European Commission

LIFE and freshwater fish

LIFE Nature

Environment

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Foreword

Photo: European Commission

Angelo Salsi
Head of the LIFE Nature Unit
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European Commission

The conservation of Europe's freshwater fish and their habitats is an important EU policy goal, supported not only through the Habitats Directive and the EU 2020 Biodiversity Strategy, but also, because of the clear and close links between water quality and fish conservation status, through the implementation of the Water Framework Directive and associated River Basin Management Plans.

As the only specific source of European-level funding for nature conservation, the LIFE programme has made a huge contribution to the improved status of threatened fish species across the EU. This includes vital work in favour of near extinct species such as the houting (*Coregonus oxyrinchus*), allis shad (*Alosa alosa*) and saramugo (*Anaecypris hispanica*). In all, LIFE has already targeted 51 of the 65 freshwater fish species listed in the Annexes of the Habitats Directive.

Projects within this publication can be divided into several categories: those that highlight the impact of river habitat restoration projects on fish species (some 80% of all freshwater fish projects); those that reintroduce or restock target fish species; those that overcome barriers to migratory species through the addition of fish passages; and those that raise awareness of the threats facing protected fish species and that engage with stakeholders to improve conditions for those species.

In addition to highlighting the positive impacts of LIFE on freshwater fish conservation, this new brochure provides food for thought by outlining some lessons from completed projects and potential improvements or areas of renewed or increased focus in future.

As the project examples highlighted in this publication demonstrate, in many cases LIFE co-funding has helped inspire further conservation actions that build on the work started through the programme.

In addition to their pump-priming effects, LIFE projects have had demonstrable effects in terms of ecosystem services, for instance by improving the overall health of river systems, increasing populations of species fished commercially and for leisure, and indirectly strengthening flood defences through reinstating natural river dynamics, an important co-benefit that helps in climate change adaptation.

LIFE projects have also added value at European level through cross-border cooperation and through networking events such as the LIFE Platform Meeting on riverine species, held in Estonia in September 2014.

Freshwater fish conservation and river habitat restoration will continue to be supported by traditional LIFE projects for the 2014-2020 funding period. The scope of funding has been widened to include species in the IUCN European Red List, enabling LIFE to have a positive impact on an even greater number of threatened species. Furthermore, the addition of integrated projects to the programme's portfolio promises to improve linkage between the Natura 2000 network and the River Basin Management Plans, as well as enabling larger and more ambitious projects at regional and national scale. In this way, LIFE funding can have an even greater impact in terms of job growth within the vitally important blue and green economy.

Contents

INTRODUCTION

Freshwater fish conservation in Europe

Freshwater fish populations are under threat across Europe, mainly as a result of degradation of riverine systems by human activity. Factors include weir and dam construction, river regulation, loss of riverbed substrate, water extraction and eutrophication, and stream fragmentation.

Freshwater fish are one of the most diverse groups of vertebrate species in Europe, and they represent around one quarter of all vertebrates worldwide. Within Europe, the areas of highest fish species richness are within the lower parts of the large EU rivers flowing to the Black and Baltic seas, such as Danube and Vistula. Eastern and central Europe are also particularly rich, as is all of the Balkan Peninsula and the catchments of the Elbe and the southern Baltic Sea basin.

The majority of fish species present are endemic and only occur in Europe. Many species occur in just one catchment, in few springs or streams, and about 60% of all freshwater fish assessed as being 'critically endangered' in the latest IUCN European Red List[1] occur in these areas. Mediterranean rivers and water bodies (for example lagoons) are the ones that hold the most endangered species.

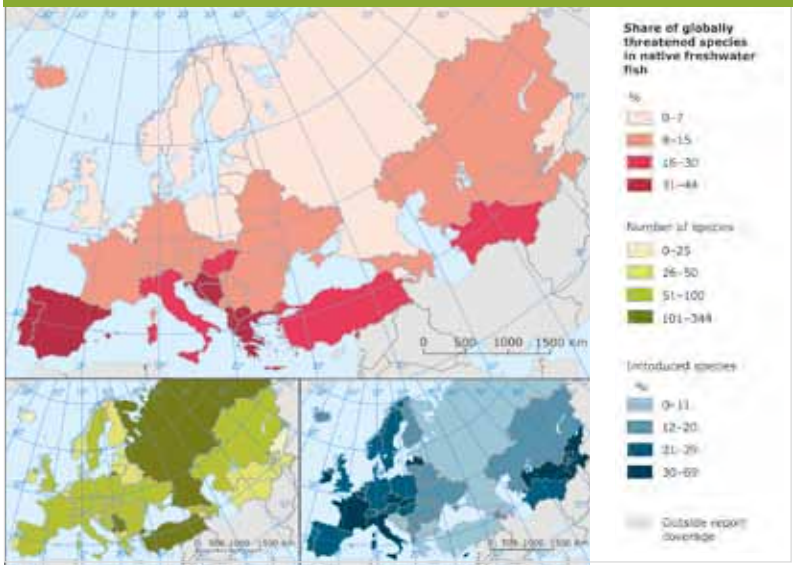
The Natura 2000 network

Natura 2000, the EU-wide network of nature protection areas established under the Habitats Directive (92/43/EEC), is the centrepiece of EU nature and biodiversity policy. Its aim is to ensure the long-term survival of Europe's most valuable and threatened species and habitats. The network is comprised of Special Areas of Conservation (SACs) designated by Member States under the Habitats Directive and incorporates Special Protection Areas (SPAs) which are designated under the Birds Directive. Many of the 27 300 Natura 2000 sites (as of June 2014), which cover more than 1 million km^2 and represent more than 18% of total EU surface area, play a crucial role in helping to conserve freshwater species and their habitats.

At present, 85 of the 202 freshwater fish species in Europe are considered as 'threatened', according to the latest IUCN Red List assessment. A total of 77 freshwater fish species are listed in Annexes II, IV and V of the Habitats Directive. This assessment also shows that there are 60 freshwater fish species threatened at the EU-27 level which are not covered by the relevant annexes of the Habitats Directive.

Assessments of the conservation status of the habitat types and species of community interest included in the annexes of the Habitats Directive have been carried out in the EU-25 for the period 2001-2006 and in the EU-27 for the period 2007-2012,

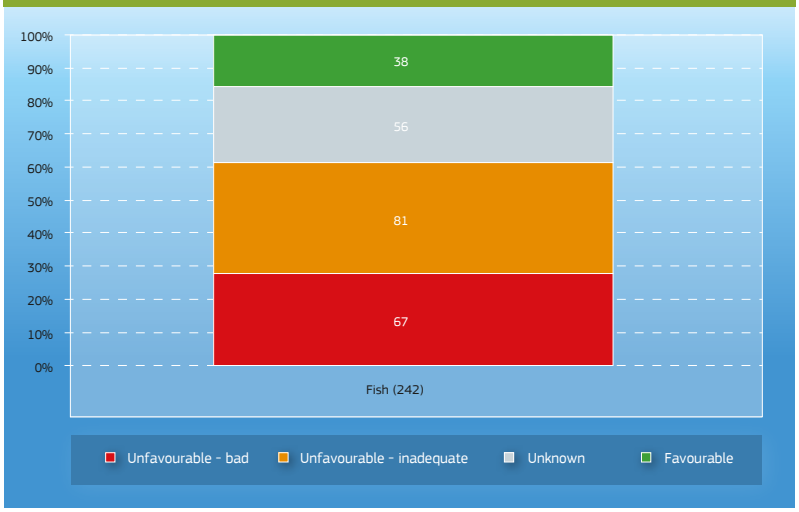
Fig. 1: **Distribution of freshwater fish in the pan-European region**



Source: EEA, 2007 - http://www.eea.europa.eu/data-and-maps/figures/ds_resolveuid/15874F65-F340-4C76-BCC3-D19970F62BBC

1 Freyhof, J. and Brooks, E. 2011. European Red List of Freshwater Fishes. http://ec.europa.eu/environment/nature/conservation/species/redlist/downloads/European_freshwater_fishes.pdf

Fig. 2: **Assessment of conservation status of freshwater fish species (2001-2006)**



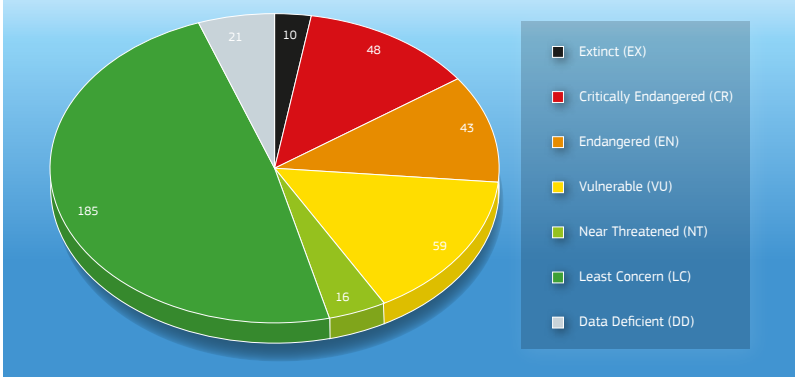
under what is known as the Article 17 reporting process. According to the 2006 report, more than 60% of fish species have an 'unfavourable' conservation status, with more than 25% of them reported as 'unfavourable-bad' (see Figure 2).

Threats to freshwater fish

According to the IUCN, pollution is one of the most widespread threats affecting fish, but it is not the most serious in terms of extinction risk. Significant threats to freshwater fish are water abstraction (by the agriculture sector, for example) and the introduction of alien species that are causing declines for some freshwater species.

Many European fish are highly susceptible to the impact of invasive alien species, be they predators or competitors. Local fish populations are easily wiped out if ecologically more competitive alien species invade their habitats.

Fig. 3: **European freshwater fish species within each IUCN Red List category - EU-27**



Most freshwater fish are very sensitive to alteration of their natural habitat. In addition, many require long upstream or downstream migrations to fulfil their lifecycle (see box, p.5). Obstructing these migration routes can therefore seriously hamper their access to breeding areas and feeding sites. Free movement between such habitat features throughout a species' lifecycle is often essential to its survival.

There are few rivers in Europe that have not been impacted by dams for hydropower or irrigation purposes. The first dam upriver of an estuary is now usually the end point for the migration of anadromous species (those that live in the sea as adults and migrate upriver to spawn in freshwater). Dams are also a major threat for catadromous species (those that grow in rivers and migrate to the sea), such as the European eel (*Anguilla anguilla*) (see Figure 4).

The European Environment Agency (EEA) recognises that, "river fragmentation is understood as more threatening to fish (aquatic) communities than pollution." Ensuring free movement of fish is therefore a priority for the implementation of the Water Framework Directive and Habitats Directive. This is particularly true for "true migratory fishes", which can be either catadromous or anadromous species.

For example, several endangered sturgeon species listed in Annex II of the Habitats Directive as priority for conservation rely on a good environmental status of their river systems, including unimpeded access to freshwater spawning sites and adequate river conditions during their freshwater life. Obstacles of any kind will negatively affect the free movement of these fish. They may be either prevented from reaching their intended spawning destinations or lose so much time and energy reserves that they arrive too late or too exhausted to spawn.

The EEA notes that these factors alter anadromous fish species communities by, "disrupting their structures (size components of the community, functional groups, species diversity and relative abundance) and in extreme cases result in the extinction of a population or even of the species." Figure 4 shows how dams have reduced capacity of fish to migrate in large areas of Europe. The areas where obstacles obstruct the free passage of migratory fish species are marked in orange.

EU 2020 Biodiversity Strategy

In May 2011, the European Commission adopted a new strategy for EU action over the next 10 years to meet the 2020 biodiversity headline target set by EU leaders in March 2010[2]. The strategy is built around six mutually supportive targets that address the main drivers of biodiversity loss and aim to reduce the key pressures on nature and ecosystem services in the EU. The six targets are:

- Full implementation of EU nature legislation to protect biodiversity;
- Restoration of ecosystems, and more use of green infrastructure;
- More sustainable agriculture and forestry;
- Better management of fish stocks;
- Tighter controls on invasive alien species; and
- A bigger EU contribution to averting global biodiversity loss.

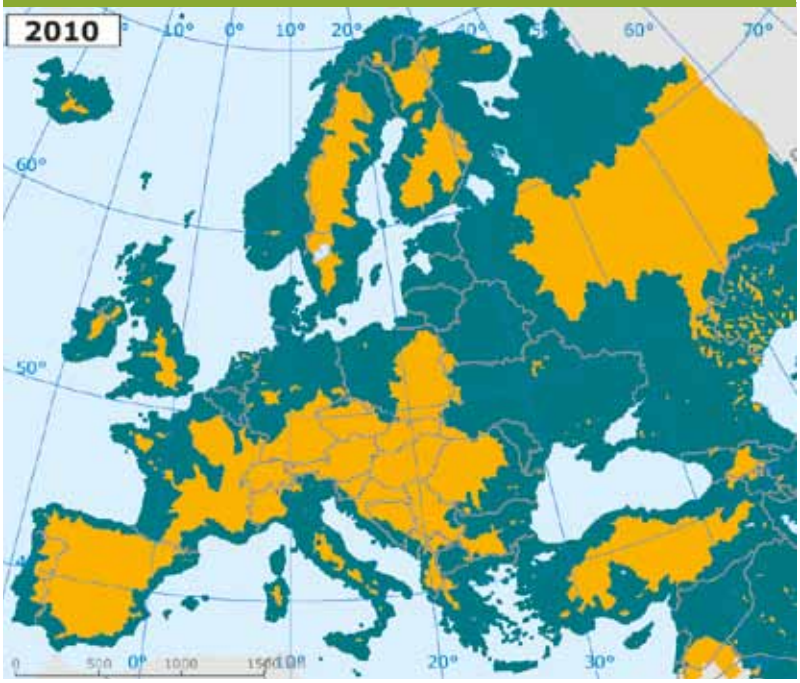
The 2020 Biodiversity Strategy builds on learning from the 2006 EU Biodiversity Action Plan and raises the level of ambition for 2020. Consequently, in addition to halting the loss of biodiversity, the strategy also highlights, for the first time, the important value of ecosystem services and the urgent need to maintain and restore these for the benefit of both nature and society. Biodiversity loss is in fact very costly for society, particularly for sectors that depend heavily on services ecosystems provide. For example, freshwater fish are an important source of food and provide livelihoods for millions as well as recreational fishing and ornamental fish for aquariums. Fish communities can also regulate the water quality of nutrient-rich lakes. Fish are important bio-indicators and even provide cultural services, by inspiring art, literature and society through the ages.

Water Framework Directive

The Water Framework Directive requires that Member States achieve, "good ecological status of water bodies which have been heavily modified, by 2015." One of the key conditions therefore is the need for unimpeded fish migration, emphasising the need to mitigate upstream and downstream migration difficulties. To meet the directive's minimum requirements the river or watercourse must ensure that there is connectivity between all river zones, from estuary to source. In addition, the directive includes requirements for increased monitoring of aquatic ecology and improved protection and recovery of European rivers. In particular, Member States are expected to tackle any remaining water pollution problems. It deals with surface and groundwater quality and quantity, and aims to enforce sustainable levels of water abstraction.

2 *http://ec.europa.eu/environment/nature/biodiversity/comm2006/2020.htm COM(2011) 244 Our life insurance, our natural capital: an EU biodiversity strategy to 2020*

Fig. 4: **Loss of accessibility for migratory fish due to dams in major European river basins - 2010**



Accessible (green) and inaccessible (orange) areas for migratory fish in Europe.
Source: EEA - http://www.eea.europa.eu/data-and-maps/figures/loss-of-accessibility-for-migratory/loss-of-accessibility-for-migratory-3)

Freshwater fish migration

For the purposes of reproduction, freshwater fish usually migrate to spawning areas located elsewhere to their feeding grounds. Fish migration is generally triggered by environmental factors such as temperature changes or flood events. Different species of fish run at different times of year. Whitefish start their spawning run in autumn whilst most cyprinids (the carp and its relatives) begin theirs in spring.

Photo: LIFE07 NAT/IRL/000342/Ruairí Ó Conchúir

INTRODUCTION

LIFE **improves conservation status of freshwater fish species**

The LIFE programme is an important resource for improving the conservation status of freshwater fish species and a vital tool for the management of the Natura 2000 network. It has done much to deliver key targets in the EU Biodiversity Strategy to 2020.

LIFE has co-financed some 1 500 projects across Europe targeting nature conservation and biodiversity, contributing approximately €2 billion since 1992.

The programme has made a major contribution to the implementation of the Natura 2000 network, in particular with regards to requirements for the protection and conservation of habitats and species, and the management of sites established by the EU Habitats and Birds directives.

In so doing, LIFE is contributing towards the achievement of goals set out in the EU Biodiversity Strategy to 2020[1], in particular, Target 1 of the strategy: to halt the deterioration of the conservation status of all species and habitats covered by EU nature legislation and achieve a significant and measurable improvement in their status by 2020.

1 *http://ec.europa.eu/environment/nature/info/pubs/docs/brochures/2020%20Biod%20brochure%20final%20lowres.pdf*

Figure 1.: **Freshwater fish species targeted by LIFE projects (1992-2013)**

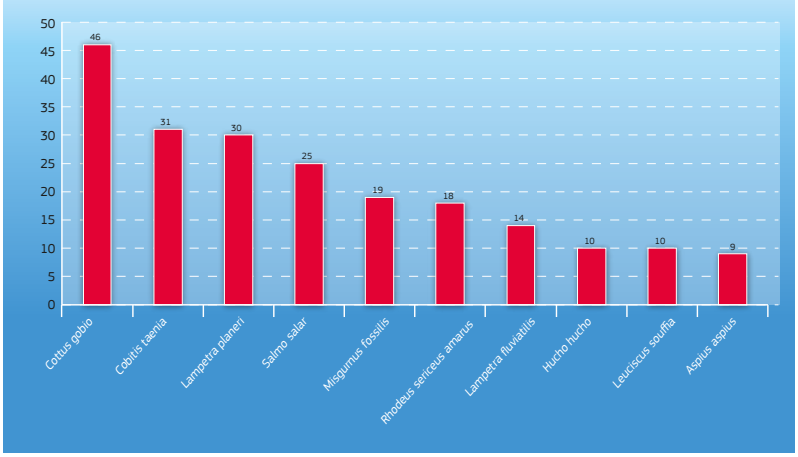


Figure 1 - Source: LIFE programme database

More than 135 LIFE Nature projects have directly targeted freshwater fish species, mobilising a total investment in excess of €150 million since 1992. These projects have targeted 51 of the 77 freshwater fish species included in Annexes II, IV and V of the Habitats Directive, or some 66% of species eligible for support.

According to the most recent Article 17 reports from EU Member States, several of the species targeted have either improved or maintained their conservation status. This publication includes key examples of LIFE project actions that have contributed to improving the conservation status of freshwater fish species.

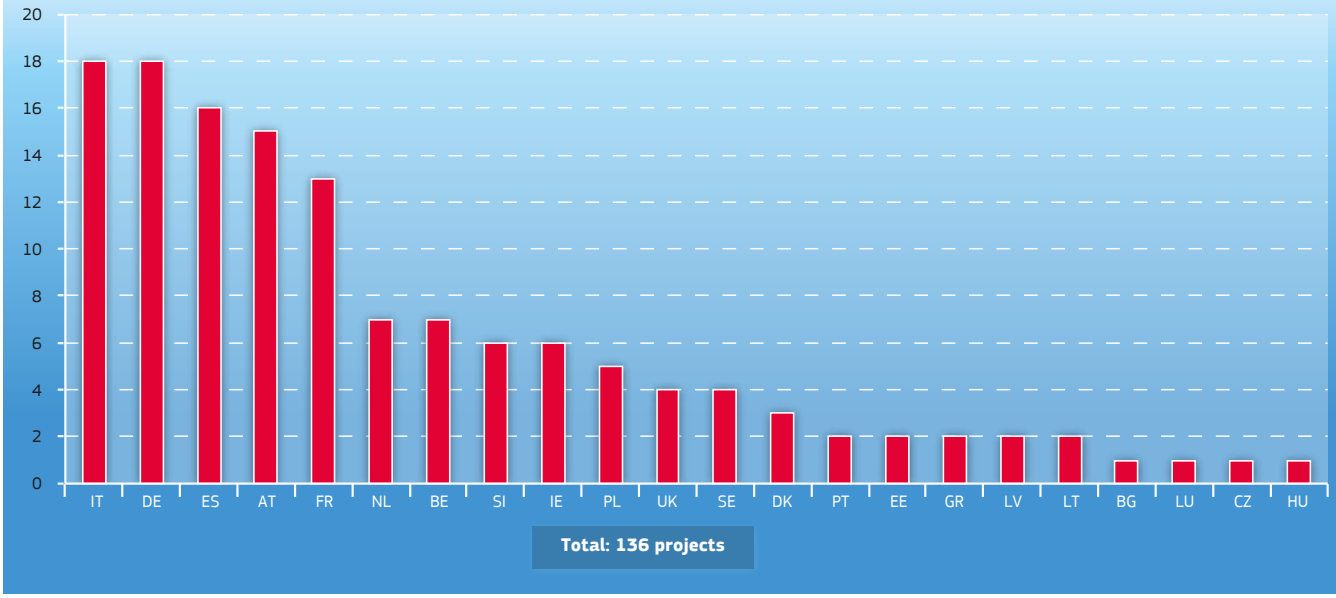
The most targeted fish species, each with more than 25 projects, have been the European bullhead (*Cottus gobio* – see box page 7), spined loach (*Cobitis taenia*), European brook lamprey (*Lampetra planeri*) and salmon (*Salmo salar*) (see Figure 1).

As Figure 2 illustrates, LIFE freshwater fish projects have taken place in 22 of the 28 EU Member States. The five most-frequently represented nations have been Italy, Germany, Spain, Austria and France.

Help for freshwater ecosystems

Target 2 of the EU Biodiversity Strategy to 2020 aims to maintain and enhance ecosystems and ecosystem

Figure 2: **LIFE freshwater fish projects by Member State (1992-2013)**



services. Specifically, it seeks to establish green infrastructure and restore at least 15% of degraded ecosystems.

When assessing the overall impact of the LIFE programme on freshwater fish species conservation it is important also to take into account projects that have targeted freshwater habitats listed in Annex I of the Habitats Directive. For instance, a total of 269 LIFE projects have carried out concrete conservation actions in favour of the Annex I-listed habitat, *91E0 Alluvial forests with Alnus glutinosa and Fraxinus excelsior (*Alno-Padion, Alnion incanae, Salicion albae*).

Actions to restore rivers and recreate freshwater habitats have the indirect benefit of improving conditions for threatened fish species and giving them the opportunity to recover. It is also important to recognise the role that LIFE has played in improving connectivity for fish species by establishing green and blue infrastructure in and between Natura 2000 network sites. In both these ways, the LIFE programme can be seen to be contributing towards Target 2 of the 2020 biodiversity strategy.

European bullhead (*Cottus gobio*)

The European bullhead is a freshwater fish distributed across six biogeographical regions in Europe. It lives on clean and well-oxygenated gravel and rock bottoms in streams, rivers and lakes, in estuaries and in shallow brackish waters of the Baltic Sea.

The species has been targeted by 46 LIFE projects since 1992. However, none of these projects have exclusively targeted the European bullhead or had the specific aim of carrying out actions to improve its conservation status. Nevertheless, projects have indirectly benefitted the species through the following:

- Reconnection of river side channels (oxbows) with the main river;
- Reconnection of floodplain with the river; and
- Restoration of several riverine habitats (mainly the Annex I-listed habitat, Alluvial forests with *Alnus glutinosa* and Fraxinus excelsior (*Alno-Padion, Alnion incanae, Salicion albae*).

The impact of such actions has been limited to the local level (the site where habitat restoration took place), with no discernible impact on the full range of the species at national level in any Member State. In addition, the majority of the 46 projects that have targeted the species have not conducted follow-up monitoring to assess the long-term impact of their actions. This is a gap that also applies to other species, as was highlighted in the conclusions of the first LIFE riverine Platform Meeting (see pages 54-56).

Photo: LIFE05 NAT/UK/000143/Jenny Wheeldon

The European bullhead (Cottus gobio) is the freshwater fish species most targeted by LIFE

Controlling invasive alien species

Target 5 of the EU Biodiversity Strategy to 2020 refers to invasive alien species (IAS). It seeks to identify and prioritise IAS and their pathways, control or eradicate the most harmful species and manage pathways to prevent the introduction and establishment of new IAS. A number of LIFE projects targeting freshwater fish have taken actions that support these goals and also support the implementation of the new EU Regulation on Invasive Alien Species[2]. A prime example is provided by a series of projects in Spain that have benefitted the endangered Spanish toothcarp (*Aphanius iberus*) by eradicating the invasive eastern mosquitofish (*Gambusia holbrooki*) – see pp. 32-35. Further examples can be found in the chapter on river habitat restoration (pp. 9-12).

LIFE actions: an overview

Table 1 summarises the main project actions that LIFE freshwater fish projects have carried out, including actions to improve habitats that have indirectly benefitted fish species, as well as actions that have directly targeted fish populations.

2 Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1417443504720&uri=CELEX:32014R1143

Photo: LIFE06 NAL/NL/000078

LIFE has supported essential work to restore and recreate habitats across Europe

This publication highlights a host of examples of the type of LIFE project actions summarised in Table 1. The following pages highlight both established and innovative best practices in freshwater fish species conservation. Project outcomes and the resultant impact on species conservation provide useful lessons for freshwater fish conservationists, policy-makers and river users across the EU.

Table 1 – Actions by LIFE freshwater fish projects

Main target of action	Type of action financed	Objective	Technology/Technique
Habitat	Habitat restoration	Improve habitat conservation status	Opening of side river (oxbows) and connection with floodplain
	Habitat recreation	Recreate new habitats for species	Flooding and reconnecting floodplains with main river and planting water plants and/or riverine forest Re-naturalisation of river margins and river dynamics (eg. Removal of river banks)
	Habitat restoration	Improve river connectivity and allow fish migration	Removal of river barriers (e.g. weirs, small dams and bridges)
	IAS control and eradication	Control of IAS that affect freshwater habitats (e.g. plant species)	Manual and/or chemical control, traps, etc (depending on the invasive alien species)
Fish species	Captive breeding facilities	Reintroduction and restocking of fish populations	Breeding protocols and genetic population studies
	Building of infrastructure	Improve river connectivity and allow fish migration	Construction of fish passages (fish ladders/elevators/channels)
	Improving reproductive success	Improve spawning areas and boost reproduction	Various techniques, including depositing gravel to create new spawning areas
	IAS control and eradication	Reduce/eliminate competition and predation by IAS	Electro-fishing, traps (depending on the IAS)
Project actions involving stakeholder engagement, dissemination and communication			

HABITAT RESTORATION

River restoration to **support endangered fish**

Alterations to the hydrology of rivers, obstructions to migratory routes and the introduction of invasive alien species can all adversely affect native fish populations. LIFE projects have carried out a range of river restoration activities to tackle these common problems.

Since 1992, the LIFE programme has financed more than 400 projects targeting river habitat restoration. The main riverine habitat restoration actions targeting fish species are:

- Reconnections of side branches (such as oxbow lakes) and floodplains;
- Elimination and control of invasive alien species that threaten fish species (such as alien fish species, invasive plants or invertebrates);
- Restoration of spawning grounds;
- Removal of barriers such as weirs, dikes and bridges;
- Improving water regulation (weir construction and channels);
- Restoration of floodplain habitats, such as gravel bars, alluvial softwood forests, etc.

It should be noted that, because it can take time for the impact of restoration projects to become apparent, not all LIFE projects have been able to measure or demonstrate an impact on the conservation status of fish species.

LIFE and river basin conservation

Several LIFE projects (mainly under the Environment strand) have been working at river-basin scale with the objective of reaching the "good ecological status" that the Water Framework Directive (WFD) requires of rivers. Some of these projects directly benefit the conservation status of fish species by improving hydromorphological features, connectivity, flow regimes or water quality.

The WALPHY project (**LIFE07 ENV/B/000038**) developed a methodology for assessing the restoration of water bodies in Belgium's Walloon Region and piloted a structured approach to improving the hydromorphological quality of the River Meuse basin in Wallonia. In total, the project was able to remove 20 obstacles for fish migration (19 on the river Bocq and one on the Eau Blanche). In some cases the obstacles were destroyed (e.g. the demolition of a dam). However, in many cases such action was not possible.

Digging channels to restore riparian ecosystems along the Lower Drava in Slovenia

Photo: LIFE11 NAT/SI/000882/Dominik Bombek

Some dam owners did not consent because of existing or planned micro hydroelectric power plants.

In other cases, the role of the dam is important in relation to bridges and other constructions. In these instances, other solutions were implemented solely or in combination, including the creation of river by-passes, pre-dams and fish ladders. At one site where the river Bocq is transformed into a concrete canal, it was not possible to establish a by-pass. Instead blocks of stone of various sizes were fixed on the concrete bottom.

The project also improved the transversal continuity of 22 km of river using a range of techniques. In several locations the works were limited to the river bed with small-scale meandering and various structures put in place to diversify the habitat. In other areas, more ambitious works were implemented such as the restoration of a former meander on the Eau Blanche. The project also reopened and reconnected a former side river of the Eau Blanche plain (the Grand Morbi) with the Eau Blanche. Monitoring has shown that the removal/management of obstacles improved the mobility and population size of several fish species.

LIFE SEGURA RIVERLINK (**LIFE12 ENV/ES/001140**) is exemplifying the importance of restoring natural river habitats for fish populations. Located in the south-east of Spain, the Seguara River basin comprises all the rivers entering the Mediterranean between the mouths of the Gola del Segura and the river Almanzora, The area is subject to an extreme Mediterranean climate, experiencing periods of drought as well as torrential rain and floods. The river basin has been heavily modified, mostly through dams and weirs, and all these structures have negatively affected the within-river connectivity.

A LIFE project was set up to ensure the restoration of the Segura river basin, by removing one weir and constructing fish passes across eight others. By improving the continuity of the river, the project expects to bolster the biodiversity of the area and expand the range of fish species, such as the Andalusian Barbel (*Luciobarbus sclateri*), for which dams and weirs represent insurmountable barriers during their annual breeding migration.

Signs of increased migration are now being recorded. Using this information, the project organisers hope to gather support for the approval of an official River Basin Management Plan (RBMP) for the Segura River. They also plan to develop a land custody network that encourages private owners to become involved in the management of the river.

The restoration of the longitudinal connectivity along the whole river length (325 km) is a long-term goal for the area, along with the recovery of the ecological functions of the wider Segura river basin. In this way the project will make a significant contribution to demonstrating how the requirements of the EU Water Framework Directive can be achieved.

LIFE SEGURA RIVERLINK is helping to expand the range of fish species such as the Andalusian barbel (Luciobarbus sclateri)

Photo: LIFE12 ENV/ES/001140

Invasive threats to fish

Invasive alien species in European rivers and freshwater areas threaten the survival of many endangered native fish species, but LIFE projects have demonstrated some measures to combat this type of threat.

Invasive alien species can pose a serious problem for the conservation of a range of fish species and actions to remove or control their populations can have a positive effect on several endangered species. For example, the Spanish project, LIFE Potamo Fauna (**LIFE12 NAT/ES/001091**), is focusing on 13 species of aquatic fauna, including fish, whose populations are decreasing. This ongoing project is controlling exotic terrapins and crayfish to minimise their impact on native species. It is also aiming to reduce by 25% the number of adult exotic fish species in the Banyoles lake natural area, the target of the project. “These fish are being controlled by electrofishing and the use of large nets,” says Miquel Campos, project leader.

Photo: LIFE08 NAT/E/000078/Consorci de l'Estany

Control of invasive alien fish species has been an important element of a number of LIFE projects

The lake, the second largest in the Iberian Peninsula, is home to several species protected by the Habitats Directive, and an earlier project, PROYECTO ESTANY (**LIFE08 NAT/E/000078**), first targeted the improvement of the Natura 2000 habitats and species found in the Banyoles area. Exotic fish species introduced to encourage angling had led to the drastic decline in numbers and even disappearance of most the lake's native fish population. Freshwater blenny (*Salaria fluviatilis*) and the Mediterranean barbel (*Barbus meridionalis*) had been confined to just a few small streams, whilst the European eel (*Anguilla anguilla*) was the only species still found in the lake. The three-spined stickleback (*Gasterosteus aculeatus*) died out at the beginning of the 20th century.

The main invasive alien species that were controlled were the large-mouth black bass (*Micropterus salmoides*), pumpkinseed sunfish (*Lepomis gibbosus*), carp (*Cyprinus carpio*), European perch (*Perca fluviatilis*) and zander (*Sander lucioperca*). Large predators such as the bass and zander are particularly harmful to the native fauna. Conservation measures also included the reintroduction of more than 20 000 autochthonous fish species, of which three-quarters were Mediterranean barbel.

At the end of the project, more than 100 000 invasive fish had been removed, leading to a 75% decrease in the population of largemouth black bass and a 90% drop in carp. New breeding grounds for the barbel were also established.

Another fish species to have benefited from the removal of invasive species is the Adriatic sturgeon (*Acipenser naccarii*), which is endemic to the Adriatic basin and which is a priority species under the Habitats Directive. In its last stronghold in the Po river basin in Italy, the construction of dams has led to a marked population decrease, as sturgeons are prevented from reaching their main spawning areas. But the sturgeon population has also declined with the rapid rise in the numbers of the wels catfish (*Silurus glanis*), a species that did not naturally occur in this river basin.

In 2003, the LIFE project, ACIPENSER TICINO-LOMB (**LIFE03 NAT/IT/000113**) was launched to catch the large invasive catfish in the Ticino River, a tributary of the Po, and conduct further analysis of this species to better understand how it competes with the endangered sturgeon. The project team found that the wels catfish can occupy all the habitat types in the tributary, from shallow areas to the big pools and from slow flowing reaches to the cascades. Moreover, it feeds on gammarids (crustaceans), an important food source of the Adriatic sturgeon. Hence, the project removed some 2 000 catfish from the Ticino river to boost the sturgeon population.

The project also undertook research showing that in recent years the wels catfish has been directly predating on young sturgeon. The control of the catfish species is therefore vital, and the sturgeon has now begun to recolonise areas of the Po Basin.

Also focusing on alien species removal is an ongoing LIFE biodiversity project, BIOAQUAE (**LIFE11 BIO/IT/000020**). It is removing the North American brook trout (*Salvelinus fontinalis*) from high-altitude

Photo: LIFE03 NAT/IT/000113

The removal of thousands of predatory catfish is one of the LIFE actions that is helping to improve the conservation status of the Adriatic sturgeon (Acipenser naccarrii) in Italy

alpine lakes in order to improve the biodiversity of the rivers, streams and lakes of Italy's Gran Paradiso National Park.

These alpine lakes originally lacked fish species and the endemic fauna consisted mostly of zooplankton, arthropods and the common frog (*Rana temporaria*). But its ecosystems have degenerated as a result of the introduction of brook trout and some species have become extinct locally. Moreover, in some rivers in the region, such as the Campiglia and Forzo, the native marble trout (*Salmo marmoratus*) is hybridising with non-native introduced populations of the brown trout (*Salmo trutta subsp. fario*).

Another, just-started project in Italy is LIFE BARBIE (**LIFE13 NAT/IT/001129**). The Emilian tributaries of the Po River have faced local population extinctions caused by habitat alteration and fragmentation, river discontinuity and competition with alien species. Thus, the project aims to eradicate the invasive barbel species that are competing with two targeted native barbels (*Barbus plebejus* and *Barbus meridionalis*).

Removing migratory obstacles

In northern Sweden, road infrastructure (such as culverts) and dams often present an impassable barrier for migrating fish. It is estimated that some 5 000 to 8 000 culverts impede fish in the counties of Norrbotten and Västerbotten alone. The ReMiBar project (**LIFE10 NAT/SE/000045**) was set up to target 2-5 million m^2 of affected watercourses in these counties, so as to allow migratory Atlantic salmon (*Salmo salar*) and brown trout (*Salmo trutta*) to reach suitable spawning grounds further upstream. To date 213 barriers have been removed, according to the beneficiary, the Swedish transport association, Trafikverket."The aim of the project is to remove 300 barriers within five different catchment areas," says Ida Schönfeldt, project leader. "We will not be able to see any changes in population during the project but hope that the Swedish national monitoring of fresh water pearl mussel and electrofishing will show results in the future."

Reaction to the project has been very positive, she says: "Most of the local people are interested and encouraging. A few landowners are against the actions but hopefully we will get an agreement during the project (which runs until September 2016)."

The project has already established two demonstration sites and a high number of visitors have come to see first hand the measures that it is taking. "We are also going to produce a short movie to spread the word about our project and the problems that can occur when building stream crossings if you don't take ecology into account," says Ms Schönfeldt.

HABITAT RESTORATION

Restoring the Vindel's tributaries to **recreate fish habitats**

The Vindel River LIFE project removed timber-floating infrastructure, including wooden dams that obstructed fish migration, put large natural structures back into cleared streams, reopened side channels and created spawning sites for fish.

Photo: LIFE08/NAT/S/000226/Marcus Stenman

Before and after photos showing the addition of gravel and boulders to improve the quality of fish spawning sites on the Vindel River

The river Vindel (Vindelälven) and its tributaries were once important transportation routes for timber in northern Sweden. To ease the movement of logs downstream, floatway structures were constructed, including wooden dams that held back water in lakes until it was needed for timber transport. Tributaries were cut off as streams were channelised and cleared, using dynamite and bulldozers. These straight channels had fast and uniform water flows making them ideal for moving logs but less suitable for fish and other wildlife.

Since 1976, timber has been transported solely by lorry and thus the Vindel river basin began its return to a more natural state. Studies of the earliest restored sections of the river, however, showed that there was still much to be done. "The previously restored sections did not have larger structures, such as large boulders and trees in the water, and that was where the LIFE project started, because research had shown that these larger structures were important," says project manager Johanna Gardeström of Umeå University.

Vindel River LIFE is a collaborative project involving Umeå University, the Ume/Vindel River Fishery Advisory Board, the Swedish University of Agricultural Sciences and the Swedish Agency for Marine and Water Management. It aims to reverse the remaining effects of fragmentation and channelisation in the tributaries of the Vindel river, all located within the Natura 2000 network. The project is a step towards achieving European policy objectives, including good status with reference to the Water Framework Directive and favourable conservation status for species listed in the Habitats Directive. The project partners are monitoring, in particular, the effects of restoration on Atlantic salmon (*Salmo salar*), brown trout (*Salmo trutta*), bullhead (*Cottus gobio*), brook lamprey (*Lampetra planeri*) and freshwater pearl mussel (*Margaritifera margaritifera*).

"We have 25 locations, representing two types of restoration," notes Dr Gardeström. "Ten previously-restored locations have again been restored, this time with more advanced techniques such

as the addition of large structures - we call this 'demonstration restoration' - whilst the other stretches have been restored by more traditional best-practice methods." The project area covers a combined stretch of around 59 km in 25 tributaries of the Vindel River.

The importance of large structures

"You need large structures to slow water," explains Dr Gardeström, pointing to the large boulders and trees in the water, "they are especially important during high water conditions to prevent smaller materials being flushed away."

Hydro-geomorphic modelling was used to predict where to place big rocks in order to get the required water current variations in the demonstration sites. The LIFE project's technical coordinator, Daniel Holmqvist, a Fisheries Officer with the Ume/Vindel River Fishery Advisory Board, describes how excavators fitted with a special bucket for river restoration placed large boulders with precision in the demonstration areas. In addition, rocks of all sizes were spread across the riverbed to help create a natural mosaic of habitats, with rapids, bends and points, deeper pools and shallower areas.

Initially, there was much scepticism from landowners about placing timber logs in the streams, but their presence was found to be particularly important. "Wooded in-stream structures are a really good collector of organic material," explains Dr Gardeström. "This is really the base of the food web. Aquatic insects eat this organic material and they are in turn eaten by fish." If nothing stops the downstream progress of leaves, grass and other organic material, it will be flushed down to the nearest lake or the main river. "People initially thought putting trees into streams made them look messy," she recalls. "However, following a big information campaign, in which brochures were sent to landowners, people could see that trees worked as food storage areas for fish. After that, people started to call wanting more wood in their streams."

Previously, gravel areas used by fish for spawning have been bulldozed out or flushed away by the high water velocities in cleared channels. A combination of reintroducing different-sized boulders and gravels to recreate more natural stream beds and more varied water flows, and the unblocking of side channels to open new routes for migrating fish, however, has paved the way for the re-establishment of high-quality fish-spawning sites.

Creating spawning sites

The LIFE project created almost 800 individual spawning patches, by adding gravel of appropriate size (2-5 cm pebbles) into streams. Dr Holmqvist points into the water at one demonstration site, toward brighter areas of gravel in which fish had recently dug and laid eggs: "Here in the river Hjuksån we have restored a lot of spawning areas for brown trout. All of this gravel was transported to the river during the winter by snow mobile and manually placed next to (naturally-occurring) riffle crests in summer, thus increasing the amount of favoured spawning habitat."

"Salmonids seek out riffle crest situations, where accelerating water over the crest causes the water to go through the substrate," explains Dr Holmqvist, "This is called a hyporheic flow." Water therefore flows through the redd (nest) and this is important because, after the eggs hatch in April, the alevins go deeper into the gravel to consume their yolk sac before emerging as fry in June. "The fry drift downstream, so it is also important we have good nursery areas downstream of the spawning sites, otherwise the fry would get flushed away or eaten by predators," says Dr Holmqvist.

The movement of the gravel has been measured by PIT tags. These are placed into grooves, cut using a diamond drill, and sealed in with epoxy glue.

River restoration work in progress (June 2011)

Photo: LIFE08/NAT/S/000226/ASTRALE EEIG/Inga Racinska

Hand-held detectors are used after the spring floods and after spawning to detect how far the gravel has moved.

"From our studies of spawning grounds, we estimate that they will last 15 to 20 years," says Dr Gardeström. "We learnt that it is important to make the gravel beds quite deep and also that fish prefer to use spawning grounds in the centre of streams." Studies showed that there was a 60-80% survival of embryos in the spawning areas, well above what is usually recorded in Sweden. Dr Holmqvist adds: "In general, trout search for tributaries to spawn and salmon spawn in the main river, but we have recently seen more salmon fry seek these tributaries to use as nursery areas."

Photo: LIFE08/NAT/S/000226

Dr Johanna Gardeström: "Large structures... are especially important during high water conditions to prevent smaller materials being flushed away."

Renaturalising the river

"In the 1940s, there were approximately 160 floatway dams in the Vindel catchment area," says Dr Holmqvist. "Although most have been taken away, a number remained that were migratory obstacles to fish. We have removed 17 dams during this project, to gain 226 km of river stretches and 3 700 ha of previously inaccessible lake habitat for fish species." Dams have been replaced with riffles, enabling fish to navigate upstream. "One of the most important things when replacing dams is that a lot of infrastructure, such as bridges, is located with reference to their height, so a wooden core is placed by the lake outflow to keep the same water level in the lake."

Monitoring studies conducted in the demonstration areas, including electrofishing, have shown that migratory species gain most from the restoration work, especially brown trout that venture furthest up in the tributaries. "In the last 10 years though, we are seeing more salmon in these tributaries every year and we have found them really high up," states Dr Holmqvist. However, he notes that more time is needed to assess the impacts of restoration on resident species, such as bullhead and brook lamprey. With the extension of the LIFE project to October 2015, monitoring activities should also include fish tagging to investigate why some spawning grounds are preferred to others.

"The freshwater pearl mussel is dependent on juvenile salmon and trout to complete its lifecycle, so improving conditions for these fish in the tributaries will also benefit mussel populations," says Dr Holmqvist. "The mussel is a very good indicator of water quality because it requires clear water with high oxygen levels."

"The aim is to restore the river system to a condition close to what it was before the logging era started, to recover the diversity of the river and also to reconnect the terrestrial and the aquatic communities," concludes Dr Gardeström. The hyporheic flow favoured by spawning fish also benefits the riparian (river bank) zone, because it moves nutrient-rich water through the shoreline substrate. Removing the sharp division between land and water caused by channelisation, and opening up side channels, creates a wider and more complex tributary system with a greater range of wetland habitats for riparian plant and animal species.

Furthermore, Vindel River LIFE has directly created employment for people doing river restoration work, increases the attractiveness of river landscapes in the Natura 2000 area for visitors, increases fish populations to the benefit of angling tourism, and indirectly benefits the economy in rural areas along the river.

Project number: LIFE08 NAT/S/000266

Title: Vindel River LIFE

Beneficiary: Umeå University

Contact: Johanna Gardeström
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Website: http://vindelriverlife.se
Period: 01-Jan-2010 to 31-Oct-2015
Total budget: €2 676 000
LIFE contribution: €1 338 000

HABITAT RESTORATION

Safeguarding fish populations in Estonia

Priority fish species in the Emajõgi River have been boosted by efforts to reconnect oxbow lakes and by an ongoing river restoration project.

Photo: LIFE12 NAT/EE/000871

The project reconnected oxbow lakes to the Emajõgi River to help secure populations of four priority fish species

The Emajõgi River in southern Estonia, known as the mother river, connects two of the biggest and most important fishing lakes in Estonia – Lake Peipsi (by area the fourth largest in Europe) and Lake Võrtsjärv. For the fishing industry the main importance of this river is that it is the migration route and spawning area for the fish of the whole basin.

The Emajõgi is a great illustration of how rivers progress over time to create a meandering course way. In many cases, the silt deposits have increased to the point of isolating stretches of the river as oxbow lakes. These geo-morphologic formations are not ideal for fish populations, however. Many species spawn in the alluvial meadows and, in particular, in the oxbow lakes in springtime when the river level temporarily rises to reconnect the lakes. The drop in the river level in the months that follow causes whole populations to become isolated and the fish die in vast numbers in the deoxygenated, stagnant lakes.

Half a century ago, sediments were removed to help secure the populations of the European priority species – asp (*Aspius aspius*), spined loach (*Cobitis taenia*), Eurasian weather loach (*Misgurnus fossilis*) and European bullhead (*Cottus gobio*). Nevertheless, around 10 years ago oxbow lakes started forming again and preparatory measures for a new conservation initiative began.

The result was the Best of the Best Life Nature project, HAPPYFISH (**LIFE07 NAT/EE/000120**). "Fish were losing their habitats and we wanted to give these habitats back to them," says Meelis Tambets of Eesti Loodushoiu Keskus, the project beneficiary.

The project focused on the Alam-Pedja Natura 2000 site and initially identified 20 oxbow lakes that it wished to reconnect to the main river. The list was halved to 10 (though the remainder have now also been reconnected thanks to a follow-up project financed through EU Cohesion Funds). This time around the oxbow lakes were opened up in such a way as to minimise the amount of sediment likely to build up again. Furthermore, often just one end of the oxbow lake was opened up to avoid river through flow. By allowing one end to remain blocked off, the temperature of the water is increased, making the lake more favourable to spawning fish populations.

According to the project, the total length of the 10 reconnected oxbow lakes is greater than the length of the river before the actions. The scale is indeed impressive. Restoration took place over a 14.7 km stretch of the river (50.2 hectares of water surface) and sediment was removed over river sections amounting to a length of 720 m. The work is expected to enable fish to freely access these reconnected areas for the next 50-60 years.

Fish populations also benefit from the removal of shrubs and bushes on the floodplain's wet meadows. The meadows had become overgrown and unsuitable as spawning sites when flooded, but thanks to the project more than 50 ha of spawning ground has been protected. In total, the reopening of the meanders and floodplain management has provided an additional 24 fish spawning sites.

Spreading the happiness

Asps are protected by law in Estonia and so it is illegal to fish them. It is considered an umbrella species: thus widening the mouths of oxbow lakes and guaranteeing good habitats for this target species also ensures healthy populations of many other fish species found in the river. But to specifically target the asp, the project tagged individuals to determine when and where they go to spawn. A total of 70 individuals were monitored using telemetry. Studies found that each year the same migration patterns occur. The data suggest each oxbow lake can be seen as a unique ecosystem, and if a particular lake becomes unsuitable for spawning then this will result in the disappearance of a whole population of fish.

To promote the quick recovery of the asp population in the river, reintroductions were carried out. At the start of the project, 53 000 one-summer-old individuals were released into the Emajõgi River at the Natura 2000 site. The fish are being monitored thanks to the cooperation of local fishermen, who note that populations have already markedly improved in the restored areas. Moreover, telemetry tagging and the breeding programmes yielded valuable knowledge that is proving useful for the beneficiary's follow-up project, LIFE HAPPYRIVER (**LIFE12 NAT/EE/000871**) which is carrying out further river restoration measures along the River Laeva, a tributary of the Emajõgi, at the Alam-Pedja Natura 2000 site. "During the HAPPYFISH project we got the strong feeling that the river should be restored, hence LIFE HAPPYRIVER," says Meelis Tambets.

Photo: LIFE12 NAT/EE/000871

Reintroducing asps (Aspius aspius) to the Emajõgi River

Preparatory work has already been completed. "We have been clearing meadows and reopening spawning grounds for fish to be reconnected to the restored river. This mainly involves cutting bushes. This is especially good for Eurasian weather loach and spined loach," says Mr Tambets.

Monitoring is taking place to determine the impact of the project. "It is problematic if there are no good data indicating the difference before and after the project...so we want to show this difference," he says.

This task is mostly carried out using a special monitoring net with different mesh sizes in order to record all types of fish. In confined areas where nets are not practicable, the project is using electrofishing, a common census method in which the fish are temporarily stunned by an electrical current that results in them swimming to an electrode placed in the water. After counting and measuring the fish, they can then be released unharmed.

As well as restoring the Laeva riverbed and the alluvial meadows, the project is also continuing the asp reintroductions and creating spawning grounds for this emblematic species.

The project reconnected 10 oxbow lakes to the river

Photo: LIFE12 NAT/EE/000871

HABITAT RESTORATION

Conserving the Atlantic salmon

To bolster threatened salmon populations, LIFE has demonstrated a range of effective conservation measures including reintroductions, habitat improvements and improved regulation of fishing practices.

Photo: LIFE09 NAT/IE/000220

A leaping Atlantic salmon (Salmo salar) on its journey upstream to spawn

The Atlantic salmon (*Salmo salar*) is a silvery fish and a close relative in Western Europe to the brown trout (*Salmo trutta*) and the Arctic char (*Salvelinus alpinus*). Most Atlantic salmon are anadromous, traveling long distances from spawning rivers to their feeding grounds at sea where they undergo their main growth. They then return as large adults to spawn in their natal freshwater streams and rivers. Throughout its European range the salmon is an important component of subsistence, recreational and commercial fisheries.

The Atlantic salmon has been present in most European rivers serving the Atlantic, North Sea and Baltic Sea; there are also some landlocked populations (see Lake Saimaa box). The species has undergone historical decline and has become extinct in many rivers throughout its range. According to the latest studies (Hedger et al. 2013), the abundance of Atlantic salmon is at a historically low level in some rivers in Europe. A 2001 WWF study found that many populations at river basin level were in very unfavourable condition, with only Iceland

being assessed as having virtually unaffected natural salmon populations (99%) of river basins considered 'healthy'), and only Ireland (38%), Norway (47%), Scotland (63%) and England and Wales (33%) having significant proportions of their salmon rivers remaining in a healthy state.

Freshwater populations of the Atlantic salmon are listed in Annex II (except for Finland) and Annex V of the EU Habitats Directive. The species is also covered by the Convention for the Conservation of Salmon in the North Atlantic Ocean (NASCO) which entered into force on 1 October 1983. This multilateral convention aims to promote the conservation, restoration, enhancement, and rational management of salmon stocks in the North Atlantic Ocean. According to the latest European IUCN Red List assessment the species status is 'vulnerable'. And according to the latest Article 17 (Habitats Directive) assessment report (2007-2012) the status of this species is assessed as being 'unfavourable' but improving in the Alpine, Atlantic and Continental biogeographical regions, and 'unfavourable' with no trend in the Boreal region. At Member State level, only Finland and Lithuania are reporting that the species is in a 'favourable' conservation status.

Atlantic salmon usually return to their natal stream for reproduction, but barriers, such as dams and weirs, as well as river modifications, have become an increasing problem in recent decades. Habitat deterioration, commercial fishing and decreasing water quality are also factors explaining local extinctions. The main requirements for salmon (as for other anadromous species) during the freshwater part of their lifecycle are a clean and plentiful supply of water, good habitat conditions, free upstream passage for adult fish and downstream passage for smolts (juvenile fish) and an adequate food supply. Since 1992, more than 20 LIFE projects have helped to improve populations of this threatened species.

A good example of river management to boost salmon numbers was carried out on the River Mulkear, located in the Lower Shannon SAC in Ireland. The main focus of the MulkearLIFE project (**LIFE07 NAT/IRL/000342**) was the conservation of sea lamprey (*Petromyzon marinus*), European otter (*Lutra lutra*) and Atlantic salmon, which after many years of site mismanagement had become seriously threatened. Modifications to the river, such as straightening its course and installing weirs, represented particular obstacles to the conservation of these species. Furthermore, the planting of exotic conifers and the spread of invasive plants, such as giant hogweed (*Heracleum mantegazzianum*), Japanese knotweed (*Fallopia japonica*) and Himalayan balsam (*Impatiens glandulifera*) can affect the clogging of salmon spawning beds with sediments.

The objective of MulkearLIFE was to increase populations of salmon and sea lamprey using best practice techniques in so-called in-stream habitat rehabilitation. The specific measures carried out by the project are, "designed to mimic the conditions typically found in a natural river or an undrained river," says Ruairí Ó Conchúir, project manager.

"These works alter the river flow, gradient, bed, channel or banks. All of MulkearLIFE's instream work was carried as part of a holistic restoration plan, to improve habitats and enhance instream complexity of the river environment for Atlantic salmon and other species," he adds.

As part of the project, 28 rubble mats were installed to rehabilitate more than 10 km of the Mulkear River using more than 5 000 tonnes of rock. Additionally, the project used more than 1 500 tonnes of locally-sourced rock to improve habitat in over 15 km of river channel in the Dead, Bilboa, Newport, Clare-Annagh and Killeengarriff rivers. It also installed other in-stream measures - such as random boulders, paired deflectors and vortex weirs - to increase flow and habitat variability.

Inspecting a newly-constructed rubble mat (instream work) on the Mulkear River

Photo: LIFE07/NAT/IE/000342/Ruairí Ó Conchúir

Electrofishing survey work on the main channel of the Mulkear River in 2011, prior to the installation of rubble mats, clearly demonstrated that the proposed sites were not being used by salmon fry. Indeed, only a very limited number of salmon parr were sampled. But the picture is now "totally different", says Mr Ó Conchúir. "The results for the 2013 and 2014 season reveal that hundreds of salmon fry are utilising the rubble mats surveyed. The average density is an amazing 0.72 fry/m^2. In the space of three years, the average salmon parr density has more than tripled. MulkearLIFE is delighted to conclude that the rubble mats are an outstanding success."

Blackwater restoration

Atlantic salmon was also among a number of target species that are benefiting from restoration measures carried out on the River Allow in Ireland under the Blackwater Samok project (**LIFE09 NAT/IE/000220**). The river's catchment area lies in the Upper Blackwater River SAC, a site that in recent years has suffered from agricultural practices through nutrient enrichment and pollution. Modifications to the river have also led to its degradation whilst, similar to the MulkearLIFE project, the spread of invasive plants (in particular Himalayan balsam) and overgrown bank vegetation also present a threat to the spawning beds and food sources of the fish.

According to Fran Igoe, the project leader, the project is on track to reach its targets. "The project initially intended to remove the invasive plant Himalayan balsam from 4.6 km without using chemicals (i.e. manually). We have now addressed 35.7 km of riverbanks and drains, possibly making it the largest continuous non-chemical Himalayan balsam control project of its kind in Europe! Results are very good with 100% eradication in most places."

The project has developed an innovative transferrable method for fencing off livestock in areas vulnerable to flooding. "The fence can withstand major flood events through a simple technique that the farmers can maintain easily. Similarly we have developed a novel system for trapping silt in farm drains before it enters the Special Area of Conservation," says Mr Igoe.

Furthermore, the project is demonstrating how the problem of river bank erosion can be addressed to aid salmon conservation. Monitoring has already shown that such river restoration has resulted in a fourfold increase in the density of juvenile salmon at one site.

Salmon fishing in Scotland

The Atlantic salmon is still present in almost all rivers in Scotland and even though water quality is generally good, the species is facing other threats. Rivers such as the Dee, Tweed, Tay and Spey are prized around the world for their salmon fishing, and thus the conservation and sustainable exploitation of salmon stocks is essential. Under the project, Conservation of Atlantic salmon in Scotland (CASS), (**LIFE04 NAT/GB/000250**) eight Salmon

Before (left) and after shots showing improvements to a fish pass on the Spey River, one of the CASS project's actions that has opened up 150 km of salmon habitat in Scotland

Photo: LIFE04 NAT/GB/000250

fisheries boards came together to address a series of threats on eight major salmon rivers in Scotland.

Through this partnership, the CASS LIFE project removed 25 obstacles, opening up 150 km of salmon habitat and allowing the fish access to parts of the river systems that had been inaccessible for many years.

Initial monitoring shows that salmon are returning to these rivers, one of which, the Coy, has not seen salmon for over 250 years. More than 70 000 m^2 of juvenile spawning habitat was improved and two of the rivers were gradually restocked over the lifetime of the project. Some 76 km of fencing was erected to control grazing by cattle and associated degradation of the river banks. This was accompanied by a programme of riparian management, including the removal of coniferous trees to reduce acidity, coppicing to increase light and planting of native tree species.

Boosting the endangered Loire salmon

The population of Atlantic salmon of the Loire/Allier basin was historically very important. With nearly 1 000 km to travel through freshwater before reaching spawning grounds, these salmon were large-sized long-distance migrants. Numbers were estimated at around 100 000 fish at the end of the 18th century, but the population has fallen drastically since. At the start of the project, Saumon Loire (**LIFE00 NAT/F/007252**), the population was threatened with extinction, with only around 300-500 mature fish per year returning to the spawning grounds – the minimum threshold for this population to be viable is considered to be 2 400. This decline has been caused by threats such as dams, pollution and the silting of the river, along with the degradation of spawning grounds and nurseries.

The project aimed to increase the population on the Allier and Gartempe axis using eggs, hatchlings and young salmon produced by the Chanteuges salmon-hatchery farm. It also aimed to remove migratory barriers and create fish passages, as well as improve river habitats. At the end of the project the number of juveniles in the Allier was estimated at 150 000-324 000. Nevertheless barriers to fish migration still remained – namely the Poutès dam, which represents a major obstacle to the establishment of a sustainable population of salmon[1]. Whilst stock numbers can be maintained at sufficient levels by optimised breeding techniques (even in the event of the reintroduction of salmon fishing, which has been prohibited since 1994), the goal of opening up spawning grounds so that population levels are self-sustaining was still a work in progress at the end of the project.

1 The electricity provider, EDF, intends to remodel the dam to improve fish passage. Work is due to be completed in 2018.

Sustainable fishing in Lake Saimaa

Lake Saimaa in south-eastern Finland is home to several species in the salmon family: landlocked salmon (*Salmo salar*), brown trout (*Salmo trutta morpha fario*), Arctic char (*Salvelinus alpinus*) and grayling (*Thymallus thymallus*). All these species, however, are threatened owing to changes in the water quality, the disappearance of natural spawning grounds, long-term changes in the weather conditions and intensive fishing. Effective management is essential to ensure the future genetic diversity of these native populations.

The objective of the Saimaan lohikalojen project (**LIFE10 INF/FI/000052**) was therefore to promote sustainable fishing practices in the lake. The beneficiary, the ELY Centre (Pohjois- Karjalan ympäristökeskus) acts as an advisory body on issues relating to professional and recreational fishing and the ownership, administration and management of fishing waters in Finland. It attended over 100 meetings with fishery districts and joint ownership associations, giving presentations on the lifecycle and the endangered status of the salmonids. (A total of 82 groups were reached under the project: 64 were fishery districts or joint ownership associations, and 18 were fishing clubs.)

These meetings resulted in the drawing up of fishing plans that set minimum catch sizes for salmonids, minimum mesh sizes for surface and midwater gillnets, the prohibition of salmon line fishing and the establishment of protected fishing zones. The project also established ascent routes and restrictions for the number of hooks per lure. Finally, agreements were reached regarding fishing quotas and release of landlocked salmon with intact adipose fins (i.e. wild-born fish as opposed to hatchery fish with clipped adipose fins).

The project's short duration meant that significant changes were not expected to be observed whilst in progress – but the organisers believe that its impact will be noticeable within five years of the project's conclusion (i.e. by 2019).

Photo: LIFE10 INF/FI/000052

HABITAT RESTORATION

Houting project brings **multiple benefits in its wake**

A Danish project to improve conditions for a highly-endangered salmonid has had positive effects on a whole river system.

The North Sea houting (*Coregonus oxyrhunchus*) is a salmonid species with a characteristic pointed 'snout'. It is a priority species for conservation according to the EU Habitats Directive. Like salmon, the houting is anadromous, living and maturing at sea, but ascending the larger freshwater courses in autumn to spawn. Unlike salmon and sea trout, the houting is a poor swimmer (see box – characteristics of the houting).

As a consequence of this, houting are unable to pass even small obstacles in rivers when they return to spawn. Pollution, dike building and canalisation have had a drastic impact on numbers of a species once widespread in the Wadden Sea, the intertidal zone that lies between the Frisian Islands and the coasts of Denmark, Germany and the Netherlands. In 2000, the population was an estimated 7 000 adult spawners, restricted to just six river systems in Denmark.

In 2003, the Danish Nature Agency published a national action plan for the houting and, to help implement it, secured funding in 2005 for what was at the time the most expensive LIFE Nature project ever. Jan Steinbring Jensen from the agency wrote the project proposal and has been involved in the project through to the after-LIFE communications phase.

Characteristics of the houting

Jan Steinbring Jensen: "The houting is able to switch from freshwater to saltwater in a span of three or four months - after it hatches in January/February. Once the eggs hatch, the larvae drift almost passively downstream. They need nursery areas with large areas of reed beds or flooded meadows otherwise they would be flushed into the Wadden Sea before they are prepared to enter the saline environment. The juveniles stay in these stagnant areas and feed on small crustaceans until they have reached 6-7 cm in length and their physiological system is prepared for the saline conditions.

"It is not known where the houting go and what they do when they enter the Wadden Sea. The Danish Nature Agency has fitted transmitters to some fish and results of this monitoring programme should be known in 2015. They return upstream to spawn in late November each year. They have a different strategy to salmon when it comes to reproduction – a houting can reproduce 10 times in its lifetime, rather than once or twice. The fact that it is recognised as a poor swimmer makes the houting a sign of good water quality and free passage. If the houting can pass a stretch there will be a great tail of better swimming organisms that follow it. So, if we have a sound population of houting we have pristine ecological conditions in the Wadden Sea area."

Photo: LIFE05 NAT/DK/000153

No compromise

"One of the philosophies of the houting project was that every time you compromise with the needs of the species the result will be poorer," explains Mr Steinbring Jensen. "When you do river restoration it is always best to make as much use of the water bearing as possible. Every time you give up one litre of water you get a poorer result."

This philosophy informed the project's actions, which took place on four of the six Danish rivers where the houting is found – the Vidå, Ribe, Sneum and Varde. Thus, in each river system impassable dams and weirs were removed and natural river conditions restored – e.g. by constructing riffles or meanders that

allow the houting to migrate upstream, and natural wetlands that allow the juveniles to develop.

Natural replenishment

Another important project philosophy was no restocking of houting: "Once we have created the habitat requirements then it is supposed to recover by itself. If you go into large re-stocking programmes you run the risk of re-introducing weak genes or bad genes. The fish have to do it themselves by natural selection," explains Mr Steinbring Jensen. This lesson was learned from experience: between 1987 and 1992, the Danish Nature Agency released some 1.7 million houting fry into the country's river systems, but these efforts failed to provide lasting results because they were not accompanied by habitat restoration.

Success factors

Although the project took longer than expected (it was delayed by the effects of a major administrative reorganisation and by bad weather), in the end it achieved all its ambitious goals (see box) and was recognised as a Best LIFE Nature project 2013.

Results of the project

- Natura 2000 network extended by 18 km of water course;
- Barriers to migration removed from eight fish farms, two hydro-electric dams and one former mill pond;
- 15.5 km of River Varde restored to create more than 20 km of naturally-meandering river with a natural hydrological regime;
- 114 ha of nursery areas for juvenile houting created on the rivers Sneum and Vidå.
- Migratory fish have gained access to an additional 120 km of river; and
- Some stretches of the River Vidå have been made accessible to houting for the first time in 400 years.

An important success factor, says Mr Steinbring Jensen, was being able to "draw in all the competence in Denmark to find the best solutions available". That included partnerships with landowners, fish farms, anglers and other interest groups. For instance, the project was able to purchase commercial fishery netting rights at the mouth of the Ribe to stop the risk of by-catch of houting. Elsewhere, obstacles were removed or by-passed at fish farms. "As long as the work does not compromise the management of the farms too much or the owners are compensated then we can come quite a way. With the houting project it was all done on a voluntary

The project restored natural meanders to rivers used by the houting

Photo: LIFE05 NAT/DK/000153/ASTRALE EEIG/Justin Toland

Photo: LIFE05 NAT/DK/000153/ASTRALE EEIG/Justin Toland

Jan Steinbring Jensen: "People recognise the improvements not only in nature but also as a valuable asset to the region"

basis from the landowners," explains Mr Steinbring Jensen. "Once they agreed to participate in the project, the levels of compensation were set by the competent authorities - there was no negotiation about the price."

Selling the benefits

A key strategy in selling the project, not only to interested parties such as fish farm operators but also to the wider public, was to highlight the additional benefits that would come in the wake of river restoration: "It was not only the houting that was the issue here - it was all the other accompanying effects for nature, for salmon, for fish; and also reductions in nutrient loads and improvements to all kinds of biodiversity attached to this environment in the south-western part of Jutland," explains Mr Steinbring Jensen, who adds that the project's actions "have increased the stability of the system in relation to climate change and flooding incidents."

These dissemination efforts – which generated hundreds of press articles and much radio and TV coverage for a fish that very few people have ever seen – have paid off handsomely. "People recognise the improvements not only in nature but also as a valuable asset to the region. We have these magnificent watercourses; we have fully self-reproductive indigenous salmon and there's lots of money and tourism attached to salmon," says Mr Steinbring Jensen. "The challenge now is to exploit the result in a sustainable way."

The success of the project has also inspired further action to remove obstacles to migratory fish. In the town of Gram, the Danish Nature Agency bought the right to produce electricity from the owner of a hydro-electric turbine at the castle, an acquisition that enabled the agency to construct a 1.5 km watercourse by-passing the obstacle. The completion of this two million euro project in autumn 2014 has restored free passage to more than 100 km of the River Ribe. This not only benefits the houting, the Danish Fisheries Agency has been able to cease salmon restocking activities in this river, "a very big achievement in Danish nature management," according to Mr Steinbring Jensen.

"The government has spent €10 million on river restoration projects in this part of the country, which I doubt would have been the case if the houting project had not been there," he believes. "The LIFE project broke down the walls in the four river systems in which we operated. Since then with the additional money we have moved further upstream to increase water quality or the habitat quality of the rivers."

Go for the maximum

Mr Steinbring Jensen sees some important lessons from the houting project for other river restoration practitioners: "What should inspire across the EU is that our project has been more or less no compromise. Where it could be achieved we have gained more or less all the water bearing of the water course. The solutions that we have chosen do not involve recurring management, so all the money that has been spent has gone - one time - to habitat restoration which will be there probably for ever.

"It's better to go for the 100% solution than the big compromise with only a 10 or 15% solution because along with compromises go recurring management. You have to avoid that because otherwise you will bind money for the future," he concludes.

Project number: LIFE05 NAT/DK/000153

Title: Houting - Urgent actions for the endangered Houting "Coregonus oxyrhunchus"

Beneficiary: Danish Nature Agency, Waddensea (Naturstyrelsen, Vadehavet)

Contact: Jan Steinbring Jensen
Email: jsj@nst.dk
Website: www.snaebel.dk
Period: 01-Feb-2005 to 31-Dec-2012
Total budget: €13 386 000
LIFE contribution: €8 031 000

HABITAT RESTORATION

Conserving **Portugal's threatened saramugo**

LIFE is strengthening populations of the critically endangered saramugo through the restoration of their shelter, feeding and reproduction habitats.

The saramugo (*Anaecypris hispanica*), is one of the endemic freshwater fish species of the Iberian Peninsula that contribute to the region's outstanding biodiversity. It is listed as 'critically endangered' in the 'Portuguese Red Data Book of Vertebrates' and its conservation status according to the latest Article 17 report (Habitats Directive) was assessed as 'unfavourable-bad'.

Thus the project LIFE Saramugo - Conservation of the Saramugo (*Anaecypris hispanica*) in the Guadiana basin (Portugal) (**LIFE13 NAT/PT/000786**) has been launched to carry out essential habitat conservation measures. "Our main aim is to promote suitable habitat in the areas of the species occurrence, furthering our understanding of the species, whilst at the same time preventing its disappearance from some sites," says Rita Alcazar, project leader.

An important objective of this species conservation project is to identify potential threats and devise mitigation measures. The project is assessing the impact of coexistence with the invasive bleak (*Alburnus alburnus*) and testing barriers that could prevent bleak entering into saramugo areas. Similarly, it is aiming to reduce water pollution caused by livestock farming, in order to improve water quality for the species.

Furthermore, the project is assessing the feasibility of transferring certain techniques new to the EU, such as an automatic device for the removal of invasive alien species, to other sites. It is eager to ensure the conservation of saramugo in the long term, and, as well as carrying out public awareness activities, it is encouraging cooperation amongst landowners, farmers, livestock producers and decision-makers.

At the end of the project, it is expected that invasive alien species will have been removed from three locations – two in the Natura 2000 site Moura/Barrancos and at the Guadiana site. "Our aim is to break the population structure of the invasive species, in order to decrease their recovery possibilities after the removals, since the full removal of these species is probably not 100% possible," says Ms Alcazar.

A database (using GIS) will also be created by the project, giving updated conservation status indications for the target species. Also foreseen is the removal of sediment in two areas and the recovery of a 4 km riverside gallery to improve its habitat.

Earlier success

This ongoing project is building on the achievements of a LIFE project that ran from 1997-2000, Saramugo - A conservation strategy for Anaecypris Hispanica (**LIFE97 NAT/P/004075**). The earlier project focused on promoting cooperation amongst the competent bodies within the Guadiana basin as well as drawing up conservation proposals. "It provided precious information about the species distribution and ecology and the causes for the decline that are essential for the habitat management foreseen in the new project," says Ms Alcazar.

An ongoing LIFE Nature project is working to improve the conservation status of the saramugo (Anaecypris hispanica)

Photo: LIFE13 NAT/PT/000786/Carlos Carrapato

HABITAT RESTORATION

Restoring habitat for the Romanian darter

A LIFE river restoration project in Romania was successful in saving a critically endangered endemic fish, but the long-term survival of the target species is far from guaranteed due to a range of threats to its habitat.

River restoration measures were central to the LIFE project targeting the Romanian darter (*Romanichthys valsanicola*) an endemic species of the Arges basin in Romania. The species is extremely rare and only found along several kilometres of the Vâlsan river. Assessed as 'critically endangered' by the IUCN, the fish is threatened by insufficient discharge from the hydroelectric dam.

The LIFE project Survival of Romanichthys valsanicola (**LIFE99 NAT/RO/006429**) undertook habitat restoration work, such as the dropping of stones in the river bed, negotiated an increased discharge from the Vâlsan hydroelectric dam and initiated the employment of a warden to prevent illegal poaching, dumping and rock extraction. At the end of the project, the population was reinforced thanks to yearly natural reproduction. The population size was estimated at 200 individuals and at least three successive generations could be found in the Vâlsan in 2003. The population's distribution was also extended, both upstream and downstream, from the range observed at the project commencement.

Nevertheless the Romanian darter remains at risk of extinction due to its restricted distribution and its habitat is in a precarious situation, dependent on the continuity of water released by a single reservoir.

Romanian darter (Romanichthys valsanicola)

Photo: Telcean Ilie

Biodiversity indicator

The authors of a 2011 report on the fish, which was published in the North-Western Journal of Zoology, emphasised that the fate of this species could have serious consequences for the overall biodiversity of the area. "Assuring the survival of the species is of great importance for the entire protected area established at the level of the hydrographic basin of Vâlsan River." The report's research team captured a sub-adult in 2011, which they say proves that the species is still reproducing in the river. However, they conclude that, "its present distribution range is reduced and fragmented."

The report follows the first study of the movement of the Romanian darter in its natural environment, conducted in 2004 and 2005. Researchers tracked the movements of 10 individuals. They found that, "the net movement of the radio-tagged fish was in a downstream direction from the point of release. Fish appeared to spend periods of time in a restricted area before relocating, always downstream. They never return to areas of previous occupancy, or to the area of release, in the 72 hours of the tracking protocol."

The LIFE project was important for species survival. But there remains much to do for this critically endangered fish. A lack of local awareness about the species and inadequate monitoring needs to be addressed and there are many threats to the species habitat, such as new housing being built near the riverbed and a lack of a specific water management plan for the area.

HABITAT RESTORATION

River restoration projects in the upper Danube

Pollution and overfishing were once the main threats to fish in the upper Danube; today obstacles to migration and habitat loss are of most serious concern. A range of LIFE river restoration projects are successfully supporting endangered fish species.

The Danube is the longest river in the EU and the only major European river that flows west to east. In the upper Danube basin area, in Germany and Austria, the Danube and its tributaries are important feeding and spawning areas for many migrating fish, including several endangered species listed in the annexes of the Habitats Directive. However, the construction of hydroelectricity plants and dams has fragmented the river and disconnected many of its side-rivers, whilst river regulation and deepening have reduced the available habitats for fish.

A number of LIFE projects have addressed these problems, by removing or by-passing barriers that prevent fish migrating upstream and by taking measures to restore natural river dynamics.

Photo: LIFE99 NAT/A/006054/TKaufmann

Construction work on a fish migration facility, one of the actions of the 1999 project, Living Space for Danube salmon habitat

By-passes and gravel beds

Living Space for Danube salmon habitat (**LIFE99 NAT/A/006054**) was the first project to eliminate obstacles to fish migration in the upper Danube river basin. It equipped weirs and other barriers with fish by-passes, and reconnected three tributaries with the Danube, to improve migration opportunities for Danube salmon (*Hucho hucho*) and other endangered fish species. The project initiated an ongoing fish monitoring programme on this part of the Danube in lower Austria, which confirmed that the endemic Danube salmon had spawned in some of the newly-accessible river habitats.

River restoration was extended to upstream and downstream areas in two follow-on projects. Wachau (**LIFE03 NAT/A/000009**) implemented large-scale restoration measures along a 33 km free-flowing section of the Danube in the Wachau Valley. Among the project's actions, gravel banks and islands were created at 13 sites between Melk and Mautern, using gravel that is dredged annually from the nearby shipping channels; this recycling of gravel is now river authority policy. Species recorded using the new gravel areas include the nase (*Chondrostoma nasus*), whose numbers had declined dramatically in previous years. Additionally, three former tributaries were reconnected to the Danube by the Wachau project. The Aggsbach, for example, was reopened and dredged in 2007 and in the following year 22 fish species were recorded, many new to this watercourse.

The other follow-on project, Donau-Ybbs (**LIFE04 NAT/A/000006**) conducted habitat restoration

activities where the river Ybbs meets the Danube. Initial monitoring at this site identified 39 fish species: 11 listed in Annex II of the Habitats Directive and five endemic to the Danube basin. The project team constructed a by-pass to give these fish access to the tributary beyond the Melk Power Station, allowing them to reach potential upstream spawning grounds. The 2 km long gravel-bottomed channel was built using an innovative water-supply technique, which ensured that water flowed even when river levels were low.

Monitoring after completion showed that 42 fish species used the channel, including the endangered zingel (*Zingel zingel*). The project also widened the mouth of the Ybbs to create additional fish habitats. This area now provides a nursery for commonly-occurring Danube fish and protected species such as asp (*Aspius aspius*) and Danube roach (*Rutilus pigus*). More recently, the Netzwerk Donau project (**LIFE10 NAT/AT/000016**) is aiming to construct additional by-passes and create gravel habitats to improve the conservation status of fish along the whole 352 km stretch of the Danube in Austria. The project beneficiary, Verbund Austrian Hydro Power, is constructing fish by-passes around obstacles at three power plants and is creating gravel habitats in the reservoirs of five hydropower stations.

Floodplain restoration

Floodplains are characterised by fertile meadows or woods that are inundated by high water levels and dynamic river erosion and sedimentation processes that give rise to gravel beds, oxbow lakes and other distinctive habitat features. Altering natural floodplain dynamics reduces the amount of available habitat, with a corresponding loss of biodiversity, and can also make areas downstream more prone to flooding. A cluster of river restoration projects in the upper Danube have reversed the canalisation process to allow rivers to find a more natural course, effectively increasing their length and creating more riverine habitats suitable for several species including fish.

The Donauauen project (**LIFE98 NAT/A/005422**) restored and managed alluvial floodplain on the river Danube in the Donau-Auen National Park in Austria. The project returned the area to a semi-natural state and facilitated fish migration by lowering river banks, modifying weirs and dams, and building a gravel island. Habitat improvement actions not only help to improve the conservation status of endangered species, they also help to protect Vienna, a short distance downstream, from flooding by giving the river more room to sprawl, an important ecosystem service.

LIFE river restoration projects have enabled many endangered, rare and endemic fish species to increase in number in the upper Danube, by facilitating migration and creating improved conditions for feeding and breeding. These projects have benefits both upstream and downstream of the restored areas, whilst the creation of features such as gravel banks and islands also enhances the landscape for visitors.

Danube salmon (Hucho hucho)

Photo: LIFE99 NAT/A/006054/C.Ratschan

REINTRODUCTIONS AND RESTOCKING

Reintroduction and restocking of freshwater fish populations

LIFE projects demonstrate that ex-situ conservation is a viable method of reintroducing and restocking fish species. A coordinated approach, involving local community stakeholders and habitat restoration, delivers the best results.

A total of 15 LIFE projects have targeted fish species with ex-situ[1] conservation actions and consequent reintroduction and reinforcement of wild populations. More than 10 species have been targeted, with several species - the Loire salmon (*Salmo salar*), Spanish toothcarp (*Aphanius iberus*), allis shad (*Alosa alosa*), Adriatic sturgeon (*Acipenser naccarii*) and European sturgeon (*Acipenser sturio*) - being subject to the actions of more than one project. Such projects that reinforce fish populations through captive breeding often include habitat restoration actions to encourage the successful reintroduction of juvenile fish and fry back into the wild. Prior to beginning the breeding process, the species' genetic variability needs to be evaluated in order to avoid mixing between isolated but genetically distinct populations.

Typically, large numbers of captive-bred fry are released. For instance, one Estonian project (**LIFE07 NAT/EE/000120**) reintroduced more than 50 000 fry of the asp (*Aspius aspius*) into the Emajõgi River. An ongoing German-led project (**LIFE09 NAT/DE/000008**) is aiming to restock between 1.5 and 2 million allis shad larvae per year in the Gironde watershed in France, from 2011 until 2015.

Successful restocking projects often persuade anglers and fish farmers to get involved in captive breeding and river restoration. For example, an Italian project (**LIFE13 NAT/IT/001129**) aims to preserve and restore the native barbel populations (*Barbus meridionalis* and *Barbus plebejus*). To guarantee a successful reintroduction and restocking of the target species in all Natura 2000 sites where the species were previously present, the project needs to establish agreements with local stakeholders to combat poaching, encourage a sustainable river management and avoid the introduction of non-native species.

Conservation of Corsican macrostigma trout

The colourful macrostigma trout (*Salmo trutta macrostigma*) is a Mediterranean sub-species of the brown trout listed in Annex II of the Habitats Directive. It is genetically distinct from other types of trout. In France, it is only found in Corsica. The TRUITE project (**LIFE03 NAT/F/000101**) has helped to improve the conservation status of this sub-species, identifying 15 new populations of the fish during the project, a 107% increase in numbers between 2004 and 2007 and a 77% increase in biomass.

The project studied the pure macrostigma strains and provided valuable scientific information about their characteristics and distribution. This enables better protection of the fish themselves and their natural habitat. The project showed that it is preferable to focus on in-situ conservation actions, such as habitat restoration and working with stakeholders (see pp. 49-53), than to undertake ex-situ initiatives. A planned semi-natural breeding facility was not realised, both because there are insufficient numbers of breeding fish in the wild and because of the inability of this sub-species to successfully adapt to captivity.

The TRUITE project on Corsica identified 15 new populations of macrostigma trout (Salmo trutta macrostigma)

Photo: LIFE03 NAT/F/000101/J-L Teyssié

1 For the LIFE projects covered, the ex-situ processes involved breeding in aquariums or readapted fish farms.

REINTRODUCTIONS AND RESTOCKING

A European approach to **conserving the allis shad**

In a cross-border approach, LIFE is combining the conservation of the largest remaining allis shad population in Europe - in the Gironde river system in France - with reintroductions to the Rhine.

Allis shad (*Alosa alosa*) is a fish species of the herring family, which lives in saltwater and migrates long distances upriver to reproduce in freshwater. This anadromous species was originally found in almost all of Europe's Atlantic tributaries, including the Rhine[1] – which at the beginning of the 20th century, held one of the most important allis shad populations in the species' northern distribution range. Within 30 years, however, this population had collapsed: its demise blamed on over-fishing, increased river pollution, destruction of spawning grounds and barriers to migration such as dams and weirs.

A very successful first LIFE project (**LIFE06 NAT/D/000005**) targeted the conservation and protection of the allis shad in Europe through its reintroduction to the Rhine river system. Involving partners and contributors from three Rhine-bordering countries - Germany, France and the Netherlands – the project developed a breeding programme in south-west France, where the species is still found naturally, and then planned and carried out the transportation of larvae from France to Germany and the restocking of the Rhine river system.

Outside expertise

The project worked with a US expert, who had experience of a reintroduction programme for the closely-related American shad (*Alosa sapidissima*), to increase understanding of the optimal processes for release of the larvae. The scientists examined passage conditions and mapped the suitability of spawning sites for the fish along the Rhine. Laboratory experiments assessed the effect of aspects such as different substrate types and waves from shipping on the hatching, survival and behaviour of larvae. This led to a first reintroduction management plan for the Rhine river area.

Over the three breeding seasons covered by the project - 2008-2010 - the LIFE team caught a total of 644 spawning shad through fish lifts at two sites on the Garonne and Dordogne rivers in France. With a local NGO specialised in diadromous fish protection plans, they then tested breeding and rearing

1 *A tributary of the North Sea, a marginal sea of the Atlantic Ocean*

Inside the allis shad (Alosa alosa) breeding centre in Aquitaine (France)

Photo: LIFE09 NAT/DE/000008

procedures. The allis shad were treated with hormones to speed up spawning and the fertilised eggs kept in breeding tanks. The emerging fry swam into hatchery tanks where they were fed with brine shrimps (Artemia spp.), which were also reared in tanks.

Egg survival rates

The project developed considerable know-how around caring for eggs, optimal water conditions and preventing infections. The egg survival rate in the rearing process increased from 28% in 2008 to 65% in 2010. It also optimised processes for treating the adults with hormones and marking larvae with pigment to enable tracking and monitoring after their release. The amount of eggs produced per female was also increased.

Photo: LIFE06 NAT/D/000005/RHEINFISCHEREIGENOSSENSCHAFT NRW/STAAS Stefan

Juvenile allis shad caught in the lower Rhine during their seaward migration

The first restocking of the Rhine occurred in June 2008 and was repeated and expanded over the following two years. In total, some 4.8 million larvae were released. Much was learnt about optimal conditions and processes including the benefits of acclimatisation and additional feeding in basins in the rivers, releasing at night to avoid predation, optimal transport bags and conditions, and the best age at which to transport larvae.

The success of the project was highlighted when a total of 30 juveniles were caught in the lower Rhine near the German/Dutch border in the autumns of 2010 and 2011. These were the first allis shad to be caught there for more than 50 years and showed the young fish were successfully migrating downstream: Their marking revealed they had been released by the project and their size showed them to be developing healthily and appropriately at age 3-4 months. Increasing numbers of adults in the upper Rhine and tributary rivers as well as repeated proof of naturally-reproducing young shads in 2013 and 2014 indicate that the possibility of a self-sustaining and growing population of allis shad in the Rhine system seems very promising.

In south-west France, meanwhile, as recently as the year 2000, the allis shad population in the Gironde watershed sustained hugely important economic activity: with catches of several hundred tonnes per year. However, from 2006 onwards (i.e. before the measures of the previous LIFE project started), there has been an alarming decline in the return rates of mature shad to the Gironde river area. The reasons are still not well understood, but this has resulted in a moratorium on allis shad fishing since 2008.

A second LIFE project (**LIFE09 NAT/D/000008**) is now underway with two principal objectives – to continue and to optimise the Rhine restocking measures started under the earlier project - adding an estimated 1.5-2 million larvae per year - and to identify the reasons behind the unexpected collapse of the Gironde stocks.

Another key objective will be the transfer of aquaculture techniques from France to Germany and the development of techniques to maintain an ex-situ stock in Germany. These are important conservation tools for fish population restoration and have also been implemented in recovery plans for the European sturgeon (*Acipenser sturio*) and Atlantic salmon (*Salmo salar*).

As part of these activities, a pilot ex-situ facility has been established in Aßlar in Germany. It is hoped that the further development of captive rearing and breeding techniques will eventually enable fewer shad to be removed from French rivers and to include fish returning to the Rhine system in the ex-situ stock in the future. In addition, these techniques can be used in other European river systems where shad populations are endangered.

The project is also re-examining the design of existing fish pass facilities for European allis shad, especially in France, in the light of the latest knowledge and improvements coming from the United States – where numbers of returning shads have been significantly enhanced after modernisation of the fish passes. Based on the findings of a field trip to the US, the LIFE team will produce guidelines and implement improvements to its shad fish ways.

REINTRODUCTIONS AND RESTOCKING

Saving Spain's endemic toothcarps from extinction

Most endangered European freshwater fish species are found in Mediterranean river catchments. The Spanish toothcarp and Valencia toothcarp are two such examples of highly threatened fish species that have been targeted by LIFE.

LIFE toothcarp conservation efforts began in the very first round of project funding back in 1992. The Pego Oliva/samaruc project (**LIFE92 NAT/E/014400**) specifically targeted the Valencia toothcarp (known in Spain as the *samaruc* - see box), conducting studies that greatly increased knowledge of its biology and habitat. This knowledge fed into the drafting of a species recovery plan that was later officially approved and served as a basis for the work of several additional LIFE projects, in particular through the establishment of a first captive-breeding programme. This was based at the El Palmar fishery research station, where LIFE co-funding was used to adapt infrastructure and develop protocols for reproduction, transforming a former state-owned fish farm into a breeding centre for a number of endangered aquatic species[1].

1 Such as the European pond turtle (Emys orbicularis) – see LIFE and Invasive Alien Species

Pilar Risueño, who co-coordinated the Pego Oliva/samaruc project on behalf of the department of environment of the Valencian regional authority, is now coordinator of the Freshwater Species Conservation Centre of the Valencian Region (FSCCVR), located in El Palmar. She explains the pump-priming effect of that initial burst of LIFE funding: "The reproduction and reintroduction protocols and the technology and methodology acquired and developed at the time was transferred to Murcia and Catalonia, and used in their LIFE projects."

The team at the FSCCVR has also learned from the initial LIFE project, building on the successes of its reintroduction and restocking efforts and the first experiences of habitat recovery for the species. So much so, in fact, that it was able to adapt captive breeding techniques and equipment for the Spanish toothcarp (see box) and now the El Palmar

Valencia toothcarp (*Valencia hispanica*)

The Valencia toothcarp is a small fish (6-8 cm) which is noted for its upwards-facing mouth and a jaw fitted with teeth, indicating carnivorous behaviour (it eats mainly invertebrates). According to the IUCN, the species underwent a population decline of more than 80% between 1996 and 2006 as a result of habitat destruction for urbanisation and agriculture, water extraction and pollution, and the introduction of predatory invasive alien fish species, the eastern mosquitofish (*Gambusia holbrooki*) and pumpkinseed sunfish (*Lepomis gibbosus*). There are seven remaining populations of Valencia toothcarp (six in the Valencian Community, one in Catalonia). These are largely isolated and genetically distinct. The species mainly occupies small coastal freshwater bodies formed from upwellings of spring water, known locally as *ullals*. It may also inhabit coastal lagoons and wetlands with dense vegetation, which provide cover and an abundance of invertebrate prey.

- Listed as **priority for conservation** in Annexes II and IV of the Habitats Directive
- Art 17 Conservation status (2007-2012): '**Unfavourable-bad**'
- IUCN Category (2006): '**Critically Endangered**'

Photo: Benjamin Albiach Galan

station breeds both species. This has enabled it to establish a 'reserve' stock of both fish with suitable genetic variability and quality to regenerate natural populations in case of disaster.

Mrs Risueño explains that it is easier to breed the Spanish toothcarp than the Valencian, "the *samaruc* is much more demanding in terms of reproduction requirements, and *samaruc* reproduction is 10 times less than the *fartet*."

The El Palmar research station continues to operate to this day with the support of EU regional funds and now has nine full time employees. By the end of 2012, it had bred some 350 000 Valencia toothcarps. Annual production today is approximately 12 000-15 000 fish.

Thanks to LIFE project restoration of wetlands and subsequent reintroduction, the range of the *samaruc* has increased and is today stable. Nevertheless, the species is still highly endangered, principally because of the invasive eastern mosquitofish and pumpkinseed sunfish.

Recreating toothcarp habitat

There have been several LIFE projects in the Valencia region that have restored and recreated coastal habitats, mainly dunes and intra-dune lagoons, and wetlands with springs (*ullals*). Dunas Albufera (**LIFE00 NAT/E/007339**) and a subsequent LIFE Nature project, Valencia Enebro (**LIFE04 NAT/ES/000044**) added new populations of both the Valencia toothcarp and Spanish toothcarp along the Devesa coastline, south of the city of Valencia. To achieve this, the projects first concentrated on establishing appropriate habitats, namely intra-dune lagoons (known locally as *malladas*), creating permanently flooded sections by lowering the dune profile to the level of the (fresh)water table. "Using stocks produced at El Palmar, both species have been reintroduced to these newly-created and enlarged malladas. And it was a success: now we have one of the best *fartet* and *samaruc* populations in Valencia," says Antonio Vizcaíño, the coordinator of the two projects. The El Palmar station continues to regularly monitor fish populations, water levels and water quality, working in partnership with the project beneficiary, the municipal authority.

LIFE co-funding was secured for another project in 2004, which sought to recover the two most important permanently-flooded freshwater pools within the lagoons, Ullal de Baldovi and Ullal dels Sants. Projecte Ullals (**LIFE04 NAT/ES/000048**) has contributed to the recovery of the Valencian toothcarp through actions to improve habitat conditions and a reinforcement release of more than 2 500 individuals bred at the El Palmar station. The project increased scientific understanding of the species through a phased release programme that saw several specimens monitored and kept in conditions of semi-freedom for the best part of a year before their final release.

Reintroduction and reinforcement in Catalonia

LIFE actions in favour of Catalonia's toothcarp populations began in 1996 when the Especies en Humedales (**LIFE96 NAT/E/003118**) project took

Spanish toothcarp (*Aphanius ibericus*)

The Spanish toothcarp (*fartet* in Spanish) is a small fish restricted to 10 sites along the Mediterranean coast of Spain from Catalonia to Almeria. The main pressures on the species come from invasive alien species, pollution of surface waters and urbanisation. The Spanish toothcarp can be found in various habitat types, including coastal lagoons, salt marshes and freshwater streams with submerged vegetation. It is highly adaptable and tolerates a wide range of salinities from pure freshwater to hypersaline conditions (it is found in salt pans at Mar Menor, Murcia). As a result of their isolation, the populations of this species exhibit notable differences in genetic structure.

- Listed in Annex II of the Habitats Directive
- Art. 17 conservation status (2007-2012): '**unfavourable-inadequate**'
- IUCN Category (2006): '**Endangered**'

Photo: Freshwater Species Conservation Centre of the Valencian Region (FSCCVR)

steps to conserve both toothcarp and bird species in Mediterranean marshes. One of the key achievements of this project was to contribute to the improvement of a captive-breeding programme for toothcarp in Catalonia. This ex-situ conservation action saw the refurbishment of an existing breeding facility with 20 artificial pools and six semi-natural pools, followed by the subsequent production of 35 000 Valencia toothcarps from Catalonia's only wild population (in Santes Creus), as well as 20 000 *fartets* from three wild populations (in Salou, Isla de Buda and Alfacada). These captive-bred fish were released into the wild to enlarge the distribution area of both species.

Photo: LIFE04 NAT/E/000035/Salinas Marchamalo

The Marchamalo salt pans, one of two Spanish toothcarp habitats targeted by the 2004 project, Fartet Murcia

Commencing the same year, another LIFE project, Isla de Buda (**LIFE96 NAT/E/003180**), reintroduced 2 500 specimens of each of the priority toothcarp species to two small lagoons (100 m^2) on the island of Buda. These fish were bred at the centre that was upgraded concurrently by the Especies en Humedales project. A later census collected a number of juvenile toothcarps, confirming the breeding success of the reintroduced fish.

Fartets in Murcia

LIFE has also supported toothcarp conservation in another of Spain's Mediterranean regions. The 2004 project, Fartet Murcia (**LIFE04 NAT/ES/000035**), aimed to conserve the most endangered Spanish toothcarp populations in Murcia.

The project focused on two, genetically very different, *fartet* populations: one inland, at the source of the Chícamo River and the other coastal, in the Marchamalo salt pan lagoons. "The species has a huge tolerance to salinity and there is a huge difference in the favoured habitat and genetic characteristics of the two populations as well," explain Francisco J. Oliva-Paterna and Mar Torralva, the scientific advisers from the project partner, University of Murcia (UM). The university helped develop a captive breeding-programme based at one of its sites and at a renovated storage facility belonging to the beneficiary, Murcia's regional authority for agriculture and water.

The project implemented its two-site approach to ex-situ conservation to avoid problems of genetic contamination: one site breeds fish from the Chícamo River and the other from the Marchamalo salt pans. In addition to laboratories for breeding, the two sites both feature external ponds allowing individuals to be held in semi-captivity before reintroduction.

Captive breeding stocks at the FSCCVR in El Palmar

Photo: Freshwater Species Conservation Centre of the Valencian Region (FSCCVR)

Eradicating invasive alien species

Another important aspect of the Fartet Murcia project was its work to eradicate the invasive eastern mosquitofish and Louisiana crawfish (*Procambarus clarkii*) from the headwaters of the Chícamo and a section of the Rambla Salada-Fortuna. The project developed new eradication techniques using nets and traps. More than 36 000 eastern mosquitofish were eliminated in two areas, including complete eradication of the invasive alien fish in the upper Chícamo. "This was one of the major achievements of the project, the first eradication of *Gambusia* from a location with *fartet*," notes Mr. Oliva-Paterna.

Other project actions in the upper Chícamo included the restoration of existing ponds and construction of new ones. To protect the river from disturbance, the project built two bridges - ending the need for vehicles to ford the river bed - and installed a standpipe to give farmers access to water without having to access - and disturb - toothcarp habitat.

Photo: LIFE04 NAT/E/000035

Spanish toothcarp habitat at the source of the Chicamo River

The project also began a pilot programme designed to enlarge the amount of habitat available for toothcarp on the Chícamo River by maintaining small groups in irrigation ponds. This programme is already reporting good results. Habitat restoration in the salt pans took the form of restoration of the walls of some pans and the construction of channels linking them to the Mar Menor.

At the Rambla Salada complex, the Fartet Murcia team restored ponds to establish a semi-captive stock from the Chícamo River. They also removed asbestos from the walls of ponds at the Rasall salt pans as well as restoring the water entrance area. The rehabilitation of the Rasall salt pans centred on the recovery of a *fartet* population from the genetic stock of the specimens in the Marchamalo salt pans.

An important project result was the creation of a protocol for the establishment of *fartet* populations in Murcia. These guidelines emerged from monitoring work carried out by UM. The university and NGOs are continuing to monitor Murcia's toothcarps in order to assess the progress of the releases.

Impact on conservation status

The most recent Article 17 report from Spain (2013) lists the conservation status of the Spanish toothcarp as: 'unfavourable-inadequate', but improving in comparison with the 2007 assessment. The Spanish authorities reported a positive trend for the species' range and population, largely thanks to the LIFE reintroduction projects; however the long-term trend remains negative. The situation is worse for the Valencian toothcarp, whose status is assessed as: 'unfavourable-bad', because of its poor future prospects and shrunken range and reduced overall population size. Although LIFE has helped prevent the species from becoming extinct, there has been no genuine improvement in its status since 2007 and the outlook for the species remains negative.

Socio-cultural impact

According to those who worked on the LIFE projects, the programme's support for toothcarp conservation has had positive socio-cultural consequences within the regions where the species are found. In the Valencian Community, LIFE-funded campaigns have raised public awareness of the plight of the Valencia toothcarp. "The *samaruc* is now is an emblematic species for the people of Valencia and especially for its politicians. Every time we do reinforcement or reintroduction there is a lot of media interest," points out Mrs Risueño.

Awareness-raising and conservation action have had a similar impact in Murcia on behalf of the *fartet*. "The Spanish toothcarp is now an umbrella species in the region," says Mar Torralva from the UM.

REINTRODUCTIONS AND RESTOCKING

Stepping-up Rhone streber conservation after LIFE

Ex-situ reproduction and reintroduction continue apace following two French LIFE projects targeting a critically endangered freshwater species, the Rhone streber, also known as the apron.

LIFE04 NAT/FR/000083/G.Episse

Rhone streber (Zingel asper)

The Rhone streber (*Zingel asper*) is a small, freshwater species of the perch family. It was formerly found in the majority of the Rhone river basin in France and Switzerland. Nowadays it remains only in few relatively small and fragmented populations. It is in 'critical danger of extinction', according to the IUCN's European Red List; and is an Annex II and IV-listed priority species for protection under the EU Habitats Directive. In the current Habitats Directive Article 17 report, covering the period 2007-2012, the conservation status remains 'unfavourable-bad' for both the Continental and the Mediterranean biogeographical regions.

The Rhone streber's overall range declined dramatically during the 20th century, falling from a distribution along 2 200 km of rivers, to around 240 km today (11% of its presumed historical presence). The main reasons for the decline are hydraulic engineering works such as dams and weirs that have created barriers and separated and isolated populations from one another. River pollution and flow changes, resulting from water abstraction for agricultural purposes, have also led to a severe degradation of suitable habitat. This solitary, nocturnal fish lurks at the bottom of rivers – preferring clear oxygenated waters with gravel or pebble beds.

The management and conservation of the Rhone streber has been targeted by two LIFE projects and is currently the focus of a national action plan. A specialist in aquaculture and water courses, Marianne

Georget, of the regional conservation NGO, CEN RA, was the project manager of Apron II (**LIFE04 NAT/FR/000083**) the second of the two LIFE Nature projects targeting the species.

Excellent indicator species

"It's a demanding species, which needs varied conditions to accomplish its whole lifecycle. As a result, it is an excellent environmental indicator species," she says, adding that because it's so demanding in terms of water quality, "if it starts to decline, then we know there's a problem. It's in everyone's interest to protect the species."

As little was known about the Rhone streber, the first (1998-2000) LIFE project, Apron I (**LIFE98/NAT/F/005208**) considerably improved knowledge of its ecological requirements. Managed by *Réserves Naturelles de France*, it also conducted a feasibility study of ex-situ breeding for reintroduction and developed a long-term conservation strategy contained in its published guidelines for the management and conservation of apron populations. "The first project was important in bringing together what we knew about the species, and it helped to lay the groundwork for the second project," explains Ms Georget.

CEN RA was the beneficiary of the latter project. Working with the national agency for water and aquatic environments (ONEMA) and other partners, its main task was to stop the decline of the species by implementing the various measures proposed under the guidelines drawn up by the initial project.

Specific aims were threefold: to improve genetic exchange and increase the overall population size through the construction of fish passes; to determine the feasibility of reintroducing the species through trials at test sites; and to improve knowledge of populations and habitat by field surveys.

In 2004, knowledge of the population distribution was still partial. Extensive annual surveys were therefore carried out by ONEMA to establish the presence of *Z. asper* in the region (a total of 296 km was surveyed at night on foot). Currently, the remaining (four) populations are to be found at the Loue river; the Ardèche and its tributary, the Beaume; the Durance and some of its tributaries (Buëch, Jabron, Asse, Verdon); and the Drôme. Another action saw the establishment of 21 apron observatories situated along the rivers to count individuals and assess habitat conditions (using physical-chemical, hydro-biological and morphological parameters).

Drôme River reintroductions

An important part of the project concerned reintroduction testing to increase long-term survival chances. In collaboration with Besançon Natural History Museum (another partner), tests started in 2005 on artificial Rhone streber reproduction. These led to the hatching of thousands of fry and confirmed, for the first time, the feasibility of this methodology for conserving the species. Trials were then carried out in 2006, 2008 and 2009 by releasing aquarium-born fish mainly into the Drôme. In total, some 1 700 apron were released into the river during the project.

The early results were encouraging, with monitoring confirming the survival of individuals after two years. However, it was concluded that this objective was only partially successful, because natural reproduction was not proven during the project lifetime.

Since the LIFE project finished, and as a direct consequence of the LIFE work, the species is now covered by a national action plan comprising 36 separate management measures. Under this plan, Ms Georget reports that the ex-situ work at Besançon and releases into the wild have continued with some recent, "very encouraging results." Notable advances in artificial reproduction techniques, such as when researchers discovered that colder water temperatures during winter-time benefits egg maturation, have led

Reintroducing Rhone strebers to the Drôme

LIFE04 NAT/FR/000083/M. Georget

LIFE04 NAT/FR/000083/M. Georget

Filming the project video. The Rhone streber thrives in clear, oxygen-rich waters with clean gravel beds

to a substantial increase in numbers of fry reintroductions. "Finally the new techniques and strategies are starting to pay off," she says.

The next step is to find out through monitoring - which continues annually under the national action plan - whether this will translate into significant results in terms of natural reproduction. "Up to now, we didn't really have substantial proof of the effectiveness of the measure, because we had low results from the reintroductions," admits Ms Georget, who adds that, "much better results," should start to appear from 2015 onwards.

Important discovery

An important recent discovery in the Drôme, thanks to DNA advances, is the occurrence in the wild of a hybrid third-generation apron. Tests show that this comes from a reintroduced fish, which has mated with a species that was either already in the river, or was from another subpopulation in the Durance. "This is important: it shows the fish have adapted and that the conditions suit them. Now with the genetic proof we can see that they are reproducing."

The other key action of the second LIFE project was the installation of five fish passes at weirs on the Loue, Durance and Ardèche rivers to re-establish connectivity and thus allow better genetic mixing, and to reduce the risk of inbreeding and optimise the species' long-term chance of survival. These needed to be adapted to suit the species' [limited] swimming capabilities. "This was a real achievement," notes Ms Georget, noting that this small fish, "doesn't have the same ability to swim, or jump, up waters like other migratory fish, for example the salmon. And of course, in adapting these passages for the apron, we are also benefitting all migratory species."

As with the reproduction experiments, however, it was not possible to fully assess the impact of the passes at the end of the LIFE project. "The three-year period was too short," she concedes, adding that in the longer term the passes have proved their worth - as shown by regular surveys. She cites, for example, the, "very satisfactory," results of a survey carried out in 2010-11 at one of the fish passes on the Loue river: "In terms of overall numbers, the Rhone streber was the second most captured species over a 12-month period, with the highest numbers observed in spring and in autumn," she says.

Importantly, these works are continuing under the national action plan – with for example, two more fish passages installed on the Ardèche since the closure of the LIFE project and three more in the pipeline. Across the region a total of 17 fish passes are scheduled.

Good news

In spite of all these efforts, the conservation status of the Rhone streber remains of serious concern. Ms Georget is reluctant to be drawn on overall numbers, explaining that for a variety of reasons – including its short life-span (of just 3-4 years) and changing natural conditions, e.g. floods – numbers fluctuate considerably from year to year. For this reason, she says the distribution of the species is the main indicator: "The known populations are still there. That's good, it means we haven't had any subpopulations becoming extinct. Also, for certain populations, there has been an extension of their distribution area, which is undoubtedly due to the fish passes. I would even say that there has been an improvement in habitat in certain places," she concludes.

Project number: LIFE04 NAT/FR/000083

Title: Apron II - Programme for the conservation of the Rhône-Apron (Zingel asper) and its habitats

Beneficiary: Conservatoire Rhône-Alpes des Espaces Naturels (CREN)

Contact: Marianne Georget
Email: marianne.georget@espaces-naturels.fr
Website: www.aprondurhone.fr
Period: 01-Apr-2004 to 31-Mar-2010
Total budget: €3 508 000
LIFE contribution: €1 579 000

REINTRODUCTIONS AND RESTOCKING

Multiple benefits flow **from support for Greece's gizani**

A project on Rhodes increased know-how about conserving an endangered fish species, led to habitat improvement and stimulated stakeholder commitment to water management.

Launched in 1998, the Ladigesocypris Ghigii project (**LIFE98 NAT/GR/005279**) was the Greek authorities' first attempt to conserve an endemic, endangered, freshwater fish species, the gizani (*Ladigesocypris ghigii*). The project not only boosted the prospects of the target species, it also forged advantageous new working relationships between private businesses, public authorities, and environmental scientists.

Integrated approaches

Carefully coordinated and joined-up nature conservation approaches were crucial to project success. A combination of threats, including water shortages during droughts, as well as water pollution and habitat loss linked to human development, had all impacted adversely on the gizani.

Extinction was a real risk for the small and inconspicuous fish in some parts of its territorial range prior to the project taking effect. A major concern was the lack of knowledge about the species' conservation needs, so early work for the LIFE team involved building sufficient scientific understanding of how to manage the remaining populations.

In-situ studies helped to identify opportunities for strengthening gizani stocks in its native habitat and ex-situ work also created a contingency pool of specimens that could be used to preserve the gizani's genetic diversity during any future restocking operations. Findings from the studies showed that significant genetic variations existed between populations and these data were applied to help tailor site-specific conservation work.

Habitat enhancements concentrated on establishing new pond features that were designed as refuges to hold large numbers of gizani in their preferred environs and protect them from drought pressures. Automatic water pumps and solar-powered water quality monitoring devices were used to safeguard the new river habitat features. Public awareness measures were also introduced at one of the project sites.

The approach helped redress the gizani's decline and other species, including freshwater turtles (*Mauremys caspica*) and eels (*Anguilla anguilla*), also benefitted.

In addition, the project results highlighted the partners' ability to work together and boosted their collective confidence in broadening such collaboration beyond the original LIFE project into new water catchment management activities.

Greece submitted an Article 17 report under the Habitats Directive in December 2014. In it, although the gizani was noted as having an 'unfavourable-inadequate' conservation status, the range and population size of the species are 'favourable' and the short term trend is stable. In recent years several previously unknown populations have been found.

Photo: LIFE98 NAT/GR/005279/M. Th. Stoumboudi

A gizani (Ladigesocypris ghigii) in its natural habitat

Project number: LIFE98 NAT/GR/005279

Title: Ladigesocypris Ghigii – Conservation measures for the endangered fish Ladigesocypris ghigii

Beneficiary: National Centre for Marine Research - Institute of Inland water

Period: 01-Feb-1999 to 31-Oct-2003

Total budget: €834 000

LIFE contribution: €625 000

REINTRODUCTIONS AND RESTOCKING

Facilitating **habitat functionality for the Adriatic sturgeon**

LIFE has co-financed a collection of successful fish conservation activities in northern Italy that continue to improve the mobility and sustainability of Adriatic sturgeon in aquatic watercourses.

The Adriatic sturgeon (*Acipenser naccarii*), a priority species for conservation under Annex II of the Habitats Directive, is currently restricted to the north-eastern Adriatic sea basin. It spawns in freshwater following a period of growth at sea. The species can attain a length of 150 cm and is characterised by seasonal migrations from the sea to spawning areas located in the middle reaches of the Po, Adige, Piave and Brenta rivers. Sturgeons are particularly threatened both because of their large size and the fact that they take a long time to reach maturity (7-8 years).

Traditionally, the sturgeons' main reproductive sites covered large areas of these river basins but the species is now at risk of extinction in some parts of its distribution range.

Dams and weirs prevent the Adriatic sturgeons from reaching their main spawning areas. This disruption, combined with water pollution, illegal fishing, and a rapid increase in numbers of competitive alien species, such as the catfish (*Silurus glanis*), all contribute to the sturgeons' demise.

These barriers to migration have created a landlocked sturgeon population that cannot access the sea.

The uncoordinated management of the river basin, which falls under the jurisdiction of four regions and 15 provinces, is another major problem for this species.

The combination of the factors outlined above contributed to an 'unfavourable-bad' conservation status for the species in the 2006 Article 17 report. It is categorised as 'critically endangered' in the IUCN European Red List of freshwater fish.

LIFE funding has proved to be a useful source of help to tackle this nature conservation challenge. A series of projects have concentrated their efforts on

The Adriatic sturgeon (Acipenser naccarrii) is recognised as 'critically endangered' by the IUCN European Red List

Photo: LIFE11 NAT/IT/000188

recovering Adriatic sturgeon populations through ex-situ conservation, as well as complementary actions to improve habitat functionality in Italy's Po river basin.

Italian action

Thanks to LIFE co-finance, early work began in 2003 through a project managed by the Lombardy Ticino Park, ACIPENSER TICINO-LOMB (**LIFE03 NAT/IT/000113**). Outcomes greatly improved the competent authorities' understanding about the landlocked population of sturgeon from the Ticino River and its conservation needs. This instigated a coherent management plan that involved introducing fishing restrictions and removing thousands of predatory catfish.

Other LIFE funds deployed during a corresponding project (**LIFE04 NAT/IT/000126**) succeeded in restocking 12 different river sites by releasing more than 160 000 sturgeons (around 20 000 of which were of medium-size with 140 000 post-larvae). This work was aided by LIFE support for sturgeon breeding centres at Treviso and Orzinuovi that boosted know-how about optimal methods for managing and maintaining genetic variability. The restocking of sturgeon in three different regions is an important conservation action for the species. The project area covers almost the whole distribution area of the species. The project prepared a data bank for the restocking and monitoring activities, which is a useful instrument for the conservation of the species.

Monitoring work carried out as part of the project by a 500-strong network of rangers, fishers, and volunteers recorded positive findings from the restocking programme. Data were used to build a GIS tool that helped further increase the capacity of nature bodies to understand and conserve migrating sturgeon. In addition, an official sturgeon action plan was agreed by all the parties involved, to act as a legal instrument for the future management of the species.

Conservation cooperation

Stakeholder cooperation can be seen as one of the main success factors for LIFE's effort to conserve the Adriatic sturgeon. All of the project teams involved acknowledge that they could achieve more by joining forces than by working individually. This allowed them to be more cost-effective, to introduce operations with a wider reach, and to benefit from knowledge transfer.

Photo: LIFE11 NAT/IT/000188/ Parco del Ticino

Breeding Adriatic sturgeons in a closed cycle system. LIFE projects have helped optimise methods for managing and maintaining the genetic variability of the species

Such lessons continue to be applied in an ongoing project (CON.FLU.PO. - **LIFE11 NAT/IT/000188**) that is helping to increase networking between local authorities. Improvements are underway through this strategic approach to shared governance of the sturgeon's large and diverse freshwater habitat. A variety of additional fish species are also being assisted by the project. Its actions address fluvial habitat fragmentation by building fish pass infrastructure and facilitating further improvements in river corridor continuity, along approximately 300 km of the Po delta.

Studies carried out by another, earlier, fisheries project from northern Italy (Salmo Ticino - **LIFE00 NAT/IT/7268**) are being used to guide the development of these new sturgeon conservation measures. They include a beneficial suite of public awareness investments designed to expand the range of sturgeon stakeholders and gain long-term support for river management methods that intend to remove the Adriatic surgeon from Europe's list of critically endangered fish species.

The latest Italian Article 17 report (2007-2012) maintained the conservation status as 'unfavourable-bad' but improving, mainly thanks to LIFE project actions. According to the report, "the efforts made in the last years for the defragmentation of the hydrographic net of northern Italy will enlarge the species and range in the short term, improving the general status of *Acipenser naccarii*. In particular, the future realisation of a fishpass at Isola Serafini Dam will remove the main barrier to fish migration."

OVERCOMING RIVER BARRIERS

LIFE provides **safe passage for migrating fish**

LIFE projects have constructed fish passes and by-passes to help fish navigate beyond barriers that prevent them reaching important habitat areas, such as spawning grounds.

Photo: LIFE10/NAT/AT/000016/EZB/TB Zauner

One of three major hydro-power plants that the Danube Network project is enabling migrating fish to by-pass

The majority of LIFE projects described in this publication have carried out habitat restoration to improve connectivity between freshwater fish populations or reconnect migratory fish habitats with the sea. In some cases this has involved the removal of small barriers. A smaller number of projects have overcome larger obstacles such as dams. This latter group of projects serves to illustrate the extent to which infrastructure in rivers has created obstacles to fish movement.

Depending on the local context, fish migration barriers on rivers, such as dams or weirs, can either be physically removed, made passable by adding fish passes (fish ladders), or transformed so that fish can more easily overcome them. Although such barrier mitigation actions may be one among many objectives in a LIFE project targeting freshwater fish, they are a major aim of the projects highlighted in this article.

Obstacles to fish movement within rivers include weirs and industrial infrastructure; although the major barriers are dams built for hydroelectricity production or for water regulation and extraction purposes. A significant cluster of LIFE projects has addressed the problems caused to fish migration by dams. These have mainly established by-passes at particular sites, to allow both upstream and downstream fish migration. Normally this kind of project involves a large investment, so structures have to be properly designed to cost-effectively fulfil fish migration and ecological objectives.

Optimising fish passes

The period from the 1950s to the 1990s was a phase of major dam building throughout Europe, mainly for hydroelectricity generation. At that time, ecological principles were rarely integrated into planning processes. From the 1980s onwards, fish passes were built at dams that had stopped upstream and downstream fish movement. However, with little previous experience to draw upon, a number of these fish passes were ineffective.

The Rio Miño project (**LIFE99 ENV/E/000347**) involved the construction of a fish passage at the 33 m high Frieira Dam, the first such project in Galicia (Spain). The construction included a fish ladder in the lower part of the dam, enabling fish to pass around the dam barrier in a series of relatively low steps, and a cable-car elevator system (250 m long) to transport fish in tanks from capture pools to a channel situated upstream of the dam. However, the expected benefits of the implementation of this project, such as the recovery of fish populations upstream of the dam, were not realised. In particular, no salmon were recorded using the fish elevator.

With more experience and knowledge to draw upon, LIFE projects can now implement cost-effective and flexible solutions that are adapted to the requirements of targeted fish species. The houting (*Coregonus oxyrinchus*), for instance, cannot navigate weirs or fish passes so all river obstacles have to be demolished (see pp. 22-24), whilst stronger-swimming migratory species such as Atlantic salmon (*Salmo salar*) are relatively good at navigating fish passes (see pp. 18-21).

Hydrological and fish monitoring are important parts of these LIFE projects. It is necessary to carry this through to the after-LIFE planning stage, because the monitoring of fish is crucial to measure the success of particular types of action. Demonstration projects thus identify methods for improving fish pass or by-pass efficiency and provide successful models for future river restoration actions. The monitoring programme for the Roer Migration project (see box) showed some of the difficulties and benefits of fish monitoring.

Advanced monitoring techniques are being implemented in ongoing LIFE projects involving fish passes and by-passes. Danube salmon (*Hucho hucho*) and other targeted species, for example, have been measured and tagged to study migration at two fish passes that have been modernised in the Ljubljanica Connects project (**LIFE10 NAT/SI/000142**). Automated counting of tagged fish using passes can be conducted using PIT tag technology[1].

Side-channels and by-passes on the Danube

The development of the river Danube for hydroelectric power generation has reshaped about 80% of its course, with dams splitting the river into a series

1 Marking fish with passive integrated transponders - small tags containing a micro-chip that enable fish to be tracked without causing them harm.

Roer Migration (LIFE06 NAT/NL/000078)

The project team worked to re-establish migratory access to spawning grounds and improve habitat conditions for several Annex II-listed Habitats Directive fish species in the Roer, a tributary of the Maas. In particular, activities at sites in Hambeek and the ECI hydropower station in Roermond removed the last obstacles to migration on the Dutch section of the river.

A poorly-functioning fish ladder (fish pass) constructed in the 1980s at Hambeek was adapted, for example, by moving its downstream opening to enable fish to again access the river upstream of the dam. However, subsequent monitoring was unsuccessful, according to Rob Gubbels, the ecologist with beneficiary Waterschap Roer en Overmaas, "in 2008, we tried to monitor the fishway in Hambeek, but within several hours the fykes were polluted with algae. Catching fish was impossible, and we stopped monitoring."

At the ECI hydropower station, the project team built a fish pass for upstream migration, with a total length of 480 m and bridging a height of around 2.5 m, along with two channels, one for downstream migrating eels and one for salmon smolts. Monitoring confirmed that several targeted species, including salmon, sea lamprey (*Petromyzon marinus*) and European bullhead (*Cottus gobio*), were using the fish pass in the years after its construction. "We gained a detailed insight into the upstream and downstream migration patterns of many fish species," says Mr Gubbels. The data for downstream migration was particularly valuable, he adds, because most monitoring of fish migration is limited to upstream migration. Insights were also obtained into fish populations and the success of the salmon recovery programme on the upstream part of the Roer, in Germany.

The ECI fish pass incorporated adjustable elements, to make individual compartments wider or narrower so water flow could be adjusted to optimise migration upstream, as well as an underwater viewing window in the visitor's room at the hydropower station.

Photo: LIFE06 NAT/NL/000078

of isolated sections. Moreover, floodplains and their water bodies are now, for the most part, cut off from the main river and many tributaries are no longer connected with the Danube or with one another.

The Danube Network project (**LIFE10 NAT/AT/000016**) aims to three build by-pass "rivers" that will help the fish to circumvent three major hydroelectricity power plants on the Danube, as well as restabilising fish spawning grounds in the reservoir sections of the river above the dams. The project will thus make a significant contribution towards maintaining and improving the river's connectivity, and to the creation of stepping stones and spawning areas, to the benefit of the entire fauna of the Austrian Danube, including 57 native fish species. In the long term, the benefits for fish will be felt both upstream and downstream, where other projects have been carried out, and perhaps even beyond the national borders of Austria. The project will incorporate other LIFE project areas, such as the 2 km-long channel constructed during the Donau-Ybbs project (**LIFE04 NAT/A/000006**) to by-pass a hydropower plant (see pp. 27-28).

In addition to the large hydropower stations and associated dams, there are also numerous smaller hydroelectricity-generating weirs in European rivers that are characterised by a low turbine head. The main drawback of these weirs is that although their energy output is often rather marginal, fish are nevertheless unable to pass them. The Moveable HEPP project (**LIFE06 ENV/D/000485**) demonstrated the potential of a movable hydroelectric power plant on existing weirs and proved that it could operate economically at different water heights. Water flows above and below the hydroelectric power plant (HEPP) equipment to facilitate free movement of fish, whilst some fish were even able to swim through the slowly rotating turbine. It is hoped that such pilot actions can demonstrate that fish migration and hydropower production can be compatible.

The ongoing LIFE MIGRATOEBRE project (**LIFE13 NAT/ES/000237**) aims to help migratory fish populations recover in the final stretch of the Ebro River in Spain. The project plans to adapt weirs and a dam to facilitate upstream and downstream fish migration, and to increase more than tenfold the spawning habitat available for European sturgeon (*Acipenser sturio*), twaite shad (*Alosa fallax*) and sea lamprey, and the growth area for adult specimens of European eel (*Anguilla anguilla*).

In northern Sweden, two LIFE projects are removing obstacles to fish migration, which were erected as part of timber-floating operations and during road construction. River Vindel LIFE (**LIFE08 NAT/S/000266**) has removed 18 wooden floatway dams on tributaries of the Vindel River, which were used to hold back water in the spring in order to release it to float timber downstream during the drier summer months (see pp 13-15). ReMiBar (**LIFE10 NAT/SE/000045**) has removed around 300 dams and migratory barriers caused by road infrastructure, after inventories showed that approximately 30%-50% of all culverts built to carry water under roads in the project area were acting as migratory barriers because of poor positioning.

There has been much recent discussion, for example, at the Riverine LIFE Platform Meeting in Tartu (Estonia) in September 2014 (see pp.54-56), about harmonising and standardising procedures for fish passes and by-passes in Europe's multinational river systems. LIFE demonstration projects are showing the way forward for a widespread adoption of best practices, so as to enable all fish species to make full use of river habitats.

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Aerial view of the 2 km-long fish pass constructed by the Donau-Ybbs project

Photo: LIFE04 NAT/AT/000006/FWH Melk

OVERCOMING RIVER BARRIERS

Improving **river continuity to boost sea lamprey**

The conservation status of the sea lamprey is a good indicator of river quality in Liguria. The Montemarcello-Magra Natural Park authority doubled the species' range and increased reproduction sites by improving the continuity of rivers.

The national park authority launched the LIFE project, 'P.A.R.C. - Petromyzon And River Continuity' (**LIFE07 NAT/IT/000413**), to specifically target the sea lamprey (*Petromyzon marinus*), which in Italy is only known to reproduce in two rivers. Artificial constructions, such as barrages and dams, however, had interrupted the natural continuity of the rivers and had fragmented fish populations, including those of the Twaite shad (*Alosa fallax*), western vairone (*Leuciscus souffia*), south European roach (*Rutilus rubilio*) and the Italian barbel (*Barbus plebejus*). When river levels are low, fish were being prevented from migrating to their natural reproduction areas, and some species, including the sea lamprey, were then forced to reproduce in unsuitable parts of the river.

The main aim of the project was therefore to create fish passes to overcome these obstructions and increase suitable reproduction areas for the fish. The sea lamprey swims upstream to spawn in the medium to high parts of the river. Upon hatching, its larvae sink themselves into the silt or mud of the river bed and remain buried there for several years before migrating to the sea. By creating fish passes, the fish are able to withstand fluctuations in water levels and reach these upper areas to reproduce.

Monitoring carried out during the project showed the significant positive impact on fish populations of the passes, as well as of the construction of rocky breakwaters – especially in areas where the river has been straightened. The team from the University of Genoa, a project partner, recorded fish numbers below and above the passes, as well as inside them. The monitoring demonstrated that the fish often prefer to reside in the oxygenated water that the passes generate. When river levels drop during summer, sometimes river water only flows through the passage ways since their entrances are lower than surrounding parts of the barrage. The fish are then able to shelter in the torrents created by the passes' rocks and boulders and are less vulnerable to predation from birds.

Photo: LIFE07 NAT/IT/000413

Sea lamprey (Petromyzon marinus)

Continuity supports life

"The functioning of the river has in part been restored," says Sebastiano Salvidio of the University of Genoa, "and the sea lamprey is its most important species, so the increase in its population supports this claim." Local fishing associations were also involved in the collection of the monitoring data, as well as in efforts to raise awareness of the need to protect this emblematic species.

Photo: LIFE07 NAT/IT/000413

Fish pass near Sarzana railway bridge. The project found that sea lampreys prefer passes with boulders in a grid pattern

The larvae of the sea lamprey were being used by fishermen as bait, but for conservation reasons this practice is now illegal and the police are enforcing this new ban. Surveillance to prevent poaching has been stepped up and fines are a sufficient deterrent to its occurrence. Nevertheless, Gaia Cappellini, the project manager, is eager to emphasise that the conflict with fishermen has been minimised. "They were largely sympathetic to the aims of the project and recognise the need to improve the ecological conditions of the river," she says.

Monitoring also took the form of PIT tagging, colouration with dyes and some electrofishing. "We didn't exactly know [what would be the result], but the same type of passes had been used in France, and we believed that they would work here," says Dr Massimiliano Cardelli of the park authority. "But every river has its own particular characteristics depending on its ecological and climatic aspects."

On the widest stretch of the river where passes were constructed, i.e. near the railway bridge of Sarzana, the project used two different types - one with boulders in a grid pattern and the other with rows of boulders - in order to determine which one works best. As a result the researchers found that the most appropriate passes depended on the fish species – the sea lamprey preferring the grid type.

Overall, the project installed four fish ramps on the River Magra and another four along the River Vara, re-establishing continuity along almost 50 km of river. The number of sea lamprey reproduction sites increased by around 100, as confirmed by the presence of larvae. Furthermore, the range of the Twaite shad was increased by 19 km.

The fish passes, moreover, proved to be resistant to flooding, especially the serious flooding that occurred in 2011. "One of the risks of the project was flooding and we built with that in mind," says Dr Salvidio. Boulder dams, however, were damaged by the flood, particularly the one at Pian di Madrigliano, but the existing boulders were relocated.

During periods of high water levels, the passes and breakwaters created by the project are a place of "refuge and rest" for the fish, explains Dr Andrea Balduzzi, from Genova University. For this reason, he adds, the park arranged meetings with the regional authority during the project to achieve an agreement that each new barrier constructed in the future will include a fish ramp.

Today, the river bears testimony to the improvements that river restoration projects can produce. Schoolchildren regularly visit the sites to learn first hand about conservation, whilst local people and visitors can enjoy the informative nature paths and four observational areas created by the project. Furthermore, the ties established during the project with the Province of Spezia are enabling Montemarcello-Magra Park to promote flood protection measures that take into account the overall biodiversity of the area and not just the protection of the local population.

Project number: LIFE07 NAT/IT/000413

Title: P.A.R.C. - Petromyzon And River Continuity

Beneficiary: Ente Parco di Montemarcello-Magra

Contact: Patrizio Scarpellini
Email: lifeparc@parcomagra.it
Website: www.lifeparc.eu
Period: 12-Jan-2009 to 31-Dec-2012
Total budget: €1 511 000
LIFE contribution: €756 000

OVERCOMING RIVER BARRIERS

Creating **blue corridors in Poland**

Many fish species are highly mobile, spawning in one place and feeding in another. Some even travel thousands of kilometres, migrating from salt water to freshwater habitats or vice versa. LIFE projects in Poland are constructing so-called blue infrastructure that allows fish to keep on moving.

Atlantic salmon (*Salmo salar*) spend most of their adult life in the salty waters of the Atlantic Ocean or the Baltic Sea. However, they return to the freshwater streams where they once hatched to spawn. Young salmon stay in their native river for up to four years, before they slowly begin their journey back to the ocean. There they feed and grow into adults that, once they are ready to spawn, return to their native river to begin the cycle anew.

For spawning, salmon need large stretches of gravel beds where they can dig out nests ("redds") and bury their eggs; and the young salmon need clear, cool, well-oxygenated and fast-flowing rivers and streams to develop and grow.

Dwindling populations

As in many parts of the EU, the Atlantic salmon populations of the Ina basin in Western Pomerania and the Rega River in north-western Poland have dwindled over recent decades. As a result since 2005, the Rega has been restocked with Atlantic salmon and 121 440 fry of this species have been put into the river. Since existing spawning grounds are not large enough to restock salmon it has been necessary to clear spawning channels and create appropriate spawning grounds. Since 2011 and 2012, two LIFE projects (**LIFE10 NAT/PL/000654** and **LIFE11 NAT/PL/000424**) are supporting the restocking effort. They aim to conserve and improve the biodiversity of the water ecosystems in target areas, which encompass several Natura 2000 sites, mainly by creating a blue wildlife corridor interlinking sites.

Reconnecting isolated sites

In the Ina and the Rega basins populations of many species have become isolated as the result of human activities (e.g. road-building, development, logging, etc.). The populations separated in this way are weakened, reduced or even eliminated due to a lack of genetic diversity and inbreeding. Opening up new passageways or wildlife corridors allows an exchange of individuals between populations, strengthening them and moderating the effects of habitat fragmentation.

The project teams are also building fish passes to clear migration routes along the Ina and Rega rivers and their major tributaries. Although there are good natural spawning sites further upstream, the fish cannot currently reach them, as they are hampered

The projects have constructed fish passes for Atlantic salmon

Photo: LIFE10/NAT/PL/000654/Joanna Pawelec/Elżbieta Typańska

by artificial structures. Therefore, large parts of the migratory fish population are concentrated downriver. Very few manage to migrate upriver, which has a negative impact on the conservation status of a number of species, including the Atlantic salmon.

Whilst the fish passes already in place have been quite beneficial for the fish, they have also proven to be popular with poachers. As a countermeasure, volunteers are guarding the passes and have already caught hundreds of would-be poachers, some of whom received fines for illegal fishing. The project partners are also organising awareness-raising sessions in schools to teach children about the negative effects of poaching on biodiversity.

Trees to offer shade

In addition to fish passes, LIFE funding is helping to create artificial spawning grounds and enlarge natural spawning grounds, as the currently available areas are not large enough for a healthy salmon population. Some 12 000 alder and 1 000 elm seedlings have already been planted along roughly 20 km of the Ina river bank and a further 25 000 alder seedlings along a 19 km stretch of the Rega River. Further planting is planned along the Rega. This will create shaded areas and lower the water temperature, making these stretches better suited to the needs of young salmon.

Along the Rega, the team is also setting up monitoring devices that will provide detailed records of fish migration, specifying when and where Atlantic salmon and other fish species access the spawning sites. These records will be used to plan and carry out future conservation measures.

In addition, the Rega project partners are installing electronic barriers in strategic locations where the turbines of hydroelectric power stations are located. These barriers transmit electric impulses, which deter fish from entering the area. The electric waves are strong enough to steer the fish away from the turbines and to guide them towards the fish passes, but weak enough to avoid doing any harm to the fish. As a result, fish mortality is expected to be drastically reduced.

The bigger picture

All of this work will not only benefit the Atlantic salmon, but also numerous other endemic species, including the spined loach (*Cobitis taenia*), the European bullhead (*Cottus gobio*), the European bitterling (*Rhodeus sericeus amarus*), the river lamprey (*Lampetra fluviatilis*), and the brook lamprey (*Lampetra planeri*).

What's more, solving the local biodiversity issues is only part of the picture. The action undertaken in the framework of both projects aims to demonstrate transferable solutions regarding the reconstruction of functional water ecosystems for migratory fish species elsewhere.

The recently started LIFEDrawaPL project on the protection of water-crowfoot (*Ranunculus aquatilis*) habitats and wildlife corridor restoration in Poland (**LIFE13 NAT/PL/000009**) involves the active protection of lowland rivers in West Pomerania, including the Drawa, Grabowa, Radew and Korytnica. The project aims to improve river habitats and species by removing existing barriers and making adjustments to hydrotechnical structures, in order to make upper-river areas more accessible to migrating species, such as river lamprey and Atlantic salmon. It will also enhance natural river reproduction of river lamprey, Atlantic salmon, European bullhead and spined loach.

The LIFENaturaSlowinskaPL project (**LIFE13 NAT/PL/000018**) aims to modernise the drainage system of the Łupawa River floodplain. The initiative will help regulate water levels according to the habitat needs of fish and bird species in the Słowiński National Park. It will also include the clearing of the Łupawa River wildlife corridor for migrating fish, involving the construction of a fish ladder to negotiate the dam at the hydroelectric power plant in Smołdzino.

Drawa river basin in autumn. The LIFEDrawaPL project aims to remove obstacles that impede access to migrating fish species

LIFE13 NAT/PL/000009/Elżbieta Hołubczat

STAKEHOLDER ENGAGEMENT AND AWARENESS-RAISING

Connecting with river communities **to conserve fish populations**

Engaging with fishing communities, landowners and others who live and work on rivers has played a crucial role in the success of many LIFE projects. Ongoing projects can therefore build on the rich experience already gained in driving stakeholder involvement and raising awareness.

Photo: LIFE09 INF/GR/000319

Fisherwoman on Lake Prespa. The PROM.SUS.FIS.PR. PRESPA project (LIFE09 INF/GR/000319) worked with many stakeholders to raise awareness

In an environmental context, the term stakeholder refers to all individuals or organisations affected by environmental decisions. Stakeholders may also have the means to influence the outcomes of those decisions. Decisions regarding ecosystem management benefit from the participation of multiple stakeholders with different interests in the services provided by the ecosystem in question. These stakeholders can bring a diversity of knowledge and experience to the decision-making process.

Pivotal to the success of LIFE Nature projects has been the creation of mutually-beneficial partnerships of stakeholders involving, for example, landowners, anglers, farmers, fishermen, local community groups, non-governmental organisations, businesses and research organisations. Raising awareness of the issues at stake has been the glue holding these partnerships together, helping all parties to understand and appreciate each other's viewpoints. Freshwater fish, for instance, can be

viewed in terms of biodiversity or as an economic resource of importance to local economies.

All the LIFE projects in this brochure have relied on stakeholder involvement. Key stakeholder groups that need to be on board for freshwater fish conservation projects often include the owners of the land that rivers run through, owners of hydroelectricity installations and fish farms in the project area, local or regional authorities, fisherman who earn all or part of their livelihoods from catching fish, and angling associations representing those who fish as a recreational activity. This article focuses on a selection of projects, mainly within the Information and Communication strand of the LIFE programme, where stakeholder involvement and raising awareness have been key objectives.

Angling and fish conservation

Although data are difficult to obtain, the European Angling Association (EAA) estimates that there are around 25 million anglers in Europe. Fish may be caught for personal consumption, but much recreational fishing is catch-and-release. River restoration and fish conservation projects can have long-term benefits for the angling sector in terms of sustainable fish populations, so raising awareness and gaining the active cooperation of angling associations can be important for the success of LIFE projects.

Data collected by anglers can help with the general monitoring of fish populations. For example, in Sweden, the Vindel River LIFE project area (see pp. 13-15) is accessible for recreational fishing, but only under license and anglers are obliged to report all salmon catches.

In Corsica, an endemic subspecies of trout (*Salmo trutta macrostigma*) had become endangered in the 1990s as a result of poaching, hybridisation with introduced trout and habitat degradation caused by human activities. Corsica's brown trout lives entirely in freshwater, but moves between resting, growing and reproduction zones in rivers. The TRUITE project (**LIFE03 NAT/F/000101**) improved knowledge about the distribution of the endemic trout, protected populations in key locations, and raised awareness concerning its importance. The cooperation of different stakeholder groups - including anglers, who were partners of the project - was crucial to the success of the initiative.

The project identified 15 new populations of native Corsican trout. Knowledge of their distribution led to a 2 548 ha extension of the Natura 2000 network in Corsica so as to include 16 of the 20 known pure macrostigma populations. The project team purchased fishing rights, with the support of landowners, and established angling reserves covering 15 watercourses, with all fishing forbidden in four other areas. Thanks to the cooperation of

Close cooperation with the angling community was essential to the success of the TRUITE project, which targeted macrostigma trout

LIFE03 NAT/F/000101/J.L.Teyssié

Photo: LIFE09 INF/GR/000319

Poster for Crafted by Time, a documentary about Lake Prespa that was screened at the 15th Thessaloniki Documentary Film Festival

anglers in the extended Natura 2000 network area, the initiative resulted in an increase in Corsican brown trout numbers.

To protect against hybridisation with non-native trout, the project beneficiary (the Corsican Confederation of Fishing) agreed to suspend the release of Atlantic brown trout into the river areas with endemic brown trout populations for three years, despite the impact of this measure on fish stocks for anglers.

Another important project action was the establishment of an efficient surveillance network to reduce poaching. This was policed with the help of stakeholder organisations and led to 23 prosecutions during the LIFE project, mainly for illegal fishing, and enabled the recapture of 837 illegally-caught macrostigma trout. In addition, a range of activities helped raise awareness amongst anglers, the general public, environmental managers and schoolchildren about the conservation of Corsica's trout.

Protecting endemic species

The protection of endemic fish with the cooperation of local stakeholders was also the goal of the PROM.SUS.FIS.PR. PRESPA project (**LIFE09 INF/GR/000319**), which worked to conserve threatened species in the two lakes of the Prespa basin, located between Greece, Albania and Macedonia. The lakes contain around 23 native fish species, including eight that are endemic. These unique fish species assemblages are threatened by habitat degradation, especially in their spawning grounds, competition from non-native species, water pollution and illegal fishing.

Project beneficiary, the Society for the Protection of Prespa (SPP), encouraged stakeholder participation, especially the participation of local authorities and fishermen in activities directly related to fish conservation. For instance, the multi-stakeholder Wetland Management Committee was extended as a result of the project to include the formal participation of fishermen for the first time. Amongst the management decisions made by this committee, which operates within the management body of Prespa National Park, was an extension of the closed fishing period, to allow more protection for endemic species during the spawning season.

An extensive awareness-raising campaign informed stakeholders, including anglers, professional fishermen and women and local communities about endemic fish, sustainable fishing practices and water quality. The campaign included TV broadcasts featuring local fishermen explaining the threats to fish biodiversity, and radio spots advising of closed season dates when angling is prohibited. Other activities included the production of a documentary film, meetings, publications, and educational materials that reached 600 students in schools.

The PROM.SUS.FIS.PR. PRESPA project held regular meetings with the fishing community

Photo: LIFE09 INF/GR/000319

Raising awareness amongst all the stakeholders was a challenging but essential part of the project, according to SPP's managing director, Myrsini Malakou. "Through the LIFE project we wanted to create a common base of understanding between the local, national and international actors about the importance of these fish," she says. "It was important for us to understand people's needs, expectations and worries. It was also important for the community to understand the findings of our scientific research." Establishing a mutual understanding, notes Ms Malakou, helps to avoid confusion and is important for the implementation of future management plans.

RESTORE (LIFE09 INF/UK/000032)

The RESTORE project responded to a need for better access to previous experience and knowledge on river restoration, by working to share and promote information on best practices in Europe and to connect river restoration professionals. Key actions were the development of a website (www.restorerivers.eu) and the RiverWiki platform.

RiverWiki (riverwiki.restorerivers.eu) is an interactive database of over 500 river restoration case studies, to which registered users can add information. It provides a pan-European network of information that links policy-makers, river restoration practitioners and other stakeholders. These groups can find, share and comment on river restoration projects through the RiverWiki platform.

The project team also published Rivers by Design, a guide for planning and development professionals that gives step-by-step practical advice on restoring rivers. Workshops organised by the project helped share information and raise awareness, for example, about the costs and benefits of river restoration and flood risk management.

The RESTORE project finished in December 2013, but continuity has been ensured by the European Centre for River Restoration (ECRR), a European network established in 1995. The ECRR now hosts the website, while the RiverWiki is managed on its behalf by the River Restoration Centre (RRC) in the UK.

Photo: LIFE09 INF/UK/000032/JORMOLA Jukka

Changes in attitudes to fish biodiversity were monitored during and after the project. This showed that awareness of the issues surrounding endemic fish had increased amongst both anglers and professional fishermen. This is a key step towards decreasing illegal fishing incidents in the Prespa lakes and ensuring the sustainability of the project's achievements, through the SPP's ongoing collaboration with local authorities and fishermen.

Exchanging best practice

River restoration projects all over Europe have worked to mitigate barriers to fish migration, for example through the construction of fish passes, and to create habitats for freshwater fish, most notably spawning grounds. However, the information has often been scattered and not put to best use by ongoing projects implementing similar measures. The LIFE RESTORE project (see box) established a platform for exchanging information on river management measures. It has therefore played an important role in moving river restoration activities forward, from a series of localised activities to more coordinated large-scale implementation of best practice measures.

Raising awareness of the threats to salmon populations in Finland and the negotiation of an agreement amongst stakeholders responsible for fish-related decisions were key objectives of the Saimaan lohikalojen project (**LIFE10 INF/FI/000052**). The project drew up fishing plans for the most important salmon habitats (see pp. 18-21).

Saving wild Danube sturgeons

Five of the six sturgeon species in the Danube river basin are classified as either 'endangered' or 'critically endangered' by the IUCN. A long life-span and late maturity make them particularly vulnerable to threats that include barriers to migration, habitat degradation, the introduction of exotic species and genotypes, and overfishing - particularly for the valuable caviar they produce. Overexploitation for caviar and poorly-enforced fishing regulations caused a severe decline in sturgeon populations in the 1990s, which led to the Action Plan for the Conservation of the Sturgeons (*Acipenseridae*) in the Danube River Basin being adopted in 2005. Temporary bans on the commercial fishing of wild sturgeon were subsequently introduced in Romania (2006) and Bulgaria (2011). However, sturgeon continued to be illegally exploited.

The Saving Danube Sturgeons project (**LIFE11 INF/AT/000902**) is raising awareness of the over-exploitation of Danube sturgeons in Romania and Bulgaria, and helping to implement several key objectives of the 2005 Action Plan. The project beneficiaries (WWF Austria with WWF Romania and WWF Bulgaria) are particularly focusing on the fishing sector, to inform fishing communities about the threats facing sturgeon and to reduce illegal fishing activities.

"In this project I have two positions, I'm the project officer and I'm a sturgeon advocate," says George Caracas of the WWF. "That means periodically I go to fishing villages, talk with fishermen to see what their problems are, bring solutions to their problems, and also act as a go-between between the fishermen and the authorities." The project team found that fishermen, in 15 fishing villages in Romania and seven in Bulgaria, were initially reluctant to answer questionnaires. "The first approach was to go directly on the river shore and talk to the fishermen," recalls Mr Caracas, "but being a very sensitive issue most of them didn't want to talk to us." The heads of the relevant fishing associations played an important role in facilitating contact with the fishermen and, over time, the role of sturgeon advocate has become accepted in the fishing communities.

The results of before-and-after questionnaires in Romania showed a dramatic increase in the number of fishermen who agreed that sturgeons needed protection in order to survive - from fewer than half to 91%. The majority of fishermen, however, thought bans on fishing seriously endangered their livelihoods, and that as long as there are sturgeons in the Danube they should be fished. "The fishermen are against the form of the sturgeon ban," says Mr Caracas. "They want compensation and finally the authorities understood that and as this ban will continue for some 10 or 20 years they will see if they can get some compensation measures for the fishermen." Most fishermen backed measures for sustainable fishing, such as the doubling of net mesh size (to 80 mm) to avoid catching sturgeon fry.

The knowledge of local fishermen can be useful in the success of LIFE projects, particularly those involving rare and endemic species. Discussions with fishermen in this case helped identify the best place to release sturgeons for restocking. Around 11 000 juveniles of the vulnerable sterlet (*Acipenser ruthenus*) species, were released in the Danube in Persina Nature Park in Bulgaria in 2014, with further releases of sturgeon species planned.

In the spring of 2014, the project team held workshops in Bulgaria concerning alternative incomes for fishermen, for example involving tourism, to replace that lost by bans on catching sturgeon. In one village, notes Mr Caracas, "they have an old restaurant and they would like to rehabilitate it and to provide fresh fish for the tourists, and also to offer some trips on the Danube." Work toward aiding seizures of illegal caviar should also support those fishing communities holding regulated permits. There is an obligatory caviar labelling system in force, which promotes caviar from sustainable aquaculture sources.

A crucial part of the Saving Danube Sturgeons project has been the development of a shared strategy with key stakeholders to ensure the long-term sustainability of the project's actions. This provides a good example for future LIFE projects of how to bring stakeholders together to manage complex ecosystem management issues for the benefit of endangered freshwater fish.

Public outreach by the Saving Danube Sturgeons project at a festival in Romania

Photo: LIFE11 INF/AT/000902/Doru Oprisan

CONCLUSIONS

Lessons from LIFE for freshwater fish conservation

LIFE networking events have provided useful lessons from freshwater fish conservation projects. Such know-how can be applied to improve the impact of traditional or integrated projects for the 2014-2020 LIFE funding period.

Photo: LIFE11 INF/AT/000902/Jiri Bohdal

Beluga sturgeon (Huso huso) - one of the species targeted by SAVING DANUBE STURGEONS (LIFE11 INF/AT/000902)

The first Platform Meeting to address riverine species was held in Tartu (Estonia) on 10-12 September 2014. Attended by representatives from over 15 - completed and ongoing - LIFE projects concerning the conservation of freshwater species, particularly migratory fish, the meeting focused on species reintroductions, monitoring, migration barriers and fish passes, as well as the benefits of involving local community stakeholders in LIFE projects.

The participants came from the private, public and third sectors. The event highlighted many challenges and opportunities for future conservation. Specifically, the technical requirements for target species and the legal regulations in force regarding fish pass parameters were considered, as were approaches to monitoring restocking or reintroduction activity. Jörn Gessner from the Leibniz Institute for Freshwater Ecology and Inland Fisheries and Paolo Bronzi, the Vice-President of the World Sturgeon Conservation Society, noted a lack of efficiency in many fish passes and presented the case for harmonising operating procedures, with particular reference to sturgeon. Participants also discussed the technical requirements of fish passes for different species and legal regulations in different European countries.

Regarding project quality, the delegates spoke about a range of issues, including how to manage potential conflicts between respect for endangered species, protected habitats and stream quality. Another key topic was stakeholder involvement and dissemination, including an examination of the most efficient

outreach methods and legacy issues, namely, how to maintain the integrity of freshwater habitats beyond the end of a project. Demonstrating a project's added value to local people and efforts to involve landowners, interest groups and politicians were noted as being important in this regard.

Enhancing ecosystem services

By restoring riverine habitats, LIFE projects can also enhance the ecosystem services they provide. The UC4LIFE project (see box) provided one such example, as it improved river quality by raising water levels in a number of Swedish rivers to create a more natural floodplain hydrology. Although the project's target species was a freshwater mussel, biodiversity was generally increased as a result of the measures taken. The lesson learnt was that a good quality LIFE river restoration project must include knowledge of what constitutes a good fish spawning ground and what is the best type of riverbed substrate for the type of river.

Also concerned with wider ecosystem functioning, the Life Grote Nete (**LIFE05 NAT/B/000090**) and Wald-Wasser-Wildnes (**LIFE09 NAT/DE/000006**) projects restored multiple habitat types in a Belgian lowland river and in the Eifel National Park in Germany, respectively.

Getting the message across

Participants at the Platform Meeting emphasised the benefits of tuning river restoration projects to the interests of local actors, e.g. fishing associations, landowners. Doing so helps communicate the message that such projects can add value to a local natural resource, for example through general improvements in water quality. Involving local people and organisations and keeping them motivated can help to sustain long-term riverine habitat management and enhance the cost-effectiveness of a project.

Best-in-class insight

The LIFE platform meeting leveraged knowledge gained from a range of conservation project types, including:

- **Restoration**
  NGO Wildlife Estonia, which hosted the meeting coordinates the HAPPY-FISH project (**LIFE07 NAT/EE/000120**) to restore oxbow lakes and its follow-up project LIFE HAPPYRIVER (**LIFE12 NAT/EE/000871**).
- **Restocking**
  The UC4LIFE project (**LIFE10 NAT/SE/000046)** reintroduced to rivers in Sweden the thick-shelled river mussel (*Unio crassus*), whose complex life-cycle involves an obligatory phase on a host fish.
  LIFE-Projekt Maifisch (**LIFE06 NAT/D/000005**) successfully reintroduced allis shad (*Alosa alosa*) into the Rhine river system in Germany. These actions have been further expanded in the frame of a follow-up project, Alosa alosa (**LIFE09 NAT/DE/000008**).
- **Removing barriers**
  The Ljubljanica Connects project (**LIFE10 NAT/SI/000142**) in Slovenia removed barriers to fish migration.
  The ReMiBar project (**LIFE10 NAT/SE/000045**) removed around 300 barriers, mainly in smaller rivers and streams in northern Sweden.
  The LIFE Free Fish project (**LIFE12 NAT/BG/001011**) is removing migration barriers in Bulgaria.
  The Houting project (**LIFE05 NAT/DK/000153**) removed or by-passed barriers to migration of the world's only remaining population of houting (*Coregonus oxyrinchus*).
- **Raising awareness**
  The SAVING DANUBE STURGEONS (**LIFE11 INF/AT/000902**) project is raising awareness of overexploitation to village communities and fishermen.
  The UK project, RESTORE (**LIFE09 INF/UK/000032**) created a 'RiverWiki' to share best practices with policy-makers, practitioners and researchers of river restoration.

Platform Meeting recommendations

A number of recommendations arose from the concluding panel discussion in Tartu, including the need for a better linkage between the Water Framework Directive (WFD) and LIFE Nature projects, a greater emphasis on climate change, enhanced capacity building to help set up new projects, simplified administration for project managers, and improved guidelines for LIFE project applicants. A greater focus on

Prolonging conservation after LIFE

Reviving waters, a three-day international conference on stream restoration in Sweden that concluded the activities of the Vindel River LIFE project also took place in September 2014.

As well as practical examples of stream and river restoration from seven Member States, the conference highlighted both the importance of stakeholder consultation and involvement, and the need for long-term monitoring of the effects of restoration actions. In addition, there was a presentation on the preparation of Finland's first proposal for an integrated project (on freshwaters), a new category of LIFE project introduced in 2014.

after-LIFE monitoring was recommended, with more responsibility given at Member State level.

It was agreed that: river restoration should be more science-based with more reliance on natural processes; restocking and reintroduction projects must include elements to check the fitness of fish species for natural environments before release; and greater project transparency should extend to information about costly fish passes.

LIFE's achievements and new opportunities

LIFE projects have implemented many actions to improve fish conservation status, as defined in the Habitats Directive. One of the main achievements of the programme has been to identify and address key threats to freshwater fish, and as well to implement actions to improve their conservation status. These key actions have been focused mainly on river restoration, such as mitigation of migration barriers, improving water quality and, in a few cases, regulation of recreational or professional fishing.

Since 1992, a large number of LIFE Nature projects throughout the EU have successfully demonstrated the feasibility of such actions and some have been followed by a surprisingly rapid recovery of fish populations.

The so-called 'traditional' LIFE projects are normally successful if a number of favourable conditions are collectively fulfilled, amongst which are the availability of co-funding, significant local motivation and the capacity to manage such projects. These projects are thus strongly driven by a favourable local context and quite often build upon local stakeholder involvement.

The LIFE programme for 2014-2020 includes a number of new developments that should enable LIFE funding to have an even-greater impact in favour of nature conservation. For instance, the Nature & Biodiversity strand of the programme now permits projects to target species included in the IUCN European Red List.

The LIFE programme for 2014-2020 also includes a new project category: 'integrated projects'. These are designed to overcome the shortcomings of a primarily local perspective by implementing Prioritised Action Frameworks or River Basin Management Plans, thereby addressing the most important priorities at regional or national level, whether those are species, habitats or environmental problems.

The most recent information on the conservation status of fish species of Community importance included in the annexes of the Habitats Directive (Article 17 reporting) shows there is still much for the LIFE programme to do.

LIFE is expected to continue playing an essential role in restoring and managing key Natura 2000 network sites for fish species and thus fulfilling the objectives of the EU 2020 Biodiversity Strategy. It will do this both through the site-level actions of 'traditional projects' and through the new integrated projects at regional or national level. Rather than replacing the traditional projects, the future integrated projects are thus meant to be an important complement, focusing on those conservation and restoration priorities that would otherwise have been overlooked. However, given the limitations of available LIFE funding, it is also clear that other funding sources should increasingly be used to achieve the conservation objectives. Some important initiatives are already being co-funded, for instance, through EU Structural Funds and the European Maritime and Fisheries Fund (EMFF).

In the case of freshwater fish conservation, project managers are quite often unaware of wider policy objectives. For example, for freshwater biodiversity conservation, there are strong synergies between Natura 2000 and the Water Framework Directive, in particular when it comes to the setting of strategic conservation priorities. This is precisely the gap that the Prioritised Action Frameworks and LIFE integrated projects have been designed to plug.

LIFE riverine Platform Meeting excursion to HAPPYFISH and LIFE HAPPYRIVER project sites in Estonia

Photo: LIFE07 NAT/EE/000120

Selected projects focusing on freshwater fish since 1992

The table below provides examples of some of the LIFE projects focusing on freshwater fish since 1992. For more information on individual projects, visit the online database at: http://ec.europa.eu/environment/life/project/Projects/index.cfm.

PROJECT	TITLE
Acipenser naccarii	
LIFE03 NAT/IT/000113	Conservation of Acipenser naccarii in the River Ticino and in the middle reach of the River Po
LIFE04 NAT/IT/000126	Conservation and breeding of Italian cobice endemic sturgeon
LIFE11 NAT/IT/000188	Restoring connectivity in Po River basin opening migratory route for Acipenser naccarii* and 10 fish species in Annex II
Acipenser sturio	
LIFE94 NAT/F/000862	Restoration of the sturgeon Acipenser sturio.
LIFE98 NAT/F/005212	Conservation and restoration of the European sturgeon
LIFE13 NAT/ES/000237	Migratory fish recovery and improved management in the final stretch of the Ebre River
Alburnus albidus	
LIFE05 NAT/IT/000026	Urgent conservation actions for Fortore River pSCI
Alosa alosa	
LIFE99 NAT/UK/006088	Safeguarding Natura 2000 Rivers in the UK
LIFE06 NAT/D/000005	The re-introduction of allis shad (Alosa alosa) in the Rhine System
LIFE08 NAT/D/000007	Restoration of a side channel of the river Rhine near Wesel, Lower German Rhine
LIFE08 NAT/UK/000201	Irfon Special Area of Conservation Project
LIFE09 NAT/DE/000004	Rhine wetlands near Rastatt
LIFE09 NAT/DE/000008	Conservation and restoration of the Allis shad in the Gironde and Rhine watersheds
LIFE09 NAT/LT/000234	Inventory of marine species and habitats for development of NATURA 2000 network in the offshore waters of Lithuania
LIFE10 NAT/DE/000010	River and floodplain improvement Emmericher Ward within the EU Bird Area Unterer Niederrhein
Alosa fallax	
LIFE99 NAT/UK/006088	Safeguarding Natura 2000 Rivers in the UK
LIFE05 NAT/LT/000095	Natura 2000 site conservation and management on the Lithuanian coast
LIFE07 NAT/IT/000413	Petromyzon And River Continuity
LIFE08 NAT/UK/000201	Irfon Special Area of Conservation Project
LIFE11 NAT/IT/000188	Restoring connectivity in Po River basin opening migratory route for Acipenser naccarii* and 10 fish species in Annex II
LIFE13 NAT/ES/000237	Migratory fish recovery and improved management in the final stretch of the Ebre River
Anaecypris hispanica	
LIFE97 NAT/P/004075	A conservation strategy for Anaecypris Hispanica
LIFE13 NAT/PT/000786	Conservation of the Saramugo (Anaecypris hispanica) in the Guadiana basin (Portugal)
Aphanius fasciatus	
LIFE02 NAT/IT/008523	Environmental rehabilitation of the Natural Reserve of Tarquinia Salt-works
LIFE09 NAT/SI/000376	Man and Nature in Secovlje salt-pans
Aphanius iberus	
LIFE96 NAT/E/003118	Conservation of priority species in Mediterranean marshes (Aphanius iberus, Valencia hispanica, Botaurus stellaris, Larus audouinii)
LIFE98 NAT/E/005323	The 'Albuferas de Adra" (Almeria), conservation plan
LIFE99 NAT/E/006386	Arrangement and management of the Baix Ter Coastal lagoons and marshes
LIFE00 NAT/E/007339	Model of restoration of dunes habitats in 'L'Albufera de Valencia'
LIFE04 NAT/ES/000035	Conservation of Aphanius iberus genetic stocks (Murcia)
LIFE04 NAT/ES/000044	Recovery of the littoral sand dunes with Juniper spp in Valencia
LIFE09 NAT/ES/000520	Restauración y gestión del hábitat en dos lagunas costeras del Delta del Ebro: Alfacada y Tancada

PROJECT	TITLE
Aspius aspius	
LIFE05 NAT/LT/000095	Natura 2000 site conservation and management on the Lithuanian coast
LIFE06 NAT/NL/000078	Restoring migration possibilities for 8 Annex II species in the Roer
LIFE06 NAT/SI/000066	Conservation of biodiversity of the Mura river in Slovenia
LIFE07 NAT/EE/000120	Saving life in meanders and oxbow lakes of Emajõgi River on Alam-Pedja NATURA2000 area
LIFE10 NAT/AT/000016	Danube Network
LIFE10 NAT/PL/000654	Creating a Blue Wildlife Corridor in the Ina basin
LIFE11 NAT/SI/000882	Riparian Ecosystem Restoration of the Lower Drava River in Slovenia
LIFE12 NAT/EE/000871	Restoring the integrity of freshwater habitats in Alam-Pedja Natura 2000 area- bringing the River Laeva back to life
LIFE13 NAT/HU/000388	Transboundary cooperation for revitalization of riverine habitat complex in Drava region within Natura 2000 sites
Barbus meridionalis	
LIFE08 NAT/E/000078	Improvement of the Natura 2000 habitats and species found in Banyoles: a demonstration project.
LIFE11 NAT/IT/000188	Restoring connectivity in Po River basin opening migratory route for Acipenser naccarii* and 10 fish species in Annex II
LIFE12 NAT/BG/001011	Conservation and restoration of Natura 2000 rheophilic fish species and their migratory routes in key SCIs in Bulgaria
LIFE12 NAT/ES/001091	Conservation of river fauna of Community interest in the Natura 2000 network sites of the Ter, Fluvià and Muga river basins
LIFE13 NAT/IT/001129	Conservation and management of Barbus meridionalis and Barbus plebejus in the Emilian tributaries of Po River
Barbus plebejus	
LIFE98 NAT/IT/005138	Requalification of Taro fluvial habitats vital to avifauna
LIFE07 NAT/IT/000413	Petromyzon And River Continuity
LIFE09 NAT/IT/000213	Restoration of Bacchiglione springs and habitat of SPA IT3220013 and SCI IT3220040
LIFE11 NAT/IT/000188	Restoring connectivity in Po River basin opening migratory route for Acipenser naccarii* and 10 fish species in Annex II
LIFE13 NAT/IT/001129	Conservation and management of Barbus meridionalis and Barbus plebejus in the Emilian tributaries of Po River
Chalcalburnus chalcoides	
LIFE12 NAT/AT/000321	Natural wood lands, bogs and habitat network around Aussee
Chondrostoma genei	
LIFE98 NAT/IT/005138	Requalification of Taro fluvial habitats vital to avifauna
LIFE09 NAT/IT/000213	Restoration of Bacchiglione springs and habitat of SPA IT3220013 and SCI IT3220040
LIFE11 NAT/IT/000188	Restoring connectivity in Po River basin opening migratory route for Acipenser naccarii* and 10 fish species in Annex II
Chondrostoma polylepis	
LIFE13 NAT/ES/000772	Actions towards the protection and conservation of Iberian Cyprinids of community interest
Chondrostoma soetta	
LIFE11 NAT/IT/000188	Restoring connectivity in Po River basin opening migratory route for Acipenser naccarii* and 10 fish species in Annex II
Cobitis taenia	
LIFE98 NAT/IT/005032	Lake Caldaro - an oasis for migratory birds in the heart of the Alps
LIFE99 NAT/A/006055	Combine of the flood plain-forests of the Upper Drau-river valley (Kärnten)
LIFE00 NAT/D/007057	Restoration of clear water lakes, mires and swamp forests of the Lake Stechlin
LIFE00 NAT/F/007277	Preservation and restoration of the Rhine's valley habitats
LIFE05 NAT/B/000090	Restoration of the lowland river system 'Grote Nete'
LIFE06 NAT/A/000127	Life in Upper Drau River
LIFE06 NAT/LV/000110	Restoration of Biological Diversity in Military Training Area and Natura 2000 site "Adazi"
LIFE06 NAT/LV/000196	The improvement of habitats management in Natura 2000 site - Vestiena
LIFE06 NAT/NL/000072	Marsh area "De Zouweboezem": conservation, restoration and development
LIFE06 NAT/NL/000076	Restoration of brackish ecosystems in Westzaan polder
LIFE07 NAT/EE/000120	Saving life in meanders and oxbow lakes of Emajõgi River on Alam-Pedja NATURA2000 area
LIFE08 NAT/D/000007	Restoration of a side channel of the river Rhine near Wesel, Lower German Rhine
LIFE08 NAT/D/000008	Near-natural river and flood plain development of the River Ems at Einen – river dynamics and habitat diversity
LIFE08 NAT/F/000471	Restoration of the dynamics of Rhine alluvial habitats on Rohrschollen island
LIFE09 NAT/BE/000411	Large scale habitat restoration in the valley of the Kleine Nete
LIFE09 NAT/DE/000004	Rhine wetlands near Rastatt

PROJECT	TITLE
LIFE10 NAT/AT/000016	Danube Network
LIFE10 NAT/DE/000010	River and floodplain improvement Emmericher Ward within the EU Bird Area Unterer Niederrhein
LIFE10 NAT/PL/000654	Creating a Blue Wildlife Corridor in the Ina basin
LIFE11 NAT/BE/001061	Natuurherstel Most-Keiheuvel: natuurherstel op de gradiënt van veen naar stuifzand
LIFE11 NAT/IT/000188	Restoring connectivity in Po River basin opening migratory route for Acipenser naccarii* and 10 fish species in Annex II
LIFE11 NAT/SI/000882	Riparian Ecosystem Restoration of the Lower Drava River in Slovenia
LIFE12 NAT/BE/000438	Grote NeteWoud: wilderness on a human scale
LIFE12 NAT/BE/000596	Habitat Restoration of alluvial forests and creeks within the flood controlled Scheldt estuary site Kruibeke-Bazel-Rupelmonde.
LIFE12 NAT/EE/000871	Restoring the integrity of freshwater habitats in Alam-Pedja Natura 2000 area- bringing the River Laeva back to life
LIFE12 NAT/NL/000134	Booming business: wetland restoration in the marshes of Natura 2000 Alde Feanen
LIFE12 NAT/NL/000372	Restoration programme for Natura2000 fen areas in the Netherlands
LIFE13 NAT/ES/000772	Actions towards the protection and conservation of Iberian Cyprinids of community interest
LIFE13 NAT/HU/000388	Transboundary cooperation for revitalization of riverine habitat complex in Drava region within Natura 2000 sites
LIFE13 NAT/NL/000167	Biotope improvement and development for Bittern and Great reed warbler in the IJsseldelta
LIFE13 NAT/PL/000009	Active protection of water-crowfoots habitats and restoration of wildlife corridor in the River Drawa basin in Poland
Coregonus oxyrhynchus	
LIFE05 NAT/DK/000153	Urgent actions for the endangered Houting "Coregonus oxyrhunchus"
LIFE08 NAT/D/000007	Restoration of a side channel of the river Rhine near Wesel, Lower German Rhine
LIFE10 NAT/DE/000010	River and floodplain improvement Emmericher Ward within the EU Bird Area Unterer Niederrhein
Cottus gobio	
LIFE99 NAT/UK/006088	Safeguarding Natura 2000 Rivers in the UK
LIFE03 NAT/A/000011	River management of the central (inner) river Mur
LIFE03 NAT/D/000003	Restoration of the habitat type "oligotropic low mountain stream"
LIFE04 NAT/AT/000006	Donau- Ybbs Linkage
LIFE04 NAT/FR/000082	Headwater streams and faunistic Heritage associated
LIFE05 NAT/A/000078	Conservation strategies for woodlands and rivers in the Gesäuse Mountains
LIFE05 NAT/B/000087	Actions for the valleys and turf moors of Croix Scaille (Belgium)
LIFE05 NAT/D/000056	Upper Hotzenwald
LIFE05 NAT/D/000057	Optimisation of the pSCI "Lippe flood plain between Hamm and Hangfort"
LIFE05 NAT/S/000109	From source to sea, retoring river Moälven
LIFE05 NAT/UK/000143	River Avon cSAC: demonstrating strategic restoration and management
LIFE06 NAT/A/000127	Life in Upper Drau River
LIFE06 NAT/D/000003	Rohrhardsberg, Upper Elz and Wilde Gutach
LIFE06 NAT/F/000142	Protection of the forests of Basse Lauter and Vosges moyennes
LIFE06 NAT/LV/000196	The improvement of habitats management in Natura 2000 site - Vestiena
LIFE06 NAT/NL/000074	Wetlands: challenges and innovation in succession management
LIFE06 NAT/NL/000078	Restoring migration possibilities for 8 Annex II species in the Roer
LIFE07 NAT/D/000214	Rehabilitation of streams in the " Arnsberger Wald"
LIFE07 NAT/EE/000120	Saving life in meanders and oxbow lakes of Emajõgi River on Alam-Pedja NATURA2000 area
LIFE07 NAT/IT/000433	Improvement of the conservation status of SCIs in the high appenine area and in the plain around Prato.
LIFE08 NAT/A/000613	Water development Gail - An integrated model for Natura 2000
LIFE08 NAT/A/000614	Mur experience - Alpine river management Upper Mur
LIFE08 NAT/D/000007	Restoration of a side channel of the river Rhine near Wesel, Lower German Rhine
LIFE08 NAT/D/000009	Restoration and improvement of the SCI "Möhne Oberlauf" and the SCI "Möhne Mittellauf"
LIFE08 NAT/S/000266	"Restoration of tributaries of the Vindel river combined with monitoring
LIFE08 NAT/UK/000201	Irfon Special Area of Conservation Project
LIFE09 NAT/BE/000411	Large scale habitat restoration in the valley of the Kleine Nete
LIFE09 NAT/DE/000004	Rhine wetlands near Rastatt
LIFE09 NAT/DE/000006	Optimisation of NATURA-2000-habitats in the National Park Eifel
LIFE09 NAT/IT/000213	Restoration of Bacchiglione springs and habitat of SPA IT3220013 and SCI IT3220040

PROJECT	TITLE
LIFE10 NAT/AT/000016	Danube Network
LIFE10 NAT/AT/000017	LIFE+-Lavant: Habitats network for endangered small fish species
LIFE10 NAT/DE/000008	Rur and Kall – fluvial habitats
LIFE10 NAT/FR/000192	LIFE ecological continuity, management of catchment area and associated patrimonial fauna
LIFE10 NAT/PL/000654	Creating a Blue Wildlife Corridor in the Ina basin
LIFE10 NAT/SE/000045	Remediation of migratory barriers in Nordic/fennoscandian watercourses
LIFE11 NAT/CZ/000490	Grasslands and streams restoration in SCI Krkonoše: Future of Nardus grasslands*, Dwarf gentian* & Bullhead
LIFE12 NAT/AT/000321	Natural wood lands, bogs and habitat network around Aussee
LIFE12 NAT/BE/000438	Grote NeteWoud: wilderness on a human scale
LIFE12 NAT/BG/001011	Conservation and restoration of Natura 2000 rheophilic fish species and their migratory routes in key SCIs in Bulgaria
LIFE12 NAT/DE/000093	Bogs, flowing waters and nardus grasslands in the Bavarian Forest National Park
LIFE12 NAT/EE/000871	Restoring the integrity of freshwater habitats in Alam-Pedja Natura 2000 area- bringing the River Laeva back to life
LIFE12 NAT/NL/000372	Restoration programme for Natura2000 fen areas in the Netherlands
LIFE13 NAT/ES/001210	Restoration of lentic habitats and aquatic species of Community interest in high mountains of the Pyrenees
LIFE13 NAT/PL/000009	Active protection of water-crowfoots habitats and restoration of wildlife corridor in the River Drawa basin in Poland
LIFE13 NAT/SE/000116	Triple Lakes – Catchment restoration and preventive action for aquatic habitats in a climate change perspective
	Eudontomyzon spp.
LIFE05 NAT/A/000078	Conservation strategies for woodlands and rivers in the Gesäuse Mountains
LIFE08 NAT/A/000613	Water development Gail - An integrated model for Natura 2000
LIFE08 NAT/A/000614	*Mur experience - Alpine river management Upper Mur*
LIFE10 NAT/AT/000017	LIFE+-Lavant: Habitats network for endangered small fish species
	Gobio albipinnatus
LIFE04 NAT/AT/000006	Donau- Ybbs Linkage
LIFE10 NAT/AT/000015	Restoration of the Lower Morava floodplains
LIFE10 NAT/AT/000016	Danube Network
LIFE10 NAT/PL/000654	Creating a Blue Wildlife Corridor in the Ina basin
	Gobio kessleri
LIFE12 NAT/BG/001011	Conservation and restoration of Natura 2000 rheophilic fish species and their migratory routes in key SCIs in Bulgaria
	Gobio uranoscopus
LIFE10 NAT/AT/000016	Danube Network
LIFE10 NAT/AT/000017	LIFE+-Lavant: Habitats network for endangered small fish species
LIFE12 NAT/BG/001011	Conservation and restoration of Natura 2000 rheophilic fish species and their migratory routes in key SCIs in Bulgaria
	Gymnocephalus schraetzer
LIFE06 NAT/SI/000066	Conservation of biodiversity of the Mura river in Slovenia
LIFE10 NAT/AT/000015	Restoration of the Lower Morava floodplains
LIFE10 NAT/AT/000016	Danube Network
	Hucho hucho
LIFE99 NAT/A/006054	Living space of Danube salmon
LIFE03 NAT/A/000009	WACHAU
LIFE03 NAT/A/000011	River management of the central (inner) river Mur
LIFE04 NAT/AT/000006	Donau- Ybbs Linkage
LIFE06 NAT/A/000127	Life in Upper Drau River
LIFE07 NAT/A/000010	Living space in the rivers of Mostviertel- Wachau
LIFE08 NAT/A/000614	Mur experience - Alpine river management Upper Mur
LIFE10 NAT/AT/000016	Danube Network
LIFE10 NAT/SI/000142	Restoration of the Ljubljanica River corridor and improvement of the river's flow regime
LIFE13 NAT/AT/000301	LIFE+ Wilderness Wetland Wachau
	Knipowitschia panizzae
LIFE12 NAT/IT/000331	Habitat 1150* (Coastal lagoon) recovery by SEagrass RESTOration. A new strategic approach to meet HD & WFD objectives
LIFE13 NAT/IT/000115	coAstal laGoon long teRm managEmEnt

PROJECT	TITLE
Ladigesocypris ghigii	
LIFE98 NAT/GR/005279	Conservation measures for the endangered fish Ladigesocypris ghigii
Lampetra fluviatilis	
LIFE92 NAT/IRL/013500	Conservation of habitats of Community importance in Ireland under the Birds and Habitats Directives (1st phase)
LIFE93 NAT/IRL/012200	Protection of habitats of Community importance under Council Directives 79/409/EEC and 92/43/EEC (2nd phase)
LIFE94 NAT/IRL/000407	Extension of the 2nd Phase of the protection of habitats of Community importance under Council Directives 79/40/EEC and 92/43/EEC
LIFE99 NAT/UK/006088	Safeguarding Natura 2000 Rivers in the UK
LIFE05 NAT/UK/000143	River Avon cSAC: demonstrating strategic restoration and management
LIFE06 NAT/LV/000110	Restoration of Biological Diversity in Military Training Area and Natura 2000 site "Adazi"
LIFE06 NAT/NL/000078	Restoring migration possibilities for 8 Annex II species in the Roer
LIFE07 NAT/IRL/000341	Control of aquatic invasive species and restoration of natural communities in Ireland
LIFE08 NAT/UK/000201	Irfon Special Area of Conservation Project
LIFE09 NAT/DE/000004	Rhine wetlands near Rastatt
LIFE10 NAT/PL/000654	Creating a Blue Wildlife Corridor in the Ina basin
LIFE12 NAT/PL/000033	Improvement of fish living conditions in River Drwęca and its tributaries.
LIFE13 NAT/PL/000009	Active protection of water-crowfoots habitats and restoration of wildlife corridor in the River Drawa basin in Poland
LIFE13 NAT/PL/000018	Conservation of selected habitats and species in Ostoja Słowińska PLH220023 and Pobrzeże Słowińskie PLB220003 Stage I
Lampetra planeri	
LIFE92 NAT/IRL/013500	Conservation of habitats of Community importance in Ireland under the Birds and Habitats Directives (1st phase)
LIFE93 NAT/IRL/012200	Protection of habitats of Community importance under Council Directives 79/409/EEC and 92/43/EEC (2nd phase)
LIFE94 NAT/IRL/000407	Extension of the 2nd Phase of the protection of habitats of Community importance under Council Directives 79/40/EEC and 92/43/EEC
LIFE99 NAT/UK/006088	Safeguarding Natura 2000 Rivers in the UK
LIFE00 NAT/D/007057	Restoration of clear water lakes, mires and swamp forests of the Lake Stechlin
LIFE00 NAT/F/007277	Preservation and restoration of the Rhine's valley habitats
LIFE03 NAT/D/000003	Restoration of the habitat type "oligotropic low mountain stream"
LIFE04 NAT/FR/000082	Headwater streams and faunistic Heritage associated
LIFE05 NAT/B/000087	Actions for the valleys and turf moors of Croix Scaille (Belgium)
LIFE05 NAT/B/000090	Restoration of the lowland river system 'Grote Nete'
LIFE05 NAT/B/000091	Transboundery habitat restoration in the valley of the Dommel
LIFE06 NAT/D/000003	Rohrhardsberg, Upper Elz and Wilde Gutach
LIFE06 NAT/F/000142	Protection of the forests of Basse Lauter and Vosges moyennes
LIFE06 NAT/LV/000110	Restoration of Biological Diversity in Military Training Area and Natura 2000 site "Adazi"
LIFE06 NAT/LV/000196	The improvement of habitats management in Natura 2000 site - Vestiena
LIFE06 NAT/NL/000078	Restoring migration possibilities for 8 Annex II species in the Roer
LIFE07 NAT/D/000214	Rehabilitation of streams in the "Arnsberger Wald"
LIFE08 NAT/D/000008	Near-natural river and flood plain development of the River Ems at Einen – river dynamics and habitat diversity
LIFE08 NAT/D/000009	Restoration and improvement of the SCI "Möhne Oberlauf" and the SCI "Möhne Mittellauf"
LIFE08 NAT/S/000266	"Restoration of tributaries of the Vindel river combined with monitoring
LIFE08 NAT/UK/000201	Irfon Special Area of Conservation Project
LIFE09 NAT/BE/000411	Large scale habitat restoration in the valley of the Kleine Nete
LIFE10 NAT/AT/000016	Danube Network
LIFE10 NAT/DE/000008	Rur and Kall – fluvial habitats
LIFE10 NAT/FR/000192	LIFE ecological continuity, management of catchment area and associated patrimonial fauna
LIFE10 NAT/PL/000654	Creating a Blue Wildlife Corridor in the Ina basin
LIFE11 NAT/BE/001061	Natuurherstel Most-Keiheuvel: natuurherstel op de gradiënt van veen naar stuifzand
LIFE12 NAT/BE/000438	Grote NeteWoud: wilderness on a human scale
LIFE12 NAT/PL/000033	Improvement of fish living conditions in River Drwęca and its tributaries.
LIFE13 NAT/PL/000018	Conservation of selected habitats and species in Ostoja Słowińska PLH220023 and Pobrzeże Słowińskie PLB220003 Stage I
Lethenteron zanandreai	
LIFE11 NAT/IT/000188	Restoring connectivity in Po River basin opening migratory route for Acipenser naccarii* and 10 fish species in Annex II

PROJECT	TITLE
Leuciscus souffia	
LIFE98 NAT/IT/005037	V. Curone - V. S. Croce : protection priority habitats
LIFE98 NAT/IT/005138	Requalification of Taro fluvial habitats vital to avifauna
LIFE05 NAT/A/000078	Conservation strategies for woodlands and rivers in the Gesäuse Mountains
LIFE06 NAT/A/000127	Life in Upper Drau River
LIFE07 NAT/IT/000413	Petromyzon And River Continuity
LIFE08 NAT/A/000613	Water development Gail - An integrated model for Natura 2000
LIFE09 NAT/IT/000213	Restoration of Bacchiglione springs and habitat of SPA IT3220013 and SCI IT3220040
LIFE10 NAT/AT/000016	Danube Network
LIFE10 NAT/SI/000142	Restoration of the Ljubljanica River corridor and improvement of the river's flow regime
LIFE11 NAT/IT/000188	Restoring connectivity in Po River basin opening migratory route for Acipenser naccarii* and 10 fish species in Annex II
Misgurnus fossilis	
LIFE06 NAT/NL/000072	Marsh area "De Zouweboezem": conservation, restoration and development
LIFE06 NAT/NL/000074	Wetlands: challenges and innovation in succession management
LIFE06 NAT/NL/000078	Restoring migration possibilities for 8 Annex II species in the Roer
LIFE06 NAT/SI/000066	Conservation of biodiversity of the Mura river in Slovenia
LIFE07 NAT/EE/000120	Saving life in meanders and oxbow lakes of Emajõgi River on Alam-Pedja NATURA2000 area
LIFE08 NAT/D/000001	Upper Main valley
LIFE08 NAT/D/000013	Improvement and Long-Term Safeguarding of the Natura 2000 Site "Dessau-Wörlitz Elbe Floodplain"
LIFE09 NAT/DE/000004	Rhine wetlands near Rastatt
LIFE10 NAT/AT/000015	Restoration of the Lower Morava floodplains
LIFE10 NAT/AT/000016	Danube Network
LIFE10 NAT/DK/000099	Restoring Sølsted Mose - a contribution to the network of Danish raised bogs (7110*) in favourable conservation status
LIFE10 NAT/PL/000654	Creating a Blue Wildlife Corridor in the Ina basin
LIFE12 NAT/EE/000871	Restoring the integrity of freshwater habitats in Alam-Pedja Natura 2000 area- bringing the River Laeva back to life
LIFE12 NAT/NL/000134	Booming business: wetland restoration in the marshes of Natura 2000 Alde Feanen
LIFE12 NAT/NL/000372	Restoration programme for Natura2000 fen areas in the Netherlands
LIFE12 NAT/PL/000033	Improvement of fish living conditions in River Drwęca and its tributaries.
LIFE13 NAT/HU/000388	Transboundary cooperation for revitalization of riverine habitat complex in Drava region within Natura 2000 sites
LIFE13 NAT/NL/000167	Biotope improvement and development for Bittern and Great reed warbler in the IJsseldelta
LIFE13 NAT/PL/000018	Conservation of selected habitats and species in Ostoja Słowińska PLH220023 and Pobrzeże Słowińskie PLB220003 Stage I
Pelecus cultratus	
LIFE05 NAT/LT/000095	Natura 2000 site conservation and management on the Lithuanian coast
Petromyzon marinus	
LIFE92 NAT/IRL/013500	Conservation of habitats of Community importance in Ireland under the Birds and Habitats Directives (1st phase)
LIFE93 NAT/IRL/012200	Protection of habitats of Community importance under Council Directives 79/409/EEC and 92/43/EEC (2nd phase)
LIFE94 NAT/IRL/000407	Extension of the 2nd Phase of the protection of habitats of Community importance under Council Directives 79/40/EEC and 92/43/EEC
LIFE99 NAT/UK/006088	Safeguarding Natura 2000 Rivers in the UK
LIFE06 NAT/NL/000078	Restoring migration possibilities for 8 Annex II species in the Roer
LIFE07 NAT/IRL/000341	Control of aquatic invasive species and restoration of natural communities in Ireland
LIFE07 NAT/IRL/000342	Restoration of the Lr.Shannon SAC for Sea lamprey, Atlantic salmon and European otter
LIFE07 NAT/IT/000413	Petromyzon And River Continuity
LIFE08 NAT/UK/000201	Irfon Special Area of Conservation Project
LIFE13 NAT/ES/000237	Migratory fish recovery and improved management in the final stretch of the Ebre River
Phoxinellus stymphalicus	
LIFE12 NAT/GR/000275	Sustainable management and financing of wetland biodiversity – The case of Lake Stymfalia
Pomatoschistus canestrinii	
LIFE12 NAT/IT/000331	Habitat 1150* (Coastal lagoon) recovery by SEagrass RESTOration. A new strategic approach to meet HD & WFD objectives
LIFE13 NAT/IT/000115	coAstal laGoon long teRm managEmEnt

PROJECT	TITLE
Rhodeus sericeus amarus	
LIFE00 NAT/F/007277	Preservation and restoration of the Rhine's valley habitats
LIFE05 NAT/B/000091	Transboundery habitat restoration in the valley of the Dommel
LIFE06 NAT/A/000127	Life in Upper Drau River
LIFE06 NAT/NL/000074	Wetlands: challenges and innovation in succession management
LIFE06 NAT/NL/000076	Restoration of brackish ecosystems in Westzaan polder
LIFE06 NAT/NL/000078	Restoring migration possibilities for 8 Annex II species in the Roer
LIFE06 NAT/SI/000066	Conservation of biodiversity of the Mura river in Slovenia
LIFE08 NAT/A/000613	Water development Gail - An integrated model for Natura 2000
LIFE08 NAT/D/000008	Near-natural river and flood plain development of the River Ems at Einen – river dynamics and habitat diversity
LIFE09 NAT/DE/000004	Rhine wetlands near Rastatt
LIFE10 NAT/AT/000015	Restoration of the Lower Morava floodplains
LIFE10 NAT/AT/000016	Danube Network
LIFE10 NAT/PL/000654	Creating a Blue Wildlife Corridor in the Ina basin
LIFE11 NAT/SI/000882	Riparian Ecosystem Restoration of the Lower Drava River in Slovenia
LIFE12 NAT/BG/001011	Conservation and restoration of Natura 2000 rheophilic fish species and their migratory routes in key SCIs in Bulgaria
LIFE12 NAT/NL/000372	Restoration programme for Natura2000 fen areas in the Netherlands
LIFE13 NAT/HU/000388	Transboundary cooperation for revitalization of riverine habitat complex in Drava region within Natura 2000 sites
LIFE13 NAT/PL/000018	Conservation of selected habitats and species in Ostoja Słowińska PLH220023 and Pobrzeże Słowińskie PLB220003 Stage I
Rutilus alburnoides	
LIFE13 NAT/ES/000772	Actions towards the protection and conservation of Iberian Cyprinids of community interest
Rutilus arcasii	
LIFE13 NAT/ES/000772	Actions towards the protection and conservation of Iberian Cyprinids of community interest
Rutilus frisii meidingerii	
LIFE10 NAT/AT/000016	Danube Network
Rutilus lemmingii	
LIFE13 NAT/ES/000772	Actions towards the protection and conservation of Iberian Cyprinids of community interest
Rutilus pigus	
LIFE00 NAT/IT/007268	Conservation of Salmo marmoratus and Rutilus pigus in the River Ticino
LIFE00 NAT/SLO/007231	Peatbogs in Triglav National Park
LIFE10 NAT/AT/000016	Danube Network
LIFE10 NAT/AT/000017	LIFE+-Lavant: Habitats network for endangered small fish species
LIFE10 NAT/SI/000142	Restoration of the Ljubljanica River corridor and improvement of the river's flow regime
LIFE11 NAT/IT/000188	Restoring connectivity in Po River basin opening migratory route for Acipenser naccarii* and 10 fish species in Annex II
LIFE13 NAT/AT/000301	LIFE+ Wilderness Wetland Wachau
Rutilus rubilio	
LIFE07 NAT/IT/000413	Petromyzon And River Continuity
Sabanejewia aurata	
LIFE10 NAT/AT/000016	Danube Network
Salmo macrostigma	
LIFE00 NAT/F/007273	For a conservatory management of the laricio pine habitats
LIFE03 NAT/F/000101	Conservation of the macrostigma trout in Corsica
LIFE12 NAT/IT/000940	Trout population RecOvery in central iTAly
Salmo marmoratus	
LIFE97 NAT/IT/004089	N.EC.TO.N Project (New Ecosystems on the Noce River): urgent action for renaturalisation in the La Rocchetta biotope (Trentino, Italy)
LIFE00 NAT/SLO/007231	Peatbogs in Triglav National Park
LIFE11 NAT/IT/000188	Restoring connectivity in Po River basin opening migratory route for Acipenser naccarii* and 10 fish species in Annex II
Salmo salar	
LIFE96 NAT/IT/003169	Conservation of priority habitats with Abies alba in Natura 2000 Sites in central and southern Italy
LIFE98 NAT/F/005225	Big Loire salmon preservation

PROJECT	TITLE
LIFE99 NAT/UK/006088	Safeguarding Natura 2000 Rivers in the UK
LIFE00 NAT/DK/007116	Restoration of habitats and wildlife of the Skjern River
LIFE00 NAT/F/007252	Big Loire salmon preservation
LIFE00 NAT/IT/007268	Conservation of Salmo marmoratus and Rutilus pigus in the River Ticino
LIFE04 NAT/GB/000250	Conservation of Atlantic salmon in Scotland
LIFE05 NAT/L/000116	Restoration of pearl mussel populations in the Ardennes
LIFE05 NAT/LT/000095	Natura 2000 site conservation and management on the Lithuanian coast
LIFE05 NAT/S/000109	From source to sea, retoring river Moälven
LIFE05 NAT/UK/000143	River Avon cSAC: demonstrating strategic restoration and management
LIFE06 NAT/F/000142	Protection of the forests of Basse Lauter and Vosges moyennes
LIFE06 NAT/NL/000078	Restoring migration possibilities for 8 Annex II species in the Roer
LIFE07 NAT/IRL/000341	Control of aquatic invasive species and restoration of natural communities in Ireland
LIFE07 NAT/IRL/000342	Restoration of the Lr.Shannon SAC for Sea lamprey, Atlantic salmon and European otter
LIFE08 NAT/S/000266	"Restoration of tributaries of the Vindel river combined with monitoring
LIFE08 NAT/UK/000201	Irfon Special Area of Conservation Project
LIFE09 NAT/IE/000220	Restoration of the Upper River Blackwater SAC for the Freshwater Pearl Mussel, Atlantic Salmon, European Otter and Kingfisher
LIFE10 NAT/DE/000008	Rur and Kall – fluvial habitats
LIFE10 NAT/SE/000045	Remediation of migratory barriers in Nordic/fennoscandian watercourses
LIFE11 NAT/PL/000424	The construction of the blue ecological corridor along the valley of Riga river and its tributaries
LIFE12 NAT/PL/000033	Improvement of fish living conditions in River Drwęca and its tributaries.
LIFE13 NAT/ES/000899	Biodiversity conservation in river Miera
LIFE13 NAT/PL/000009	Active protection of water-crowfoots habitats and restoration of wildlife corridor in the River Drawa basin in Poland
LIFE13 NAT/PL/000018	Conservation of selected habitats and species in Ostoja Słowińska PLH220023 and Pobrzeże Słowińskie PLB220003 Stage I
Thymallus thymallus	
LIFE13 NAT/SE/000116	Triple Lakes – Catchment restoration and preventive action for aquatic habitats in a climate change perspective
Umbra krameri	
LIFE06 NAT/SI/000066	Conservation of biodiversity of the Mura river in Slovenia
LIFE09 NAT/SI/000374	Conservation and management of freshwater wetlands in Slovenia
LIFE11 NAT/SI/000882	Riparian Ecosystem Restoration of the Lower Drava River in Slovenia
Valencia hispanica	
LIFE92 NAT/E/014400	First phase of an action programme for the conservation of two wetlands and the creation of a reserve network for Valencia Hispanica
LIFE95 NAT/E/000577	II phase of an action program for the conservation of Valencian wetlands and creation of reserve areas for Valencia hispanica
LIFE96 NAT/E/003118	Conservation of priority species in Mediterranean marshes (Aphanius iberus, Valencia hispanica, Botaurus stellaris, Larus audouinii)
LIFE00 NAT/E/007339	Model of restoration of dunes habitats in 'L'Albufera de Valencia'
LIFE04 NAT/ES/000044	Recovery of the littoral sand dunes with Juniper spp in Valencia
LIFE04 NAT/ES/000048	Recovery of a priority habitat in l'Albufera natural Park
Zingel asper	
LIFE04 NAT/FR/000083	Programme for the conservation of the Rhône-Apron (Zingel asper) and its habitats
LIFE98 NAT/F/005208	Strategy of conservation of Apron
LIFE04 NAT/AT/000006	Donau- Ybbs Linkage
LIFE10 NAT/AT/000016	Danube Network
LIFE10 NAT/AT/000017	LIFE+-Lavant: Habitats network for endangered small fish species
LIFE13 NAT/AT/000301	LIFE+ Wilderness Wetland Wachau
LIFE04 NAT/AT/000006	Donau- Ybbs Linkage
LIFE10 NAT/AT/000015	Restoration of the Lower Morava floodplains
LIFE10 NAT/AT/000016	Danube Network
LIFE13 NAT/AT/000301	LIFE+ Wilderness Wetland Wachau

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LIFE "L'Instrument Financier pour l'Environnement" / The financial instrument for the environment

The LIFE programme is the EU's funding instrument for the environment and climate action

Period covered 2014-2020

EU funding available approximately €3.46 billion

Allocation of funds Of the €3.46 billion allocated to LIFE, €2.59 billion are for the Environment sub-programme, and €0.86 billion are for the Climate Action sub-programme. At least €2.8 billion (81% of the total budget) are earmarked for LIFE projects financed through action grants or innovative financial instruments. About €0.7 billion will go to integrated projects. At least 55% of the budgetary resources allocated to projects supported through action grants under the sub-programme for Environment will be used for projects supporting the conservation of nature and biodiversity. A maximum of €0.62 billion will be used directly by DG Environment and DG Climate Action for policy development and operating grants.

Types of projects Action Grants for the Environment and Climate Action sub-programmes are available for the following:

> "Traditional" projects – these may be best-practice, demonstration, pilot or information, awareness and dissemination projects in any of the following priority areas: LIFE Nature & Biodiversity; LIFE Environment & Resource Efficiency; LIFE Environmental Governance & Information; LIFE Climate Change Mitigation; LIFE Climate Change Adaptation; LIFE Climate Governance and Information.

> Preparatory projects – these address specific needs for the development and implementation of Union environmental or climate policy and legislation.

> Integrated projects – these implement on a large territorial scale environmental or climate plans or strategies required by specific Union environmental or climate legislation.

> Technical assistance projects – these provide financial support to help applicants prepare integrated projects.

> Capacity building projects – these provide financial support to activities required to build the capacity of Member States, including LIFE national or regional contact points, with a view to enabling Member States to participate more effectively in the LIFE programme.

Further information More information on LIFE is available at http://ec.europa.eu/life.

How to apply for LIFE funding The European Commission organises annual calls for proposals. Full details are available at http://ec.europa.eu/environment/life/funding/life.htm

Contact

European Commission – Directorate-General for the Environment – B-1049 Brussels (env-life@ec.europa.eu).
European Commission – Directorate-General for Climate Action – B-1049 Brussels (clima-life@ec.europa.eu).
European Commission – EASME – B-1049 Brussels (easme-life@ec.europa.eu).

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LIFE Publication / LIFE and freshwater fish

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