered in this standard.

The terms and definitions section is an important part of the standard. There are nearly 20 terms and definitions described in the standard, including those for attraction, passage and overall fish pass efficiency. The term ‘Fish Passage Solution’ (FPS) is defined as ‘any device, structure or mechanism which is designed or managed to facilitate the safe movement of fish in an upstream and/or downstream direction when overcoming one or several impediments’, so it is not only fish passes that are covered, but also other approaches to moving fish past an impediment, such as operational procedures. The standard also uses the word impediment rather than obstruction as studies may be examining the impact of a depleted reach or area of poor water quality rather than a dam or a weir.

The Experimental Design section covers all aspects of telemetry studies from pre-planning through to the capture, tagging and release of fish:

- ✓ Pre-planning
- ✓ Sample size
- ✓ Timing and duration of investigations
- ✓ Baseline, control, reference data
- ✓ Receiver positions
- ✓ Capture, tagging and release of fish
- ✓ Supporting data

Real life examples of receiver positions in seven different telemetry studies are described, along with photographs, diagrams and details of the lessons learnt.

5 Contentious Issues

The standard doesn't prescribe what method should be used. It only applies when the decision has been made to study the efficiency of a fish pass using telemetry.

One of the issues which has been raised a number of times is; why does the standard only cover efficiency monitoring? What about effectiveness monitoring? There was a lot of discussion about this at the workshops. There are a whole host of methods for monitoring fish passes depending on the aims of the study e. g. fish counters, traps, electric fishing upstream of a fish pass, eDNA, but they are all very different methods and it would be a huge task to create a standard to cover all of these. The decision was made to take it one step at a time and create a standard to cover efficiency monitoring using telemetry to start with.

There are also other non-telemetry methods that allow some aspects of efficiency to be obtained e. g. CMR and electric fishing plus trapping, however usually only limited info e. g. passage efficiency can be obtained. Again, the decision was taken to produce a standard for telemetry methods first, but there is no reason it can't be incorporated during one of the 3-5 year review stages.

6 Lessons Learnt

Communication is key, right from the initial contact to gauge appetite and inform through to ongoing communications to maintain momentum.

Participation: Engage people within the organisation first and get their commitment, then nationally, then wider. This process of engagement led on to the formation of an unofficial network of interested people, which in turn led to the formation of the workshop groups.

The workshop method to produce the drafts worked really well as there were minimal distractions and participants could completely focus on the task in hand. The contentious issues could be discussed in detail until consensus was reached. There were between fifteen and twenty participants at each workshop and this was about the right number. Participation was altered slightly between workshops to increase the breadth of experience but enough people attended both workshops to maintain continuity.

Leadership and ownership of the project is important. You need people with the time to keep pushing things on so that everyone remains engaged and the project doesn't lose momentum. A clear project leader can also grapple with the intricacies of the CEN process and filter out the relevant information so others involved are not overwhelmed with information. A rough estimate of the time involved equates to about 0.25 of a Full Time Employee, although the workload is not evenly spread over the year.

Consensus building is vital as this is the foundation of a CEN standard. It is not always straightforward as there are so many different experiences, opinion and pressures on people and the project may go a different way to that first envisaged! This approach helps to address concerns about any threat to national standards. The standard can only be published when all member states are happy with the content.

One step at a time. Don't try and do too much in one go. It is far better to get something finalised which can then be built upon.

Contact:
Dr. Emma Washburn
Environment Agency England
Tel.: 00447771542629
E-Mail:
emma.washburn@environment-agency.gov.uk

1996-1999
BSc. in Marine Biology (University of Wales, Swansea)

1999-2005
PhD – Factors influencing salmonid use of a tidal pool and weir fish pass (University of Wales, Swansea)

2002-2012
Various fisheries roles with Environment Agency Wales

Since 2012
Technical Advisor in the National Fisheries Services Team, Environment Agency England

Project Work:

- Fish counter site selection and the planning, installation and operation of fish counters and monitoring systems in open river and fish pass sites throughout Wales
- Coordination and implementation of mobile hydroacoustic fisheries survey programmes
- Research and development of a cost effective video solution for monitoring fish passes
- Development of a Fish Passage and Obstruction database for England
- Review of fish pass performance research and the development of a European Standard for fish pass monitoring