Preservation of Margaritifera margaritifera at SCI in Zamora (Spain)

SPREADING DOCUMENT

Conservación de Margaritifera margaritifera en LIC de Zamora (España)
DOCUMENTO DIVULGATIVO

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LIFE NÁYADE

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Esther Peñín - Environment Agent - tasks performed technical and scientific assistance in all phases of the project LIFE.

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December 2007

Junta de Castilla y León

LIFE NÁYADE

PRESERVATION OF *MARGARITIFERA MARGARITIFERA* AT SCI IN ZAMORA (SPAIN)

LIFE-03/NAT/E/000051
SPREADING DOCUMENT

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I. INTRODUCTION

By decision of the European Community on September 4th, 2003, the financial aid for carrying out the **Project LIFE**: "Conservation of *Margaritifera margaritifera* in Zamora SCI (Spain)" LIFE-03NAT/E/000051 was approved. The foreseen execution term is 4 years (October 2003 – October 2007) and it has a budgetary resource of 516.000 €. The project is coordinated by the Department of Natural Spaces, of the Zamora Territorial Service of the Environment, dependent on the Environmental Ministry of the Junta de Castilla y León.

The *Margaritifera margarifera* (Linnaeus, 1758) species, also known as freshwater pearl mussel, naiad or margaritifera, is a freshwater bivalve mollusc. It inhabits in clean and clear water rivers, therefore being a bio indicator of the good quality of the ecosystem. The life cycle is characterized by being associated to certain species of fish, principally salmonoids; in these waters the common trout (*Salmo truta).*

LIFE Náyade Action Area

Species reproductive cycle

The MAIN conservation PROBLEMS that the species presents in this territory could be grouped in two:

***1st*. Alteration and loss of their optimal habitats:**

-.Presence of big hydraulic works in the main Tera River bed

- Existence of many outdated traditional Small Weirs that divide the river and create big sheets of water.

-. The increase of solid accumulation due to surface runoff from areas where the ground is not protected from the effect of frequent fires, aggressive ploughing and inappropriate construction of paths and firebreaks. If this coincides with the period of naiad pregnancy, it causes the abortion of glochidium. The sedimentation causes the death of young individuals, due to the accumulation of material and the alteration of their microhabitat.

-. Excessive and uncontrolled cuts of riverbank vegetation, basically *Alder woods.*

-. The aggressive urbanization of the riverbanks in specific areas.

-. Deterioration of the water quality by organic contamination from small population centres.

2nd. Decrease of the population of its host, the common trout, and alteration of the natural composition of the fishing community: This is directly related with the facts mentioned previously, since both species have similar ecological requirements.

The project's **GENERAL OBJECTIVES** are:

1. Get to know the conservation status of the species, characterize its habitat, determine its host's potential and the factors that most affect their population dynamics.

2. Contribute to the survival of the current population and the conservation of its habitat.

With the aim of fulfilling these objectives, a series of tasks are being developed, each one is included within a basic line of actions (A, C, D, E and F).

Code	Description of the action
A. Preparative actions and management plans elaboration:	
A.1	Scientific study about the species and its habitat.
A.2	Hydro biological study of the Negro River.
A.3	Potential host species estimate.
A.4	*Development of the Action and Management Plans.*
A.5	Preparation of the proposed conservation action projects.
C. Single biotype management tasks:	
C.1	Actions for recover of water quality.
C.2	Actions for restoring and improving the habitat.
D. Periodic management of the biotype:	
D.1	*Follow-up, evaluation and maintenance of the conservation actions.*
E. Information awareness to the public and disclosure of the results:	
E.1	*Preparation of informative material for disclosing the project.*
E.2	Exchange experiences with similar projects.
E.3	Communication of project results and creation of a Web page.
F. Functioning of the project	
F.1	Scientific and technical follow-up of species and habitat conservation measures.
F.2	Project external audit.

Lines of actions and LIFE Project actions.

II. PREPARATIVE ACTIONS AND MANAGEMENT PLANS ELABORATION (A).

Action	2003	2004				2005				2006				2007		
	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III
A1																
A2																
A3																
A4																
A5																

• A1. Scientific study about the species and its habitat.

Definition of the situation of the species in the study area

During 2004, sampling and characterization activities of the river habitat were carried out in order to determine the naiad's distribution area, its conservation status, and to identify the principal risk factors. A total of 125 field counts were performed, in which adult specimens were systematically found and counted, and biometrical data, measurement of physical-chemical parameters, habitat characterization (granulometry, water speed, shading, *alder tree* density) were taken, also sand sieving to find young specimens and to set companion specimens. This is a summary of some of the results obtained:

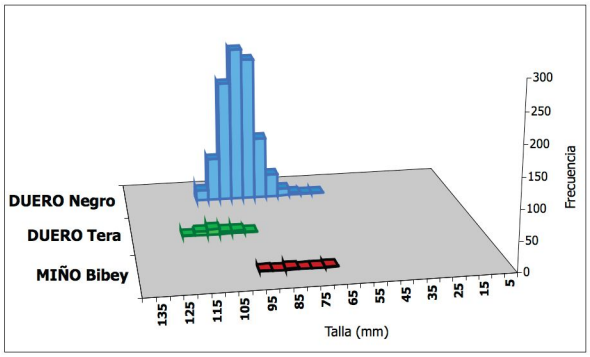
- The main mollusc populations are found in the mid-section of the Negro River, a vast part in a river section that was not initially included in the Tera Rivers and its tributaries SCI (ES 4190067), which caused the last Natura 2000 proposal of Castilla y León to include this section (July 2004). A relict population was found in the mid-section of the Tera River, and another one in the Bibey River, which belongs to the Miño basin where the species was not quoted, all of them included in Natura 2000 spaces.

- The Negro River population has relatively important elements, and in some sections there are good colonies, inside the general standard of decline of all the remainder of the known populations in continental

Europe. The naiads' estimated population is around 3 000-3 500, along 27 km of the main course of Negro River. Among the 67 counts where naiads were detected, only 30 can be considered as part of a "colony".

➢ The density found in the colonies was low (variations between 0,001 and 1,065 naiads/m2, being the average value 0,129 naiads/m2), which complicates fertilization of the females.

➢ All the naiads found, and the valves of dead specimens also correspond to adult individuals. The average size in the Negro River is 91,43 ± 7,28 mm (range 109 – 55,7), and in the Tera River, with even larger specimens of 106,1 ± 5,88 mm (range 116,5 – 94,6). Although no alometric growth parameters specific to these populations is established, the relationship between size and age suggests that they are specimens with an average age between 57 and 77 years in the Negro River and 70 to 107 in the Tera River; there are many hundred-year-old naiads, especially in Tera River.



Frequency of sizes (mm.) of *M. margaritifera* found in the main rivers of Zamora

➢ It is a senescent population in the Negro River and very relict, and even more senescent in the Tera River, without counting the recruitment of juveniles in no population for many decades, although adults continue being sexually active; consequently it is a fertile, but not prolific, population.

➢ The glochidium release takes place between the 2nd half of August and the end of September. At the beginning of September some fields were found in the Negro River with a 100% rate of pregnant individuals, which involves a very high proportion of hermaphrodites, which is a known symptom of a "serious population decline".

➢ The viability of the margaritifera population is conditioned to the closing of the reproductive cycle of the species, recruiting juvenile individuals to renew the population. This depends both in the conservation of the reproductive adults and of the populations of host fishes.

Description of the habitats conditions

➢ Naiads are found in superficial zones with an average depth of 22cm at maximum ebb tide (5 to 55cm), in zones with a generally low flow (0.08 to 0.5m/s) in the Negro river, and somewhat larger in the Tera (0.3 to 0.54 m/s). Almost all of the naiads have been found at altitudes situated between 800 and 900 m, in sections with an average slope of 0.4%.

➢The naiads live mainly in the shadow of riparian trees (riverbank forests (*Alnus Glutinosa* forests) Mediterranean, siliceous soil, Code EUR25: 91EO*) in zones with densities between 40 and 148 feet/100m; and at an average distance from the riverbanks of 0.65 m (range 0.2 to 6.5m). There are no specimens detected in areas with treeless river banks or in the centre of riverbeds greater than 10 m, where the alder trees' shadow doesn't reach.

➢ They live in well oxygenated waters, at levels close to saturation, with an average of 9.6 mg O_2/l (ranges between 6.8 and 12.6) with minimum values in August, and an average surface water temperature of 11.3ºC (ranges between 3.2 and 22ºC), water pH acidity between 5.7 and 6, with peaks up to 5.2 during de-icing. The great acidity of the water causes the chemical abrasion of the naiads' umbo which frequently ends up perforated.

➢ The waters have very low mineral content along the entire section of the Negro occupied by the species, with values of electrical conductivity between 2 and 27 μS/cm, very constant (in monthly terms) around 17 – 19 uS/cm, except in the de-icing season. This low mineral content significantly complicates the formation of the mineral matrix of valves; therefore in this area the metabolic growth rate should be very slow.

➢ The sections of the Negro River with naiads present a good quality pattern, although we are dealing with oligo and ultra-oligotrophic waters; in the section of the Tera River occupied by the species the water is enriched to a greater extent with some of the measured nutrients, and presents greater quantities of

chlorophyll. No concerning quantities of phosphates and nitrates in the water were detected for the species; these have been described as negative factors for the juvenile phases of development.

➢ Mineral content values are low. Calcium and manganese have been measured with special intensity due to their importance in the valve's formation. Low values of both were measured in every river, plus the principal cation calcium: (0.7 mg/l of average calcium in the Negro River and 1 mg/l in the Tera River). The low values of calcium limit the growth in concentric layers of calcium carbonate of the valves.

➢ The waters in the entire area are scarcely buffered (average alkalinity of 0.164 meq in the Tera River and 0.138 in the Negro River), thus they possess little capacity to assume an impact or external influence that could produce significant changes in the water quality, and therefore it is especially important to control the dumps.

Photo gallery in: A1_POBLACIONES

• A2. Hydrobiological study of Negro River.

Limnologic description of Negro River

The study was carried out between April 2004 and April 2005. Five physical-chemical follow-up points were chosen in the Negro riverbed, in which the following 22 parameters were measured every two weeks: Temperature, Ph, dissolved O_2, oxygen saturation, conductivity, cloudiness, stream speed, width of the ordinary river bed, granulometry of the substrate, alkalinity, apparent colour, chlorophyll, total material in suspension (non filtered waste, nutrients (total P, nitrates and silica), mineralization (chlorures, calcium, magnesium, manganese, iron) and $D.B.O._5$.

At all sampling stations two water samples were taken, one of 1600 ml preserved in the cold, and another of 2000 ml of water at room temperature, that was only used to measure the material in suspension.

Some of the main conclusions obtained from the hydrobiological study of the Negro River are:

➢ The waters are cold, very low in mineralization, not very buffered, very acidic, oligosaproby; very transparent in the riverheads and dystrophic in the mid and low sections. The alkalinity is very weak, which is further reinforced by the acidity of the water, therefore most of the dissolved carbon appears as CO_2, and there are scarce dissolved carbonates, necessary for the *Margaritifera margaritifera's* metabolism and for the rest of the freshwater biotic.

➢ The strong water acidity complicates the metabolic oxidation processes, and the low buffering slows down and controls the river's metabolic rate, which seems to be slow. That acidity is maintained during the entire year, being more elevated in the lower sections of the river; and it is even present in the summer season with higher water temperatures. This pattern is inverted with regards to the normal development of the river, that should be more buffered in the lower sections due to the greater primary production; due to this fact, there is a possible anthropic implication in the river acidification, plus the natural acidity of the river courses in the whole area because they drain a silicon crystal substrate that is not very soluble.

➢ The thorough follow-up of the surface water temperature allows us to know the thermodynamics of the river in the colonies' river sections. The river presents warm waters during the entire summer, with periods when waters should not be classified as "trouted" according to the parameters of Law 6/92 of the Castilla y León aquatic ecosystems protection. There is also a certain deficit of water oxygenation in the summer of about 3 and 6 fortnights; increased by the strong ebb tide that the river has experienced during the study period.

➢ There aren't any significant dumps of urban source "nutrients", therefore the "riverbanks woods <-> river" ecosystem functions on a dystrophic way. Nevertheless, there is an excess of nitrates in the river's upper and mid sections, and phosphates in the lower third section, coming from the recurrent fires along the Negro's entire sub-basin. Except for the upper section studied, there is a risk of partial eutrophization of water, since the atomic relationship N:P is lower than 17. This fact favours proliferation of cyanobacteria that fixes atmospheric N2, in strong insolation condition in the riverbanks.

➢ The primary production measured in the river allows to catalogue its waters as oligotrophic – mesotrophic, along the water's direction of flow. In the river's lower section, and during the summer, the water quality is quite neglected and it can be assigned to hypertrophic waters, depending on the chlorophyll and eutrophic, due to the total phosphate levels. The control of the primary production in the Negro River sediment is performed by the insolation level (through the density of alder trees) and the water's mineralization and buffering levels.

➢ The river bottom has great biodiversity, both animal and vegetable, however this diversity is being negatively affected by the deposit of very fine materials in suspension, which persist due to the scarce flow, the Mediterranean regimen of the Negro River, and the proliferation of dams that slow down the river course.

➢ The riverbanks are generally well preserved and have a high density of alder trees.

➢ The strong summer storms produce special increases of solids in the river, producing a great deal of murkiness in the water and a very harmful effect over the benthonic community (among them, the *Margaritifera margaritifera*), therefore causing the abortion of the pregnant naiads, the fill in of the gravel and sand interstices, as well as decreasing the penetration of light coming which can reach the benthon micro seaweeds. The effect of the sedimentation of these accumulations, together with the previously described risk factors, may explain the absence of young naiads for the last decades.

➢ The fish community is low in the mid river section, and it seems that there is no usual recruitment of fish, since there is an absence of intermediate and very high sizes, especially of trout. The mid and lower sections present a cyprinid community with an intrusion of allochthonous fish as the pumpkinseed (*Lepomis gibbosus*) in the lower section. Only the upper sections located upstream from the naiads' distribution area present a mono specific community of trout with low densities and scarce biomass. This negative population dynamic of the *Salmo trutta* could be due to the same conditions as the salmonoid spawning sites previously mentioned for the young margaritifera.

	Electrical conductivity	Water temperature	pH	Total material in suspension	Principal nutrients			Water mineralization			
	µS/cm	° C		total phosphorous µg/l	Nitrates µg/l	Silica mg/l	Alkalinity meq/l	Chloride mg/l	Chlorures mg/l	Calcium mg/l	Sum of Divalent cations mg/l
Average:	**16,38**	**9,8**	**5,8**	**2,14**	**8,67**	**37,03**	**1,72**	**0,13**	**1,38**	**0,83**	**1,53**
Maximun rate	27	19,9	6,7	7.860,3	64,56	90,91	2,07	0,30	19,8	1,554	2,77
Minimun rate	9	1,3	5,3	0,067	2,4	4,41	0,66	0,04	0,08	0,08	0,08

Table

Photo gallery: A2_HIDROBIOLÓGICO

• A3. Potential host species estimate

Electric fishing campaigns in the NW Zamoran rivers

A number of electric-fishing campaigns were carried out in order to determine the composition of the fish community and to inspect the gills of the captured species, especially brown trout (*Salmo trutta* var. *fario*). Altogether 1.948 trout were inspected. 5 of the captured individuals in the Negro river were naturally infected. Although the capacity of infecting is greater in the 0+ and 1+ specimens, a 3+ trout (268 mm size) infected by *Margaritifera, margaritifera* glochidium was captured. In the sections with the best naiad populations a density between 0,01 and 0,08 trout/m2 aged 0+ and 1+ has been found, inferior to the 0,1 alevins/m2 of other studied European populations where naiad reproduction has been observed. It was ruled out that other fish species could act as hosts.

Photo gallery in: A3_1_PESCA ELÉCTRICA

Controlled environment study of the infection capacity of the *M. margaritifera* glochidium

During 2005 we carried out the controlled environment infection (aquariums) of trout alevins (0+, 1+). Mature glochidiums were extracted from the Negro, Tera and Tuela Rivers naiads' gills through the use of siphons, using a pipette. Next, these were diluted in a recipient with 10 l. of water in which they were kept in contact with alevins 5-15 minutes. After this, the infected alevins were kept isolated to check the cysts.

The infection results in a controlled environment were positive, confirming that trout (0+ and 1+) from the Negro River, as well as those from the Tera River, developed cysts in their gills

Once the development of the first metamorphosis phases was completed, it could be checked by microscope that the cysts maturation alter their fixation in Glutaraldehyde. The glochidium release could not be stated.

Photo gallery in: A3_2_EXPERIMENTO TRUCHAS

• A4. Development and adoption of action and management plans

This document is organized in five large sections; its main objective is that of stimulating the necessary actions so that the species achieves a more favourable conservation status than the current one. In order for this, the following general objectives have been established

- Eliminate or minimize the non natural factors that cause the actual *Margaritifera margaritifera* regression, enabling the viability and expansion of its current reproduction nucleus.

- Preserve and promote the population of its host species (*Salmo Trutta*), and the balance and nature of fish populations.

- Preserve the integrity of its current and potential habitat, promoting actions that contribute to its recuperation and the improvement of its present conditions.

- Establishing an adequate legal and administrative framework that guarantees the species, its host, and habitat protection, allowing for the achievement of the goals that have been set.

The application field would include all of the rivers of the Castilla y Leon Community, in which the current or recent presence of the species has been detected, as well as the trout sections of the river located upstream, that would be vital for the trout's survival and reproduction.

Photo gallery in: A4_PLAN DE ACCIÓN

• A5. Preparation of the proposed conservation action projects

The different projects for the execution of the various actions are written each year.

III. SINGLE BIOTYPE MANAGEMENT TASKS (C).

Action	2003	2004				2005				2006				2007		
	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III
C1																
C2																

• C1. Occasional correction of the contamination in the more sensitive areas

C1.1 Preparation and cleaning of septic tanks and uncontrolled dumps in especially sensitive zones of the Tera River's and tributaries' SCI's ES4190067

C1_1_LIMPIEZA DE FOSAS

The cleaning and/or adjusting of almost all of the septic tanks that discharge their water into the Negro River sub-basin, as well as others from the Tera River that were damaged - scorning the quality of the naiad's and its host's habitat - was carried out. In total, 23 septic tanks were cleaned, corresponding to 19 municipalities.

C1.2. Elimination and recovery of an uncontrolled waste dumping point's surrounding areas

In the proximities of the Negro River (in Otero de Centenos) and in areas close to naiad colonies, a waste dump was sealed and the river banks arranged.

C1_2_ESCOMBRERA

- The intervention consisted of the selective cleaning and posterior removal of the non biodegradable materials accumulated in the waste dump.
- Later, the rest of the material was levelled out and compacted, before being covered with natural earth.
- The final phase consisted in revegetation with hardwood plantlets from the area, hydrosowing herbaceous and delimitation with milestones, installing a prohibition poster.

C1.3. Removal of urban waste from the riverbeds.

Abundant quantities of waste which had been deposited in the water course and margins of the Tera River in and *Tera River Bank's and tributaries'* SCI (ES4190067), were removed; the waste presented a significant source of pollution and alteration of the fluvial environment. The principal intervention zone was situated between the localities of El Puente de Sanabria and Puebla de Sanabria, although other conflictive points along the Castro and Negro Rivers were also acted upon.

C1_3_RETIRADA DE BASURAS

- The intervention involved approximately 2.500 linear metres of river banks, estimating an area of action at 4,17 Ha, and removing 1.800kg of waste.
- Also, an old iron footbridge dragged by a flood in 1989, rusting and blocking the course of the Negro River in its mid-section since then, has been removed

• C2. Conservation and improvement of the habitat

The main performed interventions are:

C2.1. Recovery of the traditional heritage of the flour mill pipes

➢ **Adaptation of a mill pipe as spawning site and alevin area for the trout; Rioconejos mill.**

The intervention consisted of recovering and transforming the abandoned pipe of a traditional mill in a river arm suitable for trout spawning.

C2_1_a_RECUPERACIÓN DE CAÑOS

- The pipe was cleared, the dead alder tress pruned and the ground was levelled in order to establish a continued slope.
- The gravel and sand were raked to provide these with adequate structure and to clean their interstices.
- Big stones were placed as flow deflectors to create greater water turbulence.
- In order to assure the use of the pipe by the migrating trout, a "calling" was installed in the pipe's moth, built with two consecutive stone jumps.

➢ **Transformation of an abandoned pipe in a river arm adequate for naiad and trout spawning and hatchery: Donadillo pipe.**

An abandoned pipe that was dry several months of the year, and in which high mortality existed due to beaching after the floods, was restored in a river arm suitable for naiads and trout. The area suffered progressive deterioration due to the extended seasons in which it remained outside the river's flow.

- First, the pipe was cleaned, the dead alder tress pruned and the ground was levelled in order to establish a continued slope.

- The materials were accumulated on site to be reused; stone from a dumpsite in the area was brought in, and also gravel and rubble from a nearby gravel pit in the Tera River.
- Later, a section of the pipe's stone walls were rebuilt with natural material and incorporated into the slope through a staking fence. These elements allow for maintaining adequate flow in the pipe and to fix the slope's collapse which was covering the pipe's light at several points. The walls' surface was not filled-in with concrete so the roughness and voids typical of the masonry work can be used by the aquatic fauna.

C2_1_b_RECUPERACIÓN DE CAÑOS

- The bottom of the pipe was given the adequate inclination and different kinds of washed gravel and rubble were put in order to give an appropriate texture to the pipe's bed.
- Some stream deflectors were put at the bottom of the pipe to cause a turbulent flow and a great quantity of hideouts for the aquatic fauna.
- Some locks were installed at the pipe's mouth and exit, to allow for regulation of the flow.
- Both the slopes and the water bank were replanted to accelerate the *alnus glutinosa* forest resprout. Willow, Rhamnus glandulosa and hazelnut tree staking coming from other nearby river sections were used, and also in the areas further from the riverbed with hardwoods plantlets were introduced.
- All of the intervention area was hydro sown with species typical of these riverbanks and the base of the fences was sown manually with alder tree seeds, collected during the previous winter from the same river.

➢ **Transformation of an abandoned pipe in a river arm adequate for adult naiads; Lanseros mill.**

The intervention consisted of restoring a pipe which remained with little flow for many months of the year, and in which a high mortality rate had been detected, due to beaching after the floods in an arm of the continuously flowing river.

C2_1_c_RECUPERACIÓN DE CAÑOS

-The activity was initiated with the adaptation of the pipe's mouth for the entry into the mill from the dam so that at low water should maintain sufficient flow. A large quantity of gravel was removed, since it blocked-off the entrance and it was adapted with a stone structure.
- In some of the canal's sections the stone walls were recovered, since they had collapsed, and a natural exit for the water heading for the river was achieved.
-Replanting along the canal's sides wasn't necessary, since these were already occupied by natural alders, which provided adequate shadow to the sheet of water.
-Improvements were also performed on the pond which supplies the mill; it was used by the local population as a traditional cleaning space. The works were completed with walls in old stone masonry from old breakwater stone, and the cement zones were eliminated.

C2.2. Cleaning and restoring of spawning sites

The notable incidence of the forest fires in the river basins of every river of the Zamoran Northwest favours the continuous accumulation of ash, organic matter, sand, etc. from the slopes. These particles accumulate in the riverbed, filling in the interstices and limiting the benthonic microbiota in gravel and sand. This occurrence, jointly with the lack of continuous high flows which wash the riverbed, turns a large majority of spawning sites remain unusable during draught years. Annually, at the beginning of autumn, the manual cleaning of the spawning sites has been undertaken by raking. Complementarily, actions have been performed to favour the creation of superficial currents of the turbulent type through the placement of small natural submerged barriers.

➢ **Manual raking of spawning sites**

C2_4_ LIMPIEZA Y RECUPERACIÓN DE FREZADEROS

- The riverbed of certain sections of the streams of the Negro and Tera River sub-basins, which remained covered by algae and other sediments, were raked. The removal of these sediments cleans the interstices of the sand and gravel where the trout spawn, favouring its oxygenation and inhabitability by means of the benthonic microfauna and the juvenile naiad.

➢ **Creation of new trout spawning sites**

-The insertion of small submerged gabions generates a type of current which is adequate for trout spawning and the young naiad.
-The construction of these structures (gravel and blocks) was achieved by filling in bags made of jute and other plant fibres, with gravel from the area.

C2.3. Activities to improve fish passage

➢ **Construction of fish ladders**

C2_2_b_RECUPERACIÓN DE AZUDES

In order to favour trout migration upstream in the spawning season and, in general, the mobility of the fish community through some obstacles which are difficult to pass, three fish ladders were build, two in Negro River (Cerezal de Aliste and Rosinos de Requejada) and another one in the Tera River (Ribadelago Nuevo). An existing fish ladder was also adapted in the Castro River (Lobeznos).

- The objective is to increase the possibility of overcoming obstacles with the least possible effort; to achieve this, successive ponds were built and ramps with irregular sections, rough and with a slight slope.

C2.4. Works for the recovery of river dynamics.

➢ **Installing defectors and submerging dams for recovery of river dynamics.**

A traditional crossing in the Negro River was recovered, restoring it as a flow deflector that will increase the water turbulence regimen.

- A traditional crossing was recovered putting stone blocks that act as flow deflectors that will increase turbulence in the water.
- With the same objective, slight reductions were introduced on the rims of some of the traditional weirs, providing them with a V section in order to assure an overflow point over the top with some depth during the ebb tide season.

C2. 5. Actions involving the restoration and recovery of river banks in especially sensitive zones

➢ Recovery of the burnt riverbanks around the Fontirín River.

During the summer of 2004, a strong fire devastated the high basin of the Fontirín River, one of the main enclaves of reproduction for the common trout. Several demonstrative stabilization activities and revegetation of the slopes were carried out.

C2_5_a _RESTAURACIÓN EN LADERAS QUEMADAS

- The intervention initially consisted in the removal of dead and burnt vegetation of the riverbank.
- Natural barriers were installed (using the removed material) in order to reduce the accumulation of ashes and solids obtained from surface runoff.
- The area was revegetated with fast growing annual plants (hydro sowing) and the riparian tree mass was increased by direct staking.

➢ Reduction in the accumulation of solids from surface runoff.

The activities, demonstrative in nature, consisted in the creation of a number of transversal drainage channels in four firebreaks that channel the runoff water, loaded with fine sediments, towards the decantation ponds and areas with abundant vegetation. Two slopes with paths were restored and a ford was built to avoid new runoffs. Furthermore, two footbridges were restored in order to reduce the vehicle traffic through the riverbed.

- The runoff sedimentation dykes were built at the base of the firebreaks, next to the banks of the Negro River.
- These measures were complemented with transversal ditches in maximum slope points in order to reduce the erosion effect of runoff, as well as to guide them to areas with abundant vegetation cover to act as a filter.
- The sedimentation pond made out of stone and concrete were integrated in the vegetation structure of the alder forest through the use of live fences and/or staking fenced and the revegetation of the ground with typical herbaceous plants from the area, and autochthon tree plantlets.
- Between these dikes and the Negro riverbed small semi buried fences were installed as well as staking ditches as a complementary measure to retain the effluent of the dikes and to favour sedimentation before reaching the river.
- In the most important area for the naiad colonies, a recent agricultural path with no drainage gutters, and no corrective measures to avoid fine particles from spilling into the Negro River, was dismantled. Following this, it was revegetated with plantlets and the natural resprout of autochthonous shrub was encouraged.
- In another nearby path a gravel dike was placed in order to break the strength of the runoff through the gutter, as well as to direct overflow to a grassland area. The area was revegetated with tree sprouts and autochthonous bushes of verdant species.
- In a service path of Pinar de Otero a hollow ford made of pines and gravel was built in order to prevent vehicles from stamping over the drainage runoff.
- Two pedestrian footbridges were rebuilt with natural materials in the Fontirin River headwaters, to prevent traffic from vehicles from passing through the river bed.

➢ Improvements of the riverbank mass conservation status.

The excessive pressure formerly exercised by men over the alder trees forest motivated the performance of various demonstrative activities directed to favour their structural and specific diversification, compatible with the performance of certain traditional uses.

-. Several diversification cuts were carried out in four tree stands of the Negro River sub basin (13,53 Ha.) following the next basic criteria:

C2_5_b_ REDUCCIÓN DE INERTES A LOS CAUCES

- The stems that were in the best vegetative status and configuration, out of the three major ones were respected, aiming to alternate between adjoining vines.
- At least one of the three smallest stems with diameter over 10 cm was respected.
- The following criteria prevailed: Maintaining those stems which provide greater shadow to the river.

- These improvement tasks allowed us to extract the plant material required for the staking, basically *Salix sp*.

➢ Construction of hideouts for the common trout.

The upper sections of the river represent the principal spawning point for the common trout. In dry years or in years with strong ebb tides, the river flow decreases notably and this fact is further emphasised in the headwaters, as a result it is convenient to create small weirs or “submerged” dams (< 1m draught) that may serve as shelter for the larger trout, which will be the next reproducers.

- 5 small submerged dams were built using natural materials, basically stone and wood, and with different techniques in the Trefacio (2) , Fontirin (1) and Sapo (2) Rivers.

➢ Actions to recover the river dynamics

A traditional crossing in the Negro River was recovered, restoring it as a flow deflector that will increase the water turbulence regimen.

- A traditional crossing was recovered putting stone blocks that act as flow deflectors that will increase turbulence in the water.

➢ Promotion and development of public use.

A number of activities have been performed in order to improve natural services and information in areas that have traditionally been developed for public use activities (hunting reserves, camping areas,

swimming areas…). The aim is to increase awareness and to guide the use of those areas that are less conflictive for the conservation of naiads'.

C2_5_c_ ORDENACIÓN USO PÚBLICO

- Some stone picnic tables have been placed in these areas for the enjoyment of the riverbanks.
- Selective weed clearing along with pruning of riverside trees has been carried out in the public use areas.
- An interpretation point of the Life Naiad Project has been built, with two informative panels on species' and fish community biology.
- Another 4 informative panels of the Natura 2000 Network were installed in the Negro River sub basin and another one with information regarding naiad biology in the Tera River (Galende fishing reservation).

IV. PERIODIC MANAGEMENT OF THE BIOTYPE (D).

Action	2003	2004				2005				2006				2007		
	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III
D1																

• D1. Follow-up, evaluation and maintenance of the conservation activities

A follow-up of the actions to recover the biotype has been performed (Action C), so that its undertaking be performed with the required sensitivity and precautions, avoiding or minimizing any kind of damage to the fluvial ecosystem. Emphasis was placed on training the workers involved in the construction works.

Maintenance and preservation of the performed works has been done, searching for their full functionality.

The repercussion of the actions on the *Margaritifera* habitat has finally been scientifically evaluated. In 2006 the first of these evaluation reports was written; it evaluates the importance and efficacy of every one of the biotype management actions performed until now (August 2006) and its conservation status, while proposing corrective or complementary measures when necessary.

At the end of 2007, the 2nd follow-up report of activities performed to improve the biotype was presented. The global evaluation of the actions on the whole was favourable, showing its adequacy and considering its performance as necessary in other conflictive points of the action area.

D1_SEGUIMIENTO Y EVALUACIÓN

V. PEOPLE'S AWARENESS AND DISCLOSURE OF THE RESULTS (E).

Action	2003	2004				2005				2006				2007		
	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III
E1																
E2																
E3																

- **E1.Elaboration of brochures for transmitting the results and undertaking of an informative campaign.**

E1.1 Publishing of informative brochures

E1_1 CUADERNO DIVULGATIVO

There was a print run of 15 000 informative leaflets and some panels to promote visibility. It was principally distributed through Town Halls, nature interpretative centres, park houses, schools, territorial environmental departments... as well as during the environmental awareness campaigns.

E1.2 Publishing of an annual river information bulletin

E1_2 INFONAYADE

"Infonayade", the informative bulletin regarding rivers has been published annually, with a print run of 4 000 numbers.

E1.3 Informative campaign and publishing of a school textbook

E1_3 CAMPAÑA DIVULGATIVA

A travelling exhibit through schools, town halls, park houses,... entitled "Naiads, our river lookouts" was prepared; it consisted of 8 panels and 2 interpretative tables, a valve collection with the main Castilla and Leon species, a photographic exhibit with some of the activities for restoring the biotype and an informative video about the species' biology: "Margaritifera margaritifera: a singular species".

There were various informative talks and environmental education activities with students, in which approximately 1700 people participated.

E1.4 Broadcasting of the LIFE Project in different Media.

E1_4 DIFUSIÓN

Participation took place in three TV programs (national, regional and local); 25 articles were published in the printed press and other specialized media, and participations in radio programs.

- **E2. Experience Exchange with participants in similar projects**

E2.1. Meetings and Conferences specific to LIFE NAIAD

E2_1 REUNIONES

A total of 5 technical conferences with personnel specialized in conservation of the species, fish fauna and fluvial habitat management were performed. The conferences were specially addressed to the various management organs involved in fluvial ecosystems preservation, although experts such as Dr. Rafael Araujo, European Coordinator of the Action Plan for the Recovery of the Species, participated.

E2.2. Convention participation and attendance, technical visits, and courses of scientific character

E2_2 INTERCAMBIO EXPERIENCIAS

There was a participation in more than 25 scientific events and many contacts were done with the supervisors of three other LIFE projects related with Margaritifera recovery and the river restoration. A collaboration agreement with the National Museum of Natural Science was signed and there was collaboration with the University of Salamanca in different studies.

- **E3. Communication of project results and creation of a Web page**

Since 2004 there is a specific web page dedicated to the Project as part of the Web server of the Junta de Castilla y León; www.jcyl.es. There is a great deal of information regarding the project and a variety of PDF documents. There is also an e-mail address: infonayade@jcyl.es.

VI. PROJECT FUNCTIONING (F).

Action	2003	2004				2005				2006				2007		
	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III
F1																
F2																

• F1. Control of the interventions performed during the Project according to the Management plan for assessing the efficacy of the adopted conservation measures.

These types of actions were principally performed during 2006-2007, keeping the periodical physical chemical controls at each of the sampling stations and evaluating the efficacy and repercussion of the biotype improvement actions performed to the present date.

As a result of this follow up the following work was written: "Follow up of the biotype improvement actions performed within the scope of the LIFE NAIAD program for the conservation of the *Margaritifera margaritifera* in SCI of Zamora, Spain, (LIFE03—NAT-E-000051), altogether with intervention D.

• F2. External audit.

The following control visits have been carried out by European Union Technicians and the technicians of the external assistance companies of the LIFE program.

- May, 2004: Visit of the ATECMA external assistance technicians and Mr. Tomás Mateo (representative of the European Union)
- May, 2005: Visit of ATECMA
- June, 2007: Visit of Mr. Juan Perez Lorenzo (representative of the European Union) and Mr. Iñigo Ortiz of the new external assistance company: IDOM.

During the last months of 2007 an external financial audit of the project was performed with the intention of evaluating the execution and financial situation of the project during its undertaking.

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