



LIFE Project Number
LIFE09 NAT/DE/000008

Final Report
Covering the project activities from 01/01/2011 to 31/12/2015

Reporting Date
08/05/2016

LIFE+ PROJECT NAME or Acronym
**Conservation and restoration of the Allis shad in the
Gironde and Rhine watersheds**

Data Project

Project location	Germany/France
Project start date:	01/01/2011
Project end date:	31/12/2015
Total budget	1.605.827 €
EC contribution:	789.414 €
(%) of eligible costs	49.16 %

Data Beneficiary

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ANNEX

List of abbreviations

LANUV NRW = Landesamt für Natur, Umwelt und Verbraucherschutz Nordrhein-Westfalen / North Rhine-Westphalia State Agency for Nature, Environment and Consumer Protection (coordinating beneficiary)

CEMAGREF = Centre National du machismo Agricole, du Génie Rural, des Eaux et des Forêts (associated beneficiary), has been reorganized and renamed into

IRSTEA = Institut nationale de recherche en sciences et technologies pour environnement et l'agriculture (formerly CEMAGREF)(associated beneficiary)

EPIDOR = Etablissement Public Territorial du Bassin de la Dordogne (associated beneficiary)

MIGADO = Association Migrateurs Garonne Dordogne (associated beneficiary)

ONEMA = Office Nationale de l'Eau et des Milieu Aquatiques (associated beneficiary)

RhFV = Rheinischer Fischereiverband von 1880 e.V. (associated beneficiary)

SMÉAG = Syndicat Mixte d'Etudes et d'Aménagement de la Garonne (associated beneficiary)

NRW = North Rhine Westphalia

HH-Group = Hermann Hofmann Group

YOY = young of the year; fish in their first year of life

2. Executive summary

- Project objectives

The overall objective of the project is the conservation and protection of the Allis shad in Europe. Besides the continuation and optimization of the measures aiming on the re-introduction of the Allis shad to the Rhine system, as being part of the previous Life Allis shad project, the Life+ project aims on the identification of the causes for the current decline of the Allis shad populations in the Gironde basin in the Southwest of France, which furthermore serves as the donor population for stocking the Rhine system. The Life+ project shall thus not only contribute to protect the remaining Allis shad populations in Europe from suffering a similar fate, which led to the species disappearance from the Rhine system and large parts of the former distribution range, but to promote the return of the Allis shad to the Rhine system and thus to serve as a template for future reintroduction and conservation projects for the Allis shad and other species of migratory fish.

One of the main results of the project will be breeding of up to 10 Million Allis shad in the existing Allis shad fish farm in Bruch, France, and stocking these into waters in the Rhine basin, the tracking of adult returners and spawning activities on the Rhine the preparation of guidelines on requirements of Allis shads towards fish passes, an assessment on the efficiency of present fish ways in Gironde watersheds, installation of pilot facilities for Allis shad ex situ stocks in France and Germany and information on the habitat requirements and survival of YOY Allis shad in the Gironde watersheds.

The coordinating beneficiary is LANUV NRW, department 26, and the associated beneficiaries are ONEMA, MIGADO, EPIDOR, IRSTEA (formerly CEMAGREF) and SMÉAG in France and the RhFV in Germany. Co-financing is coming from the Conseil régional d'Aquitaine, HIT-Umweltstiftung, Agence de l'Eau Adour-Garonne, Hessisches Ministerium für Umwelt, Energie, Landwirtschaft und Verbraucherschutz, Électricité de France, Rheinfischereigenossenschaft NRW, Bezirksregierung Düsseldorf, Verband hessischer Fischer and Sportvisserij Nederland.

The numbers of Allis shad found to return to the Gironde watersheds for spawning were, despite the fishing ban in Gironde is still in force, in all years of the project duration, regardless of different hydro-climatic conditions still on a alarming low level, and amongst the smallest ever observed. For that and for organizational reasons not all project actions could be implemented as scheduled.

On the contrary the largest quantities of adult allis shad since the extinction of the original population were recorded in the Rhine system. In two consecutive years furthermore the shads have successfully spawned which was indicated by YOY shads from natural reproduction.

- List of key deliverables and outputs
 - Project management and coordination

The project management is provided by Daniel Fey (who replaced Dr Klinger after his retirement) from the coordinating beneficiary LANUV NRW and Dr Andreas Scharbert, employed by the associated beneficiary RhFV and responsible for the coordination of the project. Besides the organization of events, public awareness campaigns, media work, the main tasks were to coordinate the project actions in France, Germany and the Netherlands

- Study on the efficiency of and improving the of fish-ways

In total 222 shads were trapped and tagged with radio transmitters in order to study their migratory behavior and fish passage facility utilization. The study revealed massive deficits with regard to the efficiency of the fish ways with regard to the ability of the shads to enter and also to stay after having found the entrance. These findings are in line with

the conclusions that can be drawn after visiting modern technical fish passage facilities in the US. Guidelines have been developed for the optimization of fish passage facilities for shads that will be of major importance for future fish ways in recent or potential shad rivers

- Study on the migration routes of allis shad in the Rhine

This study was altered according to the propositions in the Midterm report. Methods for monitoring adult shad returnees by means of floating gill-nets for the Rhine have been developed and successfully implemented: Three adult allis shad returnees were detected this way in the Lower Rhine.

- Installation of pilot facilities for Allis shad ex situ stocks

After the former provider and supporter of facility, the HH-group had to give up the Trockenstabilatanlage the situation for the maintenance of the pilot facility has changed basically and also led to higher than scheduled costs incurred to the project. After an electric short that occurred after retrofitting works the entire ex situ population Aßlar was lost. The growth and condition of the specimen has shown that the conditions for ex situ stocks are promising. Great progress has been made with regard to preventing the development of cystic malformations and related mortalities by adapting the diet. In 2015 the first allis shad were found to mature in captivity, which confirms that it is possible to principally obtain off-spring from genitors in ex situ stocks and the objectives of this action to be reached. .

- Allis shad production, marking, stocking and accompanying monitoring measures

The breeding success in the hatchery in Bruch was not optimal in all years of the project duration due to difficulties with a hormone and the conditions of the genitors in some (cold) seasons. Due to the weak spawning run it was furthermore not possible to increase the amount of genitor fish from the wild spawning population. The overall amount of larvae produced and released in the Rhine was smaller than intended. Although the releasing of the larvae was conducted without encountering any problems as in the previous years no larvae or juveniles were recaptured in the monitoring measures

- Survey on the YOY allis shad on the Gironde basin

Regardless of the small size spawner stock in all years of study (2011 to 2014) and the related small size of the YOY cohort it repeatedly succeeded to sample YOY shads in the Garonne (148 in total by means of push-nets as well as by means of seine and gill-nets. The numbers of the juveniles caught was still too small to analyze the relatedness to habitat conditions. By means of otolith readings the age of the YOY and by that the timing of emigration from the rivers and possible threads imposed by the passage through the hypoxic lower reaches of the Garonne could be assessed.

- Public awareness

Major press events were held, one on the occasion of allis shad festival, the school class programme, the inauguration of the allis shad exhibition in the Aquazoo and the return of adult shads to the Rhine. An international symposium about shads brought international and renowned migratory fish experts, stakeholders and decision makers together and helped to pave the way for addressing future conservation needs. A vast number of articles, TV and radio reports, scientific publications, technical reports, the layman's report and the After-Life-Conservation-Plan about the Life+ project were released.

3. Introduction

In a combined European approach the LIFE+ Project *Alosa alosa* was focussing on two different main objectives: the reestablishment of a self-sustaining allis shad population in the River Rhine basin as well as the conservation of the formerly largest remaining population in the Gironde basin. In the Rhine basin the actions comprised the releasing of allis shad larvae which were obtained from the so far only existing allis shad hatchery in the French Aquitaine, the monitoring of the YOY following their releasing, as well as the monitoring of the returning of allis shad from the past stocking and spawning activities in the Rhine, in order to proof the success of the reintroduction programme and the onset of a natural population development in the Rhine basin. The hatchery, the breeding, marking and releasing techniques have yet been developed in a previous Life project (LIFE06 NAT/D//000005), in which already 4.8 Mio allis shad larvae had been released in the Rhine basin between 2008 and 2010, which have according to the regular life cycle duration of the species to be expected about five years after the beginning of the reintroduction project from 2013 onwards, i.e. in the LIFE+ projects duration. Besides the continuation of the achievements of the previous LIFE project the LIFE+ project also aimed to develop and implement techniques for monitoring the returnees. Please note that these actions furthermore represent the first attempt to reintroduce the allis shad in Europe into a river system at all.

By the beginning of the 20th century this anadromous clupeid species still occurred widespread across the river basins between North Africa and South Sweden draining into the Atlantic Ocean, the North Sea and Western Mediterranean Sea and was very abundant and economically important. In the biggest part of the original distribution area, amongst these in the Rhine basin, the population collapsed due to combination of factors from which the most important were over-exploitation, habitat loss and fragmentation, as well as water pollution. The species is today listed in the annexes II and V of the EU habitat directive. Vital allis shad populations remained only in the very South-West of the distribution area in some rivers in France, Portugal and Morocco, from which that in the Gironde-Garonne-Dordogne system was still one decade ago the largest and economically most important. For that reason it was also selected to serve as the donor population for the re-introduction project in the Rhine basin. In 2006, right when the proposal for the first LIFE project was submitted, this population began to decrease sharply and unexpectedly. Although 2008 a fishing moratorium was imposed the population didn't recover on her own. Already in 2003 a monitoring of the YOY allis shad in the Gironde estuary yielded a decreasing of the YOY – yet at a time when the spawner stock was still large and apparently vital. Obviously these findings already indicated problems in the recruitment, which became more and more obvious in the following years with a related and ongoing decreasing of the numbers of adults returning for spawning. As no major changes that could explain this collapsing occurred in the river basin and no relevant habitats were lost or cut-off by newly created obstacles for migrating shads, the decreasing must be addressed to other factors, which to identify and to point out how the situation can be improved was the objective of the Life+ project in the Gironde watershed part of the project area. At the time when the proposal for the Life+ project was submitted impairments of migration caused by the inefficiency of technical fish ways as well as with regard to the survival of the YOY in the first weeks of life, which are spent freshwater before the young shads emigrate to the estuary and from there to the Sea, seemed to be the most likely hypothesis and were addressed by specific surveys in the proposal. Furthermore pilot studies on ex situ techniques for allis shad and an associated study on the maturation of the shads in captivity aimed to contribute to the conservation of the species and future stocking measures. No specific sites (apart from the fish ways) or habitat types were targeted in neither basins. The major socio-economic aspect is to improve the prospects of allis shad fisheries as many of the formerly numerous fishing companies had to give up in the meanwhile.

4. Administrative part

4.1. Description of the management system

The project objectives were realised by a project team consisting of the coordinating beneficiary LANUV NRW, one German associated beneficiary RHFV, which main task is the project coordination as well as five French associated beneficiaries, which are mainly responsible for the implementation of the actions in France but also exchanges with the German actions: The main tasks of the beneficiary ASSOCIATION MIGADO, already project partner in the previous Life project, was the production of Allis shad larvae for stocking the Rhine and the transfer of know-how for rearing techniques to Germany. The associated beneficiary CEMAGREF was renamed into IRSTEA. The legal state and role as an associated beneficiary hasn't changed towards CEMAGREF. IRSTEA's main responsibility was the maintenance of the pilot facility for an ex situ stock in the Aquarium La Rochelle and the conduction of the studies on the maturation parameters. The beneficiary ONEMA prepared the guidelines for the optimization of fish passage facilities for Allis shad. The beneficiary EPIDOR task is to assess the efficiency of the existing fishways on the lower parts of the Garonne and the Dordogne. The beneficiary SMÉAG will conduct the studies on the YOY shads during the freshwater phase. Besides the support of the EU, co-financing is coming from French (Conseil regional d'Aquitaine, EDF, Agence de l'Eau Adour Garonne), German (HIT-Umweltstiftung, RFG NRW, Bezirksregierung Düsseldorf, Hessisches Ministerium für Umwelt, Energie, Landwirtschaft und Verbraucherschutz, Verband Hessischer Fischer) and Dutch (Sportvisserij Nederland) organisations.

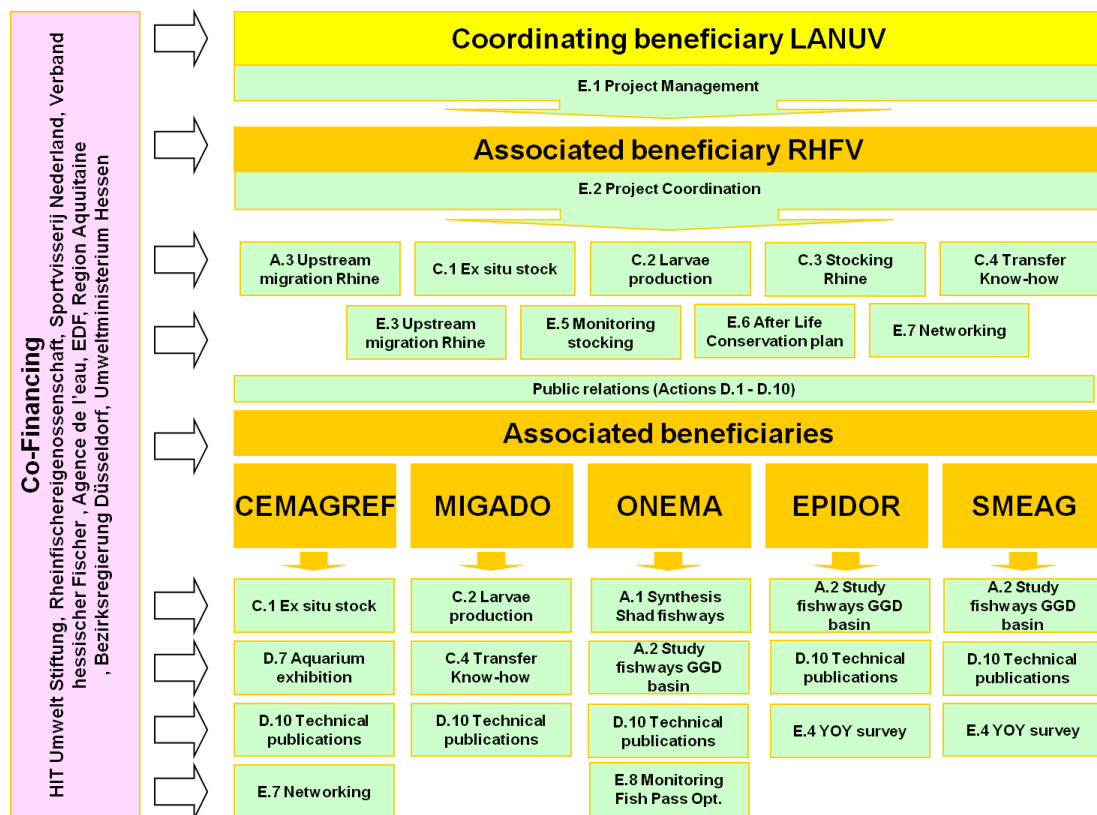


Figure 1: Organigramme of the project team and project management structure. Please note that CEMAGREF was renamed into IRSTEA in 2011

The project management is shared between the LANUV which responsibility is besides representative tasks, the conduction of financial-administrative remits, tendering procedures and the communication with the EU (action E.1) and the RhFV at which the external project coordinator Dr. Andreas Scharbert is employed, who is responsible for the overall technical and organisational management and the coordination of the beneficiaries and the actions carried out by these, the financial reporting, the preparation of the external auditing, the organisation of events and dissemination activities, including press releases and conferences (action E.2). Please note that besides the actual tasks of the project management, the maintenance of the pilot ex situ stock facility and the implementation of action C.1 belonged to the fields of duty of the project coordinator, which required a considerable additional effort (see action C.1), including several meetings and practical involvement into the installation, and into maintenance works. To lessen the effort for these tasks local managers for the maintenance of the ex situ facility have been found from 2014 onwards.

Project meetings with the French beneficiaries were held on a regular basis, depending on the tasks to solve at least once to four times per year. These meetings were regularly held in the Aquitaine, where all French beneficiaries are resident.

Apart from these meetings at which all associated beneficiaries participated, further events like allis shad festivals, the best-of-the-best-award in Brussels or getting-together with external or strategic partners (e.g. University of Coblenz-Landau in Landau/Germany, Association Saumon-Rhin in Strasbourg/France etc.) were used for additional meetings and to exchange organisational and technical issues with the attendant beneficiaries. Publications of the project, including the project documentary, flyers, brochures, the laymans report, the after-life-conservation plan as well as technical publications were as possible coordinated with all beneficiaries. This also applied to the preparation of the project symposium in Bergerac/France held in October 2015. The local organization of the symposium was mainly implemented by the associated beneficiary EPIDOR.

Table 1: Regular project meetings

Date	Location	Participating beneficiaries	Particip	Other participants
22.02.2011	Bordeaux/F	Dr. Andreas Scharbert (RhFV), David Clavé (MIGADO), Philippe Jatteau (Cemagref), Aline Chaumel (Sméag), Matthieu Chanseau (Onema), Olivier Guerri (Epidor)		Maren Thomas (Region Aquitaine)
15.03.2011	Düsseldorf/D	Dr. Andreas Scharbert (RhFV), Dr. Heiner Klinger (LANUV)	Jörg Böhringer	Dr. Schulze-Wiehenbrauck, Ingrid Rudolph (MKULNV NRW), Frank Klingenstein (BMUB)
25.05.2011	Bruch/F	Andreas Scharbert (RhFV), David Clavé (MIGADO), Philippe Jatteau (Cemagref), Aline Chaumel (Sméag), Matthieu Chanseau (Onema), Olivier Guerri, Pascal Verdeyroux (Epidor)	Jörg Böhringer	
20.06.2011	Braunfels/D	Andreas Scharbert (RhFV), David Clavé, Sylvie Boyer-Bernard (MIGADO), Philippe Jatteau (Cemagref)		
18.10.2011	Wetzlar/D	Dr. Andreas Scharbert (RhFV), Dr. Heiner Klinger (LANUV)	Jörg Böhringer	Walter Fricke (RP Giessen)
16.02.2012	Mouleydier/F	Andreas Scharbert (RhFV), David Clavé (MIGADO), Philippe Jatteau (Cemagref), Aline Chaumel (Sméag), Matthieu Chanseau (Onema), Olivier Guerri, Pascal Verdeyroux (Epidor)		
10.05.2012	Cestas/F	Andreas Scharbert	Jörg	

		(RhFV), David Clavé (MIGADO), Philippe Jatteau (Irstea), Aline Chaumel (Sméag), Matthieu Chanseau (Onema), Olivier Guerri, Pascal Verdeyroux (Epidor)	Böhringer	
23.05.2012	Brüssel/B	Dr. Heiner Klinger (LANUV), Andreas Scharbert (RhFV), Alain Guillaumie (MIGADO), Philippe Jatteau (Irstea),		Hans Burgwinkel (Poller Maigeloog), Dr. Stefan Staas (Rheinfischerei genossenschaft NRW), Karl Apel (HMUELV), Cristoph Heider (HIT-Umweltstiftung), Walter Sollbach (RhFV)
06.06.2012	Aßlar/D	Andreas Scharbert (RhFV), David Clavé, Sylvie Boyer-Bernard (MIGADO), Philippe Jatteau (Irstea)		
12.09.2012	St. Seurin/F	Andreas Scharbert, Frank Molls (RhFV), David Clavé (MIGADO), Philippe Jatteau (Irstea), Daniel Fey (LANUV),		
25.06.2013	Mouleydier/F	Andreas Scharbert (RhFV), David Clavé (MIGADO), Philippe Jatteau (Irstea), Aline Chaumel (Sméag), Matthieu Chanseau (Onema), Olivier Guerri, Pascal Verdeyroux (Epidor)	Jörg Böhringer	
17.03.2014	Mouleydier/F	Andreas Scharbert (RhFV), David Clavé		

		(MIGADO), Philippe Jatteau (Irstea), Aline Chaumel (Sméag), Matthieu Chanseau (Onema), Olivier Guerri, Pascal Verdeyroux (Epidor)		
03.06.2014	Le Passage/F	Andreas Scharbert (RhFV), David Clavé (MIGADO), Philippe Jatteau (Irstea), Aline Chaumel (Sméag), Matthieu Chanseau (Onema), Olivier Guerri, Pascal Verdeyroux (Epidor)	Jörg Böhringer	Alain Guillaumie, Alain Lartique (MIGADO)
29.01.2015	Mouleydier/F	Andreas Scharbert (RhFV), David Clavé (MIGADO), Philippe Jatteau (Irstea), Aline Chaumel (Sméag), Matthieu Chanseau (Onema), Olivier Guerri, Pascal Verdeyroux (Epidor)		
13.04.2015	Le Passage/F	Andreas Scharbert (RhFV), David Clavé (MIGADO), Philippe Jatteau (Irstea), Aline Chaumel (Sméag), Matthieu Chanseau (Onema), Olivier Guerri, Pascal Verdeyroux (Epidor)		Alain Guillaumie, Alain Lartique (MIGADO)
09.09.2015	Giessen/Kirchhündem/D	Andreas Scharbert (RhFV), Karin Camara, Elisabeth Holterhoff (LANUV)	Jörg Böhringer	Frau Rack, Herr Heeres (EC), Dr. Heiner Klinger (ex LANUV); Frank Klingenstein (BMUB)
09.12.2015	Mouleydier/F	Andreas Scharbert (RhFV), David Clavé (MIGADO), Philippe Jatteau (Irstea), Aline Chaumel (Sméag), Matthieu Chanseau		

		(Onema), Pascal Verdeyroux (Epidor)		
02.2016	Siegburg	Andreas Scharbert, Frank Molls (RhFV), Daniel Fey (LANUV)	Jörg Böhringer	

The project coordinator prepared partnership agreements between the coordinating and the associated beneficiaries, which rule the role, obligations, and rights of each of the contracting parties, delivery deadlines, and payment schemes, and further aspects which are relevant to guaranteeing a smooth cooperation and project progress. Such partnership agreements have been signed by all participating beneficiaries and were sent to the commission together with the inception report.

No major amendments from the grant agreement were required. Minor changes with regard to technical aspects (e.g. in action A.3), delays in the conduction of certain actions (e.g. A.1) and shifts between cost categories (e.g. in action A.2) were communicated to the commission in earlier reports or letters.

The project coordinator participated at Life workshops and meetings, held presentations and published at following occasions:

- Participation at several LIFE workshops (in Germany, Estonia)
- Various technical presentations at seminars and workshops (e.g. BFG, DAFV, ICPR, Grüne Liga, Universities, and steering groups of migratory fish programs) in Germany, Switzerland and France have been held
- Various journal articles, book chapters, and conference proceedings have been written and published
- Major press releases have been coordinated
- Monitoring schemes have been organized implemented under the participation of the project coordinator
- Networks that enabled to gather information about shad occurrences in the Rhine basin, the collection, and investigation of shad specimen without charging costs to the project have been developed.
- Journalists have been supported. That way documentaries and reports about the project were prepared

4.2 Evaluation of the management system

The cooperation in the binational project team worked out very smooth and constructive and no problems were encountered in the entire project duration. The splitting of project management's tasks between the coordinating beneficiary LANUV and an external project coordinator employed with the associated beneficiary RhFV was proven to work out very efficiently and was already established in the previous LIFE project. The project coordinator Dr. Andreas Scharbert, successor of Dr. Peter Beeck in September 2010, was the same as in the LIFE project although at this time employed at the STIFTUNG WASSERLAUF. The same applies to the collaboration with French associated beneficiaries, as the Association MIGADO as well as IRSTEA/CEMAGREF, were already associated beneficiaries in the previous LIFE project. The original project manager Dr. Heiner Klinger in the LANUV retired in autumn 2013, as announced to the commission in the midterm report. The tasks of the project management weren't not affected by this and the cooperation between his successor Mr Daniel Fey, the project coordinator and the beneficiaries was as well as with Dr. Klinger.

The major issue affecting the implementation of the actions was not due to organisational reasons but to the even worse than expected development of the allis shad population in the Gironde-Garonne-Dordogne-System. Regardless of these implications no deviations from the project proposal and the arrangements fixed in the partnership agreements occurred in general. All beneficiaries not only contributed their share to the project that was fixed in the above documents, but also supported the project management in terms of collaborations at dissemination materials, events and scientific publications. Additional support was provided with regard to the translation into the opposite languages.

A notable added value was reached in terms of networking far beyond the actual project topics with regard to cross border collaboration even in other migratory fish species, e.g. technical exchanges about the salmon reintroduction projects in North Rhine Westphalia and the Dordogne basin, as well as the support provided to external scientific studies at the Universities of Coblenz-Landau and the University of Giessen, mainly by the associated beneficiary MIGADO in terms of tissue samples, eggs and the possibility to let the students live and work together with the team in the allis shad hatchery in Bruch. Together with the beneficiaries a remarkable network was built comprising most people in Europe that work with shads ensuring the exchange of information between scientists and stakeholders in the river basins. Although already many of these experts participated at the Life+ allis shad symposium in Bergerac additional input for the shad Network as well as for the other topics of work of the beneficiaries could be won at this occasion.

At least one team meeting per year was attended by Mr Böhringer from the external Monitoring team and used to exchange about the recent developments in the project and to communicate with the commission. The project management frequently consulted Mr Böhringer in different technical, organisational and financial issues emerging from recent developments. Misses Rack and Mr Heeres from the European Commission visited the ex situ stock pilot facility in Aßlar and the associated scientific studies at the University of Giessen and the LANUV office in Kirchhundem in September 2015.

5. Technical part

In the previous Life project (LIFE06 NAT/DE/000005) measures aiming on the reintroduction of the Allis shad to the Rhine basin, have been started. The project also represented the first attempt to artificially breed allis shad from genitor fish coming from one the few remaining population of the species to re-establish a population and by releasing the progeny in a river system in its native range. Accompanying monitoring studies have the young Allis shad proven to settle in river habitats and to successful grow into juveniles which finally emigrate from the river to the estuary in autumn. With these findings an important threshold for the long-term objective to re-establish a self-sustaining Allis shad population in the Rhine basin was reached, all the more since mappings of potential spawning habitats and studies on how young Allis shad might be impaired by the intensive navigation on the Rhine, have demonstrated, that the habitat conditions in the Rhine are suitable for achieving these aims.

However, the objective to re-establish a self-sustaining population requires to continue the stocking measures for an extended period and many generations in order to ensure the development of a sufficient stock of adults as a basis for the recruitment in the wild as well as conducting monitoring studies being suitable to measure the progress (i.e. survival of YOY, numbers of adult returners to the basin, proofed spawning in wild, natural recruitment etc.). For the period from 2011 to 2015 the LIFE+ project was to ensure that the stocking measures can be continued by producing shad larvae in the fish farm in Bruch (action C.2) and by implementing the know-how gained so far in terms of the rearing, transporting and stocking procedures (action C.3) and that monitoring schemes can be carried out to further improving the stocking measures (action E.5) and to gathering information on returning adults (action A.3), their migration routes in the Rhine basin and spawning activities (action E.3).

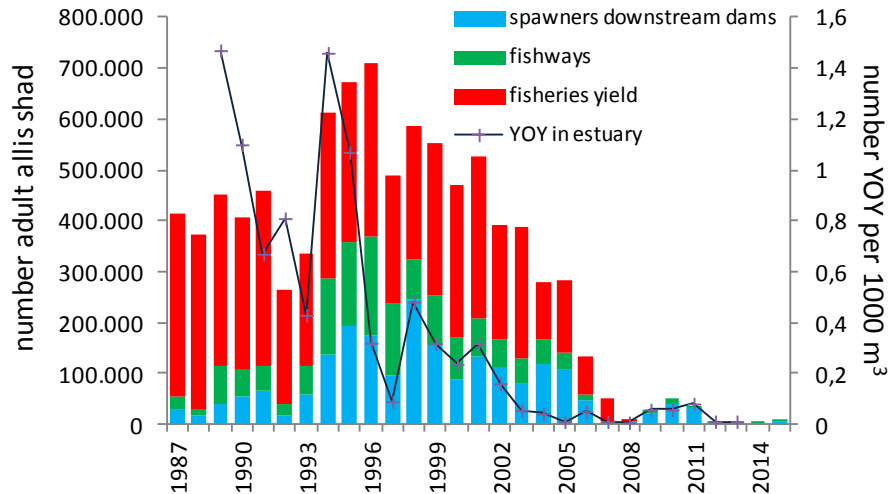


Figure 2: Development and exploitation of the allis shad population in the Gironde watersheds: The number of allis shad caught by fishermen (red – since 2008 no fisheries for allis shad), the number counted in the fishways at the dams (turquoise) and on the spawning grounds downstream of the dams in the rivers Garonne and Dordogne (blue) and the number of the YOY allis shad (per 1000 m³) sampled in monitoring studies in the Gironde estuary (crosses). Please note that the assessment of the YOY stock in the estuary is based on a rather small sample size and not as accurate as the monitoring of the adult stock.

When the Life+ project proposal was submitted the Allis shad population in the Gironde watershed has already begun to decrease severely. Although in 2008 a moratorium on Allis shad was set into force, which henceforth prohibited the exploitation of the Allis shad's population in the Gironde basin, the numbers of adults entering the rivers for spawning did not increase again but seem to have recently stabilized on a low level. As the number of shads passing through the fish-ways on the Garonne and Dordogne didn't amount to much more than one thousand specimen in the last three years, and as the number of the entire assessed population was only between 3000 and 5000 spawners, which is less than 1% of the population in the 1990ies decade and even much lower than in the most pessimistic assessments at the time of the project proposals submission. Within the LIFE + project we aimed to analyse the bottlenecks for the species like river connectivity (action A.2), or reproduction success (action E.4) and improve the migration possibilities with re-defining the state-of-the-art fish pass design with new information from the USA (action A.1). Furthermore we aimed to develop the basis for future ex situ stock facilities for Allis shad at locations in France and Germany (action C.1), in order to ensure, that shad populations can be kept in captivity for genetic conservation purposes and to obtain young shads for stocking purposes without needing to exploit the populations in the wild. Please note that some of the actions carried out in the Gironde basin were affected negatively, due to either a reduced availability of adults as well as juveniles from natural reproduction as the basis for the studies (A.2, E.4). Regardless of the smaller than envisaged available sample sizes, all actions could be conducted according to the project proposal and yielded some interesting results

5.1. Technical progress

5.1.1. Action A.1 A synthesis of knowledge of shad passage facilities

Like in other migratory fish species habitat fragmentation caused by dams and other anthropogenic obstacles is considered to be one of the main reasons for the declining of the populations also in the allis shad. Even though many of these structures have been equipped with different kinds of fish migration helps in the last decades, such as slot and pool passages, fish lifts, ramps etc. and helped to regain formerly inaccessible habitats in the upstream regions for salmon and other diadromous species, the requirements of the allis shad towards fish ways seem to be more complex and constitute problems for the populations in the current shad rivers and rivers formerly housing shad populations.

The main objectives of A.1 action were to realize a knowledge synthesis on the efficiency of the various fish ways used in France and Europe for the Allis shad and write a report on the current knowledge and main recommendations to be considered in order to minimize the impact of obstacles and maximize the efficiency of fish ways. There is little data on the behaviour of European shad at obstacles and in fish ways. As there is more significant information on the American shad, especially for the East Coast of the United States, it appears important to have in practice a better knowledge concerning the fish ways built in the US, their efficiency and the way to improve it, and also the behaviour of fish.

The study was coordinated by the associated beneficiary ONEMA. Originally it was intended to conduct the study together with the fish migration experts Michel Larinier and Jean Travade, who retreated unexpectedly in 2012. The identification, tendering and availability of alternative service providers with adequate skills required that the excursion to the US as part of the study needed to be postponed several times. After commissioning the experts of WSP the excursion took place in May. Additionally and as intentionally planned experts from EDF, which operate the majority of hydropower stations in France, were involved in the study. Besides the experts met at the dams in the US (Dams Companies and Laboratories; Alden, Conte) additional knowledge was gained by exchanging with British experts and companies (please note that a shad fish pass tour was organized from 14/04 to 17/04/2015 in France (Adour and Dordogne systems) with participants from the LIFE+ project team and experts from the Environmental Agency, Severn Rivers Trusts, Canal and River Trust and Fishtek) and experts from Portugal.

The schedule of implementing action A.1 was as follows:

- 1) Determination of the rivers and obstacles to visit (from 2011 onwards)
- 2) Creation of a data bank (studies, reports, publications) on Dropbox by WSP
- 3) Literature analysis and in particular the studies conducted on the sites to be visited
- 4) US trip May (18-29, 2015): coordinating with dam managers; organization of meetings with Alden Laboratory and S.O. Conte Anadromous Fish Research Center
- 5) Analysis of data and exchanges with US experts concerning complementary information or studies...
- 6) Writing the report (in summer and autumn 2015)

In deviation from an inquiry in the mid-term report neither David Clavé from the associated beneficiary MIGADO nor the project coordinator Andreas Scharbert could attain the excursion



Figure 3: View of Conowingo powerplant and the fish lift on the Susquehanna river (left) and the fish pass of Cabot Station on the Connecticut river (right)



Figure 4: View of the downstream entrance of the fish lift of Holtwood powerplant on the Susquehanna river (left). Unfavourable hydraulic conditions downstream Gate House on the Connecticut river (right).

After successfully implementing action A.1 the objectives were fully reached. The outcome is a document which will be very soon the reference for fish ways suited for allis shad in France and probably in other countries.

However, it seems impossible to guarantee efficiencies of more than 70-75% even when complying with recommendations established in the report, especially for sites of significant size. Considering these conditions, the cumulated impacts of a couple of structures on one migratory axis quickly become very significant and can sometimes make the management and restoration of the species difficult, especially when the structures are located in the lower sections of basins, downstream of the best areas for reproduction and growth of juveniles (as being the case in GGD basin).

Table 2: Main characteristics of rivers, powerplants and fish pass visited in the US

SITE		DISTANCE À L'Océan (km)	MODULE (M³/s)	DÉBIT MOYEN EN MAI (M³/s)	DÉBIT MAX. DÉRIVÉ (M²/s)	TYPE DE PASSE	NOMBRE ENTRÉES FONCTIONNANT EN 2015	DÉBIT TOTAL DANS LA PASSE (M³/s)	ANNÉES DE SUIVI	EFFECTIFS ALOSES		
										Min.	Moy.	Max.
Susquehanna	Conowingo	16	1 165	1 365	2 400	Ascenseur	2 ¹	8,5	1997 - 2015	8 341	58 113	193 574
	Holtwood Usine	39	1 090	1 280	1 700	Ascenseur	2	17	1997 - 2015	21	20 099	109 976
	Holtwood Déversoir					Ascenseur	1	5,7				
	Safe Harbor	50	1 060	1 245	3 200	Ascenseur	2	17	1997 - 2015	8	15 324	89 816
	York Haven	88	980	1 150	480 ²	Passe à bassins (chicane)	1	7,5	2000 - 2015	0	1 929	16 200
Merrimack	Lawrence	48	245	355	210	Ascenseur	1	3,5	1983 - 2015	1 205	25 550	86 857
	Lowell Usine	70	225	330	215	Ascenseur	1	3,5	1989 - 2015	383	4 647	17 310
Connecticut	Holyoke Usine	139	505	680 ³	235	Ascenseur	2	6,8	1967 - 2015	19 000	259 901	720 000
	Holyoke Déversoir					Ascenseur	1	5,7				
	Turners Falls Centrale Cabot	198	395	540	390	Passe à bassins (Ice Harbor)	1	10,5	1980 - 2015	11	14 773	60 089
	Turners Falls Gate House				500	Passe à bassins (2 fentes)	2	14,3				
	Turners Falls Déversoir				Déversoir de crue	Passe à bassins (Ice Harbor)	1	9				
	Vernon	228	365	500	485	Passe à bassins (Ice Harbor + chicane)	1	7,3	1981 - 2015	9	7 265	39 791
	Bellow Falls	280	295	465	410	Passe à bassins (1 fente)	1	2,3	44 aloses en 2015			

Table 3: Summary of some US studies concerning the efficiency of fish pass for shad

RIVIÈRE	SITES (ANNÉE)	RÉFÉRENCE	TYPE DE PASSE	ATTRACTIVITÉ "LOINTAINE"	ATTRACTIVITÉ "PROCHE"	ATTRACTION "TOTALE"	TAUX DE FRANCHISSEMENT DU DISPOSITIF	EFFICACITÉ
Susquehanna (États-Unis)	Conowingo (2010)	Normandeau et Gomez and Sullivan, 2011	Ascenseur	90 % (n = 80)	81 % (n = 65)	73 %	62 % (n = 40)	45 %
Susquehanna (États-Unis)	Conowingo (2012)	Normandeau et Gomez and Sullivan, 2012	Ascenseur	64 % (n = 42)	69 % (n = 29)	44 %	59 % (n=17)	26 %
Susquehanna (États-Unis)	Holtwood (2008)	Normandeau et Gomez and Sullivan, 2011	Ascenseur	--	--	75 % (n = 96)	15 % (n = 14)	11 %
Susquehanna (États-Unis)	Holtwood (2010)	Tryniewski et al., 2012	Ascenseur	--	--	63 % (n = 86)	53 % (n = 46)	34 %
Susquehanna (États-Unis)	York Haven (2010) ¹	York Haven Power Company, 2011	Passe à bassins (fentes + chicanes)	82 % (n = 28)	32 % (n = 9)	26 %	56 % (n = 5)	15 %
Connecticut (États-Unis)	Holyoke (1980)	Barry et al., 1982	Ascenseur usine ²	--	--	--	--	42 % (n = 5)
Connecticut (États-Unis)	Holyoke (1981)	Barry et al., 1982	Ascenseur	--	--	--	--	67 % (n = 4)
Connecticut (États-Unis)	Holyoke (2011)	Sprinkle, 2012	Ascenseur	--	--	--	--	65 % (n = 35)
Connecticut (États-Unis)	Turners Falls - Gate House (2008)	Castro-Santos et al., 2014	Passes à bassins (fentes) avec canal collecteur	--	--	51 % (n = 19)	47 % (n = 9)	24 %
Connecticut (États-Unis)	Turners Falls - Gate House (2009)	Castro-Santos et al., 2014	Passes à bassins (fentes) avec canal collecteur	--	--	14 % (n = 6)	50 % (n = 3)	7 %
Connecticut (États-Unis)	Turners Falls - Gate House (2009) ³	Castro-Santos et al., 2014	Passes à bassins (fentes) avec canal collecteur	--	--	36 % (n = 5)	60 % (n = 3)	21 %
Connecticut (États-Unis)	Turners Falls - Gate House (2010)	Castro-Santos et al., 2014	Passes à bassins (fentes) avec canal collecteur	--	--	47 % (n = 18)	50 % (n = 9)	24 %
Connecticut (États-Unis)	Turners Falls - Gate House (2010) ³	Castro-Santos et al., 2014	Passes à bassins (fentes) avec canal collecteur	--	--	98 % (n = 45)	27 % (n = 12)	26 %
Connecticut (États-Unis)	Vernon	Castro-Santos, 2011	Passe à bassins (Ice Harbor)	58 % (n = 19)	42 % (n = 8)	24 %	0 %	0 %
Merrimack (États-Unis)	Lawrence (1993)	Lawrence Hydroelectric Associates, 2013	Ascenseur	--	--	--	30 %	--

It seems necessary to address future research to the behaviour of the shad near and inside the fish ways. In France, interesting information could be extracted from the fish ladders with multiple entrances built at major hydroelectric stations on the Rhine, Rhône, Dordogne and Garonne. It appears also important to monitor rock ramps, which are said to be efficient for shad, but for which we do not have precise information. It would be useful to optimise the V trap system of lifts. Finally, improvements that will be made in the US as to optimise migration and related studies for the hydroelectric authorisation renewal must be monitored

(including Holyoke and Turners Falls on the Connecticut, Lowell on the Merrimack, and Conowingo, Holtwood and York Haven on the Susquehanna).

The main requirements with regard to optimising fish ways for shads can be described as following: Given their a) short migration period, b) the fact that they move in schools, and c) their exploratory capacities which are far more limited than other species such as the salmonids, it is essential to allow shad to easily and quickly find the fish ways, to enter into them with minimum reluctance and move without constraint.

To do so, it appears important in particular:

- that the water discharge in the fish way should correspond to a minimum of 3% to 5% of the concurrent flows (more if possible) ;
- the fish ways should be installed in various areas of the obstacles likely to be visited by shad (i.e. in case of multiple channels, diverted reaches, etc.);
- to multiply the number of entrances while making sure they are located in calm areas (from a hydraulic point of view to ensure attraction. The installation of several entrances must be assessed when the structures' width is more than 20 m. For structures with a width of more than 100 metres, it is necessary, in most cases, to install several entrances or fish ways;
- for hydroelectric stations, to implement rules on the prioritization of units in operation in order to attract fish near the entrances (without reducing the attraction);
- to ensure good attraction of entrances up to flows of about twice the mean annual discharge of watercourses, while maintaining falls of 0.20 to 0.25 m;
- to have entrances of large size given that the species moves in schools. Minimum width and depth of 2 m and 1.5 m, respectively, can be considered which corresponds to flows per entrance of 5 to 6 m³/s. On small obstacles, entrances must have a minimum width and depth of 1 m and 0.7-0.8 m, respectively, i.e. a minimum flow of about 1.5 m³/s.

Conditions favourable for an easy and quick migration of shad must be ensured once fish are inside the fish ways. The following criteria are particularly important: a) selection of the type of fish way, b) internal hydraulic conditions and c) the size of the structures (considering the fact that shad move in schools).

The report is available in French and English language (see Appendix 1 and 2). It will be available on the website of ONEMA, the official project website and the symposium website. It will be presented during the national seminary organised by ONEMA in May 2016. A scientific publication will be prepared and probably be submitted in 2017.

This report will be very soon the reference in France and probably in others countries. It will be sent also to American experts, Environment Agency and some companies which work on fish ways (for example Fishtek in Great Britain, Ingenieurbüro Flocksmühle, Ebel, etc. in Germany) or the Bundesanstalt für Gewässerkunde in Germany, the Rijkswaterstaat agency in the Netherlands etc..

The findings of the action A.1 will already be implemented to improve the efficiency of the present fish ways in the GGD basin (see following chapter A.2)

5.1.2. Action A.2 Study of the efficiency of fishways located on the lower part of the Gironde-Garonne-Dordogne basin

The Bergerac, the Tuilières, and the Mauzac dams located on the lower Dordogne river and the Malause-Golfech structure on the lower Garonne are major impediments for the migratory fish populations and inhibit the access to the majority of the breeding habitats of the allis shad and of the sea lamprey. These upstream areas are considered as the most favourable and historically important spawning grounds.

Although the dams were all equipped with fish passage facilities for upstream migration (pool-type passes, fish lifts and/or baffle fishways) between 1985 and 1989, the efficacy of those devices has never been precisely measured and for a number of years observations indicate that the fish are sometimes confronted with substantial difficulties to pass those structures. In the context with the decreasing of the allis shad population and taking into account that the current spawning activity in Dordogne river of 95 % of allis shad population is confined to an only 30 km long river lower reach stretch around the city of Bergerac, it became important to describe the shad behaviour and difficulties to cross the dam in order to identify ways to improve the effectiveness of these fish passage facilities.

The shad's behaviour during its upstreaming migration and the efficiency of the fishways at the dams of Golfech (Garonne river), Bergerac and Tuilières (Dordogne river) was addressed in this action by using radio telemetry techniques. The study was conducted by the staff of the associated beneficiary EPIDOR.

The aim of this action was to assess the fish ladders efficiency, to find out which part of each ladder can be problematic and if possible to propose measures for improvement. A total of 222 allis shad was trapped at the fishways in Tuilières (Dordogne) and Golfech (Garonne) for tagging. The shads were narcotized, measured and equipped with coded ATS radio-transmitters (model F1820 C), which allow the identification of each single tagged specimen, which movements in the river stretch as well as the approaching and moving at the fishway could be recorded with mobile and fixed antenna stations. After full recovery from narcosis the shads were released downstream the 3 dams of Golfech, Bergerac and Tuilières and their movements tracked for several weeks. This way not only information about the behaviour of the allis shads towards as well as inside the fishways, but also spatio-temporal movement patterns including the location of the spawning, were won. Because of the small number of shads sampled, no individual has been released downstream Mauzac. As no tagged shad managed to surmount the Tuilières dam, no data are available for the Mauzac dam.

24 tagged shads have been detected downstream close to the dams. They have tried to get upstream during a total of 29 days. At Golfech, the tagged shads entered 15 times in the fish ladder (during 6 days). At Bergerac, they came 3 times in the fish ladder (during 2 days). Not any single specimen managed to successfully enter the Tuilières fish passage facility. Finally, only one tagged shad has succeeded to get upstream through one of the fish passage facilities (at the Bergerac dam).

Although the planned number of tagged shads has not been reached, the study revealed some specific problems at the three fish passage facilities under study, which can be concluded as follows. In Golfech, the most problematic issue seems to be the progression of shads in the device.

Table 4: Figures of the total and upstream migrating part of the allis shad population at the fish passage facilities on the Garonne and the Dordogne and numbers of intended (according to the project proposal) and actually tagged shads between 2011 and 2014.

	Garonne			Dordogne			Entire population			
	estimated population	number of passed shads	number actually tagged	estimated population	number of passed shads	number actually tagged	estimated population in basin	total number of migrants (Golfech and Tuilières)	intended number for tagging	total of actually tagged shads
2011	28000	2794	40	8000	21	1	36000	2815	100	41
2012	1600	733	17	2200	261	16	3800	994	100	33
2013	1200	630	31	4200	682	84	5400	1312	100	115
2014	3300	1099	33	1600	170	0	4900	1269	100	33
			121			101			400	222

Table 5: Number of the tagged allis shad per behavioural categories in the studied fish passage facilities.

	Number of						
	Shad tagged	different shads coming back	days of presence	actives prospectons	prospections with entry in the fishway	entry in the fishway	shads passing upstream
Golfech	121	4	7	7	6	15	0
Bergerac	27	4	4	4	2	3	1
Tuilières	74	16	55	18	0	0	0
TOTAL	222	24	66	29	8	18	1

Indeed, for 15 come in the device, no shad has been able to passed throw the tightening of the trap of the elevator. Bergerac seems to be the most efficient device. Actually it is the only dams where a tagged shad has been able to pass upstream. But the point that deserves the most attention is the ability of shad to find the entry of the device. Finally, Tuilières emerged as the most problematic (see Appendix 4). No tagged shad has penetrated into the facility. At least, the attractiveness of the gate and the suitability of the facility to make the fish get in are apparently insufficient.

The overall conclusion to draw from the action A.2 study is that it provided valuable insights into the behaviour of the shads at the base of the first structures on the Garonne-Dordogne, and identifying the problems that this species faces. Although this method has often been used with other species it has been rarely applied to shad because of the fragility of the species.

As a consequence of the drastic decline of the population since the submission of the project proposal, the number of tagged individuals has been much smaller lower than envisaged. Nevertheless, some of the difficulties faced by the shads when attempting to cross the structures have been identified. They are linked to the capacity of the individuals to approach the fish passes entrances frequently (in the case of Tuilières and Bergerac), to enter inside of the passes (in the case of Tuilières and sometimes of Golfech), or to continue in their progression upstream after successfully entering inside the passes (in the case of Golfech).

Table 6: Assessment of efficiency of the studied fishways for migrating allis shad

	Attractiveness of entrances		Ease of entry		Progression inside the fishway	
Golfech	Good	14 % of the time 16 approaches / Inc site 1 approach / 15 min	Variable	from 0 to 7 entry / Inc site 1 entry / from 71 to 621 min on site 1 entry / from 4 to 62 app. 1 entry / de 5 to 68 min in front of the entrances	Bad	No passage upstream of funnel for 15 entries. Swift exit (often from 2 to 1)
Bergerac	Medium	9,5 % of the time 2,1 approaches / Inc site 1 approach / 28 min Nearly immobile shads	Medium	1 entry/ 5 Inc onsite 1 entry / 291 min onsite 1 entry / 10 approaches 1 entry / 28 min in front of the entrances	Good ?	1 successful incursion on 3 attempts
Tuilières	Very variable	de 0,4 à 14 % of the time de 0 à 27 app. / Inc site 1 app. / de 6 à 338 min Better when valve et G1 closed	Bad	No entry for : - 100 h on the site - 3h52 in front of the entrance	?	

Due to insufficient availability of shads to be tagged the data is too poor to write and to submit a paper to a scientific journal. However, a report in [French](#) and [English](#) language is been prepared which is available to the interested public on the projects websites (e.g. www.lifealose2015.com) (see also Annex 3 and Annex 4)

The possible technical modifications to improvements the surmountability of the dam structures for the shads as a consequence of the A.2 study are neither obvious, nor easy to implement. If possible improvements are the modification of a part of the pass at Golfech (junction of the 2 entrances) and at Bergerac (creation of a new entrance), they seem more complex at Tuilières, where it appears that the attractiveness of the combined elements of the site compared to the attractiveness of the sole fish lift does not allow for significant improvement to be made to the pass without undertaking a reflection on the structure as a whole and noticeably on the management of the different hydraulic components and the necessity of a second pass.

Together with the results of the A1 action, the information will lead to concrete measures that aim to improve the conditions for shad migration in the rivers Garonne and Dordogne in the After-LIFE-Time:

- Golfech: a solution will be studied to improve the junction of the two entrances channels in 2016/2017,
- Bergerac: the study on the feasibility of the construction of a second entrance for the present fish pass has already started,
- Tuilières: discussions have been engaged to determine the best solution to reduce the problem of the downstream facility which attract fish (shad but also salmon and probably lamprey too) at the opposite bank from the fish lift,
- Mauzac: a second fishpass will be built at the dam in 2017,

These projects should be financed by EDF and Agence de l'eau Adour-Garonne, both supported the LIFE+ project as co-financiers.

5.1.3. Action A.3 Monitoring of allis shad returnees

The initial objective of action A.3 was to track the migration routes of adult allis shad through the complex Rhine delta branches by tagging adult allis shad trapped at the dams in Gironde basin with NEDAP radiotransmitters. This action needed to be modified because of the decreasing of the allis shad population in the Gironde basin as the shads were too precious for the population to take the risk of losses at the long transport (which has ever been applied for more than one to two hours before) and the surgery as the NEDAP transmitters on the opposite to the ATS transmitters must be implanted into the body cave, which additionally appeared to be too risky in this extraordinary sensitive species.

According to the explanation in the mid-term report and the agreement of the commission the action A.3 was thus modified and now aimed on detecting adult allis shad and returnees coming from the stocking measures carried out in the previous LIFE and the running LIFE+ project. As no information existed whether and if how many adult allis shad might return from the stocking actions the objective of the study was to catch any adults (in order to obtain their otoliths to proof whether they origin from the stocking) and if possible to quantify their abundance. According to the quantity of the released larvae (for the first time nearly 2 Mio larvae in 2009) and the life-cycle characteristics (maturation at an age of 3 to six years) promising conditions should be meet in 2014 when the study was conducted. As fisheries with floating gill and trammel nets were the most frequently used, highly efficient and cheap to implement, professional fishermen from the Garonne that have made their living from allis shad fisheries before the moratorium in the Aquitaine was set into force, were won for a feasibility study, that was financed by funds from the fishing tax of North Rhine Westphalia. This study aimed to figure out if fisheries with floating gill-nets are applicable on the Rhine with his heavy shipping which turned out to be possible after the bottom has been cleaned from major obstacles.

After a tendering in 2014 the same fishermen (Philippe Moro and Eric Montíllaud) were commissioned to apply the monitoring which was conducted for two weeks (06 – 09 May and 12. – 15 May 2015) on the lower Rhine as we expected the first shads to be most likely to pass through this section in this time frame. Although the conditions were insufficient due to a drop in water temperature and hydro-engineering measures at the most downstream section (river km 835,1 – 836,1), due to which the width of stretch for sampling was less than half towards the situation during the preliminary study, the sampling could be conducted successful. Besides 721 specimens, mainly of the species bream, ide, and barbel, 3 adult allis shad were trapped between river kilometre 835,1 and 836,1 (1 female of 51 cm total length on the 9th of May) as well as between river kilometre 825,1 and 826 (2 females of 52 and 49 cm total length on the 14th of May). All three specimens were collected and passed on to the Universities of Giessen for further inspections (length weight, gonadal state, condition, health etc.) and the otoliths were removed at the University of Landau for age and OTC-mark determination. Each one otolith was inspected at the University of Landau and the Lab of the associated beneficiary Irstea. All these analysis were conducted externally and free of charge for the project. The three shad were healthy, not yet spawned, and their gonads were not fully developed, which indicates that the shads were still on their spawning run but not ready for spawning yet. The inspection of the otoliths proofed that shads actually came from the LIFE stocking, which is a resounding success for the project!

As we expected the shoals of shads to move as far upstream as possible another sampling campaign with the floating gill-nets was carried out between the 26th and 30th of May on the Upper Rhine section around river km 468. Here no allis shad could be detected. After all it can be stated, that the implementation of the method was very successful with regard to

catching adult allis shad actively. However, when aiming on determining the size of the spawner stock at least semi-quantitatively a considerably higher sampling effort will be required, which will in turn cause mortality in potential spawners.

Added value of this study was the participation of several stakeholders involved in fisheries in North Rhine-Westphalia and Hesse as well as the training of apprentices of fisheries at the LANUV and a [TV report](#) about the feasibility study. [Another TV report](#) was issued at the occasion of the first allis shad caught in this study. The nets that have been especially constructed by the fishermen for allis shad fisheries on the Rhine were left with the project management for future studies. With regard to its lethality and the conservation status of allis shad in the Rhine basin, the method will however not be used as standardised monitoring tool, unless samples of dead specimen are required. Nevertheless this method has turned out to provide valuable data about benthic and pelagic fish species, which are often underrepresented in standardised electric fishing surveys and will be implemented in future surveys of the Rhine's Ichthyofauna (see Annex 5).

The main information about the development of the stock of returning adults will be obtained from the counts in video surveys of the fish ways on the Upper Rhine, and the tributaries Moselle, Main and Sieg, where monitoring stations are yet present. However, as these stations are situated relatively far upstream in the Rhine catchment and it is furthermore known that only a small proportion of the population is able to surmount the fish ways (see previous chapter), these figures only represent a small fraction of the shad population. In order to determine the population more precisely and to count the numbers of shads spawning downstream, active spawning sites must be identified and a bull monitoring as conducted for the monitoring of shads in French rivers must be implemented in the Rhine. A development of such a bull monitoring is part of LIFE project proposal that was submitted to the commission in October 2015.



Figure 7: Fishing with floating gill-nets was successfully tested in preliminary study in October 2013 and implemented in May 2014 – the first allis shad caught in the lower Rhine!

5.1.4. Action C.1 Ex situ stock

The probably most ambitious action of the LIFE+ project was the inauguration of ex situ stocks in Germany and in France. It aimed to rear allis shad from the larval stage, in which the fish so far were taken out of the allis shad hatchery in Bruch and released in the Rhine, to adult fish. Providing that seemed a notable challenge as previous attempts to keep the larvae in culture for an age of more than 20 days were going along with significantly increasing mortalities, as also the simulation of the complexly changing habitat (e.g. in terms of salinity) requirements throughout the life-cycle were. However, getting able to rear allis shad from larvae (which can be already quite easily obtained from the hatcheries (see under actions C.2 and C.4) into adult fish would mean a big progress for the conservation of allis shad, particularly with regard to breeding off-spring from ex situ stocks and implementing future releasing action without needing to exploit the wild populations. Besides developing techniques to rearing the allis shad for the time frame of five years the species regularly requires to getting mature in two facilities in France and in Germany, an accompanying study on the shads in the La Rochelle facility in France aimed to monitor the process and factors of maturation in a histological and physiological survey.

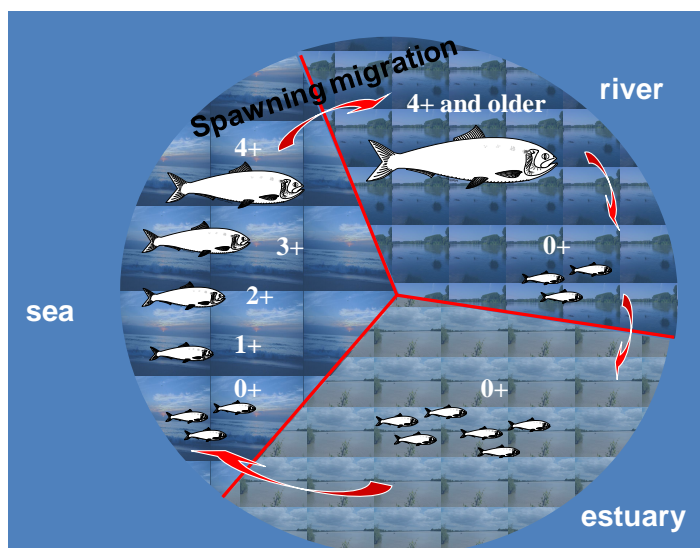


Figure 8: Scheme of the regular life-cycle of the allis shad.

Severe obstacles and setbacks were encountered by trying to reach the objective to rear allis shad from larvae into adult fish in both pilot facilities.

In the Aquarium La Rochelle in France a blackout occurred on the 5 November 2011 in the recirculation systems the fish were kept in. This accident led to mortality in groups of allis shads of different origins:

- A batch from the 2008 cohort, transferred from St Seurin experimental facility (Irstea) in 2008 in the framework of the first Life project. A total of 139 juveniles died (no survival).
- A part of the batch 2011 cohort transferred from the Bruch facility (Migado) in October 2011. A total of 255 juveniles died and 54 survived.

The batch transferred in June 2011 as larvae was not affected by this blackout. A total of 539 juveniles were then available for rearing and monitoring of gonad development in captivity.

The initial objective to establish an ex situ stock on the grounds of a sturgeon hatchery inside the Biblis nuclear power plant in Hesse needed modification before it could be started. Due to the political decision to give up nuclear energy production in Germany and to shut down the Biblis nuclear power plant immediately in March 2011, an alternative location for installing the ex situ stock pilot facility needed to be identified at short notice. The reason was the objective to have mature specimen available at the end of the project and the fact that female allis require five years to reach maturity. This demanded to found the stock in the 2011 rearing season in which larvae for the founding could only be obtained by the end of June at the latest. Thanks to the commitment of the district government Giessen of the federal state of Hesse an alternative spot was found on the grounds of a recycling and waste treatment facility, the so-called Trockenstabilat facility of the Hermann Hofmann Group in Aßlar. Additional funds were discovered by the opportunity to invest eco points for the compensation of deforestation for the construction of wind parks by the Hermann Hofmann Group granted by the federal state of Hesse, which enabled the Life+ project to obtain not only electricity and heated water from a power plant in the Trockenstabilat facility free of charge. In addition, it was also possible to build a recirculation system with three voluminous round tanks to be able to keep some hundreds to thousands of shads of different cohorts and a small breeding facility for breeding larvae and rearing these into juveniles before transferring into the big recirculation facility containing brackish water in order to simulate the marine part of the shads life cycle. At this time, the only disadvantage compared to the initial plan to settle the ex situ stock at Biblis nuclear power plant was the unavailability of the expertise by a fish farmer to oversee the pilot facility.



Figure 9: Breeding unit (left) and the actual ex situ stock unit (right) in the Aßlar facility in 2012

The recirculation systems were planned and constructed by an expert (Per Thuesen - DDT Aquaculture design). The hall including the electricity, water supply and heating devices was built by the staff of the Trockenstabilat facility without charging any costs for the equipment to the LIFE+ project. This way it was possible to stock the facility with a first cohort of shad larvae in June 2011. In 2012, when the facility was officially and festive inaugurated, the first larvae also obtained from the hatchery in Bruch hatched in the facility out of their eggs. Although, high mortalities were encountered in the weeks following hatching, mainly due to direct and indirect effects of malformations of the mouth and heads in the larvae and juveniles, more than 500 specimens could be transferred to the big recirculation system in autumn. Even in the stock in the Aquarium La Rochelle the development of such malformations was found to be a major cause of mortality.

After the promising beginning of the Aßlar ex situ facility severe setbacks were encountered in the years following 2012. In March 2013 the Hermann Hofmann Group was forced to shut down the Trockenstabilat facility, which meant for the ex situ facility not only the end of obtaining heating water and energy for the ex situ facility free of charge, but also the loss of the staff of the Trockenstabilat facility, which were formerly involved in the maintenance of the ex situ facility and took care of the stocks in half hourly intervals even at night time and thus substituted an alarming system for the facility. This lack could hardly be compensated by the external assistants commissioned by the LIFE+ project. An installation of an alarming system turned out to be too expensive and impracticable due to the lack of network coverage around the remote facility. Ironically, as a consequence of retrofitting works in the ex situ facility, a blackout occurred in the night of the 4th December 2013 which led to the death of all specimens in the facility. The inspection of the fish revealed large differences with regard to head and mouth malformations which occurred less frequent and drastic in fish from the 2011 cohort (which was stocked in tanks that were just sheltered by a tent which enabled the young shads to prey on insects and their tank-born) and very abundant in fish from the 2012 cohort. As the malformations could not be attributed to parasites, diseases or toxics and were also observed in shads reared in the Aquarium La Rochelle and the Aquazoo, it was decided to take the loss of the stock as an opportunity to combine the restocking of the facility with experiments on the effect of diet on the health and condition of the shads in ex situ stocks. These experiments were conducted by Johanna Heinrich and supervised by Patrick Schubert of the University of Giessen in 2014 and 2015. It turned out that providing the larvae and juvenile fish with increased levels of fatty acids and prebiotic compounds not only prevented the development of malformations, furthermore the specimens suffered much lower mortalities and were in a significantly better condition and performed a much more relaxed behaviour than in the previous years. These findings are essential for future rearing actions.



Figure 10: Cystic growth and related malformations in YOY juvenile allis shad

In April 2016 finally the Aßlar ex situ facility was affected by another severe setback. Due to an overheating of the side channel compressor and a related melting of the PVC tubes toxic gas emissions went with the aeration into the recirculation system and killed the entire 2014 cohort (n= 204)! After 440 specimens from the 2012 cohort and 54 specimens from 2011 that have been lost at the total fishkill in December 2013, it will be hardly possible to compensate this further setback and to reach the initial project to have 50 premature allis shad in stock at the end of the project duration!

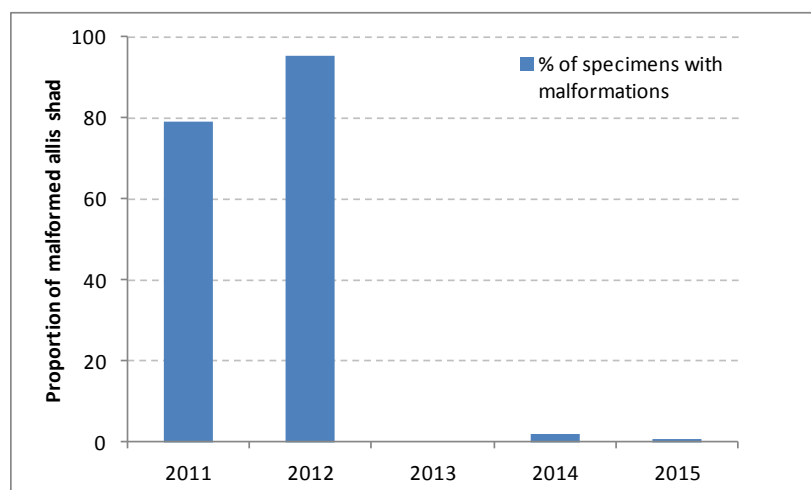


Figure 11: Percentage of specimens per year cohort reared in the ex situ stock pilot facilities in Aßlar and the accompanying experiments at the University of Gießen (in 2014 and 2015) after adapting the feeding protocol. Please note that only data for 2011, 2012 and 2014 refer to the entire cohort (after the total kills). 2013 no data.

Besides the malformations, further sources of mortality were encountered in both pilot facilities. Escaping from the tanks in older juvenile specimens, water quality deterioration and particularly increased NO₂ levels due to an accumulation of waste and food rests within the recirculation system and insufficient efficiency of the biological filters systems, as well as associated parasitic and bacterial pathology were the most prominent. In the shads in the La Rochelle stock an additional source of mortality was found to come from calcareous nodules in the shad's kidneys "nephrocalcinosis" which is promoted under high concentrations of dissolved CO₂ and low pH values. The recirculation system was modified by improving the biological filter system and adding a degassing column.

Taking into account the losses caused by blackouts and that according to the objectives of the action the whole stock in the Aquarium la Rochelle needed to be successively sacrificed in order to monitor the gonad development and onset of maturity in captivity it can be concluded that it turned out to be principally possible to keep the shads in captivity for the duration of a life-cycle. Problems going along with the keeping in recirculation systems could be identified and widely solved. Great improvements have been made with concerning the feeding and related effects on health and condition of the shads. Finally, at least for the four year old allis shad in the Aquarium La Rochelle, the onset of maturity could be determined in several males and one female specimen (please note that the results of the final survey in the 4.5 year old fish, which will allow to conclude about the maturation in captivity will not be available by the beginning of June, i.e. after the submission of this report). The final report covering the results by March 2016 is attached in Annex 6.



Figure 12: Five year old allis shad in the La Rochelle ex stock pilot facility

A paper about the results gained in this part of the study will be written and submitted in 2016.

Added value from this action has been reached by involving PhD and master students at the Universities of Giessen and Koblenz-Landau, which not only contributed additional knowledge and improvements to the ex situ techniques and the stocks but also scientific publications about the topic. Furthermore, specimen for Aquarium exhibitions in the Aquazoo Löbbecke Museum in Düsseldorf and the Aquarium in La Rochelle, which have been marvelled by hundreds-of-thousands visitors, have been obtained from the ex situ stocks. One paper already emerged from the accompanying studies by Hannah Wünneman and was accepted in the Journal of Fish Diseases in 2016, one further paper has been submitted (see for both manuscripts in Annex 7 and 8) and one paper addressing the results of the feeding experiments will be submitted in 2016 (see for the results of the 2015 survey the Master Thesis of Martin Kutzner in Annex 9, the Thesis of Johanna Heinrich from 2014 was submitted with the progress report in 2015).



Figure 13: Mature female allis shad from the La Rochelle ex situ stock. Arrows indicate the developed gonads.

After all, the initial objective to recruit offspring from ex situ stocks in the future seems realistic, however further research and application is required, particularly with regard to the optimization of the recirculation systems and the effect of feeding on the gonad development. This topic was thus addressed in a project proposal for a new Life project, in which the lessons learnt will be incorporated and improved ex situ stocks techniques will be implemented in a new, professionally conducted and highly efficient facility at University of Giessen. The idea to found a future ex situ stock with the remaining cohorts from 2014 and 2015 still kept in the facilities in Aßlar and the University of Giessen in order to ensure that the first shads which will be old enough to reach maturity and to be available yet two to three years after the inauguration of the new facility, will not be implemented as intended. This incident underlines that a future ex situ stock facility needs not only the capacities to realistically reach the objective of breeding shads from ex situ stocks, but also be under the permanent supervision and maintenance of approved scientists and have access to energy supply. Due to its remote location, its limited capacities and the missing space and potential for expansion and the high costs for energy, this objective cannot be reached in the facility in Aßlar, which compounds will where possible be integrated in the new facility. For the meantime (in terms of a soon granting of the means in a new Life project proposal) the costs for energy, consumable material and the personnel (i.e. external assistance) are covered by the federal state of Hesse in order to ensure the durability of the ex situ stock if the Life project application will be granted..

5.1.5. Action C.2 Allis shad production and marking

Action C.2 comprises the different steps of the production of young Allis shad for stocking the Rhine system, including the catch of genitors at fishways in Golfech (Garonne) and Tuilières (Dordogne), their transport to the Allis shad fish farm in Bruch, which has been installed during the previous LIFE Allis shad project, the rearing and marking of Allis shad larvae and their transport to Germany. The conductance of the measures lies in the responsibility of the associated beneficiary Association MIGADO. The techniques were already well established and highly efficient when the LIFE+ project started. Further adjustments in the breeding process enabled to breed up to 1 Mio larvae by using just 40 genitor fish given the surrounding environmental conditions were adequate. These achievements were the prerequisite to maintain the breeding of shad larvae by using wild genitors from the GGD population even under the conditions of the dramatic decreasing of the population the recent years (less than 1% of the average population in the 1990ies decade). In order not to further impair the population it was agreed that about 80 genitors can be trapped for the breeding purposes (which corresponds to about 1% of the population in the basin).

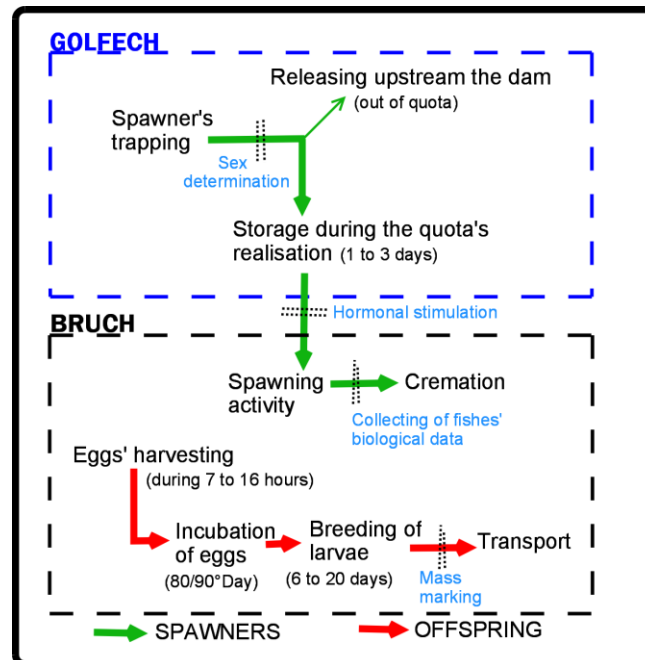


Figure 14: Scheme of the breeding process of allis shad in the hatchery in Bruch

However, only healthy, nearly reaped and yet not spawned specimen are selected in order to meet the requirements for the artificial reproduction. After having obtained a hormone (LHRH) the genitors are grouped in big spawning tanks, which can be darkened and in which a strong current simulates the conditions the fish require for their natural nocturnal spawning in the river and makes them spawn in portions for up to several weeks until they die. The eggs are sieved at the tanks discharge and transferred into breeding jars from which the larvae hatch after some days. The survival rate of the eggs has considerably increased since the inauguration of the allis shad hatchery in 2008 (e.g. due to an improved hormone donation and to the treatment of the incubated eggs against fungal infections several times per day) and is now 55% on average. After some days of rearing and starting of external feeding with extremely small sized *Artemia* nauplii, the larvae are marked by being exposed to an OTC solution and after some further days transferred into water-filled plastic bags in which they are transported to the stocking locations in Germany. The survival of the larvae from hatching

to day 12 is nearly 95%. The mean breeding efficiency in the hatchery in the Life+ project duration was 43.000 larvae per female genitor.

Major negative deviations occurred in 2013 and 2015 and are mainly attributed to the inefficiency of the hormone which needed to be changed in 2013 and bad conditions of the genitors and egg quality in 2015. The latter effect couldn't even be compensated to heating of the water in the hatchery, even though temperature depressions are commonly considered to negatively affect the spawning efficiency.

Besides the limited availability of genitors for producing larvae for the releasing programme of the Rhine the sub-average breeding efficiency in these years and particularly in 2015 caused that the guideline value of 7.5 Mio larvae which should according to project proposal have been produced and released in the LIFE+ project duration was not achieved (6.2 Mio larvae).



Figure 15: Preparing of genitors for the transport from the trapping location at the Golfech dam to the hatchery in Bruch (upper), larvae rearing unit in the hatchery in Bruch (lower left) and marking of the larvae in an OTC solution (lower right and detail)

Regardless of the issue of the bad conditions of genitors and their sexual products, which is not solved yet and will require additional research, after eight years of breeding allis shad larvae in the two LIFE projects it can be concluded that the breeding technology and the hatchery are although unique well established and can serve as a template for future allis shad hatcheries and breeding projects elsewhere.

Table 5: Details and ratings about the number of genitors, egg harvest and the produced larvae in the LIFE (2008 -2010 in blue, sum 4.8 million larvae) and the LIFE+ project (2010 – 2015 in green; sum 6.2 million larvae) duration in the LIFE allis shad hatchery in Bruch. Remarks refer to explanations for the breeding efficiency (red when sub-average).

Year	Female	Male	Sex ratio	Production of eggs (kg)	Amount of eggs (grams) per female	Survival rate of eggs	Larvae transported	Larvae produced per female	Remarks
2008	51	67	1,31	18,0	352,7	28%	480.000	9.412	Old hormone protocol
2009	128	153	1,20	40,1	313,0	42%	1.745.000	13.633	Old hormone protocol
2010	107	148	1,38	42,0	392,5	65%	2.642.501	24.696	Old hormone protocol
2011	32	51	1,59	46,0	1.436,3	64%	2.225.000	69.531	Maximum use of genitors
2012	18	26	1,44	26,0	1.441,7	61%	980.000	54.444	Maximum use of genitors
2013	32	49	1,53	11,5	359,4	62%	680.000	21.244	Trouble with hormone quality
2014	33	44	1,33	37,4	1132,7	71%	2.030.000	61.515	Maximum use of genitors
2015	34	44	1,29	15,1	444,1	26%	280.000	8.235	Trouble with genitors and egg quality

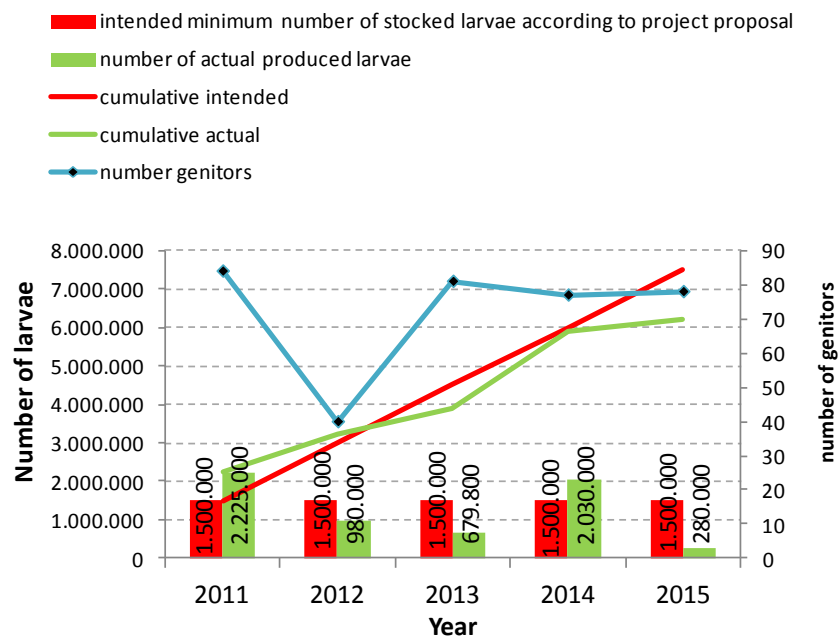


Figure 16: Numbers of actually stocked larvae in the Life+ project and intended numbers to be stocked according to the project proposal (lines indicate cumulative numbers) as well as genitors (blue line) involved

The hatchery in Bruch is intended to even produce larvae for the After-LIFE-Time, in the different scenarios under debate. Even, as intended as an action of a new project proposal, a second hatchery will be constructed on the Upper Rhine (following the template of the hatchery in Bruch) in order to ensure a sustainable development of the founder population in the Rhine, the production in Bruch will go on and ensure a basic stocking amount and splitting of the risks of production between the Rhine and the Gironde river basins. In this LIFE project the hatchery will also produce larvae for a scientific stocking project in the Gironde basin. The continuation of the stocking in 2016 which will be definitely not supported by LIFE funds will also be ensured by the production of allis shad larvae in Bruch and be financed by the HIT environment foundation. .

5.1.6. Action C.3 Allis shad stocking in the Rhine basin

The releasing of the larvae over many years have been started in the previous LIFE project and aims on founding a population of the allis shad in the Rhine basin. The intention is that the larvae after being successful released and having grown into juveniles and emigrated to the Sea, from which (some of) these specimens return as adults after three to six years and contribute to the development of the population by reproducing in the Rhine basin. By identifying and mapping suitable habitats for the releasing of the tiny, vulnerable and precious larvae and developing stocking techniques adapted to the species and the developmental stage, it is intended to ensure high survival rates and stocking efficiency. In this respect the releasing sites were selected flexibly depending on the current situation and in order minimize losses and threats to the larvae which are mainly harsh currents, insufficient forage conditions and abundant competitors and predators. For these reasons it was, apart from the releasing on the occasion of public relation events, avoided to release large quantities of larvae in the Rhine directly, but preferably in stagnant and plankton-rich backwaters as well as navigation-free and free-flowing tributaries.

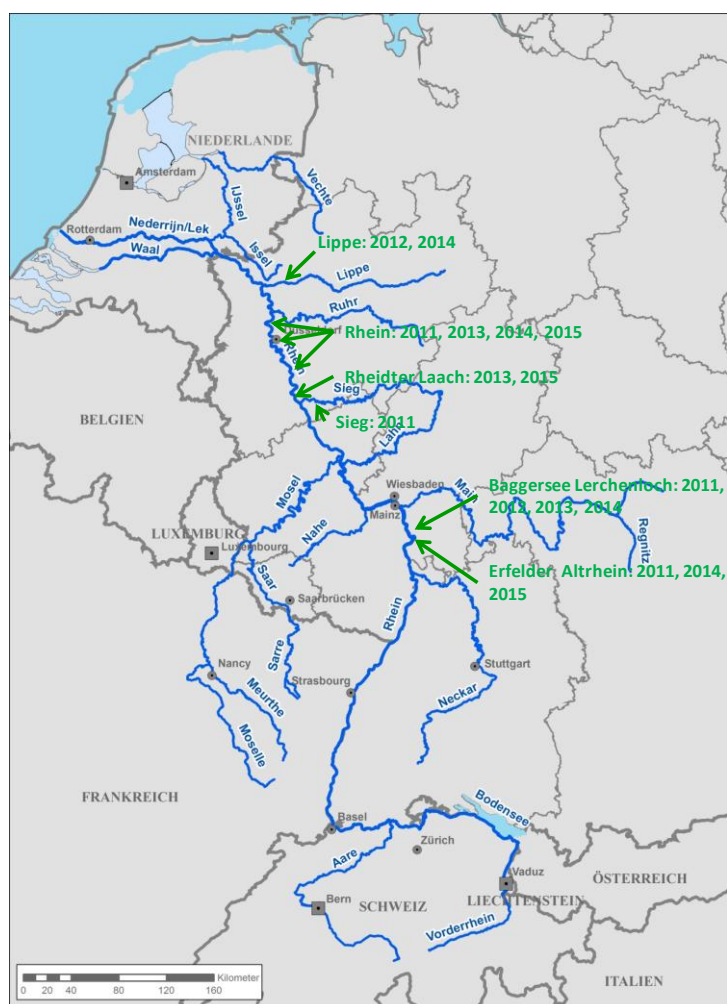


Figure 17: Map of the Rhine basin with the stocking locations in the LIFE+ project duration

Particularly in the running waters, where it seemed reasonable to release the shad larvae at or after sunset, it was proceeded to keep the larvae in round tanks, supplied with river water and fed with *Artemia* in order to facilitate the acclimatisation and recovering of the larvae after the transport. Nearly no mortalities occurred in these treatments and the larvae demonstrably ate prey and are considered to be advantaged towards the larvae directly released out of the transportation bags, which has been observed to go along with high direct and related mortalities in the beginning of the LIFE project. Stocked were locations in the German federal states NRW and Hesse, which both supported the Life projects from the beginning. In Hesse the releasing sites in all years were the oxbow Erfelden-Stockstadt and the former gravel-pit Lerchenloch, both permanently connected with the Rhine but stagnant waterbodies at average discharge conditions. The Oxbow is donated with Rhine water at increased discharges at the upstream end and turns to a watercourse with moderate currents then. Under adequate conditions and in terms of spreading the risk the shad larvae were released in both locations. At stocking dates later in the season when competitors and potential predators (other YOY species) were already abundant and bigger than the shad larvae as well as under flood and turbid conditions the gravel pit Lerchenloch was preferred. Another factor for the releasing site selection was with regard to intended monitoring action (action E.3), i.e. the design and method envisaged. These factors determined also about the stocking site selection in NRW. Only in 2011, when the larvae transports arrived quite early in the season and other YOY didn't seem to significant competitors or act as potential predators the river Sieg, the preferred stocking habitat in the LIFE project was selected. In the following years due to abundant YOY, floods or inappropriate water temperatures preference was given to the river Lippe or the Rheidter Laach, a connected oxbow near Bonn (see table 6 and figure 17 for details). The quantities of larvae released in the Rhine basin were directly linked with the production of larvae in the hatchery in France (action C.2 – see previous chapter). In total the deviation towards the project proposal was 6.2 instead of 7.5 Mio larvae (see Figure 16). The overall transport and handling mortality was assessed to be less than 5%. The reports about the stocking operations in the year 2015 can be found in Annex 10 and 11. Please note that the reports about the stocking operations were attached to the inception, the midterm and the progress report.

The stocking operation and the monitoring of the stocking efficiency (action E.3) were tendered as a package for each federal state and carried out by selected experts. These were the expert bureaus LimnoPlan and BFS, respectively. By means of their technical contribution and exchanges with the project management the stocking requirements, techniques and methods are well established and transferrable to any other area or river basin. In the Rhine basin and probably also in Gironde basin the stocking operations will be continued in the After-LIFE time.

Table 6: Number of allis shad larvae per age and occasion stocked in the Life+ project duration (2011 -2015) in stocking locations in NRW and Hesse

Year	Occasion	Age (days)	Number	Date	Destination	Stocking location
2011	first transport	7	403400	17.05.2011	NRW	Sieg
	school class program	7	10000			Rhine near Duisburg
	first transport	11	366600	30.05.2011	Hesse	Oxbow Erfelden-Stockstadt
	second transport	5 to 11	870000			Gravelpit Lerchenloch near Trebur
		15 to 21	580000		NRW	Sieg
2012	first transport	17	266000	13.06.2012	NRW	Lippe at
		13	244150			Krudenburg
		11	83600			
		8	213750		Hesse	Gravelpit
		5	142500			Lerchenloch
2013	first transport	7	534.603	24.05.2013	NRW	Rheidter Laach
	allis shad event	2	18.504	12.06.2013		Rhine near Cologne
	second transport	4	15.016	03.07.2013	Hesse	Gravelpit
		13	18.433			Lerchenloch
		21	93.244			near Trebur
2014	first transport	5	640.000	02.06.2014	NRW	Lippe
		17	360.000			
	second transport	3	68.000	17.06.2014	Hesse	Oxbow Erfelden-Stockstadt
		5	21.000		NRW	Rhine at Düsseldorf
	school class program	5	89.200		Hesse	Oxbow Erfelden-Stockstadt
	second transport	9	360.400			
		10	142.800			
	third transport	3	138.950	25.06.2014		Gravelpit Lerchenloch near Trebur
		6	133.000			
		12	77.000			
2015	first transport	14	138.248	03.06.2015	NRW	Rheidter Laach
		5	19.069			Rhine near Cologne/Rheidter Laach
	Second transport	19	12.079	27.06.2015	Hesse	Oxbow Erfelden-Stockstadt
		17	24.158			
		16	7.247			
		15	12.079			
		12	14.495			
		2	38.652			
		1	13.287			

5.1.7. Action C.4 Transfer of know-how of Allis shad production and rearing from France to Germany

The action aims to implement the know-how of shad breeding and rearing techniques that have been established in France by the associated beneficiary Association MIGADO in Germany. According to the project proposal action C.4 should have begun in 2011 and a batch of 100.000 should have been obtained in France, delivered to Germany and bred in the LANUV facility in Albaum. It was early considered by the project management not to implement the breeding in the LANUV facility, because of the rather low water temperature conditions in Albaum (the facility daily business is keeping and breeding salmonids like Atlantic salmon and trout species, which require cold water conditions as typical at this altitude). It was thus obvious to link the action C.4 with the ex situ facility (action C.1) in order to bundle competencies and to create synergies by focussing on only one location in Germany. We successfully bread about 150 grams of eggs which have been obtained from the allis shad fish farm in Bruch in Aßlar. The larvae successfully hatched from their eggs on the 2nd of June 2012. David Clavé from the associated beneficiary association MIGADO not only brought eggs and larvae to Aßlar, but also trained the personnel of the Aßlar facility and even some interested fish farmers in a three day workshop. The project coordinator Andreas Scharbert organized and attended the workshop and was also responsible for the translation. The program contained information and practical exercised on how to incubate the eggs, how to identify, to count and to remove dead eggs and larvae, as well as decapsulating and preparing *Artemia* for the feedings and the requirements of young shads in Aquaculture..

Due to the following developments around the Trockenstabilatanlage and the conditions to maintain the ex situ facility the ideas organize a second bigger workshop could not be realised.



Figure 18: David Clavé from the associated beneficiary association MIGADO trained the staff of the ex situ facility and some interested fish-farmers the principles of shad breeding and food production. For the first time in Aßlar allis shad larvae hatched from eggs from that have been obtained from the allis shad fish farm in Bruch (France).

For the After-LIFE-Time it is planned to develop and operate a second allis shad hatchery on the Upper Rhine. This action is a central part of a Life project proposal submitted in October 2015. Besides the construction of the facility MIGADO will conduct the training of the local staff and be responsible for the technical supervision ensuring best practice implementation.

5.1.8. Action E.3 Monitoring of adult upstream migration and reproduction activities of expected returning Allis shad in the River Rhine basin

The Monitoring of the development of the allis shad population after the launching of the reintroduction measures in terms of a) numbers and origin of adult returnees, b) spawning activities and c) indications upon successful reproduction, is crucial for assessing the success of the pilot measures implemented in the Life and the Life+ project. The first stocking of shad larvae in the river Rhine system was carried out in 2008 so that with regard to the life-cycle and maturation characteristics of the allis shad the first returnees to the Rhine were to be expected in 2013 with, according to the stocking efforts, increasing numbers in the consecutive three years. Thus the active search for returnees was started in 2014 (see action A.3). By developing networks involving the authorities of fish monitoring tasks, researchers and professional fishermen and anglers along the entire Rhine axis it was ensured to obtain any notifications about any allis shad observations in the Rhine by these stakeholders.

As a consequence of the findings of 2013 and 2014 yielding, besides a notable number of adult allis shads detected while passing over fish ways at the first two dams on the Upper Rhine, numerous YOY in the Upper Rhine section which clearly indicated a successful natural reproduction of the allis shad returnees in Upper Rhine section downstream of the Iffezheim dam, the first transversal obstacle for migrating fish in the so far free-flowing Rhine. Furthermore, some carcasses of spawned allis shad in the Middle Rhine section around Coblenz gave additional hints for spawning activities in this river stretch. Thus, an acoustic survey to identify nocturnal spawning activities was conducted in the respective river sections in 2015. Although the number of allis shads surmounting the fishways at the Iffezheim and Gambsheim dam in 2015 was smaller than in 2014, the return of allis shad originating from the stocking measures is undoubtedly going on. The decreasing compared to 2014 can be explained with flood conditions on the Upper Rhine in the migration period, which presumably misdirected the shad in the stronger donated weir channels instead of the turbine channels where the entrances to the fishways are situated (please note that three quarters of the run-off discharged over the weirs for a big part of the migration period!).

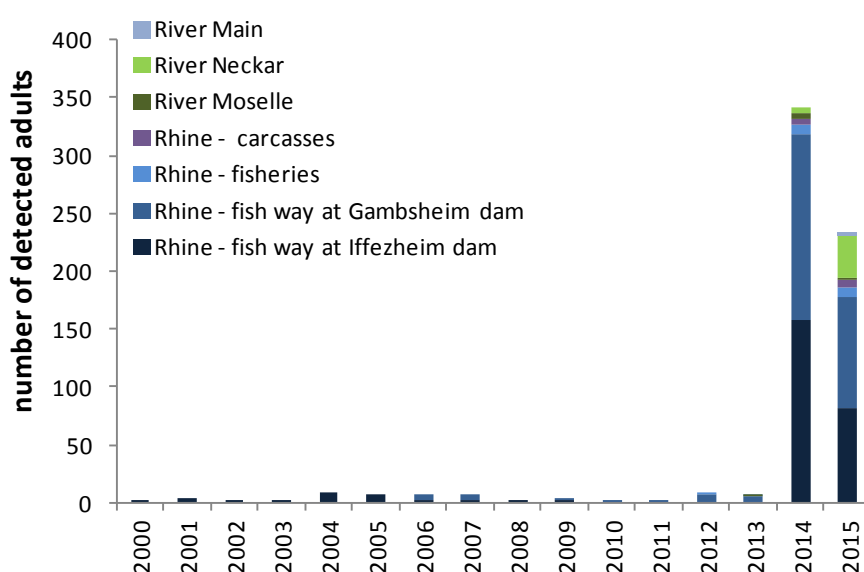


Figure 19 Number of adult allis shad observations in the Rhine between 2000 and 2015

On the contrary the number of allis shad observed in the river Neckar ($n = 36$ - in only five days of counting migrating fish at the fish way at the weir of Ladenburg) and the river Main ($n = 3$) had increased. The number of shads caught by professional fishermen and the carcasses found was nearly similar to 2014. As in 2014 the chronology and the size pattern of the shads counted at the Iffezheim and the upstream situated Gamsheim dam indicate that a notable part of the shads detected in Gamsheim didn't surmount the Iffezheim dam via the fishway, but the navigation locks and that the figures doesn't mean double counted shads.

After tendering, the study on spawning activities was conducted in nights between 21st of May and 26th of June, when promising conditions in terms of discharge, temperatures moon phase and weather occurred, which are known to positively affect the spawning activities in the shad. The study comprised four habitats on the Upper Rhine (river inner bends at Au am Rhein, Speyer, Nordheim and Biebesheim) and four habitats in the Middle Rhine section (river Moselle downstream weir Coblenz, Rhine downstream of the mouth of the river Lahn, Isle Niederwerth, mouth of the side channel "Rote Nahrung" until the bridge of Urmitz). All of these habitats have been mapped as potential spawning habitats in the previous LIFE project. Except of the location at Biebesheim each habitat was monitored for three to four nights (Upper Rhine) and up to nine nights in the middle Rhine section in the time frame from sunset to before sunrise. Actually, one observation was made at the upstream part of the Isle Niederwerth, which the field team clearly addressed to have been spawning allis shad and described similarly as [spawning activities recorded in France](#). Unfortunately the bull (the French term for spawning shad) was interrupted when the boat approached in order to film. The description, however, leaves no doubt about that indeed spawning activities of allis shad have been observed for the first time in the Rhine since the extinction of the population. Findings of allis shad carcasses (please note that the majority of shads dies after spawning) in this and the downstream river section (until Cologne and Leverkusen in NRW) support this observation. For details see Annex 12.

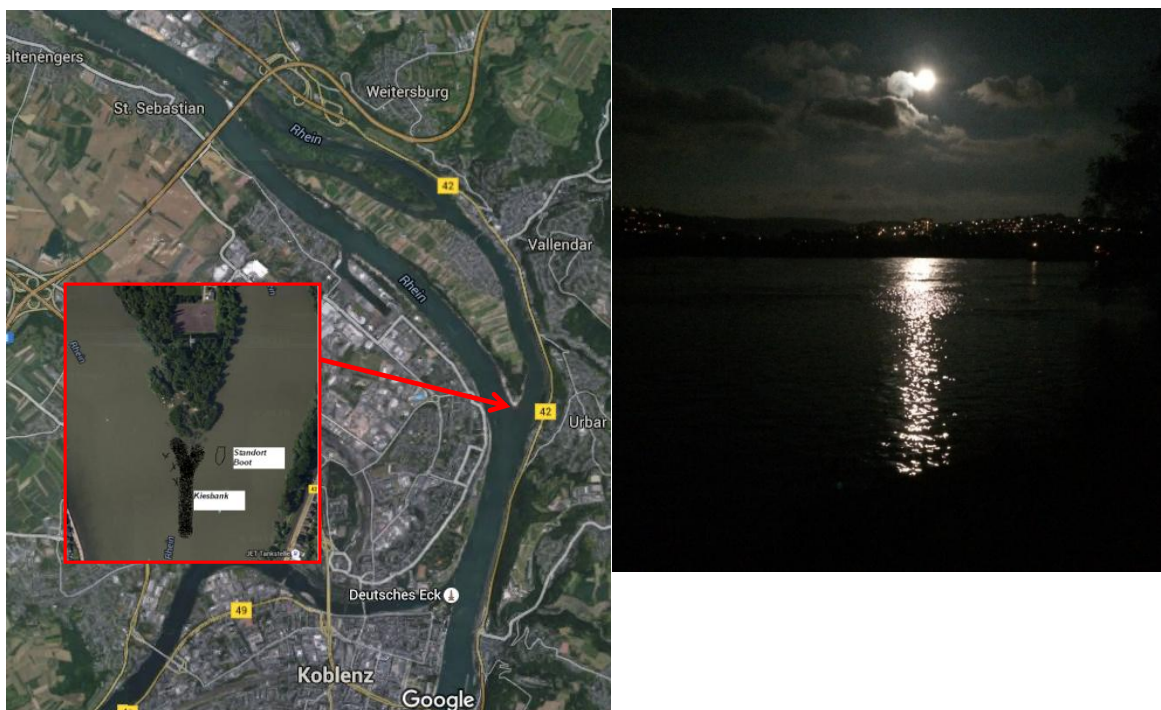


Figure 20: Aerial picture with scheme of the habitat at the Isle of Niederwerth with presumable spawning observations in the night the 16th of June (source Google maps)

In 2013 and 2014 proofs for the successful natural reproduction have been obtained through a monitoring of fish in the cooling water intake of the Nuclear power plant at Philippsburg on the Upper Rhine, where three and 72 YOY shads (all of these not marked with OTC) have been found in 2013 and 2014, respectively. This (external) monitoring was unfortunately terminated in 2014, so that no data that would allow to assessing the natural recruitment the YOY stock over the last three was available. A total of 20 YOY was trapped in anchored stow-nets in the lower (11) and middle Rhine section (4) as well as in a cooling water removal facility of coal power plant in the Netherlands (5). Please note that the proofs are no result of a targeted and continuous monitoring but of a randomized trial. In eleven of these YOY analysed at the University Coblenz-Landau no OTC marks were detected, which proofed them to come from natural reproduction. This indicates that the population is reproducing naturally since three consecutive years!

The analysis of five adult specimens at the University of Coblenz-Landau even revealed no OTC marks in the otoliths, which is not surprising after the findings of 2014, which have also been shown, that the detection of the OTC marks in the adult returnees is very difficult and the method of marking apparently not reliable in older specimens. This underlines the necessity to establish genetic tools that allow to clearly assigning whether a specimen comes from certain parents in a hatchery or not by just getting small tissue or fin clip samples. Please note that a PhD study in cooperation with LIFE+ project is currently carried out at the University of Coblenz-Landau, in which frame it was also provided to collect and analyse the shad samples in the last three years.

These findings are an overwhelming success for the Life+ project and demonstrate that the actions conducted in this pilot project aiming on the reintroduction and the conservation of the allis shad have been successful with regard to the stocking effort but also the attempts to monitor the success. Several reports and papers have been issued by the project management (see Annex 12). The findings about the returnees represent presumably only the tip of the iceberg, as the shads passing through the fish ways on the Upper Rhine and into the tributaries represent only a fraction of the population, but at least this standardized way of collecting data and processing will be ensured for the After-LIFE-time as the networks have been established and the information are passed on to the current project management. Additional measures that allow to more precisely trace the development of the spawner stock and the recruitment will require additional funds. Their development and implementation is an integral part of a LIFE project application submitted in October 2015.

5.1.9. Action E.4 Survey of the young of the year (YOY) on the Gironde Garonne Dordogne Basin

The objective of action E.4 was to establish techniques for the monitoring of the YOY stocks of allis shad throughout the freshwater phase and to assign differences in abundance to environmental parameters and to draw conclusions about possible impairments of recruitment in this phase of the life cycle, which is one of the possible hypothesis for the decreasing of the population in the GGD basin. Attempts to monitor the YOY in the past have failed which can be mainly explained by the pelagic life-style and well developed swimming capabilities of the juveniles. Responsible for the implementation of the study was the associated beneficiary Sméag, who tendered subcontractors (biologists and professional fishermen) for the field work and the data analysis. In order to test the performance of the different gears under field conditions a feasibility study was carried out in 2011 and the actual sampling from 2012 to 2014. Additional to the sampling an otolith analysis in order to calibrate age determination was tendered and carried out in 2015 and presented in the [final report](#).

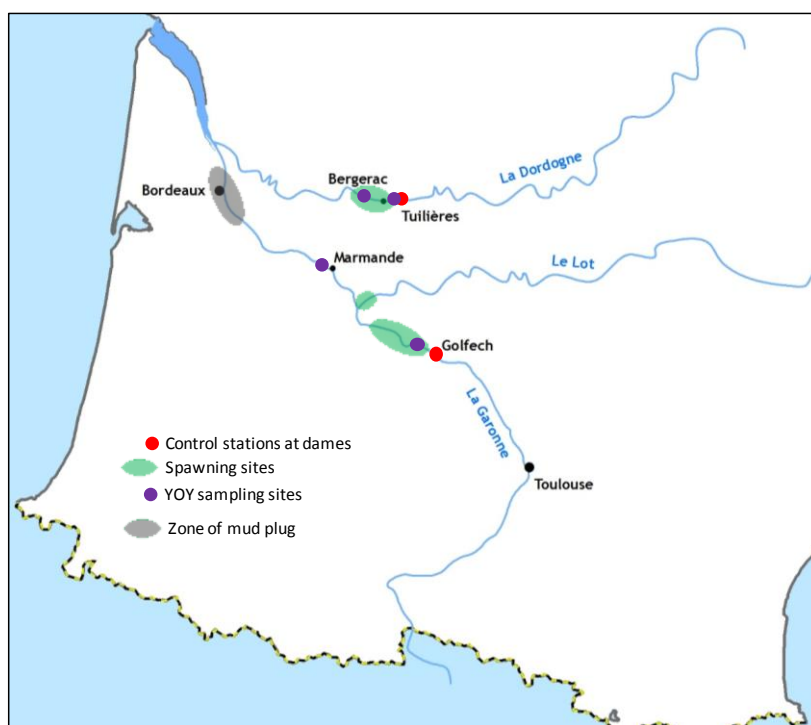


Figure 21: Map with the YOY sampling locations downstream of the current spawning sites in the Garonne and the Dordogne

The standard method that was specifically developed for this study and designed to allow to quantifying the YOY was the sampling with push-nets installed on a boat. Additional sampling techniques were the fishing with an *Epuisette*, a big dip-net, floating gill-nets and seine-nets.

The standardized sampling was begun about 6 weeks after the peak spawning period (end of June) in order to meet good conditions for abundant YOY and conducted once per week and for about 8 to 10 weeks and stopped when no further YOY were observed.

The sampling was conducted on 58 occasions (see table 7). In fact it succeeded to catch YOY in all of the years of regular sampling but only at the river Garonne. The in relation to the notable sampling effort comparably small seeming number of 20 YOY shads is perceivable, as standardised sampling of YOY shads has never been successfully implemented before. The number of the detected YOY is related to the number of the spawners and are as in the other actions in which the numbers stated in the proposal could not be reached explained by the, at this time, unexpected sharp decreasing of the population. The developed gear and sampling techniques have been proven to sample the pelagic juvenile stages shads and even to quantify via the filtered volume or the length of the sampling stretches. However, with regard to mesh sizes used, related backwash effect and the swimming performance, which increases with the size of the fish the sampling with push-nets doesn't seem to be perfectly suitable to sample the juvenile stages, i.e. requires a high sampling effort. When applying in shorter temporal and spatial distance to the spawning gravities sampling with push-nets is a promising method to sample the larval stages, eventually by additionally narrowing the mesh width. For sampling the juveniles fishing with floating gill-nets and seines was much more efficient.

Table 7: Overview about the sampling effort per sampling site, river and year at the regular sampling in action E.4

Sampling Echantillonnage		2011	2012	2013	2014	Total
Garonne	Saint-Sixte	2	8	9	6	25
	Couthures	1	-	5	7	13
Dordogne	Prignonrieux	-	7			7
	La Gravière	-		5	8	13
Total		3	15	19	21	58

Table 8: Numbers of the YOY caught at the regular sampling (upper table) and additional to the sampling with floating gill-nets (lower table)

Alosons YOY		2011	2012	2013	2014	Total
Garonne	Saint-Sixte	0	4	0	0	4
	Couthures	0	-	8	8	16
Total		0	4	8	8	20

		2011	2012	2013	2014	Total
Alosons YOY		60	57	12	19	148

At only 34 sampling occasions 128 juvenile YOY shads were caught. Particularly with regard to the working and gear effort sampling with floating gill-nets is much less intensive than in the standardised sampling. The mean size (total length) of the juvenile shads sampled was 89 mm and ranged between 64 and 152 mm. Age determination by means of otolith readings revealed a mean age of 90 days in the analysed specimen from the 2011 and 2012 cohorts (n = 68) and 170 days in the 2014 cohort (n = 15). As no YOY were caught from August onwards it can be concluded that the majority of the specimen has emigrated from the sampled river stretches and approached the estuary. The results of the E.4 study have thus

précised the knowledge about the presence n the freshwater and help to assess the potential risk caused by the mud plug (bouchon vaseaux), the zone with accumulated fine sediments and oxygen depletion in the Garonne’s lower reaches around the city of Bordeaux. It can thus be assumed that the majority of the juveniles have to pass through the mud plug in a time when the situation is worse and hazardous for the shads

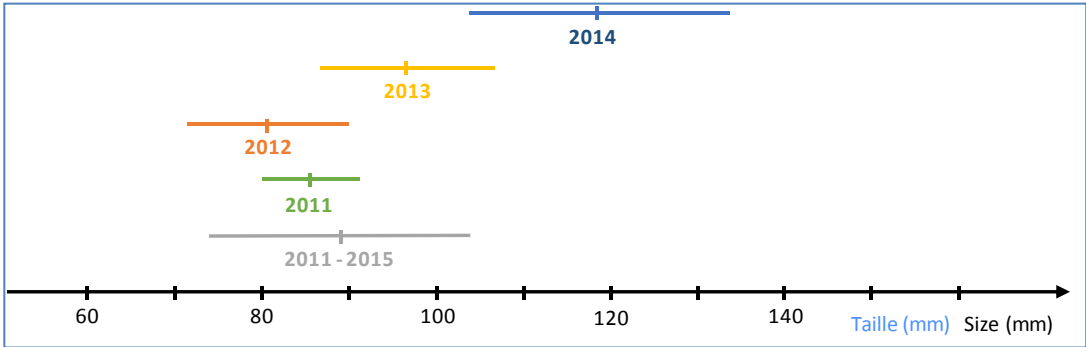


Figure 22: Mean and range of the size (Total length in millimetres) of the juvenile allis shad caught in the action E.4 survey per year of sampling

The main achievements of action E.4 are to have established sampling techniques for YOY shads in freshwater. Although the sampling with the push-nets yielded some juveniles it seems somewhat inefficient to specifically targeting juveniles with regard to the high working effort, at least under the conditions in terms of rather low abundances of the YOY corresponding to the overall situation of the population in the basin. With some modifications of the gears (smaller mesh widths of the push-nets) the methods is promising to sample and to quantify younger developmental stages.

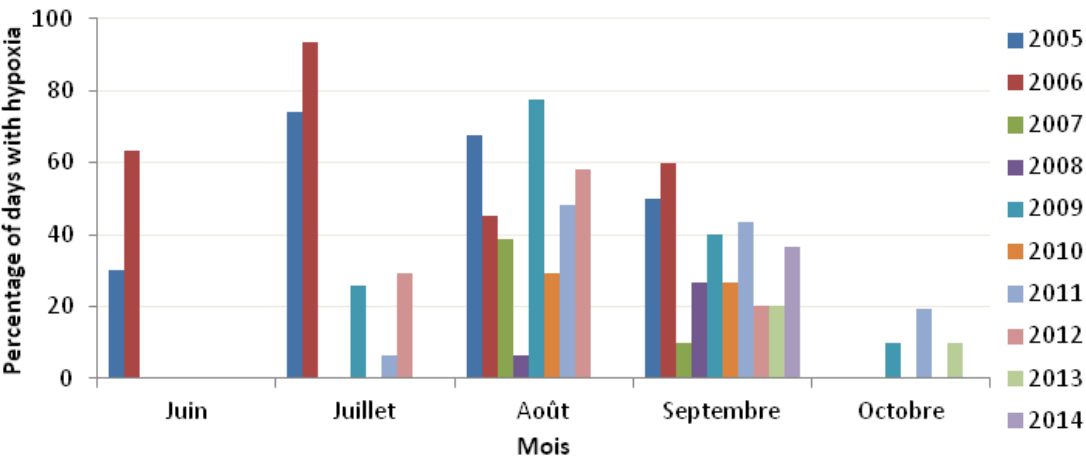


Figure 22: Proportions of days in which hypoxia occurs in the lower Garonne around the city of Bordeaux in the time frame between 2005 and 2014

The sampling with floating gill-nets was however very efficient and provided numerous YOY, although uncertainties remain with regard if the catches are quantifiable and allow drawbacks on the actual abundance. This technique is very promising for future studies and will be implemented in the case of monitoring the success of a stocking action in the Garonne and the Dordogne as part of a future Life project. By determining the proportions of YOY to be identified to origin from the stocking (by OTC marking or genetic tools) it endeavoured to gain information on the actual abundance.

Besides achievements concerning the sampling of the YOY valuable information were won with regard to the size and the age of the YOY and the point of emigration from the river and possible implications for the passage through the mud plug section, which underline the danger posed by this threat. In fact the major part of the YOY stock is passing through the mud plug section in the river Garonne in phases of severe hypoxia. This might explain the still steep decreasing of adult returnees particularly in the Garonne. This hypothesis is supported by the findings of a study on the natal origins of shad returnees in the major shad rivers in South-West Europe, which indicated that at least in certain years nearly no adults recruit from the Garonne population (see the presentation of [Daverat et al](#) held at the allis shad symposium in Bergerac). Taking into account that 4 (6 %) of 64 adult returnees from the Garonne could not be attributed to any natal origin, the remaining originated from natal rivers in Adour basin (14; 22%) or the Dordogne (46; 72%). On the opposite no adults in the Dordogne were found to have their natal origin in the Garonne and only one adult (in the river Mondego/Portugal) was identified to originate from the Garonne in the whole dataset!

Table 9: Numbers adult allis shad of caught in the rivers Garonne and Dordogne assigned to natal river origins (from Daverat et al., 2015). Adults were sampled in 2012 and 2013.

% of Allocation to natal origin (Otolith signature, model)					
	Garonne	Dordogne	Adour	Nivelle	Un-determined
Collection site	Dordogne 2012 & 2013	61			10
	Garonne 2012 & 2013	46	11	3	4

Specific case of Garonne and Dordogne

Due to the small number of YOY abundant in the context of the overall situation of the population, the numbers sampled were too small to analyse the data and prepare a scientific publication. However, a comprehensive report was developed which is available in [French](#) and [English](#) language for experts and the interested public as well (see Annex 13 and 14). As the other project actions the results of the [action E.4 was also presented](#) by Aline Chaumel (Sméag) at the LIFE+ allis shad symposium in Bergerac.

5.1.10. Action E.5 Monitoring of the stocking efficiency in the Rhine basin

Due to the small numbers of shad larvae that could be released in 2015 comprehensive monitoring studies as conducted in the years before did not seem very promising. Even in order to save costs the monitoring was restricted to direct observations of the post-releasing behaviour of the larvae in NRW and Hesse as well. In both states and stocking dates respectively the larvae were released successfully. No mortalities, abnormal behaviour or immediate predation was observed.

For the entire project duration it must be concluded, that regardless of a) the various methods applied to detect YOY shads following the releasing, b) the temporal or c) spatial distance, d) the stocking location and type of water body (stagnant or flowing) and e) monitoring team, it did not succeed to re-catch released YOY shads.

By now the only positive detections of YOY shads in freshwater have been yielded with only some methods of fishing techniques: by means of drift nets exposed in the current downstream of stocking locations in fluvial systems visual observations following stocking (like in the river Sieg and the oxbow Erfelden in conjunction with monitoring measures of the preceding LIFE project), by means of floating gill-nets and push-nets (both in action E4 of this Life+ project) as well as by means of anchored stow-nets and external monitoring studies cooling water removal facilities at power plants with (juveniles at seaward migration). Classical methods of YOY monitoring like electric fishing with special adaptations (e.g. point abundance sampling) or beach seining failed so far in detecting the pelagic larvae and juveniles of allis shad.

All these findings confirm the difficulties to find YOY shads even in close proximity to their source at least when these are not abundant.

Table 10: Overview over the applied sampling techniques to detect YOY allis shad in action E.5

Year	Federal state	Water body	Sampling in close proximity to releasing	Sampling in weeks after releasing
2011	Hesse	Oxbow Erfelden	Visual observation of dispersing	Electric fishing Floating gill-nets
2011	Hesse	Gravelpit Lerchenloch	Visual observation of dispersing	Floating gill-nets Beach seine-net
2011	NRW	River Sieg	Drift nets	Electric fishing
2012	Hesse	Gravelpit Lerchenloch	Visual observation of dispersing	Floating and fixed gill-nets
2012	NRW	River Lippe	Visual observation of dispersing	Floating gill-nets, electric fishing
2013	Hesse (sampling in NRW)		River Rhine	Floating gill-nets
2013	NRW	Rheidter Laach/River Rhine	Visual observation of dispersing	fixed and floating gill-nets
2014	Hesse	Oxbow Erfelden	Push-nets	floating gill-nets
2014	Hesse	Gravelpit Lerchenloch	Visual observation of dispersing	
2014	NRW	River Lippe	Push-nets	
2015	Hesse	Oxbow Erfelden	Visual observation of dispersing	
2015	NRW	Rheidter Laach	Visual observation of dispersing	

5.2. Dissemination activities

5.2.1. Objectives

The dissemination activities targeted various stakeholders with different levels of knowledge, interest and expertise. It was tried to set up all dissemination tasks in a way that these different levels feel addressed. The activities reached from action addressing the broad, local and general public e.g. via the website, the project video, the allis shad festivals, the laymans report, brochures and flyers and publications and newspaper articles, TV-reports etc., a school class programme specifically targeting pupils, experts and decision makers by means of the LIFE+ allis shad symposium, the After-LIFE-Conservation Plan and technical and scientific publications. As the conservation needs for allis shad and the objectives of the Life+ project cannot be understood without a providing a certain technical background it was tried to provide the information adapted to respective level of the addressees.

5.2.1.1. Action D.1 Project website

The project website is available under the same domain address as the project website of the previous LIFE project (www.alosa-alosa.eu) and is maintained by the coordinating beneficiary, the LANUV. The user is passed on to the contents of the LIFE+ project automatically. The contents of the former Life project are still available as a sub-menu of the new website, including a summary of the most important objectives, achievements and prospects how the objectives will be pursued in the future. Almost all products are available for downloading from the respective download section. Even the products of the LIFE+ project will be available on the website for downloading in the coming weeks. The website will be also updated with a summary about the LIFE+ and its achievements.

It must be clearly admitted that the effort for translating into English, French and Dutch and the maintenance of the different language versions by the project team was underestimated in the project proposal. That's why only a German and English language version was online. In order to reach more stakeholders in the French and English speaking area the website installed for the project symposium (see action D.5) is used as an additional communication platform of the project and for distributing the [products of the project](#). Please note that besides these project websites, the website of the beneficiaries, e.g. the [LANUV](#), the [RhFV](#) and related organisations, like the [Ministry of Environment](#) and the [Stiftung Wasserlauf](#) were also used for pointing out to events, distribution of press releases and communicating the projects contents. All these platforms will be used for informing about the development of the allis shad populations in the two river basins and the implementation of the After-Life measures.

5.2.1.2. Action D.2 Project flyer/brochure

Since the first adult Allis shad from the stocking measures in the Rhine basin, which have begun in 2008 as a key action of the previous Life project, are to be expected to return to the Rhine about five years later from 2013 onwards, we have produced a flyer which not only informs about the Life+ project but also allows the secure identification of allis shad in order to enable fishermen, anglers and other stakeholders which might get in touch with allis shads to identify possible catchers or findings. This flyer was produced in German, Dutch, French i.e. all languages spoken in the Rhine catchment, and also in English. The distribution of the Flyer via the beneficiaries, the involved federal states and fisheries federations to anglers, the fisheries administration and professional fishermen has helped to obtain information about catches as well as carcasses found on the Rhine and some tributaries. The flyer was sent to the commission with the mi-term report.

Besides this product more or less specifically addressing stakeholders in the Rhine basins a brochure was produced that focuses on the situation of the allis shad population in the GGD basin, as the reasons for the unavailability of the formerly abundant and highly demanded allis in the public are widely unknown. The brochure gives an overview about the historical situation in the basin and all possible detrimental factors impinging the shads in the different phases of their life-cycle and provides suggestions how negative influences can be addressed and lessened. Promising developments as the increasing numbers of returning allis shad in the Rhine, originating from genitors from the GGD population, breed in France and released Germany, are presented in the context of the situation in the GGD basin and in order to demonstrate that supporting to re-establish a population in the Rhine does not weaken the GGD population but provides prospects for their recovery. A key intention of the brochure is to clearly point out that all detrimental factors acting on the shads also affect the populations of other diadromous species, most of them listed in the Annexes of the EU habitat directive, and that in turn they benefit from actions undertaken to conserve the allis shad.

The brochure was produced in [French](#) and in [English](#) language and are available for downloading on the project websites and are attached in the Annexes 15 and 15.



Figure 23: Cover of the brochure targeting stakeholders in the GGD basin in English and French language.

5.2.1.3. Action D.3 Information panels

The intended dissemination action to produce and install information panels at exposed locations along the rivers Garonne and Dordogne with different topics displayed about the former role of the locations in conjunction with the utilisation of habitats in the Life cycle, fisheries and culture, could not be implemented in the project duration. The reason is, that the negotiations concerning the permission of installation and the concrete topics displayed on the panels could not be maintained by the German project management. The French beneficiaries had already contributed to project implementation beyond their actual tasks and could not invest more working time to implement this much more than intended time consuming action.

5.2.1.4. Action D.4 Project video

The filming for the project video was made in 2012 and it was published in February 2013. The Video has a length of 36 minutes and is available in French, English and German Language. The three versions were requested on YouTube nearly 2400 times by June 2015 (please see https://www.youtube.com/channel/UCpbnDZqEFfb-NK2VZ5xZ_hQ). DVD copies can be requested at the project management. The DVD was sent to the commission with mid-term report. The video was shown on several events, like the allis shad festivals, school class programmes, school lectures beyond the Life+ school class programme, exhibitions and other occasions. Parts of the project video were inter alia used in a documentary about the allis shad project on the Rhine in programme format [Xenius](#) in the French-German TV channel Arte.

5.2.1.5. Action D.5 Organisation of events

An international symposium on the conservation and restoration of allis and twaite shad populations with 110 participants from nine countries was carried out in Bergerac/France between the 15th and 17th October 2015. The local organisation, the maintenance of the symposium website and the debriefing of the symposium was conducted by the associated beneficiary EPIDOR (see Annex 17).

A total of 25 presentations and speeches addressing the various threats the two shad species have to face these days were held. The first block of presentations addressed the history of the franco-german collaboration regarding the conservation of the allis shad and the objectives and the achievements of the LIFE and the LIFE+ allis shad projects that have been implemented together, followed up by presentations about all actions carried out in the LIFE+ project. Further presentations by external speakers in the one and a half day lecture programme addressed:

- the demands of allis shads towards technical fish ways and migration issues,
- -the effect of the mud plug on estuarine migration,
- Temperature and oxygen requirements of the YOY (in relation to degradation caused e.g. by the mud plug,
- Features of and monitoring of the allis shads spawning habitats
- The prospects of genetic tools for developing conservation strategies of shad populations,
- The dispersal and homing of different natal origins of allis shad by means of otolith micro-geochemistry analysis,
- The restoration plan for the American shad in the Susquehanna river,
- A planned restoration project for the twaite shad on the Severn river in the UK,
- The current situation of the allis shad populations in Portugal (which have recently decreased in a similar way as in the Gironde basin) and finally
- The conservation issues for the twaite shad

A lecture about the fisheries and their development in history on the Dordogne river on the occasion of the symposium dinner in the city hall of Bergerac as well as an excursion to the degraded current spawning sites of the allis shad upstream of Bergerac with an historical boat and to the dam and the fish way at Tuilières on the Dordogne added the symposium programme and were highly appreciated by the participants. All presentations and speeches were synchronously translated from French into English and vice versa. The Poller Maigeloog contributed an exhibition about the culture of allis shad fisheries in Cologne and Europe and the cooperation with the LIFE supported allis shad projects.

The objective of the symposium was to bring renowned shad experts apart from these of the project team together in order to discuss the conclusions to draw from the project actions in order to assess which steps must be gone to save the allis shad population in the Gironde watershed from extinction and to figuring out where additional knowledge about the already identified bottlenecks is required, was fully reached.

Unfortunately only few German participants registered, as the symposium fell into the autumn holidays and the beginning of the winter semester at the Universities, which has not when terminating the date for the Symposium.

A bilingual symposium website www.lifealose2015.com was developed for registering and informing on the beforehand on which also a [report](#) about the Symposium (see Annex 18) and all [presentations](#) and [photos](#) taken at the symposium are there available now. This website is also used for distributing the [technical reports and products](#) from the Life+ project.



Figure 24: Some impressions from the LIFE+ allis shad symposium in Bergerac

In total about 80 public events were organised or participated by the project coordinator. In all of these the project was presented (PPT-Presentations, talks, speeches) and in total many thousand auditors were reached, covering the range from the broad public to allis shad and migratory fish experts and political decision makers (see Table 11).

Table 11: List of events and presentations held and participated in conjunction with the Life+ project between 2011 and 2015

Date	Occasion	Location	Kind of presentation
11.01.2012	Dow chemicals	Stade	lecture about allis shad breeding techniques
24.02.2012	AAT Artenschutzfachtagung	Jena	Talk/presentation of the Life+ project
20.03.2012	Living North Sea project conference	Hamburg	Talk/presentation of the Life+ project
20.03.2012	Training for teachers in the Aquazoo	Düsseldorf	Talk/presentation of the Life+ project/practical exercises with migratory fish
18.04.2012	annual meeting of the fisheries consultants of the federal states	Kassel	Talk/presentation of the Life+ project
19.04.2012	Gewässerpartnerschaft Dill-Lahn-Ohm	Aßlar	Talk/presentation of the Life+ project/guide through the ex situ facility
23.05.2012	best-of-the-best award ceremony	Brussels	presentation of the Life project
06.06.2012	Inauguration of ex situ facility	Aßlar	Talk/presentation of the Life+ project/guide through the ex situ facility/press conference
13.06.2012	stocking of allis shad	near Krudenburg	Poster presentation of Life+ project/press conference
21.06.2012	Radio Interview	Aßlar	Radio Interview
26.06.2012	filming of the ex situ facility	Aßlar	technical consulting TV report
15.07.2012	lecture event for the public in the Aquazoo	Aquazoo/Löbbecke Museum	Lecture about migratory fish and the Life+ allis shad project
09.10.2012	annual meeting of the fisheries advisory board of Hesse	Wetzlar	Talk/presentation of the Life+ project/guide through the ex situ facility
29.09.2012	Annual fisheries day in North Rhine Westphalia	Olpe	Talk/presentation of the Life+ project
31.10.2012	seminar for representatives of water affairs/federation of hessian fishers	Aßlar	Talk/presentation of the Life+ project/guide through the ex situ facility
07.11.- 23.11.12	Exposition in the state parliament - 20 years of Life in North Rhine Westphalia	Düsseldorf	Poster presentation of Life+ project/press conference
04.02.2013	lecture for school class	Ursulinengymnasium Köln	Talk/presentation of the Life+ project
19.02.2013	meeting of experts for migratory fish/Bundesanstalt für Umwelt conference	Bonn	Talk/presentation of the Life+ project
11.04.2013	Meeting of the steering group for the migratory fish programme NRW	Düsseldorf	Talk/presentation of the Life+ project
May 2013	Europe Day Regional council of the Aquitaine	Bordeaux	Poster presentation of Life+ project/ongoing cinema presentation of the project documentary

Table 11 (continuation): List of events and presentations held and participated in conjunction with the Life+ project between 2011 and 2015

Date	Occasion	Location	Kind of presentation
04.07.2013	SEFS-Symposium	Münster	Talk/presentation of the of the Life+ project carried out in the Rhine basin
04.07.2013	SEFS-Symposium	Münster	Talk/presentation of the of the Life+ project carried out in the Gironde basin
22.08.2013	LANUV Fachtagung "Fischschutz in NRW"	Kirchhundem	Talk/presentation of the Life+ project
10.09.2013	GFG-Symposium Gewässernachbarschaft Ahr	Niederzissen	Talk/presentation of the Life+ project
29.09.2013	DAFV-Verbandsgewässerseminar	Göttingen	Talk/presentation of the Life+ project
11.10.2013	Contribution to TV-report about the Life+ project	Rees	Interview for WDR TV
07.11.2013	Contribution to TV-report about the Life+ project	Düsseldorf	Interview for WDR TV
09.11.2013	Freunde und Förderer der Außenstelle Zool. Inst. Uni Köln	Rees	Talk/presentation about the feasibility study floating gill-net sampling on the Rhine
22.11.2013	Seminar of the academy for nature conservation Hesse	Wetzlar	Talk/presentation of the Life+ project
04.12.2013	Meeting of the steering group for the migratory fish programme NRW	Düsseldorf	presentation of the recent developments in the Life+ project (Peter Beeck on behalf of A. Scharbert)
18.12.2013	Meeting with migratory fish experts in the Rhine axis	Stockstadt	talk about the needs and restrictions for the monitoring of allis shad in the Rhine
09.01.2014	Meeting with fisheries experts - Development of a fish monitoring concept for the Rhine in NRW	Düsseldorf	Presentation of the recent monitoring results
05.02.2014	Meeting of the ICPR migratory fish experts	Koblenz	presentation of the recent developments in the Life+ project (Karin Schindehütte on behalf of A. Scharbert)
06.02.2014	Representation of the migratory fish programme and Life+ project at the Fair "Jagd & Hund"	Dortmund	representation at the stand of the fisheries federation NRW
23.02.2014	Presentation for students of the University Tours	Siegburg	Talk/presentation of the Life+ project
25.03.2014	Meeting with migratory fish experts NRW	Düsseldorf	Discussion about the future prospects of migratory fish actions in NRW
03.04.2014	Interview Blog Aquazoo	Düsseldorf	Interview
06.05.2014	WDR3-Radiointerview about the Life allis shad projects	Mondorf	Radiointerview
10.05.2014	Interview about the first allis shad returnee for WDR-TV	Düsseldorf	Interview/Contribution to TV-report
22.05.2014	Erfahrungsaustausch: Erfassung der Wanderfische im Rahmen des bundesweiten FFH-Monitorings im Bundesamt für Naturschutz	Bonn	Presentation of the recent monitoring results
17.06.2014	allis shad school class programme	Düsseldorf	Poster presentation of Life+ project/press conference/TV-Interview
27.06.2014	Seminar "Energiewende und Gewässerschutz" Grüne Liga e.V.	Freiburg im Breisgau	Talk/presentation of the Life+ project
10.09.2014	Life riverine platform meeting (9.-12.09.2014)	Tartu/Estonia	Talk/presentation of the Life+ project (D. Clavé (MIGADO) and A. Scharbert)

Table 11 (continuation): List of events and presentations held and participated in conjunction with the Life+ project between 2011 and 2015

Date	Occasion	Location	Kind of presentation
19.11.2014	Meeting of the steering group for the migratory fish programme NRW	Meeting of the steering group for the migratory fish programme NRW	Meeting of the steering group for the migratory fish programme NRW
09.12.2014	Technical meeting on the impact of invasive fish species and their impact on native fish communities in the Rhine	Rees	Talk about the possible effects on juvenile allis shad
11.12.2014	Meeting with fisheries experts from Rhineland-Palatinate and Baden-Württemberg concerning the future involvement of additional federal states	Kandel	Talk, presentation and technical discussions about ideas for future measures to support the populations of allis shad
09.01.2015	Fisheries fair "Angelmesse Duisburg"	Duisburg	Presentation of the Life+ project at the stand of the Rhenish fisheries federation
22.01.2015	Fair "Boot"	Düsseldorf	Presentation of the Life+ project at the stand of the Aquazoo/Löbbecke Museum
03.02.2015	Meeting with the fisheries consultants of the Ministries of environment of the federal states of NRW, Hesse, Baden-Württemberg and Rhineland-Palatinate	Mainz	Talk, presentation and technical discussions about ideas for future measures to support the populations of allis shad
03.02.2015	Meeting with migratory fish experts in the region Alsace - the association Saumon Rhin	Oberschaefolsheim/ F	Talk, presentation and technical discussions about ideas for future measures to support the populations of allis shad (together with David Clavé)
11.02.2014	Interkulturelle Weiterbildungsgesellschaft e.V.	Düsseldorf	Presentation of the Life+ project as an example for EU supported reintroduction and conservation project for students of fisheries science from Kasachstan
14.02.2014	Triregionales Lachssymposium	Basel/Ch	Talk/presentation of the of the Life+ project (a video of the presentation can be watched here: http://www.rheinlachs.ch/symposium/de/content/referat9)
25.03.2015	Meeting of the steering group for the migratory fish programme NRW	Düsseldorf	Meeting of the steering group for the migratory fish programme NRW
21.04.2015	Meeting with representatives of the fisheries administration of the Region Alsace	Oberschaefolsheim/ F	Talk, presentation and technical discussions about future measures to support the populations of allis shad in the Rhine (together with David Clavé)
26.04.2015	Fair "Fishing masters"	Duisburg	Presentation of the Life+ project at the stand of the Rhenish fisheries federation

Table 11 (continuation): List of events and presentations held and participated in conjunction with the Life+ project between 2011 and 2015

Date	Occasion	Location	Kind of presentation
05.05.2015	Advisory board of the HIT environmental foundation	Siegburg	Presentation of the state of the art achievements of the Life+ project and plans for the the After-LIFE-time
18.05.2015	Meeting with representatives of the fisheries administration of Baden-Württemberg (D), Alsace (F) and Switzerland	Gambsheim/F	Presentation of the current achievements of the Life+ project and plans for the the After-LIFE-time/future cooperation
03.06.2015	Allis shad festival and school class programme	Cologne	Talk about the Life+ pröject and future plans
22.06.2015	World Fish Passage Conference	Groningen/NL	Presentation of the Life+ allis shad project by Gerard de Laak (Sportvisserij Nederland) on behalf of theproject management
23.06.2015	Life Start workshop	Bonn	Participation
24.06.2015	Metting with the Journalist Arno van't Hoog	Düsseldorf	Presentation of recent developments in the Life+ project
25.06.2015	GfG-Event Gewässernachbarschaft Sieg	Siegen	Life+ project presentation for stakeholders in water management of the river Sieg catchment
17.07.2015	Meeting with administration and staff of the University of Cologne	Cologne	Presentation of the Life+ project and ideas for future measures for the allis shad in the Rhine
18.07.2015	"Twait shad festival Kripp	Kripp am Rhein	Presentation of the Life+ project and press conference
22.08.2015	RhFV-event "day of the fish"	Meerbusch	Poster presentation on the occasion of the day of the fish event
09.09.2015	Project visit of the Life Unit of the EC	Aßlar/Gießen/Kirchh undem	Presenation of the stae of the art of the project implementation and schedule until the termination
14.10.2015	International Life+ project symposium	Bergerac/F	General presentation of the project and the major actions
06.11.2015	Interkulturelle Weiterbildungsgesellschaft e.V.	Düsseldorf	Presentation of the Life+ project to kasakh students
28.11.2015	RhFV-Infor-Event	Oberhausen	Presentation of the Life+ project to Anglers and members of the fisheries associations in the RhFV
02.12.2015	Workshop about the Ichthyfauna in the Rhine in NRW, Minsitry of Environment	Düsseldorf	Presentation about the recent developments around the allis shad in the Rhine

5.2.1.6. Action D.6 Allis shad festival / school class programme

The allis shad festival with the accompanying school class programme was conducted for the last time in the project duration on June the 3rd in Cologne-Poll. Besides the Rhenish Fisheries Federation (RhFV), the LANUV, the University of Cologne, LANUV NRW and Watercourse Foundation (Stiftung Wasserlauf) and the Poller Maigeloog contributed to the programme. The invitation flyer is attached to Annex D.6. About 40 children participated at the school class programme and undertook small courses at information stations situated at the banks of the Rhine. Besides a beach seining station at which the pupils got an insight into the fish communities of the Rhine, they learned how to determine invertebrates and to obtain information about the water quality of their environment, the life cycle and the environmental demands of allis shad and other diadromous species and released small elver eels into the Rhine. Finally they saw the LIFE+ allis shad documentary in the Fischerhaus. After all pupils and teachers were fascinated about the intensive programme and the participating schools asked for the opportunity to be involved in future offers.

The highlight for the remaining pupils (as the official allis shad festival started at 12 o'clock and most school and Kindergarten groups had to leave earlier) was the releasing of allis shad larvae together with the Minister of Environment of North Rhine-Westphalia Johannes Remmel, the state secretary in hessian Ministry of Environment Dr. Beatrix Tappeser and the Major of Cologne Elfi Scho-Antwerpes. Around 200 representatives, guests and visitors participated at the allis shad festival and the releasing of the shad larvae.

The culinary highlight were just for this occasion prepared allis shad dishes by the Poller Maigeloog that have been obtained from a Spanish fishermen which fascinated all invited guests. More [information and photos of the event](#) can be found on the website of the [Poller Maigeloog](#).

The table below gives an overview about the official school class programmes and allis shad festivals at the Rhine (one at the occasion of the inauguration of the Aßlar ex situ pilot facility) carried out in the project duration.

Table 12: Date, location, participants and contributors in conjunction with the official school class programme and allis shad festivals in the Life+ project duration

Allis shad festival				school class programme		organizers (in bold) and contributors
Year	date	location	Special guests	location	number of participating pupils	
2011	17.05.2011			Duisburg/NRW	30	RhFV , Watercourse Foundation
	21.06.2011	Stockstadt /Hesse	Lucia Puttrich (Minister of Environment of Hesse) Dr. Martin Woike (Head of Department, Ministry of Environment of NRW) Pierre Lanapats (Consule of the French Republic)			RhFV , Watercourse Foundation, Hessian Ministry of Environment
2012	06.06.2012	Aßlar/Hesse	(inauguration of the ex situ pilot facility) Monique de Marco (Vice president of the Region Aquitaine) Marc Weinmeister (state secretary Hessian Ministry of Environment) Dr. Martin Woike (Head of Department, Ministry of Environment of NRW) Hermann Hofmann (Director of the Hermann Hofmann Group) Jean-Claude Tribolet (General Consule of the French Republic) Roland Esch (Major of the City of Aßlar) and many others			RhFV , Hermann Hofmann Group , Hessian Ministry of Environment , Watercourse Foundation, Association
2013	11.06.2013	Cologne/NRW	Dr. Peter Beeck (Fisheries consultant, Ministry of Environment NRW) Florian-Peter Koch (Fisheries consultant, Ministry of Environment Hesse) Johannes Nüsse (President of the Fisheries Federation NRW) Jean Möhring (Honorary Consule of the Netherlands) Jaques Laborde (Honorary Consule of French Republic) Elfi Scho-Antwerpes (Major of Cologne) and many others	Cologne/NRW	190	RhFV , LANUV , Poller Maigeloog , Watercourse Foundation , University of Cologne, Fisheries Federation NRW
2014				Düsseldorf/NRW	20	RhFV , Watercourse Foundation, Aquazoo Löbbecke Museum
2015	03.06.2015	Cologne/NRW	Johannes Rimmel (Minister of Environment NRW) Dr. Beatrix Tappeser (state secretary Ministry of Environment Hesse) Walter Sollbach (Vice President Fisheries Federation NRW) Elfi Scho-Antwerpes (Major of Cologne) and many others	Cologne/NRW	40	RhFV , Watercourse Foundation , LANUV , Poller Maigeloog , University



Figure 25: Some impressions from the Life+ allis shad festival and school class programme.

5.2.1.7. Action D.7 Aquarium exhibition in La Rochelle Aquarium, France and the Aquazoo-Löbbecke Museum, Germany

A second allis shad exhibition in the Aquazoo-Löbbecke Museum in Düsseldorf was officially inaugurated in May 2013. A press conference was held on that occasion and yielded regional TV-reports and articles in newspapers and online media. The Aquazoo offered one of its most exposed Aquariums with a volume of 10 m³ for the exhibition in which 33 one year old allis shad from the Aßlar ex situ facility together with three sturgeons were presented. As in the Aquarium La Rochelle panels informed about the increasing endangerment of the allis shad, its former relevance along the Rhine and the background and the aims of the Life+ project. Unfortunately the Aquazoo was closed in November 2013 for structural restoration and renovation works (which are still not finalized) and the Aquazoo was closed for the public. As all other exposed animals also the allis shad exposition must be reversed. The shads and the sturgeons were brought back to the Aßlar facility in late November. Before that 233,000 visitors have seen the exhibition. Some of them and interested people from all over Europe visited the Aquazoo only in order to see and to take photos of the allis shad.



Figure 26: Allis shad exhibition in the Aquazoo. The exhibition in the Aquazoo was officially inaugurated in May 2013.

The allis shad exposition in the Aquarium La Rochelle was launched in 2011. A loss of the old adults exposed there in 2013 was compensated by taking three year old specimens from the ex situ stock in the Aquarium la Rochelle that were exposed in a big Aquarium together with other Clupeid fishes in an own thematic section dealing with migratory fish. A new information panel was installed on this occasion which gives reference to the Life+ project. Many hundred thousand visitors have seen the allis shad exposition in La Rochelle and are well informed about the conservation needs for allis shad and the Life+ projects objectives to ensure that. It is intended to continue the exposition in the After-LIFE-time and the natural death of exposed fish, respectively, unless juveniles can be obtained from the hatchery on Bruch. The Aquarium La Rochelle will together with other branches of the Life+ project also contribute to the World Fish Migration Day in 2016.

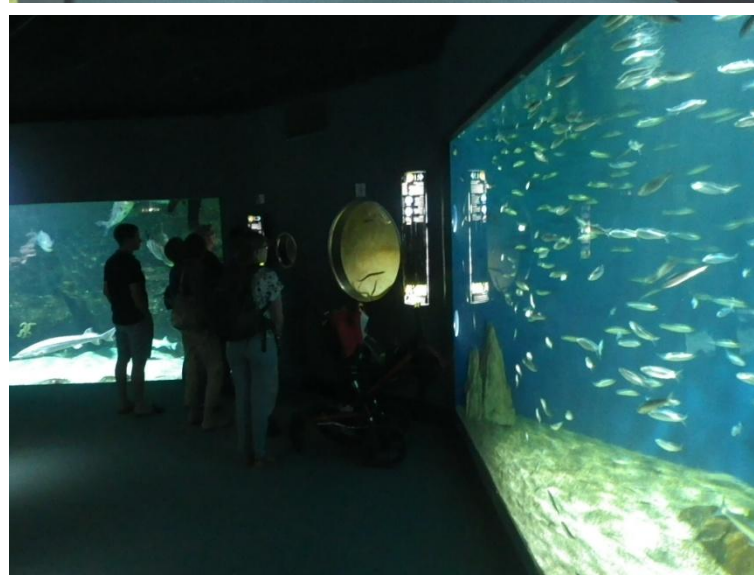


Figure 27: Some impressions from the allis shad expositions in the Aquarium La Rochelle (upper two) and the Aquazoo L  bbecke Museum (below)

5.2.1.8. Action D.8 Layman's report

A layman's report was produced in four languages (F, D, GB, NL) in electronic format and prints as an issue of the renowned LANUV technical report series (as the LANUV Fachbericht No 70). The layman's report gives a sound overview about the background, objectives and achievements of the project as well as about the possible scenarios for the future continuation. Even though it is comprehensibly written and richly illustrated it contains enough details to satisfy the thirst for knowledge even in more advanced and specialised stakeholders (which is probably true for the majority of inquiring addresses). The Layman's report can be found in the Annexes 20 to 23.

2500 print copies in German and each 1000 in the other languages (covering of the costs by the LANUV)

Besides the possibility to ordering prints free of charge the four language versions are available for free downloading from all project platforms.



Figure 28: Example of the English language cover of the Life+ allis shad project layman's report

In the entire project duration a total of 49 print media articles, 115 online media article, 8 radio, and 8 TV reports about the Life+ project were released (see Annex 24 and 25). Please note that not all articles and reports could be obtained by the project management.

5.2.1.10. Action D.10 Technical publications

Technical publications have been produced as part of the actions A.1, A.2, A.3, C.1, E.3 and E.4. With regard to the smaller than expected data in most cases a scientific publication in technical journals turned out to be impossible. The technical reports, most of them available in French and English language, can be obtained via the websites of the projects (www.alosa-alosa.eu and www.lifealose2015.com and these of some beneficiaries. Three (to be) peer reviewed articles have already been submitted (one additional not directly emerging from the Life+ project but referring to it), from which two are already published and another 3 will be submitted in 2016 and 2017. Some further Articles were published by the project management which are attached in Annex 26.

5.2.1.11. Action E.6 After Life Conservation plan

The After-Life-Conservation Plan was published at the very end of the project as a brochure. It deals with the continuation and development of the six main contents of the Life+ project developed in the Rhine and the Gironde basin.

As all stakeholders and target groups are English speaking and this is also the language of communication between the partners, regions and nations involved it was decided to publish only an English language version as the basis for the implementation of future actions.

1. Surveys on the development of a population of the allis shad in the Rhine
2. Improving the conditions for migration and natural reproduction of the allis shad in the Gironde watersheds
3. Dissemination and communication of the Life+ project activities in the future
4. Pilot facilities for ex-situ stocks and knowledge gathered within
5. Production and stocking of allis shad larvae

The After-Life-Conservation Plan is attached in Annex 27.

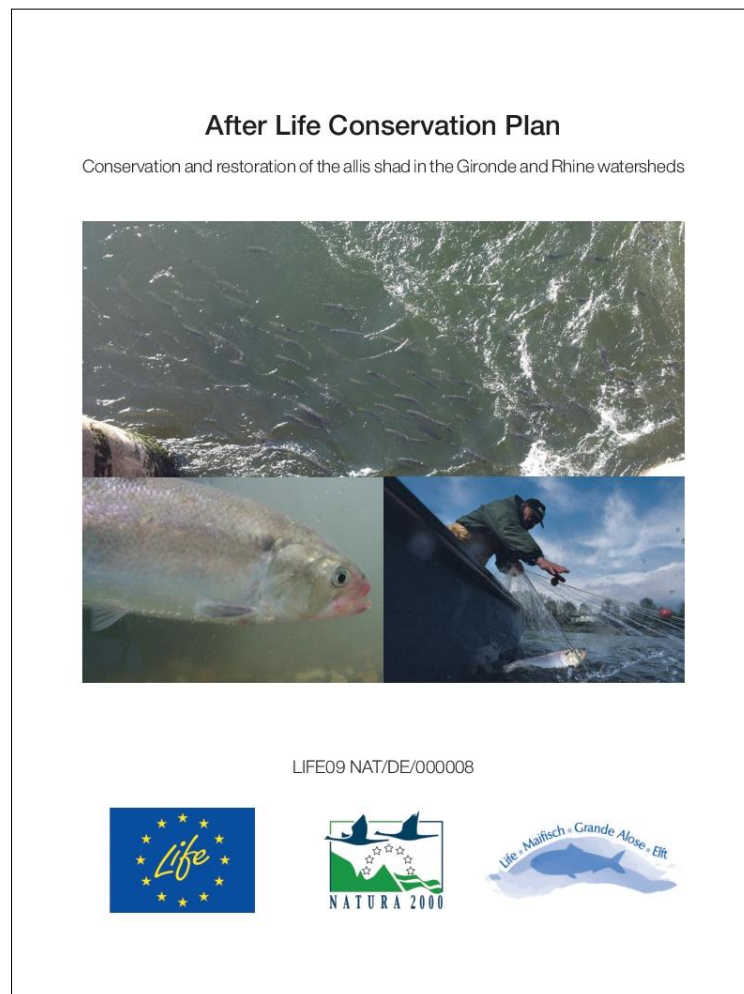


Figure 29: Cover of the After-Life-Conservation Plan of the Life+ project *Alosa alosa*

5.2.1.12. Action E.8 Monitoring the optimization of fish passages in the project area

Action E.8 aims on to putting the findings of the actions A.1 and A.2 into practice. The results shall immediately be implemented at the present fish ways in the Gironde basin in order to increase their efficiency and by that means to increase the chance of adult shads to reach suitable spawning grounds and to enhance recruitment. In sum the findings of the telemetric study in action A.2, the literature survey and experiences in the US indicate that migrating shads often fail in finding the entrance to technical fish ways or avoid to pass through them when once having entered. Current plans to modernise the fish ways in Garonne and Dordogne or to build additional facilities at the dams will take these findings into account. The implementation will start when the Life+ project is already terminated.

Table 13 Gantt-chart for demonstrating the progress of the single actions from the beginning of the project until May 2015. Black bars refer to whether the action proceeded as scheduled (X). Green bars to proposed modifications of the scheme (see 5.1 for details)

Action Number/name	2010		2011				2012				2013				2014				2015				
	September	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I
Overall project schedule (progress reports)			X				X						X					X					X
A.1. Shad passage facilities			X	X	X	X	X	X	X	X													
A.2. Study of the efficiency of fishways			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					
A.3. Identification of the migration routes in the Rhine			X	X	X	X	X	X	X	X													
C.1 Ex situ stock			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
C.2. Larvae production, marking			X	X			X	X			X	X			X	X			X	X			
C.3. Allis shad stocking in the Rhine basin				X	X			X	X			X	X			X	X			X	X		
C.4. Transfer of Know-how of Allis shad production				X				X															
D.1. Website			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
D.2. Project flyer/brochure							X	X	X	X	X	X	X										
D.3. Information panels			X	X	X	X	X	X	X	X	X	X		X									
D.4. Project video			X	X	X		X	X															
D.5. Organisation of events			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
D.6. Allis shad festival school class programme			X	X			X	X			X	X							X	X			
D.7. Aquarium exhibitions				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
D.8. Layman's report																							
D.9. Media work				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
D.10 Technical publications			X	X	X	X	X	X	X	X	X	X	X	X							X	X	
E.1. Management LANUV			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
E.2. Management RHFV			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
E. 3. Monitoring of adult upstream migration and reproduction activities in the River Rhine							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
E.4. Survey of the (YOY) on the GGD basin			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					
E.5. Monitoring stocking efficiency in the Rhine																							
E.6. After Life Conservation Plan																							
E.7. Networking			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

5.2.1.13. Outside LIFE: additional measures

A scientific collaboration was established between the LIFE+ project and research activities at the University Koblenz-Landau (Rhineland-Palatinate) and the University of Gießen (Hesse), as we agreed that it will be meaningful to cooperate in terms of conducting scientific research on topics, which are not direct part of our project, however, will increase our knowledge and benefit to the project objectives.

Besides the PhD study of Matthias Hundt at the University Koblenz-Landau which was already introduced in the Midterm report two additional studies have been implemented at the campus Landau: Alisa Pies has investigated the Otoliths of all allis shad specimen caught or found in the Rhine basin for marks and determined their age. Kathrin Metzner started their PhD study in which is financed by DBU support in order to develop a parental assignment method for allis shad in order to be able to determine the origin of shads in the Rhine without the need to sacrifice the fish in order to obtain otoliths. The material from the parental fish has been obtained from the allis shad fish farm in Bruch. Problems have been encountered in analyzing the parental DNA due to its degradation and impurity. The University is optimistic that these issues can be solved and there are good chances that the system will operate in the near future.

The students of the University Landau enabled us to collect, to store and to analyze all shads found ore trapped in the Rhine system. The knowledge gained here was very valuable for assessing the positive development of the population in the Rhine and didn't incur costs to the LIFE+ project.



Figure 3015: Hannah Wünnemann from the Clinic for Birds, Reptiles, Amphibians and Fish of the Justus-Liebig University Gießen has received the prestigious Wilhelm-Schäperclaus-award from the European Association of fish Pathologists in 2014 for her studies on diseases of allis shad.

Two institutes at the University Giessen collaborate with the LIFE+ project. The Zoological Institute at which Johanna Heinrich and Martin Kutzner has conducted the feeding experiments in conjunction with the maintenance of the pilot ex situ facility in Aßlar and the Clinic for Birds, Reptiles, Amphibians and Fish of the Justus-Liebig University Gießen, where Hannah Wünnemann is preparing her PhD thesis. Hannah Wünnemann also accompanies the rearing of the allis shad in the ex situ facility as a veterinary and helps us to improve the conditions in which the allis shad are kept. All allis shad having died in Aßlar are thoroughly investigated by Hannah Wünnemann. She also investigated all shads found or trapped in the Rhine system in 2013 and 2014 and also inspected all genitor fish in the allis shad hatchery in Bruch and compared the parasite communities of shads of the different origins. The quality of her studies yielded Wilhelm-Schäperclaus-award from the European Association of fish Pathologists in 2014. Two papers of Hannah Wünnemann with co-authorship from the project management have already been submitted.

The HIT-Environmental foundation, which is already co-financier in the Life and the Life+ allis shad projects is supporting a study at the Senckenberg-Institute which aims to develop a eDNA-Monitoring tool which can enable to identify the presence of allis shad in a waternody only by analyzing the water and determining traces of allis shad DNA within. This study has been proposed and is supported by the project management by providing tissue material from allis shad and water samples from the ex situ facility in Aßlar for developing this tool, which has prospects to facilitate the monitoring allis shad populations in the future.

All these studies will provide scientific publications which will refer to the LIFE+ project.

The feasibility study that formed the basis for the returnee monitoring was financed by funds of the fisheries tax in North Rhine Westphalia.

A field study about the allis shad spawning characteristics analysed with hydro-acoustic methods which was conducted in the duration of the LIFE project has led to a publication in the peer reviewed Journal of fish Biology by Manual Langkau. David Clavé from the association MIGADO is co-author. Additional data were provided by the project management. As is the other publications the LIFE+ project is explicitly mentioned and acknowledged (see Annex 28).

5.3. Evaluation of the project implementation

The project actions were implemented successfully in both parts of the project area, the Rhine and the Gironde basin. Except for only one exception, which led to the cancellations of an action (action D.3 Installation of information panels), all actions were implemented according to the project proposal. One action (Action A.3) needed to be repurposed, due to the unavailability of allis shad that should have been obtained from the GGD population. Actually, at the time when the project proposal was written, the unexpected steep decreasing of the allis shad population in the GGD basin is the main reason for the problems encountered in the project implementation and hampered us from reaching the target figures in some action, although their overall implementation was successful.

This affected the

- Action A.2, as only 222 instead of 400 shads could be tagged,
- Action A.3 (see above),
- Action C.2 and C.3, as too few genitors were available to compensate insufficient breeding efficiency and lower than scheduled numbers of larvae released in the Rhine basin in three years
- Action E.4, as the natural spawning and the related YOY were negatively affected by the collapsing of the spawner stock.

In most cases the poor database is responsible that in deviation from the project proposal no scientific publications (Actions A.2, A.3, E.4) could be submitted. Additional publications however were contributed from associated measures, not directly part of the LIFE+ project

Regardless of that the methods with which the actions were implemented were adequate, cost efficient and suitable to reach the objectives in technical actions that have been continued and further developed after the previous Life project (C.2, C.3, E.5) and those that have been established for the first time (A.1, A.2, A.3, C.1, E.2, E.4) with promising results for the future implementation and valuable knowledge for conservation of shad populations. Although even in action C.1 the objectives in terms of getting able to keep allis shad for the entire (in the Aquarium La Rochelle ex situ pilot facility) or at least a part of the life-cycle (in the ABlar ex situ pilot facility) and to mature them mature in captivity, the means in this action were too small to avoid the setbacks encountered and to reach the optimum. This applies on one hand to the personnel, as full-time positions for skilled Aquaculturists are required to maintain recirculation systems and to conduct facilities with this sensitive species and the complex demands. On the other hand the financial means involved were too small to technically adapt and retrofit the facilities after the knowledge gained. Please note that the implementation of the action C.1 in Germany was only possible as external funds were provided by the federal state of Hesse and the Hermann Hofmann group. After the retreatment of the Hermann Hofmann group severe setbacks causing the death of the stocks occurred as no additional, but required means were available to install technical emergency devices and no staff was available to impose counter measures. Nevertheless, valuable knowledge was achieved to be established in future ex situ facilities. The probably biggest success of the project was the beginning of the population development in the Rhine basin, in terms of increasing number of returnees from the stocking actions (which can be directly related to the breeding and releasing of larvae with a delay of three to five years), and spawning und reproducing in the Rhine. These findings proof the first attempts to breed and to successfully

re-establish the allis shad in a river system where the original population was lost! However these findings are resulting mainly to external monitoring schemes and studies (video control stations or studies in fish ways, YOY and adults in external monitoring studies and forwarded notifications of fishermen and anglers) and were collected and evaluated thanks to intensive networking activities. In order to monitor the population development beyond gathering indications a much higher monitoring effort and implementation of additional monitoring methods and in other words much higher means are required than in the respective budgets of the Life+ project. The effects of the beginning recruitment out of the natural reproduction will be hopefully confirmed in future monitoring studies.

Table 14: Evaluation of the implementation of the project actions

Task	Foreseen in the revised proposal	Achieved	Evaluation
A.1 A synthesis of knowledge of shad passage facilities	<ul style="list-style-type: none"> Preparation of fish pass guidelines to improve the efficiency of fish ways for allis shad after a survey of most current state of literature and an excursion to shad fish ways in the US Reports in English and French 100 copies on CD Scientific publication 	<ul style="list-style-type: none"> Preparation of fish pass guidelines to improve the efficiency of fish ways for allis shad after a survey of most current state of literature and an excursion to shad fish ways in the US Reports in English and French 100 copies on CD Free downloading Scientific publication (will be submitted in 2017) 	Due to personal reasons and the unexpected retreating of preselected experts and identification of alternative service providers the action was repeatedly postponed but finally successfully implemented in the project duration. The report will serve as a guideline for fish pass improvements and future plans in France and other European states and the USA. The scientific publication must be coordinated with superior organisations and will be submitted after the project termination.
A.2 Study on the efficiency of fish ways located in the lower part of the GGD basin	<ul style="list-style-type: none"> By tagging a total of 400 adult allis shads with radio-transmitters and pursuing the fish, their behaviour and their movements in the adjacent river stretches possible deficits of the four fish ways in the area of study (Bergerac, Tuilières and Mauzac on the Dordogne; Golfech on the Garonne) should be identified in order to be able to improving the conditions for migration and reaching productive spawning grounds in order to let the population recover. The insufficient accessibility of historically important 	<ul style="list-style-type: none"> In the four year study a total of 222 shads were successfully tagged and valuable information about the deficits of three fish ways were identified (due to the small number of shads and the even smaller numbers approaching the most upstream obstacle in Mauzac no data could be won here). Suggestions for improvements have been developed for all facilities. A comprehensive and comprehensible technical report with the suggestions for improvements was published in English 	The reason for the smaller than intended number of tagged shads is the worse development of the population and the restricted number of potential natural spawners for the scientific studies. Regardless of that the objectives of the study were fully reached. The findings will together with those of action A.1 be implemented in measures for the improvement of shad migration directly in the After-LIFE-time.

	<p>and still healthy spawning ground which forces the major part of the population to spawn on less suitable grounds is one of the core hypothesis that explains the concerning situation of the population.</p> <ul style="list-style-type: none"> • A technical report on the efficiency of the fish ways will be the basis for the optimisation of the fish ways • A scientific publication will be submitted 	<p>and French language and is available for free downloading to any interested group of persons.</p> <ul style="list-style-type: none"> • Because of the small dataset and the small proportion of the specimens finally surmounting the fish ways no scientific publication could be submitted 	
A.3 Identification of the upstream migration routes of allis shad in the Rhine basin	<ul style="list-style-type: none"> • By trapping of 20 adult allis shad in the GGD basin, transporting them to the Netherlands in a special transporter, tagging them with NEDAP radio-transmitters and releasing them in the lower parts of the Delta Rhine Area information about the possibility to orientate and taking migration routes of the shads in the hydrological complex delta area should be won. • A technical report will be published • Together with the results of action E.3 a scientific publication will be produced. 	<ul style="list-style-type: none"> • Due to the unavailability of adult allis and many insecurities about the feasibility of the study, action A.3 was repurposed • Not least due to first experiences gained in an externally financed feasibility study the action was implemented successfully in 2014 and yielded the <u>first three allis shad</u> proofed to be returnees from the LIFE and LIFE+ stocking stocking. • A technical report about the sampling with floating gill-nets was produced • Together with the results of action E.3 a scientific publication as written and successfully submitted 	The repurposing of the action A.3 led to a successful implementation of sampling techniques and proofed allis shad in the Rhine to be returnees from the Life stocking. The available budget for this action was limiting to detect further shads.
C.1 Ex situ stocks	<ul style="list-style-type: none"> • In pilot facilities for ex situ stocks of allis shad in the aquarium La Rochelle (France) and Nuclear power plant in Biblis (Germany) should be inaugurated to rear until maturity shads in captivity. An accompanying scientific study should monitor the onset and conditions of maturation in captivity. The development of these techniques can be important for 	<ul style="list-style-type: none"> • Regardless of the need to unexpectedly identify a new location for the German pilot facility and a series of setbacks causing the partial or total loss of cohorts in both facilities, which was tried to compensate by rearing and restocking the facilities with allis shad in all years of the project duration in the end the action was successfully implemented. As the sampling scheme in the 	Regardless of unexpected technical and organisational challenges, serious setbacks and simply a lot of bad luck, the action could be finally implemented successfully. It turned out that ex situ techniques have a high potential for the conservation of allis shad. Some problems going along with the maintenance of recirculation systems could be solved and paved the way for future actions, which indeed seem very promising. The main conclusion to draw is that the

	<p>conservation purposes and future reintroduction projects.</p> <ul style="list-style-type: none"> • The expected results were: • The development of techniques for ex situ stocks • Installation of a pilot ex situ facility in Germany • Long term captive rearing of Allis shad with a final output of 50 premature or mature Allis shad at the end of the Life+ project in the pilot facility in Germany • Development of a maturation index for Allis shad • Scientific publication on Allis shad maturation 	<p>French part of the action must be postponed for one year</p> <ul style="list-style-type: none"> • The last sampling was carried out in spring 2016 the last results about the proportion of matured specimens will not be available before June 2016 male (which normally mature one to two years earlier) and also female specimen have been proofed to mature in captivity! This also confirms that the obtaining offspring from genitors from ex situ stocks is principally possible. • Unfortunately repeated losses which can be mainly addressed to changes in the surrounding conditions and on the grounds where the facility was installed in the German ex situ facility will make it impossible to keep the shads by the regular end of their life-cycle there. By the lessons learned about the the maintenance of recirculation systems and the involvement of external scientific studies however valuable information about feeding optimisation and benefits for the health and survival of shad were won. • A technical report about the ex situ techniques was published and is available for free downloading • Two PhD and one MSc thesis were produced in cooperation with the ex situ facility in Germany, a renowned award was granted to one PhD student • One scientific publication was already successfully submitted. 	<p>means in the project were too to reach the optimum. For future attempts is recommended to ensure a full-time position for a skilled Aquaculturist and to provide means for the required equipment.</p>
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		At least one further will be submitted in 2016	
C.2 Allis shad production and marking	<ul style="list-style-type: none"> By means of allis mass production and marking techniques that have been established in the previous Life project in total of 7,5 – 10,000 marked allis shad larvae (1,5 – 2 mill per year) should be breed from wild genitor fish rapped at fish ways on the Garonne and the Dordogne and transported to Germany for releasing in the Rhine. This way the founding of an allis shad population in the Rhine should, begun in the previous Life project should be supported by means of the donor population in the GGD basin 	<ul style="list-style-type: none"> A total of 6.2 million allis shad were breed, marked and transported to Germany and contributed to found a population in the Rhine. 	Although the breeding techniques were further improved and allowed to breed up to one million larvae by recruiting only 40 genitor fish from the wild spawner stock when the surrounding re well (in terms of are well hydro-climatic and the related condition of genitors), cold periods in the spawning season and a necessary change of the hormone used for inducing the spawning impaired the productivity in the hatchery.
C.3 Allis shad stocking in the Rhine basin	<ul style="list-style-type: none"> A total 7.5 – 10 million marked allis shad larvae (1.5 – 2 mill per year) should be obtained from the hatchery in the Aquitaine (see C.2) and released in preselected and well suited habitats in the Rhine basin in the federal states of NRW and Hesse. Yearly technical reports about the stocking operations and the accompanying monitoring measure (see E.5) will be produced 	<ul style="list-style-type: none"> A total of 6.2 million marked allis shad larvae were obtained from the hatchery in Bruch and successfully released in preselected and well-suited habitats in the Rhine basin 	Although the intended number could not be released due to the above stated reasons the handling of the larvae and the releasing went out well without any mentionable losses.
C.4 Transfer of know-how of allis shad production and rearing from France to Germany	<ul style="list-style-type: none"> Breeding and rearing of 100.000 Allis shad eggs and larvae in the fish farm of the LANUV in 2011 with the help of French experts. Establishing the techniques in Germany A workshop about shad rearing techniques for fish farmers in Germany 	<ul style="list-style-type: none"> Breeding of about 50,000 eggs in the newly recently ABlar pilot ex situ facility in June 2012 with the help of the association MIGADO. A workshop was conducted on the same occasion for the purpose of training the staff in the ABlar facility and also involving interested fish farmers 	It succeeded to breed larvae from the eggs. The breeding techniques were successfully established in Germany
D.1	<ul style="list-style-type: none"> A project website using 	<ul style="list-style-type: none"> The website 	Although the action was

Website	the same domain www.alosa-alosa.eu will be produced to inform about the project actions and announcements to the broad public	www.alosa-alosa.eu was online in German and an English language from the Launching of the Life+ project <ul style="list-style-type: none"> A 2nd website www.lifealose.2015.com was produced in conjunction with the hosting of the Life+ allis shad symposium, which was and will be henceforth also used to publish the project's products in order to better reach the French and English speaking stakeholders 	successfully implemented it turned out to be difficult to maintain the website content-related and in four different languages by the project coordinator and the other beneficiaries. For the future planning it would be desirable to have a separate responsibility for this task.
D.2 Project flyer/brochure	<ul style="list-style-type: none"> A flyer and a brochure will be produced in the four languages (F, D, GB, NL) interesting for specialists and amateurs and wearing the Life and the Natura 2000 Logo Flyer 2500 per language Brochure (500 per language) 	<ul style="list-style-type: none"> A flyer mainly addressing stakeholders in the Rhine basin which informs about the project objectives and helps to identify allis shad was produced even to ensure that notifications about allis shad observations will reach the project management. The flyer was issued in the four languages (2500 in German, 1000 in the other languages (the costs were covered by the LANUV) A brochure was produced specifically targeting the stakeholders and the broad public in the GGD basin and informing about the reasons for the decline and need for conservation of the local the allis population in French and English The brochure is available for downloading 	The action was successfully implemented
D.3 Information panels	<ul style="list-style-type: none"> 5 information panels will be installed at strategic places in the Rhine and the GGD basin in order to inform the interested public about the Life+ project 	<ul style="list-style-type: none"> The action failed 	It was intended to produce five panels in the GGD basin at locations of relevance for the allis shad population in the basin. This turned out to bring too much time effort along to get implemented
D.4 Project video	<ul style="list-style-type: none"> A documentary will be produced in four 	<ul style="list-style-type: none"> The video was produced in 2012 in the shad 	Action was successfully implemented

	<p>languages (F, D, GB, NL) in 2011 and 2012.</p> <ul style="list-style-type: none"> • 100 copies each 	<p>seasons and issued in spring 2013</p> <ul style="list-style-type: none"> • All project actions and additional background information are represented. • Three language versions were produced (D, F, GB) and are available on YouTube. DVD copies can be obtained on demand 	
D.5 Organisation of events	<ul style="list-style-type: none"> • Public relation events will be organised targeting different audiences on local, national and EU level 	<ul style="list-style-type: none"> • About 80 public events were organised or participated. In all of these the project was presented (PPT-Presentations, talks, speeches) and in total many thousand auditors were reached, covering the range from the broad public to allis shad and migratory fish experts and political decisionn makers • An international Life+ allis shad symposium with about 110 participants was organised in Bergerac in October 2015 	Action was successfully implemented
D.6 Allis shad festival/school class programme	<ul style="list-style-type: none"> • Allis shad festivals in 2012 and 2014 in Cologne • Four years of school class programme (240 pupils) 	<ul style="list-style-type: none"> • Allis shad festivals in 2011, 2012 (inauguration of the Aßlar pilot facility), 2013, 2015 • School class programme in 2011, 2013, 2014 an 2015 (in total about 280 pupils) 	Action was successfully implemented
D.7 Aquarium exhibitions in France and Germany	<ul style="list-style-type: none"> • Temporary allis shad exhibitions in the Aquazoo/Löbbecke Museum Düsseldorf • Permanent allis shad exhibition in the Aquarium la Rochelle 	<ul style="list-style-type: none"> • Temporary allis shad exhibitions in the Aquazoo/Löbbecke Museum Düsseldorf • Permanent allis shad exhibition in the Aquarium la Rochelle • Many hundred thousand visitor at both expositions 	Action was successfully implemented
D.8 Layman's report	<ul style="list-style-type: none"> • A layman's report in four languages (F, D, GB, NL) will be produced in electronic and print format. • 500 copies in four languages 	<ul style="list-style-type: none"> • A layman's report was produced in four languages (F, D, GB, NL) in electronic format and prints as an issue of the renowned LANUV technical report series. • 2500 print copies in D 	Action was successfully implemented

		<p>and each 1000 in the other languages (covering of the costs by the LANUV)</p> <ul style="list-style-type: none"> • Available for free downloading at different platforms 	
D.9 Media work	<ul style="list-style-type: none"> • At least one press conference will be held per year in Germany and France • 50 newspaper • 50 online articles • 5 radio reports • 5 TV reports will be yielded 	<ul style="list-style-type: none"> • Numerous local and national press conferences and releases were made yielding to 49 newspaper articles, at least 115 online articles, 8 radio and 8 TV-reports (please note that not all articles and reports published could be obtained) 	The Action was successfully implemented
D.10 Technical publications	<ul style="list-style-type: none"> • 5 scientific publications will be submitted to international peer reviewed journals 	<ul style="list-style-type: none"> • 3 scientific publications have already been submitted (one additional not directly emerging from the Life+ project but referring to it), another 3 will follow in 2016 and 2017. • Five technical reports about the results of project actions (A.1, A.2, E.4) all bilingual, and A.3, and C.1 in English or German for downloading and print copies on demand • More than 15 articles and book chapters written from or contributed by the project coordinator and the other beneficiaries (all refer to the Life+ project) 	Regardless of the weak shad run and repercussions of actions in the GGD basin which should have led to scientific publications, which turned out to cannot be reached for reasons of the poor data base, the action could be finally successfully implemented, as additional paper were or will be submitted and the reports are available to all interested persons.
E.1 Project management at LANUV	<ul style="list-style-type: none"> • A senior project manager and financial and administrative staff ensure the duly financial administrative implementation of the project and the representative project management 	<ul style="list-style-type: none"> • A senior project manager and financial and administrative staff ensure the duly financial administrative implementation of the project and the representative project management 	Regardless of a change in the position of the senior project manager (Dr. Heiner Klinger was substituted by Daniel Fey) the action was successfully implemented
E.2 Project coordination at RhFV	<ul style="list-style-type: none"> • A project coordinator will be employed in order to ensure the duly technical and organisational implement project implementation (in 	<ul style="list-style-type: none"> • A project coordinator was employed and insured the duly technical and organisational implement project implementation (in 	The project coordinator changed already in the end time of the previous Life project in which Dr. Andreas Scharbert substituted Dr. Peter Beeck. Although the sum of the tasks to solve was

	<p>terms of technical coordination, contract award process and project management, reporting to the EU, accounting, coordination of public awareness campaigns, etc.).</p>	<p>terms of technical coordination, contract award process and project management, reporting to the EU, accounting, coordination of public awareness campaigns, etc.).</p> <ul style="list-style-type: none"> Besides these tasks and deviating from the project proposal the project coordinator was also responsible for the implementation of the action C.1 in Germany 	<p>marginal to get implemented by one project coordinator alone, the project management was successfully implemented</p>
<p>E.3 Monitoring of adult upstream migration and reproduction activities of expected returning allis shad in the river Rhine basin</p>	<ul style="list-style-type: none"> By means of the following methods information about returning allis shad from the LIFE and LIFE+ stocking actions and their natural reproduction should be gathered between 2013-2015: information campaigns for professional and recreational fishermen Data collection at monitoring stations at fish ways Monitoring of nocturnal spawning activities 	<ul style="list-style-type: none"> A total of 546 allis shad was detected while passing through fish ways at the Upper Rhine and the major tributaries in 2014 and 2015 (62 in sum in the time frame between 2000 and 2012!) Another 29 allis shad were reported (and proofed by samples and/or photos) from professional fishermen and anglers to be caught or found dead at the banks thanks to information campaigns and a special flyer (see D.2) from Germany and the Netherlands A monitoring of nocturnal spawning activities yielded the first records of the allis shad spawning in the Middle Rhine. Samples from numerous unmarked YOY trapped even far upstream of the stocking locations between 2013 and 2015 proofed that allis shad recruit naturally in the Rhine 	<p>The action was successfully implemented and demonstrates in an impressive manner the success of the actions carried out in the Rhine basin!</p>
<p>E.4 Survey of the YOY on the GGD basin</p>	<ul style="list-style-type: none"> By means of a targeted sampling YOY shad will be detected and quantified (between 2011 and 2013) and put in relation to spawning activities in the basin in order to allow conclusions about the 	<ul style="list-style-type: none"> A total of 20 YOY were sampled with quantifiable methods and another 148 by means of semi-quantitative methods between 2011 and 2014. Although it succeeded for the first time to 	<p>With regard to the critical situation of the GGD population and the weak natural reproduction the fact that it succeeded to develop and establish sampling techniques for YOY shad is a main success. The additionally won data</p>

	<p>spawning efficiency in the lower parts of the basin</p> <ul style="list-style-type: none"> • A technical report and scientific publication will be produced. 	<p>targeted sample YOY the number was very small and is attributed to the weak natural reproduction in the lower parts of the basins.</p> <ul style="list-style-type: none"> • The number of the sampled YOY is too small to produce a scientific publication. Interesting information about the age and size of the YOY and the time of emigration from the freshwater were won • A report covering this interesting insights and possible implications for the YOY was produced in 2015 in French and English language and is available for free downloading 	<p>contribute a lot to the understanding of the growth and the behaviour of the YOY and implications of the downstream migration i.e. the passage through the mud plug section in the Garonne.</p>
E.5 Monitoring of the stocking efficiency in the Rhine basin	<ul style="list-style-type: none"> • By means of different methods the stocking efficiency and the post-releasing behaviour of the YOY in the Rhine basin should be won • Yearly reports about the stocking and monitoring actions should be produced 	<ul style="list-style-type: none"> • Regardless of intensive sampling with adapted sampling methods and a variety of possible gears it does not succeed to re-catch any single YOY in longer temporal or spatial distance to the stocking location. • Yearly reports about the stocking and monitoring operations were produced for the measures in NRW and Hesse • YOY shads were actually detected in the Rhine basin by measures not being directly part of the Life+ project (anchored stow-net fisheries conducted by professional fishermen, monitoring of cooling water removal facilities 	<p>Although best practice methods were applied and methods were tried and adapted to the situation in the German stocking locations that succeeded to detect YOY in French shad rivers (see E.4) the fact that no YOY shads could neither be detected nor quantified underlines the difficulty to catch YOY shad (see E.4). This might be compensated by increasing the sampling effort. The fact that stocked YOY have been detected in previous studies and particularly the proving of returnees from stocking measures confirms that the stocking itself was successful.</p>
E.6 After-Life-Conservation Plan	<ul style="list-style-type: none"> • The After-Life-Conservation Plan sets out how it is planned to continue and to develop the initiated actions in the Life+ project and how the long term management of the allis shad in two river basins 	<ul style="list-style-type: none"> • The After-Life-Conservation Plan was published at the very end of the project as a brochure. It deals with the continuation and development of the six main contents of the Life+ project developed 	<p>The Action was successfully implemented</p>

	<ul style="list-style-type: none"> will be ensured The plan will be translated in English, German, French and Dutch 	<p>in the Rhine and the Gironde basin.</p> <ul style="list-style-type: none"> As all stakeholders and target groups are English speaking and this is also the language of communication between the partners, regions and nations involved it was decided to publish only an English language version as the basis for the implementation of future actions 	
E.7 Networking	<ul style="list-style-type: none"> The Diadfish Network was founded at the beginning of the 21st century and hosted by the associated beneficiary CEMAGREF/Irstea. This platform should be mainly used for networking in order to improve the knowledge and sustained management of migratory fish in Europe with the special emphasize on Alosa populations 	<ul style="list-style-type: none"> The DiadFish Network is not active and the website was not updated since 2009. However intensive networks have been developed with and by means of the following institutions and organisations: ICPR Associations for migratory fish conservation in France Migratory fish programme NRW World Fish Migration Foundation Living North Sea projects American shad projects in North America LIFE riverine platform Life+ allis shad symposium Monitoring institutions in federal states in Germany and along the Rhine axis Professional fishermen and angler associations in the river basins (F, NL, D, CH) etc.. 	The Action was successfully implemented
E.8 Monitoring the optimisation of fish passages in the project area	<ul style="list-style-type: none"> In this action the improvements implemented at the fish ways in the GGD basin should be followed. 	<ul style="list-style-type: none"> Immense financial means and further feasibility studies are required to ensure the duly implementation of improvement measures. The optimisation of the fish ways will be implemented from 2016 onwards after the project termination. 	Although not yet done and much more complicated than naively stated in the project proposal there are good chances for the successful implementation by 2020 (see After-Life-Conservation Plan for details)

		However, it is agreed between the French authorities and the financiers (EDF, Agence de l'eau Adour-Garonne) of the optimisation on the basis of the findings made in the actions A.1 and A.2	

One main success of the project is the dissemination of the project objectives and achievements. Experts, stakeholders and decision makers as well as the broad public could reached

Using multipliers such as the Poller Maigeloog, the Migratory Fish Programme NRW, the Watercourse Foundation, branches of the beneficiaries and the Co-financiers (i.e. Sportvisserij Nederland for communicating in the Netherlands)

Immense interest by the media in Germany, the Netherlands and France, supported by regular press conferences and releases, if possible released by superior authorities like the Ministries of Environment

Publishing the project documentary and TV reports on YouTube

5.4. Analysis of the long-term benefits

5.4.1. Environmental benefits

Thanks to the implementation of the Life+ project direct benefits were won in both river basins of the project area. The increasing of the number of allis shad returning to the Rhine basin and their natural reproduction not only confirms the success of the project design of the Life and the Life+ project, it also marks the point at which a population of this formerly extinct species starts to develop on her own. Although a continuation of the stocking measures will be required to ensure the durable establishment of a population in the Rhine, the fact of success cannot be highlighted enough. In the coming years allis shad are expected to actually utilise some Natura 2000 sides which have been designated to be potential spawning habitats (e.g. the “Rhein-Fischschutzzonen between Emmerich and Bad Honnef” in NRW). Other so far not identified relevant habitats for allis shad might be designated accordingly. In some cases it might become necessary to find compromises between hydro-engineering and the maintenance of the navigation and habitat protection, as some of the shallow inner-bend areas and riverbed aggradations in the channel are regularly excavated to ensure the shipping maintenance.

Going along with the increasing numbers of this long-distance migratory species the fish ways already built at the dams and barrages in the migration axes of the basin will become stronger utilised and their efficiency for shads will become more and more important as the shads might tend to occupy the more upstream situated stretches with increasing population growth, as to conclude from migration patterns related to the population size in the GGD basin. For the Rhine basin that means that the habitats in the Upper Rhine region upstream of the Iffezheim dam, which has so far not been considered as an environment for allis shad, as well as the surmountability of physical obstacles situated in the migration axes must be assessed to get increasingly frequented by allis shad. The fish pass guidelines developed in this project (action A.1) will contribute to facilitate the accessibility of so far insufficiently developed and isolated parts of the basin. As the biological consistency is a key concern of the EU water frame-work directive valuable synergies are provided.

The implementation of the action in the GGD basin has significantly increased the awareness for the dramatic situation of the allis shad population in the basin and the need to impose counter measures. Particularly the allis shad symposium at which national and international renowned experts and with NGO's, professional and recreational fishermen, administrative bodies, political decision makers and hydropower providers nearly all relevant stakeholders were brought together, was a good opportunity to communicate the need to move ahead soon. The studies on the conditions for migration and spawning success provided valuable knowledge about the deficits and suggestions for improvement which have been appreciated and will be implemented soon and should contribute to improve the conditions for the sustainable recovery of the population. Positive effects on the populations of other species (amongst these also migratory species targeted by the EU habitat directive) will go along with it.

5.4.2. Long-term benefits and sustainability

As further detrimental factors, e.g. the mud plug in the lower Garonne, have been highlighted there are good chances that the tasks for a sustainable improvement of these environmental issues will be also directly targeted. The suggestion to start a scientific stocking programme in the GGD basin following the example and the experiences made in the Rhine basin, accompanied by the intensification of monitoring measures and aiming to determine the survival of the YOY (a still unanswered question) and to promote the recovery of the population, will be supported. These measures will depend on additional funds and are part of a new Life project application.

Although the fisheries moratorium for allis shad is imposing a major threat for the small fisheries companies in the basin and forced many to give up their business, the restrictions on utilisation are widely accepted and abided with regard to the recovery of the population. Many fishermen adapted their gears used for catching other economically important species such as Sea lamprey to minimise the risk of incidental shad by-catches. Please note that skills of professional fishermen are unique and fishermen in both basins were commissioned for monitoring studies and had an alternative income from the LIFE+ project (in action A.3, E.3, E.4) and were also involved in dissemination activities (e.g. documentary and TV-reports), which provides a good basis for the future cooperation and communication.

However, the actions undertaken for the recovery of the shad population not only aim to improve conservation of the species; the long-term objective is to make it vital again to be able to stepwise re-open fisheries and ensuring the cultural anchorage of allis shad fisheries and cuisine in the culture of the Region. The same objective is envisaged for the Rhine basin, where the allis shad has had a similar cultural importance in former times. In fact some allis shad have despite the low fishing pressure in the Rhine basin already incidentally caught by professional fishermen and anglers, which has aroused some enthusiasm in the fishermen and their scenes. Although it will be a long way to re-open fisheries for allis shad in both basins (please note that the allis shad is protected throughout the year in Germany), professional fisheries and also specialised angling is very famous and offers a notable economical potential. However, the exploitation through fisheries can only be established under the umbrellas of basin specific management plans in order to ensure the sustainability,-

The main objectives for ensuring the long-term sustainability and ways of implementation are defined in the After-LIFE-Conservation Plan of the project. This report has only been produced in English language, as most of addressed actions require cross-border implementation and the involved stakeholders are all English speaking.

The main tasks for the After-Life time are the following. For all these tasks the financing for the next years or the hold-up time before recovering required funds for a longer implementation (in some actions) are insured. Please note that all these actions are also part of a new Life project application which would provide besides additional and required actions to ensure the implementation of the actions for long-term conservation of the allis shad populations:

1. Surveys on the development of a population of the allis shad in the Rhine

These comprise the monitoring of fish ways in the Upper Rhine and some major tributaries. The data will be provided to the coordinating beneficiary LANUV and the associated beneficiary RhFV and will be processed and analysed. Additional information about by-catches of fishermen, spawning observations, carcasses and YOY from the entire Rhine axis will be obtained through the networks that have been developed and analysed

accordingly. These studies will cause no direct costs, but will however only allow to monitoring major trends. More detailed surveys that allow assessments on the population development and recruiting will require additional funds and are part of the new Life project application.

2. Improving the conditions for migration and natural reproduction of the allis shad in the Gironde watersheds

Improving of the conditions for migration in the GGD basin by adapting or rebuilding fish ways in the Garonne and Dordogne is clearly envisaged. Modifications on the first fish ways will start in 2016 and will be financed by the former co-financiers of the Life+ project EDF and Agence de l'Eau Adour-Garonne. The costs amount to more than 5 million Euro. The French beneficiaries are also involved into the implementation and the monitoring of this modifications and surveys on the shad populations,

3. Dissemination and communication of the Life+ project activities in the future

Dissemination activities will be conducted by all beneficiaries in the LIFE+ project in France and in Germany. The German beneficiaries LANUV and RhFV implement the migratory fish programme NRW, which directly promotes the continuation of the re-establishing measures of the allis shad in the Rhine basin and also introduce the issues into the ICPR, which itself supports the and communicates to the member countries. School class programmes on shad with releasing events will be conducted by the RhFV and watercourse foundation in NRW/Germany and the Association MIGADO in the Region Aquitaine-Limousin-Poitou-Charentes/France as well. In the Netherlands releasing events and the communication of the project objectives and future developments will be even in future communicated by the former Co-financier Sportvisserij Nederland. Releasing events will be also coordinated with other events like the World Fish Migration day on 21st of May. The Aquarium exhibition established in the Aquarium la Rochelle will be continued in the After-Life-Time and point out to the conservation needs and achievements of the Life+ project. The project websites www.alosa-alosa.eu and www.lifealose2015.com are provided by the beneficiaries LANUV and Epidor and will be maintained and updated with project-related news, as well as products of the project will be even available in the future.

4. Pilot facilities for ex-situ stocks and knowledge gathered within

The knowledge gained in the pilot facilities should as possible be implemented in improved future ex situ stocks in order to actually breed allis shad off-spring from such stocks. The pilot facilities themselves cannot be maintained in the future without additional means. They furthermore do not have the required capacities and dimensions to reach these objectives, which was addressed in a new Life project application by an improved and adapted action and a modern ex situ facility which integrates the knowledge gained. For the hold-up time the remaining specimen from C.1 action are kept in a provisional facility at the University of Gießen which is currently financed by the Land Hesse. If the costs which amount to about 20,000 € per year can be covered by the land Hesse for a longer time will depend on the future prospects and size of the remainder stock.

5. Production and stocking of allis shad larvae

Regardless of the proofed natural reproduction and the related onset of a population development the continuation of the stocking measures in the Rhine must be insured to guarantee the durable establishment of a population in the Rhine, which is still too small to maintain itself. For the future it desired to build a hatchery after the template of Bruch

in the Rhine basin in order to breed larvae from genitors returning to the Rhine system, which is a core action of a new Life project application. Given no further decreasing of the population in the Gironde basin in the case of granting so far only allis shad hatchery in Bruch in the Aquitaine will primarily produce larvae for a scientific releasing programme in the Gironde basin. However, a basic stocking amount of about one million larvae per year can be obtained from Bruch. The costs amount to approximately 50,000 Euro per year. For 2016, in which no Life funding can be expected the stocking will be financed by the HIT environment foundation, co-financer in the LIFE+ project and a stocking support allowance of the Land NRW. In case of the rejection of the Life application alternative ways of funding for the following years must be found, which however seems to be promising.

5.4.3. Replicability, best practice lessons, innovation and demonstration value, long-term indicators

The LIFE supported allis shad projects are the so far first and only projects specifically addressing this highly threatened species and comprise concrete conservation measures. The achievements of the projects are convincing as it was proven that the methods developed are a success and led to returning allis shad and their natural reproduction in river basin where the population was extinct. These findings are promising with regard to bringing back the allis shad to other formerly occupied river basins with a respective habitat potential. Furthermore the knowledge gained about the demands for fish ways offers the opportunity to at least partly reopen formerly isolated habitats elsewhere.

Most actions implemented in the LIFE+ project have pilot and demonstration character. This applies to the still unique breeding and stocking techniques, the monitoring of the YOY, the ex situ stock rearing techniques, the floating-gillnet fisheries, and other methods established. Reports and papers about the methods, gears, techniques and the implementation have been published in the LIFE+ and the previous LIFE project and ensure the transferability. They can be easily obtained on the projects websites. The experts in the beneficiaries will be at the disposal for inquiries about these topics even in the future. For the after-Life-time it is intended to establish techniques that have so far only been used in the Gironde basin (and some other river basins still housing shad populations) in the Rhine basin and to adapt and probably further develop to the specific conditions in this basin. This knowledge can and will be transferred to other river basins and countries. The fish passage guidelines for allis shad are right already urgently requested from stakeholder in the UK, Germany and the North America and the knowledge gained here will be implemented in the future plans and improvements of existing fish ways. The long-term indicators will be the evolution of the allis shad population in the Rhine and the Gironde basin. In the Rhine the numbers of returnees are expected to first decrease a little as a consequence of the lower than envisaged stocking amounts in the years 2012, 2013 and 2015, but should, a continuation of the stocking actions for some further years provided, stabilise and then increase as a consequence of the natural recruitment. In The Gironde basins the improvements of the conditions for migration will lead to a higher proportion of shads that are able to surmount the dams and spawn on the better suited spawning sites upstream of the obstacles. Even if not the total number of shads surmounting the dams will increase immediately, which depends on the recovery of the population to which the improvement of conditions for upstream migration is only one agents, the ratio towards the fish spawning downstream is expected to increase at least.

6. Comments on the financial report

6.1 Summary of costs incurred

The costs incurred to this project in the different partner were in accordance with the grant agreement and the partial budgets of the beneficiaries and cost categories, respectively. The overall expenditures were 1,604,888 €, i.e. slightly lower than eligible (1,605,827 €). The costs were incurred in seven cost categories, comprising personnel, travel, external assistance, equipment, consumables, other costs and overhead costs, although not all types of costs were incurred in all beneficiaries. All costs were listed in internal accounting systems of the beneficiaries and the financial tools delivered from the commission as well. As the commission agreed an inquiry to be allowed to submit the financial reporting tool in use since the beginning of the project, the project team is grate to can save the time that would have gone along with these modifications, but added additional columns that help to assign the cost items to actions and beneficiaries, respectively.

Major discrepancies occurred in the personnel, consumables, other costs and overheads. They cone be mainly explained by shifts between cost categories, i.e. external assistance to personnel (in action A.2, C.2 in 2011) and equipment to consumables (in action C.1), as communicated to the commission in earlier reports. Further deviations occurred in the other cost (caused by higher than expected costs for the duly implementation of the project symposium in Bergerac) and overheads budget (by charging overheads to the LANUV budget). Please note that as stated in earlier reports the implementation of action C.1 i Germany was only possible due to external means amounting to about 250,000 € and provided by the land Hesse and the Hermann Hofmann group, which have been fully invested into the equipment of the allis shad ex situ facility in Aßlar.

Table 15: Statement of expenditures

Project costs incurred			
Cost category	Budget according to the grant agreement	Costs incurred within the project duration	%
1. Personnel	€ 604.939	€ 689.087	114
2. Travel	€ 94.866	€ 76.2421	80
3. External assistance	€ 646.893	€ 563.123	87
4. total non-depreciated cost			
- Infrastructure sub-total	€ 0	€ 0	0
- Equipment sub-total	€ 145.100	€ 105.836	73
- Prototypes sub-total	€ 0	€ 0	0
5. Consumables	€ 14.000	€ 52.034	372
6. Other Costs	€ 16.500	€ 23.595	143
7. Overheads	€ 83.529	€ 94.972	114
Total	€1.605.827	€ 1.604.888	100

Personnel costs

Personnel costs have been incurred in all beneficiaries except for Onema. Major discrepancies occurred in the budget of the beneficiaries Epidor (shifting external assistance to personnel costs in Action A.2) , additional costs for the organisation, implementation and debriefing of the Life+ allis shad symposium (D.5) and the layout of the brochure (D.2). Please note that higher personal costs in the beneficiaries Irstea (action C.1), RhFV (action D.6) and Sméag

(action E.4) weren't actually charged to project budget but carried by higher self-finance contribution of the beneficiaries. In other beneficiaries the personnel costs were lower than applied for (in action E.1 due to the lower salaries of the senior project manager Mr Fey compared to Dr Heiner Klinger; in action E.2 to lower salaries of the project coordinator Dr Andreas Scharbert) and also in action C.2, despite parts of the external assistance budget due to the unexpected retreating of the service provider la "Ferme de Ciron" immediately at the start of the breeding season in 2011 (see inception report), which was compensated by the staff of MIGADO.

Even though of getting aware and communicating the changes leading to this deviations to the commission immediately the exceeding of the eligible personnel costs budget was not avoidable without threatening the implementation of actions.

All personnel costs incurred are calculated on the basis of the salaries of the persons involved and their working time effort, which was documented and controlled via the time sheets of the staff. The timesheets were delivered to the project management on short and regular intervals. Examples have been provided to the commission via the Particip monitoring team during project visits. Following the mid-term report the commission has requested documents regarding the personnel costs in some beneficiaries. These are attached in the Annex "Requested documents mid-term report". Please note that the documents are sorted by Beneficiary and not per cost category.

Table 16: Costs incurred per beneficiary

Beneficiary	Sum of costs	Overheads	Total	According to the grant agreement	Difference
Epidor	173.213 €	10.756 €	183.969 €	160.000 €	-23.969 €
Irstea	169.875 €	5.533 €	175.407 €	155.433 €	-19.974 €
LANUV	208.069 €	18.700 €	226.769 €	267.142 €	40.373 €
Migado	377.420 €	24.363 €	401.783 €	408.200 €	6.417 €
RhFV	397.044 €	27.153 €	424.197 €	415.053 €	-9.144 €
SMEAG	138.053 €	8.466 €	146.520 €	150.000 €	3.480 €
Onema	46.242 €	0 €	46.242 €	50.000 €	3.758 €
Sum	1.509.917 €	94.971 €	1.604.888 €	1.605.828 €	940 €

Travel costs

Travel costs were incurred to the project according to the internal rules of the beneficiaries. Examples for how driving costs have been charged to the project have been provided with earlier reports. No travel costs have been charged by the coordinating beneficiary LANUV and the associated beneficiary ONEMA, but by all other beneficiaries. Besides driving costs, they comprise flights, toll costs, parking costs, daily rations (in RhFV following the public law for travelling costs in NRW) and meals allowances after the rules of the French

beneficiaries provided they are eligible and charged in conjunction with the implementation of project actions, team meetings and public and dissemination events.

The global travel cost budget was not exceeded and the travel costs were below the beneficiaries budgets according to the grant agreement. Please note that the travel cost budget of ONEMA was repurposed into external assistance costs. The tendered service provider WSP organised the excursion (including the expenses going along with that in the USA). The travel budget of the associated beneficiary RhFV was however significantly over-exploited as a matter of maintaining and conducting of the ex situ facility in Aßlar (which could not be charged to the action C.1), team meetings in France in order to ensure the duly implementation of the actions and the participation of workshops and symposia in conjunction with the Life+ project (e.g. Life platform meeting in Tartu/Estonia in September 2014). Examples for the summarized travel costs of the project coordinator Andreas Scharbert (RhFV) have been requested following the mid-term report and are attached in Annex “Requested documents mid-term report”.

These costs are charged following the public law for travelling costs in NRW and comprise driving efforts (mileage allowance 0.3 € per kilometre), reimbursement of tolls, parking fees, daily rations (separated into national and international accommodations) flight costs and hotel costs. The costs for meals, including breakfast are covered by the daily rations and were not charged to the project. A further example for the calculating and charging travel costs of the beneficiary Sméag including the calculation of charging driving costs are also attached in the Annex “Requested documents mid-term report”.

External assistance

The global budget of external assistance costs was not fully exploited. The external assistance budget of ONEMA in action A.1, which was exceeded due to repurposing the travel costs into external assistance in this action and higher expenses in action D.4 in conjunction with the Life+ allis shad project video, money was saved in most other actions. Service providers and suppliers were in general selected by the beneficiaries responsible for the implementation of an action and tendered according to the external rules. For example the threshold between direct treaty and public tender in the LANUV is set at 500 €, above which at least three different offers for the supplying or the service must be requested. Please note that in some special cases the demanded service could not be offered by this amount of providers. In case of many providers the economically most meaningful offer was selected when the requested level of the service was provided. In some cases, e.g. in action C.1 when unexpected occurring incidents imposed a threat to the action (the loss of the stock) and when no alternative service providers could be identified on short notice services were commissioned without being able to tendering (damage at the aeration device of the ex situ facility, pathogenic diseases causing the loss of specimens in the stock and the risk of further losses etc.).

Equipment costs

The budget for Equipment was not globally exploited. Equipment costs were incurred in the actions A.2, C.1, C.2 and E.4. With exception of the action C.2 the budget available for this cost type was not exhausted. In C.2 the additional costs were incurred in order to ensure better breeding efficiency in the allis shad hatchery in Bruch, which was communicated and agreed by the commission on the beforehand. AS in the other cost categories the selection of the supplier underlie the responsibility of the respective beneficiary and followed their internal

rules (see under external assistance costs). Please note that in some actions deviating from the grant agreement no equipment purchases have been made (e.g. in D.6, E.1) or weren't used due to the cancellation of an action (D.3). Please note that in case of the ex situ facility in Aßlar some purchases required advance payments, which are not permitted in the responsible coordinating beneficiary LANUV. In these cases the goods were paid by the project coordinator who was reimbursed for the original invoices later on.

All equipment goods have been listed and assigned to be funded by Life+ means.

Consumables

The consumables budget was the strongest exceeded for various reasons. On one hand some materials did not fall under the rules of equipment as they were not durable (e.g. in action A.1, C.1, C.2) or were simply demanded to duly implement the actions. This particularly applied to actions of breeding and having allis shad in culture (actions C.1, C.2) with high demand for food, chemicals, salt etc.. Please note that not having applied these treatments would have led to losses of the stocks or the endangered the implementation of these actions in general, particularly after the retreatment and no further supporting from the Hermann Hofmann Group from the ex situ facility in Aßlar. This meant inter alia that henceforth energy costs, which have been formerly provided free of charge must be paid by the coordinating beneficiary. These issues and implications were reported to the commission in earlier reports. Unfortunately, the budget must be over-exhausted and rules for the eligibility of costs must be broken.

Other costs

The budget for other costs was also slightly exhausted, however remained in the boundaries of eligibility. Other costs were not occurred in all actions according to the grant agreement. No other costs were charged in the dissemination actions except for D.5 (Life+ symposium) and D.10 (translation of technical publications from French to English in order to reach broader target group beyond France). Please note that the budget for the action D.5 and D.10 was actually foreseen to be part of the LANUV budget, but that the local coordination in France was dedicated to the beneficiary Epidor and that it also was reasonable to tender the translation services in France directly

Furthermore the other costs in action C.2 (allis shad production) were considerably higher than foreseen in the Grant agreement, which was mainly due to higher costs for the accommodation of the seasonal staff. Please note that the total budget in this action not exhausted.

Overheads

Overheads have been charged by all beneficiaries with the exception of Onema on the basis of 7% of the beneficiaries total costs budget. Please note that deviating from the Grant Agreement overheads were also charged by the coordinating beneficiary LANUV.

6.2 Accounting system

The accounting is ensured on the beneficiaries and on the project management level. All beneficiaries have their own accounting systems and are responsible for the documentation in the beneficiaries' financial reporting tools, which have been sent to the project management on demand.

All expenditures have been equipped with an internal code in the beneficiaries accounting systems which have also been adopted in the master file of the project management, which ensures to clearly assigning the costs to belong to the LIFE+ project in all accounting systems. The original invoices and financial documents are equipped with the same code. If not already in the original invoice a link to the LIFE+ project was given, the invoice was equipped with a stamp and code in the beneficiaries accounting departments. The procedure in the coordinating beneficiary was the following: Service providers or suppliers were tendered on the beforehand. After submitting their invoice to the accounting department of the LANUV FB 36, the accounting staff asked the project coordinator for confirming the mathematical, content-related and eligible correctness. After receiving the respective note or comment from the project coordinator, the LANUV FB 36 accounting department was sending a payment instruction was sent to state treasury of the Land NRW, which implemented the payment to the supplier. The LIFE+ project owns a specific bank account which has been used for all transactions (payments of co-financiers, the coordinating beneficiary self-finance contribution, payments of the EU) to and from the project management and allows to identify all project specific payments. The state treasury sent afterwards confirmations about the payment to the LANUV FB 36 department, where they were equipped with project specific codes (Year and sequential number), which can be found on the original invoices and were also used in the financial reporting tool. That means that all transaction in conjunction with the Life+ project can be identified in the local, the state treasury accounting systems and the project specific accounting system. This also applied to payments to the associated beneficiaries who justified their payment request with an allocation of the costs incurred. Even in these cases the conformation of the project coordinator was a prerequisite of the payment.

As explained in section 6.1 personnel costs were charged on the basis of the gross salary and the number of working time units spent to the implementation of project actions in all beneficiaries (please note that with exception of the project coordinator no full-time position occurred in the beneficiaries staff). The respective working time units were documented in the beneficiaries' internal time registration systems and then documented on the Life time sheets. The time sheets were approved and signed by the managing directors or presidents of the beneficiaries on short intervals (regularly monthly). Upon approval the time units were provided in the financial reporting tool and the personnel costs charged to the LIFE+ project accordingly.

6.3 Partnership agreements

Partnership agreements have been made with the coordinating beneficiary and all associated beneficiaries and were submitted to the commission in earlier reports. No amendments from the partnership agreements were necessary as no deviations from the statements therein occurred.

6.4 Auditor's report/declaration

The external audit was commissioned to the company KOMTAX after a regular tendering and was implemented according to the LIFE+ Common provisions and following the template provided by the commission. Diverging from the statements in earlier reports and originally intended the audit survey could not be provided by the internal department of the LANUV for reasons of inadmissibility, which emerged soon before the submission of the final report. The delay caused by the tendering and selection of an auditor is the main reason for the delayed submission of this final report and was accepted by the commission.

Details of the Auditor:

WP/StB Marcus Wilming

KOMTAX Wirtschaftsprüfungs GmbH

Splietterstraße 54

48231 Warendorf

Germany

Membership number at the German Chamber of Public Accountants: 150942101

Website: www.komtax.de

The audit report is attached in Annex 35 Audit report

6.4 Summary of costs per action

Comments on the costs per action and the beneficiaries can be found in chapter 6.1.

Table 17: Summary of costs per action

Action	Personnel	Travel	External assistance	Equipment	Consumables	Other direct costs	Costs incurred in the project duration	Costs according to the grant agreement	Difference
A.1			46.242 €				46.242 €	47.700 €	1.458 €
A.2	80.746 €	8.266 €		66.091 €	3.466 €		158.569 €	153.650 €	-4.919 €
A.3	1.370 €	832 €	22.000 €				24.202 €	22.000 €	-2.202 €
C.1	54.499 €	7.668 €	142.386 €	4.418 €	27.382 €		236.353 €	217.700 €	-18.653 €
C.2	126.604 €	18.003 €	165.726 €	28.115 €	21.021 €	10.775 €	370.243 €	357.800 €	-12.443 €
C.3/E.5			54.590 €				54.590 €	80.000 €	25.410 €
C.4	3.299 €	1.675 €					4.974 €	14.997 €	10.023 €
D.1							0 €	0 €	0 €
D.2							0 €	3.000 €	3.000 €
D.3							0 €	5.000 €	5.000 €
D.4			13.590 €				13.590 €	10.000 €	-3.590 €
D.5	2.759 €				29 €	10.565 €	13.353 €	9.500 €	-3.853 €
D.6	18.460 €						18.460 €	17.620 €	-840 €
D.7		1.642 €	2.994 €				4.637 €	3.000 €	-1.637 €
D.8			1.922 €				1.922 €	1.000 €	-922 €
D.9							0 €	0 €	0 €
D.10						1.320 €	1.320 €	0 €	-1.320 €
E.1	27.222 €		5.600 €				32.822 €	47.951 €	15.129 €
E.2	342.636 €	35.949 €					378.585 €	372.280 €	-6.305 €
E.3			11.067 €			935 €	12.002 €	20.000 €	7.998 €
E.4	31.493 €	2.207 €	97.006 €	7.212 €	136 €		138.053 €	139.100 €	1.047 €
see C.3/E.5									
E.6							0 €	0 €	0 €
E.7							0 €	0 €	0 €
E.8							0 €	0 €	0 €
Sum	689.087 €	76.242 €	563.123 €	105.836 €	52.034 €	23.595 €	1.509.917 €	1.522.298 €	12.381 €

Annexes

