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Editorial

Undisturbed river continuity – freeflowing and without artificial barriers – is fundamental to the hydromorphological and ecological health of rivers. Recent studies and inventories indicate that the degree of river fragmentation by artificial barriers is remarkably high in many regions and countries of greater Europe and river restoration is considered as the most progressive mechanism to improve this.

Across the European Centre for River Restoration (ECRR) member countries it was commonly agreed that there was no overview of longitudinal river continuity restoration policy, planning and implementation progress across different countries. Therefore, the River Continuity Survey was set up to investigate the situation in each country and to ask the national river management authorities to clarify the general and country specific policies, demands and the support that is needed. This survey has obtained a pan-European overview of the current status of policies and future plans regarding river continuity in all countries. The overall

conclusion is that European and national governments, supported by NGOs and (knowledge) networks (such as the ECRR), can together contribute to developing the policy, planning and implementation to achieve the specific goals of longitudinal continuity restoration.

This article is a special summary of the full report that can be downloaded from the ECRR website, <u>www.ecrr.org</u>. Many ECRR Member organizations, national institutions/organizations and individuals contributed to the design, implementation, and reporting of the survey. We would like to thank each country's national authority participants for investing their valuable time in compiling the survey answers, as well as attending the survey participants meeting.

The ECRR Board would like to especially thank the main supporter of the survey, the Dutch Foundation for Applied Water Research (STOWA), and the authors of the full report and this article, for their dedicated and professional work to make the survey a real success.

Martin Janes, Chairman ECRR.



New upstream fish passage made of composite in the Pite River in the north of Sweden. © Bart Fokkens



A pan-European survey to develop policies and strategic planning regarding river continuity restoration

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1. Introduction



River barriers, including dams, weirs, culverts, fords, sluices, and ramps or bed sills, are man-made obstacles that are installed in rivers for specific, mostly provision-related, ecosystem services such as flow regulation, hydropower generation, water level control or erosion reduction (AMBER, 2020). Other functions include transport (navigation), recreation, water storage for agriculture (irrigation) and drinking water, flood protection, and cultural heritage. However, they obstruct a river, disrupting the longitudinal flow of the water, sediment and aquatic biota. The disruption of river continuity has been shown to result in a major decrease in species diversity (Joy & Death, 2001; Morita & Yamamoto, 2002), as well as population declines and even extirpation of freshwater fishes and mammals (Allan & Flecker, 1993; Miller et al., 1989; Page et al., 1997). Only 37% of rivers around the world that are longer than 1,000 kilometers are still free flowing and only 23% flow into the ocean without interruptions (Grill et al., 2019), so the current status of global river continuity is not good, and it is worsening.

2. Rationale

A river continuity survey approach made it possible to investigate the current situation in every participating country regarding the recognition of the importance of river continuity in national policies and the potential for restoration. By getting to know the country specific situations, the questions have provided insight into policies and the required support concerning guidance and tools. In order to advance river continuity restoration, what should be the main strategy per country and/or group of countries? This has been analysed through 60 questions, put to national governments which covered the following topics: *1. Recognition of river continuity in current national policies 2. The potential of river continuity restoration in each country 3. Observations/opinions on the importance of and opposition to river continuity restoration*

The answers to this survey and the results of their analyses have allowed initial conclusions and recommendations to be drawn as to the current situation regarding river continuity restoration policies and strategic planning in wider Europe. This information can be used in follow-up activities to formulate advices, improve current policies or propose and develop new policies and national restoration strategies, and generate greater support. Altogether, this could subsequently be developed into a Europe-wide openly accessible database on the plans, progress and status of river continuity, assisting national governments and river authorities in restoring river continuity. This will be beneficial for all the participating countries for achieving the relevant water legislation targets and UN Sustainable Development Goal 6.5.

3. Survey results

3.1 Participating countries



Figure 1. The 29 participating countries (green).

29 out of the 49 contacted countries, covering more than 80% of the area, have participated in the survey (figure 1). The participants mainly consist of specialists and senior research officers at environmental ministries, nature agencies, and marine and riverine knowledge institutes for water resources management.

All survey questions and the answers can be found in the full report 'A pan-European survey to strengthen and improve policies and strategic planning regarding river continuity restoration' by Verheij, Fokkens and Buijse (2021). In this special newsletter, only the most important results will be shown.



3.2. Recognition of river continuity in current national policies

• 80% of all participating countries have any form of national river continuity restoration policy or strategy, while the other 20% have broader and more comprehensive plans.

- The EU WFD and fish migration improvement are the main drivers for river continuity restoration.
- Hydropower generation is the main barrier function conflicting with river continuity restoration, followed by flood protection.
- Functional uses of a barrier are on average for 80% regulated by law and/or permits, especially for hydropower generation and flood protection, but hardly for recreation and cultural heritage.
- In case of a permit, in 40% of the countries there is no obligation to remove a barrier after the term of the permit has expired.

• Half of the countries has a priority list of barriers where river continuity should be improved. The prioritized barrier types are (in order of importance):

- 1. Those with the largest environmental/ecological impact
- 2. Easy to implement measures (low hanging fruit)
- 3. Any barrier lacking a (functioning) fish passage
- 4. Obsolete barriers
- The measures to restore river continuity that are currently applied to river barriers are (in order of the extent to which they are applied):
 - 1. Adding a fish passage
 - 2. Constructing a bypass channel
 - 3. Barrier removal
- Funding of river continuity restoration measures is mainly covered by national and European funds. Global funds comprise only 1% of all available and used funds. With all the present financial instruments combined, on average 35% of the policy goals over the participating countries can theoretically be achieved.

While most countries (83%) do, five countries (17%) do not have any national policies or strategies operative to restore river continuity. These countries do address broader and overarching aspects of water courses through the implementation of the EU WFD: no policy documents specifically targeting river continuity are adopted (Malta); river continuity is either addressed in a more comprehensive RBMP (Croatia) or in a national strategy as a whole (Russia); there are higher priorities such as pollution prevention (Latvia); or multiple fields of jurisdiction decide which legal bases are implemented at administrative bodies (Bosnia and Herzegovina). For those countries that do have policies that include river continuity restoration, the two following results apply:

Drivers of river continuity restoration in national policy

The WFD and fish migration improvements both have the highest average value (8.2) followed by habitat (connectivity) restoration (6.4) and Nature2000/nature conservation policies (6.2) while the UNECE Water Convention scored the lowest (2.5) (figure 2). For some drivers, scores range from 0 to 10, meaning the importance of these drivers vary a lot per country. This is the case for the restoration of hydro-morphological processes, water (quantity) management, and making use of opportunities.

Figure 2. Relevance of drivers towards river continuity restoration in national policies on a scale of 0 (not applicable) to 10 (highest priority). The coloured boxes indicate 50% of the scores that have been answered, while the crosses indicate the average values, and the dots are outliers. (n=24)

Barrier functions conflicting with river continuity restoration

On the other hand, river continuity restoration can be opposed by the barrier functions. Hydropower is the highest scored function (7.5), while inland navigation appears from the answers to only be an opposing function to a small extent (2.9). Cultural heritage scored 4.5 on average, even though it has been stated in literature that this is an important function (Born *et al.*, 1998). The same applies to recreation (4.0), which is the only function left for the majority of the dams (Hoenke *et al.*, 2014). However, for almost every function listed, answers from 0 to 10 are given, meaning there are great differences between the participating countries on whether or not these functions conflict. The conclusions should therefore be contextually nuanced.





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Regulation of the functional uses of barriers

Various functional uses of a river barrier are regulated either by law or permit (figure 3). This differs greatly per function, especially for cultural heritage and recreation, which are either regulated by law (56% & 41%, respectively) or with no law or permit at all (26% & 33%, respectively). For the other functions, most countries regulate them by law, except for renewable energy which is mostly (52%) regulated by permits, with a varying time span of validity. For the other uses, the permits are either valid for a short

(lasting between 0 and 25 years) or a very long time (100+ years/indefinite). Most countries have a single regulation for each of the functional uses, meaning they are all regulated by either a law or permit and the permit validity has the same time span for each functional use.

Legal obligations to remove barriers once their permit ends

A substantial number of the countries (41%) does not have a legal obligation to remove a barrier after the validity of a permit has expired (figure 4). For seven countries (24%) it is an obligation to restore river continuity, and one country requires by law the removal of the barrier. For those answering 'other' (31%) there are no obligations yet, but in the near future the WFD will be implemented to legally require removal of barriers after a permit ends (Croatia). Scotland states that river connectivity has to be restored by adding or renovating fish passages, when the barrier remains in place. After a certain period of time, a permit can be revised and requested again (Hungary, Sweden). On the other hand, if a renewal of a permit is not requested the barrier does not necessarily have to be removed instantly, since this could in some cases lead to threatening of habitats (Germany). These results should therefore be dealt with case by case.



Figure 4. Distribution of the number of countries with and without legal obligations, and the type of legal obligation to remove a barrier once the permit ends. (n=29)

National priority lists of barriers where river continuity should be improved

There is a small majority (52%) of countries that do have a priority list of river barriers where river continuity should be improved. The countries which do not have such a list indicate that a list is still in development and is due to be adopted at a



Figure 3. Regulations for various functional uses of a river barrier. (n=28)

later time, or there is a list for parts of the country or only on designated water bodies, or for a single use (hydropower). For a few countries there is simply no obligation or strategy yet. For the countries that do have such a list, eleven (38%) have officially established this list. This priority list is established on different scales: 50% nationally, 30% regionally and 20% together with other countries.

Type of barriers prioritized for measures to improve river continuity

Barriers with the largest environmental or ecological impact clearly scored highest (8.7, figure 5). For obsolete and small structures the answers are very country dependent. For high dams it is practically unanimous that these are not or barely addressed (1.5), although two countries indicated high dams to be of high or even the highest priority (England and Estonia).



Figure 5. Type of barriers that are prioritized for measures to improve the river continuity on a scale of 0 (not considered) to 10 (highest priority). (n=15)

Measures to restore river continuity

The most implemented measure is the addition of a fish passage to an already existing barrier (6.2) whereby the functional use remains intact. Then, constructing a bypass channel or barrier removal (5.2). Complete removal of a barrier varies much among countries. This makes sense as it is not always possible to remove a barrier for instance when it is used for hydropower generation. For a several countries (Wales, Scotland,



Ireland, Denmark, and Cyprus), removal is scored high. It could be because these countries have relatively few hydropower dams compared to other European countries (Manzano-Agugliaro *et al.*, 2017). Lowering the barrier is scored lowest (3.0). Overall, it is rather country dependent as to which one is applied more often or is considered more effective than others (figure 6). Therefore, table 1 shows the scores per country.



Figure 6. Type of measures that are applied to restore river continuity on a scale of 0 (not considered) to 10 (highest priority). (n=28)

Table 1. Country-specific answers to the question 'Which measures	
are applied to restore connectivity or river continuity?'.	

Country code	Adding a fish passage	Constructing a barrier bypass channel	Barrier removal	Structural modification to improve environmental or ecological flows	Lowering the barrier	Overall
UK: WLS						
PL						
UK: SCT						
ES						
IE						
EE						
FR						
FI						
UK: ENG						
DK						
CY						
SE						
DE					_	
AI					_	
					-	
					-	
SK						
NL					_	
NO					- 1	
HU						
LV						
BA					Ī	
RU						
MT						
Overall						

Table legend: Score categories

Low

Overall categories

ligh

High

Available financial sources for river continuity restoration

There are few global funds available or used (1.3%). European funds (29%) are the primary financial source in Eastern European countries, while national government budget allocations (34%) are widely used in Western Europe, explaining the wide range. The three remaining financial sources – private funds, regional government budget allocations and (special) national funds – each account for approximately 10% on average (figure 7). The percentage of the total policy goal that can be achieved with the available financial instruments is indicated to be 35% on average, meaning that 65% of the goal cannot be achieved. Thus, budgets have to be increased or other forms of financial sources have to be found and opened up.



Figure 7. Financial sources that are available and used for river continuity restoration. (n=29)

3.3 The potential of river continuity restoration in your country

• A national database of artificial river barriers is used by 70% of the countries. Most of them have the number of barriers registered for a greater part of the country, while a few know all of them.

• Knowing the quantity of the majority of dams is sufficient. However, if no information is known for a certain country, more effort should be put into finding out the right numbers to a sufficient extent.

• 10% of the listed number of barriers is already passable for fish or has a fish passage, while 50% can be adjusted to become passable.

• 20% of all barriers is thought to be obsolete, of which a third is believed to be removable (7% of the total). A mere 1% has been removed so far.

• 15% of the barriers are planned to include hydromorphological and ecological restoration measures.

• 85% of the countries have expressed the ambition to contribute to the EU Biodiversity Strategy implementation. It has been indicated that much more can be done with low-cost actions through regular river maintenance and by barrier removals with smart resource allocations.



Barrier numbers

Most participating countries (72%) have a national database on the artificial river barriers, with eight not yet (Wales, North Macedonia, Northern Ireland, Lithuania, Bosnia and Herzegovina, Cyprus, Denmark & Norway). In four countries (14%) the total number of all barriers is known and in nineteen countries (66%) the majority. The remaining six countries (21%) only have details of the major barriers.

The recipients were requested to provide the following information about barriers and continuity restoration measures. There is an estimated total of 680,227 barriers in all the participating countries combined. From this total, 9.5% has a fish pass included, or the barrier is passable for fish. 46% of all barriers can be adjusted to include fish passage. 20% of the barriers is thought to be obsolete of which a third can be removed. The removed barriers account for only 1%. Lastly, 13% of the barriers are already planned to include hydromorphological and ecological restoration measures. Overall, European wide there is still a long way to go to acquire all the numbers of barriers in each country. The table with all provided numbers is included in the full report.

Biodiversity Strategy 2030

With an overall mean of 5.6 and a wide range, the extent to which attempts are made in the participating countries to reach the goal of the Biodiversity Strategy 2030 to restore 25,000 kilometres of rivers to be free flowing greatly differs across Europe. Only four countries do not have the ambition to contribute (Malta, England, Scotland & Switzerland). For Malta this is because their rivers are very small and generally restricted to watercourses with intermittent flows and fluctuating water levels. Switzerland and the UK countries are not in the EU, so any contribution to this goal is not legally obliged, though there are great opportunities to contribute.

The twenty-five countries (86%) that do contribute mention that it can (partly) be achieved with low-cost actions through standard and regular river maintenance measures. There is societal responsibility and political pressure to contribute to the goal. It is generally recognized that many barriers and rivers require improvement and restoration. Several country-specific examples of actions are: Wales established a River Restoration Programme in which physical modifications are priori-

tized; Poland has a National Surface Water Restoration Programme; Ireland has funded a project to identify and prioritize barriers for removal; a fish pass for Iron Gates I and II in Romania is under development; Croatia assesses its floodplain status to identify possible actions; the first dam removal in Lithuania took place in July 2020. Many other conservation projects and strategies are in operation to restore 100 (Estonia), 400 and 1,260 (in two federal states of Germany), 2,000 (Poland), 3,000 (Spain), even up to 22,000 (Denmark) kilometres of rivers. For France, the goal of restoring 25,000 kilometres of rivers was already a goal for the country itself before the Biodiversity Strategy came into effect.

3.4 Observations/opinions on the importance of/opposition to river continuity restoration

- On average, the countries consider the importance of river continuity restoration as moderate (5.8).
- Most countries frequently face strong local conflict/opposition in relation to river continuity restoration projects ranging from 'sometimes' to 'with (nearly) every project' in 65% of the cases.

• The actions that are mostly used to improve the quality/ quantity of river continuity restoration are:

- 1. Improving information and knowledge
- 2. Legal enforcement and regulations
- 3. Financial support

• Governmental communication on river continuity restoration towards the public can be improved by awareness raising, public participation, and demonstration of best practices.

• The best ways to amplify the influence of NGOs on the government to implement policies on river continuity restoration are education, training and campaigning.

Local conflict/opposition

Four countries never observe local conflict/opposition in relation to river continuity restoration projects (Malta, Romania, Bosnia and Herzegovina and Cyprus), while three countries do so with (nearly) every project (Poland, Ireland and Portugal). In general, the conflicts are indicated to arise from agricultural farmers/landowners fearing natural threats and the interests of the energy sector that are not respected with barrier removals. Besides, citizens often oppose change.

Actions to improve the quantity and/or quality of river continuity restoration

There is no clear distinction which action is used more often than others each having a mean value of around 5 and the answers range from 0 to 10 for almost every action (figure 8). 'Complementing/ improving currently available information/

10 9 Legal enforcement and regulations 8 Better integration of policies and directives (energy, flood etc.) 7 Development of (best) practices 6 X Optimizing already existing 5 continuity measures × Financial support for projects and/or 4 the transversal structure owner 3 Complementing/improving currently available information/knowledge 2 Increasing political attention 1 Raising public awareness on the 0 issue Actions to improve river continuity restoration

Figure 8. Actions that are carried out to improve the quantity and/or quality of river continuity restoration on a scale of 0 (not used at all) to 10 (strongly performed). (n=29)



knowledge' has a slightly higher average score (5.4) and the least variation. Since there is so little variation between the actions and on the other hand so much differences between the countries the country-specific information is given (table 2). This shows that some countries need to take actions improving the quantity and/or quality of river continuity restoration efforts (Latvia, Bosnia and Herzegovina, Malta, Hungary, Cyprus, Croatia, Ireland, Russia, Norway and Poland), while other countries already implement most actions (Austria, North Macedonia, Wales, Slovakia, France, Denmark and the Netherlands).

Table 2. Country-specific answers to the question 'To what extent are the following actions used in your country to improve the quantity and/or quality of river continuity restoration?'.



Management planning: from idea to implementation

There are examples of projects with a short operation time frame from idea until implementation of measures on barriers, but many take much longer, up to more than 10 years before measurers are (properly) implemented. This is caused by diverse reasons, mainly related to the policy and planning process. Recommendations as to how this time frame could be shortened are:

- Increasing public awareness of the benefits of project outcomes (Wales);
- Careful selection and optimization of dam removal (Poland);
- Change in legislation to compel owners to cooperate, better
- funding systems and better planning requirements (Ireland);
- Increasing financial resources (Romania, Norway & Switzerland);
- Early collection of data and using in-house expertise (Scotland);
- Improving cooperation of governmental institutions and awareness raising of the issue (Estonia);

• Improving the collaboration process by arranging meetings for all participants together (Sweden);

• Carry out consultation with all interested parties and local communities at an early stage to find out what everyone would like for the river (France);

• Reviewing indefinite permits by changing them to a defined timescale (Finland).

Ways to improve the communication of governmental policies towards the public

The best way for governments to communicate river continuity restoration policies towards the public is by awareness raising (7.9, figure 9). This corresponds to literature on river management (Awoke *et al.*, 2016; Edelenbos *et al.*, 2017; Smits *et al.*, 2006) and was also concluded during the EU Green Week 2020 conference. Awareness raising is, however, no top priority in all countries (table 2). Besides raising awareness, public participation and demonstration of best practices also score high (7.4), while citizen science, promotion and advertising have been scored 0 a few times, meaning by some countries these actions are indicated to not be effective at all. Again, these answers were very country dependent.



Figure 9. Ways to improve the communication of governmental policies regarding river continuity restoration towards the public on a scale of 0 (not effective at all) to 10 (greatest impact). (n=29)



Ways to amplify the influence of NGOs on the government to implement policies

The best way to amplify the influence of NGOs on the government to implement policies on river continuity restoration is considered to be through education (7.4), but the difference with the other options is small with advocacy having the lowest mean value of 6.0 (figure 10).



Figure 10. Ways to amplify the influence of NGOs on the government to implement policies on river continuity restoration on a scale of 0 (not effective at all) to 10 (greatest impact).

4. Recommendations

The response to the 62 questions produced a tremendous amount of information on this aspect of river management in Europe. It is clear that the 29 countries differ considerably in their starting points and individual goals. This complicates drawing specific conclusions and recommendations for all countries as well as individual countries. It is however possible to make recommendations for different target audiences: policymakers and planners, implementers, and researchers.

Support, collaboration and communication

We have seen many changes in recent years in terms of new tools and technologies, process-based restoration, growing awareness and recognition of river continuity as an issue, as well as the expectations that the ecological status of rivers

will improve through restoration, and the communication between stakeholder groups has become more effective. It is important to keep improving the communication between policymakers & planners, implementers, and researchers. Direct collaboration and involvement between these groups is necessary to further progress the science and application of river restoration. This is where knowledge organizations and the civil society can combine forces to contribute on a social level by bringing people together and use their influence. This will help to scale up and carry out river continuity restoration in Europe to its full potential to achieve the European-wide goals of sustainable development.

Recommendations summary

Overall

- Countries should have a national policy on river continuity restoration.
- Countries should have a prioritisation strategy for barrier removals.
- Prioritisation of applied measures for river continuity restoration has not been asked for in the survey, but explorations for measure prioritisation approaches should be carried out.
- Countries should have a national database of artificial barriers, but the usefulness and necessity of the completeness of such a database should not be overestimated.
- There are clearly significant opportunities in river continuity restoration, so national governments should have implementation programmes in place.

Policymakers & planners

- All countries should improve or develop the present approach regarding strategy, policy and planning of river continuity restoration.
- Each countries can use the following outlines to check the status and development of the existing policy framework:
 - a. The barrier database

b. The prioritisation of basins, catchments, waterbodies, and barriers

- c. Prioritization of single or multiple barrier removals
- d. Prioritization of one or more barrier removals in river basins, catchments, or waterbodies
- e. The country-specific available plans and measures to be used
- f. Funding and financial instruments
- g. Technical knowledge and expertise
- h. Technical guidance and support
- i. Monitoring and evaluation
- j. Public participation
- k. Awareness raising

'Natural look like' bypass construction in the Vuoksi River in Imatra, Finland © Bart Fokkens.





• Develop the strategy, policy and planning framework in consultation with the whole group of countries that contributed to the survey, considering arranging together special guidance and support.

• With all participating countries, commonly investigate the existing strategies and their objectives and ambitions concerning policies, planning, prioritisation, guidance, instruments and tools.

Implementers

• Before developing and implementing river continuity restoration programmes and projects, the drivers and strategies should be clear and used as starting points.

• Increase the efforts in raising awareness locally among the general public, involve stakeholders from the start and show-case best practices.

Researchers

• Contribute to improve, expand and verify the information, methodologies, techniques and measures that are currently available and could be developed.

• Jointly investigate the scope and cross-compliance of policies and their implementation and the extent whether countries are able to implement the requirements of their national policies and/or the EU WFD. This can be done by testing and verifying the long term outcomes of the work and better integrating existing and new science into application on the ground. Furthermore, by monitoring baseline and changes, learning from implementation, providing the evidence on which to help change and improve policy and decision making.

EU Policy

• Many of the conclusions and recommendations can be of direct help for national governments to implement the EU Biodiversity Strategy 2030 and the EU Green Deal serving the EU Climate Pact.

Reflection and feedback on the survey

After the survey had been completed by most of the countries, there was a meeting with the majority of the participating countries. In this interactive meeting the results and their interpretation have been reflected upon and the questions and answer options have been evaluated by the participants. The discussions that have been conducted provided many useful insights on the given feedback on the survey as well as ideas on how the survey results and the ECRR can support other organisations to restore river continuity in the various countries. The way the questions from the survey have been asked and how they could have been improved has been clarified.

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The events calendar is regularly updated and allocated on ECRR website www.ecrr.org/News-Events/Events.

Call for articles

The newsletter of the ECRR should also be a way to share with one another what interesting work is being done, information about seminars or literature. One way of doing this is by writing an article of any project, event or literature you may be acquainted with. Send this article (*maximum of 500 words*) to the secretariat of the ECRR at info@ecrr.org

We will take a close look to the content and if it is coherent with the philosophy of ECRR (ecological river restoration and sharing knowledge) your article will be published with pleasure in the next edition (s) of the ECRR Newsletter.

The secretariat of the ECRR hopes to receive any article on ecological river restoration from any of its members

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