



Fishfriendly Innovative Technologies for Hydropower



Funded by the Horizon 2020 Framework Programme of the European Union

D5.2 Stakeholder feedback on tools and products of FIThydro

Part 1: Summary report of the 2nd FIThydro regional stakeholder workshop for the Iberian Peninsula

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1. Introduction

1.1 FIThydro background

FIThydro (Fishfriendly Innovative Technologies for Hydropower: <http://www.fithydro.eu>) is a 4-year EU research and innovation action (funded under Horizon 2020; duration 2016-2020) which aims to support decisions on commissioning and operating hydropower plants (HPP) by use of existing and innovative technologies. It concentrates on mitigation measures to develop cost-effective environmental solutions and strategies to avoid individual fish damage and to support the development of self-sustainable fish populations, with main emphasis on run off river low-head HPP.

FIThydro brings together 26 partners (13 research, 13 industrial) from 10 countries, involving several of the leading companies in the renewable and hydropower energy sector in Europe. Methods, tools and devices are applied and evaluated at 17 test sites all over Europe, covering four regions: Alpine region, Scandinavia, north-west Europe and the Iberian Peninsula). Scenario modelling in the four different geographic, climatic and topographic regions will allow the quantification of effects, resulting costs and comparisons of the test case regions to draw conclusions about future hydropower production mitigation options in Europe.

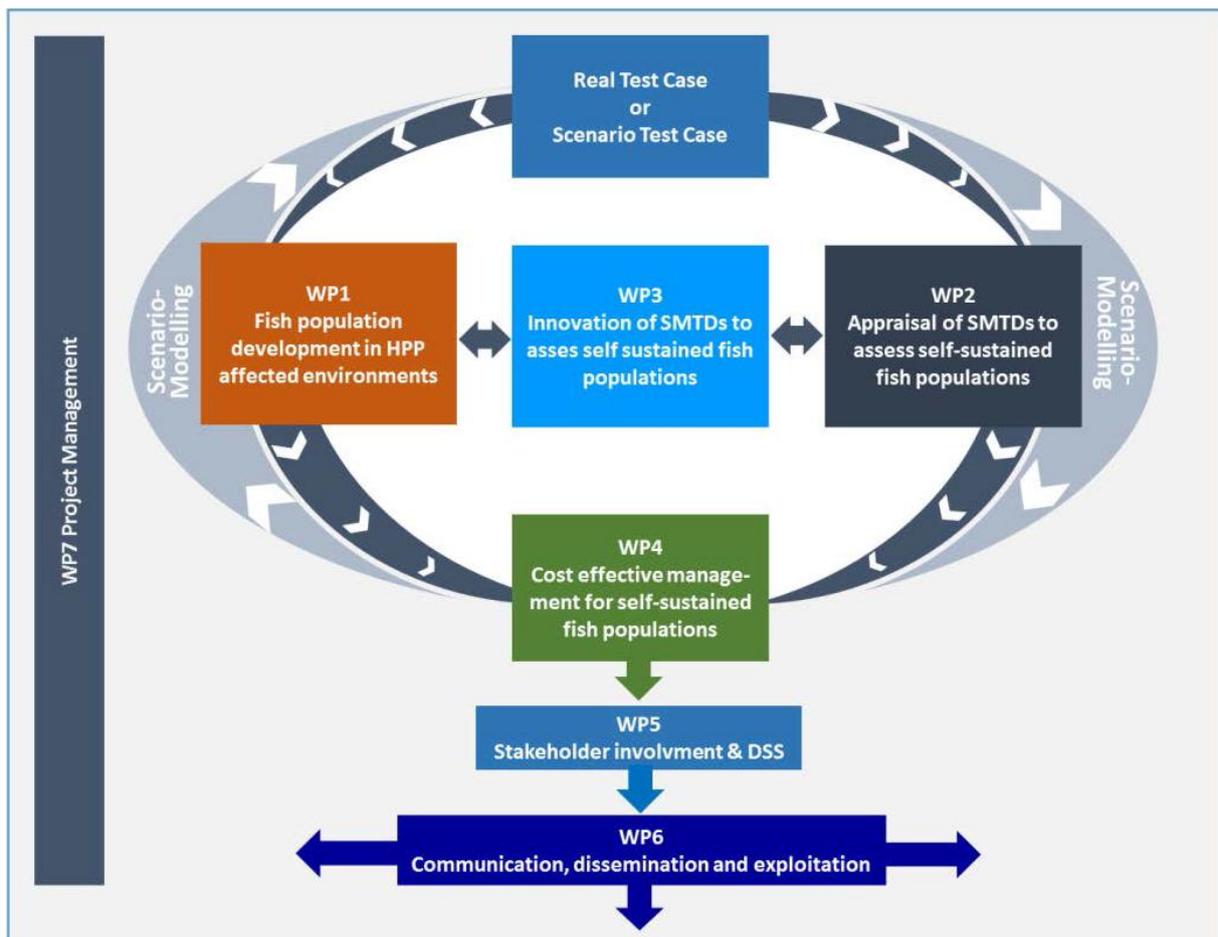


Figure 1 FIThydro approach and key work-packages

1.2 Aims of the stakeholder workshop

The 2nd FIThydro Regional Stakeholder Workshop on Fish-friendly Hydropower took place on 20 March 2018, at the IST (Campus Alameda) in Lisbon, Portugal.

The workshop was the second in a series of four regional workshops and served as a platform for consultation and exchange between FIThydro scientists, stakeholders and water users on key open issues and possible solutions relevant to the assessment and planning of ecologically compatible hydropower production in the Iberian Peninsula. The workshop mainly addressed authorities involved in HPP authorization processes, HPP operators, environmental NGOs, consultants, planners, fisheries associations and the research community.

The workshop and the FIThydro project as a whole are key to support the implementation of the Water Framework Directive (WFD) as well as meeting the objectives of energy policy.

Presentations were given by the FIThydro team as well as energy providers, legislators and scientists involved in the field of hydropower in Portugal and Spain.

At this workshop, key aspects of the FIThydro work-program were presented and participants were invited to give their feedback and highlight, from their perspective, the key open issues on the assessment and planning of ecologically compatible hydropower production.

36 participants attended the workshop, including stakeholders from Portugal and Spain and scientific partners of the FIThydro consortium.

The key sessions covered the following topics:

- Cyprinid species: ecology and constraints.
- Fish-passages for up and downstream migration: attraction flow.
- The impacts of hydropeaking and mitigation measures.
- Environmental flows: applicability to Mediterranean-streams.
- Cost-effectiveness assessment of mitigation strategies and socio-economic/policy challenges for decision-making.

The workshop sessions addressed the main pillars of FIThydro's outputs and plans for the next stages of the project and also reflected on relevant activities taking place in the hydropower sector in Portugal and Spain.

A cover note was prepared for the workshop participants. The purpose of the cover note was to stimulate dialogue by outlining the key topics and by proposing some key questions to guide the discussions in the main sessions.

For each of the 5 specific topics of the workshop, which are outlined further below, the following were proposed as **guiding questions** for interactive exchange with the participating stakeholders:

Guiding questions for discussion with stakeholders

- a) What do you consider as the **major issues (key problems, open questions)** relevant to the assessment and planning of ecologically compatible hydropower production in the Iberian Peninsula (Portugal/Spain) (specifically on the 5 key topics below)?

- b) What **approaches and solutions** are applied to address the key problems and **open issues** in the Iberian Peninsula (Portugal/Spain)?
- c) What are your **recommendations or requests to the work-programme of FITHydro** (with specific relevance to the 5 key topics below)?

These questions were used to structure the interactive discussion after the presentations in each session of the workshop. Participants also received a paper hand-out to provide voluntary written feedback to these questions during and after the workshop, so that each participant had the opportunity to make a contribution to each topic.

1.3 About this summary report

Sections 2 to 4 of this report present a summary of the discussions and key conclusions of the workshop based on the presentations and ensuing discussions, as well as the participant feedback forms collected for each session.

Please note that the FITHydro consortium plans to give written feedback to the recommendations made by stakeholders during this workshop in Lisbon. This written feedback is expected to be provided in autumn 2018 in order to take into account stakeholder recommendations raised in the following two regional stakeholder events scheduled until October 2018 in the Scandinavian and Alpine regions.

The Annexes to this report include all detailed feedback provided by participants via the participant feedback forms, the programme of the workshop and list of participants.

2. Introductory session

To open the workshop, welcome and brief introductions were given by Peter Rutschmann - TUM (coordinator of FITHydro), António Pinheiro - IST (FITHydro regional case leader for Portugal) and Javier Sanz-Ronda - ITAGRA (FITHydro regional case leader for Spain).

The introductory talks introduced the FITHydro project, including an overview of the project's test cases and the challenges at these sites. The objectives of the workshop and the programme for the upcoming sessions were also presented. Furthermore, a brief overview of the workshop participants and stakeholders was given. In addition to the FITHydro team, stakeholders present at the workshop included, both from Portugal and Spain: hydropower producers (i.e. Iberdrola Generación, EDP), research institutes (e.g. IST, ISA, UTAD, Universidad de Murcia), technical/engineering consultants (e.g. AQUALOGUS, COBA) and governmental institutions (e.g. Confederacións Hidrográficas, APA, ICNF)

3. Cyprinid species: ecology and constraints (Session 1)

This session covered key issues regarding river fish population ecology of Cyprinid species, the challenges fish populations are exposed to in regulated rivers as well as fish response and resilience to river fragmentation and hydropower. From the FITHydro work-programme, first steps towards a fish population hazard index for hydropower were also presented.

In session 1, the presentations given covered the following:

- **FITHydro activities related to Session 1 (Ruben van Treeck, IGB).**

- This addressed among others species hazard/biological sensitivity, type-specific and site-specific mortality as well as population effects.
- **Iberian cyprinids: habitat requirements and vulnerabilities (Francisco Godinho, HIDROERG)**
 - This presented the native fish species in the Iberian Peninsula, and how they are affected by Mediterranean hydrological regimes.

3.1 Discussion during the session

The key issues raised during questions and discussions between the participants in this session addressed the following:

- **Invasive species:**
 - The project does not focus specifically on the impact of invasive species to fish populations.
 - Some connections might be made in the project, for example looking at how flow alterations act as a variable to introduced species success.
 - In the Alpine region, the project explores the creation of additional suitable habitats at the side of reservoirs, which could be relevant here.
- **Small vs. large HPP impacts**
 - There is a need to focus on the impacts of small HPP, as they are about triple in number to large HPP.
- **Cumulative impacts**
 - The project is developing a Cumulative Impact Tool, though, perhaps, not all questions will be addressed, as this is a particularly difficult issue, which has received little attention so far.

3.2 Participant feedback via paper forms

Additional feedback was collected from participants through feedback forms distributed during the session on (1) the major issues (key problems, open questions) with regard to fish populations and habitats, (2) approaches and solutions applied in the Iberian Peninsula to handle key problems, and (3) recommendations or requests to the work-programme of FIThydro.

Following session 1, a total of five feedback forms were collected.

The following summarizes the issues which the participants considered as important/relevant. The full responses in the feedback forms can be found in the Annex.

Key problems, open questions

1. Habitat loss/fragmentation.
2. Low efficiency of fish passes.
3. Invasive fish species domination. No effective program is related to control invasive species, besides legislation.
4. The change of type of water, from rivers to lentic waters (reservoirs).
5. Dams as barriers, especially the ones which are so high that it is not possible to build a fish pass solution sustainable in time.

6. The lack of scientific and technical knowledge about the biology of cyprinid species and their communities, and about their habitat requirements. In general, until very recently, little attention has been paid to Iberian cyprinid species.
7. Hybridization and genetic variability loss
8. Cumulative impacts

Approaches and solutions to handle key problems in Portugal and/or Spain

1. Considering habitat loss Spanish regions adopted dam removal programs. Portugal developed recently a dam removal strategy.
2. Naturalized fish passes have recently been implemented.
3. Fish ladders and lifts.
4. Changes in environmental flows.
5. Habitat improvement
6. Restocking

Stakeholder recommendations of general nature

1. E-flows should attempt to decrease the WUA (Weighted Usable Areas) of invasive species.
2. New design of reservoirs, with a „channel“ or part of it designed as a „river“ with gravel spawners inside (maybe using water from a tributary river).

Stakeholder requests with relevance to FIThydro

1. The fish hazard index should reflect the cumulative impacts of several structures.
2. Contribute to the development of models to assess fish habitat suitability (at the scale of communities rather than at the species level) of the cyprinids, in order to identify the possible affectations in reaches influenced by hydropower.
3. Increase knowledge on ecology and biology (relevant for efficiency of mitigation measures)
4. Compilation or construction of preference (or suitability) curves for different cyprinid species.
5. Mitigation measures toolbox and guidelines to select best measures based on a cost-benefit analysis.

4. Fish-passages for up and downstream migration: attraction flow (Session 2)

This session addressed upstream and downstream passage of fish, together with the attraction flows for fish migration. These aspects are assessed in the appropriate test cases that are included in the project. In particular, the attractiveness of fishway and bypass facilities shall be assessed regarding their positioning, scale, design and operation as well as possible bypass systems and technical solutions, devices and operational management options to enhance downstream migration.

In session 2, the presentations given covered the following:

- **Effectiveness of fish passage: engineering and practice (Javier Sanz-Ronda, ITAGRA)**
 - This presentation provided an overview of various technical design aspects of fishways as well as indicators to measure their effectiveness. Approaches to estimating effectiveness include expert criteria, a hydraulic assessment approach, and a biological assessment approach.
- **Fishways design for Iberian cyprinid fish species (Ana Quaresma, IST)**
 - This presentation dove deeper into the technical elements of various types of fishway design, particularly with respect to cyprinids. The test case in Guma, Spain was presented.
- **Solutions for downstream migration (Laurent David, CNRS)**
 - This covered the specific challenges associated with downstream fish migration; the different types of solutions depending on the fish species, flow conditions, and site conditions; as well as giving an overview of different solutions acceptance.

4.1 Discussion during the session

The key issues raised during questions and discussions between the participants in this session addressed the following:

- There are challenges associated with tracking the use of fish passages in rivers and possible **fragmentation of populations**. It is often larger fish that do not migrate upstream when a barrier is introduced. The FIThydro project will not include any genetic studies to investigate population fragmentation related to barrier use.
- Some operators face problems related to **invasive species using fish passes**, as the passes are generally suitable for many fish species.
- There is concern related to barriers preventing fish from reaching spawning grounds – particularly gravel areas. While the project will not focus on this issue as it is related to reservoirs, there are options such as side-rivers or gravel replenishment.

4.2 Participant feedback via paper forms

Additional feedback was collected from participants through feedback forms distributed during the session on the (1) major issues (key problems, open questions) , (2) approaches and solutions applied in the Iberian Peninsula to handle key problems, and (3) recommendations or requests to the work-programme of FIThydro.

Following session 2, a total of five feedback forms were collected.

The following summarizes the issues which the participants considered as important/relevant. The full responses in the feedback forms can be found in the Annex.

Key problems, open questions

1. Reservoir effect: How to help fish face the reservoir while moving to suitable spawning grounds
2. Lack of monitoring of fish passes in order to assess their efficiency.

3. Little attention to downstream migration.
4. Attraction flows and fishway locations (especially attraction).
5. Issues related to fish passes: they are often built without evaluating if they are really necessary; they are designed without taking into account the species that are going to use it, nor the needs of migrations downstream; they are not maintained adequately throughout their lifetime; their operation is almost never monitored (or is poorly done).
6. Fishway entrance location and attraction flow which will compete with discharge and turbine flows.
7. New fish passage design.

Approaches and solutions to handle key problems in Portugal and/or Spain

1. Monitoring of eflows is now implemented in many hydropower dams in Portugal.
2. Fish passes are more common in the relatively most recent dams.
3. Nature-like fish passes are becoming more common.
4. In recent decades, fish passages (preferably for upstream migrations) have been built. But in the Iberian rivers there are more than 1,300 large dams, in addition to a large number of weirs. Some of these hydraulic works (very few) are useless or obsolete and can be removed, but this is not possible for a vast majority, due to their purpose and dimensions. It will also be difficult or impossible to build fish passages in many existing dams.
5. The management of the opening of the gates (gates operation rules) and the changes performed into the river-bed and the downstream stilling basin contributed to the efficiency of the Açude-Ponte de Coimbra (Coimbra Bridge-Weir Dam) Fishway.

Stakeholder recommendations of general nature

1. Operating regime should be compatible with fishway functioning/operation.

Stakeholder requests with relevance to FIThydro

1. Analyse fish pass selectivity (e.g. native versus exotic species).
2. Location and attraction ability of the fish passes need to be emphasized.
3. Special study for higher dams. All of the presented studies are based or focused on small dams.
4. What could be a „technical“ and „economical“ solution for the intakes (turbine circuits) in order to decrease the mortality?
5. To analyse fishways built at small-scale hydropower plants that work badly and analyse solutions to improve them, if possible.
6. Protocol to assess fish passage suitability.
7. Define best solutions for both downstream and upstream migration.
8. Study fish pass suitability concerning seasonal Mediterranean flow variability.

5. The impacts of hydropeaking and mitigation measures (Session 3)

This session addressed the effects of hydropeaking on movement, behaviour, habitat and spawning of target fish. Further, the session covered the guidelines for developing a

hydropeaking tool to assess the impact of the operation regime, as well as the guidelines to develop mitigation solutions.

In session 3, the presentations given covered the following:

- **FIThydro activities related to Session 3 (Atle Harby, SINTEF)**
 - This presentation introduced the concept of hydropeaking, as well as explaining how it is covered by the FIThydro project, specifically through the hydropeaking tool.
- **The hydropeaking tool (Matthias Schneider, SJE)**
 - Building on the first presentation, this gave further details on the project's hydropeaking tool, going into the specifics of the various effect factors that make up the tool.
- **Hydropeaking mitigation measures (Isabel Boavida, IST)**
 - This presentation gave an overview of different types of hydropeaking mitigation measures (structural, morphological, operational), as well as how they can be evaluated and monitored.

5.1 Discussion during the session

The key issues raised during questions and discussions between the participants in this session addressed the following:

- There is a noted lack of good quality **control data in the pre-operational stage**. Operators should start considering more biological and physiological factors in pre-operational studies such as Environmental Impact Assessments.
- It was mentioned that for HPP with hydropeaking, in order to achieve a good ecological potential, operators can look at **combining measures, operational measures, and technical changes**:
 - This can be different for new vs. old plants; sometimes it is more a question of technical feasibility, than about money.
 - The liberalized market can sometimes make it difficult to change the operational rules of the HPP.
- There is a lack of data from the Iberian Peninsula on **how fish species behave under peak flows** – a scientific goal to begin collecting this information should be set.
- Similarly, some developing **hydropeaking related criteria** would be useful in the region (e.g. flow reduction in the summer).
- **Hydropeaking can create resilience** amongst fish species – moderated peaking can be better than a flat flow rate.

5.2 Participant feedback via paper forms

Additional feedback was collected from participants through feedback forms distributed during the session on the (1) major issues (key problems, open questions) with regard to methods and technologies, (2) approaches and solutions applied in the Iberian Peninsula to handle key problems, and (3) recommendations or requests to the work-programme of FIThydro.

Following session 3, a total of five feedback forms were collected.

The following summarizes the issues which the participants considered as important/relevant. The full responses in the feedback forms can be found in the Annex.

Key problems, open questions

1. Hydropeaking mitigation, contrary to eflows, is not yet taken into account on mitigation measures for hydropower.
2. Rehabilitation measures as a consequence of hydropeaking are not applied (fish refuge, gravel deposition, riparian plants, bank stabilization, etc.).
3. The main problem is the lack of knowledge of the real effects of hydropeaking on cyprinid species. There are still very few studies, and many different scenarios (river reaches with hydropeaking) that do not allow reliable extrapolations of results. Many impacts attributed to hydropeaking are theoretical. If the effects are not known, it is impossible to have adequate mitigation measures.
4. Erosion and sediments may be significant impacts that usually are not mitigated.
5. Design and assessment of efficiency of key measures to minimize the impacts of hydropeaking without affecting significantly the production of electricity and without changing the function in the market of each hydroelectric plant

Approaches and solutions to handle key problems in Portugal and/or Spain

1. Only the hydropeaking impacts are monitored; not much more being done at present
2. In the Spanish legislation (Hydrological Planning Instruction) there are specific criteria for limiting the effects of hydropeaking (e.g. limiting the rate of change of flow per unit of time, but at the moment this criterion is inapplicable, due to the function that the hydroelectricity fulfils within the national system of production of energy).
3. Solutions are not being applied nor tested for impacts from erosion and sediments.

Stakeholder recommendations of general nature

1. Mitigation measures should be related to the hydropeaking impacts on target fish species but as well on banks, riparian vegetation, etc.
2. It should be mandatory to study or include mitigation measures for hydropeaking during the Environmental Impact Assessment of new Dams.

Stakeholder requests with relevance to FIThydro

1. A Handbook of Mitigation Measures should be created in order to be applied for all of new projects. In order to have a „Handbook of Measures“, more studies and monitoring of already implemented mitigation measures should be done.
2. Increase more detailed knowledge on hydropeaking impacts on native Iberian fish species.
3. To monitor habitat modification, e.g. spawning grounds dewatering as a consequence of hydropeaking.
4. Contribute to the development of criteria, indexes and work methodologies that allow identifying and quantifying objectively the effects of hydropeaking on fluvial ecosystems.

5. Guidelines to minimize impacts of hydropeaking, taking into account the complex market of energy.
6. Study of measures based on non-alteration of hydropower exploitation regime (e.g. improving downstream habitat)

6. Environmental flows: applicability to Mediterranean streams (Session 4)

This session addressed the activities related to environmental flows within FIThydro and promoted the discussion of their applicability in streams with Mediterranean climate.

In session 4, the presentations given covered the following:

- **FIThydro activities related to Session 4 (Laurent David, CNRS)**
- **The Eflows methodology (Atle Harby, SINTEF)**
 - These two presentations were combined, and offered an introduction to the concept of environmental flows and various e-flows methods. There was also a more detailed overview of environmental flows in France, specifically the approach to determining e-flows downstream from HPPs.
- **Environmental flows in Mediterranean-type streams (António Pinheiro, IST)**
 - Building on the previous presentation, this presentation discussed the applicability of e-flows in the Mediterranean context. It was stressed that the FIThydro project is not developing new e-flows methods, but rather taking advantage of the test case experiences and addressing existing e-flows regime effectiveness.

6.1 Discussion during the session

The key issues raised during questions and discussions between the participants in this session addressed the following:

- The issue of **sediments in relation to flows** is one that will be considered in the project.
 - Not in the context of large reservoirs, but rather for maintenance of downstream spawning grounds.
- Some rivers have a flow regime which is the opposite of the “normal” regime, i.e. high flows in summer and low flows in winter. Sometimes the **maximum flow** can be more dangerous than the minimum flow.
- It can take many years to determine if a new Eflow is effective, sometimes more than 5-10 years. As such, there is a need for **indicators to measure short-term progress**. A combination of monitoring and resulting indicators should be used in a useful way.

6.2 Participant feedback via paper forms

Additional feedback was collected from participants through feedback forms distributed during the session on the (1) major issues (key problems, open questions) with regard to methods and technologies, (2) approaches and solutions applied in the Iberian Peninsula to handle key problems, and (3) recommendations or requests to the work-programme of FIThydro.

Following session 4, a total of five feedback forms were collected.

The following summarizes the issues which the participants considered as important/relevant. The full responses in the feedback forms can be found in the Annex.

Key problems, open questions

1. The minimum flow issue is the first obstacle to restoring rivers in the Iberian Peninsula.
2. Extreme flows in summer for a short period of time could be particularly detrimental.
3. The strategy followed by the Spanish public administration to impose environmental flows has not been able to seek the support and collaboration of water users, which has led to many complaints of affected rights, lawsuits, etc.
4. The Spanish legislation on environmental flows mixes different methodologies that are not compatible and establishes criteria lacking ecological basis. As a consequence, the results are highly variable, arbitrary and inconsistent, which increases the conflict between the water authority and the affected users.
5. Key open questions are “How are these flows determined?” “What methods should be used to determine these flows?”
6. Environmental flows during droughts
7. Environmental flows and the specificity of Iberian habitats
8. The environmental objectives of environmental flows
9. Compatibility with other uses and objectives

Approaches and solutions to handle key problems in Portugal and/or Spain

1. Mitigation measures downstream.
2. There are environmental flows that were applied but of which we don't know if they were suitable or not, so we need to assess what eflows were already applied before changing them.

Stakeholder recommendations of general nature

1. Analyse the results of the monitoring already made on applied environmental flows and draw practical conclusions from the results.
2. Regarding the ecological flows, and given the already extensive scientific bibliography on the methods for the definition of ecological flows, it would be very useful to develop a framework for the evaluation of their efficiency, particularly the realization of the objectives, the key indicators and the expectation of response in temporal terms. The framework, built in part with the current technical-scientific knowledge, would be very important to clarify the dialogue between the different stakeholders

Stakeholder requests with relevance to FIThydro

1. Prepare a guideline or „handbook“ to support decision making and to assess environmental flows efficacy (e.g. environmental goals, efficacy indicators).

2. Contribute to objectify the methods of calculation of environmental flows everywhere and develop indicators that allow to assess the ecological effectiveness of environmental flows once implemented.
3. Adapt solutions and devices to release these flows in existing dams.

7. Cost-effectiveness assessment of mitigation strategies and socio-economic/policy challenges for decision-making (Session 5)

This session covered issues concerning the design of mitigation strategies for achieving self-sustained fish population in regulated rivers and ways to estimate their effectiveness and costs (i.e. costs of implementation and operation). This session also covered issues with regard to opportunities and challenges of the regulatory policy framework and financial mechanisms for planning and operating hydropower plants as well as social aspects, especially the public acceptance of hydropower.

In session 5, the presentations given covered the following:

- **Mitigation strategies in FIThydro and the assessment of their cost-effectiveness (Atle Harby, SINTEF)**
 - The main groups of mitigation measures to be addressed in FIThydro include flow release, habitat adjustments, fish migration, and sediment management. The work of FIThydro on the cost-effectiveness of mitigation measures will address among other things how to determine the best economic choice when comparing very different mitigation methods;
 - FIThydro will systematically develop guidance for diagnosis of bottlenecks, and finding cost-effective mitigation solutions.
- **FIThydro Public Acceptance Survey (Pedro Leitão, HIDROERG)**
 - Brief presentation of the FIThydro Public Acceptance Survey and explanation of what feedback is needed from the participants for its validation.

7.1 Discussion during the session

The key issues raised during discussion between the participants in this session addressed the following topics:

- An important concern raised relates to who is responsible for paying for mitigation measures and whether expropriation of the property is considered an option.
 - In most countries, the polluter-pays principle applies, for hydropower; the operator has to do as much as possible, without adverse effect on use.
 - There is the possibility of implementing grants and green labels, so that consumers pay extra to get their power from these producers.
- With regards to the public acceptance survey, it is imperative that the questions are not overly complex – feedback from stakeholders will help avoid this.
- The method of carrying out the survey, particularly the locations where it will be carried out, must be determined, and should avoid unnecessary bias.

7.2 Participant feedback via paper forms

Additional feedback was collected from participants through feedback forms distributed during the session on the (1) major issues (key problems, open questions) with regard to methods and technologies, (2) approaches and solutions applied in the Iberian Peninsula to handle key problems, and (3) recommendations or requests to the work-programme of FIThydro.

Following session 5, a total of five feedback forms were collected.

The following summarizes the issues which the participants considered as important/relevant. The full responses in the feedback forms can be found in the Annex.

Key problems, open questions

1. Active operation permits that condition changes in production regime or in eflows.
2. There is no law enforced criteria for decision-making regarding the application of mitigation strategies.
3. The lack of social awareness about the environmental problems, in general, and the hydrological characteristics of the Iberian Peninsula, which have determined a strong tradition of water management focused on supply guarantees (urban, agricultural, industrial, ...) ahead of other functions, such as the adequate conservation of aquatic ecosystems.
4. How to quantify the benefits in Iberian Peninsula - socio-economic importance of preservation of cyprinid species. This question is important for the cost-effectiveness assessment of mitigation measures.
5. As far as measures are concerned, it is essential that their implementation is based on a cost/benefit analysis. It is therefore necessary that the environmental objectives to be achieved and the efficiency/effectiveness indicators are clear and that the investments or production losses associated with the measures must also be quantified.

Approaches and solutions to handle key problems in Portugal and/or Spain

1. Isolated research studies of some universities should be enlarged

Stakeholder requests with relevance to FIThydro

1. It is important to clarify some of the concepts used with regard to mitigation measures in the surroundings of hydroelectric plants (e.g. ecological flows, fishways); the inherent perspective is the remediation or rehabilitation, not restoration (return to the original ecosystem).
2. A „Handbook of criteria“ (design, operation, post-evaluation, monitoring) unified in Europe is required. FIThydro should have as main objective to fix that in order to be transferred into regulation laws.
3. Contribute to knowledge on the real state of the situation in order to identify the key points and contribute, through knowledge and information, to solving the main problems (see key problems above).
European benchmark for electricity production companies concerning environmental obligations, implementation, funding, assessment and success of measures.

8. Annex 1 – Workshop Programme

Agenda: 2nd Regional Stakeholder Workshop – Iberian Peninsula

20 March, Lisbon, Portugal

Meeting information

Meeting: 2nd Regional Stakeholder Workshop – Iberian Peninsula	Location: Instituto Superior Técnico (Campus Alameda), Lisbon, Portugal
Initiated by: FIThydro Portugal and Spain representatives	Date: 20 th March 2018
Distribution: FIThydro Steering Committee and Portuguese and Spanish Stakeholders	Schedule: Check detailed program below
Host: IST-ID - Association of Instituto Superior Técnico for Research and Development	Venue: IST, Civil Engineering Building Room 4.41, 2 ^a floor

AGENDA

Tuesday, 20th of March

Time	Item	Presenter
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Time	Item	Presenter
9:00 – 9:20	Presentation of FIThydro Project and of Stakeholders	Peter Rutschmann (TUM) António Pinheiro (IST) Javier Sanz-Ronda (ITAGRA)
Session 1: Cyprinid species: ecology and constraints		
9:20 – 9:35	FIThydro activities related to Session 1	Ruben van Treeck (IGB)
9:35 – 9:50	Iberian cyprinids: habitat requirements and vulnerabilities	Francisco Godinho (HIDROERG)
9:50 – 10:30	Discussion (ca. 40 min)	All
10:30 – 10:50	<i>Coffee break</i>	
Session 2: Fish-passages for up and downstream migration: attraction flow		
10:50 – 11:05	Effectiveness of fish passage: engineering and practice	Javier Sanz-Ronda (ITAGRA)
11:05 – 11:20	Fishways design for Iberian cyprinid fish species	Ana Quaresma (IST)
11:20 – 11:35	Solutions for downstream migration	Laurent David (CNRS)
11:35 – 12:15	Discussion (ca. 40 min)	All
Session 3: The impacts of hydropeaking and mitigation measures		
12:15 – 12:45	FIThydro activities related to Session 3 The hydropeaking tool	Atle Harby (SINTEF) Matthias Schneider (SJE)
12:45 – 13:00	Hydropeaking mitigation measures	Isabel Boavida (IST)

Time	Item	Presenter
13:00 – 13:30	Discussion (ca. 30 min)	All
13:30 – 14:40	<i>Lunch</i>	
Session 4: Environmental flows: applicability to Mediterranean-streams		
14:40– 15:00	FIThydro activities related to Session 4 The Eflows methodology	Laurent David (CNRS) Atle Harby (SINTEF)
15:00 – 15:15	Environmental flows in Mediterranean-type streams	António Pinheiro (IST)
15:15 – 15:55	Discussion (ca. 40 min)	All
15:55 – 16:15	<i>Coffee break</i>	
Session 5: Cost-effectiveness assessment of mitigation strategies and socio-economic/policy challenges for decision-making		
16:15 – 16:30	Mitigation strategies in FIThydro and the assessment of their cost-effectiveness	Atle Harby (SINTEF)
16:30 – 16:45	Discussion (ca. 15 min)	All
16:45 – 17:00	FIThydro Public Acceptance Survey	Pedro Leitão (HIDROERG)
17:00 – 17:15	Discussion (ca. 15 min)	All
17:15 – 17:30	Final remarks - conclusions	António Pinheiro (IST)

9. Annex 2 – List of workshop participants

2nd FIThydro regional stakeholder workshop for the Iberian Peninsula,

Lisbon, Portugal, 20 March 2018

List of Participants

First Name	Last Name	Institution	Country
Carlos	Alexandre	Marine and Environmental Sciences Centre	Portugal
Isabel	Boavida	Instituto Superior Técnico para a Investigação e Desenvolvimento	Portugal
Pedro	Brufao Curiel	Universidad de Extremadura	Spain
Rui	Cortes	Universidade de Trás-os-Montes e Alto Douro	Portugal
Sergio	Costa	AQUALOGUS, Engenharia e Ambiente, Lda.	Portugal
Maria João	Costa	Instituto Superior Técnico para a Investigação e Desenvolvimento	Portugal
Hugo	Custódio	COBA - Engineering Consultants and Environment, S.A.	Portugal
Juan Jose	Dapena	Iberdrola Generación	Portugal
Laurent	David	Centre national de la recherche scientifique-Pprime	France
Pedro	Eira Leitão	Hidroerg	Portugal
Nuno	Forner	ZERO - Associação Sistema Terrestre Sustentável	Portugal
Francisco	Godinho	Hidroerg	Portugal
Atle	Harby	SINTEF	Norway
Eduardo	Lafuente	Confederación Hidrográfica del Segura	Spain
Carlos	Marcos	Confederación Hidrográfica del Duero	Spain
Verónica	Onofre Pinto	Agência Portuguesa do Ambiente	Portugal
João	Pádua	EDP Labelec	Portugal
Antoni	Palau	University of Lleida	Spain
Anabela	Peres	EDP -Gestão da Produção S.A.	Portugal
Paulo	Pinheiro	AQUALOGUS, Engenharia e Ambiente, Lda.	Portugal
António	Pinheiro	Instituto Superior Técnico	Portugal

First Name	Last Name	Institution	Country
Maria Manuela	Portela	Instituto Superior Técnico	Portugal
Ana	Quaresma	Instituto Superior Técnico	Portugal
Pedro	R. Almeida	Universidade de Évora	Portugal
Ignacio	Rodríguez	Confederación Hidrográfica del Duero	Spain
Pablo	Rodríguez Porras	Ministry of Agriculture and Fisheries, Food and Environment	Spain
Juan Carlos	Romeral	C.H. Salto Vadocondes, S.A. - SAVASA	Spain
Peter	Rutschmann	Technical University of Munich	Germany
António	Sá da Costa	Associação Portuguesa de Energias Renováveis	Portugal
Marta	Santo	Instituto da Conservação da Natureza e das Florestas	Portugal
José Maria	Santos	Instituto Superior de Agronomia	Portugal
Fco. Javier	Sanz-Ronda	University of Valladolid	Spain
Matthias	Schneider	SJE Ecohydraulic Engineering GmbH	Germany
John	Tarpey	Ecologic Institute	Germany
Ana	Telhado	Agência Portuguesa do Ambiente - APA	Portugal
Ruben	van Treeck	IGB Leibniz-Institute of Freshwater Ecology and Inland Fisheries	Germany

10. Annex 3 – Participant feedback forms

Table 1: Session 1 – Cyprinid species – ecology and constraints

Q1: What do you consider as the major issues (key problems, open questions) with regard to cyprinid species in reaches influenced by hydropower in the Iberian Peninsula?	Q2: What approaches and solutions are applied in the Iberian Peninsula to address the key problems and open issues with regard to cyprinid species in reaches influenced by hydropower ?	Q3: What are your recommendations or requests to the work-programme of FiThydro with regard to cyprinid species in reaches influenced by hydropower ?
Habitat loss	Considering habitat loss Spanish regions adopted dam removal programs. Portugal developed recently a dam removal strategy	The hazard fish index should reflect the cumulative impacts of several structures
Low efficiency of fish passes	Naturalized fish passes have recently been implemented	e-flows should attempt to decrease the WUA of invasive species
Invasive fish species domination	No effective program is related to control invasive species, besides legislation	
The change of type of water, from rivers to lentic waters (reservoirs)	„Fish stairs“ (Fish ladders) and elevators	New design of reservoirs, with a „channel“ or part of it designed as a „river“ with gravel spawners inside (maybe using water from a tributary river)
The barriers that dams are, especially the ones which are so high that is not possible to build a solution sustainable in time	Changes in environmental flows	
Increasing of exotic fish species		
The lack of scientific and technical knowledge about the biology of these species and their communities, and about the use they make of the fluvial channel in terms of physical habitat.	In general, little attention is paid to Iberian cyprinid species. I do not know relevant management experiences.	Contribute to the development of models of use of the fluvial channel as physical habitat (at the scale of communities rather than at the species level) of the cyprinids, in order to identify the possible affectations in reaches influenced by hydropower.
Hybridization and genetic variability loss	Habitat improvement	Increase knowledge on ecology and biology (relevant for mitigation measures efficiency)

Cumulative impacts	Restocking	Compilation/construction of preference (or suitability) curves for different cyprinid species
		Mitigation measures toolbox and guidelines to select best measures based on a cost-benefit analysis

Table 2: Session 2 - Fish passages for up and downstream migration – attraction flow

Q1: What do you consider as the major issues (key problems, open questions) with regard to fish passages for up and downstream migration in the Iberian Peninsula?	Q2: What approaches and solutions are applied in the Iberian Peninsula to address the key problems and open issues with regard to fish passages for up and downstream migration ?	Q3: What are your recommendations or requests to the work-programme of FIThydro with regard to fish passages for up and downstream migration ?
Reservoir effect: How to help fishes to face the reservoir in the direction to the spawning grounds	Monitoring of e-flows are now implemented in many hydropower dams in Portugal	Analyse fish pass selectivity (e.g. native versus exotic species)
Lack of monitoring of fish passes in order to assess its efficiency	Fish passes are more common in the new dams	Location and attraction ability of the fish passes need to be emphasized
Low attention to downstream migration	Nature-like fish passes are getting more common	
Attraction flows and fishway locations (especially attraction)		Have a look and special study for higher dams. All of the presented studies are based or focused on small dams.
		What could be a „technical“ and „economical“ solution for the intakes (turbine circuits) in order to decrease the mortality
They are often built without evaluating if they are really necessary;	In recent decades, fish passages (preferably for upstream migrations) have been built. But in the Iberian rivers there are more than 1,300 large dams, in addition to a large number of weirs. Some of these hydraulic works (very few) are useless or obsolete and can be removed, but this is not possible for the rest. Due to its design and dimensions, it is also not possible to build fish passages in many dams.	Contribute to correct the problems identified in Q1
They are designed without taking into account the species that are going to use it, nor the needs of migrations downstream;		

They are not maintained adequately throughout their lifetime		
Their usefulness is almost never evaluated (or is done poorly).		
Fishway entrance location and attraction flow which will compete with discharge and turbine flows	The management of the opening of the gates (gates operation regime) and the changes done to the bed and the downstream stilling basin contributed to the efficiency of the Açude-Ponte de Coimbra (Coimbra Dam) Fishway	To analyse fishways built at small-scale hydropower plants that work badly and analyse solutions to improve them, if possible
Operating regime should be compatible with fishway operation		
Efficiency of existing fish passages		Protocol to assess fish passages suitability
New fish passage design		Define best solutions for downstream and upstream
		Study fish passages suitability concerning seasonal Mediterranean flow variability

Table 3: Session 3 - The impacts of hydropeaking and mitigation measures

Q1: What do you consider as the major issues (key problems, open questions) with regard to the impacts of hydropeaking and mitigation measures in the Iberian Peninsula?	Q2: What approaches and solutions are applied in the Iberian Peninsula to address the key problems and open issues with regard to the impacts of hydropeaking and mitigation measures ?	Q3: What are your recommendations or requests to the work-programme of FIHydro with regard to the impacts of hydropeaking and mitigation measures ?
Hydropeaking on contrary of e-flows are not taken into account yet on mitigation measures	Actually only the hydropeaking impacts are monitored...not much more	To know more in detail hydropeaking impact on native Iberian fish species
Rehabilitation measures as a consequence of hydropeaking are not applied (gravel deposition, riparian plants, bank stabilization, etc.)		To monitor habitat modification, e.g. spawning grounds removal as a consequence of hydropeaking
Mitigation measures should be related to the hydropeaking impacts on target fish species but as well on banks, riparian vegetation.		
It should be mandatory to study or include mitigation measures during the Environmental Impact Assessment of new Dams	Mandatory measures for the Licensing Authorities	
Also a Handbook of Mitigation Measures should be created in order to be applied for all of new projects		
In order to have a „Handbook of Measures“, more studies and monitoring of already implemented mitigation measures should be done		
The main problem is the lack of knowledge of the real effects of hydropeaking. There are still very few studies, and many different scenarios (river reaches with hydropeaking) that do not allow reliable extrapolations of	In the Spanish legislation (Hydrological Planning Instruction) there are specific criteria for limiting the effects of hydropeaking (eg limiting the rate of change of flow per unit of time, but at the moment	Contribute to the development of criteria, indexes and work methodologies that allow identifying and quantifying objectively, the effects of hydropeaking on fluvial ecosystems.

results. Many impacts attributed to hydropeaking are theoretical. If the effects are not known, it is impossible to have adequate mitigation measures.	this criterion is inapplicable, due to the function that the hydroelectricity fulfills within the national system of production of energy.	
Erosion and sediments are significant impacts that are usually not mitigated	Solutions are not being applied nor tested	
	To test measures might change the idea that the measures imply a reduction of economic benefits/profitability	
Design and assessment of efficiency of key measures to minimize the impacts of hydropeaking without affecting significantly the production of electricity and without changing the function in the market of each hydroelectric plant		guidelines to minimize impacts of hydropeaking, taking into account the complex market of energy;
		Study of measures based on non-alteration of hydropower exploitation regime (e.g. improving downstream habitat)

Table 4: Session 4 - Environmental flows – applicability to Mediterranean streams

Q1: What do you consider as the major issues (key problems, open questions) with regard to environmental flows in the Iberian Peninsula?	Q2: What approaches and solutions are applied in the Iberian Peninsula to address the key problems and open issues with regard to environmental flows ?	Q3: What are your recommendations or requests to the work-programme of FIThydro with regard to environmental flows ?
Extreme flows in summer for a short period of time	Mitigation measures downstream	Prepare a guideline or „handbook“ of criteria for taking decisions
The strategy followed by the Spanish public administration to impose environmental flows has not been able to seek the complicity and collaboration of water users, which has led to many cases of complaints of affected rights, lawsuits, etc.	The Spanish legislation on environmental flows mixes different methodologies that are not compatible and establishes calculation criteria that do not have too much ecological basis. As a result, the results are highly variable, arbitrary and inconsistent, which increases the conflict between the water authority and the affected users.	Contribute to objectify the normative methods of calculation of environmental flows everywhere and develop indicators that allow to verify the ecological effectiveness of environmental flows once implemented
How are these flows determined? What methods should be used to determine these flows?	There are environmental flows that were applied but of which we don't know if they were suitable or not, so we need to assess what was already applied	Analyse the results of the monitoring already made and take practical conclusions of the results
Adapt solutions and devices to discharge these flows in already built dams		
E-flows during droughts		Guidelines to assess environmental flows efficacy (e.g. environmental goals, efficacy indicators)
E-flows and specificity of Iberian's habitats		
Environmental objectives of e-flows		
Compatibility with other uses and objectives		

Table 5: Session 5 - Cost-effectiveness assessment of mitigation strategies and socio-economic/policy challenges for decision making

Q1: What do you consider as the major issues (key problems, open questions) with regard to the cost-effectiveness assessment of mitigation strategies and socio-economic/policy challenges for decision making in the Iberian Peninsula?	Q2: What approaches and solutions are applied in the Iberian Peninsula to address the key problems and open issues with regard to the cost-effectiveness assessment of mitigation strategies and socio-economic/policy challenges for decision making ?	Q3: What are your recommendations or requests to the work-programme of FIThydro with regard to the cost-effectiveness assessment of mitigation strategies and socio-economic/policy challenges for decision making ?
Already signed licenses that conditioning changes in production regime or eflows	Isolated studies of some universities	„Handbook of criteria“ (design, operation, post-evaluation, monitoring) unified in Europe is required. FIThydro should have as main objective to fix that in order to be transferred into regulation laws
There is no „standard“ or guideline of criteria for decision making regulated in law		
The lack of social awareness about the environmental problems in general and the hydrological characteristics of the Iberian Peninsula, which have determined a strong tradition of water management focused on supply guarantees (urban, agricultural, industrial, ...) ahead of other functions, such as the adequate conservation of aquatic ecosystems.	I do not know. I think there is not much work done in this area.	Contribute to know the real state of the situation in order to identify the key points and contribute, through knowledge and information, to solve the problems raised in Q1.
How to quantify the benefits in Iberian Peninsula - socio-economic importance of preservation of cyprinid species. This question is important for Cost-effectiveness assessment of mitigation measures. Evaluate costs and results.		European benchmark for electric companies concerning environmental obligations, implementation, funding, assessment and success of measures.