



LIFE Project Number

LIFE10 NAT/SI/142 Progress Report

Covering the project activities from 01/01/2012 to 31/03/2016

Reporting Date

31/03/2016

LIFE+ PROJECT NAME or Acronym

Restoration of the Ljubljanica River corridor and improvement of the river's flow regime

Project Data

Project location:	Ljubljana, Slovenia
Project start date:	01/01/2012
Project end date:	31/08/2016
Total budget:	1,188,015.00 €
EC contribution:	584,382.00 €
(%) of eligible costs:	50%

Beneficiary Data

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1 Executive summary

1.1 General progress

Due to the delays from the beginning of the project, in 2015 we still worked on some actions that should already have been completed. Nevertheless, this past year we have been working also on the activities within the scheduled actions. Despite our efforts to eliminate delays and problems, and optimistic forecasts in the last progress report, we were not able to eliminate all the delays made by March 2015. The reasons and explanations are given below.

After more than four years of implementing the project most of the actions are completed, nevertheless some actions are still in progress. Since the last progress report the following major actions were completed: C2 and C3. Within action C2 we reconstructed the fish passes at Ambrožev trg and the Fužine weir, which now once again perform their original function. Last but not least, within action C3, the lifting system of the Ambrožev trg barrier was improved. Barrier's lifting system has been modernized and now enables precise water level regulation, which is extremely important during low flows in the Ljubljanica River.

Since we anticipated that all actions would not be successfully implemented within the deadlines (until 31 December 2015), and with the required quality, 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 ongoing work on action E2. Namely, the implementation of action E2 was influenced by the delays in implementing actions A1 and C2, and unsatisfactory results of the originally selected method for monitoring fish migration. The request for a postponement of the end date of the project was approved by the EC with Amendment No. 2 to Grant Agreement for project LIFE10 NAT/SI/000142. In the additional time we will be able to implement the overall monitoring of fish migration with cameras during one whole year (including the very important spawning season).

In the year 2015 we modernized and improved the barrier's lifting system at the Ambrožev trg (action C3). The outdated engine was replaced by a new one. A touch screen displaying the position of the right barrier was added. The refurbished barrier propulsion system now allows for movement to 200 mm above the threshold with the lowest step of 5 mm. This is particularly important because the displacements of the barrier before the improvement have been causing sudden changes in the water and the water level of the Ljubljanica River.

We organized a River Connectivity conference on 22 and 23 October 2015 (action E4). The purpose of the conference was to bring together fish pass designers and experts who, in their work, deal with the status of the Danube salmon in Europe and with revitalization of rivers. The aim of the conference was to present the work of experts in the field of connectivity of rivers and their interconnection. Furthermore, at the conference the results of our project and the development of the system for monitoring the migration of fish in the fish passes were presented.

To increase awareness of the importance of fish migration over the obstacles on the rivers we organized two round tables. The first one was organized in May 2015 on the premises of the Municipality of Ljubljana. It was intended both for the general public and experts from the fields of our project (e.g. fishermen, civil engineers, biologists). The second one, organized in November 2015 on the premises of the Faculty of Civil and Geodetic Engineering, was

primarily intended for UL FGG's students who will in the future face similar problems as those addressed by our project.

Moreover, the results of our project were disseminated at various presentations. In particular, we focused on younger residents (primary and secondary schools) to raise their awareness of the importance of migration of fish over the obstacles on rivers and of the concept of river connectivity.

1.2 Assessment as to whether the project objectives and work plan are still viable

According to the progress of the project since the last progress report and owing to the prolongation of the end date of the project we can conclude that the project objectives will be achieved by the end of the project (i.e. 31 August 2016). Now we are implementing actions under Overall Project Operation and Monitoring (E) and Public Awareness and Dissemination of Results (D1).

1.3 Problems encountered

During project implementation, we encountered some problems that were not foreseeable when we were applying our project proposal. All problems have been solved more or less successfully.

As we reported in the previous progress report, one of the technical problems was the collapse of the fish pass in Fužine, which showed that a different approach to reconstruction had to be taken than the one initially planned and described in the project proposal. The initially proposed measures were no longer appropriate due to the questionable stability of the entire fish pass construction. An alternative technical solution was developed, focusing on ensuring the elements for better operation of the fish pass. The project team prepared a new plan and the work was concluded in April 2015.

We also reported about the difficulties that we encountered at the Ambrožev trg barrier where the plans for improving the barrier had to be changed completely due to the technical heritage status of the barrier. Any changes to the structure's exterior appearance were not allowed. Therefore, we requested for a non-substantial modification on this action, which was approved. New plans for improving the barrier were prepared and the work was completed in September 2015.

The delay of fish migration monitoring, which occurred due to the financial problems of the Geateh Company, was solved by handing over the work to external assistance, and is now in progress. The reasons for Geateh's financial problems are described in Progress Report with reporting date 29 January 2015.

Also in the past year we encountered a few other problems, in relation to which we requested for approval of non-substantial changes to achieve project objectives. It was revealed that the method planned in the project proposal to be used for monitoring the migration of fish after reconstruction of fish passages (marking with Visible Implant Elastomer tags) to prove their performance, was not the most appropriate. A second technique for monitoring under E2 action is the method involving cameras installed in the fish passes. The first camera for monitoring of fish migration in the fish pass was installed at the beginning of June 2015 when the reconstruction of the fish pass at Ambrožev trg was completed (C2 action). The second

camera was installed at Fužine after the first analyses of results from Ambrožev trg. This method showed satisfactory results immediately. We observed that monitoring with cameras can provide us with even better results as those obtained using the VIE tagging method, but this monitoring will typically take longer. Therefore we requested for a postponement of the end date of the project, i.e. until 31 August 2016.

With the approved prolongation of the project we will also extend a few other activities on other actions. Until the end of the project we will continue with dissemination actions (D1), networking (E4), and measurements of eco-hydrological conditions (E3). Accordingly, the postponement of the project also affects the management of the project (E1), the completion of the after LIFE conservation plan (E5), and the final independent financial audit.

Besides the aforementioned problems with delays in some actions, the implementation of the project was also marked by the financial and economic crisis in Slovenia. For this reason the number of suitable contractors to carry out the delicate project actions was greatly reduced. This has entailed the lack of competition in the market and a significant increase in the prices of contractors for their services. Therefore it was more economical to invest in our own researchers' work than paying for external assistance. Our employees have developed some incredible solutions, costs of which amounted to only a few percent of the market price (e.g. monitoring cameras in the fish passes for which our researchers already received a recognition award by the Slovenian Association of Geodesy and Geophysics). For the reasons described in this paragraph, the funds provided for under the Personnel category are not sufficient to cover all the salaries of our employees who will work on the ongoing actions until the end of the project. Therefore, on 26 February 2016 we sent a request for a modification of the financial structure. In the request we asked that the funds, which remained available in the categories External Assistance (55,000 €), Equipment (82,500 €) and Consumables (14,000 €), which were not spent because our employees found cheaper solutions during the implementation of the project, are transferred to the Personnel category. We would like to increase the category Personnel by 151,500 €, with the overall budget remaining the same.

By postponing the date of the end of the project and through the approval of the modification of financial assets in the Personnel category (salaries for employees on the project), we guarantee that we will achieve all the objectives of the project and that all actions will be completed successfully.

2 Administrative part

The coordinating beneficiary of the project LIFE10 NAT/SI/142 is the University of Ljubljana. There are two associated beneficiaries, i.e. Purgator d.o.o. and Geateh d.o.o. companies.

After initial problems with work organization among the partners the division of work is now well-functioning. The coordinating beneficiary has convened several meetings during the past year. Partners mainly discussed the implementation of actions in progress and tried to solve problems which they encountered. The meetings were held on 12 January 2015, 11 March 2015, 13 August 2015, 7 September 2015, 9 October 2015, 16 October 2015, 23 November 2015 and 27 January 2016. Throughout the year the coordination between partners occurred via email and phone. The associated beneficiaries participated at the meetings, where they informed the coordinating beneficiary about the progress on the actions for which they were responsible.

The project steering group (Figure 1) consists of one representative from each partner and of one representative from the co-financers. The role of the steering group is to review the situation on the project and to help find solutions when necessary. The steering group meets approximately once a year.

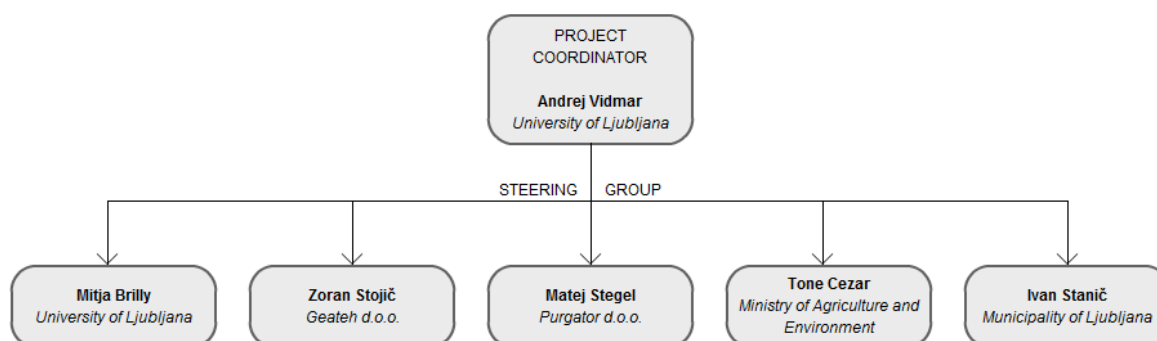


Figure 1: Organisational chart of the project steering group

The project team (Figure 2) consists of experts from different fields that are employed by one of the partners in the project. The number of employees by the Faculty of Civil and Geodetic Engineering is changing but the following remain: coordinator, project manager, environmental engineer (researcher), and administrator. In the year 2015 the number of employees by the Faculty was 9 (part- and full-time). The employees of the Purgator Company mostly worked on action E1, while other actions that they worked on were completed during the past year (C2, C3). At Geateh company the number of employees working on the project in 2015 was 2.

The project team has changed after non-substantial modifications, which were confirmed by EC on 22 August 2014. The Faculty of Civil and Geodetic Engineering took over the implementation of action E2 and is now employing a biologist, who before worked for Geateh (Figure 2, *italic*) and who works with faculty's environmental engineers.

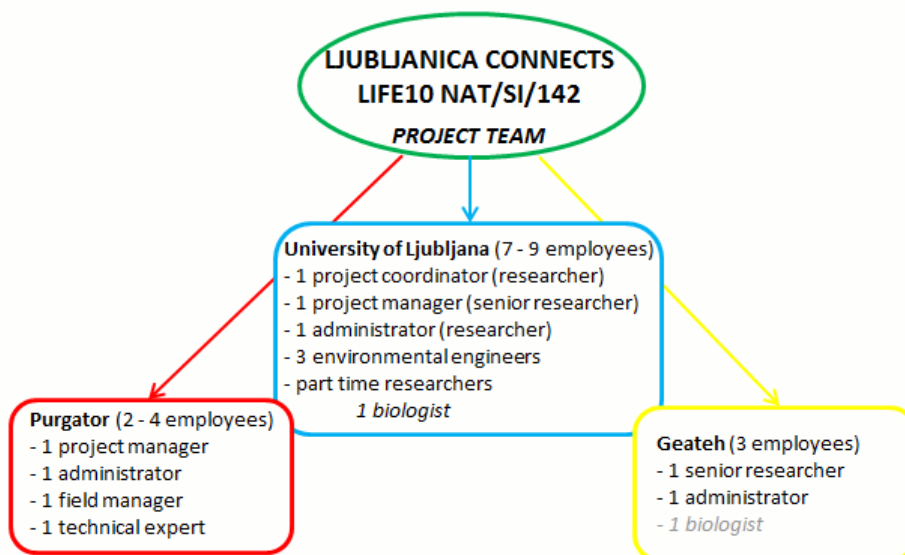


Figure 2: Organigram of the project team

In accordance with the Grant Agreement (Activity reports foreseen), four reports have been already delivered since the start of the project: Inception Report (30 September 2012), Progress Report No. 1 (31 January 2013), Midterm report (31 January 2014) and Progress Report No. 2 (29 January 2015).

We evaluate that the cooperation between partners is successful. The project's progress is on track with the new timetable (confirmed on 1 December 2015 by EC).

3 Technical part

3.1 Actions

3.1.1 Action A1: Preliminary study of the habitat, hydrological and hydraulic conditions in the Ljubljana river corridor, estimation of Danube Salmon, Danube Roach and Striped Chub population

Action A1 is completed.

Please find the summary of what has been done, which objectives were achieved and which problems we encountered on A1 action in Progress Report No. 2 (29 January 2015).

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

Action A2 is completed.

Please find the summary of what has been done, which objectives were achieved and which problems we encountered on A2 action in Progress Report No. 2 (29 January 2015).

3.1.3 Action A3: Eco hydrological survey

Action A3 is completed.

Please find the summary of what has been done, which objectives were achieved and which problems we encountered on A3 action in Progress Report No. 2 (29 January 2015).

3.1.4 Action C1: Reconstruction of the sill in Zalog

Action C1 is completed.

Please find the summary of what has been done, which objectives were achieved and which problems we encountered on C1 action in Progress Report No. 2 (29 January 2015).

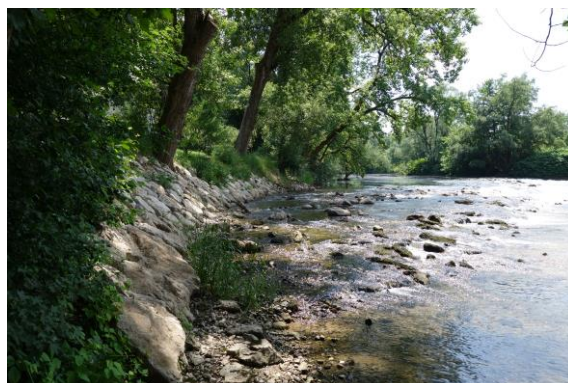


Figure 3: Reconstructed sill in Zalog

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

Action C2 is completed.

What has been 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 English translation of the Minutes of the meeting with company B&B Papirnica Vevče in the annex 1.
- The project documentation and the technical design for reconstruction were prepared by DK-proTIM d.o.o. in October 2014.
- The reconstruction of the fish passes was performed 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 (Figure 4).



Figure 4: Fužine fish pass before (left) and after the reconstruction (right)

- The reconstruction of the fish pass at Ambrožev trg ended in May 2015. The destroyed stairs of the fish pass were repaired by installing new wooden ones.
- Protection against floating debris was installed at the inflow into the fish pass at Ambrožev trg (Figure 5). Inside of the fish pass a pipe that attracts fish at the entrance to the fish pass has been installed. Also, an additional step at the inflow into the fish pass for flow regulation through the fish pass was added.



Figure 5: Situation before (left) and after (right) the installation of protection against floating debris at the inflow into the fish pass (Ambrožev trg)

Were the objectives achieved?

- Reconstruction of the fish pass at the Fužine weir. ✓
- Reconstruction of the fish pass at the Ambrožev trg barrier. ✓

Problems encountered:

- In November 2013 the fish pass in Fužine collapsed, so new reconstruction plans had to be produced. A more careful planning was necessary due to the construction that is more worn out than expected. The new reconstruction plans revealed that the costs of reconstructing the whole fish pass are much lower than the costs of reconstructing its parts separately. The reconstruction of the entire object is less complicated and therefore cheaper.

3.1.6 Action C3: Improvement of Ambrožev trg barrier

Action C3 is completed.

What has been done?

- Building permit and technical design were prepared by the company Montavar d.o.o. in April 2015.
- 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.
- 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.
- 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.
- The work on the barrier has been supervised by the concessionaire of the barrier Hidrotehnik d.d.
- Works were carried out in August and September 2015. The outdated engine was replaced by a new one. A touch screen displaying the position of the (right) barrier was added (Figure 6). The refurbished barrier propulsion system now allows the movement up to 200 mm above the the threshold with the lowest step of 5 mm.



Figure 6: Touch screen displaying the position of the barrier

Were the objectives achieved?

- Modernization of barrier's lifting system to enable precise water level regulation. ✓

Problems encountered:

- Ambrožev trg barrier is protected as a technical heritage therefore no actions that would affect the original appearance of the structure are allowed. Because of this restriction the initial plans for improving the barrier's lifting system had to be modified, while the preparation of new plans was more complex and took more time than expected,
- Due to the specific requirements only few contractors are able to carry out the refurbishment. Because of that and due to the constant high water flow and rainfall (Annex 1 in Progress Report No. 2) the implementation of the action according to the time table has been delayed (Figure 7).

	2014		2015		
	III	IV	I	II	III
Predicted	X	X	X		
Actual	X	X	X	X	X

Figure 7: Progress of action C3

- The procedure for selecting the most advantageous contractor was delayed. We had to repeat the selection procedure for the contractor for reconstructing the electrical equipment, because the originally selected contractor withdrew from the offer. The contractor originally selected for reconstruction of the electrical equipment also tendered for reconstructing the hardware of the barrier; however, the company did not deliver the most advantageous offer and therefore could not be selected. The contractor then delayed the signing of the contract for reconstructing the electrical equipment of the barrier and, in the end, resigned by mutual agreement from the signing of the contract. The search for a contractor was repeated. This delayed the start of work on the barrier at Ambrožev trg. The works started in August 2015.

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

Action D1 is in progress.

What has been done? (Figure 8)

- Creation and development of the project's website and its regular updating.
- We designed and published the first brochure in October 2013 and distributed it among project partners, students, national and private institutions, and other societies. The second brochure was designed and published in July 2015 and it is being distributed among project partners, students, national and private institutions and other societies together with a 30-minute film on DVD.
- Four yearly bulletins were published (in 2012, 2013, 2014 and 2015) and distributed.
- We prepared and distributed two posters in the Slovenian language among project partners and others; one poster in English was designed and printed on canvas for presentation of the project at international workshops.
- A shorter version of the film was already made and published on YouTube and shown in the faculty lobby, while the scenes for the longer version of the film were filmed in October 2015, and the film is now being edited.
- We prepared a flyer in English and distributed it at international workshops (Slovakia and Estonia, September 2014),

- Meetings of the steering group are held once a year (13 November 2012, 14 February 2013, 16 January 2014, 11 March 2015, 27 January 2016).

Were the objectives achieved?

- Management of the project. ✓
- Meetings of the steering group. ✓

Problems encountered:

- Due to the financial crisis, the partners on the project have difficulties in providing enough funds to cover the costs of action implementation, which has caused some delays. During intensive meetings and discussions, the project coordinator, the project manager, and partners' representatives were looking for various solutions allowing for successful implementation of project's actions by the end of the project, regardless of the financial crisis.
- During the project implementation we tried to eliminate all the delays and problems that occurred, but the postponement of the end of the project (31 December 2015) will allow us to complete the monitoring and fully evaluate the project results which represent an important contribution in this scientific area. Therefore in October 2015 we sent a request for postponing the end of the project, i.e. from 31 December 2015 to 31 August 2016, to the EC. The main reason for the prolongation of the project was ongoing work on action E2. In the additional time we will be able to implement the overall monitoring of fish migration with cameras during one whole year, including the spawning season. The implementation of action E2 was affected by delays in the linked actions (A1 and C2) and unsatisfactory results of the originally selected method for monitoring fish migration. On 1 December 2015 an Amendment No. 2 to Grant Agreement for Project was signed by EC and the coordinating beneficiary, which states that the project is extended until 31 August 2016.

3.1.9 Action E2: Monitoring and evaluation of the project restoration achievements

Action E2 is in progress.

What has been done?

- Monitoring of fish migration on the fish passes using a camera with on-line connection (monitoring has started in June 2015 after the fish pass reconstruction at Ambrožev trg).
- Analysis of recordings from the cameras on the fish passes to define fish species migrating through the fish passes (started in August 2015).
- Marking of the caught fish with VIE (Visible Implant Elastomer) tags before returning them into the river (21 October 2014, 15 June 2015).
- Implementation of fish monitoring by boat and electrofishing at different times of the year (21 October 2014, 15 June 2015).

Were the objectives achieved?

- Monitoring of fish migration through fish passes. *in progress*
- Obtaining data about different fish species using fish passes. *in progress*
- Study migration of targeted fish species in the research area. *in progress*
- Implementation of fish monitoring. *in progress*

Problems encountered:

- The start of E2 action was postponed. There were two main reasons for that: the late start of A1 action (E2 action is its continuation) and a lot of rain in 2014 when rivers had constant high flow and floods were frequent (annex 1). Thus, the implementation of the action intensively started in 2015.

- The method with VIE tagging turned out to be inadequate as we have not been informed about any re-catch of the fish. Therefore we focused on using a new monitoring method, i.e. with FishCams installed in the fish passes. The new method with cameras provides excellent results. Every time a fish swims past the camera, the camera takes a photo which is locally stored at the site and in an online directory, which is available from our office. At Fužine we were not able to install the cameras immediately after the end of the reconstruction works due to problems with availability of electricity and the internet. The camera at Fužine was installed in September 2015.

Please find the abstract of the report about the second fish tagging in action E2 in annex 5.

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

Action E3 is in progress.

What has been done?

- Field trips are 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 controls 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.

Were the objectives 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. ✓

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

Action E4 is in progress.

What has been done?

- We organized a workshop about *Hucho hucho* and its status on 18 June 2013.
- We took part at the international meeting River Revitalization Workshop in Slovakia, from 3 to 4 September 2014.
- We took part at the Riverine LIFE Platform Meeting in Estonia, from 10 to 12 September 2014.
- We took part at an international conference Fish Passage 2015 in Groningen, the Netherlands.

- We formed an organizing team for preparing the international conference held in October 2015.
- We organized a two-day River Connectivity conference from 22 to 23 October 2015 in Ljubljana.



Figure 9: Welcome speech by the project manager (left) and participants on the first day of the conference (right)

Were the objectives achieved?

- Organization of a workshop. ✓
- Participation at other LIFE+ restoration sites. ✓
- Organization of an international thematic conference. ✓

Please find the Electronic Book of Abstracts from the workshop in the Mid-term Report, annex 8.

Please find the Electronic Book of Abstracts from the conference in annex 4.

3.2 Envisaged progress until the next report

The next report, according to the Grant Agreement, is the Final Report which will be prepared after the end of the project. Until then all the actions will be completed and we expect that also all objectives will be reached.

Until April 2016 we will distribute the fourth yearly bulletin together with the longer version of the film. Until the end of the project (31 August 2016) we will carry out the following activities:

- All special lectures and presentations on the project delivered (we expect to have some after the end of the project, too).
- Regular updating of the web site.
- Meeting of a steering group, and, in the mean time, meetings with the project team about once every three months.
- Monitoring of fish migration, analysis of data, and preparation of the final report.
- Field trips to gather data, control the operation of water stations and measurements of discharge (this will continue also after the end of the project).

The actual project progress and the proposed (expected) situation per actions by the end of March 2016 are presented with a Gant chart (Figure 10).

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												PROGRESS REPORT: 31/03/2016				● END: ● 31/08/2016				
A1	Proposed	X	X	X	X																
	Actual	X	X	X	X	X	X														
A2	Proposed	X	X	X	X	X	X	X													
	Actual	X	X	X	X	X	X	X	X	X	X										
A3	Proposed	X	X	X	X	X															
	Actual	X	X	X	X	X															
C1	Proposed				X	X	X														
	Actual				X	X	X	X	X												
C2	Proposed							X	X	X											
	Actual							X	X	X	X	X	X	X							
C3	Proposed											X	X	X							
	Actual											X	X	X	X						
D1	Proposed		X	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	X
E1	Proposed	X	X	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	X	X
E2	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	
E3	Proposed				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	
E4	Proposed			X											X	X	X	X	X		
	Actual				X										X	X	X	X			
E5	Proposed														X	X	X	X			
	Actual														X	X	X	X			
E6	Proposed				X							X									X
	Actual				X							X									X

Figure 10: Gant chart of the current situation on the project

3.3 Impact

There are three sites included in the project where major restoration actions are being implemented: the sill in Zalog, the fish pass and the barrier at Ambrožev trg, and the fish pass at the Fužine weir. Reconstruction works have been completed at all three sites. In the previous report we already reported on the first indicators about achieving the desired impact. We observed a noticeable rise in the water level in the oxbow as a result of reconstructing the sill in Zalog. The effect was noticeable right after the reconstruction.

The impact of reconstruction works at the other two sites has also been noticeable. Proof that fish passes became functional after the reconstruction can be found in the images that are recorded using the cameras installed inside the fish passes. The cameras in the fish passes have already recorded images of targeted fish species and also of other fish that live in the Ljubljana River. However, we must emphasize that the cameras were installed after the

spawning season when fish use the fish passes the most. This was one of the main reasons that in 2015 we requested for a postponement of the end date of the project. We want to get results about the functioning of the fish passes from the most critical period of the year, i.e. the spawning season.

Another important aspect of the project is project dissemination. After the increased number and intensity of organizing workshops, the project's goals and awareness of the people about the fish in the Ljubljanica River and about their migration have improved and are more widely recognized.

3.4 Activities outside LIFE

University of Ljubljana, Faculty of Civil and Geodetic Engineering, is an educational institution, therefore the data, knowledge, and experiences from the project are used in different ways outside the project's framework. Some of the activities that have already taken place are the following:

- Graduation theses using the data collected within the project or focusing on the topics treated within the project.
- Inclusion of international students who want to gain practical experience during their studies with research work on the project.
- Discharge measurement in rivers that are not included in the project but are connected to the Ljubljanica River.
- Presentation of project's results at various (non-LIFE) conferences and meetings in Slovenia and abroad.
- Presentation of the project and implementation of various educational workshops for primary and high school students.
- Publishing articles based on the project and its results in different journals.

4 Financial part

4.1 Costs incurred

Table 1: Costs on the project according to categories from 1 January 2012 to 29 February 2016

Budget breakdown categories	Total cost in €	Costs incurred in €	% of total costs
1. Personnel	563,621.00	675,033.74	119.77%
2. Travel and subsistence	20,460.00	10,454.08	51.10%
3. External assistance	176,386.00	153,912.52	87.26%
4. Durable goods			
Infrastructure	0	0	
Equipment	312,287.00	193,834.49	62.07%
Prototype	0	0	
5. Land purchase / long-term lease	0	0	
6. Consumables	31,600.00	11,003.93	34.82%
7. Other Costs	7,200.00	6,629.16	92.07%
8. Overheads	76,461.00	52,397.76	68.53%
TOTAL	1,188,015.00	1,103,265.68	92.87%

The costs that were planned at the beginning of the project and the costs incurred from the start of the project until 29 February 2016 are presented in Table 1. In three years almost 93% of total estimated costs were spent.

So far, funds have been exceeded only in category Personnel, i.e. by 111,412.74 €. Due to the implementation of monitoring (Action E2), the end date of the project was extended until 31 August 2016. The costs for Personnel will end up even higher, because most of the employees work on action E2 on the project. As explained in the *Executive Summary* to this report, on 26 February 2016 we sent a request for a modification of the financial structure. With this modification we would like to increase the funds available for salaries of our employees, considering that the overall budget remains the same. We have asked for a reallocation of the financial resources among the different cost categories. We would like to increase the category Personnel by allocating the funds from categories External Assistance, Equipment and Consumables. The realization of project tasks was conducted differently than planned when submitting the project proposal. During the project implementation, we have realized that our employees have much more knowledge than we expected and that they can cope with various problems and find solutions that are as good, or even better, when achieving project objectives as those of external contractors. Please find a more detailed explanation for this request in Annex 7.

The first six actions (Table 2) are completed and the costs were exceeded for some of these actions (mostly for C1, D1, and E2). Because of the difficulties encountered during the

project, some actions required more work than anticipated at the beginning. Due to our own approach to implementing some of the actions, the costs of some actions were lower than expected at the beginning (mostly for actions C2 and C3). For example, the different approach to barrier's reconstruction required less input of smaller elements and the funds available for consumables remained unspent. With the approval of the request for modifying the financial structure, we expect that the costs per action will not exceed 10% or 30,000 €.

Table 2: Costs on the project according to actions from 1 January 2012 to 29 February 2016

Action number and name	Foreseen costs	Spent so far	Remaining
Action A1 (completed)	39,931.00	34,462.28	5,468.72
Action A2 (completed)	30,321.00	30,137.83	183.17
Action A3 (completed)	77,238.00	77,840.31	-602.31
Action C1 (completed)	91,531.00	120,575.90	-29,044.90
Action C2 (completed)	188,750.00	94,436.59	94,313.41
Action C3 (completed)	210,017.00	117,425.82	92,591.18
Action D1	44,465.00	89,583.32	-45,118.32
Action E1	197,760.00	182,649.92	15,110.08
Action E2	134,528.00	205,865.31	-71,337.31
Action E3	70,180.00	76,054.51	-5,874.51
Action E4	6,789.00	9,231.58	-2,442.58
Action E5	12,045.00	12,604.55	-559.55
Action E6	8,000.00	0	8,000.00
TOTAL	1,111,555.00	1.050.867,92	60,687.08

Annexes

Annex 1: English translation of the Minutes of the meeting with company B&B Papirnica Vevče.

Annex 2: Second brochure of the project (July 2015).

Annex 3: Bulletin for 2015.

Annex 4: Example of the second poster.

Annex 5: Book of Abstracts of the River Connectivity conference.

Annex 6: Abstract of the report on the second fish tagging in action E2.

Annex 7: Request for a modification of the financial structure sent to EC on 26 February 2016.

Annex 8: Replies to the annexes from the correspondence between the beneficiaries and EC.

Annex 1:

**English translation of the Minutes of the meeting with company
B&B Papirnica Vevče**



**Minutes of the meeting of LIFE10 NAT/SI/142 project partners – UL FGG,
Purgator d.o.o., and B&B Papirnica Vevče
Date of Meeting: 19 October 2015
Meeting Location: Papirniški trg 16, Ljubljana**

Attendees: Boštjan Smrekar (Papirnica Vevče), Matej Stegel, Metod Dolinšek (both Purgator d.o.o.), Mitja Brilly, Andrej Vidmar, Anja Vihar (all UL FGG)

Ad1) The objective of the meeting was to reach an agreement regarding further improvements of the fish pass at Fužine Castle, and to clear the misunderstanding due to an incorrect presentation of the renovation works undertaken at the fish pass to date.

Ad2) Mr Vidmar explained that one of the “Ljubljana Connects” project goals is to improve river connectivity, which includes the reconstruction of the fish pass at Fužine Castle. To improve the operation of the fish pass, he proposed that an element preventing the inflow and deposition of debris is installed at the inlet.

Ad3) Prof Brilly explained there was a communication issue resulting from an incorrect presentation of the fish pass restoration to date, which was given as part of the City Municipality of Ljubljana’s (MOL) round table of 19 June 2015. The destroyed fish pass was fully repaired and brought back into operation, which was financed by Papirnica Vevče. This was confirmed by both Mr Stegel and Mr Dolinšek. Prof Brilly explained that within the “Ljubljana Connects” project, there was a plan to improve the fish pass even further – by installing a deflector and filling the cracks in the pass. Furthermore, Prof Brilly explained that for installing the deflector a consent of Papirnica Vevče is required.

Ad4) Mr Smrekar explained that Papirnica Vevče owned the structure, i.e. the weir, and thus also the fish pass; furthermore, Papirnica Vevče holds a concession for exploiting hydroelectric power. To obtain the consent, Papirnica Vevče would require an application with a detailed description of work and a sketch of the deflector, which would then be subject to approval. It was suggested that the consent would be given provided that Papirnica Vevče would bear none of the installation costs, that the power plant’s operation would not be limited (neither during the installation works nor after), and that the power plant’s capacity would not decrease due to the installation. It was proposed that the required consent is obtained by the project partner, Purgator d.o.o., which will also install the deflector.

Ad5) Prof. Brilly concluded that the deflector would not only improve the operation of the fish pass, but of the weir as a whole, because debris would no longer get caught behind the net.

Minutes taker: Anja Vihar, UL FGG

The Minutes from the meeting on 19 October 2015 were approved by the attendees:

- Prof. Mitja Brilly, PhD
- Andrej Vidmar, MSc
- Boštjan Smrekar
- Matej Stegel
- Metod Dolinšek

Annex 2:

Second brochure of the project (July 2015)

LJUBLJANICA POVEZUJE

Projekt LIFE I0NAT/SI/I42: Obnovitev koridorja Ljubljanice
in izboljšanje rečnega vodnega režima



RIBJA STEZA PRI FUŽINSKEM JEZU

Ribja steza, zgrajena že leta 1921, je bila nujno potrebna obnove. Zaradi nepravilne izvedbe pred obnovo ni delovala v času nizkih do srednjih pretokov, zaradi ne vzdrževanja pa je bila tudi povsem zaraščena. Visoka voda jeseni 2013 pa je del zunanjšega zidu steze porušila, tako da ta sploh ni več delovala.



Ribja steza na Fužinah pred porušitvijo in po porušitvi jeseni 2013

Stezo smo najprej očistili mahu in ostale zarasti, nato pa so bili v sodelovanju s Papirnico Vevče na porušenem delu nameščeni jekleni nosilci. Na nosilce so pritrčili lesene vezane plošče, dodatno impregnirane, da je bila zagotovljena večja odpornost lesa na različne vremenske vplive. Prilagodili smo tudi vtok in iztok iz steze, tako da sedaj steza deluje pri različnih pretokih. Pred vtok v stezo smo namestili zaščitni element, ki preprečuje vnos plavja ter s tem zamašitev ribje steze.



Obnovljena ribja steza

RIBJA STEZA PRI ZAPORNICAH NA AMBROŽEVEM TRGU

Na Ambroževem trgu stojijo Plečnikove zapornice, ki niso bile obnovljene že vse od končane izgradnje leta 1944. Zapornice služijo reguliranju pretoka Ljubljanice v času nizkih do srednjih pretokov ter s tem uravnavanju gladine reke gorvodno od zapornic vse do Ljubljanskega barja.



Zapornice na Ambroževem trgu

V desnem bregu za armiranobetonskim opornikom se nahaja ribja steza, ki je bila pred obnovo tako dotrajana, da v času, ko so bile zapornice zaprte, ribe niso mogle prehajati skozi stezo preko zapornic gorvodno.



Ribja steza na Ambroževem trgu pred obnovo

Tudi to stezo smo najprej očistili, porušene stene med posameznimi stopnicami pa nadomestili z novimi. V stezo smo namestili cev, ki na iztoku iz ribje steze ustvari hitrejši tok, da ribe lažje zaznajo vhod

v ribjo stezo. Na vtoku v stezo smo postavili zaščitni element, ki preprečuje vnos in zastajanje plavja.



Element za preprečevanje vnosa plavja v ribjo stezo

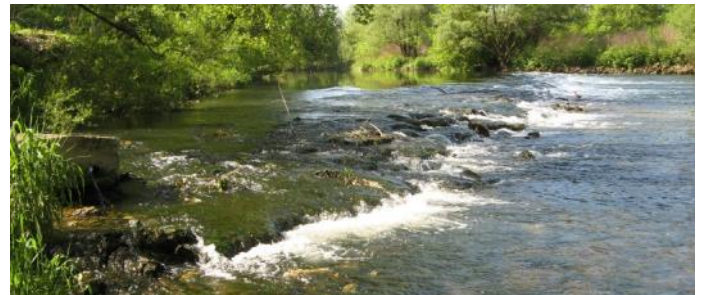
Izboljšali bomo tudi sistem za fino regulacijo zapornic. Z izboljšavo sistema za fino regulacijo zapornic bomo omogočili natančnejše reguliranje zapornic do dviga 200 mm nad pragom z najmanjšim korakom 5 mm. Tako ne bo več prihajalo do nenadnih izpustov vode skozi zapornice, kar je prej povzročalo odplavljanje za zapornicami nabranega mulja in s tem v skrajnem primeru celo pogin rib.

PRAG V ZALOGU

V Zalogu ob strugi Ljubljanice se nahaja mrtvica. V njej so zaradi skoraj stoječe in nekoliko toplejše vode nastali edinstveni habitatni pogoji, zato v njej najdemo številne živali in rastline. Poleg povrčnih delov Ljubljanice tudi mrtvica predstavlja priljubljeno okolje za drstenje rib.



Mrtvica v Zalogu



Prag pred obnovo

Poleti, v času nizkih pretokov Ljubljanice, je bil dotok vode v mrtvico večkrat prekinjen, kar je negativno vplivalo na habitatne pogoje. V ta namen je bil nekaj sto metrov dolvodno od mrtvice že pred časom zgrajen prag, ki pa zaradi različnih poškodb ni več opravljal svoje namembnosti. Prag smo obnovili, ga dvignili ter s kamnito zložbo utrdili brežino. Tako smo zagotovili višji vodostaj Ljubljanice gorvodno ter s tem dotok vode v mrtvico tudi v času nizkih pretokov.



Obnovljen prag v Zalogu

Avtorica prispevka: Anja Vihar

MONITORING GIBANJA RIB

V okviru projekta Ljublanica povezuje sta bila obnovljena dva ribja prehoda, prvi na Ambroževem trgu in drugi pri Fužinskem jezu. Z obnovo smo izboljšali slabo stanje za migracijo rib na Ljublanici.

Po končani obnovi je potrebno izvajati monitoring rib in dokazati, da so obnovljeni ribji prehodi funkcionalni in omogočajo nemoten prehod ribam v Ljublanici.

Monitoring prehajanja rib skozi ribje prehode se izvaja na tri načine.

MONITORING Z MARKIRANJEM

V lanskem letu smo izvedli ihtiološko raziskavo. Opravili smo izlov rib v sedmih točkah na 2 km dolgem odseku reke Ljublanice od Plečnikove zapornice do jezu v Vevčah. RIBE smo markirali z rdečim in rumenim barvilom.

Izlove rib bomo do konca projekta izvedli še nekajkrat in preverili, ali so markirane ribe uspešno prečkale ribje prehode na Plečnikovi zapornici in na Fužinskem jezu bodisi gorvodno ali dolvodno.



Označevanje rib z rdečim in rumenim barvilom v plavut ali za oko (odvisno od lokacije izlova)

MONITORING S KAMERO

Naslednji način, ki ga uporabljamo za monitoring prehajanja rib skozi ribje prehode je monitoring s kamero, ki je nameščena v ribji stezi. Sistem monitoringa s kamero smo razvili na naši katedri, uporabili smo Sony analogno kamero. Prednost te kamere je dobro delovanje tudi pri zmanjšani svetlobi. Ker se večina rib seli v nočnem času, je to zelo pomembno. Kamero smo opremili tudi z infrardečo osvetlitvijo, kar nam omogoča snemanje tudi v popolni temi. Kamera je nameščena blizu izhoda iz ribje steze. V tem delu ribje steze se voda umiri, kar nam omogoča zajem kakovostnih slik.



Kamera in infrardeča osvetlitev



Sestavni deli podvodne kamere

Kamera je povezana s tabličnim računalnikom. Na računalniku je nameščena posebna programska oprema, ki zazna gibanje rib. Slike se hranijo na računalniku, dostopne pa so tudi na spletni strani projekta.



Posnetek iz ribje steze

MONITORING PREHAJANJA RIB Z VRŠO OZIROMA RIBJO PASTJO

Naslednji način monitoringa rib je monitoring z vršo oziroma ribjo pastjo. Izvedemo ga tako, da na koncu oziroma na izhodu iz ribjega prehoda namestimo vršo. Za natančno oceno števila in vrste rib, ki uporabljajo ribji prehod je bistveno, da vršo namestimo pravilno in pokrijemo ves izhodni profil.

Vrša je narejena tako, da ribe vanjo lahko zaidejo, iz nje pa ne morejo. Vršo je potrebno redno prazniti. Ribe, ki se ujamejo vanjo, izmerimo in označimo ter izpustimo nazaj v reko. S tem načinom monitoringa dobimo neposredni vpogled, katere ribe in ribje populacije uporabljajo ribji prehod za selitev po reki.

Za analizo ribjih vrst, ki ribjo stezo uporabljajo, pa občasno stezo tudi zapremo, naredimo izlov v notranjosti same steze in pregledamo ribe v njej.



Ribja past

MODELIRANJE LJUBLJANICE

HIDROLOŠKI MODEL

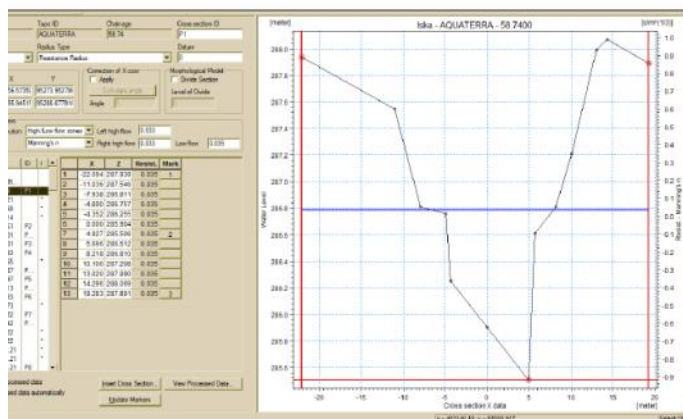
Za izdelavo hidrološkega modela Ljubljanice smo uporabili program HBV. Porečje Ljubljanice smo razdelili na 6 podporečij ter na eno višinsko in dve vegetacijski coni. Pri modeliranju smo upoštevali podatke o padavinah, temperaturi zraka, pretoku Ljubljanice in evapotranspiraciji.



Podpovodja Ljubljanice, uporabljena v modelu

HIDRAVLIČNI MODEL

Hidravlični model reke Ljubljanice smo izdelali v programu MIKE II. Model je bil umerjen z uporabo podatkov o visokih vodah leta 1972 in 2010.



Primer prečnega profila v modelu

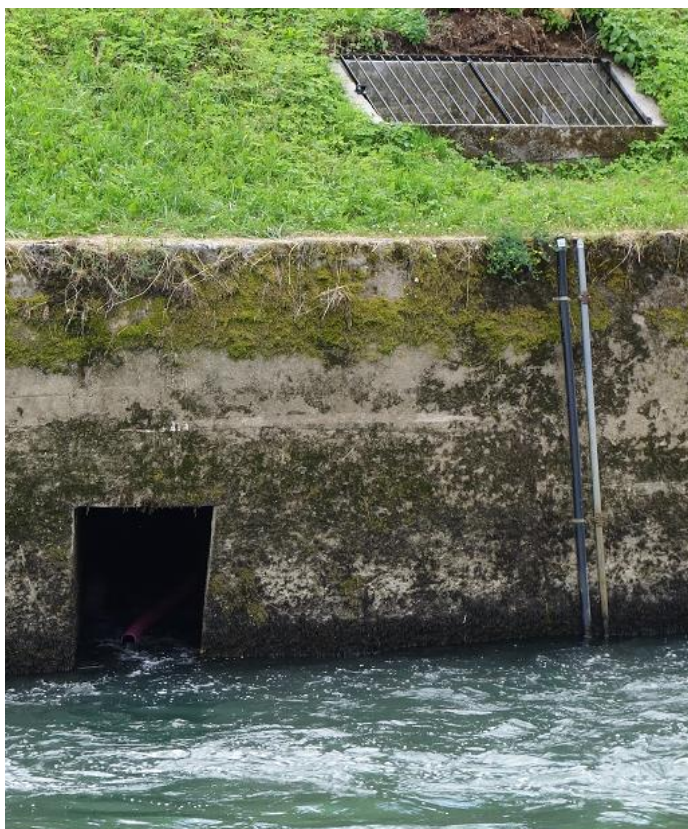
Avtor prispevkov: Matej Sečnik

MERITVE KAKOVOSTI VODE

OPIS INŠTRUMENTOV

Preživetje ribjih populacij in drugih vodnih organizmov v Ljubljani ni odvisno samo od ureditve prehodnih objektov, ki jim bodo omogočali selitve gorvodno do ugodnejših mest za drst, temveč tudi od ugodnih razmer vode. Za ribe, na katere se osredotočamo v sklopu projekta Ljubljana povezuje, so najpomembnejši pokazatelji ugodnih razmer koncentracija raztopljenega kisika v vodi, temperatura vode in vodostaj.

Prosti, v vodi raztopljeni kisik je bistvenega pomena za aerobne vodne organizme. Vir prostega kisika v vodi sta absorbiran kisik iz zraka in kisik kot produkt fotosinteze zelenih rastlin. Koncentracija kisika v vodi je odvisna od temperature vode, zračnega tlaka, turbulence vodnega toka, slanosti, sedimentov, globine vode, respiracije vodnih organizmov in stopnje aktivnosti primarnih producentov. Glavni vir toplote vode je sonce, vendar lahko na temperaturo vode vplivajo tudi površinski odtok, podtalnica in padavine.

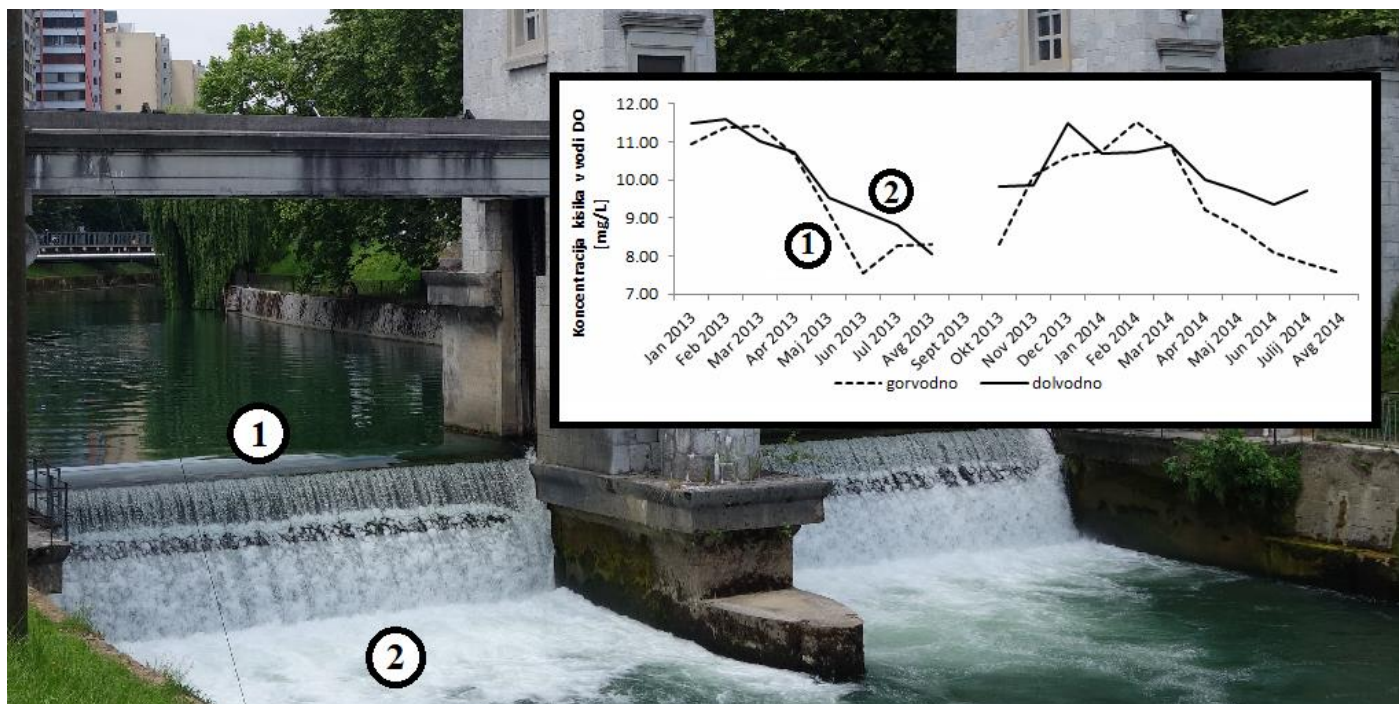


Merilca koncentracije raztopljenega kisika (levo) in vodostaja (desno) v ceveh, pritrjenih na betonsko brežino pred vhodom v ribjo stezo na Ambroževem trgu



Prikaz namestitve merilca vodostaja na terenu

Januarja 2013 smo začeli s kontinuiranim merjenjem vodostaja in temperature vode na 17 merilnih mestih na Ljubljani, ki smo jih postavili v sklopu projekta. Na treh izmed teh merilnih mest, na Ambroževem trgu pred in za zapornico ter v Zalogu v mrtvici, merimo tudi koncentracijo raztopljenega kisika. Tako senzor za merjenje vodostaja kot senzor za merjenje koncentracije raztopljenega kisika omogočata hkratno merjenje temperature vode. Merilca sta produkt proizvajalca Onset HOB0. Na terenu sta pritrjena na kovinski nosilec in vstavljena vsak v svojo zaščitno cev ter potopljena v vodo. Senzorja izmerita vrednost vsakih 10 min. Podatke iz senzorjev odčitamo tako, da senzor priklopimo na napravo za prenos podatkov (ang. shuttle). Ko je postopek prenosa končan, se naprava za prenos



Razlika med koncentracijami kisika gorvodno in dolvodno od zapornic na Ambroževem trgu

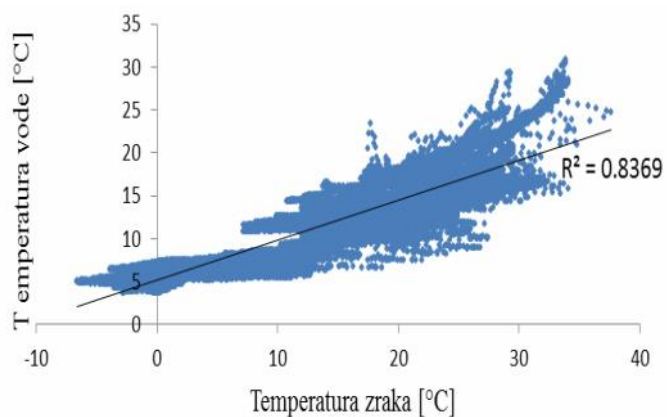
podatkov s pomočjo USB kabla priključi na računalnik. Ustrezna programska oprema na računalniku nam omogoča pregled in obdelavo merjenih vrednosti.

REZULTATI

Podatke, ki so bili izmerjeni v obdobju od januarja 2013 do avgusta 2014 smo deloma že obdelali. Tako smo že dobili povratne informacije o stanju vodnega ekosistema Ljubljanice. Obdelali smo podatke o koncentraciji kisika in temperaturi vode, izmerjene na merilnih mestih na Ambroževem trgu, gor- in dolvodno od zapornice. V analizo smo vključili tudi podatke o temperaturi zraka, ki jo merimo v neposredni bližini Ambroževega trga. Zaključki analize kažejo, da je povprečna koncentracija kisika dolvodno od zapornic na Ambroževem trgu večji del obravnavanega obdobja višja od koncentracije raztopljenega kisika gorvodno. Največje razlike v koncentracijah so opazne v sušnih, poletnih mesecih, ko je pretok vode najmanjši in so zapornice na Ambroževem trgu zaprte. Zaradi spuščeni zapornic se ustvari preliv, preko katerega pada voda in zaradi katerega pride dolvodno od zapornic do bogatenja vode s kisikom.

Primerjava temperature vode in koncentracije raztopljenega kisika v vodi kaže na negativno korelacijo med spremenljivkama. To pomeni, da se z

višanjem temperature vode koncentracija kisika v vodi zmanjšuje in z nižanjem temperature koncentracija raztopljenega kisika v vodi narašča. Maksimalne koncentracije kisika v Ljubljanici smo izmerili v zimskem času, najnižje pa v poletnem času.



Povezava med temperaturo zraka in temperaturo vode

Na podlagi dosedanje analize merjenih vrednosti ugotavljamo, da so na območju zapornic na Ambroževem trgu temperaturne in kisikove razmere ugodne za ciljne ribje populacije (sulca, platnico in blistavca). Z meritvami bomo nadaljevali tudi po koncu projekta, saj bomo s podatki iz daljšega časovnega obdobja lahko izvedli kompleksnejše statistične analize, hkrati pa bomo imeli za vsak trenutek meritev podatek o kakovosti vode v reki Ljubljanici, ki je ključnega pomena za preživetje različnih vodnih in obvodnih organizmov.

Avtorica prispevka: Klaudija Sapač

SODELOVANJE Z MLADIMI

Ker je Ljubljana pomemben del naše prestolnice in okolja, v katerem živimo, je prav, da jo bolje spoznamo. Projekt Ljubljana povezuje pokriva veliko zanimivih področij, ki jih učitelji in profesorji z veseljem vključijo v pouk pri predmetih biologije, kemije ali geografije. Pozitiven odziv pedagogov nas je spodbudil, da smo pripravili številne različne delavnice in tematska predavanja pri naravoslovnih predmetih in v sklopu tehničnih, naravoslovnih ali eko dni. Z veseljem smo sodelovali z različnimi šolami in učencem okolje, v katerem živijo, predstavili še na drugačen način.

TEMATSKA PREDAVANJA

Osrednja tema predavanj je projekt Ljubljana povezuje in njegova predstavitev, katere poudarek je na predmetu, pri katerem gostujemo. Največkrat nam učitelji odstopijo dve šolski uri, v katerih si po predavanju pogledamo še predstavitevni film projekta ali skozi interaktivne naloge, ki jih učenci rešujejo v skupinah, bolje spoznamo okolje, po katerem Ljubljana teče in živali, ki jih najdemo v in ob reki.

Reka Ljubljana kljub regulacijam predstavlja življenjski prostor za številne živali in rastline. Nekateri izmed ukrepov za upravljanje z vodnimi viri so prekinili povezanost njihovega življenjskega okolja, zato se trudimo, da bi to z obnovitvenimi akcijami čim bolj omilili. Rezultate spremljamo na različne načine, ki temeljijo na opazovanju gibanja rib. Na reki Ljubljani merimo pretok, višino vodne gladine, temperaturo in kisik. Vrednosti teh

parametrov določajo kvaliteto življenjskih pogojev v reki.

Vse te teme, ki jih zajamemo s predstavitvijo, so zelo aktualne in zanimive za učence in dijake. Z njimi jih želimo seznaniti o tem, kaj vse se dogaja v njihovi okolici in jih spodbuditi, da postanejo bolj pozorni.



Tematsko predavanje na gimnaziji Jožeta Plečnika

DELAVNICE OB REKI

Vse, s čimer se ukvarjamo na projektu, najlažje pokažemo kar na terenu, ob vodi. Tako se z učenci in dijaki pogosto odpravimo do Gradaščice, pritoka Ljubljane, ki teče v naši bližini. Je veliko manjša kot Ljubljana in zato omogoča bolj varno delo.



Dijaki gimnazije Jožeta Plečnika določajo profil Gradaščice

Delavnice so po navadi krajše in trajajo do dve uri. Udeleženci, ki se razdelijo v skupine, sodelujejo pri določanju rečnega profila, meritvah višine vodne gladine in hitrosti vode, ki jih uporabijo pri računanju pretoka. Pod našim vodstvom opravijo meritve temperature in pH vode ter njene nasičenosti s kisikom ter tako določajo kvaliteto vode.



Tematsko predavanje na OŠ Martina Krpana: učenci spoznavajo različne živali, ki jih najdemo v in ob Ljubljani



Učenci OŠ Vič merijo nasičenost vode s kisikom in ugotavljajo, če je ta ustrezna

V LABORATORIJU

Določanje parametrov kvalitete vode lahko poteka tudi v laboratoriju. Na projektu sicer opravljamo samo meritve na terenu, vendar se na Oddelku za okoljsko gradbeništvo UL FGG na Inštitutu za zdravstveno hidrotehniko nahaja dobro opremljen laboratorij. Vanj dijake povabimo v primeru slabega vremena, saj tako vseeno lahko opravimo različne vaje.



Sodelovanje pri interaktivnih delavnicah na Morski biološki postaji Piran

Predstavitve projekta v laboratoriju pa smo pripravili tudi v Piranu, saj smo bili ob Svetovnem dnevu oceanov povabljeni k sodelovanju pri Dnevu odprtih vrat Morske biološke postaje Piran. V sklopu interaktivnih delavnic z naslovom »Poskusi z vodo« smo pokazali model podtalnice in med drugim spregovorili tudi o projektu Ljubljanica povezuje.

NARAVOSLOVNI DNEVI

Občasno tematska predavanja, delavnice ob reki in v laboratoriju združimo ter organiziramo cele naravoslovne dneve. Največkrat šolarji in dijaki obiščejo nas v stavbi Oddelka za okoljsko gradbeništvo UL FGG, z veseljem pa se tudi mi odpravimo na njihovo šolo, predvsem če v bližini najdemo kakšen potok ali reko, kjer lahko izvedemo nekaj meritev.

Po kratkem uvodu je najprej na vrsti predstavitev projekta. Učencem želimo pojasniti, zakaj so meritve, ki jih bomo izvedli, pomembne in kaj nam njihovi rezultati povejo.

Po predstavitvi projekta sledi odhod na teren, kjer opravimo različne meritve, podobno kot to delamo na krajših delavnicah.



Dijaki Srednje vzgojiteljske šole in gimnazije iz Ljubljane določajo nasičenost vode s kisikom



Za dijake Škofijske klasične gimnazije smo predstavitev projekta pripravili kar na terenu

Za pomoč pri izvedbi delavnic se zahvaljujemo dr. Sabini Kolbl (UL FGG, IZH). Za več informacij o organizaciji delavnic se lahko obrnete na katarina.zabret@fgg.uni-lj.si

Avtorica prispevka: Katarina Zabret

POVEZOVANJE

Povezovanje z ostalimi projekti in udeležba na konferencah ter srečanjih sta vedno dobrodošla, saj dajeta zagon za nadaljnje delo, omogočata izmenjavo izkušenj in porajata nove ideje. Projekti, ki bi se, podobno kot naš, ukvarjali s sanacijo starejših vodnih objektov, so redki, vendar pa navdih za delo in primere dobre prakse iščemo v različnih okoljih, kjer se izvajajo podobne naloge. Kar nekaj različnih projektov se namreč ukvarja z izboljšanjem prehodnosti reke za lažjo migracijo rib ali z renaturalizacijo rečne struge.

OGLED PRIMEROV DOBRE PRAKSE



Projekt HappyFish, odpiranje rokavov mrtvic na reki Emajogi, Estonija: pozimi je močvirje poplavljeno, zato ribe lahko pridejo v mrtvice. Povezava med njimi in reko pa je poleti prekinjena in v mrtvicah ujete ribe ne dobijo dovolj hrane in kisika, kar so s tem projektom rešili.



Delujoča ribja steza ob mali hidroelektrarni na reki Hron, Slovaška: ribja steza je zelo široka, stopnje pa so dokaj nizke. Tako je omogočen tudi prehod za slabše plavalce. Nad vhomom je nameščena cev, iz katere škropi voda in privablja ribe v stezo.



Renaturalizacija reke Chriesbach v Švici: prvotno je reka tekla v ozkem betonskem kanalu, ki so ga v sklopu renaturalizacije porušili. Prostor ob reki so razširili, poskrbeli za razgibanost rečnega dna, v reko so ponovno naselili avtohtone živalske vrste tega območja, na bregovih pa so zasadili tipične rastline tega območja, ki jih drugače zaradi vpliva človeka in invazivnih vrst le redko najdemo v naravi.

SODELOVANJE NA KONFERENCAH



Na 33. Goljevščkovem spominskem dnevu, ki sta ga organizirala Oddelek za okoljsko gradbeništvo UL FG in Hidroinštitut smo imeli dva prispevka. Katarina Kavčič je predstavila projekt Ljubljana povezuje, Matej Sečnik pa je govoril o sistemu za oddaljen dostop do podatkov, ki ga je razvijal v okviru projekta za potrebe postavitve on-line postaj na Ljubljani.



Na Slovaškem, v mestu Zvolen je potekala River revitalisation Workshop , na kateri smo Katarina Zabret, Andrej Vidmar in Mitja Brilly predstavili projekt, sodelovali pa smo tudi s plakatom.



Na Riverine LIFE Platform Meeting -u v mestu Tartu v Estoniji sta projekt predstavila Katarina Zabret in Andrej Vidmar. V sklopu srečanja je bil organiziran tudi izlet na reko Emajogi in ogled dobre prakse projekta HappyFish.



Nizozemsko mesto Groningen je junija 2015 gostilo Fish Passage 2015 konferenco. Dogodka se je udeležilo približno 500 strokovnjakov s celega sveta. V sklopu sekcije EU financiranja projektov smo predstavitev pripravili tudi Katarina Zabret, Matej Sečnik in Andrej Vidmar.

ŠTUDENTI NA IZMENJAVI



Vsako leto študenti magistrskega študijskega programa Erasmus Mundus Flood Risk Management pri nas preživijo tri mesece. Generacijama študentov 2012/2013 in 2013/2014 smo predstavili projekt in jih povabili na teren.



Poleti 2014 sta študentki Justyna in Alexandra s Tehnične univerze Rzeszow na Poljskem na naši fakulteti opravljali poletno prakso. Vključili smo ju v delo na projektu Ljubljana povezuje, pri katerem sta delali s podatki, ki jih izmerimo na terenu.

DELAVNICE IN OKROGLE MIZE

Za povezovanje z domačimi strokovnjaki smo v sklopu projekta 8. 6. 2013 organizirali mednarodno delavnico s poudarkom na statusu sulca v Sloveniji in sosednjih državah, 19. 6. 2015 pa okroglo mizo, na kateri smo predstavili stanje na projektu in že izvedene ukrepe. Pred zaključkom projekta bomo v oktobru 2015 pripravili še dvodnevno mednarodno konferenco ter v sodelovanju z Društvom študentov vodarstva okroglo mizo, ki bo namenjena predvsem mladim strokovnjakom.

Avtorica prispevka: Katarina Zabret



S prispevkom LIFE, finančnega instrumenta Evropske unije



Spletna stran projekta: <http://ksh.fgg.uni-lj.si/ljubljanicaconnects>

Uredniški odbor: Mitja Brilly, Andrej Vidmar, Katarina Zabret

Izdala in založila: Univerza v Ljubljani, Fakulteta za gradbeništvo in geodezijo

Tisk: Birografika Bori d.o.o., Ljubljana

Naklada: 500 izvodov

Leto izdaje: 2015

Annex 3:

Bulletin for 2015

LJUBLJANICA POVEZUJE

Glasilo projekta LIFE10NAT/SI/142: Obnovitev koridorja Ljubljanice in izboljšanje rečnega vodnega režima

Letnik 4, Številka 1, ISSN: 2335-2773



OBNOVLJENE RIBJE STEZE

Glavni del projekta LIFE - Ljubljana povezuje so ohranitveno - obnovitvena dela, med katera spada tudi obnovitev ribjih stez na Ambroževem trgu in pri Fužinskem gradu. V letošnjem letu smo tako v sklopu akcije C2 obnovili obe ribji stezi.

RIBJA STEZA NA AMBROŽEVEM TRGU

Ribja steza na Ambroževem trgu je bila močno dotrajana, predelne stene, ki ločujejo vmesne bazenčke, so bile porušene, na vtočnih rešetkah pa se je kopičilo plavje, ki je odprtino zamašilo in ribam onemogočalo izstop iz ribje steze. Zato smo ribjo stezo najprej očistili zarasti ter odstranili rešetke. Na izhodu iz ribje steze smo namestili zaščitni element, ki preprečuje vnos plavja, tako da lahko ribe sedaj nemoteno prehajajo, plavje pa vodni tok brez zastajanja odnese naprej. Dodatna stopnica omogoča reguliranje pretoka v stezi.



Element, ki preprečuje vnos plavja v ribjo stezo



Dodatna stopnica s prelivom na vtoku v stezo, namenjena reguliranju pretoka skozi ribjo stezo

Porušene predelne stene smo popravili ter namestili dodatne montažne stene. S tem smo povečali število tolmunov in tako zmanjšali višinsko razliko med njimi, da je steza za ribe lažje prehodna.

Voda, ki se preko zapornice preliva, je ribe pri iskanju vhoda v stezo ovirala. Problem smo rešili tako, da smo v notranjosti steze namestili dodatno cev, ki na vhodu ustvarja močnejši privlačni tok.

RIBJA STEZA PRI FUŽINSKEM GRADU

Ribja steza na Fužinah ob srednjih in nizkih pretokih ni delovala, zaradi dotrajanosti pa se je jeseni 2013 ob visokih vodah še porušila ter s tem postala povsem neprehodna za ribje organizme. Porušeni del ribje steze je obnovila družba B&B, Papirnica Vevče, za izboljšave pa smo poskrbeli mi.

Zaradi težke dostopnosti terena ter vprašljive stabilnosti objekta je bil porušeni del steze nadomeščen z montažno steno iz jeklenih nosilcev in 5 cm debelih vezanih hrastovih plohov. Leseni plohi so bili še dodatno impregnirani, s čimer se je izboljšala njihova odpornost na različne vremenske vplive.

Podobno kot pri ribji stezi na Ambroževem trgu smo tudi v tem primeru objekt očistili in nadomestili porušene predelne stene, na vtok pa smo namestili zaščitni element za preprečevanje vnosa plavja v ribjo stezo.



Obnovljen del porušene steze na Fužinah

Avtorica prispevka: Anja Vihar

DVIŽNI SISTEM PLEČNIKOVIH ZAPORNIC

Zapornična pregrada na Ambroževem trgu, ki je bila zgrajena leta 1956, skupaj s tisto na Gruberjevem kanalu služi reguliranju količine vode v Ljubljani in vpliva na vodno gladino gorvodno od Poljan vse do Ljubljanskega barja. V času nizkih in srednjih pretokov se z delnim odprtjem zapornic uravnava dogovorjen vodostaj na območju med zapornicami na Ambroževem trgu in Gruberjevim kanalom. Ko pretok Ljubljanice doseže 120 m³/s ali več, pa morajo biti zapornice popolnoma odprte. Zapornic na Ambroževem trgu do sedaj ni bilo mogoče natančno regulirati, ker pogon zapornice in njena nazivna moč nista bili zasnovani za počasnejše in preciznejše premike. Dvig zapornic je tako lahko povzročil nenadno spremembo v vodnem toku in zakaljenost vode.

Problem nezmožnosti fine regulacije zapornic na Ambroževem trgu in njenih posledic na ekološke razmere Ljubljanice smo vključili v projekt Ljubljana povezuje. Projekt rekonstrukcije strojne in elektro opreme zapornice na Ambroževem trgu se je začel z izdelavo potrebne projektne dokumentacije. Dela na zapornici so se začela z demontažo starega elektro motorja avgusta 2015, ko so bili pretoki nizki in je bila zapornica spuščena na prag. Izvedba del je bila vseskozi pod nadzorom upravljavca zapornic, vodnogospodarskega podjetja Hidrotehnik d.d. Zaradi zagotavljanja primarne funkcije zapornic smo morali dela usklajevati z napovedmi o padavinah in pretokih Ljubljanice prognostične službe Agencije RS za okolje. Zastavili

smo si cilj, da prenovimo pogonski sistem zapornice na Ambroževem trgu tako, da bo dovoljeval hod zapornice do 200 mm nad pragom s fino regulacijo odprtja z najmanjšim korakom 5 mm. Dela na zapornici so obsegala rekonstrukcijo strojne in elektro opreme zapornice. V sklopu prvih je bil najprej demontiran star elektro motor, ki ni ustrezal današnjim standardom in IEC priporočilom. Sledila je montaža novega motorja, izdelava mehanskega kazala in potrebnih delov za vgradnjo merilnih naprav položaja spodnje zapornice.

V sklopu elektro del so se vsa dela izvajala izključno v strojnici zapornic na desnem bregu Ljubljanice. Pomemben doprinos elektro del je na dotik občutljiv zaslon, na katerem se prikazuje položaj desne zapornice. Tako imenovani operacijski zaslon služi tudi temu, da se preko njega vpisuje novi želeni položaj zapornice. Krmilnik bo opremljen z modulom s priključkom Ethernet, da bo v prihodnosti možna tudi priključitev na medmrežje. Slednje bo odprlo možnosti za avtomatizacijo in upravljanje zapornic na daljavo, kar trenutno še ni mogoče. Zapornična pregrada na Ambroževem trgu je izboljšana s sodobno hidromehansko opremo in dodano elektroniko, tako da omogoča zvezno regulacijo gladine v reki Ljubljani. Nadzor nizkih pretokov je tako zagotovljen tudi v času najbolj kritičnih ekoloških razmer.

Avtorica prispevka: Kladija Sapač



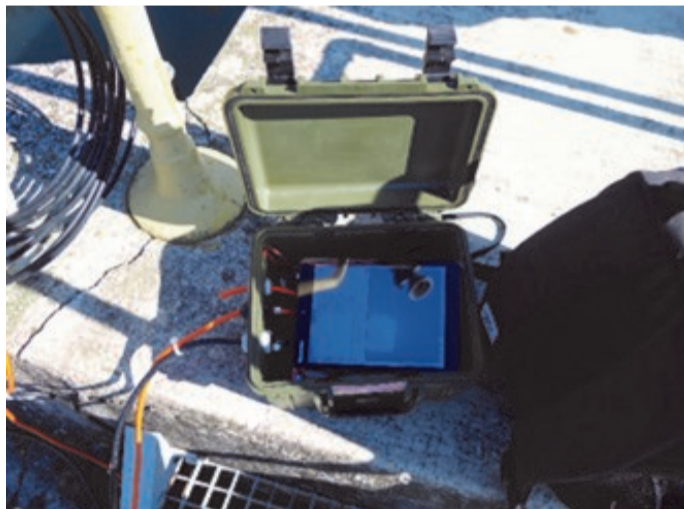
Dotrajan motor pred obnovo (levo) in nov motor (desno), ki omogoča tudi manjše premike zapornice

SPREMLJANJE DELOVANJA RIBJIH STEZ

V sklopu projekta LIFE Ljubljana povezuje smo obnovili dve ribji stezi, pri zapornici na Ambroževem trgu in na jezu pri Fužinskem gradu. Delovanje obnovljenih ribjih stez spremljamo z neprekinjenim monitoringom preko nizkocenovnega on line sistema s kamero, nameščeno v ribji stezi. Omenjeni sistem spremljanja migracije rib se je izkazal za zelo uspešnega, saj smo v ribji stezi na Ambroževem trgu od poletja do danes posneli že več kot 100.000 slik.

KAMERA V RIBJI STEZI

Sistem za monitoring rib je sestavljen iz dveh delov. Prvi del sestavlja vodoodporna škatla, v kateri je nameščen tablični računalnik. Uporabili smo tablični računalnik z Windows operacijskim sistemom. Za tablični računalnik smo se odločili ker je majhen, relativno hiter, ima majhno porabo in je preprost za uporabo. Na računalniku teče programska oprema Yawcam. Yawcam je brezplačna programska oprema, ki omogoča zajem in shranjevanje slik iz spletnih kamer. Program slike ribe shrani na lokalni disk, zaradi večje varnosti pa se slika shrani tudi v oblak (Google Drive).



Vodoodporna škatla s tabličnim računalnikom

V drugi škatli pa sta nameščeni kamera in dodatna osvetlitev. Za dodatno osvetlitev smo uporabili IR reflektor. Uporaba IR reflektorja nam omogoča snemanje rib tudi v slabših svetlobnih pogojih oziroma ponoči, kar je zelo pomembno, saj selitve rib potekajo predvsem v nočnem času.

Kamera je preko kabla povezana z računalnikom. Za delovanje kamere je treba zagotoviti še ustrezno napajanje. Zaželen je tudi dostop do interneta. V kolikor imamo zagotovljen dostop do interneta, lahko oddaljeno dostopamo do kamere. Kamero lahko nastavljamo, spreminjamo nastavitve, prenašamo slike ... Poleg tega pa lahko omogočimo tudi »on-line« video spremljanje dogajanja v ribji stezi v realnem času.

Mesto postavitve kamere v ribji stezi je zelo pomembno. Na spodnji sliki je prikazano mesto postavitve kamere v ribji stezi na Ambroževem trgu. Odločili smo se, da kamero namestimo v bližino izhoda iz ribje steze za zadnjo stopnico, kjer je voda najbolj mirna. Mirna voda brez mehurčkov je zelo pomembna, saj nam omogoča, da posnamemo kakovostne posnetke rib, kar nam kasneje olajša prepoznavo in analizo rib na slikah. Na ribji stezi na Fužinah je podobno, kamero smo ravno tako namestili v bližino izhoda pred zadnjo stopnico, kjer je voda najbolj mirna.

Kamera je preko odskih zaponk pritrjena na steno ribje steze. Nosilec kamere je narejen tako, da je mogoče kamero nastaviti oziroma usmeriti v poljubno smer.



Mesto postavitve kamere v ribji stezi na Ambroževem trgu

Trenutno pa poteka nadgradnja in izboljšava sistema za monitoring prehajanja rib s kamero. V ribjo stezo bomo namestili dve kameri, ki bosta nameščeni na nasprotno steno ribje steze in bosta obrnjeni ena proti drugi. Obe kameri bosta hkrati posneli ribo iz različnih kotov. Na podlagi teh dveh posnetkov bomo potem dokaj natančno določili še velikost ribe in ocenili njeno težo.

Video v živo z ribjih stez si lahko ogledate na spletni strani projekta: http://ksh.fgg.uni-lj.si/ljubljanaconnects/SLO/I2_camera.

REZULTATI MONITORINGA

Na ribji stezi na Ambroževem trgu smo od poletja do danes posneli več kot 100.000 slik. Na posameznih slikah je lahko tudi do 20 rib. Izvedli smo že delno analizo posnetih slik. Opazili smo, da skozi ribjo stezo prehaja vsaj 7 vrst rib: **Klen** (*Squalius cephalus*), **Mrena** (*Barbus barbus*), **Pisanka** (*Alburnoides bipunctatus*), **Potočna mrena** (*Barbus balcanicus*), **Rdečeoka** (*Rutilus rutilus*) in **Zelenika** (*Alburnus alburnus*). Poleg naštetih vrst pa smo zaenkrat posneli tudi 5 **Sulcev** (*Hucho hucho*).



Sulec (Hucho hucho)



Zelenika (Alburnus alburnus)



Mrena (Barbus barbus)



Pisanke (Alburnoides bipunctatus)



Klen (Squalius cephalus)



Rdečeoka (Rutilus rutilus)

Avtor prispevka: Matej Sečnik

KONFERENCA O POVEZLJIVOSTI REK

V okviru projekta LIFE Ljubljana povezuje smo konec oktobra organizirali mednarodno Konferenco o povezljivosti rek. Konferenca je potekala dva dni, četrtek, 22. 10. 2015, je bil namenjen predstavitvi prispevkov, petek, 23. 10. 2015, pa terenskemu izletu in ogledu točk konkretnih obnovitvenih akcij projekta. Na konferenci je bilo predstavljenih 7 prispevkov, v obeh dneh pa se je udeležilo 27 gostov.

PREDSTAVITVE PRISPEVKOV

Na konferenco je bilo prijavljenih 6 različnih strokovnih prispevkov, ki smo jih razdelili v tri sklope: Sulec in njegov status v Evropi, Načrtovanje ribjih stez in Revitalizacija rek. V sklopu konference smo pripravili tudi predstavitev projekta in lastnega razvoja sistema za spremljanje migracije rib v ribjih stezah.

Povzetke predstavitev si lahko preberete spodaj.



Udeleženci prvega dne konference

**Predrag Simonović (Univerza v Beogradu):
Connectivity solution for huchen *Hucho hucho*
(L.) in human-altered habitats**

Sulec je globalno ogrožena ribja vrsta, ki ji v zadnjem času grozijo tudi gradnje velikih pregrad za potrebe hidroelektrarn. Vzpostavitev ribogojnic in gojenje sulcev ima le omejen učinek na izboljšanje stanja, zato bo potrebno poiskati še druge rešitve. Potrebne bodo dodatne raziskave o izgradnji ustreznih ribjih stez, pripraviti in uveljaviti pa bo potrebno tudi pogoje, ki jih bodo izvajalci in lastniki hidroelektrarn morali upoštevati ob njihovi gradnji in obratovanju.



**Daša Zabrc (Zavod za ribištvo Slovenije):
Elaboration of expertise for huchen (*Hucho hucho*) habitat and population conservation in the middle Sava River – Target Research Programme**

Sulec je največja vrsta postrvi, ki jo najdemo v Sloveniji. Najbolj ga ogrožajo uničevanje habitatov in spremembe v toku rek, ki so posledica izgradnje hidroelektrarn. Zaradi navzkrižja interesov, želje po zaščiti sulca in hkrati proizvodnje električne energije, je v pripravi strokovni predlog za pomoč pri odločanju.



**Lidija Globevnik (TC Vode): The concept of
ecological restoration of subalpine river in
Slovenia**

Namen hidrotehničnih objektov in regulacij na rekah je zmanjšati poplavno ogroženost, poskrbeti za dober ekološki status reke in zagotoviti vodne pravice. Na primeru reke Mislinje je bil pripravljen koncept ekološke sanacije, pri katerem so za zasnovo vsakega hidrotehničnega objekta sledili trem ciljem: objekt naj zagotavlja zmanjšanje poplavne ogroženosti, ohranja naj ustrezne pretočne sposobnosti strug v naseljih, izven naselij pa se sonaravni deli strug lahko razširijo, z objektom pa naj bo poskrbljeno tudi za izboljšanje pogojev za življenje živali in rastlin v vodi.



Damijan Denac (DOPPS): From research to restoration, from conflict to cooperation – conserving nature at the lower Drava River in Slovenia

Projekt LIVEDRAVA - Obnova rečnega ekosistema nižinskega dela Drave v Sloveniji se osredotoča na zaradi hidroelektrarn prizadeti odsek reke Drave. S konkretnimi obnovitvenimi akcijami, kot so odpiranje zaprtih rečnih kanalov, čiščenje prodišč in preprečevanje ostalih posegov na njih, bodo izboljšali stanje za ogrožene vrste Nature 2000.



Marjana Hönigsfeld Adamič (Lutra): LIFE project AQUAVIVA

LIFE projekt AQUAVIVA je projekt, namenjen ozaveščanju in boljšemu poznavanju izraza biodiverziteta. Njegov zaščitni znak je vidra kot predstavnica vodnega življenja. V sklopu projekta je bilo izvedenih ogromno izobraževalnih, komunikacijskih in informativnih akcij, namenjenih povečanju zavedanja splošne javnosti o vodi v našem okolju in posledično izboljšanju vsakdanje prakse na tem področju.



Obnovitev koridorja Ljubljanice in izboljšanje rečnega vodnega režima - Ljublanica povezuje - 7

TERENSKI IZLET

Drugi dan konference je bil namenjen terenskemu izletu. Po kratkem uvodu, kjer smo udeležencem predstavili, kaj bodo videli, smo se odpravili na vse tri pomembnejše terenske točke projekta, kjer smo izvedli konkretne obnovitvene ukrepe. Najprej smo si ogledali ribjo stezo in njene izboljšave na Ambroževem trgu, kjer smo za obiskovalce odprli tudi strojnico same zapornice. Tako so si lahko ogledali tudi nov motor in komandni sistem za dvigovanje zapornice. Izlet smo nadaljevali v Zalogu, kjer smo se sprehodili od obnovljenega praga do mrtvice, kjer je bila voda zaradi številnih rib v njej ves čas vzvalovljena. Na zadnje pa smo se ustavili še na Fužinah, kjer smo se po brvi sprehodili vse do ribje steze in si ogledali tudi, kako kamera in pripadajoča oprema za spremljanje migracije rib dejansko izgledata na terenu.



Ogled ribje steze na Fužinah

Terenski izlet in s tem tudi konferenco smo zaključili na Ljublanici, po kateri smo se popeljali z ladjico. Mesto in reko je bilo na sončen jesenski dan prekrasno videti tudi z rečne perspektive.



Avtorica prispevka: Katarina Zabret

OKROGLE MIZE PROJEKTA

Ker se projekt Ljubljana povezuje bliža h koncu, smo v letu 2015 organizirali še dve okrogli mizi. Prva, ki je bila namenjena predvsem predstavitvi rezultatov projekta, je potekala 19. 6. 2015 v prostorih Oddelka za urejanje prostora Mestne občine Ljubljana in je bila namenjena strokovnjakom ter širši javnosti. Druga okrogla miza pa je potekala 10. 11. 2015 na Oddelku za okoljsko gradbeništvo Fakultete za gradbeništvo in geodezijo UL, organizirali pa smo jo v sodelovanju z Društvom študentov vodarstva, saj je bila namenjena predvsem študentom.

OKROGLA MIZA OB ZAKLJUČKU OBNOVITVENIH AKCIJ

Ob zaključku obnovitvenih akcij projekta (obnova praga v Zalogu in obeh ribjih stez na Ambroževem trgu in na Fužinah) smo v sodelovanju z MOL organizirali okroglo mizo, na kateri smo na splošno predstavili projekt, po tem pa smo se posvetili še vsaki izmed obnovitvenih akcij. Po predstavitvah je sledila diskusija med udeleženci.



Diskusija med udeleženci okrogle mize



Predstavitve Andreja Vidmarja

OKROGLA MIZA ZA ŠTUDENTE

Pomemben del projekta je tudi ozaveščanje širše javnosti, naša ciljna skupina pa so predvsem mladi. Zato smo drugo okroglo mizo, ki smo jo organizirali, namenili študentom. Pri organizaciji smo sodelovali z Društvom študentov vodarstva, ki je poskrbelo za promocijo dogodka med svojimi člani. Poleg udeležbe pa smo študente povabili, da tudi sami predstavijo svoje delo, na primer diplomske in magistrske naloge, ki so se nanašale na teme, ki jih obravnavamo pri projektu (reka Ljubljana kot vitalen element našega okolja, omogočanje prehodnih rek za ribe in renaturalizacija vodotokov).

Okroglo mizo smo odprli s pregledom vseh akcij na projektu in z njegovo splošno predstavitvijo, po tem pa so se s svojimi prispevki zvrstili še študenti **Matic Zakotnik** (Pregled inženirsko bioloških metod v sonaravnem urejanju vodotokov), **Timotej Lestan** (Uporaba sonaravnih ukrepov pri ureditvi vodotoka), **Tilen Koranter** (Ocena stanja in predlogi izboljšav za prehodnost vodnih organizmov na zgornji Savi), **Rožle Lavrač** (Dimenzioniranje drče na reki Savinji pri Latkovi vasi) in **Simon Lesjak** (Ureditev ribjega prehoda na Homškem jezcu).



Po predstavitvah je ob prijetnem druženju potekala še zanimiva diskusija, v kateri so si študenti izmenjali mnenja in izkušnje, predvsem tiste o sodelovanju med različnimi strokovnjaki.

Avtorica prispevka: Katarina Zabret

FISHPASSAGE 2015

Med 22. in 24. junijem 2015 je v mestu Groningen na Nizozemskem potekala Mednarodna konferenca o najboljši praksi in inovacijah na področju povezlivosti rek - Fish Passage 2015. Konference se je udeležilo približno 540 strokovnjakov s celega sveta, poleg številnih predstavitev pa je bilo organiziranih še več delavnic, razprav in izletov.

Na konferenci smo v sekciji EU-funded projects: Restoration of European Rivers predstavili tudi projekt Ljubljanica povezuje.



Predstavitve projekta Ljubljana povezuje

Tekom konference smo prisluhnili številnim zanimivim predstavitev projektov in raziskav, ki so nam dale nove ideje za nadaljnje delo. Najbolj so nas zanimali načini spremljanja delovanja ribjih stez, saj se s tem ukvarjamo tudi pri našem projektu. Na družabnih dogodkih in pri diskusijah smo spoznali raziskovalce, ki se soočajo s podobnimi problemi. Izmenjava izkušenj in dogovori o prihodnjem sodelovanju so pomemben doprinos dogodka.



Člani projekta na konferenci

OGLED NAJVEČJE RIBJE STEZE V EVROPI

V okviru konference smo odšli tudi na celodnevno ekskurzijo, kjer smo si ogledali največjo ribjo stezo v Evropi. Ribja steza Geestacht se nahaja na reki Labi, južno od Hamburga. Njena dolžina je 550 m, širina pa 16 m. Sestavljena je iz 45 prekatov in ima skupno 4 m padca.



Naši udeleženci konference ob ribji stezi

Na izhodu iz ribje steze je za namen spremljanja delovanja steze zgrajen poseben objekt, sestavljen iz pasti, kamor zaplavajo vse ribe, ki vrh steze dosežejo, bazena za zadrževanje rib in laboratorija, kjer vsako ujeto ribo stehtajo, izmerijo, popišejo in pred izpustom označijo. Med ogledom so nam delovanje tega sistema tudi pokazali.



Štetje in označevanje rib, ki so prečkale ribjo stezo

Avtorica prispevka: Katarina Zabret

LJUBLJANICA POVEZUJE TUDI V ŠOLAH

Ker je Ljubljana pomemben del naše prestolnice in okolja, v katerem živimo, je prav, da jo bolje spoznamo. Projekt Ljubljana povezuje pokriva veliko zanimivih področij, ki jih učitelji in profesorji z veseljem vključijo v pouk pri predmetih biologije, kemije ali geografije. Pozitiven odziv pedagogov nas je spodbudil, da smo pripravili številne različne delavnice in tematska predavanja pri naravoslovnih predmetih in v sklopu tehničnih, naravoslovnih ali eko dni. Z veseljem smo sodelovali z različnimi šolami in učencem okolje, v katerem živijo, predstavili še na drugačen način. Delavnice glede na čas, ki ga imamo na voljo in starost naših poslušalcev, sestavimo iz tematskih predavanj, ogleda filma projekta, meritev na terenu, prikaza naravnih procesov s fizičnimi modeli in še česa ...



Meritve pretoka na sončku (Gimnazija Jožeta Plečnika) ...



... in tudi na dežju (OŠ Vrhovci)



Interaktivne delavnice (OŠ Martina Krpana)



Meritve parametrov vode pod mostom (Klasična škofijska gimnazija) ...



... in zasilno v predavalnici (Srednja lesarska šola)



Tematsko predevanje pri nas (ŠC Novo mesto) ...



... in na obisku (Srednja ekonomska šola Ljubljana)

Avtorica prispevka: Katarina Zabret

PROJEKTNO LETO NA KRATKO

- 14. 1. 2015** - Zaključili smo z nadgradnjo opreme za meritev pretokov in batimetrije dna struge, ki je uspešno prestala prvi test.. Čoln smo poimenovali Hi3.
- 19. 3. 2015** - Obiskal nas je g. Mitja Kaligarič, zunanji nadzornik za Slovenijo. Skupaj smo pregledali stanje na akcijah projekta in potek obnovitvenih akcij na terenu.
- 21. 4. 2015** - Porušen del ribje steze na Fužinah je popravljen. Delavci so na nosilno steno, ki se ni porušila, pritrčili jeklene nosilce, prostor med njimi pa so zapolnili z lesenimi plohi.
- 5. 5. 2015** - Obiskali smo OŠ Martina Krpana, kjer smo sodelovali pri izvedbi naravoslovnega dneva na temo Ljubljana. Na kratko smo jim predstavili projekt in jim prikazali različne načine merjenja pretoka.
- 8. 5. 2015** - Obnovitvena dela v ribji stezi na Ambroževem trgu se bližajo h koncu. Porušene stopnje so popravljene, zaščita za plavje je nameščena, ribe pa k vhodu privablja voda iz na novo nameščene cevi.
- 12. 5. 2015** - Za učence 8. razredov OŠ Vič smo pripravili delavnico v sklopu naravoslovnega dne. Na reki Gradaščici (pritok Ljubljanice) smo merili pretok, višino vode, temperaturo in količino raztopljenega kisika.
- 22. 5. 2015** - Obiskali smo Gimnazijo Jožeta Plečnika v Ljubljani, kjer smo dijakom 2. letnika predstavili projekt Ljubljana povezuje. Čez štirinajst dni pa smo izvedli še terenske meritve na Gradaščici.
- 5. 6. 2015** - Na Morski biološki postaji Piran smo s predstavitev projekta sodelovali na dnevu odprtih vrat, s katerim so obeležili Svetovni dan oceanov.
- 16. 6. 2015** - Dijaki Srednje lesarske šole so svoj dan preživel pri nas. Predstavili smo jim projekt, jih popeljali v laboratorije in na naše raziskovalne ploskve.
- 17. 6. 2015** - Z dijaki Klasične škofijske gimnazije smo dopoldne preživel ob Gradaščici, kjer smo jim predstavili projekt in jim pomagali pri meritvah lastnosti reke.
- 18. 6. 2015** - Za gimnazijce Srednje vzgojiteljske šole in gimnazije iz Ljubljane smo organizirali naravoslovni dan, ki smo ga izkoristili za predstavitev projekta in ohladitev v vodi med meritvami.
- 19. 6. 2015** - Na Oddelku za urejanje prostora Mestne občine Ljubljana smo organizirali okroglo mizo ob zaključku obnovitvenih akcij projekta.
- 22. - 26. 6. 2015** - Odpotovali smo v Groningen na Nizozemskem, kjer smo na konferenci Fish Passage 2015 predstavili naš projekt.
- 9. 7. 2015** - Namestili smo prvo kamero za spremljanje migracije rib v ribji stezi na Ambroževem trgu.
- 10. 7. 2015** - Med testiranjem različnih metod za spremljanje prehodnosti ribjih stez smo na Ambroževem trgu preizkusili tudi vrše.
- 24. 7. 2015** - Kontrolna kamera na Ambroževem trgu je v ribji stezi posnela sulca!
- 21. 8. 2015** - V okviru akcije C3 (posodobitev zapornice na Ambroževem trgu) je bil zamenjan dotrajan motor za regulacijo zapornic na Ambroževem trgu.
- 2. 9. 2015** - V sklopu akcije E3 smo izvedli terenske meritve temperature z optičnim kablom. Uporabili smo novi večkanalni optični temperaturni senzor Silixa XT-DTS.
- 8. 9. 2015** - Namestili smo še drugo kontrolno kamero za spremljanje delovanja ribjih stez na Fužinah.
- 8. 10. 2015** - Za učence 9. razredov OŠ Vrhovci smo pripravili delavnico. Na reki Gradaščici in Malem grabnu (pritoka Ljubljanice) smo merili pretok, višino vode, temperaturo in količino raztopljenega kisika.
- 9. 10. 2015** - V okviru rednega monitoringa smo z g. Kaligaričem, ga. Lebez Lozej in g. Cezarjem pregledali zaključene akcije projekta in preverili dejavnosti, ki še niso končane. Stanje smo si ogledali tudi na terenu.
- 15. 10. 2015** - Na UL FGG je potekal Dan odprtih vrat, na katerem smo več kot 100 dijakom iz različnih slovenskih srednjih šol predstavili projekt in delovanje našega čolna Hi3.
- 22. - 23. 10. 2015** - Uspešno smo organizirali mednarodno Konferenco o povezljivosti rek.
- 5. in 12. 11. 2015** - Obiskali smo dijake I. letnika Srednje ekonomske šole Ljubljana in jim s predstavitev projekta in delavnicami popestrili pouk geografije.
- 10. 11. 2015** - Z Društvom študentov vodarstva smo uspešno organizirali Okroglo mizo za študente.
- 17. 11. 2015** - Trem oddelkom dijakov Srednje trgovske šole smo dan zapolnili s predavanji in terenskim ogledom zapornic na Ambroževem trgu.



S prispevkom LIFE, finančnega instrumenta Evropske unije



Spletna stran projekta: <http://ksh.fgg.uni-lj.si/ljubljanicaconnects>

Uredniški odbor: Mitja Brilly, Andrej Vidmar, Katarina Zabret

Izdala in založila: Univerza v Ljubljani, Fakulteta za gradbeništvo in geodezijo

Tisk: Birografika Bori d.o.o., Ljubljana

Naklada: 200 izvodov

Leto izdaje: 2015

Annex 4:

Example of the second poster

LJUBLJANICA POVEZUJE

LIFE 10 NAT/SI/142

Ob Ljubljanici se pogosto sprehajamo in posedamo, le redko pa se zavedamo pestrega življenja v njej. V Ljubljanici namreč plava kar 26 avtohtonih vrst rib, tu pa prebivajo tudi vidre, nutrije, želve, žabe in race.

V preteklosti je bilo na Ljubljanici zgrajenih več različnih objektov za zaščito mesta pred poplavami in za vzdrževanje ustreznega vodnega režima. Vsi poznate Gruberjev kanal z zapornicami, jez pri Fužinskem gradu in zapornice na Ambroževem trgu. Ti objekti na reki predstavljajo oviro za gibanje rib, omejujejo njihov življenjski prostor in zmanjšujejo možnosti za razmnoževanje.

S projektom **Ljubljana povezuje** bomo izboljšali povezanost reke Ljubljanice.



RIBJI STEZI

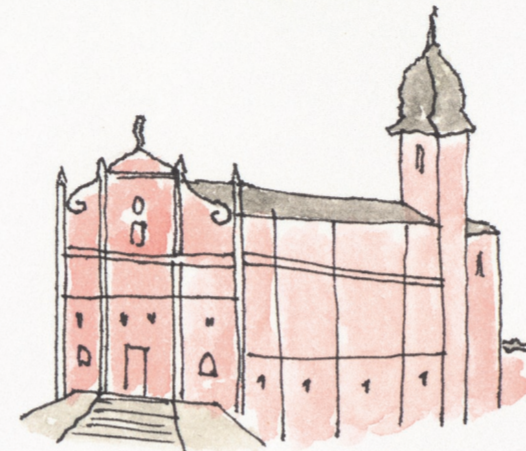
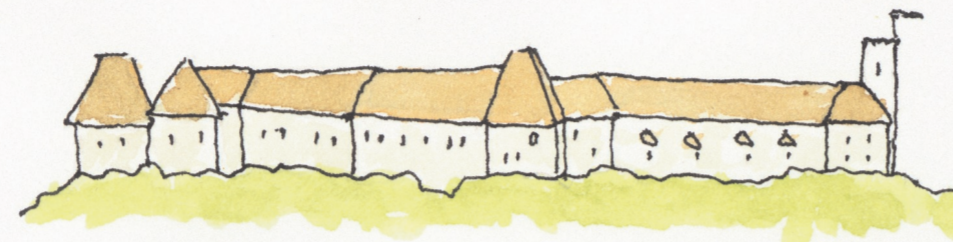
Na Ljubljanici lahko najdemo dve stari ribji stezi, na Fužinah in pri Ambroževem trgu. Prva je stara približno 100 let in se je zaradi visoke vode novembra 2013 porušila. Na Ambroževem trgu se steza nahaja v desnem bregu ob zapornici, prav tako pa zaradi dotrajanosti ni delovala. Stezi smo obnovili in opremili s kamerami za monitoring. Da bi bolje delovali, smo na vtok namestili zaščitni element, ki preprečuje zastajanje plavja (veje, listje), ob iztoku pa smo namestili še dodatno cev z močnejšim curkom vode. Hitrejši tok vode ribe privlači, zato s tem, ko mu sledijo, vstopijo v ribjo stezo.

ZAPORNICA NA AMBROŽEVEM TRGU

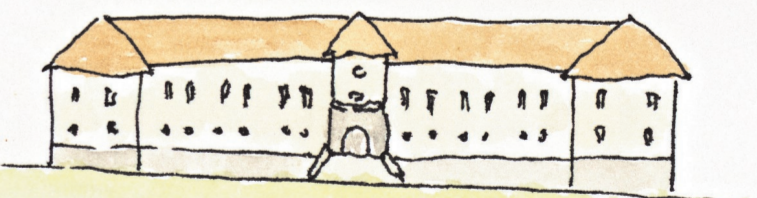
Ta zapornica uravnava gladino Ljubljanice skozi mesto vse do Ljubljanskega barja. Ker je sistem za dviganje zastarel, smo ga posodobili in tako omogočili fino reguliranje.

MONITORING

Kako se ribe gibljejo in ali uporabljajo ribje steze spremljamo z izlovi in označevanjem rib ter s kamerami. Ker pa prijetno življenjsko okolje za živali v reki ne zagotavlja le povezanost temveč tudi kvaliteta vode, merimo še vodostaj, kisik in temperaturo.



Zapornice na Ambroževem trgu



Jez pri Fužinskem gradu



Univerza v Ljubljani
Fakulteta za *gradbeništvo in geodezijo*



GEATEH
Načrtovanje in izvajanje, d.o.o.

PURGATOR

Annex 5:

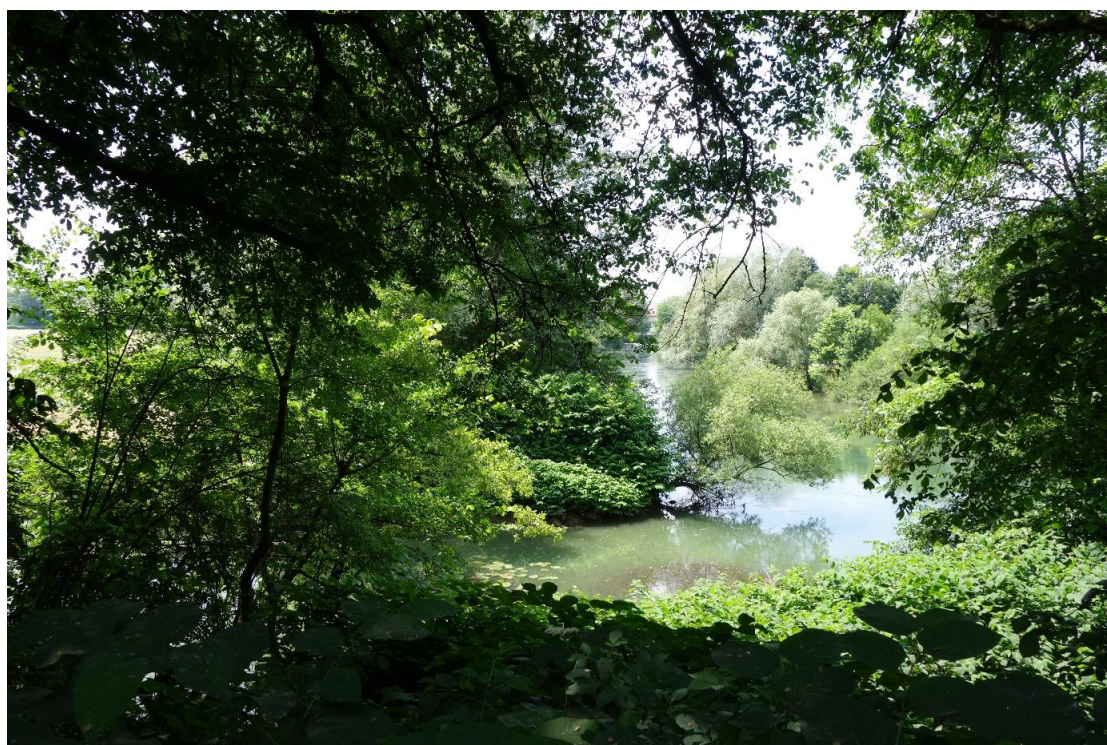
Book of Abstracts of the River Connectivity conference



THE RIVER CONNECTIVITY CONFERENCE

LIFE project LJUBLJANICA CONNECTS

BOOK OF ABSTRACTS



22 and 23 October 2015, Ljubljana, Slovenia

The river connectivity conference

International conference of LIFE project Ljubljanica connects – Book of abstracts
October 22 - 23, 2015
Ljubljana (Slovenia)

Organization committee

Katarina Zabret, University Of Ljubljana, Faculty of Civil and Geodetic Engineering
Klaudija Sapač, University Of Ljubljana, Faculty of Civil and Geodetic Engineering
Anja Vihar, University Of Ljubljana, Faculty of Civil and Geodetic Engineering
Matej Sečnik, University Of Ljubljana, Faculty of Civil and Geodetic Engineering
Andrej Vidmar, MSc, University Of Ljubljana, Faculty of Civil and Geodetic Engineering
Zoran Stojič, MSc, Geateh d.o.o

Scientific committee

Prof. dr. Mitja Brilly, University Of Ljubljana, Faculty of Civil and Geodetic Engineering
Prof. dr. Avdul Adrović, University of Tuzla, Tuzla, Department of Biology
Prof. dr. Anton Brancelj, The National Institute of Biology
Prof. dr. Marko Čaleta, University of Zagreb, Faculty of Science, Department of Biology
Prof. dr. Predrag Simonović, University of Belgrade, Faculty of Biology

Editor: Katarina Zabret

Authors of photographs: Klaudija Sapač, Matej Sečnik, Andrej Vidmar, Anja Vihar

Location: University of Ljubljana, Faculty of Civil and Geodetic Engineering, Department for Environmental Civil Engineering, Hajdrihova 28, 1000 Ljubljana, Slovenia

http://ksh.fgg.uni-lj.si/ljubljanicaconnects/ANG/13_conference/default.htm

PRESENTATION OF LIFE PROJECT LJUBLJANICA CONNECTS

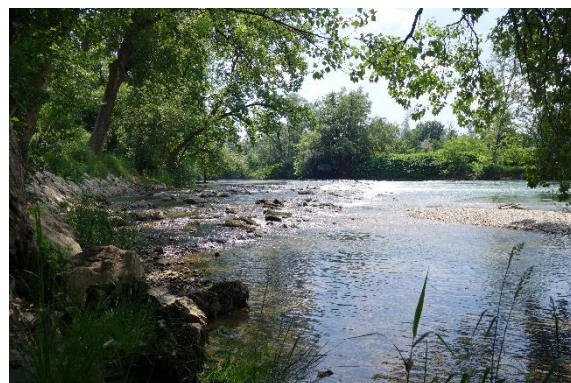
THE RIVER CONNECTIVITY CONFERENCE



The project Ljubljana connects has started in year 2012 and is implemented by Faculty of Civil and Geodetical engineering, University of Ljubljana and two partners (Geateh d.o.o. and Purgator d.o.o.). Its goal is to improve the living conditions of endangered fish populations of Danube Salmon (*Hucho hucho*), Danube Roach (*Rutilus pigus*) and Striped Chub (*Leuciscus souffia*) which are also the targeted species of Natura 2000 area.

The project consists of three sets of activities: concrete restoration actions, monitoring of fish migration and ecohydrological parameters, and raising of public awareness. The concrete restoration actions include improvement of sill in Zalog, two fish passages in Fužine and Ambrožev trg and lifting system of the barrier on Ambrožev trg.

Above the **sill in Zalog** there is an oxbow which was disconnected with main river channel during the low flows. Interrupted inflow of fresh water caused very poor living conditions for animals in the oxbow. The raise of the sill helped to improve this situation.



The **fish passes** included in the project are very old and protected as cultural and technical heritage. None was working properly and due to the protection no big and drastic measures were allowed. With smaller improvements such as reconstruction of damaged steps in the interior and installation of element for preventing entry of floating debris at the inflow we managed to re-establish their operation.



A **lifting system of the barrier** at the Ambrožev trg gate was outdated and did not allow the precise regulation which is important for regulating the water level through the city centre all the way up to Ljubljansko barje. Too fast raising of the barrier instantly caused deterioration of ecohydrological conditions downstream. With modernization of the electromechanical equipment the situation is improved.



Monitoring of fish migration is performed on two different ways. We monitor the situation of fish population with marking the fish with Visible Implant Elastomer (VIE) tags. Regarding the location of catch we implant tags beneath transparent or translucent tissue combining different tag locations (dorsal fin, post ocular tissue) and colours (red and yellow). The success of restoration of fish passes is monitored with the use of on line connected cameras installed on the fish passes. Records from the camera are analysed to evaluate number and type of fish using the fish passes.



The **ecohydrological conditions** are monitored with 17 measurement stations installed along the whole river corridor and with occasional measurements of water discharge with remote controlled boat and water temperature with optical cable.



We would like to **present our activities** and results of the project **to a broader public** so that they would be aware of what is happening around them. Therefore we are organising various thematic presentations and field workshops for school children and students and publish informative papers in journals.



SCHEDULE

THE RIVER CONNECTIVITY CONFERENCE



THURSDAY, 22 October 2015

- 13:30 - 14:00 Arrival, registration and welcome drink
- 14:00 - 14:30 Opening of the conference
- 14:30 - 16:00 Session 1: Huchen and its status in Europe
Session 2: Designing the fish passes
- 16:00 - 16:30 Coffee break
- 16:30 - 18:00 Session 3: River revitalisation
- 18:00 - 20:00 Conference dinner

FRIDAY, 23 October 2015

- 9:00 - 9:30 Arrival and coffee
- 9:30 - 10:30 Presentation of the project Ljubljana connects and introduction to field trip
- 10:30 - 13:00 Visit of project sites
- 13:00 - 15:00 Lunch on boat on Ljubljana river
- 15:00 Closure of the conference

If you are going on a field trip with us, please bring along appropriate clothing and footwear.

ABSTRACTS

SESSION 1: Huchen and its status in Europe

THE RIVER CONNECTIVITY CONFERENCE



Connectivity Solution for huchen *Hucho hucho* (L.) in human-altered habitats

Predrag Simonović, University of Belgrade, Faculty of Biology, Belgrade, Serbia

Danilo Mrdak, University of Montenegro, Faculty of Science and Mathematics, Podgorica, Montenegro

Marina Piria, University of Zagreb, Faculty of Agriculture, Department of Fisheries, Agriculture and Special Zoology, Zagreb, Croatia

Karol Hensel, Comenius University, Department of Zoology, Bratislava, Slovakia

Considering huchen globally endangered (E), and the largest, endemic salmonid fish species, threatened severely by high dams construction, there is a strong need for stopping of its recent decline. Contradiction about the huchen migratory behaviour and consistent records about their lacking from the fish ladders impose considering other solutions compensating the deleterious effects (decline in reservoir sections due to comprehensive alteration of environment; suppression of natural spawning in downstream sections due to hydropeaking; river bed siltation by flushing of reservoirs and decrease in general productivity of the riverine ecosystem; river bed erosion, sinking of the river bed and destroying of gravel bars and sand banks, the habitats and spawning grounds) of high dams on them. Establishment of hatcheries revealed only limited success due to making them feral instead of native and due to decrease of genetic variability in fragmented populations. Still remains the strong need for extensive research about the type of fish ladder, slope, flow rate and quality of feeding water and hydraulic signals appropriate for huchen to enter into the ladder in downstream and upstream directions. However, it is also necessary to think about the preconditions that constructors of future high dams and those who runs the recent ones should fulfil to make them more environment-friendly. Those preconditions are related to minimal length of flowing riverine stretches, the least number of tributaries there appropriate for huchen natural spawning, as well as the management measures that are to be applied to minimize the harmful effects of high dams (e.g., accessibility to spawning sites in tributaries, providing of sufficient amount of the water of appropriate quality in them during the spawning season, catch of young-of-the-year huchen and the way of their dispersal throughout the catchment in concern, etc.).



Elaboration of expertise for huchen (*Hucho hucho*) habitat and population conservation in the middle Sava River – Target Research programme

Daša Zabrc, Fisheries Research Institute of Slovenia, Ljubljana, Slovenia

The huchen - *Hucho hucho* (Linnaeus, 1758) is the largest species of trout living in Slovenia. To date research estimates the huchen population in the middle Sava River (Sava-Medvode-Kresnice) as the most vital population in Slovenia. This population was protected in 2003 with the establishment of Natura 2000 site within its distribution area. The main threat to the huchen population in Slovenia is the habitat deterioration and the modifications of river flow resulting from the construction and operation of hydropower plants. Due to the obvious conflict of interests- protection of the huchen populations on the one hand and the use of hydroelectric potential of the Sava River on the other-we want to prepare a scientific foundation, based on ichthyologic and genetic research of the huchen in the Sava River, and to assist in decision-making on the energy utilization of the Sava River with respect to the conservation of the habitat and the populations of the huchen.

The project will yield new information on the population of the huchen in the middle Sava River such as new data on its occurrence, a rough estimate of its abundance and size distribution, a more recent geographical distribution and new information on spawning grounds. We will assess the viability of the population and its reproductive capacity, investigate the impact of stocking and the relationship between natural and stocked populations, prepare a check-list of water obstructions on the middle Sava River with assessment of their passability and present an overview of the mitigation measures on other European rivers with hydropower plants. In addition, we will evaluate the adequacy of existing and propose new measures for recovery of the huchen in the wild and create an action plan to preserve this species in Slovenia. We will examine the impact of reduced water flow on the primary riverbed and the impact of an accumulation on the habitat suitability for the huchen in the selected section of the middle Sava River by means of habitat modelling.

In the presentation the goal and the main objectives of the project are presented, methods are described.

ABSTRACTS

SESSION 2: Designing the fish passes

THE RIVER CONNECTIVITY CONFERENCE



Brush-baffle fish pass: a fish - friendly design

Serhat Kucukali, Cankaya University, Ankara, Turkey

The flow characteristics of a new baffle-brush type fish pass were investigated experimentally in a 2 m wide rectangular flume which has a bed slope of 4% for discharges ranging between 100-550 l/s. The baffle-brush-fish way combines the properties of a super active baffle (Larinier) fish pass with the features of the brush-furnished fish way. Both types mark the extremes of the hydraulic spectrum in fish passes. The baffle fish way exposes a high turbulence flow with a mean velocity around 1,1 m/s while the brush-type fish way provides a multiple-structured migration corridor with low velocities. There are different migration corridors with typical hydraulic conditions and, very important for the fish, this corridors are continuing through the complete fish pass. No obstruction have to be overcome. Once a fish has selected a migration corridor, it can be sure that the hydraulic situation does not change along this corridors goes through the complete fish pass. The main advantage of the proposed hydraulic design is that it can be scaled-up all the parts of this type in order to adjust it to almost any demand based on the physical model test results.



Fish passes in Bosnia and Herzegovina

Avdul Adrović, Faculty of Science, University of Tuzla, Tuzla, Bosnia and Herzegovina

The flows of almost all major river streams in Bosnia and Herzegovina are intersected by dams, and parts of these flows have been transformed into aquatic accumulations. On the river Drina there are four large hydro accumulations, and only on the dam at Mali Zvornik there is a fish pass that opens during the fish spawning period every year in the spring so that fish from the lower course can move upstream and successfully spawn. So the dam of the hydroelectric power plant "Zvornik" is the only one in the country that has a fish pass. This fish ladder was designed in 1948 along with the hydro power plant "Zvornik", and was put into operation in 1955. It is made of cascading pools so that fish can more easily move upstreams. The dimensions of the fish ladder allow it to pass fish weighing from 1 to 1.5 kg, while the big fish like catfish and huchen cannot pass. The pass is long 160 meters of which 89 meters are inside the tunnel part. This pass has been regularly opened since 2003.

Erected dams, especially those in the upper reaches of the Drina River, where have not been built fish ways, as well as the continuous degradation of water quality have adversely affected the condition of the local fish population. The anthropogenic influence has especially negative impact on populations of salmonid species, and particularly on huchen (*Hucho hucho*).

The situation is similar with huchen from the River Vrbas on which were also built three large dams without fish passes.

The natural migration of fish, especially salmonids, are extremely endangered also in the Neretva River where the dams without fish passes were built. Particularly exposed to adverse effects of built dams are the populations of endemic Neretva salmonids such as *Salmothymus obtusirostris* and *Salmo marmoratus*.

On the river Spreča near Lukavac there is a large concrete dam without fish passes. A large number of small hydro-energy facilities exist in Bosnia and Herzegovina with various dams built without fish passes. The reasons for the lack of fish passes are included in the legal regulations that were in force at the time of the construction of dams. Any negative effects of building dams without fish passes on fish populations can only be speculation because they never conducted researches profiled so to show their overall negative effects.



The concept of ecological restoration of subalpine river in Slovenia

Lidija Globevnik, TC Vode, Ljubljana, Slovenia

Luka Snoj, TC Vode, Ljubljana, Slovenia

Neven Verdnik, TC Vode, Ljubljana, Slovenia

The purpose of hydro technical objects and regulation of channels is to reduce flood risk, ensure good ecological and chemical water status and secure legally binding water supply for usage (water rights). Reconstruction of existing or building new objects in a river network should therefore guarantee the above mentioned purpose but also provide development opportunities. Comprehensive plans are needed on the river basin level in considering existing hydrodynamic conditions and the primary purpose of objects, facilities and arrangements. The concept of an ecological restoration is developed for the sub-alpine river and its tributaries in Slovenia, the Mislinja River. Each of the hydro technical objects should be prepared so that it fulfils three main goals. First is to reduce flood risk by preventing rapid drainage of water from river basins and hinterland areas and retain large quantities of water in the areas with minimum potential flood damage and threat. The second goal is to maintain adequate riverbed flow capacity through settlements and the expansion of sustainable parts of the riverbed outside the settlements. The third goal is to improve living conditions for aquatic flora and fauna. The risk of flooding can be reduced by ensuring rapid drainage of the water through the settled areas and retaining it above or below the settlements in wet and dry reservoirs and natural retention or inundation areas. Existing hydro technical or water facilities are renovated in a way that is not just ensuring sufficient flow capabilities, but also improving hydrological and morphological processes. Underwater spurs are installed in the embankments, local depression and forest edges of the channels are kept and at the same time wherever possible islets and meander formations are allowed. Existing sills and dams are restored whereas damaged embankments are transformed into ecological niches. Channel stone spurs and ducts for redirection of main water flow are installed on the regulated uniformly shaped watercourse sections. Fish shelters and wooden consolidations are installed in the river banks. The main task in implementing the measures is to ensure that the design of the facilities is adjusted to bed-load discharge conditions and high flow velocities. There must be enough bed material for sediment transport, while excessive sediment deposition must be constrained.



From research to restoration, from conflict to cooperation – conserving nature at the lower Drava River in Slovenia

Damijan Denac, DOPPS – BirdLife Slovenia, Ljubljana, Slovenia

Natural dynamics of the Drava River was heavily altered after the building of hydro-power plants. Most of the water was diverted into channels, whereas discharges in the old riverbed were reduced drastically, causing the degradation of river branches and gravel bars. Concrete solutions for these problems that we carry out within the project “Riparian ecosystem restoration of the lower Drava River in Slovenia LIFE11 NAT/SI/882” and will be presented are: creating breeding banks, opening closed river branches, cleaning encroached gravel bars, preventing disturbance at gravel bars. Results of the actions are very promising as populations of endangered Natura 2000 qualifying species significantly increased. All the works in the riverbed are hydraulically modelled to achieve the best results. Moreover, water maintenance works for anti-flood protection are analysed considering both anti-flood and nature conservation aspect. Using the results from the analysis, concrete actions, experiments carried out in the field and through cooperation with relevant stakeholders we were able to prepare guidelines for water maintenance works considering the obligatory nature conservation requirements. Guidelines are site-specific for the lower Drava River and are directly useful as detailed water management plan (slo. *podrobni NUV*). With them we are introducing an example of best practice for future management of Slovenian rivers.



LIFE project AQUAVIVA

Marjana Hönigsfeld Adamič, Lutra, Institute for the Conservation of Natural Heritage, Ljubljana, Slovenia

Tatjana Gregorc, Lutra, Institute for the Conservation of Natural Heritage, Ljubljana, Slovenia

The LIFE+ project AQUAVIVA (2011 -2014) was using the otter (*Lutra lutra*) as a flagship species and representative of aquatic life for effective public campaign which aims to attract public attention to biodiversity loss in freshwater ecosystems. We related water biodiversity with human treatment of water environment. Through information, communication and education at all levels the project aimed to raise public attitude towards water environment and to improve everyday praxis. The necessity of preserving freshwater ecosystems as the living environment of different species important for everyday ecosystems services available to humanity was stressed. The project supported the implementation of European environmental policy and nature conservation legislation exposing their mutual positive impacts. The principles of Integrated Water Resources Management (IWRM) were explained to target audience and supported by assistance of the otter as a top predator and an ambassador of freshwater biodiversity. In the scope of the project With the otter through the Capital (2011) supported by Municipality of Ljubljana the otter was found also in Ljubljansko barje, the doorstep of Ljubljana. We have presented the water habitat corridor connecting Ljubljansko barje via Ljubljanica River and Gruberjev prekop to Sava River and proposed mitigation measures for animal species to enable them to overcome the barriers in the corridor.

ABSTRACTS

Presentation of the project Ljubljana connects

THE RIVER CONNECTIVITY CONFERENCE



Ljubljana connects – overview of the project

Katarina Zabret, Faculty of Civil and Geodetic Engineering, University of Ljubljana, Ljubljana, Slovenia

The project Ljubljana connects has focused on improving connectivity and living conditions in Ljubljana River which flows through capital city of Slovenia, Ljubljana. It represents living environment for endangered and Natura 2000 targeted fish species Danube Salmon (*Hucho hucho*), Danube Roach (*Rutilus pigus*) and Striped Chub (*Leuciscus souffia*).

To enable fish migration the concrete restoration measures were performed. The reconstructions of sill and two fish passes on the Ljubljana River have been implemented and barrier's lifting system on the weir was modernized. Used solutions were quite simple but still effective. The fish monitoring which helps us to evaluate success of concrete restoration actions is being performed in two different ways, with marking the fish with Visible Implant Elastomer (VIE) tags and with the use of on line connected cameras installed in the fish passes. Records from the camera are analysed to evaluate number and type of fish using the fish pass. In addition for further evaluation of living conditions the ecohydrological monitoring of water temperature and its level, oxygen concentration and discharge is continuously implemented on 17 measurement stations. The project results are presented to experts on conferences or workshops while the non-scientific general public participates on various field workshops and science days.

Cost effective system for monitoring fish migration with a camera

Matej Sečnik, Faculty of Civil and Geodetic Engineering, University of Ljubljana, Ljubljana, Slovenia

Within the project Ljubljana connects we have developed a cost-effective solution for the monitoring of fish migration through fish passages with the camera. The system for the fish monitoring is made from two parts. First is the waterproof box for the computer and charger and the second part is the camera itself. We used a Sony analogue camera. The advantage of this camera is that it has very good sensitivity in low light conditions so it can take good pictures even in poor light. For the night recording we used additional IR reflector to illuminate passing fishes. The camera is connected to an 8-inch tablet PC with a Windows operating system. We decided to use a tablet PC because it is quite small, cheap, it is relatively fast and has low power consumption. On the computer we installed software called Yawcam. Yawcam is a free software that has quite advanced motion detection capabilities, which is very important if we want to detect passing fishes. When the Yawcam detect movement, it captures an image and save it locally to disk. We are also using Google drive which allow us to have a real-time image backup in the cloud.

Annex 6:

Abstract of the report on the second fish tagging in action E2

Abstract of the report on fish tagging of 15 June 2015 as part of action E2 of the LIFE "Ljubljana Connects" project

On 15 June 2015 the second ichthyological survey was carried out on the Ljubljana River. The survey was conducted on a stretch between the Plečnik barrier to the weir in Vevče as part of the LIFE project "Ljubljana Connects".

Fish were caught in 7 locations at the same section as during the first ichthyological survey (21 October 2014). At the time of the survey the water temperature was 18 °C.

The aim of the survey was to catch and tag targeted fish species (Danube Salmon *Hucho hucho*, Danube Roach *Rutilus pigus* and Striped Chub *Leuciscus souffia*). The caught fish were counted and marked.

We caught 17 different fish species. Of the target species the following fish were caught: 7 Danube Salmon *Hucho hucho*, 15 Danube Roach *Rutilus pigus*, and 9 Striped Chub *Leuciscus souffia*.

All target fish species caught were marked by being injected with red colorant into the subcutaneous tissue behind the eye and into the dorsal fin.

4 representatives of Hrvatsko ihtiološko društvo (Croatian Ichthyological Society), Zagreb, who provided all the necessary equipment, 2 members of the LIFE Ljubljana Connects project staff, and a team of fishermen from the RD Vevče angling club were involved in the survey.

Annex 7:

**Request for a modification of the financial structure sent to EC on
26 February 2016**



University of Ljubljana
Faculty of Civil and Geodetic Engineering

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Mrs. Muriel Drukman
European Commission
Environment Directorate - General
DG ENV. E. 3

B-1049 Brussels
Belgium

Date: Ljubljana, 26. 2. 2016
Our Reference No.: 19-KSH

Subject: **LIFE10 NAT/SI/000142 Ljubljana connects – Request for modification of financial structure**

Dear Mrs. Muriel Drukman,

during the implementation of LIFE10 NAT/SI/142 project Ljubljana connects we have encountered various unexpected and unforeseeable challenges and problems which caused delays in project actions implementation and higher expenses in some budget categories than foreseen. To be able to finish the project positively for all of the participants, we are asking you **for modification of financial structure of the project.**

The project implementation was marked by financial and economic crisis in Slovenia, consequences of which were not expected at the beginning of the project. It has severely affected operation of both associated beneficiaries and required number of adjustments with the aim of successfully achieving project objectives. This had a significant impact also on project's financial structure. Considering that the overall budget remains the same, we would like to ask you to approve relocation of the financial resources among the different cost categories. As a consequence, the budget category Personnel will now exceed the 10% / 30,000 € threshold.

With the modification of financial structure we would like to increase funds available for salaries of our employees. As the structure of work on the project was adjusted due to situation on the market and due to accepted minor technical changes (non-substantial modifications submitted on 31 July 2014, accepted on 22 August 2014), the necessary Personnel funds will be ensured from other categories. We would like to increase category Personnel for 151.500 € using funds from categories External assistance (55,000 €), Equipment (82,500 €) and Consumables (14,000 €).

Realization of project tasks was conducted differently than planned when submitting the proposal. During the project implementation we have realized that the new employees on the project have more knowledge than expected and that they can cope with various problems and find as good if not even better solutions than external contractors. Our employees know the project goals very well and are more motivated to solve the problems and promote the solutions and the project itself than the contractors. Also due to financial crisis the number of contractors suitable for

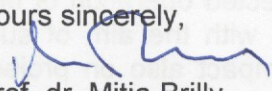
caring out the delicate project actions has greatly reduced. The lack of concurrence among the contractors increased the prices. Therefore it was more economical to invest resources in our own researchers work than paying for external assistance. For example they have developed a few amazing solutions for only a few percent of market price. One of the most acclaimed projects was development of monitoring cameras in the fish passes for which our researchers already received recognition award by Slovenian association of geodesy and geophysics.

The adjusted way of work already proved to be an excellent decision. In year 2015 more work was done than before and majority of project goals were achieved. The possibility to avoid long process of searching for a contractor and negotiating for price, work conditions and deadlines resulted in more effective work of our employees who can now put all of their energy and time to research work on the project. This also encourages the employees on the project to even greater contribution and project promotion also on other scientific fields.

Some changes in project implementations have also arose from work of associated beneficiaries affected by the crisis. Company Geateh d.o.o. lost majority of its employees (already described in second Progress report from 29/1/2015 on page 4) while company Purgator inženiring d.o.o. had to merge with company Purgator d.o.o. (described in request for partnership modification from 16/6/2014). Therefore implementation of action E2 was transferred from company Geateh to University of Ljubljana (coordinating beneficiary) and the postponed implementation of action C2 under supervision of company Purgator, which was delayed due to catastrophic weather conditions, required more funds for personnel than expected.

The new proposed financial structure of the project was carefully prepared taking into account all the expenses that might occur until the end of the project. We guarantee that with relocation of financial resources all the overall project objectives will be achieved by using our own knowledge. We are kindly asking you to examine our request and consider the proposed modification of the financial structure.

Yours sincerely,


Prof. dr. Mitja Brilly
project manager



Detailed explanation of modification of financial structure

Budget item	Original budget		Revised budget		Variation eligible costs	
	Total eligible costs in € (A)	% of total eligible costs (B)	Total eligible costs in € (C)	% of total eligible costs (D)	In € (E=C-A)	In % (F = [E/A-1]x100)
1. Personnel	563,621	48%	715,121	61%	151,500	27%
2. Travel	20,460	2%	20,460	2%	0	0%
3. External assistance	176,386	15%	121,386	10%	-55,000	-31%
4.1 Infrastructure	0	0%	0	0%	0	0%
4.2 Equipment	293,037	27%	210,537	18%	-82,500	-28%
4.3 Prototype	0	0%	0	0%	0	0%
5. Land/rights purchase/lease	0	0%	0	0%	0	0%
6. Consumables	31,600	3%	17,600	2%	-14,000	-44%
7. Other costs	7,200	1%	7,200	1%	0	0%
8. Overheads	76,461	7%	76,461	7%	0	0%
TOTAL	1,168,765	100%	1,168,765	100%	0	0%

Change No1:

Funds from	Funds to
External assistance C2 (37,000 €)	Personnel C1 (14,500 €)
	Personnel C2 (22,500 €)

Action C1 covers the reconstruction of the sill and action C2 covers the reconstruction of fish passes.

The fish pass at Fužine weir was almost destroyed during the autumn high flows in November 2013. Because of that the reconstruction works were more extensive but also the owner of the weir agreed to finance reconstruction of collapsed wall while as part of the project we took care of improvements of the fish pass. This has reduced expected costs of fish pass reconstruction.

Downstream from the Ambrožev trg fish pass a new bridge was built in past years. This has caused the rise of the water under the barrier where the outflow from the

fish pass lies. Because of that no changes were needed anymore in the lower part which significantly lowered the expenses.

The reduction of costs for external assistance in this reconstructions was already described also in request for non-substantial modifications submitted on 31 July 2014.

The expected budget for personnel on actions C1 and C2 was exceeded due to company Purgator's different structure of work and employees than anticipated and delays in actions C1 and C2 (explanation was attached as Annex 9 to project's Midterm report). We would like to use the remaining funds of this two actions to cover their salaries.

Change No2:

Funds from	Funds to
External assistance C3 (18,000 €)	Personnel C3 (12,000 €)
	Personnel D1 (6,000 €)

Action C3 covers the reconstruction of barrier's lifting system at Ambrožev trg and action D1 covers project's dissemination.

The barrier on the Ambrožev trg is protected as cultural and technical heritage. Because of that restoration of the barrier's lifting mechanism with minimal interference in building's architecture is desirable. With our own research work and with development of technology we were able to find different solution which hasn't changed the external appearance of the building but still allowed to achieve the same results as initially planned. The new solution is also more economical.

Looking for a more affordable and suitable solution required more research work therefore personnel costs on this action are higher. We would also like to use some of the remaining funds for dissemination in scope of which we also promote smaller and cheaper measures providing the same impact as in this case.

Change No3:

Funds from	Funds to
Equipment C2 (17,500 €)	Personnel E1 (17,500 €)

Action C2 covers the reconstruction of fish passes and action E1 covers project's management.

Part of reconstruction of fish passes was also purchase and installation of cameras for monitoring of fish migration through the fish passes. But as the fish passes we are dealing with are 70 and 120 years old, no modern equipment is suitable for monitoring or it has to be adjusted which is too expensive. Therefore we decided to develop our own monitoring system with on-line connected cameras. The decision has proved to be correct as the system works great.

The only difference that was required by this change was that again more funds were used for our own employees developing the monitoring system instead of buying it.

This work was taken over by Andrej Vidmar (project coordinator, action E1) and Matej Sečnik (young researcher - biologist, action E2).

Change No4:

Funds from	Funds to
Equipment C3 (65,000 €)	Personnel D1 (10,000 €)
	Personnel E2 (55,000 €)

Action C3 covers the reconstruction of barrier's lifting system at Ambrožev trg, action D1 covers project's dissemination and action E2 covers fish migration monitoring.

Similarly as expenses for external assistance also expenses for equipment on action C3 (the reconstruction of barrier's lifting system at Ambrožev trg) were reduced due to the new solution used for the reconstruction. As exceeded personnel costs on action C3 can be covered by remaining funds from external assistance we would like to use this additional sources for development of system for fish migration (by Matej Sečnik) and for its further development and maintenance. The results provided by monitoring system also needs to be analysed and functioning of fish passes has to be evaluated which can be guaranteed with this funds. Also we would like to continue with promotion of the system itself in Slovenia and abroad as part of dissemination of the project (action D1).

Change No5:

Funds from	Funds to
Consumables C2 and C3 (14,000 €)	Personnel D1 (14,000 €)

Action C2 covers the reconstruction of fish passes, action C3 covers the reconstruction of barrier's lifting system at Ambrožev trg and action D1 covers project's dissemination.

Our own approach to implementation of actions C2 and C3 also resulted in lower costs of consumables.

The different approach to barrier's reconstruction required less input of smaller elements therefore the finances available for consumables remained unspent.

Building our own monitoring system on the fish passes allowed us to economically assess the best offer of consumables needed for its development. When cooperating with contractors this is not possible as they offer a narrower range of solutions and equipment which are also more expensive due to their forwarding. We were also able to develop a monitoring system more effectively as planned. For example instead of installing the solar panels which often gets stolen we decided to connect the system with electrical network.

All of this changes resulted in lower expenses in category consumables which we would like to spent for dissemination of the project's results.

Annex 8:

**Replies to the annexes from the correspondence between the
beneficiaries and EC**

REPLIES TO THE ANNEXES FROM THE CORRESPONDENCE BETWEEN THE BENEFICIARIES AND THE EUROPEAN COMMISSION

LIFE10 NAT/SI/000142 Ljubljana Connects – Progress Report, received on 8 May 2015

Technical issues:

Action A1: Please enrich, as agreed, and complete the document »Proposals for minimization and/or elimination of negative impacts« and resubmit it with the Final report.

The document »Proposals for minimization and/or elimination of negative impacts« will be resubmitted with the Final Report.

Action A2: it is unacceptable that not all the authorizations are available when less than a year is left before the project end. Please, make all necessary efforts to obtain the permits as soon as possible.

Action A2 has been completed and all the necessary authorizations were obtained. The relevant documents and authorizations will be presented with the Final Report as part of project documentation.

Action C2: contrarily to what had been previously reported, the field visit revealed that the works on Ambrožev trg have not started yet. Moreover, it was observed that in Fužine the works are progressing very slowly. Please accelerate and conclude the due works so that the monitoring activities foreseen by action E2 can start.

Action C2 has been completed. After the completion of works we began with monitoring activities under action E2.

Action C3: Please accelerate the implementation of this action, which should have been already concluded.

Action C3 has been completed.

Action D1: I invite you, for the third time, to hold the first round table, now delayed by more than two years. Please submit all real deliverables. For instance, original poster shall be submitted, not only a copy of it.

In 2015 two round tables were held. The first round table was held on 19 June 2015 on the premises of the Municipality of Ljubljana. The first roundtable was held for the local population living along the river, fishermen, biologists, experts who deal with fish passes, and journalists. The second round table was held on 11 November 2015 on the premises of the UL Faculty of Civil and Geodetic Engineering. It was attended by the students who deal, in their master's and diploma theses, with the topic of fish migration. It was also attended by other students interested in the topic, who may encounter the problem of fish migration in their future work.

Action E2: The final aim of the project is to reconnect the northern and southern part of Ljubljana River in order to connect the fragmented populations of two target fish species. I invite you to take the monitoring activities very seriously because their results will make it possible to assess whether the project aim has been fully reached or not.

It was revealed that the method that was proposed in the project proposal for monitoring the migration of fish after reconstruction of fish passages (marking with Visible Implant Elastomer tags) to prove their performance, was not the most appropriate. Using this method, the caught fish are marked according to the location of the catch before released back into the water. Many fish were caught and marked but we received no reports on re-catch. Other researchers had the same negative experience with this method (e.g. PhD student Jeroen Tummers from Durham University, UK, who also used this method in his research). A second technique for monitoring under action E2 is a method using cameras installed in the fish passes. The first camera for monitoring fish migration in the fish pass was installed at the beginning of June 2015 when the reconstruction of the fish pass at Ambrožev trg was completed (C2 action). This method showed satisfactory results immediately. Every time a fish swims past, the camera takes a photo which is locally stored at the site and in an online directory, which is available from our office. The second camera was installed at the fish pass in Fužine, after the completion of works at the fish pass. The monitoring with cameras can provide us with even better results than the VIE tagging method, but this monitoring will typically take longer. Therefore we requested for a postponement of the end date of the project, i.e. until 31 August 2016. The request was approved by the European Commission on 1 December 2015 with Amendment No. 2 to Grant Agreement for LIFE10 NAT/SI/000142 "Ljubljana Connects". The camera takes a picture when it detects a change in movement (when a fish swims past). So far, both cameras have taken more than 100,000 pictures.