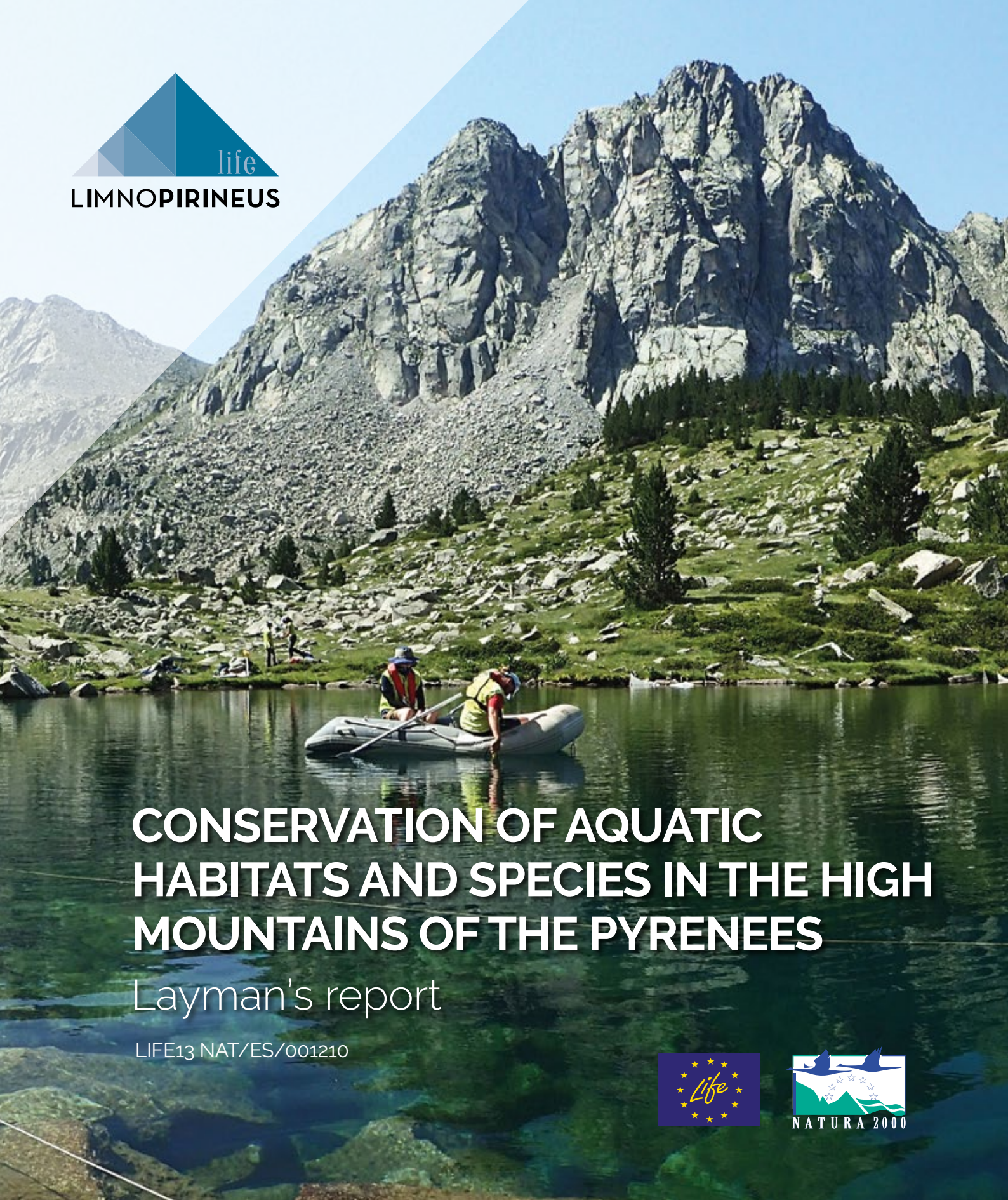

LIMNOPIRINEUS

CONSERVATION OF AQUATIC HABITATS AND SPECIES IN THE HIGH MOUNTAINS OF THE PYRENEES

Layman's report

LIFE13 NAT/ES/001210

NATURA 2000

THE PROJECT

LIFE+ PROJECT CONSERVATION OF AQUATIC HABITATS AND SPECIES IN THE HIGH MOUNTAINS OF THE PYRENEES

LIFE13 NAT/ES/001210

www.lifelimnopirineus.eu

Tittle: Restoration of lentic habitats and aquatic species of community interest in the high mountains of the Pyrenees.
Acronym: LIMNOPIRINEUS
Duration: 5,5 years (1 June 2014 – 31 December 2019)
Target areas: Three protected areas of the European Union, integrated into the Natura 2000 network, and located in The National Park Aigüestortes i Estany de Sant Maurici (SCI Aigüestortes), the Natural Park of Alt Pirineu (SCI Alt Pallars), and the Estanho de Vilac (SCI Estanho de Vielha, Val d'Aran).
Coordinating beneficiary:Centre for Advanced Studies of Blanes (CEAB-CSIC).
Partners: Departament d'Agricultura, Ramaderia e Miei Naturau, Conselh Generau d'Aran; Forestal Catalana, S.A.; Departament de Territori i Sostenibilitat, Generalitat de Catalunya; Sorelló, Estudis al Medi Aquàtic S.L. ; and Universitat de Barcelona.
Budget: €2,619,047; 55.13% (€1,443,880) funded by the EU LIFE + program.
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OUR MISSION

Aquatic continental systems are scarce environments that occupy only 2% of the Earth's surface and, on a global scale, are severely threatened. These are environments with a very specific and sensitive fauna and flora, where threatened species are abundant.

In the Pyrenees, these wetland ecosystems are generally considered very natural landscapes. Despite their remote location, anthropogenic disturbances have not been absent.

The mission of the LIFE + Project LimnoPirineus was to improve the conservation status of species and aquatic habitats of European interest in the high mountains of the Pyrenees.

The measures implemented and activities performed under the project address the main and more critical threats to aquatic habitats and species in three protected areas of the European Union, integrated into the Natura 2000 network, and located in The National Park Aigüestortes i Estany de Sant Maurici (SCI Aigüestortes), the Natural Park of Alt Pirineu (SCI Alt Pallars), and the Estanho de Vilac (SCI Estanho de Vielha, Val d'Aran).

Among the habitats of interest, there are certain types of mires, tufa-forming springs, rivers and lakes. The target species include the floating water plantain (*Luronium natans*), certain amphibians such as the common frog (*Rana temporaria*), the midwife toad (*Alytes obstetricans*) and the Pyrenean brook newt (*Calotriton asper*), as well as the Pyrenean sculpin (*Cottus hispaniolensis*), which is an endemic fish from the Central Pyrenees. There are also some mammals that feed on the aquatic environment such as the Pyrenean desman (*Galemys pyrenaicus*), the European otter (*Lutra lutra*), and two species of bats, the lesser horseshoe bat (*Rhinolophus hipposideros*) and the alpine long-eared bat (*Plecotus macrobullaris*).

Common frog

Midwife toad

Pyrenean brook newt

Pyrenean desman

European otter

Pyrenean sculpin

Floating water plantain

Lesser horseshoe bat

Alpine long-eared bat

THREATS ADDRESSED

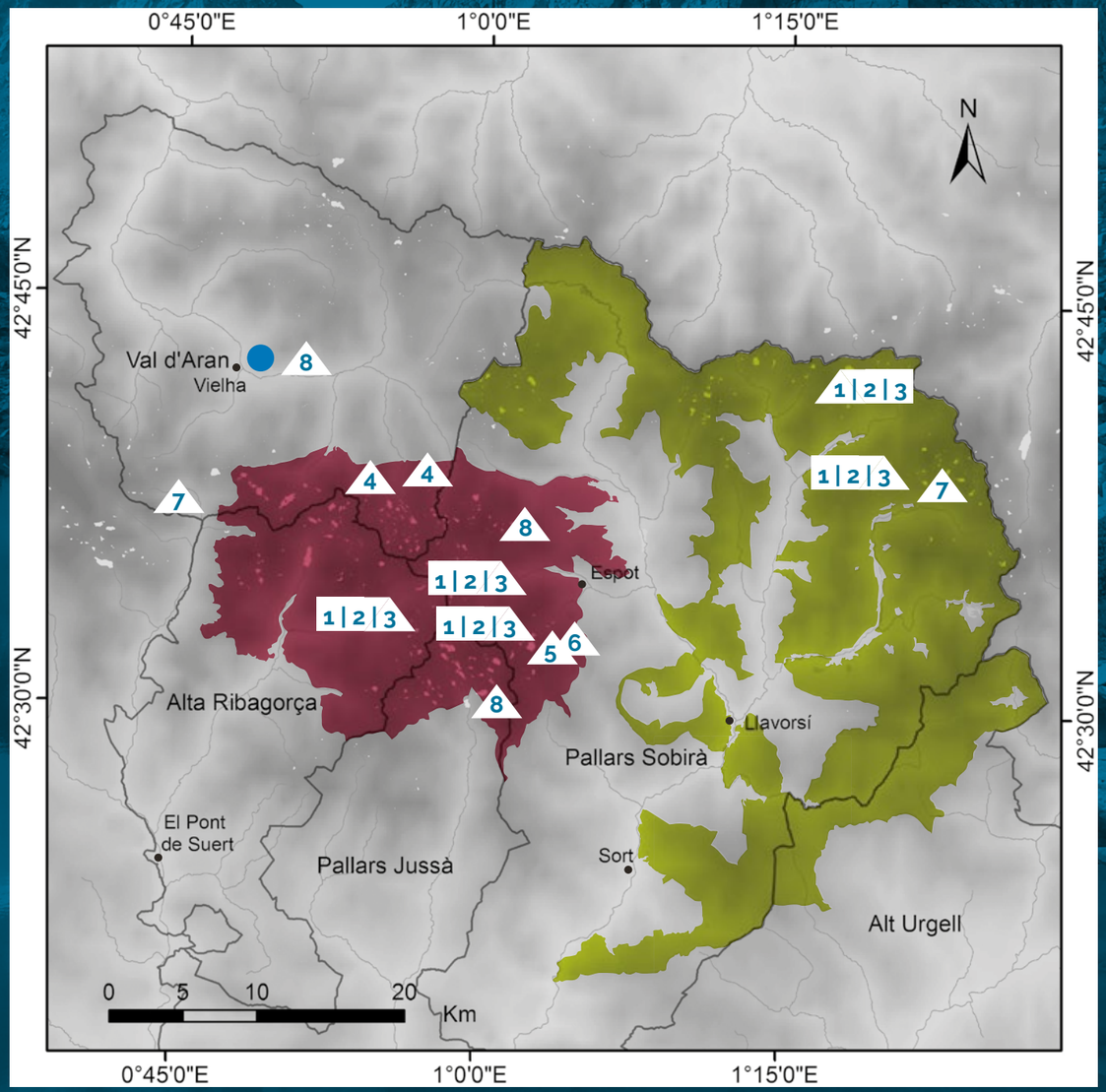
The introduction and spread of alien species, especially various species of fish (salmonids and cyprinids), abundantly introduced into high mountain lakes and streams that were originally fishless.

Changes caused by hydroelectric water level fluctuations.

The excessive presence of both livestock and tourists around mires and springs.

The high degree of isolation of the populations of some species that are now in danger of extinction, decimated by various anthropic actions, such as the floating water plantain (*L. natans*) and the Pyrenean sculpin (*C. hispaniolensis*).

CONSERVATION ACTIONS AND RESULTS

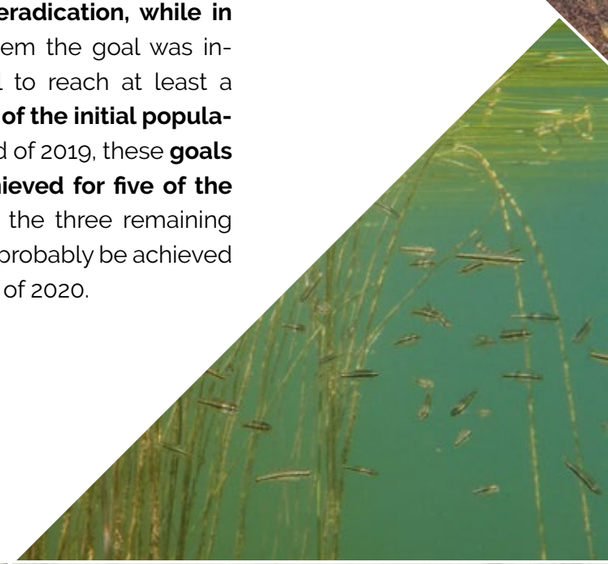


POINT 1

ELIMINATION AND CONTROL OF ALIEN FISH SPECIES IN EIGHT TARGET LAKES

The two most widespread species of fish introduced into the high mountain lakes of the Pyrenees are the common trout (*Salmo trutta*) and the minnow (*Phoxinus* sp.). Other less widespread species of salmonids are brook trout (*Salvelinus fontinalis*) and rainbow trout (*Oncorhynchus mykiss*). A combination of three catching techniques was used in the eradication of the fish introduced: gillnets of different mesh sizes, electric fishing on the shore, and small mesh creel-type traps.

In most of the lakes, the operational goal was eradication, while in only one of them the goal was intensive control to reach at least a **75% reduction of the initial population.** By the end of 2019, these **goals were fully achieved for five of the lakes,** while in the three remaining lakes, they will probably be achieved before the end of 2020.



POINT 2

RECOVERY OF THE NATURAL STATE OF EIGHT TARGET LAKES FOLLOWING THE REDUCTION OR REMOVAL OF PRESSURE FROM NON-NATIVE FISH

The change in the structure and biomass of the communities of pelagic organisms and the transparency of the water column of the target lakes only markedly occurs when minnow were the only fish species in the lakes. In these cases (Closell, Naorte and Rovinets), the elimination of the minnow led to a marked increase in the abundance of crustaceans, a decrease in phytoplankton biomass, and an **increase in the transparency of the water column.**

The group of organisms with the clearest response to fish eradication were the macroinvertebrates from the littoral zone, with an **increase in taxa richness over time and a convergence of macroinvertebrate composition to that of natural lakes.**

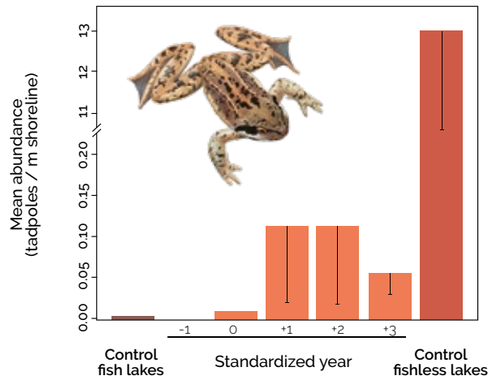
POINT 3

RECOVERY OF THE AUTOCHTHONOUS AMPHIBIAN SPECIES FOLLOWING REDUCTION OR REMOVAL OF PRESSURE FROM NON-NATIVE FISH

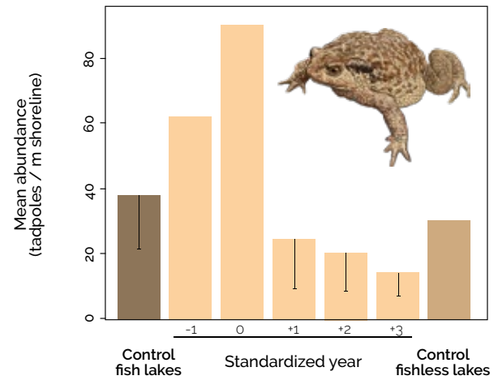
Most of the autochthonous amphibian species present in each valley have naturally colonised all lakes during or following fish removal.

The data gathered shows that **amphibian populations have recovered by their own means, reaching the specific abundance levels of the natural control lakes**, as we have progressed with the eradication of fish. This underlines the high resilience of the amphibian fauna of high mountain lakes.

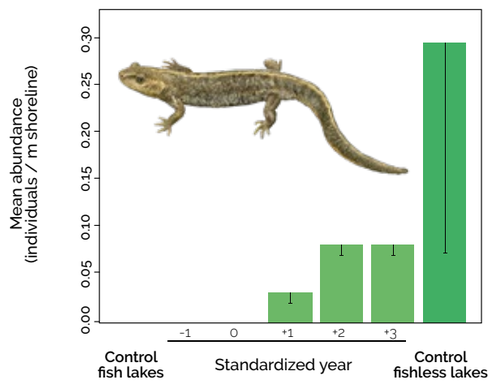
COMMON FROG



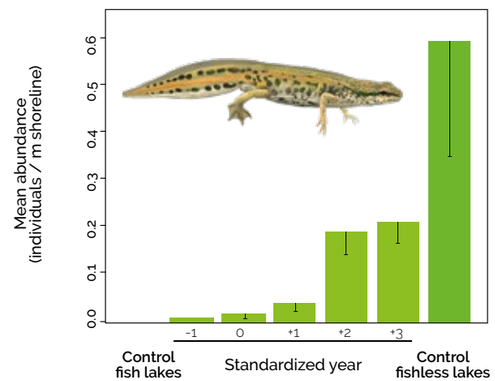
SPINY TOAD



PYRENEAN BROOK NEWT



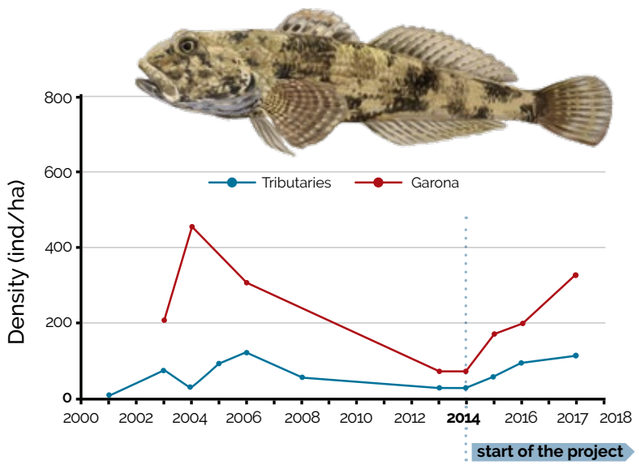
PALMATE NEWT



POINT 4

IMPROVING THE PYRENEAN SCULPIN POPULATIONS THROUGH THE TRANSLOCATION OF INDIVIDUALS

The most prominent result was the **consolidation of two population nuclei in the Ruda and Aiguamòg rivers** by releasing specimens from populations in good condition located in other sectors of the Aran valley. These translocations should also help reduce the effects of genetic isolation suffered by these population nuclei located within the "Aigüestortes" area.



Hydroelectric dams in protected mountain areas can damage the natural state of the wetlands by flooding areas of natural interest and altering the river's summer flow.

POINT 5

RESTORING THE NATURAL FLOW IN CERTAIN PEAT BOGS AFFECTED BY HYDROLOGICAL CHANGES: TRESCURO MIRE SYSTEM

Following the restoration of the summer flow of the river by regulating the valve opening of the Tort-Trullo dam, we monitored plant communities and physio-chemical variables in the mire system.

The results revealed that recovery could be compromised by extreme events of heat and drought. Variations in the water table level have the greatest impact on small-scale vegetation distribution. Communities depending on flowing surface water, chiefly occurring at mire margins, were the most affected by water table drawdown enhanced by summer drought events. Such events may enhance invasion by trees and subsequently cause the reduction of the mire area.

POINT 6

RESTORING THE DEGRADED TRANSITION MIRES AND SPHAGNUM HUMMOCKS BY REPLANTING SPECIES TYPICAL OF THESE HABITATS (BOTTLE SEDGE AND PEAT MOSSES)

We have taken the small reservoir of Font Grossa as an example of ecological restoration of mire habitats. There, a small dam was eliminated after 70 years of flooding, and a belt of bare sand remained in the place of ancient mires. Specifically, we laid the foundations for the development of two types of Habitats of Community Interest, transition mires and sphagnum hummocks.

The monitoring and subsequent actions, carried out up to summer 2019, corroborated good implantation of the *C. rostrata* population, and foresee partially good implantation of the *Sphagnum* populations patches, particularly in transition mires.

Through restoration from structural species (*Carex rostrata*, a; *Sphagnum* spp. b) we have recovered the initial forms of the two habitats of community interest.

POINT 7

IMPROVING THE QUALITY OF MIRES AND WET HEATHS UNDER HEAVY PRESSURE FROM TOURISM BY BUILDING ELEVATED PLATFORMS

We conducted the arrangement of hiker traffic in the Sotllo plain and in the Molières valley. At some points in these mire systems, frequenting resulted in a loss of vegetation and peat erosion. **The wooden footbridge effectively channels the hundreds of hikers on the way to Pica d'Estats**, a mythical destination of the Alt Pallars land.

The use by livestock and the frequenting of tourists occasionally jeopardize the conservation of wetland habitats. However, relatively simple actions can make these activities compatible with conservation.

POINT 8

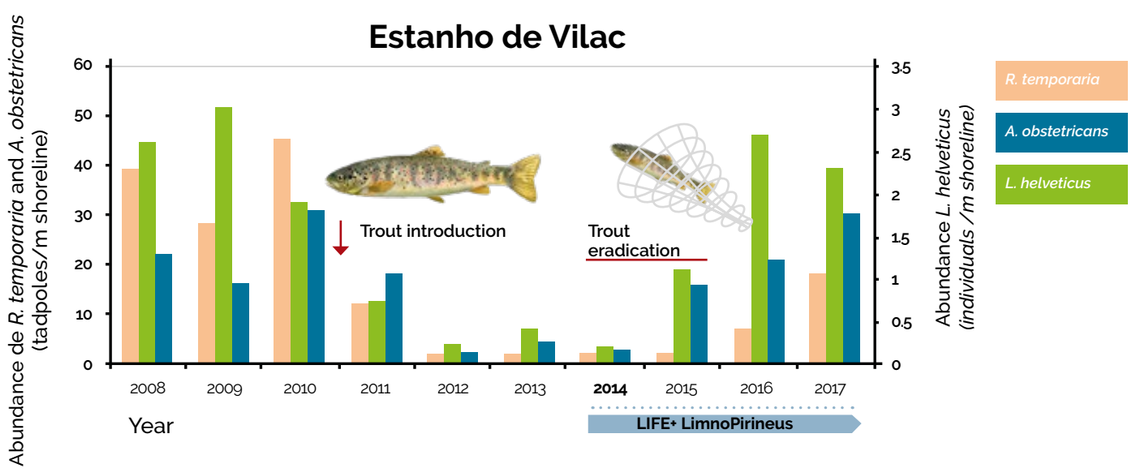
IMPROVING THE CONDITION OF TUFA-FORMING SPRINGS, NATURAL EUTROPHIC LAKES AND THE AQUATIC WATER PLANTAIN (*LURONIUM NATANS*), BUILDING WATERING TROUGHS TO REDUCE LIVESTOCK ATTENDANCE

In recent years, livestock has tended to concentrate in wetlands such as Plans d'Estanyeres de Son, in Aigüestortes. To prevent irreversible damage to these habitats and recover them, **livestock was excluded from a substantial part of the threatened habitats**.

Outside mires, there is a large supply of pasture, and specific troughs were set up.

Passive restoration of mire habitats and tufa-forming springs.

The elimination of the introduced trout and the reduction of the water flow that increased the area of the Estanho de Vilac (Estanho de Vielha, Val d'Aran) have permitted a return to more natural conditions, conducive to a **rapid recovery of littoral macroinvertebrates and amphibians and the growth of the aquatic water plantain (*Luronium natans*)**, in the only Pyrenean population of this species.



MAIN ACHIEVEMENTS OF THE PROJECT

128,429 European minnows and **7,639** salmonids removed from high mountain lakes

5 lakes freed of fish, **2** nearly freed and 1 lake with **+75%** population reduction

11 management plans and/or action plans

+11,500 visitors of 3 target areas informed about the project

+20 dissemination events

Touring exhibition **+36** localities visited and **+11,000** attendants

Environmental education in schools reached **+150** teachers and **+3,300** students

SOCIOECONOMIC IMPACT OF THE PROJECT

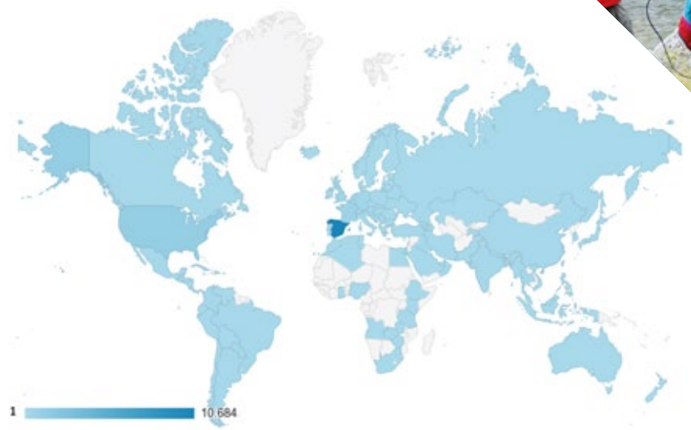
Benefits for the public and the local communities

Short- or long-term employment for 43 people, a significant portion of these being local people within the project areas

For five years, 115 people have been involved in the project as students, including graduate, master's and PhD students

The project contributed with direct investments in local infrastructure such as: installation of 15 information panels and the building of new wooden footbridges to preserve peatbogs in the target areas

More than 70 publications in the regional, national and international media in Spain and France, including TV stations, radio stations and press and in social media through the hashtag #limnopirineus



Territorial scope of the audience of the project website: ***www.lifelimnopirineus.eu***

10 conference proceedings, one book chapter and 4 scientific articles have been included in international journals such as *Biological Conservation, Biological Invasions, Frontiers in Plant Science and Ecohydrology*. Additionally, 25 technical reports were prepared on the most important activities and results of the project. The project website **www.lifelimnopirineus.eu** had 20,896 visits from 115 countries over the five-year period.

THE FUTURE

The project shows that the local and regional approach to the conservation of aquatic habitats and species can achieve a significant transformation in five years. Results from lake monitoring show the recovery of littoral macroinvertebrates and amphibians following the reduction or removal of pressure from non-native fish. The knowledge acquired on the extraction of invasive fish has already been replicated in the French Pyrenees thanks to the POCTEFA GREEN project.

Furthermore, thanks to the restoration actions of structural species (*Carex rostrata* and *Sphagnum* spp.), we now know and can apply the steps to be taken in the restoration of degraded peatbogs from the beginning.

There is still significant work to do, but the future looks good for these remote aquatic systems.

Work on the five-year LimnoPirineus project ended in December 2019, but the transformation does not stop there. These aquatic habitats have been damaged by hundreds of years of introduction and spread of alien species of fish, hydroelectric water level fluctuations, livestock pressure and, more recently, tourism in some specific locations. Now there is the need for continuing efforts to build on this conservation project.

The Project partners are committed to carrying on with a set of activities to reinforce the conservation of aquatic habitats and species, namely:

1-Continuing the monitoring and research on the habitats and species.

2-Developing new methods to better restore lakes and mire aquatic habitats.

3-Raising awareness on the significance of aquatic habitats and species in high mountain areas.

4-Capacity building for the key stakeholders of aquatic habitats and species conservation.

5-Ensuring governmental support for the implementation of EU policies and other agreements concerning habitat conservation.

«Knowledge of the distribution of the most sensitive habitats and their disturbances and threats is key to measuring the response of the land managers and planning effective conservation»

Mercè Aniz, Director of the National Park of Aigüestortes i Estany de Sant Maurici, and Marc Garriga, Director of the Natural Park of Alt Pirineu

ACKNOWLEDGEMENTS

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CEAB
exploring aquatic ecosystems

CSIC
Consejo Superior de Investigaciones Científicas

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Conselh Generau d'Aran

Parc Nacional d'Aigüestortes i Estany de Sant Maurici

Sorelló

Parc Natural de l'Alt Pirineu

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