(Projects submitting final reports after 1 January 2014 must use this format.)

LIFE Project Number

LIFE10 NAT/SI/142

FINAL Report

Covering the project activities from 01/01/2012 to 31/08/2016

Reporting Date

<25/11/2016>

LIFE+ PROJECT NAME or Acronym

Ljubljanica Connects

Project Data

Project location	Ljubljana, Slovenia
Project start date:	01/01/2012
Project end date:	<31/12/2015> **Extension date:** <31/08/2016 >
Total Project duration (in months)	56 months (including **Extension of 8 months**)
Total budget	1,168,765.00 €
Total eligible budget	1,168,765.00 €
EU contribution:	584,382.00 €€
(%) of total costs	50%
(%) of eligible costs	50%

Beneficiary Data

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2 Executive Summary

The project “LIFE10 NAT/SI/142 Restoration of the Ljubljanica river corridor and the improvement of the river's flow regime” with acronym Ljubljanica Connects started on 1 January 2012. It ended on 31 August 2016; originally it was foreseen to end on 31 December 2015. The coordinating beneficiary is the University of Ljubljana (Faculty of Civil and Geodetic Engineering), associated beneficiaries are two private companies: Geateh d.o.o. and Purgator (inženiring) d.o.o.

PROJECT OBJECTIVES

The main project objective was the improvement of the ecological function, connectivity and passability of the Ljubljanica River reach from the city of Ljubljana downstream. Other project objectives were improving the ecological status of rivers with relatively simple restoration measures, ecohydrological studies, setting-up of a hydrological and hydraulic model to improve our knowledge about the Ljubljanica, and awareness-raising among the general public, which, due to the past water management, still regards the Ljubljanica as a threat rather than an essential element of environmental quality.

PROJECT AREA AND TARGET SPECIES

The project area is the Ljubljanica River corridor with a surface area of 14,793 ha. There are two NATURA 2000 sites in the project area: Ljubljansko barje (Code SI3000271) and Sava–Medvode–Kresnice (Code SI3000262).

This area of the Ljubljanica River is an important habitat for endangered target species under Natura 2000: Danube roach (*Rutilus pigus*), striped chub (*Leuciscus souffia*) and Danube salmon (*Hucho hucho*). According to the Rules on the Inclusion of Endangered Plant and Animal Species (Official Gazette of the RS Nos. 82/02 and 42/10) these species are included in the Red List of fish and cyclostomes as endangered species, whose survival in the territory of the Republic of Slovenia is not likely if the risk factors remain in place. The main threats to the species targeted were, and remain to be, water pollution, past river channel regulations and gravel extraction, fragmentation of native distribution areas and water sports such as rafting and canyoning.

The project consists of 9 technical actions:

- A1: Preliminary study of the habitat, hydrological and hydraulic conditions in the Ljubljanica River corridor, estimation of Danube salmon, Danube roach and striped chub
- A2: Preparatory actions for implementation of concrete conservation (restoration) actions
- A3: Establishment of the ecohydrological survey and hydraulic model
- C1: Reconstruction of the sill in Zalog
- C2: Reconstruction of fish passes at the Fužine weir and Ambrožev trg
- C3: Improvement of Ambrožev trg barrier
- E1: Coordination and administration of the project by the project coordinator and the project steering group
- E2: Monitoring and evaluation of the project restoration achievements
- E3: Management of the ecohydrological survey system and hydraulic model

The project has 2 dissemination actions:

- D1: Public awareness and dissemination of results
- E4: Networking with other LIFE and/or non-LIFE projects

All the actions were successfully implemented and completed despite the difficulties and problems that we faced during the project.

KEY DELIVERABLES AND OUTPUTS

The activities that were carried out under the project will contribute to the reunification of the endangered fish species due to the improved connectivity between the Sava River and the Ljubljanica springs, i.e. the spawning grounds for the targeted fish. On the Ljubljanica River in the past several facilities were built for various reasons, which interrupt the natural continuity of the river. In the 1950s, gates were built at Ambrožev trg in order to prevent drainage of Ljubljansko barje (the Ljubljana Marshes) and consequently subsidence of soil; the gates are today protected as a cultural monument of national importance. During low flow, gates are manipulated to control the water level upstream, which has an important impact all the way to Ljubljansko barje. A few kilometres downstream the gates at Ambrožev trg, at the end of the 19th century the first Slovenian alternating current hydropower plant was built. Already then, people were aware of the importance of river connectivity, so together with the gates a fish pass was also built, but it was not properly maintained, and therefore was out of function. In the framework of this project the functionality of both fish passes was restored. Furthermore, deflectors were installed at the exit of the fish passes, which prevent the ingress of floating debris in the fish passes. The floating debris had previously prevented the fish to exit the fish passes. As further explained in this report, the deflectors are one of the most innovative project results concerning the conservation of the endangered target and other fish species.

A network of water gauging sites (17) was established, where the water level and water temperature are measured, while at 3 (out of the 17) sites also the concentration of dissolved oxygen in water is measured. The results of these measurements have served, and will continue to serve, as the basis for a variety of hydrological, hydraulic, and ecological studies of the Ljubljanica River and its tributaries. Hydrological and hydraulic models were developed and calibrated, which will in the future help to automate the manipulation of the gates at Ambrožev trg. Under action C3 we reconstructed and updated the mechanical and electrical equipment at the Ambrožev trg gate for regulating the flow up to 10 m^3/s below the gate during the Ljubljanica's low flows. The gate lifting system was redesigned in a way to allow the travel of the gate of up to 200 mm above the weir with a fine regulation of the orifice with a minimum increment of 5 mm. The lift of the gate above 200 mm remained unchanged. The improved lifting system thus allows for a continuous regulation of low flows, which is hugely important for the conservation of favourable ecological conditions on the Ljubljanica river for various living organisms, particularly the target species in our project: striped chub (*Leuciscus souffia*), Danube salmon (*Hucho hucho*), and Danube roach (*Rutilus pigus*).

In the past, downstream of Fužine in Zalog the Ljubljanica chose a new path, but the old river meander is still preserved and provides habitat for many plant and animal species. Ecological conditions in the oxbow were severely degraded due to the dysfunctional sill downstream the oxbow. A function of the sill was, in addition to the stabilization of the riverbed, also to

regulate the water level in the oxbow. The sill was reconstructed within this project, which caused the rise of the water level in the oxbow, decreasing the heating of water and thus more suitable oxygen conditions for the species that live in the oxbow. Currently (in October 2016), the handover of management to the Ministry of the Environment and Spatial Planning of the RS is taking place regarding the following facilities: the fish pass at Ambrožev trg, the gate at Ambrožev trg, and the sill at Zalog.

The project also places great importance on educating the public (especially the local population living along the Ljubljanica River and local and national decision-makers) about the importance of river connectivity for fish and other organisms. During the project implementation we participated at numerous scientific conferences and other meetings, where we gained knowledge from other successful projects and shared our experiences and results with others (e.g. Fish Passage Conference, EGU). *In the framework of the project two films were recorded (a short and a long one) in both Slovenian and English. All versions of the films are available to the wider public via YouTube channel and the project web page. Moreover, under action D1 two brochures and four yearly bulletins, two posters, Layman's Report, and two flyers were published and distributed among relevant stakeholders. Notification boards were set up at three sites (Ambrožev trg, Zalog, Fužine). Action D1 was very closely connected to action E4 – Networking. The first step to be taken to connect with other scientists and similar projects is to disseminate our work. Some published material and project presentations were prepared to encourage scientific connections and establish networking with others. Dissemination of the Ljubljanica Connects project involved 3 types using different approaches to people: using the internet or computer, using printed material, and direct contact.*

To demonstrate the effectiveness of the implemented project actions, through which the situation of endangered fish species will improve, the coordinating beneficiary has developed an innovative system with cameras for monitoring the passage of fish through fish passes. The system is completely harmless and provides continuous results in real time. Recordings from the camera can be viewed live online by anyone. With this monitoring all three target fish species were detected (on both fish passes) and also 9 other fish species migrating through either one of the fish passes were detected. This confirms the functionality of the fish passes reconstructed under action C2. The analysis of the records indicates that most fish migrated through the fish passes in June (25,023 specimens per month), April (with 3253 specimens per month), and May (with 6151 specimens per month). This also applies to target fish species, since the highest number of target fish species migrated through the fish passes in May (Danube Salmon 8, Danube Roach 16, Striped Chub 3), April (Danube Salmon 6, Danube Roach 13, Striped Chub 5) and June (Danube Salmon 5, Danube Roach 3, Striped Chub 3). It is worth mentioning that fish do not use the fish pass in the case of high water levels when the river gates are open and there is no obstacle for fish to migrate upstream.

PROBLEMS ENCOUNTERED

Unfortunately, the implementation of the project did not go according to the schedule specified in the Grant Agreement. Some substantial modifications were necessary: the project was prolonged (with an extension of 8 months), there were changes in the financial structure (transfers of funds between actions and categories), and changes brought about by the two associated beneficiaries (e.g. the merger of two companies and the transfer of liabilities from the project to another beneficiary). Despite the problems and consequential amendments, all problems were solved, and did not affect the final results of the project. The problems that

were encountered in each action, and the ways of solving them, are described in the technical part of this report. Besides the substantial modifications, we also requested the European Commission (hereinafter: EC) for non-substantial modifications (e.g. a change in implementing a measure due to the liquidity problems of the associated beneficiary, Geateh).

On 21 January 2014 the empowered District Court in Koper, Slovenia, issued a Decision related to the merger of the company Purgator inženiring d.o.o. which had until that date been one of the associated beneficiaries in the project. Namely, the company merged with company Purgator d.o.o. The merger was necessary to avoid serious problems that could have arisen following the decline in economic activity in Slovenia, especially in the sector in which the company had operated. The company had liquidity and solvency problems. If the company's operations had continued, this would cause significant problems to the company's partners, including problems related to the implementation of this project. The owners adopted a decision to merge the company with another company in their ownership to solve the situation. Consequently, as of that date, the associated partner in the project, i.e. Purgator inženiring d.o.o., which was responsible for implementing the restoration activities in the project, namely actions C1 and C2, ceased to exist. The new, merged company took over all the rights and obligations of the associated partner in the project, including all the obligations to the project "LIFE10 NAT/SI/142 Restoration of the Ljubljanica river corridor and the improvement of the river's flow regime". These obligations include the obligation to co-finance the project in the amounts envisaged in the project's documents. The change of the partner was approved by EC on 9 September 2014 with Amendment No 1.

Since we anticipated that all actions would not be successfully implemented within the deadlines set (i.e. until 31 December 2015), and with the quality required, we asked EC for a postponement of the end date of the project, i.e. to 31 August 2016. The main reason for the prolongation was the ongoing work under action E2. Namely, the implementation of action E2 was affected by the delays in implementing actions A1 and C2, and the unsatisfactory results from the originally selected method for monitoring fish migration. The request for a postponement of the end date of the project was approved by EC on 1 December 2015 with Amendment No. 2.

The project implementation was marked by the financial and economic crisis in Slovenia, consequences of which were not expected at the beginning of the project. It severely affected the operation of both associated beneficiaries and required several adjustments with the aim of successfully achieving project objectives. This had a significant impact also on project's financial structure. To be able to finish the project successfully, we requested EC for a modification of the financial structure of the project. The request was approved on 23 June 2016 with Amendment No 3.

Because of the financial problems of the associated beneficiary Geateh that was initially responsible for implementation of action E2, the University of Ljubljana took over this action. This required a change in the planned course of action. Instead of buying the equipment and merely carrying out the action of external assistance, experts in this field took care of tagging and monitoring the fish. Bids for the implementation of the action were invited and obtained and the contractors selected.

SUMMARY OF THE MAIN REPORT BY CHAPTERS

In the introductory part of this final report the general and specific objectives of the project, area or sites included in this project, the target species of the project, the main threats to the endangered target species, and the socio-economic context are presented. In this section we include the expected long-term results of improving the conditions for the endangered target species of the project (i.e. Danube salmon, Danube roach, and striped chub).

This is followed by the administration part of the report in which we describe and present the working methods and provide a review of project phases, activities, and tasks by stages and planning. In this section we included a presentation of the coordinating beneficiary University of Ljubljana (Faculty of Civil Engineering and Geodesy), and the associated beneficiaries Purgator and Geateh. The chapter provides a description of the organizational and coordination tasks of the project manager Prof. Mitja Brilly. As mentioned earlier, during the project we encountered some problems, which led to adaptation and modification of measures and actions, transfer of funds between categories, and postponement of the end date of the project. We requested EC's approval for these modifications and amendments. The second part of the chapter on the project administration covers the assessment of the managerial system, assessment of partnerships, communication with EC, and the monitoring team.

This is followed by the technical part of the report where the individual actions are described and presented as to the manner of work organization within each action, the evaluation of success of the action, the problems encountered, a comparison of the planned and carried out actions, etc. Some descriptions of the tasks are rather extensive, so in the technical part of the report we highlight only the most relevant information, while detailed information is provided in the annexes.

The last chapter relates to the financial part of the project. We report on the costs of the actions and by category.

At the end of the report several annexes are provided, which supplement the main report (in particular the technical part) with detailed reports and documentation concerning the individual tasks. Finally, the report also contains some explanations on the deviations (e.g. why were personnel costs exceeded, why was the participation at the Fish Passage 2016 conference in USA necessary).

PLEASE NOTE:
In the Grant Agreement some sentences from a previous project application remained by mistake. During the project implementation we pointed this out to EC. These mistakes are again highlighted in the technical part of this report, by actions to which they relate. Such mistake was made, for example, in action E1, where it is stated that "Stara voda will be restored, the area of an old river meander Krnica will be restored and the area of an old river meander Kačji brlog will be restored".

3 Introduction

The main project objective was the improvement of the ecological function, connectivity, and passability of the Ljubljanica River reach from the city of Ljubljana downstream. Other project objectives were improving the ecological status of rivers with relatively simple restoration measures, ecohydrological studies, setting-up of a hydrological model to improve our knowledge about the Ljubljanica, and awareness-raising among the general public, which, due to the past water management, still regards the Ljubljanica as a threat rather than an essential element of environmental quality.

The area, which is directly involved in the project, is part of the Ljubljanica River corridor between two Natura 2000 sites, i.e. Ljubljansko barje (SI3000271) and Sava–Medvode–Kresnice (SI3000262). The size of the area is 14,793 ha. Part of the Ljubljanica River, which flows through the city of Ljubljana, was in the past severely degraded, so people perceived the river like a threat rather than a vital key element of the city of Ljubljana. In fact, this part of the Ljubljanica River has represented an important habitat for endangered fish species: Danube Salmon (*Hucho hucho*), Danube Roach (*Rutilus pigus*), and Striped Chub (*Leuciscus souffia*). All three species are listed on the red list of fish and cyclostomes as endangered species whose survival in the territory of the Republic of Slovenia is not likely if the risk factors persist – these three fish species are target species of the project. Concrete actions (C1, C2, C3 actions) will contribute to the preservation, or even increase biodiversity. Namely, one of the reasons why the species were endangered is because of the impassability of the river, which prevented the spawning and reproduction in the upstream parts of the river as well as the conservation of the species.

With LIFE Ljubljanica Connects we have attempted to set the basis for other river restoration actions in Slovenia. In Slovenia there are many rivers and most of them were regulated in the past. Fairly simple engineering processes are required to minimize the impact of interventions and regulation structures in rivers and to provide a natural habitat for the life of water organisms. This is what we want to achieve in this project, i.e. to encourage the implementation of such actions in other Slovenian rivers. In addition to the initiatives in the planning and implementation of recovery river corridors, we want to raise awareness of all residents, especially those responsible at different local and national institutions. Also, the project has enabled employment of young people and thus provided their first professional experience in their field. Young people and also those who were employed by the beneficiaries previously have gathered new, additional skills (e.g. fish pass reconstruction is of course different than the construction of other facilities). However, one of the greatest long-term contributions is the development of an innovative system for monitoring the passage of aquatic organisms through the fish passes with two cameras. The advantages of such a monitoring method compared to the method of fish tagging or catching using fish traps are: continuous (24/7) monitoring, storing of images, and the possibility of a retrospective review. Such a method is not harmful to fish and other organisms, since they practically do not sense it. This method allows for monitoring of migration also during the night. Beside this also the radio-controlled boat “Hi3” was developed for the purpose of river/lake bathymetry measurements (input data for hydraulic model). Furthermore, deflectors were installed at the exit of the fish passes, which prevent the ingress of floating debris in the fish passes. The floating debris had previously prevented the fish to exit the fish passes. As further explained in this report, the deflectors are one of the most innovative project results concerning the conservation of the endangered target and other fish species.

4 Administrative part

4.1 Description of the management system

The coordinating beneficiary is the University of Ljubljana (Faculty of Civil and Geodetic Engineering, Chair of Hydrology and Hydraulic Engineering). In recent years, the department was involved in many European and national projects in hydrology. Its employees are experts in different fields of hydrology: general hydraulic engineering, erosion and sedimentation, river management, hydraulic structures, use of water for energy management, and natural hazards. Their skills provided a major contribution to this project, even if only in the sense of part-time collaboration.

The coordinating beneficiary collaborated with two associated beneficiaries: Purgator (in December 2013 Purgator Inženiring merged with Purgator) and Geateh. Purgator is a private company whose main activity is engineering and construction of water treatment plants for wastewater (design, construction, finance and management), in addition, the company also operates in other fields of civil engineering. It is located in Postojna. The company cooperates with many experts in the field of water engineering, most of whom have international experience. Geateh is located in Ljubljana. Its employees are experts in civil engineering, chemistry and chemical technology, and environmental protection. They work in environmental protection, exploitation of water resources for electricity, urban infrastructure, and project management. Notably, the merger of companies Purgator and Purgator inženiring had no effect on the implementation of the project. The merger was reported to EC with a request for approval of an amendment, which was approved by Amendment No. 2 to the Grant Agreement. The Project team changed after non-substantial modifications (approved by EC on 22 August 2014). The coordinating beneficiary took over the implementation of action E2 and employed a biologist who previously worked for Geateh (Figure 1**Error! Reference source not found.**, italic).

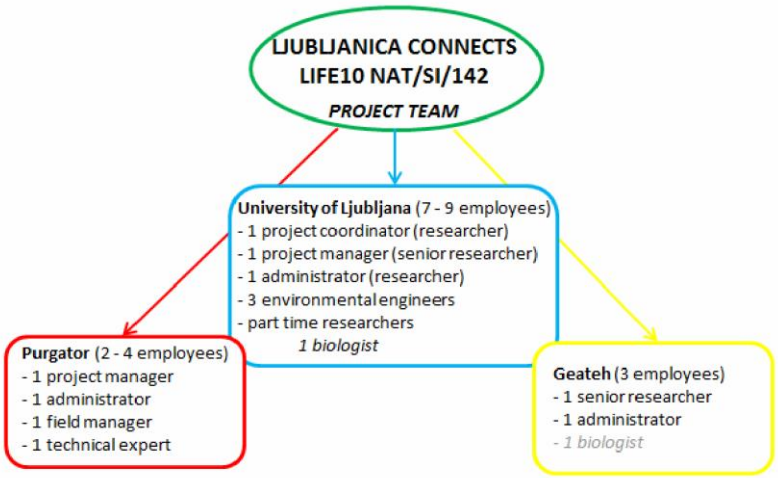

Figure 1: Organigramme of the project team

During the project, the project coordinator held several meetings for project partner representatives. The meetings were convened with a view to organise work, and to receive reports from partners about work progress, and address any problems encountered that might

impact the project activities. The project coordinator coordinated the division of labour among partners. Besides, he convened a steering group meeting at least twice a year. Minor questions and problems were addressed by phone or Email. Throughout the project, this type of communication proved to be very effective.

The project consisted of three main phases. To some degree, the durations of the phases changed in respect to what was foreseen in the Grant Agreement. Changes were regularly reported to EC. During the project implementation we encountered several problems which we could not foresee before the project start. At the beginning of the project there were many problems regarding communication between partners. Furthermore, throughout the project many bureaucratic obstacles were encountered.

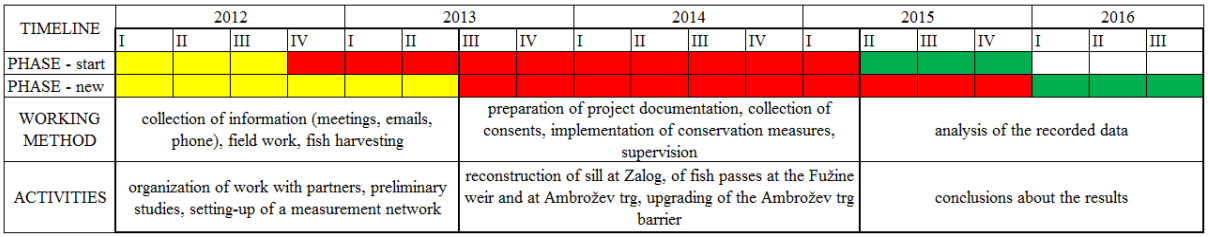

Figure 2: Schematic presentation of timeline of the project phases

The first phase was, due to the aforementioned problems, completed with delay in the first half of 2013 (Figure 2). This phase included the coordination between partners, a preliminary study of habitats, hydrologic and hydraulic study of the situation in the Ljubljanica River, establishment of a network of eco-hydrological measuring sites on the Ljubljanica River and its tributaries for eco-hydrological monitoring, and preparation for the implementation of concrete conservation actions. Working methods consisted primarily of collecting various information through various communication channels (telephone, internet, interviews). In addition, work was carried out in the field, e.g. establishment of a network of eco-hydrological measuring sites and fish catch surveys to assess the status of populations of target fish species.

The second phase did not begin until the end of the first phase, since some of the activities of the second phase were laid out during the implementation of the first phase. The second phase consisted of concrete conservation actions (C actions). As part of these actions fish passes at the sluice gate at Ambrožev trg and Fužine weir were reconstructed and the functionality of the fish passes was re-established. The lifting system of gate at Ambrožev trg was upgraded and the sill in Zalog was reconstructed. Also, the end of the second phase was slightly postponed due to unfavorable hydrological and meteorological conditions that affected the start of the reconstruction of the gate lifting system. In addition, delays were caused by bureaucratic problems, including in the selection of contractors. The last part of the second phase was completed in September 2015.

Similarly to the second phase, the third phase did not begin until the end of the previous ones, since some of the activities of the third phase were laid out during the preliminary stage. Due to the development of a new method, which requires at least one year of continuous implementation (with cameras) and because this method gives better results than the initially proposed and used method of fish harvesting and marking of fish (VIE tagging), we requested EC to approve an extension of the project of 8 months (from 31 December 2015 to August 2016). The third phase of the project, in addition to the evaluation of the monitoring results of the fish passes, includes an analysis of the performance of other concrete actions (i.e.

reconstruction of sill in Zalog and modernization of the gate lifting system at Ambrožev trg). Dissemination and networking actions began already in the first phase, i.e. with dissemination of results and public awareness raising among local and national decision-makers.

The coordinating beneficiary requested EC for three substantial modifications, which were approved with Amendments to the Grant Agreement, as follows:
1. Merger of associated beneficiary Purgator with company Purgator inženiring, which took over all the project's obligations of the initial partner, which was approved with Amendment No. 1
2. Technical amendments in actions A3, C2, C3, E2, which were approved with Amendment No. 2
3. Financial reallocation of funds by actions and by categories, approved by EC with Amendment No. 3

Partnership agreements were sent to EC together with Inception Report on 30 September 2012.

4.2 Evaluation of the management system

At the beginning of the project there were some problems among the partners identified. Namely, immediately prior to signing the contract, one of the partners withdrew from signing, and a new partner had to be found in a very short time. The new partner was Purgator inženiring d.o.o. Soon after the project started it became clear that Purgator had some problems with the initial proposal of work division, i.e. when it became clear that the company's contribution would be on a part-time only basis. At first a much bigger company was supposed to be a partner in this project; a big company would have an easier task of achieving this project's objectives than a small company, like Purgator. The management of the system was based on the division of labour between the partners, which was coordinated by the project coordinator. Each partner took care of one scope of the project. Purgator was in charge of implementation of conservation actions. Its tasks were: to ensure that design documentation was prepared in a timely manner; selection of contractors (external assistance), and supervision of contractors. Geateh d.o.o. was in charge of the originally proposed fish monitoring method (VIE tagging) and communication with angling clubs, which took part in organisation of ichthyological surveys as well as fish marking and tagging. This type of monitoring was later, however, found to be ineffective. The Faculty of Civil and Geodetic Engineering of the University of Ljubljana was in charge of flow (discharge) measurements, ecohydrological monitoring, production of hydrological and hydraulic models, and communication with EC and the national Monitoring Team. UL FGG was responsible also for all dissemination actions (D1 and E4).

The division of duties of the individual partners was, generally, as described above and did not change significantly throughout the project. The responsibilities were divided between the partners according to their know-how and experience. This shows the added value that this partnership made possible, as each of the partners was in charge of the tasks that it specialises in. In case of any queries, from either the coordinating beneficiary or any of the associated beneficiaries, the steering group sought clarifications from the Monitoring Team. The communication with the Monitoring Team and, when necessary, with EC was seamless and very effective.

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5 Technical part (maximum 50 pages)

5.1 Technical progress, per task

This project's technical progress was divided into 8 actions (A1, A2, A3, C1, C2, C3, E2, and E3). Each section explains in detail the work carried out during its development giving details on what was done and how it was done for each action. Some of the technical details of the actions are given in the annexes.

As described in the Administrative Part of this report, the project consisted of three main phases. At the beginning of each action, description, proposed and actual implementation timelines are compared using a Gantt chart. The first phase of the project included preliminary studies of habitats, hydrological and hydraulic studies of the situation in the Ljubljanica River, establishment of the eco-hydrological measurement network, and preparations to implement the concrete conservation actions. The second phase started already before the first phase was fully completed and consisted of implementation of concrete conservation actions (C1, C2, and C3). Similarly, the third phase began before the second phase was fully completed. The project's third phase included evaluation of the monitoring results of the fish passes, analysis of the performance reconstruction of the sill at Zalog, and modernization of the gate lifting system at Ambrožev trg. Dissemination and networking actions (D1 and E4) began already in the first phase and lasted until the project end and beyond – in fact, these actions still take place as After-LIFE actions.

5.1.1 Action A1: Preliminary study of the habitat, hydrological and hydraulic conditions in the Ljubljanica River corridor, estimation of Danube Salmon, Danube Roach and Striped Chub population.

Action		2012				2013				2014				2015				2016			
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Overall project schedule		START: 01/01/2012																	END: 31/08/2016		
A1	Proposed	X	X	X	X																
	Actual	**X**	**X**	**X**	**X**	**X**	**X**														

Figure 3: Proposed and actual implementation timeline of action A1.

What was done? How was it done?

- Review of historical records and existing documents in fishing clubs Barje and Vevče, and review of the Fisheries Management Plan of fishing clubs Barje, Vrhnika, Dolomiti, and Vevče (October 2012–September 2013), more detailed report in the Annex 1.
- Visits to the archives and libraries of the Fisheries Research Institute of Slovenia, National Institute of Biology, and the National and University Library, and search for reports and literature (July 2012–April 2013), more detailed report in Annex 1.
- Electrofishing, measurements and marking of fish in cooperation with expert Meta Povž, PhD, ichthyologic society and fishing associations Barje, Vevče, Dolomiti, and Vrhnika (carried out on 18 September 2013 and 26 September 2013, and 15 June 2015). The reports on the fish tagging and sampling can be found in Annex 2 and Annex 3.
- The priority list of the streams suitable for spawning places and nursery places was prepared in 2013. Please find the list in Annex 1.
- The protocols and guides for the survey of the ecological status, hydrological and hydraulic conditions of the Ljubljanica river corridor were prepared and can be found in Annex 5. An initial document was prepared already in 2013 and was updated in the subsequent years. This document was prepared in cooperation with biologists and hydrologists.
- Checking the situation in the field in cooperation with fishing associations Barje, Vevče, Dolomiti, and Vrhnika (field trips on 4 July 2013, 23 August 2013, 28 August 2013, 29 October 2013, and 24 December 2013). The report on the present situation of Danube Salmon, Danube Roach and Striped Chub populations in the Ljubljanica River corridor and its main tributaries can be found in Annex 6.
- Collecting the data from the existing measuring network on the Ljubljanica River (November 2012–January 2013) and setting-up of a database on the Ljubljanica River hydrological regime including groundwater – surface water relations. In addition, the database was updated with the data of E3 monitoring which was established in the scope of action A3. The database is available at http://ksh.fgg.uni-lj.si/ljubljanicaconnects/Data/WaterLevel/VP.htm. A more detailed report on this task can be found in Annex 7.
- On the basis of threat assessment of target fish species (part of Annex 1) and the objectives of this project, the proposals for minimisation and/or elimination of negative impacts were prepared. The document can be found in Annex 8.

All the objectives were achieved:

- investigation of past river channels on the Ljubljanica River,

- overview and description of fish population in the Ljubljanica River,
- investigation of habitat conditions in the Ljubljanica River,
- establishment of a database about the Ljubljanica River hydrological regime,
- overview of target populations,
- collection of the literature and reports about the topic.

One of the main results of this action was to identify the spawning and nursery grounds of Danube Salmon, Striped Chub, Danube Roach and other fish species in the Ljubljanica River and its tributaries. Furthermore, quantitative and qualitative assessment of the target fish species was done. Fish populations in the Ljubljanica River were evaluated based on expert opinions. It was found that in 2007 Danube Salmon was no longer the dominant species, because its habitat shrank due to the negative effects of regulations, pollution, habitat fragmentation, and other impacts. Based on the results of the preliminary studies, the basis for detailed planning of restoration measures for the improvement of the ecological coherence and connectivity between the separated Natura 2000 sites was provided. Fish population and habitat conditions were estimated. Proposals for minimisation and/or elimination of negative impacts were prepared.

Action A1 is highly interconnected with action E2, since the fish harvesting and sampling results were important for identification of the present situation of target fish species and also for monitoring of fish migration. Therefore, it was difficult to identify whether the costs should be attributed to action A1 or action E2.

Responsibility of action implementation:
The University of Ljubljana was responsible for the implementation of action A1. In implementing the tasks, the University of Ljubljana cooperated with Meta Povž, PhD, and partner Geateh. Please find a more detailed report on results of action A1 in annexes.

Deliverables:
The results of this action are two important documents. The first one can be found in Annex 5. The protocols and Guides for Survey of the Ecological Status, Hydrological and Hydraulic Conditions of the Ljubljanica River Corridor contain the information on how to determine the assessment of the ecological status and hydrological and hydraulic conditions of the Ljubljanica River corridor. The second document Proposals for Minimisation and/or Elimination of Negative Impacts is mainly focused on reducing the negative impacts on fish due to the construction of objects transversally to the watercourse and can be found in Annex 8.

Indicators:
The main indicator to test the performance of this action is the number of acquired data on the state of the target fish species in the Ljubljanica River. Additionally, another indicator of the performance of this action is the amount of data in the database about the Ljubljanica River hydrological regime.

Outside LIFE actions:
There were no complementary actions outside LIFE.

Problems encountered
The action was completed after the deadline provided for in the timetable because of the difficulties in communication with local fishermen who have very strict rules about when

electrofishing can be performed. Action A1 was completed in December 2013 but the late completion caused a delay in the start of implementation of action E2. This was already reported in the Progress Report No 2 of 31 January 2013.

Figure 4: Catching of fish, measuring its characteristics, and marking using VIE methodology

Figure 5: Electrofishing of 15 June 2015

Figure 6: Preparation for measurements of length and weight

Annexes:

Annex 1: Report on the preliminary study of the habitat, hydrological and hydraulic conditions in the Ljubljanica River corridor, estimation of Danube Salmon, Danube Roach and Striped Chub
Annex 2: Report on the first fish tagging
Annex 3: Report on the second fish tagging
Annex 4: Priority list of the streams suitable for spawning places and nursery places
Annex 5: The protocols and guides for the survey of the ecological status, hydrological and hydraulic conditions of the Ljubljanica river corridor
Annex 6: The present situation of Danube Salmon, Danube Roach and Striped Chub populations in the Ljubljanica River corridor and its main tributaries
Annex 7: Database on the Ljubljanica River hydrological regime including groundwater and surface water relationship
Annex 8: Proposals for minimisation and/or elimination of negative impacts

5.1.2 Action A2: Preparatory actions for implementation of concrete conservation (restoration) actions

Action		2012				2013				2014				2015				2016			
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Overall project schedule		START: 01/01/2012																	END: 31/08/2016		
A2	Proposed	X	X	X	X	X	X	X													
	Actual	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**										

Figure 7: Proposed and actual implementation timeline of action A2.

What was done? How was it done?

- All the necessary documents were obtained (water consent, consent of the Institute of the Republic of Slovenia for Nature Conservation, Nature Conservation Consent, consent of the Fisheries Research Institute of Slovenia, consent of the Institute for the Protection of Cultural Heritage of Slovenia, pending permit for reconstruction, project for execution and technical documentation),
- We signed the contracts for implementation of reconstructions (action C1 – company HIP plus d.o.o.; action C2 – company ELQ d.o.o.; action C3 – company Montavar projekt d.o.o.),
- Geodetic surveying and terrestrial laser scanning at project sites (October 2013),
- Development of a hydraulic model (January 2013),
- Review of documentation related to all the locations and on-site detailed inspection of structures.

Action A2 covered preparatory activities for implementation of concrete conservation measures (actions C1, C2, and C3). Various permits and consents had to be acquired for the individual conservation measures, depending on the facility to be reconstructed. Surveying and terrestrial laser scanning of the project sites were carried out; in January 2013 a hydraulic model was produced; technical documentation for implementation of actions C1, C2, and C3 as well as public procurement documentation were prepared. Part of action A2 was the supervision of preparations for concrete conservation actions. The coordinating beneficiary was in charge of action A2, with participation of partner Purgator d.o.o. The action was completed in the middle of 2014.

All the objectives were achieved:

- obtaining all the necessary permits,
- obtaining detailed geodesy of the project area,
- preparation of the initial hydraulic model of the project area,
- preparation of technical documentation and documentation for public tender contract,
- assessment of the present state of the fish passes.

Responsibility of action implementation:

The procedures for acquiring the necessary permits and consents were carried out by the associated beneficiary Purgator. In doing so, Purgator submitted a request in writing to the competent authority issuing the individual consents. If the competent authority came to the conclusion that additional clarification or information was necessary for the issuing of the

consent, the application had to be amended. Design requirements had to be acquired prior to the issuing of water consents. Namely, the water consent is issued only after the intended, i.e. planned, intervention meets the requirements prescribed.

Detailed data on geodesy and terrestrial laser scanning were obtained in autumn 2013. The geodetic plans were produced by Tadej Srdinšek s.p.; the company was selected by Purgator. Terrestrial laser scanning provided a more detailed look at the structure and helped the designer in the fish pass restoration design at the Fužine weir, which collapsed in autumn 2013 due to high flows, so the measure had to be revised (Figure 8). For the reconstruction of the sill in Zalog detailed geodesy of the sill was prepared (Annex 12).

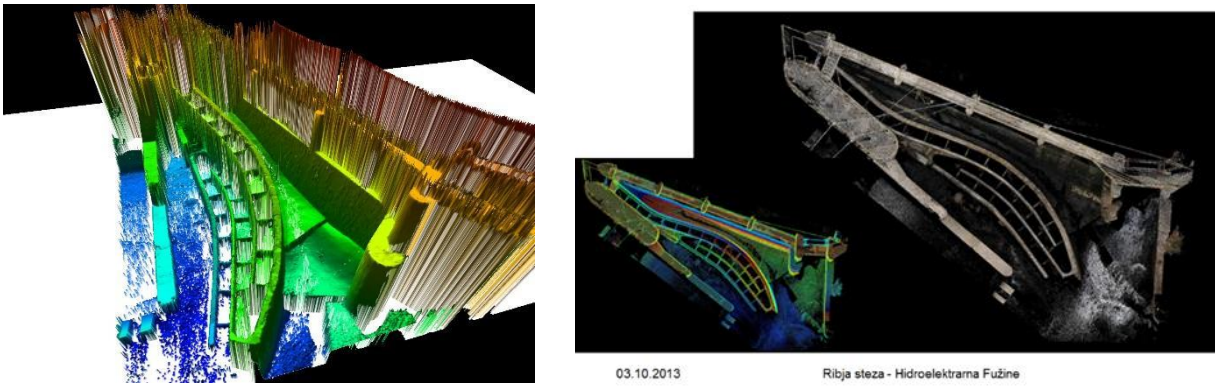


Figure 8: Recordings of the fish pass at Fužine weir, produced by terrestrial laser scanning

Part of this action was also preparation of technical documentation and documentation for public tender contract. The associated beneficiary Purgator was responsible for this task. Technical documentation for the reconstruction of the sill at Zalog (C1 action), technical documentation for the reconstruction of the fish passes at Ambrožev trg and Fužine weir (C2 action), and technical documentation for the reconstruction of electrical and mechanical equipment for the modernization of the sluice gate lift system (C3 Action) were prepared. Please find the technical documentation in Annex 15, Annex 16, Annex 17 and Annex 18.

Based on the data obtained from action A1, in December 2013 the initial hydraulic model of the Ljubljanica River was developed. The model was developed by the University of Ljubljana, Faculty of Civil Engineering, which has much experience in this field. We used Mike 11 and Mike FLOOD software. The model was later upgraded with new data obtained from the measurements made in the scope of the project Ljubljanica Connects. The measurements were made by University of Ljubljana, which also developed the equipment for river/lake bottom bathymetry – a boat called “Hi3” (Figure 9). The radio-controlled boat named “Hi3” was designed and developed in order to facilitate water velocity and bathymetry measurements. The boat is equipped with the SonTek RiverSurveyor M9 instrument that is designed for measuring open channel hydraulics (discharge and bathymetry). With “Hi3” measurements can be carried out also in potentially dangerous areas such as under lock gates at hydroelectric power plant or near the turbine outflow. More information on the boat “Hi3” and its role in the project can be found in the article which was presented at the EGU 2016 conference (Annex 21).

Figure 9: Radio-controlled boat “Hi3”

Figure 10: Results of measurements with “Hi3”

Figure 11: Camera on the “Hi3” boat for remote control

The hydraulic model was prepared for, in our estimation) the most critical part of the Ljubljanica river basin: from Ljubljansko barje (*Ljubljana Marshes*) to Moste. In this area floods are very common, which causes many problems because of the extensive agricultural land use on the Ljubljansko barje. Landowners and local residents would like to have better flood protection, but the natural characteristics of the area make this difficult. Good hydraulic and hydrological models are necessary for flood protection plans. A more detailed description of the hydraulic and hydrological models can be found in Annex 13 and Annex 14.

Indicators:
The main indicator to test the performance of this action is the percent of the necessary permits and documents obtained for actions C1, C2, and C3 (all the permits and documents were obtained).

Outside LIFE actions:
There were no complementary actions outside LIFE.

Problems encountered
The biggest problem we had was to determine the ownership of the facility at Ambrožev trg (fish passes at locks at Ambrožev trg). The owner of the facility Ambrožev trg was unknown which was, of course, an obstacle when we started to gather all the permits and tried to enter the locked fish pass. In cooperation with the Slovenian Environment Agency and the City of Ljubljana we reached an agreement about the reconstruction works and got the contact of person responsible for the key of the fish pass who gave us access to the fish pass.

Annexes:
Annex 9: The permits and documents obtained for action C1
Annex 10: The permits and documents obtained for action C2
Annex 11: The permits and documents obtained for action C3
Annex 12: Detailed geodesy of the sill in Zalog

5.1.3 Action A3: Establishment of the ecohydrological survey and hydraulic model

Action		2012				2013				2014				2015				2016			
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Overall project schedule		START: 01/01/2012																		END: 31/08/2016	
A3	Proposed	X	X	X	X	X															
	Actual	**X**	**X**	**X**	**X**	**X**															

Figure 12: Proposed and actual implementation timeline of action A3.

What was done? How was it done?

- installation of 17 water stations along the Ljubljanica River,
- development of 3 water stations with online connection,
- development of hydraulic model,
- installation of 17 measuring devices for temperature and 3 for water quality (oxygen concentration) along the Ljubljanica River.

All the objectives were achieved:

- construction of water stations,
- establishment of the hydrologic model,
- monitoring of water temperature and quality.

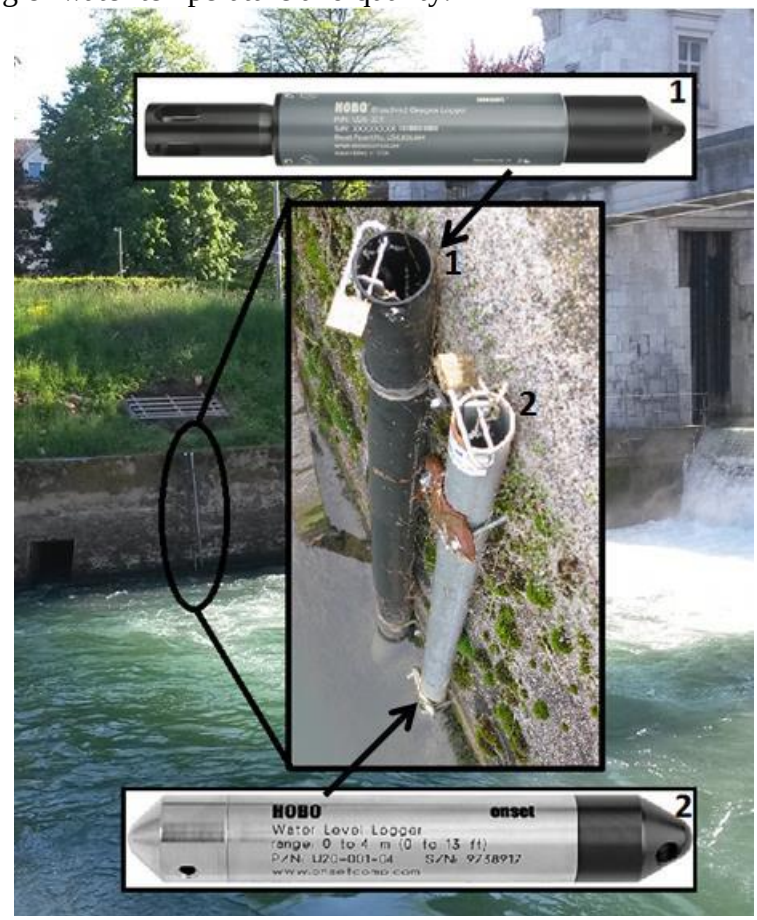


Figure 13: Sensor for measuring concentration of dissolved oxygen (1) and sensor for measuring water level (2) on the measuring site Ambrož Square, downstream of river gates

Responsibility of action implementation:
The coordinating beneficiary (UL FGG) was responsible for the implementation of the tasks in action A3.

The 3 water stations with online connection are located in the fish pass at Ambrožev trg, at the fish pass at the Fužine weir and on the bridge at Vrhnika, Močilnik, downstream of the source of the Ljubljanica River (Figure 14).

Figure 14: Locations of 3 online water stations and measuring equipment

The recorded data can be accessed in real-time at: http://ksh.fgg.uni-lj.si/avp/life/ (Figure 15).

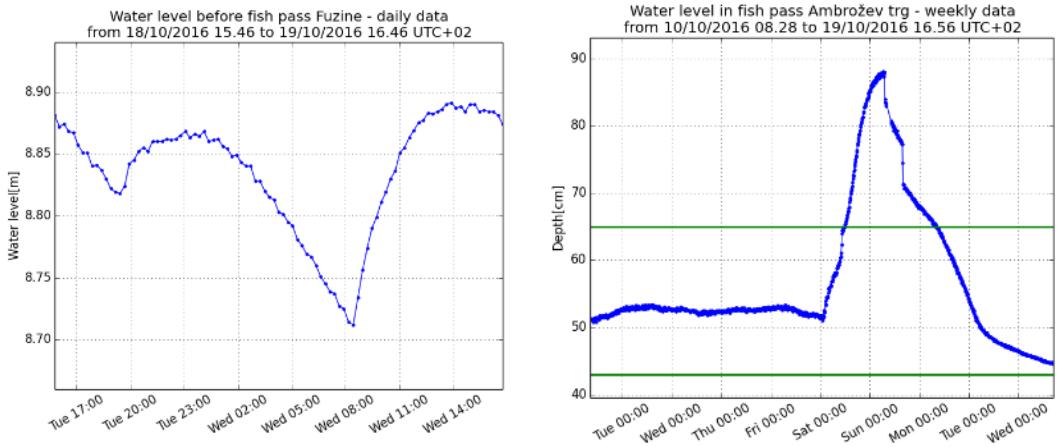


Figure 15: Example of the measured data which are available online on the website.

In the Progress Report No. 2 we explained the delay of the installation of online stations. The online stations were developed by the University of Ljubljana already in the year 2014 and were ready to be set in the field. But we did not install them then from the following reason (cited from Progress Report No 2): "The online connection can be understood on different ways. The station has online connection if you can get data from the station while you are at the office – on the field we already have that kind of stations. But most people treat online connection as something that allows constant access to data measured on the field through a specific web page for each user interested. This we haven't done yet because we don't need it yet. As after LIFE action we plan to use the constantly measured data to operate the barrier on

the Ambrožev trg when it will be modernized (action C3) but until than the online connection would only produce enormous amount of data that uses a lot of free memory space. However, we plan to test the system so that we will make this data available on our web site sometimes during the year 2015."

Data from various meteorological and hydrological stations are needed to make a hydrological model. Here, data from nine precipitation stations were included in the modelling (Nova vas, Sodražica, Želimlje, Črna vas, Sveti Vid, Rob, Tomišelj, Rakitna and Rakek). The data from water measuring stations were also used. The measurements are carried out by the Slovenian Environment Agency. Currently, three stations on the Ljubljanica River and three on its tributaries are operational but we also used historical data from five other stations from this area. For the purposes of modelling, hydrogeological measurements were also conducted. Water regime of the area was modelled in three stages. In the first stage, the runoff model was prepared, in the second stage, the hydraulics of the Ljubljanica River and the Iška River was modelled, and in the third, the interaction between surface water and groundwater was modelled.

Figure 16: Sub-basins of the Ljubljanica river basin in the hydrological model

Deliverables:
-Hydrological model
-Hydraulic model

Indicators:
The main indicators to test the performance of this action are the number of installed water stations along the Ljubljanica river and its tributaries (17), the number of installed water stations with online connection (3), the number of installed measuring devices for temperature (17), and the number of the devices installed for measuring water quality (3).

Outside LIFE actions:
The Slovenian Environment Agency carries out similar activities in the scope of its tasks (e.g. monitors and measures individual elements of the water cycle at hydrologic monitoring stations for surface water (watercourses, lakes, sea) and for groundwater and springs,

measures levels and temperature of groundwater, springs, rivers, lakes and sea, and determines changes). The Agency carries out these measurements in the territory of the whole country and, unfortunately, its measurement network is not dense enough to allow for achieving this project's objectives based on the Agency's data alone. However, its measurements are helpful in case errors occur in measurements at our gauging stations and to control our measurements.

Problems encountered:
Constant online connection is expensive; this was not foreseen in the initial financial structure of the project, so we, at UL FGG, decided to develop stations on our own to ensure a cheaper way of data transmission. The stations are now developed and installed at 3 sites. The measured data are presented in real time on our website.

Annexes:

Annex 13: Hydrological model
Annex 14: Hydraulic model

5.1.4 Action C1: Reconstruction of the sill in Zalog

Action		2012				2013				2014				2015				2016			
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Overall project schedule		START: 01/01/2012																		END: 31/08/2016	
C1	Proposed				X	X	X														
	Actual				**X**	**X**	**X**	**X**	**X**												

Figure 17: Proposed and actual implementation timeline of action C1.

What was done? How was it done?
- The project documentation and the technical design for reconstruction were prepared by company Hidrotehnik d.d. in July 2013,
- implementation of reconstruction of the sill was performed by company HIP Plus d.o.o. in September and October 2013 (2 trees were removed, 1184 m^3 material used to build an access path and sill, 94 m^3 material was used to build packed rock fill for protection of the river bank and 18 willow cuttings were planted to preserve the natural appearance after reconstruction),
- the changes in the water level near the sill are being measured (we have observed a rise in the water level immediately after the reconstruction, measurements and data collection are still ongoing as part of action E3).

All the objectives were achieved:
- reconstruction of the sill,
- increasing the water abundance in the river channel during low flow conditions.

Responsibility of action implementation:
The associated beneficiary, Purgator d.o.o., was in charge of this action, i.e. the selection of subcontractors, and also took care of all the necessary authorisations and permits for the restoration works (under action A2).

The main objective of action C1 was to reconstruct the sill at Zalog. The sill controls the water level of the Ljubljanica River. In the past, the sill was damaged and, for various reasons, became non-functional, which deteriorated the conditions in the oxbow upstream. If these damages continued to increase, the excessive gaps between the rocks would result in a decreased ability or even inability for the fish to migrate upstream.

The restoration of the sill improved the ecological conditions of the Ljubljanica particularly during low flows, when the water level was too low to provide enough hiding places for the water organisms, particularly fish.

Summary of the works: removal of two trees, the use of 1184 m^3 material for the access road and the construction of the sill, the use of 94 m^3 material for bank protection, and the planting of 18 willow saplings that would improve bank stability and help to preserve the natural appearance after the restoration. A more detailed report on the reconstruction works at sill in Zalog can be found in Annex 15.

After the restoration, we have monitored the water level in the proximity of the sill and compared it with the water levels prior to the restoration measures. The raising of the water

level was observed soon after the execution of works, while the measurements are continuously monitored under action E3 (Figure 18).

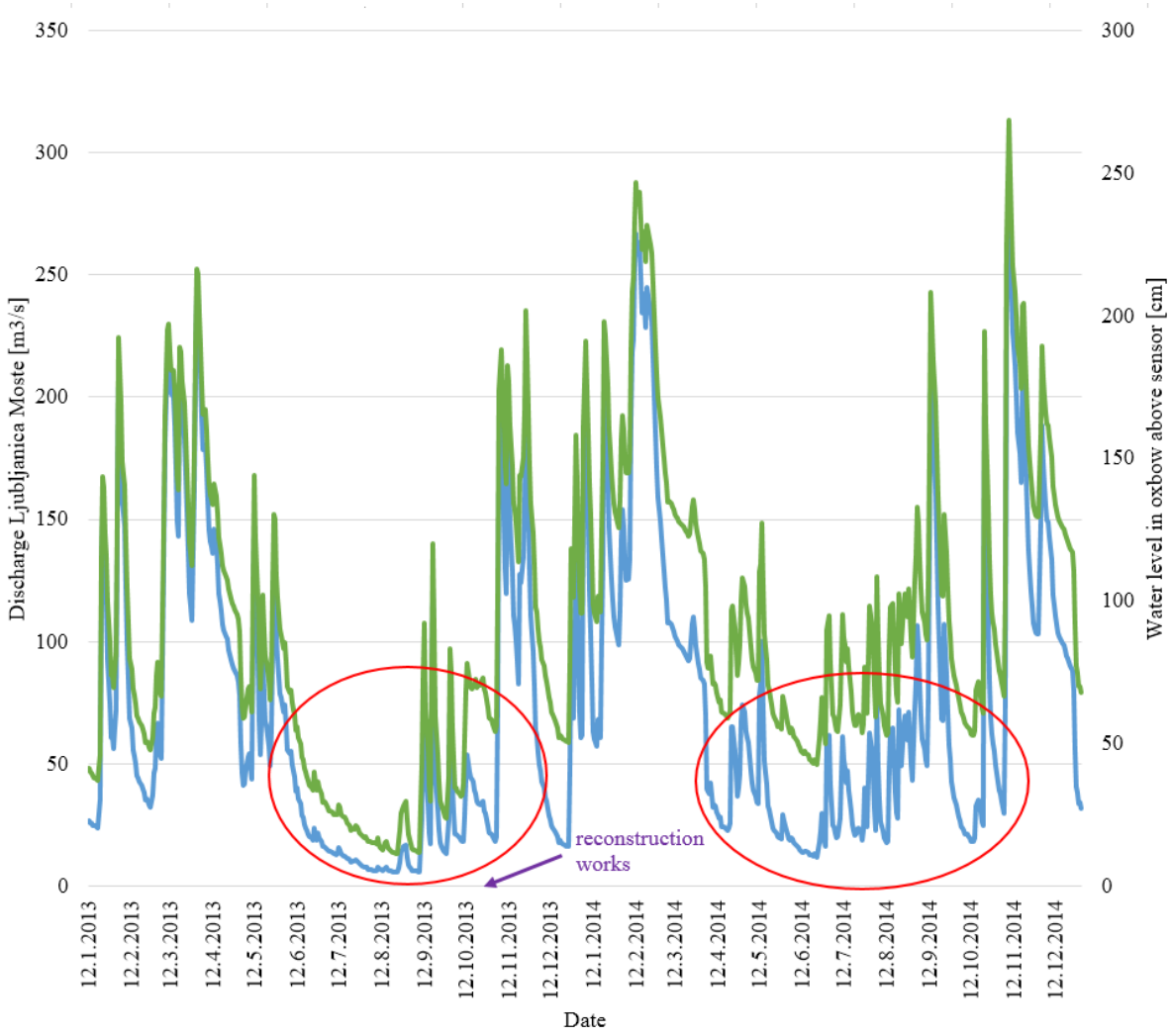


Figure 18: The raising of the water level in the oxbow in Zalog soon after the execution of works

Please find a more detailed report on the reconstruction of the sill in Zalog in the Annex 15.

Indicators:

The main indicators to test the performance of this action are the raising of the water level in the oxbow upstream of the sill at Zalog, the improvement of the oxygen conditions in the oxbow, and much less intense heating of the water in the oxbow.

Outside LIFE actions:

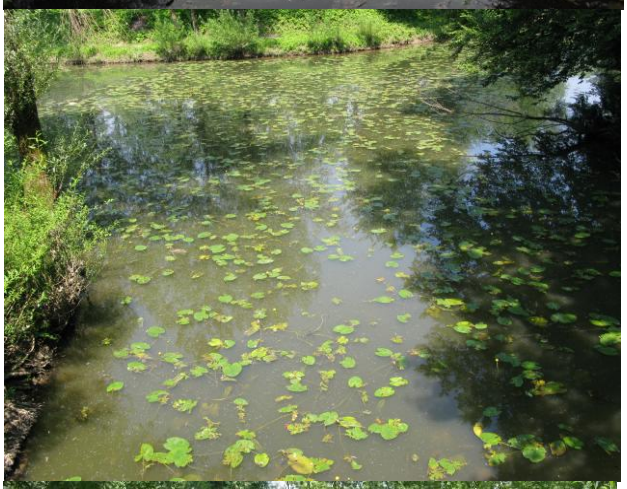
The improved situation in the oxbow following the reconstruction works at the sill at Zalog has encouraged the members of the angling club RD Vevče to voluntarily fix up the embankments and surroundings of the oxbow. They rake leaves and branches, crop bushes, saw off dead branches and pull out of the water the tree branches broken by ice (Figure below). We strive to implement similar measures as those implemented in action C1 also at Stara voda (which was mentioned by mistake in the Grant Agreement under action E1, as mentioned previously). At Stara voda there is also a sill which needs to be reconstructed to ensure the full connectivity of the Ljubljanica River.

Problems encountered

The implementation of this action was delayed in view of the timetable envisaged in the Grant Agreement. Local angling clubs have strict rules as to when a certain type of work can be implemented – the implementation depended on the type of disruption caused in the river and the low flows that lasted for almost the entire summer of 2013. The works started in September 2013 and were completed in October 2013.

Before reconstruction *After reconstruction*






Annexes:

Annex 15: Detailed report on the reconstruction of the sill in Zalog

5.1.5 Action C2: Reconstruction of fish passes at the Fužine weir and Ambrožev trg barrier

Action		2012				2013				2014				2015				2016			
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Overall project schedule		START: 01/01/2012																	END: 31/08/2016		
C2	Proposed								X	X	X										
	Actual								**X**	**X**	**X**	**X**	**X**	**X**							

Figure 19: Proposed and actual implementation timeline of action C2.

What was done? How was it done?
- An agreement was reached in the negotiations with the owner of the Fužine fish pass (company B&B Papirnica Vevče) about the measures used to renovate the fish pass and about the co-financing of this action. Please find the English translation of the Minutes of the meeting with company B&B Papirnica Vevče in Annex 17.
- The project documentation and the technical design for reconstruction were prepared by DK-proTIM d.o.o. in October 2014 (Annex 16, Annex 17).
- The reconstruction of the fish passes was carried out in January and February 2015 by company ELQ d.o.o.
- Part of the destroyed fish pass at the Fužine weir was repaired. Reconstruction works were completed in April 2015. The steel beams were attached to the remaining wall and wooden planks were installed between them.

All the objectives were achieved:
- Reconstruction of the fish pass at the Fužine weir,
- Reconstruction of the fish pass at the Ambrožev trg barrier.

Responsibility of action implementation:
Coordinating Beneficiary and Associated Beneficiary Purgator d.o.o.

Indicators:
The indicator of action C2 performance is the number of fish migrating through fish passes (results of monitoring under action E2). The monitoring using cameras has revealed that all target fish species successfully migrated through both fish passes (at Ambrožev trg and at Fužine weir).

Outside LIFE actions:
There were no complementary actions outside LIFE.

5.1.5.1 Fish passage at Ambrožev trg

The fish pass at Ambrožev trg is a part of the gate structure and is situated behind the abutment of the weir on the right bank of the river. It is intended for the passage of fish through the gate profile when the gates are lowered (i.e. closed), thus representing the connection between the aquatic habitat that the weir would otherwise divide (Figure 20).

The actions taken did not require extensive restoration works nor did they significantly interfere with the existing condition of the fish pass. Nevertheless, these measures significantly improved the functionality of the fish pass.

The restoration works were divided into two stages: the restoration of the inlet part of the fish pass and the cleaning and restoration of the fish pass interior. At the fish pass inlet (fish pass exit), the grill for the holding of debris, which was out of function, was replaced by a debris deflector installed on guides fitted to the bank wall.

All the implemented measures described the attached report (Annex 16) were planned in a way that the elements of the specific works could be dismantled and removed, if necessary, without extensive or expensive interventions.

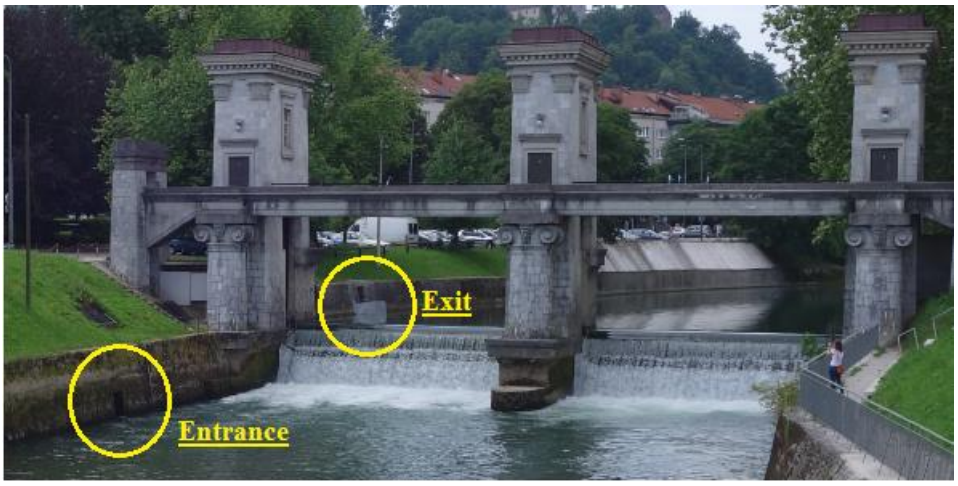


Figure 20: The location of the fish pass at the right bank along the sluice gate at Ambrožev trg, with marked fish pass entrance and exit.

Problems encountered:
The biggest problem we had was to determine the ownership of the facility at Ambrožev trg (fish passes at locks at Ambrožev trg). The owner of the facility Ambrožev trg was unknown which was, of course, an obstacle when we started to gather all the permits and tried to enter the locked fish pass. In cooperation with the Slovenian Environment Agency and the City of Ljubljana we reached an agreement about the reconstruction works and got the contact of person responsible for the key of the fish pass who gave us access to the fish pass.

5.1.5.2 Fish passage at Fužine weir

The fish pass at the Fužine weir was restored in cooperation with and (co)funding of Papirnica Vevče, i.e. the owner of the structure. In autumn 2013, the fish pass at the Fužine weir collapsed following high flows as a consequence of prolonged rainfall; therefore, the originally proposed measures provided for in the Grant Agreement were no longer appropriate.

Thus, we had to explore and consider new ways to reach the stated objectives. An agreement was reached with the company Papirnica Vevče, i.e. the owner of the weir at the hydropower plant and thus also the fish pass, and other project beneficiaries stating that Papirnica Vevče would finance the restoration of the fish pass, while, based on their consent (Annex 17), we, the project partners, would install a debris deflector deflecting the debris around the exit of

the fish pass. The installed deflector does not only improve the operation of the fish pass but of the weir as a whole, because the debris no longer accumulates behind the grill of the weir. The fish pass was restored in 2015.

Problems encountered

The restoration works at the fish pass at Fužine were scheduled to take place after the completion of the works under action C1, i.e. in the beginning of 2014. Unfortunately, in November 2013, the fish pass collapsed due to high flows, i.e. water forces acting on the fish pass walls (Figure 21). Field visits showed that the original restoration plan was not suitable, i.e. that the implementation of the originally planned works would not help us reach the project objectives of restoring the functionality of the fish pass at the Fužine weir. New design concepts and design of restoration measures had to be produced, which led to a delay in the start of works. A more careful planning was required, because the structure was more damaged than originally thought. This became apparent already during the collapse of the structure. However, it turned out that the costs of restoring the entire fish pass were considerably lower than if the fish pass had been restored only partially. Namely, the reconstruction of the entire structure is less complex and thus also cheaper.

Figure 21: The fish pass at the Fužine weir prior to the restoration and its collapse (left) and after the collapse in autumn 2013 (right).

The associated beneficiary, Purgator inženiring d.o.o., was in charge of the selection of subcontractors preparing the design documentation and designs for restoration and supervision of the proper implementation of the measures, i.e. in a way to reach the pursued objectives. In the first stage of action C2, i.e. in relation to the restoration of the Fužine fish pass, many field visits were undertaken, various measurements were made, and meetings with various stakeholders were held (with the owner of the structure, fishermen, etc.).

The design documentation was prepared by DK-proTIM d.o.o. in October 2014 (Annex 17). The restoration works at the fish pass were carried out by ELQ d.o.o. The works started in January 2015 and were completed in April 2015.

The reconstruction of the fish pass at Fužine restored the longitudinal connectivity of the Ljubljanica River between its mouth into the Sava River and the sluice gate at Ambrožev trg. Following the restoration of the sluice gates at Ambrožev trg, the connectivity was improved all the way to the upstream parts of the Ljubljanica River.

Figure 22: Weir at Fužine (left) and fish pass (right) after reconstruction works

Annexes:

Annex 16: Detailed report on reconstruction of the fish pass at Ambrožev trg barrier
Annex 17: Detailed report on reconstruction of the fish pass at Fužine weir

5.1.6 Action C3 Improvement of Ambrožev trg barrier

Action		2012				2013				2014				2015				2016			
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Overall project schedule		START: 01/01/2012																	END: 31/08/2016		
C3	Proposed											X	X	X							
	Actual											**X**	**X**	**X**	**X**						

Figure 23: Proposed and actual implementation timeline of action C3.

What was done? How was it done?

- Building permit and technical design were prepared by the company Montavar d.o.o. in April 2015 (Annex 18).
- The procedure for selecting contractors for reconstructing the hardware and electrical equipment of the barrier was carried out in June and July 2015. We issued a call for a tender for reconstruction, which was sent out to the few suitable contractors for reconstructing the hardware and electrical equipment. We received 4 tenders for reconstruction of the hardware and 2 tenders for the reconstruction of electrical equipment of the barrier. The selected contractor submitted the most advantageous tender (Annex 18).
- The most advantageous tender for the reconstruction of the hardware of the barrier at the Ambrožev trg was submitted by the company Montažna in ključavničarska dela Rudi Prosenik, s.p. (Annex 18).
- The most advantageous tender for the reconstruction of the electrical equipment of the barrier at the Ambrožev trg was submitted by the company Damjan Popelar s.p. (Annex 18).
- The work on the barrier was supervised by the concessionaire of the barrier Hidrotehnik d.d. (Annex 18).
- Works were carried out in August and September 2015. The outdated engine was replaced by a new one (Figure 24).

Figure 24: The outdated engine (left) was replaced by a new one (right)

- A touch screen displaying the position of the (right) barrier was added (Figure 25). The refurbished barrier propulsion system now allows the movement up to 200 mm above the threshold with the lowest step of 5 mm (Figure 25).

Figure 25: The touch screen displaying the position of the (right) barrier.

Responsibility of action implementation:
University of Ljubljana, Faculty of Civil and Geodetic Engineering was responsible for implementation of this action.

All the objectives were achieved:
- Modernization of barrier's lifting system to enable precise water level regulation.

Please find a more detailed report on the improvement of the Ambrožev trg barrier in Annex 18.

Indicators:
The main indicator to test the performance of this action is the movement of the barrier with a lower step compared to that prior to carrying out the reconstruction works on the barrier at Ambrožev trg (the lowest step is now 5 mm).

Outside LIFE actions:
There were no complementary actions outside LIFE.

Problems encountered and modification:
The gates at Ambrožev trg have been protected as cultural heritage, i.e. a monument of national importance, since 18 July 2009, with the Order Declaring the Work of Architect Jože Plečnik in Ljubljana a Cultural Monument of National Importance (Official Gazette of the RS, Nos. 51/2009-2500, 88/2014-3553, 19/2016-720); accordingly, any works that could change the exterior of the gates are prohibited. This was not envisaged during the project application procedure. Because of this the measures within this action were somewhat changed in comparison with those provided for in the Grant Agreement; however, the change did not affect the goals set, but the project duration was extended due to the complexity of

implementation. The modifications made to this action were confirmed by the European Commission as non-substantial modification by Email of 22 August 2014.

In June 2015 we started the procedure of selecting the relevant contractor for implementing the reconstruction measures of the gate lifting system. Due to the complexity of the requirements we were limited with the number of the appropriate service providers. The tender process for selecting the most favourable providers was guided separately for both the reconstruction of mechanical equipment and for reconstruction of electrical equipment. This was met by complications and extension of the procedure as the originally selected tenderer withdrew from the tender. Namely, the same tenderer also made a bid for the reconstruction of mechanical equipment of the sluice gate, but the bid was not the most favourable and was not selected. Then, the selected provider delayed with the signing of the contract for reconstructing the electrical equipment and finally, by agreement, withdrew from the bid. Therefore, the selection procedure for the reconstruction of the electrical equipment had to be repeated. All of this delayed the start of works at the gates; the works finally started in August 2015.

Next to the problems of selecting the contractors and adjusting the actions, these delays were also due to very high flows of the Ljubljanica in 2013 and 2014, as reported in the Progress Report No 2 (reporting date 29 January 2015). During the execution of the works the gates were non-operational, so we needed to make sure that there would be no need to use the gates to regulate the water level for at least 14 days. For the duration of the work on the gates, the Hydrological Forecasting Office of the Slovenian Environmental Agency (ARSO) provided us with flow forecasts for the next days, based on meteorological forecasts. The delay in this action did not affect the implementation of other actions.

Annexes:

Annex 18: Detailed report on the improvement of the Ambrožev trg barrier - updating lifting system at Ambrožev trg

5.1.7 Action E2 Monitoring and evaluation of the project restoration achievements

Action		2012				2013				2014				2015				2016			
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Overall project schedule		START: 01/01/2012																	END: 31/08/2016		
E2	Proposed						X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Actual						**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	

Figure 26: Proposed and actual implementation timeline of action E2.

Responsibility of action implementation:
University of Ljubljana, Faculty of Civil and Geodetic Engineering was mainly responsible for implementing action E2. Associated beneficiary Geateh was also involved in this action, mostly before the new monitoring method was implemented.

What was done? How was it done?
Long-term, good-quality monitoring of fish migration through fish passes is demanding, also in terms of workload. Various methods are used for monitoring fish migration, such as fish catch surveys in a fish pass itself or fish catches using fish pots set at the fish pass entrance or exit. These monitoring methods, however, are stressful for fish, and they involve a lot of work. Instead, we decided to use a combination of two underwater cameras to continuously monitor the migration of fish through the fish passes concerned. The cameras were developed at the Faculty of Civil and Geodetic Engineering of the University of Ljubljana (UL FGG). In fact, the camera system for monitoring the migration of fish through a fish pass was presented at Slovenian Union of Geodesy and Geophysics' (SZGG) annual general assembly and awarded the prize for the Best Hydrological Achievement in Slovenia in 2015.

Monitoring of fish migration using cameras is an established and widely adopted method for monitoring the passage of fish through fish passes (Mader et al., 2016[1]). The system allows for capturing of both images and videos of fish, where we can recognise the size and type of species of the fish migrating through a fish pass. This method is harmless and non-invasive to the fish. It also allows for continuous monitoring of fish migration.

Another method of monitoring fish migration is fish marking using VIE tags (Visible Implant Elastomer) during which the caught fish is marked according to the location of the catch before being released back into the water. It turned out that this method was not working, despite our expectations to the contrary when preparing the project proposal. The same disappointing experiences with this method were shared with us by a PhD student Jeroen Tummers from Durham University, UK, who also used this method in his research.

According to proposal made by experts at The Fisheries Research Institute of Slovenia we have also used a fishing trap. We were succesfull in catching fish but majority of them were injured by the trap, so we continued to look for a less invasive method.

[1] Mader. H., Käfer. S., Kratzert. F., 2016, The FishCam migration monitoring system for fish passes. 11th International Symposium on Ecohydraulics 2016. Richmond, Victoria. 154, 4.)

After having poor results using VIE tagging, we decided to build and use cameras in fish migration monitoring. The cameras were installed in both fish passes. The first camera for monitoring fish migration was installed in the fish pass at Ambrožev trg at the beginning of June 2015 when the reconstruction of the fish pass was finished (action C2) (Figure 27, left). Right after the completion of works at the fish pass in Fužine in September 2015, the second camera was also installed there (Figure 27, right).

Figure 27: Installation of the fish monitoring camera in the fish pass at Ambrožev trg (left) and at the fish pass at Fužine (right).

Results of online live viewing of the fish pass

An important feature of the video system for monitoring the migration of fish through fish passes is the option of live video streaming. You can watch the live stream from the fish pass via the YouTube portal (Figure 28). On-line viewing of fish passes has proven to be highly successful as more than 15,000 views were recorded by the end of the project. The video of the fish passes is streamed live to the LIFE Ljubljanica Connects project website at: http://ksh.fgg.uni-lj.si/ljubljanicaconnects/ANG/12_camera/. After the completion of the project, the monitoring of fish migration using cameras will be continued.

The analysis of camera monitoring at the Fužine fish pass was carried out from September 2015 until the end of August 2016 and at Ambrožev trg fish pass from July 2015 until the end of June 2016. In both fish passes we captured more than 200,000 photos of which approximately one fifth was usable, i.e. they allowed us determine the fish species.

The first type of cameras was installed at the Ambrožev trg fish pass while the second type was installed at both Ambrožev trg and Fužine fish passes. Together with both types of

cameras we detected 12 different fish species passing one or the other fish pass, including all three target fish species.

Figure 28: On-line, real-time YouTube streaming camera from the Fužine fish pass.

All three target fish species were detected, as follows:

- **Danube Salmon (*Hucho hucho*)**
- **Danube Roach (*Rutilus pigus*)**
- **Striped Chub (*Leuciscus souffia*)**

We also detected 9 other fish species migrating through either one of the fish passes:

- Brown Trout (*Salmo trutta m. fario*)
- Common Barbel (*Barbus barbus*)
- Common Bleak (*Alburnus alburnus*)
- Common Nase (*Chondrostoma nasus*)
- Common Roach (*Rutilus rutilus*)
- European Chub (*Squalius cephalus*)
- Grayling (*Thymallus thymallus*)
- Mediterranean Barbel or Southern Barbel (*Barbus balcanicus*)
- Schneider (*Alburnoides bipunctatus*)

Table 1: List of fish species detected at Ambrožev trg and/or Fužine fish passes

Family name	Species name
Cyprinidae	**Danube Roach (*Rutilus pigus*)**
	Striped Chub (*Leuciscus souffia*)
	Common Barbel (*Barbus barbus*)
	Common Bleak (*Alburnus alburnus*)
	Common Nase (*Chondrostoma nasus*)
	Common Roach (*Rutilus rutilus*)
	European Chub (*Squalius cephalus*)
	Mediterranean Barbel or Southern Barbel (*Barbus balcanicus*)
	Schneider (*Alburnoides bipunctatus*)
Salmonidae	**Danube Salmon (*Hucho hucho*)**
	Brown Trout (*Salmo trutta m. fario*)
Thymallidae	Grayling (*Thymallus thymallus*)

Table 2: The size (total percentage) and types of target fish species detected in the fish passes provides an estimate, i.e. the approximate number of other specimens detected with the cameras. The approximate numbers for April with 3253, May with 6151 and June with 25,023 specimens per month stand out, while in other months there were either considerably less or no specimens.

Table 2: The size (total percentage) and types of target fish species detected in the fish passes

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hucho hucho				6	8	5	5	1				
Rutilus pigus				13	16	9	1					
Leuciscus souffia				5	3	3		1				
total				24	27	17	6	2				

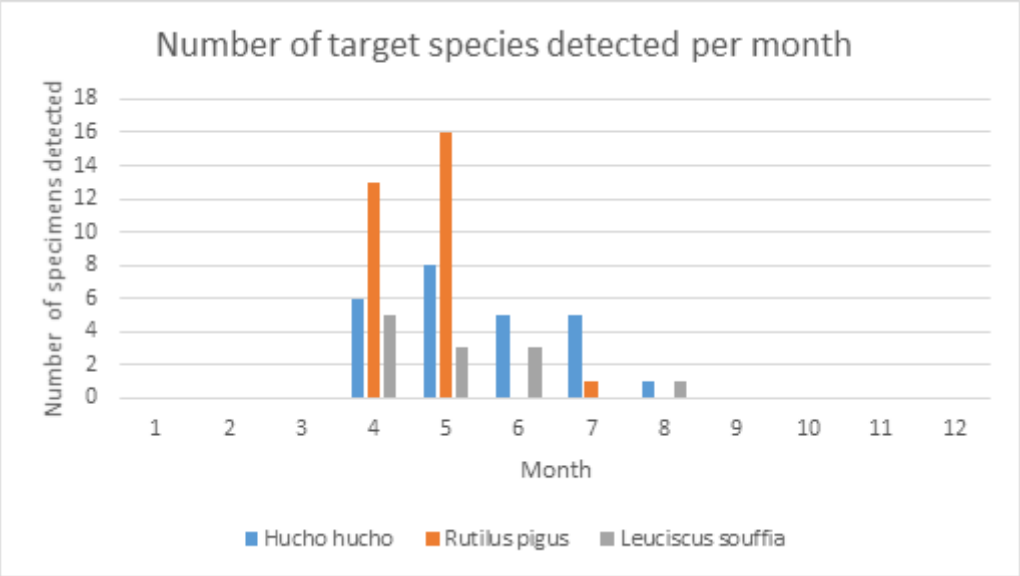


Figure 29: Number of target species detected per month

Table 3: Number and the total number of non-targeted monitored specimens per month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Alburnoides bipunctatus				70	6093	24988	95	21				
Squalius cephalus					30	17	4	6		280		
Chondrostoma nasus			1	3080								
Salmo trutta m. fario	1		1	9								
Barbus barbus					1	1	12	27				
Thymallus thymallus			1	70								
Barbus balcanicus							1					
Rutilus rutilus							4					
Alburnus alburnus								2				
Total	1		3	3229	6124	25006	116	56		280		

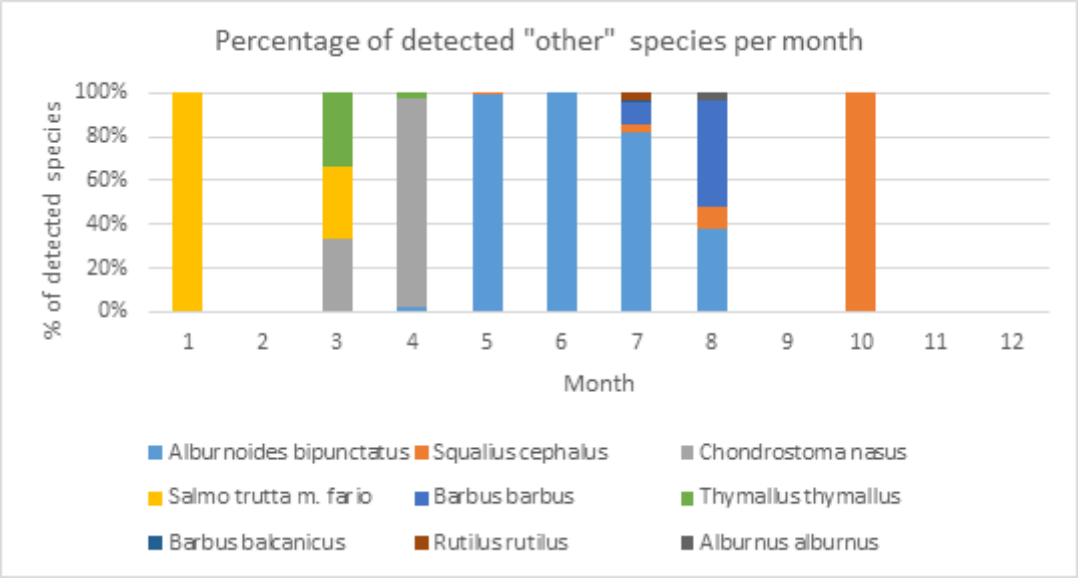


Figure 30: Percentage of detected "other" species per month

Table 4: Distribution of fish species at each monitoring site and in total

	Fužine	Ambrožev trg	F+A
Hucho hucho	27.77	34.48	33.89
Rutilus pigus	61.11	48.27	51.32
Leuciscus souffia	11.11	17.24	15.79
Alburnoides bipunctatus	9.03	90.48	89.73
Squalius cephalus	87.23	0.17	0.97
Chondrostoma nasus	1.56	9.00	8.93
Salmo trutta m. fario	1.56	0.02	0.03
Barbus barbus	0.31	0.12	0.12
Thymallus thymallus	0.31	0.20	0.20
Barbus balcanicus	0.00	0.00	0.00
Rutilus rutilus	0.00	0.01	0.01
Alburnus alburnus	0.00	0.01	0.01

Below are example photos for each fish species.

Figure 31: Danube salmon (*Hucho hucho*) (left) and Danube Roach (*Rutilus pigus*) (right)

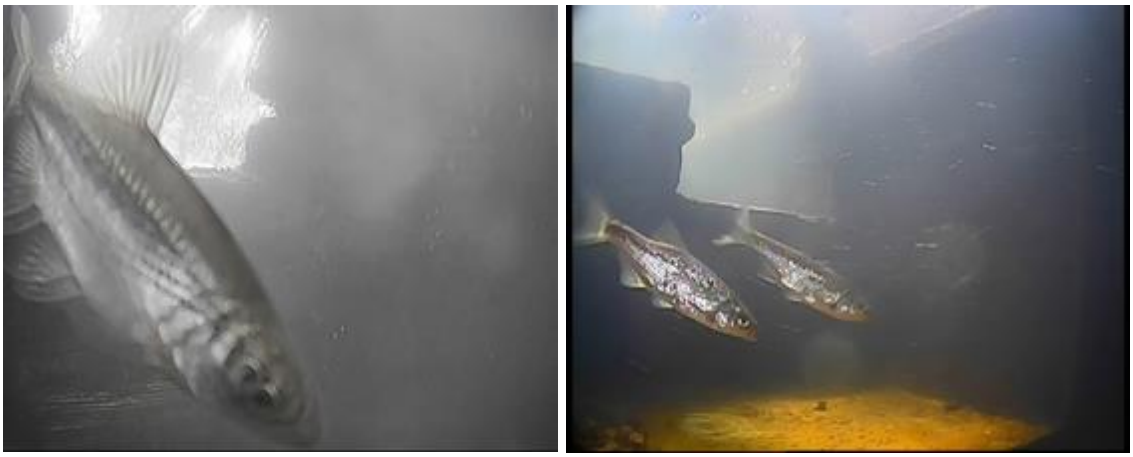


Figure 32: Striped chub (*Leuciscus souffia*) (left) and common bleak (*Alburnus alburnus*) (right)

Figure 33: Common barbel (*Barbus barbus*) (left) and common nase (*Chondrostoma nasus*) (right)

Figure 34: European chub (*Squalius cephalus*) (left) and schneider (*Alburnoides bipunctatus*) (right)

Figure 35: Brown trout (*Salmo trutta m. fario*) (left) and grayling (*Thymallus thymallus*) (right)

Figure 36: Mediterranean barbel or southern barbel (*Barbus balcanicus*) (left) and common roach (*Rutilus rutilus*) (right)

There is a pressure sensor installed at the Ambrožev trg gate for monitoring the water level at the fish pass inlet. Based on the data obtained using the sensor, we produced a graph showing the functioning of the fish pass between 1 February 2016 and 1 July 2016.

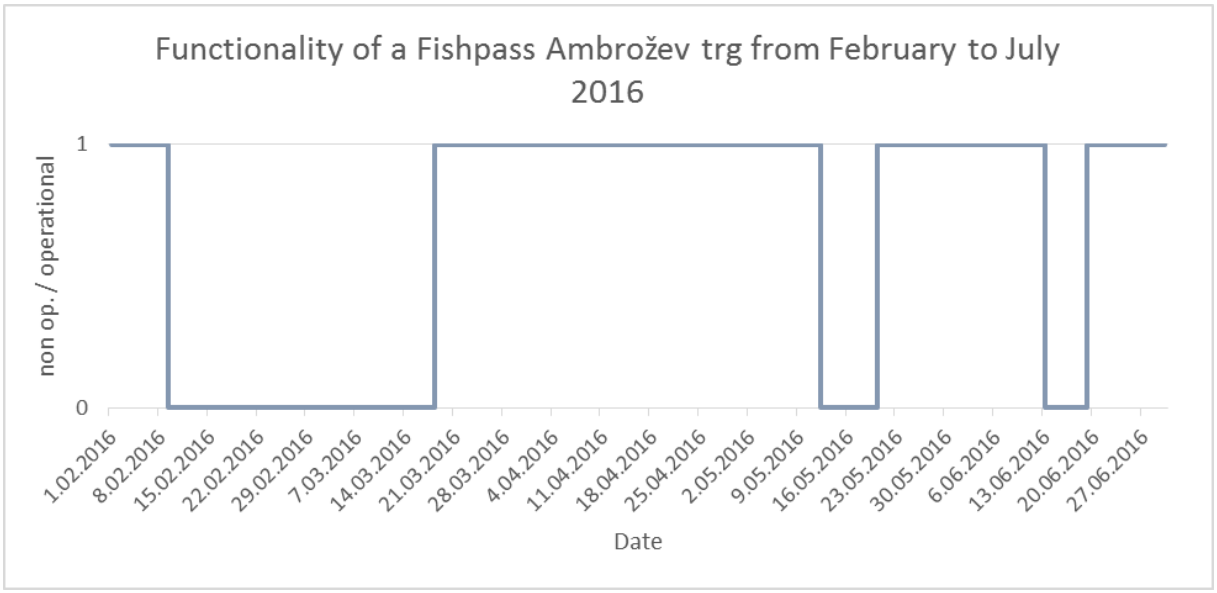


Figure 37: Functionality of the fish pass at Ambrožev trg (February–July 2016)

The graph above shows the functioning of the Ambrožev trg fish pass between February and July 2016. The gate operating regulations state that the gate at Ambrožev trg should be lifted when the Ljubljanica River discharge exceeds 110 m^3/s. The lifting of the gate causes the water level to drop upstream of the gate and, as a result, the fish pass is out of function during the time. Nevertheless, when the gates are lifted, the fish are able to migrate upstream without interruption because in the case of raised gates, there is no transversal structure to obstruct the migration. The fish migrate up the channel below the gate, past the fish pass. The fish migrating in this way are not detected.

The spawning period of Danube roach and striped chub is April–May, and that of Danube salmon March–April. The high water and, as a result, raised gates were the reason that the fish pass at Ambrožev trg was out of operation between 8 February to 18 March 2016. Based on this we can conclude that some fish migrated directly up the channel, past the fish pass at Ambrožev trg.

Summary of action E2

Cameras were used as the main method of monitoring fish migration through the fish passes concerned. This monitoring method using cameras is completely non-invasive and harmless to fish. The monitoring commenced following the installation of underwater cameras in the fish passes at Ambrožev trg and Fužine in July 2015 and September 2015, respectively.

At the Ambrožev trg fish pass we detected 12 fish species migrating through the fish passes. Among the target species we detected that all three were able to pass through both fish passes, i.e. at the Ambrožev trg and Fužine.

The most representative species is *Rutilus pigus* (51.31%/39 specimens), followed by Hucho hucho (32.89%/25 specimens) and, finally, Leuciscus souffia (15.78%/12 specimens). Around three quarters of all fish were spotted at the Ambrožev trg fish pass.

Among other species by far the most representative species overall is schneider (89.73%/31267 specimens), followed by common nase (8.93%/3081 specimens) and European chub (0.97%/337 specimens). A similar ratio appears at the monitoring site Ambrožev trg where the highest number of schneider and common nase specimens were recorded, while for Fužine the distribution of species is somewhat different with European chub at the top followed by schneider and common nase. Considering these results we can claim that schneider and common nase were the most active fish species in the monitored section of the river Ljubljanica regarding their migration along the river-bed. Furthermore, a higher number of specimens passed Ambrožev trg fish pass (34,450 against 319 specimens at Fužine) what makes us assume that the fish pass at Ambrožev trg is more suitable for fish to pass.

The recordings from the cameras demonstrate that fish are found in both fish passes; the fish at Ambrožev trg fish pass are seen from both sides, and those at the Fužine fish pass only from one side, so the camera system at Ambrožev trg is fully operational. At the same time images from camera give us important information not only about the month but also about the accurate day of spawning for different fish species (common nase from 18th to 22nd of April, grayling from 14th to 16th of April, European chub from 25th to 26th May and from 27th to 29th April).

Indicators:

The main indicator to test the performance of this action is the amount of data obtained on the migration of target and other fish species through the fish passes both at Ambrožev trg and Fužine.

Outside LIFE action:
There were no complementary actions outside LIFE.

Owing to the overall efficiency of this monitoring method, we will continue to use it in our fish migration monitoring after the completion of this project; we expect that in future the cameras will provide an even better insight into fish migration through fish passes. Furthermore, we will promote and encourage the use of this monitoring method in other fish passes in Slovenia and abroad.

5.1.8 Action E3 Management of the eco hydrological survey system and hydraulic model

Action		2012				2013				2014				2015				2016			
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Overall project schedule		START: 01/01/2012																	END: 31/08/2016		
E3	Proposed					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Actual					**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	

Figure 38: Proposed and actual implementation timeline of action E3.

What was done? How was it done?
- Field trips have been taken every month to the various locations with water stations, where we gather data, check the operation of the water stations and repair them if necessary (until now approximately 150 field checks of the stations were carried out at Ambrožev trg, Fužine, Zalog, Vrhnika, Močilnik, Planina, Želimeljščica, Kamin, Borovnica, Gradaščica, Barje and Ig).
- Discharge was measured on the Ljubljanica River and its tributaries (for example measurements were taken on 21 February 2014 on the Unica River, 25 February 2014 on the lake in Planina, 26 February 2014 on the Iščica River, 2 April on the Ljubljanica River near Kamin, 4 April and 8 April 2014 on the Ljubljanica River near the headway bridge).
- The hydraulic model is updated and calibrated according to the measured and analyzed data.
- At three measurement stations we are also measuring concentration of dissolved oxygen. These measurements together with water temperature measurements are the basic indicator of the water quality in the Ljubljanica River.

All the objectives were achieved:
- Verification of water stations' operation.
- Collection of data from water stations.
- Measurements of water discharge.
- Calibration of the hydraulic model.
- Measurements of water quality.

Responsibility of action implementation:
University of Ljubljana, Faculty of Civil and Geodetic Engineering was responsible for the implementation of action E3.

Action E3 covered activities important both for demonstrating the adequacy of the activities and measures carried out under other actions (actions C1, C2, and C3) and for monitoring the state of the Ljubljanica River. Under action C3 we checked the operation of the 17 monitoring sites (set up under action A3) on the Ljubljanica and its tributaries (Figure 39), where water temperature and water level are continuously (i.e. each 10 minutes) recorded. Under action A3, sensors for monitoring dissolved oxygen concentration in water were added at 3 monitoring sites. The equipment for continuous measurements of dissolved oxygen in water is very expensive, so it was installed only at the most critical places (in the oxbow at Zalog to check the impact of sill construction under Action C1; in front of, and behind, the gates at Ambrožev trg to check the impact of the gate and the upgraded gate lifting system on the ecological conditions in the Ljubljanica).

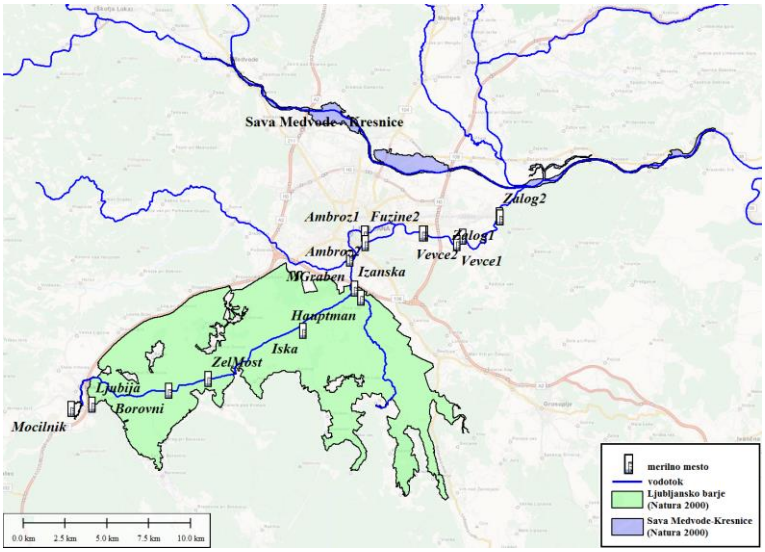


Figure 39:17 locations of measurement sites and Natura 2000 target sites of the project (Sapač et al., 2014)

Discharge was regularly measured in various locations of the Ljubljanica and its tributaries (e.g. rivers Unica, Iščica, Planinsko polje). The checking of monitoring sites and the instruments installed is carried on a monthly basis. During the project, more than 150 field checks (i.e. field visits) were done. Field checks are carried out by a researcher employed at the University of Ljubljana, Faculty of Civil and Geodetic Engineering (Figure 40).

Figure 40: Collection of measured data in the field

The hydraulic model was established as part of action A3. Under action E3 the model was, will continue to be, calibrated with the data obtained at the 17 measurement sites on the Ljubljanica river and its tributaries (set up under actionA3). Besides, the data from the Slovenian Environment Agency were obtained. The Agency is responsible for monitoring surface waters in the Republic of Slovenia. The hydraulic model was developed and calibrated by the researchers of the University of Ljubljana, Faculty of Civil and Geodetic Engineering (Figure 41). A more detailed description on the hydraulic model is found in Annex 14.

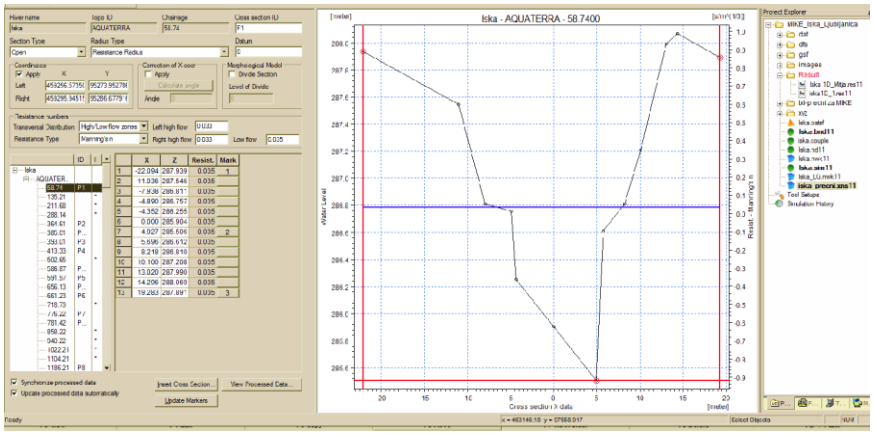


Figure 41: One of the cross-sections of the Iška River in the hydraulic model

The network of measuring stations is relatively dense. However, these measurements still provide only point data. The Ljubljanica River basin is partially karstic, so all waterways are not known. To build a good hydrological model we must know the river basin water balance. One way of discovering underground springs is to measure temperature changes. For this purpose, in the framework of this project 2 km of optical fibre for measuring temperature changes and a sensor (SILIXA ULTIMA-XT DTS Range 5 km, Figure 42) were purchased. University of Ljubljana carried out several measurements in the Ljubljanica River and its tributaries (e.g. Iščica, Želimeljščica, Borovniščica) (Figure 43, Figure 44). A more detailed description of the sensor and optical fibre operation is provided in Annex 19.

Figure 42: SILIXA ULTIMA-XT DTS Range 5 km

Figure 43: Field measurements: Iščica River on 2 September 2015

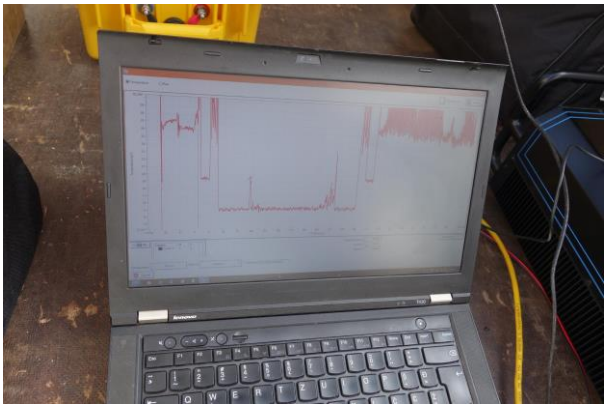


Figure 44: Very precise measurement results using the SILIXA optical fibre and sensor

The measurements carried out with this instrument were used in the hydrological model and indirectly in the hydraulic model and for the establishment of the database on the Ljubljanica river hydrological regime including groundwater – surface water relations. The instrument will continue to be used by the University for measuring temperature for the purposes of monitoring water quality and in other hydrological expert and scientific tasks.

Problems encountered

In the scope of action E3 we did not encounter any problems that would affect the implementation of the action or this project as a whole.

Indicators:

The main indicator to test the performance of this action is the amount of the data obtained in the framework of the established ecohydrological monitoring. Additionaly, another indicator is the success of the hydraulic model calibration with the data obtained in the scope of the project LIFE Ljubljanica Connects.

Outside LIFE actions:

There were no complementary actions outside LIFE.

Annexes:

Annex 19: **Detailed description of the sensor and optical fibre operation**

5.2 Dissemination actions

5.2.1 Dissemination: overview per activity

Dissemination was performed in the scope of actions D1 and E4. In general action D1 was intended to inform people about the project Ljubljanica Connects and to present them our work and importance of project's goals. Action E4 was focused more on the scientific public with a desire to gain new ideas and experiences. Activities of both actions were very interconnected. Presentations of results with posters, flyers, brochures have led to networking and learning about similar projects and experience therein. Therefore, it was difficult to identify whether the costs should be attributed to action D1 or action E4.

5.2.1.1 Action D1: Public awareness and education campaign about river corridor restoration on national and local levels

Action		2012				2013				2014				2015				2016			
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Overall project schedule		START: 01/01/2012																	END: 31/08/2016		
D1	Proposed		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Actual		**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	

Figure 45: Proposed and actual implementation timeline of action D1.

What was done? How was it done?

- The web page was set up and regularly updated with latest news, issued material, published articles and links to project's material published elsewhere.
- A few PowerPoint presentations were prepared, including the official final presentation covering all the actions and its results.
- Two films about the project were prepared, a shorter (10 minutes) and a longer (30 minutes) one. Both are available in Slovenian and English language and were put on DVD.

Figure 46: DVD with short and long film of the project Ljubljanica Connects

- Two brochures with a general overview of the project were prepared. The first brochure was published in September 2013 and the second one in June 2015 (Annex 20).

- Four bulletins with yearly news about the project were issued in February 2013, December 2013, December 2014, and November 2015 (Annex 20).
- Two posters for distribution were designed in March 2014 and July 2015 (Annex 20).
- Eight poster presentations were given at conferences and workshops across Europe (Annex 20).
- At each reconstruction site (Zalog, Fužine and Ambrožev trg) a notification board with logos and general information about the reconstruction was set up. Additionally an informative board was placed near the gate at Ambrožev trg (Annex 20).
- Eleven articles were prepared by the project team and published in various scientific papers and newspapers (Annex 20).

Figure 47: Blanca Torres Vara (Spain) and Julia Justyna Sobor (Poland) at their internship at the Faculty

- Layman's Report was written in August 2016. After the end of the project it was supplemented with some of the most important project results obtained during the final analyses. Please find the Layman's Report in Annex 22.
- Two flyers were printed for project presentation. The one in English language was used at the conferences abroad while the second one was prepared and distributed during the World Fish Migration Day (Figure 48).

Figure 48: The event in the scope of World Fish Migration Day 2016 was very successful.

- Seven special lectures about the project Ljubljanica Connects in general were given to the students. Specific results of a few actions were also presented according to the background of the students.
- Twenty-two thematic presentations were organised for primary school children and high school students. These events included project presentations with the project film, fieldwork, and workshops.

Figure 49: Fieldwork with primary school children

- Two round tables were organised. In cooperation with the City of Ljubljana a round table for the general public was organized in June 2015. In November 2015 another one was prepared for the students of Water Science and Environmental Engineering (Figure 50).

Figure 50: Roundtable for the students of Water Science and Environmental Engineering

- We participated in the preparation of four TV reports (three on evening news and one educational show), one for the radio and three for various media portals.
- We organized a press conference after the end of all concrete restoration actions.

All the objectives were achieved:

- setting up of the project website
- 1000 copies of brochures published and distributed
- 200 copies of poster produced and distributed
- an educational film produced and 200 copies of the DVD with the film distributed
- 4 special lectures, 5 thematic presentations and 2 roundtables organised
- 4 bulletins in 200 copies produced and distributed
- organisation of press releases or press conferences
- 8 articles in journals published
- 4 posters at exhibitions presented
- Layman's Report produced

We estimate that the dissemination action of the project was very successful. All of the set tasks were successfully carried out. The majority of brochures, bulletins and flyers have been distributed. The remaining products, especially DVDs and the Layman's Report, which were prepared towards the end of the project, will be distributed during the After-Life phase of the project.

Please find a more detailed report on the dissemination activities in the scope of action D1 in Annex 20.

Annex:

Annex 20: Detailed report on action D1

5.2.1.2 Action E4: Networking with other LIFE and/or non-LIFE projects

Action		2012				2013				2014				2015				2016			
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Overall project schedule		START: 01/01/2012																	END: 31/08/2016		
E4	Proposed			X											X	X	X	X	X	X	
	Actual					**X**									**X**	**X**	**X**	**X**	**X**		

Figure 51: Proposed and actual implementation timeline of action E4.

What was done? How was it done?

- An international workshop was organised on 18 June 2013. It was attended by 13 participants and 8 presentations were held.
- A thematic conference was organised between 22 and 23 September 2015. The two-day event consisted of presentations with a discussion and a field trip. In both days there were 26 participants registered and 8 contributions presented.
- We visited 4 locations with examples of good practice.
- We actively participated at 9 conferences and roundtables around Europe, where we had 12 presentations.
- Contacts with 4 other projects were established, all in person.
- Contacts with 12 researchers were established. With some of them we have, in the mean time, already worked together.

Figure 52: Participation at Fish Passage 2015 (The Netherlands)

All the objectives were achieved:

- organisation of a workshop with Slovenian and foreign experts
- visit of some good practice sites
- organisation of a two-day thematic conference with Slovenian and foreign experts

Figure 53: River connectivity conference at the faculty of Civil and geodetic Engineering (Ljubljana, Slovenia)

Figure 54: Participation at Fish Passage conference 2016 in the USA

Action E4 – networking was successfully completed. A workshop and a conference were organised and we gained many new acquaintances and connections that we will use in the future.

Please find a more detailed report on the activities in the scope of action E4 in Annex 21.

Annex:

Annex 21: A detailed report on action E4

5.3 Evaluation of Project Implementation

All the actions foreseen were successfully completed by the end of the project.

Table 5: Evaluation of the project action implementation

Task	Foreseen in the revised proposal	Achieved	Evaluation
A1	● Investigation of past river channels on Ljubljanica River. ● Overview and description of fish population in Ljubljanica River. ● Investigation of habitat conditions in Ljubljanica River. ● Establishment of database about Ljubljanica River hydrological regime. ● Overview of target populations. ● Collection of literature and reports about the topic.	All the foreseen objectives of the action were achieved.	Despite the fact that the action was completed after its deadline, this did not affect the quality of the objectives achieved. A successfully completed action A1 was the condition for the start of action E2.
A2	● Obtaining all the necessary permits. ● Obtaining detailed geodesy of the project area. ● Preparation of the initial hydraulic model of the project area. ● Preparation of technical documentation and documentation for public tender contract. ● Assessment of the present state of the fish passes.	All the foreseen objectives of the action were achieved.	The acquisition of all the necessary permits and approvals was the most time-consuming part of this action. During the implementation of action A2 we ran into previously unforeseen problems, such as unknown ownership of the sluice gates at Ambrožev trg. Eventually, in cooperation with the Slovenian Environment Agency and the City of Ljubljana, we reached an agreement on the reconstruction works at the gates and the fish pass.
A3	● Construction of water stations. ● Establishment of a hydrologic model. ● Monitoring of water temperature and quality.	All the foreseen objectives of the action were achieved.	Continuous online connection can be really expensive, which was not foreseen in the initial financial structure of the project, therefore we decided to set up and develop those stations on our own to ensure a cheaper way of data transmission. We requested for technical changes (Amendment No 2). The stations were installed at the following sites: Vrhnika, Ambrožev trg, Fužine. An added value of the project is also the established monitoring of ecological parameters (such as

			temperature and concentration of dissolved oxygen). Hydrological measurement are used for simulations with the hydrological and hydraulic models.
C1	● Reconstruction of the sill. ● Increasing the water abundance in the river channel during low flow conditions.	All the foreseen objectives of the action were achieved.	We had some problems with delayed execution of works, because fishermen have strict rules about when to not interfere with the water space in the periods of low flow. Despite the delay, the action was carried out successfully. The water level in the above-lying oxbow increased soon after the completion of reconstruction works.
C2	● Reconstruction of the fish pass at the Fužine weir. ● Reconstruction of the fish pass at the Ambrožev trg barrier.	All the foreseen objectives of the action were achieved.	Due to the collapse of the fish pass at Fužine weir, new solutions for achieving the objective of reconstructing the fish pass were needed. Furthermore, during implementation of the project, downstream of the gates at the Ambrožev trg, a new bridge was built, which caused the rise in the water level at the entrance to the fish pass. Because of these two reasons, the measures had to be adjusted and we applied for a technical amendment (Amendment No. 2). The changes did not affect the quality of the results achieved.
C3	● Modernization of barrier's lifting system to enable precise water level regulation.	All the foreseen objectives of the action were achieved.	Since the barrier is protected as a monument of national importance, adjustments to the proposed modernization of the barrier's lifting system were necessary. Technical amendments were approved by Amendment No. 2. The changes did not affect the quality of the results achieved.
D1	● Promotion of the project with web site, brochure, yearly bulletins, poster and educational film. ● Organization of special lectures, presentations and roundtables.	All the foreseen objectives of the action were achieved.	Implementation of action D1 was the most intensive in 2015 and 2016 when we already had concrete results of this project available. Project results and good practices such as monitoring of fish migration with cameras were presented all around the country

			and around the world. We believe that in this action was achieved much more than originally anticipated.
E1	● Management of the project. ● Meetings of the steering group.	All the foreseen objectives of the action were achieved.	We estimate that the management of the project went well. We had some problems with partners (liquidity problems, merger of a partner company with a third-party company), but this did not affect the project itself. Communication between partners was good, which had a positive impact on the implementation of preparatory, concrete and monitoring actions.
E2	● Monitoring of fish migration through fish passes. ● Obtaining data about different fish species using fish passes. ● Study migration of targeted fish species on the research area. ● Implementation of fish monitoring.	All the foreseen objectives of the action were achieved.	The project's duration was extended due to implementing a new method of monitoring fish migration. This action is the key to identify the success of the project.
E3	● Verification of water stations operation. ● Collection of data from water stations. ● Measurements of water discharge. ● Calibration of hydraulic model.	All the foreseen objectives of the action were achieved.	During implementation of this action a lot of new much needed data on the Ljubljanica River water level were gatthered. Therefore UL FGG assesses the implementation of the action as highly successful.
E4	● Organisation of workshop. ● Participation on other LIFE+ restoration sites. ● Organization of international thematic conference.	All the foreseen objectives of the action were achieved.	The coordinating beneficiary is a higher education institution (University of Ljubljana), so we incorporated networking primarily through participation in international (European and North American) conferences and via organization of an international conference on river connectivity. Our networking activities provided us with new knowledge and an exchange of experiences, contributing to the quality of project implementation (e.g. development of a monitoring system of fish migration through fish passes) and we believe that this action was also completed

			successfully.

5.4 Analysis of long-term benefits

1) Environmental benefits

a) Direct/quantitative environmental benefits:

The measures taken within the framework of the project (reconstruction of fish passes, upgrading of the gate lifting system, installation of deflectors at the exits of fish passes, reconstruction of the stone sill at Zalog, etc.) will make a significant contribution to realising the goals of the Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora), stating that "the aim of this Directive shall be to contribute towards ensuring bio-diversity through the conservation of natural habitats and of wild fauna and flora in the European territory of the Member States to which the Treaty applies". *This goal will be achieved with an increased population of targeted fish species. Benefits concern also increase of the fish habitat in general, which will become much larger due to the re-established connectivity achieved by enabling of fish passes and removal of barriers along Ljubljanica River.* The results of monitoring the passage of fish through the fish passes clearly demonstrate that target fish species use the fish passes restored in the project *(see Figure 55).* Future monitoring will reveal whether the provided passage through the fish passes contributes to the population size of the target fish species. *Monitoring data will improve the knowledge of the state of targeted fish species and will in future allow us to recognize potential threats.*

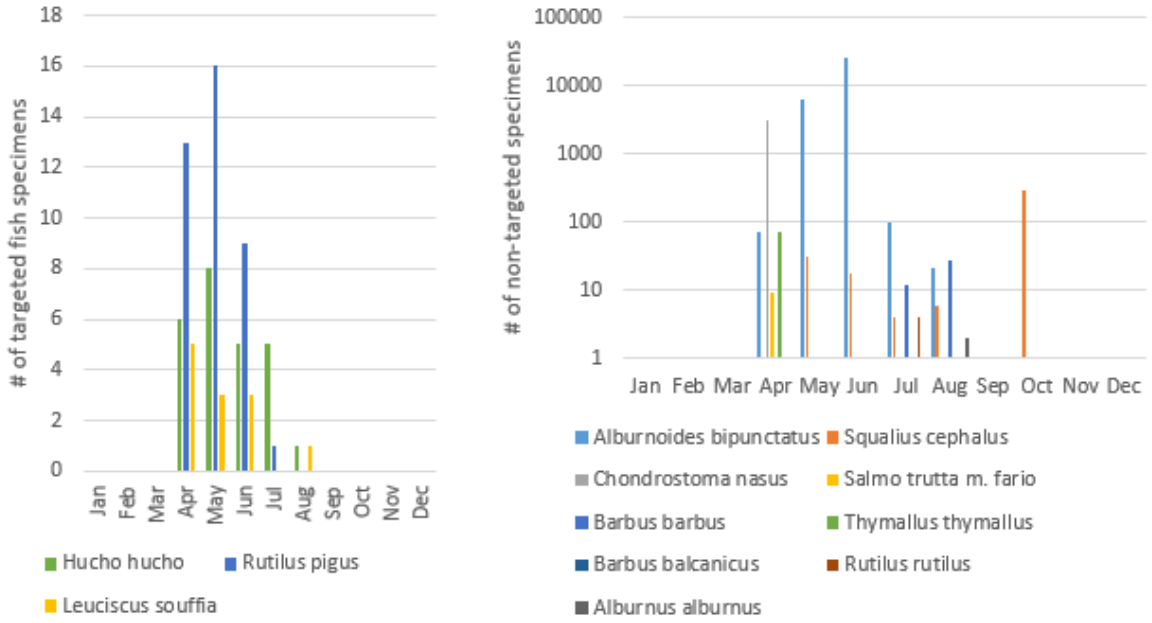


Figure 55: Number of targeted and non-targeted fish species detected per month

b) Relevance for environmentally significant issues or policy areas

Significant issues concern quality status of the Ljubljanica River. The chemical water quality is under constant process of improvement since many years due to realisation of wastewater

treatment facilities, followed by habitat characteristics such as spawning grounds and water organisms' passes, which have decisive effect on fish population. As the consequence, oxygen level in water would be on the increase, providing conditions for the growth of fish population in general. Protection of fish species in the upper Sava River Basin, with the tributary Ljubljanica has been in the priority of environmental policies. The measures involving sill reconstruction at Zalog directly improved the quality of surface water in the oxbow situated upstream – the water level in the oxbow increased, which decreased the heating rate of water; the result is a higher concentration of dissolved oxygen in water, which is essential for the life of aquatic fauna in the oxbow. The objective of the Water Framework Directive (Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, Official Journal L 327, 22/12/2000 P. 0001 - 0073) stating "Member States shall protect, enhance and restore all bodies of surface water, subject to the application of subparagraph (iii) for artificial and heavily modified bodies of water, with the aim of achieving good surface water status at the latest 15 years after the date of entry into force of this Directive", was thus achieved.

The measures taken within the framework of the project will make a significant contribution to realising the goals of the Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora), stating that "the aim of this Directive shall be to contribute towards ensuring bio-diversity through the conservation of natural habitats and of wild fauna and flora in the European territory of the Member States to which the Treaty applies". The results of innovative monitoring show that targeted and other fish species successfully use reconstructed fish passes and that the installed deflectors enable the fish to migrate through the fish passes smoothly both up- and downsteam (by preventing the intrusion of the debris). This means that we expect that the number of specimens of targeted fish species will increase in the future.

Following public awareness actions (actions D1 and E4) and the meetings with the competent ministry (Ministry of the Environment and Spatial Planning), the local community (Municipality of Ljubljana), and anglers, the public attention to the importance of river connectivity has increased. The project has provided good examples of measures that were relatively inexpensive but have had a great impact on nature conservation (e.g. deflectors that were installed at Ambrožev trg and Fužine, monitoring system with cameras installed in both reconstructed fish passes).

2) Long-term benefits and sustainability

a) Long-term/qualitative environmental benefits

The outlook for the targeted fish species is provided in this report (Technical part, action E2). Our plans to continue and develop the actions that were initiated in the LIFE project in the years following the end of the project, the long-term management of the sites, and the remaining threats are the issues addressed in the After-LIFE Conservation Plan (please see Annex 23 and Annex 24). The After-LIFE Conservation Plan is written in both Slovenian and English.

The knowledge of the situation of endangered (targeted) and other fish species has greatly improved through innovative monitoring. Information and data obtained with monitoring analysis will serve in the future for long-term assessement of the fish situation in the Ljubljanica River. Furthermore, through After-LIFE actions we will promote and strive for the inclusion of such a monitoring method on other rivers (fish passes) in Slovenia and abroad. With such a method of monitoring, scientists, experts, and ultimately the society as a whole would gain not only more data (quantity), but also qualitative data (e.g. the exact location of the observed species, time of migration). Both the interested lay public and experts have 24/7 possibility of insight into fish passes.

The eco-hydrological monitoring network was set up in such a way that will allow data acquisition long after the end of the project. The eco-hydrological monitoring data are very important for the subsequent evaluation of the changing conditions in the Ljubljanica River and its tributaries.

Reconstruction of the gate lifting system at Ambrožev trg that was implemented in the framework of action C3 enables further work for modernization and automatization of the gates. In other words, reconstruction works of the C3 action enable the preservation of cultural heritage and functionality of the gate system. Information on the previously existing ideas about demolition of the Ambrožev trg barrier can be found in the literature.

By presence of top predator like Danube Salmon in the river, other fish species will become well balanced in numbers.

With a good maintenance, it will be possible to keep river connectivity along Ljubljanica River at high level.

b) Long-term/qualitative economic benefits

Measures introduced by LIFE project will increase fish biomass in general. Care has to be taken about benthos and state of river bottom in spanning sections of the river. If those sections, which were identified in the project as spawning ground, are supervised during spawning season this is going to contribute added value to a quality of the river habitat.

Main economic benefits are expected through angling permits kept under strict controle and tourist interest for biodiversity aspects of the river such as underwater CCTV.

The development of a new monitoring method of passability provided by a fish pass using two low-cost cameras. In the future, this monitoring system will be further developed. This way of monitoring provides continuous data on fish passage and it costs much less than individual (one-off) fish catch surveys and marking, which only provide information on fish at the time of the survey. Besides, our proposed way of monitoring is non-invasive for endangered and other fish species. *The installation of deflectors around fish pass exits will reduce the costs of repairs of fish passes due to the damage caused by debris entering the fish pass. Deflectors are relatively inexpensive, but have a major positive environmental impact.* Also developed on-line water stations enable low-cost monitoring (costs of storage and maintenance) and could in future help to automatizate river gates at Ambrožev trg automatization.

Reconstruction of the fish passes carried out in the framework of the project has substantially improved the living conditions of target fish species (enabled migration upstream to the spawning areas). Furthermore, works were carried out in such a way that maintenance works are relatively simple and inexpensive. Moreover, maintenance of ecohydrological monitoring is also relatively cheap, but such monitoring constitutes a veritable treasure trove of data which can be used to build forecasting models based on which, in case of natural disasters threats (e.g. floods, drought), competent authorities could take timely action and consequently reduce economic damage. The database with ecohydrological data is freely available on the project website.

c) Long term/qualitative social benefits

The project provided employment for many young people, which can be considered a benefit at the national level; namely, the unemployment rate in the Republic of Slovenia during the implementation of the project was the highest in the country's history. *By introducing the need for systematic monitoring using the method that was developed in the framework of LIFE Ljubljanica Connects in relevant regulations, the number of jobs in developing such monitoring systems, as well as in installation and maintenance of the equipment in the field, will increase.*

Society of anglers will attract many more members on the account of fish population strengthening, especially the most attractive species, like Danube Salmon. Interest for fish in its natural environment will increase and spur activities close to the water such as swimming (quality of water in the city is nearly bathing), bird watching, boat travel etc.

It is expected that local inhabitants will be better interconnected through involvement in concrete after-LIFE conservation actions. It is also expected that good cooperation between beneficiaries and local anglers will continue. Anglers are the ones who directly perceive the improvement of the situation of endangered target fish species. They also perceived the improvement of the conditions in the oxbow in Zalog (due to reconstruction of the sill downstream). This has led them to fix up the surrounding area of the oxbow where, along with the anglers, other visitors like to stay and admire the nature, which has a positive psychological effect.

The whole corridor of the Ljubljanica River together with its riparian areas has great potential for recreation and this can contribute to public health. A heatlhy environment has a positive influence on both physical and mental health (e.g. relaxation, good spiritual experience). This potential has been exploited well.

d) Continuation of the project actions by the beneficiary or by other stakeholders

After the project’s completion, we will continue to carry out the activities related to monitoring the passability of fish passes, further improve the passability monitoring system using cameras as well as continue with the ecohydrological monitoring set up in the framework of the project. We paid particular attention to dissemination of results and networking already during the implementation of the project. We will continue to attend professional conferences at home and abroad, where we will exchange know-how and experience with other professionals concerning monitoring fish passage, ecohydrological

monitoring, analysis and application of results from monitoring, ways of fish way reconstruction, etc. Already during the project, great emphasis was placed on working with young people, and we will continue to do so in the future. We will organise thematic workshops and roundtables for primary and secondary school pupils and higher education students, and take part in various (natural, technical) science days. We will continue to inform the general public about the need to conserve and protect endangered fish species and about the need of investing in construction and/or reconstruction of the facilities that are key for the preservation of longitudinal passability and continuity of rivers. *Additionaly, it is expected that based on the reconstruction works (action C3), Ambrožev trg river gate lifting system will be modernized and automated in the future.*

3) Replicability, demonstration, transferability, cooperation

The development of the innovative monitoring method of fish pass passability has great potential to be used in other fish passes in Slovenia and abroad. Such a monitoring method is not harmful to fish, while it provides continuous data on fish passage (fish species and time of passage), and the costs of its setting-up and maintenance are relatively low in comparison to individual fish catch surveys (if taken by external contractors), which can be harmful to fish (e.g. if caught in the openings of a trap (pot)). Next to the monitoring system, we stress the importance of safety elements, i.e. deflectors, at fish pass exits preventing the ingress of debris and damage of a fish pass, while allowing for unhindered exit of fish from a fish pass – the openings do not clog up as was the case initially when the fish pass exits were protected with grills where debris got stuck between the bars. Such a way of preventing the ingress of debris and fish pass damage has also positive financial effects as maintenance costs are significantly reduced. *It is very important to highlight the fact that all the innovations that have been made in the framework of the project LIFE Ljubljanica Connects are transferable and suitable for other locations in Slovenia and abroad (e.g. deflector, monitoring system with camera).*

4) Best Practice lessons

One of the biggest contributions of Ljubljanica Connects was the development of an innovative monitoring method and system of passability of fish passes. However, the development of such a system was unfortunately not provided for already in the application of this project. The grant agreement provided for several ichthyological surveys, i.e. fish catching, marking and inventory of endangered target and other fish species. If the monitoring method that was eventually used had been already foreseen in the project application, there would have been no need to extend the duration of the project, while the costs would be lower, since there would be no need for external assistance for fish catch surveys, marking, and inventory. We want to say that during the project implementation we realized how much we actually know, since we were able to develop different systems (e.g. monitoring system with cameras, deflectors, boat “Hi3”, on-line stations) and to find different successful solutions (e.g. improvement of river gate lifting system at Ambrožev trg, where the solutions were limited due to cultural heritage protection). The lesson is that for environmental projects is very difficult to predict appropriate methods, so we have to trust in our knowledge and that we are able to solve even the most demanding challenges and find solutions when the original ideas fail.

5) Innovation and demonstration value

The monitoring system of passage through fish passes, as developed by UL FGG's staff during this project, is certainly innovative. Implementation of this kind of monitoring elsewhere in Slovenia and abroad could provide significant added value both at the national and EU levels. Also development of boat "Hi3" is an innovation, since enables discharge measurements by low flows and can be used at potentially dangerous locations for measurements, such as in the vicinity of hydropower plants. *In the scope of the project, two movies in two languages were recorded and are freely available on YouTube and project website. Everyone interested has the opportunity to watch what happens in the Ljubljanica River (more specifically in the fish passes) using live recording and broadcasting to the project website and YouTube. All deliverables of the project are freely available on the project website.*

6) Long term indicators of the project success

The best long-term indicator of the project success will be the level of improvement of the status of endangered target fish species, i.e. the increase in the population of these fish species in the Ljubljanica River corridor and its tributaries. This will be evaluated on the basis of passage of fish through the fish passes (camera recordings) and official reports and documents of competent organisations (e.g. Fisheries Research Institute of Slovenia, Ministry of the Environment and Spatial Planning of the RS). A performance indicator of restoring the sill at Zalog (action C1) will be the level of improved oxygen conditions in the oxbow situated upstream, i.e. the raising of the water level in this oxbow, which is the result of the increased inflow of water from the main Ljubljanica channel to the oxbow. These conditions will be monitored in the framework of the ecohydrological monitoring that has been set up. One of the major long-term indicators of the projects success is also greater awareness among young people about river passability and importance of biodiversity.

Another indicator is the number of after-LIFE projects and actions in the scope of Natura 2000, which will be implemented via investments by the state or the municipality.

List of long-term monitoring indicators:

- *Number of target fish species using the fish pass at Ambrožev trg (results of analysing the monitoring data obtained using the camera monitoring system at Ambrožev trg)*
- *Number of target fish species using the fish pass at the Fužine weir (results of analysing the monitoring data obtained using the camera monitoring system at the Fužine weir)*
- *Water level in the oxbow upstream of the sill at Zalog*
- *Water temperature and concentration of dissolved oxygen in the oxbow upstream of the sill in Zalog*
- *Number of local workshops and presentations on the topic of river connectivity importance*
- *Number of workshops and presentations on the topic of river connectivity importance at EU and worldwide levels*

- *Number of projects related to the provision/improvement of river connectivity (e.g. related to dam removal or fish pass building/reconstruction where necessary)*
- *Number of projects related to the promotion/improvement of river connectivity provision*
- *Number of conservation measures included in the Natura 2000 management plans*

6 Annexes

6.1 Administrative annexes

Together with Inception Report (reporting date 30 September 2012) were sent also copies of partnership agreements:

- Contract between University of Ljubljana, Faculty of Civil and Geodetic Engineering and Geateh
- Contract between University of Ljubljana, Faculty of Civil and Geodetic Engineering and Purgator
- Contract between University of Ljubljana, Faculty of Civil and Geodetic Engineering and Ministry of Environment and Spatial Planning (co-financing).

Please find attached the Annex 24, where the answers to EC annexes can be found.

6.2 Technical annexes

Annex 1: Report on the preliminary study of the habitat, hydrological and hydraulic conditions in the Ljubljanica River corridor, estimation of Danube Salmon, Danube Roach and Striped Chub
Annex 2: The protocols and guides for the survey of the ecological status, hydrological and hydraulic conditions of the Ljubljanica river corridor
Annex 3: The present situation of Danube Salmon, Danube Roach and Striped Chub population in the Ljubljanica River corridor and its main tributaries
Annex 4: Database on the Ljubljanica River hydrological regime including groundwater and surface water relationship
Annex 5: Proposals for minimisation and/or elimination of negative impacts
Annex 6: Report on the first fish tagging
Annex 7: Report on the second fish tagging
Annex 8: The permits and documents obtained for action C1
Annex 9: The permits and documents obtained for action C2
Annex 10: The permits and documents obtained for action C3
Annex 11: Hydrological model
Annex 12: Hydraulic model
Annex 13: Detailed report on the reconstruction of the sill in Zalog
Annex 14: Detailed report on reconstruction of the fish pass at Ambrožev trg barrier
Annex 15: Detailed report on reconstruction of the fish pass at Fužine weir
Annex 16: Detailed report on the improvement of the Ambrožev trg barrier - updating lifting system at Ambrožev trg
Annex 17: Detailed description of the sensor and optical fibre operation
Annex 20: After LIFE Conservation Plan (English)
Annex 21: After LIFE Conservation Plan (Slovenian)

6.3 Dissemination annexes

Annex 18: Detailed report on action D1

Annex 19: A detailed report on action E4

6.3.1 Layman's report

The Layman's Report is written, printed and published in the national (Slovenian) language and in English language. The Layman's Report is translated also to Spanish and Polish language since two students were on internship at the University of Ljubljana, Faculty of Civil and Geodetic Engineering in the summer of 2016. This versions of Layman's Report are not printed but are published on the project website.
Polish-English Layman's Report is available at:
http://ksh.fgg.uni-lj.si/ljubljanicaconnects/Data/Laymans%20report_polish.pdf
Spanish-English Layman's Report is available at:
http://ksh.fgg.uni-lj.si/ljubljanicaconnects/Data/Laymans%20report__spanish.pdf

Please find the Layman's Report (Slovenian-English) in Annex 23.

6.3.2 Other dissemination annexes

6.4 Final table of indicators

Please find the final table of indicators in the Excel document: outcomes_final_tables2010.xls

8. Financial report and annexes

In electronic form (CD) individual transactions:

2012-2016_financial_reporting_Faculty.xls
2012-2016_financial_reporting_Purgator.xls
2012-2016_financial_reporting_Geateh.xls
2012-2016_financial_reporting.xls
Summary of costs per action.xls