ACTION A3: American Mink Eradication Protocol

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New approaches for the European mink conservation in Spain
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1. Introduction

The European mink (*Mustela lutreola*) is one of the most threatened mammals in Europe. Since 2011 the European mink has been classified by the IUCN as "Critically Endangered" (http://www.iucnredlist.org/details/14018/0), and it is also included in annexes II and IV of the Habitats Directive 92/43/EEC. One of the last populations is in Spain, with a low number of specimens and showing a declining trend. The survival of the species depends directly on the conservation actions being the most effective possible, otherwise the European mink will disappear in a short space of time.

The main threat for the European mink in Spain is the competition with the American mink (*Neovison vison*; Palazón & Ruiz-Olmo 1997, Palazón et al 2003, Palazón & Melero 2014). Its rapid spread in recent years has caused extinctions on a local level and a greater fragmentation of native species (Põdra et al, 2013, Zuberogoitia et al, 2013; Palazón & Melero, 2014). Until now, the work to control and eradicate the invasive exotic species have been inefficient; thus they urgently need to be improved (MAGRAMA 2014).

The LIFE LUTREOLA SPAIN (LIFE13 NAT\ES\001171) project has the main objective of improving the conservation status of the European mink in Spain. To do this, it is essential to increase the effectiveness of the work to control the American mink and to be able to eradicate it in the distribution and influence area of the European mink. One of the fundamental tools to reach said objective is the creation of a work protocol that suitably describes the techniques that will be improved and how these works will be coordinated and unified to then be able to evaluate their success.

The American mink eradication protocol is based on the previous experience of different European eradication projects and on the results gained within the preparatory action of the LIFE LUTREOLA SPAIN project "Checking the Effectiveness of the Detection and Capturing Methodologies of European Mink and American Mink". With this action the efficiency of two American mink capturing methods were evaluated: the mink rafts used successfully in the United Kingdom, and the traditional bank trapping used in Spain in the past 20 years.

This protocol will be applied to the American mink eradication actions in the LIFE LUTREOLA SPAIN project, and improved versions may arise during the project. The document will be broadcast on the project's website www.lifelutreolaspain.com, and will be available to any interested parties via info@lifelutreolaspain.com.

This document will be applied by the partners in the scope of the LIFE LUTREOLA SPAIN project.

The priority lines of action for the conservation of the European mink in Spain and the guidelines for the management, control and possible eradication of the American mink are gathered, respectively, in the Strategy for the Conservation of the European Mink in Spain (http://www.mapama.gob.es/es/biodiversidad/temas/conservacion-de-especies/pbl_estrategia_vison_europeo_tcm7-150028.pdf), and in the Strategy for the Management, Control and Eradication of the American Mink in Spain (http://www.mapama.gob.es/es/biodiversidad/publicaciones/pbl_exo_inva_vison_americano_tcm7-29814.pdf).

1.1. American Mink Control Experiences in Spain Prior to the LIFE LUTREOLA SPAIN Project.

Since the end of the 1990s, American mink control campaigns have been undertaken in various provinces for the conservation of the European mink and other threatened species. Traps were developed in the area of the European mink, above all in areas where both species come into contact (La Rioja, Álava, Bizkaia, Gipuzkoa and in Burgos and Soria in Castilla y León) and in nearby areas (Aragon). In other areas, such as Catalonia, Galicia, Castilla -La Mancha and the Community of Valencia, American mink traps were also carried out.

The method used in all the areas was the selective live-trapping method, with cages on the banks, baited with sardines in oil, fresh fish, egg or meat, depending on the availability or the preference in each area. In the distribution area of the European mink and the nearby area, trapping campaigns were carried out following two objectives:

1. To eliminate the American mink nuclei within the distribution area (Basque Country, La Rioja and Castilla y León).

2. To stop its expansion towards the basin of the River Ebro, from the basin of the River Duero (in Castilla y León) and from the Mediterranean basins (Aragon and the Community of Valencia).

Despite the great deal of effort over many years, the American mink nuclei were not eliminated and their expansion was not avoided. However, the expansion towards the area of the European mink in the basin of the River Ebro was slowed down, keeping the native species stable for almost a decade. Unfortunately, from 2010-2011 the American Mink settled within the area of the European species and it expanded, causing a strong fragmentation in Alto Ebro (Tragsatec 2011). Simultaneously, the invasive species continued its colonization of the Cantabrian basins, causing the disappearance the majority of these rivers (Zuberogoitia et al. 2013, Zuberogoitia & Pérez de Ana 2014).

The results achieved show that the method used to control the American mink presented two important limitations: high effort and low effectiveness. It is probably these deficiencies that have made it possible that the species resisted in the trapping areas, even being able to colonize new areas as a consequence of late detection, when the species was already abundant. To achieve a more efficient eradication or control, it is necessary to improve the effectiveness of capturing the American mink.

1.2. Comparison of the Capturing Methods within the LIFE LUTREOLA SPAIN Project

During October 2014, the preparatory action A1 "Checking the Effectiveness of the Detection and Capturing Methodologies of European Mink and American Mink" was carried out. This was a comparison of two American mink capturing methods: a conventional trap and a trap on floating platforms (also known as mink raft, a method developed in the United Kingdom for the eradication/control of the American mink).

During the sample, 252 traps were placed on the riverbank and 252 rafts (one per kilometre) were placed in eight different rivers: four rivers with the presence of European mink and four with the presence of American mink; the presence of both species was determined based on data gathered in 2012. In total three trapping sessions were undertaken between September and November.

The results obtained showed that the use of the rafts was significantly more effective when capturing American minks than the conventional trap method. On all the rivers, more specimens were captured on the rafts than by means of the conventional traps (138 vs. 30). The effort necessary to capture an American mink was 7.4 times less with the rafts than with the conventional traps. The efficiency difference was greater even with the low densities of the third trapping session. On the other hand, the rafts captured more females than males, which negatively affects reproduction and the growth of the population (Tragsatec 2015).

The numerous captures obtained in the development of this preparatory action prove than the American mink was more distributed than anticipated, both in the European mink areas and in the areas considered to be at risk (areas close to the position of the Europe mink). Of the eight trapped rivers, the presence of the invasive species was register in seven, and in most of those in a high density. The European mink, on the other hand, showed very low densities. This data is alarming and highlights the importance of the actions of this project: C1 "Eradication of the American Mink Populations in the European Mink Distribution Area" and C2 "Eradication of the American Mink Populations in the European Mink Areas of Risk". Furthermore, without a successful eradication, it would not be feasible to undertake population efforts of the European mink within their area of distribution.

1.3. Conclusions

- Achieving the eradication of the feral American mink populations is not an easy objective.
- In Spain lots of efforts were made from the end of the 1990s, but the established nuclei were not eliminated, and their expansion was not prevented.
- The most used method up until now for control (trapping with cages on the riverbanks) has different important limitations: high effort and low effectiveness.
- The comparison between the two methods used to capture American mink within the LIFE LUTREOLA SPAIN project showed that the use of mink rafts is, on average, 7.4 times more effective than conventional trapping.

- The method of using rafts also has good results in low mink density conditions and in terms of capturing females, which negatively affects reproduction and thus the growth of the population.

- The main method to use in the eradication actions within the LIFE LUTREOLA SPAIN project should be the mink rafts as they are far more effective than conventional trapping, however conventional traps should not be ruled out in exceptional conditions.

2. Methodology

2.1. Description of the Mink Rafts

The raft consists of three key components: the base, the tunnel and the "pad" (Figure 1). The base of the raft is prepared with polyethylene foam (5cm thick), covered on both sides by Vacsol protected plywood so that it is water resistant. The measures of the model of the rafts used in action A1 were 1.20 x 0.58 x 0.58 m.

The rafts act both to capture and detect American minks. To detect their presence by means of paw prints, the "pad" is placed inside the tunnel. The "pad" is made of a plastic basket filled with floral foam (for natural flower) and covered with a layer of a 0.5-1 cm thick mix of sand and refractory clay powder (1:2) (Figure 2). The basket filled with said material is placed in the hole made in the raft (Figure 1). This way the sponge is on permanent contact with the water and keeps the "pad" wet, enabling the minks to leave their paw prints in the sand and clay mix. The tunnel protects the surface of the "pad" from the rain, making sure that the paw prints are not erased.

When trapping, the trap (cage) is placed inside the tunnel. The inside measurements of the tunnel are 17.5 x 17.5 cm and 62.5 cm long, and it is slightly larger than the trap (16 x 16 x 60 cm). The same traps are used as with conventional trapping. In Figures 1 to 5 the making of a raft that took place in Spain is detailed. These rafts are based on the design described by J. Reynolds et al. (2004).

Figure 1. Mink raft before its final assembly (before placing the tunnel and covering sponge of the "pad" with the mix of refractory clay and sand).

Figure 2. Mix of refractory clay and sand of approximately 0.5-1 cm, covering the sponge inside the basket. On this surface, the minks leave their paw prints.

Figure 3. Raft placed in the river to detect the presence of American minks.

Figure 4. American mink paw prints detected on the “pad”.

Figure 5. Trap placed in the raft after detecting the presence of American minks.

2.2. Trapping with Mink Rafts

Trapping with mink rafts involves the “detection - capture - detection” model: firstly the presence of the species is detected, and then it is trapped. Acting as such means that when and where to put the traps can be pre-set, thus reducing the trapping efforts. The necessary steps to follow are:

1. Monitoring: before trapping, the rafts without traps just with the “pads” will be placed in the river, which will confirm the presence of the American mink. The monitoring is also undertaken after trapping in order to evaluate the impact of the trapping carried out.

2. Trapping: after the monitoring period, each raft's "pad" will be checked and traps will be placed in those rafts where mink paw prints were registered and the immediately adjacent rafts (front and back) (Figure 6). In the areas where the species tends to use a larger section (Zabala et al. 2007) or when it is present with a low density, for example in the final phase of eradication, it would be recommendable to place traps to increase the probability of capturing, in addition to on the raft where the paw prints were registered, in the two before and two after.

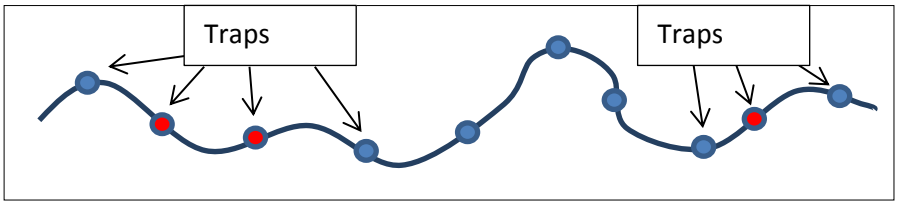


Figure 6. Visual example of how to place the traps on the rafts: of 10 located traps, the presence of American minks is detected in 3 of them (red), afterwards traps are placed on the 3 platforms with a positive presence of American mink, plus in the 4 closest to those with paw prints (7 rafts with traps in total).

During a sample, various periods of trapping are carried out and before each one a monitoring period is carried out.

A great advantage of this method is that **bait is not used**. As such, this methodology is very selective and American (or European) minks are mainly captured rather than other native carnivores. The use of bait on the raft would make it a less selective method as the range of species being captured would increase, such as beech martens, genets, cats and mice, etc.

2.2.1. Density of the Rafts to Place

Based on the experience in the United Kingdom and the action A1 "Checking the Effectiveness of the Detection and Capturing Methodologies of European Mink and American Mink" of the LIFE LUTREOLA SPAIN project, as a general rule it is recommended to place **1 raft per km of river.** In reality, and due to the morphology of the river and its banks, it is difficult to exactly achieve this distance between platforms, being able to adjust depending on the river conditions with an approximate variation of between 0.5 and 1.5 km. This density of mink rafts, in small and medium sized rivers (Cantabrian rivers and tributaries of the River Ebro) offers multiple opportunities to detect each of the specimens of American mink present in the river system. The bank where the rafts are placed is irrelevant and will depend, above all, on the access to the river, prioritising the placing of rafts in backwater areas.

In large rivers (>100 m wide) as is the case of the Ebro, there are unknown aspects in the American mink's spatial habitat use which can affect the eradication results (for example the size of the territories, the intensity of the use of one bank or another within a territory, the

large islands, etc.). Assuming this possible difficulty in the detectability, it is recommendable to have a large number of rafts.

It would therefore be necessary to place 1 raft for each 1.5 km of river on both banks (adding the corresponding effort to 1.5 raft per 1 km of river). This density of rafts should be reviewed depending on the results that are obtained in the development of the eradication actions.

2.2.2. Duration of the Monitoring and Trapping

- **Monitoring**

The length of the monitoring before and after each trapping period must be between **15 and 20 days,** and will be adapted to each territory and the staff that are going to undertake the work. In situations of high density of American mink, the monitoring before the first trapping period can be smaller (one week).

During the monitoring period, with stable weather conditions, it is not necessary to visit platforms before starting with the trapping, as these will be reviewed on the same day that the traps are placed. In the areas most frequented by visitors, or with minimum changes of the water level (up to 0.5 m), it is recommended for these to be reviewed once a week in order to prevent theft and to check that they do not get stranded on the riverbank. However, when there are sharp changes in the water level (> 0.5 m, due to rain or melting), it is necessary to review the rafts more frequently, thus guaranteeing their working, without losing information or material.

- **Trapping**

The duration of the trapping should be between **10 and 15 days**, adapting to the particular possibilities and needs. As a minimum it is recommendable to trap for 10 consecutive days, but to achieve greater success in the end stage of the eradication, it would be necessary to have longer periods of trapping of at least 15 days, as the capturing of the last specimens requires more effort.

2.3. Trapping Period

According to the experience of the LIFE LUTREOLA SPAIN project and in line with other countries, the undertaking of a short trapping campaign a year is not enough to carry out an eradication. To eliminate the species, trapping must be carried out various times in the same river.

The trapping is more successful in the periods of the year in which the American mink moves more intensely. Pursuant to the biology of the species, an intensive trapping period should be undertaken:

- **in autumn** (dispersal period, between September and December) and
- **in winter-spring** (reproductive periods, between January and April).

Following this criteria, the rafts should be in the river at a minimum from the month of **August or beginning of September, until May**, and this way the monitoring periods before and after the trapping are included.

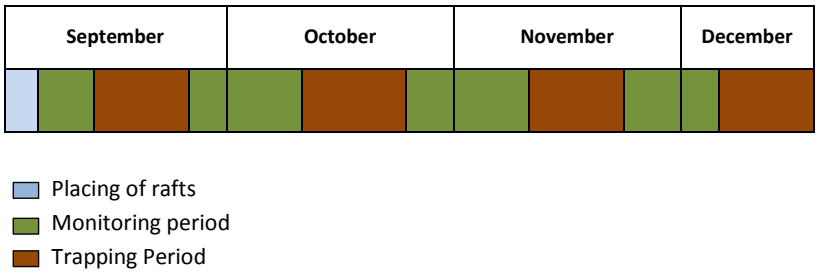
It is suggested to carry out a monitoring period plus trapping per month. A guide schedule is outlined which may act as a planning base for the work of the C1 actions "Eradication of the American Mink Populations in the European Mink Distribution Area" and C2 "Eradication of the American Mink Populations in the European Mink Areas of Risk" within the project.

The trapping period can be extended starting the work in July (in this case it would be better to keep the rafts in the river all year long). This can be done, for example, in less transited rivers (that are not used for fishing or crabbing). This period of work can provide very good results in the areas where litters have been detected prior to the dispersion. In this period, female minks actively move around their territory with their litters.

2.3.1. Trapping in Autumn (dispersal period)

Work to be undertaken between the months of September and December. The rafts would be placed at the end of August or beginning of September, and **4 trapping and 4 monitoring periods** would be carried out to complete the work. After the last trapping in December, the rafts will be left in the river to undertake the monitoring and repeat the trapping in the following months until the spring. If there is the risk of losing material due to sharp changes in the water flow, the rafts can be protected out of the water by placing them on the banks, at a sufficient height so that the water does not take them away. In January, before the next trapping period, the corresponding prior monitoring will be carried out.

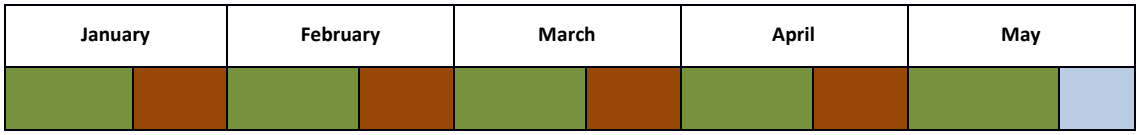
Figure 7.- Provisional work schedule for Autumn:



2.3.2. Trapping in Winter-Spring (Rutting Season)

This work will be carried out between January and April. The rafts will be placed back in the river at the beginning of January (if they were removed in December) and **4 trapping and 5 monitoring periods** will be carried out. After the last monitoring period in the month of May, and if considered necessary, the rafts will be removed from the river to prevent possible losses of material during the summer. In less transited rivers, the rafts can be left all year long.

Figure 8. Provisional work schedule for spring:



- Removal of rafts
- Monitoring period
- Trapping Period

The work schedule can be flexible, subject mainly to the weather conditions, fishing season (to avoid possible losses/theft of material), availability of staff, etc. Trapping and monitoring periods can be temporarily suspended due to very adverse weather conditions.

2.4. Selection of the Area and Place of the Trapping

Trapping with platforms can be carried out in Spain in all types of rivers. The optimal place to put rafts is near to the riverbank, as the minks often move along the slope and sections close the edge. For this calms sections of the river must be found (pools, meanders, tailwaters, etc.) preferably selecting places that are not often frequented by people, so as to avoid possible trouble or theft of material.

It is recommendable to place the rafts in the main courses of rivers and the largest tributaries, as these sections correspond to the habitat that this species most favours. The small tributaries, for example, those that do not have water all year long, do not tend to make up the optimal habitat for minks.

The results of action A1 “Checking the Effectiveness of the Detection and Capturing Methodologies of European Mink and American Mink” indicate that the trapping in a short section (20-50 km) that makes up part of a basin or sub-basin, is not enough to achieve a significant impact on the population. Even if all the specimens of American mink are eliminated in a short section, they will recolonize in a short period of time with specimens from the nearest section. Therefore, it is necessary to choose **an entire basin (or sub-basin) as a work unit**. The experience gained in the United Kingdom shows that the eradication undertaken in basins can be successful.

3. Area of Action

3.1. Action C1 ""Eradication of the American Mink Populations in the European Mink Distribution Area"

The American mink area of eradication within the range of the European mink includes the rivers in the basin of the Ebro and the Cantabrian basins where the American mink is present, or its presence is probable (according to data from the beginning of 2015).

3.1.1. River Ebro Basin

Annexes 1 and 2 outline the lengths of the rivers/sections of rivers and the number of rafts necessary to carry out the eradication of the American mink in the River Ebro basin within the C1 action.

The total length of the rivers that should be worked in within the Ebro basin is **465 km** (plus three reservoirs and the Humedales de Salburua wetlands). In this section a total of **555 rafts** will need to be placed (1 raft/km in the tributaries of the River Ebro, plus 1.5 rafts/km in the River Ebro on average).

The effort necessary in the Ebro basin is split between the territories of La Rioja and Álava as follows:

- 225 rafts in Álava
- 248 rafts in La Rioja
- 82 rafts between Álava and La Rioja (in the River Ebro)

3.1.2. Cantabrian Basins

Annexes 3 and 4 outline the lengths of the rivers/sections of rivers and the number of rafts necessary to carry out the eradication of the American mink in the basins of Cantabrian rivers within the C1 action.

The total length of the Cantabrian rivers that should be worked in is **422 km**. In this section it is necessary to place a total of **375 rafts**. In the basins of Kadagua, Nervión, Ibaizabal and Butrón, the density of the rafts is less than 1 platform/1 km due to large areas that are very civilised and not suitable for trapping.

The effort necessary is split between the territories of Bizkaia, Gipuzkoa and Álava as follows:

- 212 rafts in Bizkaia
- 120 rafts in Gipuzkoa
- 43 rafts in Álava

3.2. Action C2 "Eradication of the American Mink Populations in the European Mink Areas of Risk"

The American mink area of eradication in the risk area includes rivers in the basin of the Ebro and the Mediterranean basins where the American mink is present, or its presence is probable (data updated at the beginning of 2015).

3.2.1. River Ebro Basin

Annexes 5 and 6 outline the lengths of the rivers/sections of rivers and the number of rafts necessary to carry out the eradication of the American mink in the River Ebro basin within the C2 action.

The total length of the rivers that should be worked in within the Ebro basin is **465 km.** In this section a total of **500 rafts** will need to be placed (1 raft/km in the tributaries of the River Ebro, plus 1.5 rafts/km in the River Ebro on average).

The effort necessary is split between the provinces of Zaragoza and Teruel as follows:

- 400 rafts in Zaragoza
- 100 rafts in Teruel

3.2.2. Mediterranean Basins

Annexes 7 and 8 outline the lengths of the rivers/sections of rivers and the number of rafts necessary to carry out the eradication of the American mink in the Mediterranean basins within the C2 action.

The total length of the rivers that should be worked in within the Mediterranean basins is **355 km.** To undertake this action, a total of **355 rafts** will need to be placed (1 raft/km in the tributaries of the River Ebro, plus 1.5 rafts/km in the River Ebro on average).

The effort necessary is split between the provinces of Valencia and Castellón in the Autonomous Community of Valencia, and the province of Teruel in Aragon as follows:

- 60 rafts in Valencia
- 130 rafts in Castellón
- 165 rafts in Teruel

3.3. Coordination of the Work in Actions C1 and C2

The proposed American mink eradication area is very large. In the action C1 "Eradication of the American Mink Populations in the European Mink Distribution Area" this is undertaken in 887 km and involves the placing of 930 rafts and in the action C2 "Eradication of the American Mink Populations in the European Mink Areas of Risk" work is carried out in 820 km and a total of 855 rafts must be placed. For basins, the effort necessary will be spread out as follows:

- 930 km/1055 rafts in the Ebro basin
    - C1 465 km/555 rafts
    - C2 465 km/500 rafts
- 422 km/375 rafts in the Cantabrian basins and

- 355 km/355 rafts in the Mediterranean basins.

Although it would be recommendable, both for economic issues and due to the availability of human and material resources, in an area as large as this it is difficult to carry out an eradication acting in all the rivers or basins at the same time. Therefore, an alternative would be to start in a smaller area that includes the most important areas for the European mink and to expand this in the following years. In this case, both with the area of action C1 and action C2, it is necessary to prioritise the River Ebro basin.

In the River Ebro basin, both with action C1 and C2, it would be very recommendable to trap the entire planned area at the same time as it is all the same river network. A smaller area (for example some rivers or sections) should not be chosen, because it would not be feasible to achieve an eradication as the few specimens that stay in the sections excluded from the trapping would guarantee the prompt recovery of the species in a very short space of time.

The trapping in the area of action of action C1 should be undertaken simultaneously in the following rivers:

- River Ebro
- River Bayas
- River Zadorra
- River Ega
- River Arakil
- Rivers Oja and Tirón
- River Najerilla
- River Iregua

In the area of action of action C2 it would be necessary to tramp simultaneously in the River Jalón and the River Jiloca.

In the Cantabrian basins described in action C1 and the Mediterranean basins described in action C2, some basins can be selected for the eradication in the first year (from August 2015) and the trapping can be expanded to other basins in the following years. If the same basin is distributed between two provinces, e.g.: Álava and Bizkaia or Castellón and Teruel, it would be necessary to synchronize the work and trap during the same period to guarantee a successful eradication.

Should the eradication of the species not be achieved in the two planned years (until Spring 2017, according to the project schedule), the eradication period will have to be enlarged.

The area of action of the LIFE LUTREOLA SPAIN project does not cover the entire area of distribution of the American mink in the Ebro basin. As such, the collaboration with the closest Autonomous Communities (Navarra, Castilla y León, Cantabria and Catalonia) that are not part of the project, is highly important when it comes to dealing with the eradication of the invasive species in the Ebro basin and in the shared Cantabrian rivers.

4. Slaughter of Captured American Mink

The captured American mink will be slaughtered by means of the following methods:

1. Injectable pharmaceutical agents: For example, slaughter with prior anaesthesia with an intramuscular injection of ketamine (Imalgene 1000/500 ©) combined with xylazine (Rompun ©) or medetomidine (Domtor ©). Applied under the supervision of a veterinarian.

2. Inhalable agents CO_2. CO2 asphyxiation systems. The specimens are transported to the facilities where this equipment is, and they are put in watertight chambers.

3. Physical methods: Shot with an air gun. A gun license is not necessary, nor does the specimen need to be restrained. It takes place *in situ* in the place of the capture and in the trap itself. It is the main method used for the slaughter of captured American mink in the United Kingdom (Reynolds et al 2004).

The *in situ* slaughtering of the American mink reduces the stress of the specimens, the costs and the transport and handling efforts.

An annexed document is being creating in which these slaughter methods will be developed in more detail.

5. Evaluation of the Eradication Success

When the presence of American minks in the eradication area is not detected, it is necessary to determine if they have truly been eliminated and for the eradication actions to be brought to a close. This decision represents a considerable risk.

To reduce this difficulty, it would be necessary to undertake an extra effort in the trapped rivers. Each method has its disadvantages to detect the presence of the American mink, as the use of the mink rafts also has a certain risk of not detecting the species in very low density conditions, but to significantly reduce this risk, other complementary methods can be applied, such as the search for paw prints in the bank or camera traps.

- **Searching for prints on the riverbank**

In the case of not capturing any American minks or not detecting their presence on the rafts during the trapping campaign (Autumn or Spring), it will be necessary to undertake a complementary search for paw prints on the riverbank.

The search for prints can give reliable results if undertaken in an optimal period and with sufficient effort. The recommendable period for the searching of prints is during the months of **March and April** when the vegetation is still scare and water overflows have left beaches of sand or mud available for the detection of evidence. In this period the American mink moves a lot and that facilitates its detection by means of paw prints. For this it is recommendable to have a period without rain of at least one week, although it tends to rain a lot in this point of the year, especially in the Cantabrian basins. This method is relatively easy to carry out by staff with a certain amount of experience with the species. On the other hand, it may be costly if it needs to be undertaken in a very large area. The effort can be considered reasonable when the bank is checked around **each raft in a section of at least 200 m** (100 m each side), depending on the terrain.

The presence or absence of paw prints enables for a complementary evaluation of the efficiency of the eradication in the entire area of action of action C2 “Eradication of the American Mink Populations in the European Mink Areas of Risk”. In the area of action of action C1 “Eradication of the American Mink Populations in the European Mink Distribution Area”, the historical range of the European mink (or probability of presence), the method is not sufficient to evaluate the success of the eradication as the paw prints of the two species of mink cannot be distinguished.

- **Camera Trapping**

In the rivers with a presence of the two species of mink, camera trapping may be a useful complementary method of identifying the mink species present in the area of action.

Pursuant to the experience gained in action A1 “Checking the Effectiveness of the Detection and Capturing Methodologies of European Mink and American Mink” and in other previous

projects in which camera trapping had been used with bait and/or combined with mink rafts, this was a fairly efficient method when differentiating the two mink species. For this it is necessary to place the camera 1-1.5 m from the bait or raft (Figure 15). With this method the species can be identified if certain characteristics are able to be seen. However, in large rivers this method is difficult to put into practice as the cameras have movement sensors and the rafts are constantly moving. In these situations it would be recommendable to only place the cameras with bait on the riverbanks.

Figure 9. Camera combined with a mink raft in the River Tirón (action A1).

Figure 10. American mink detected on a mink raft and European mink detected on the bank of the River Tirón (action A1).

The cameras a placed in all places where prints were previously detected (on the rafts or riverbanks), or where American or European mink were captured. In the American mink expansion period, both species may appear in the same point. The camera must be focused on the raft and it is very important that the raft is placed somewhere with calm water, preventing the camera activating due to movement. The influx of people to river must also be taken into account to prevent the theft of the cameras.

The camera trapping should last at least 1 month, reviewing the memory card every 15 days. In the case of water level changes, it is necessary to review that camera more over and place it back again when necessary.

- **Criteria to evaluate the success**

It would be recommendable to adopt the criteria developed in Scotland to evaluate the eradication success (SMI 2013), identifying two different situations: a basin or sub-basin is considered to be free from resident American mink (“free”) when no specimens of American mink have been captured for 6 months. If more captures are made in the 6 months, the basin or sub-basin is identified as having “reduced density”.

The basins and sub-basins are assessed individually, considering if they are “free” or have a “reduced density”. For this the evolution obtained in the trapping is observed (basin to basin as a whole), detecting if re-colonisations are made in neighbouring areas etc. This evaluation will be subject to the recommendations that are proposed by LIFE LUTREOLA SPAIN’s Scientific Committee.

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Annexes

Annex I

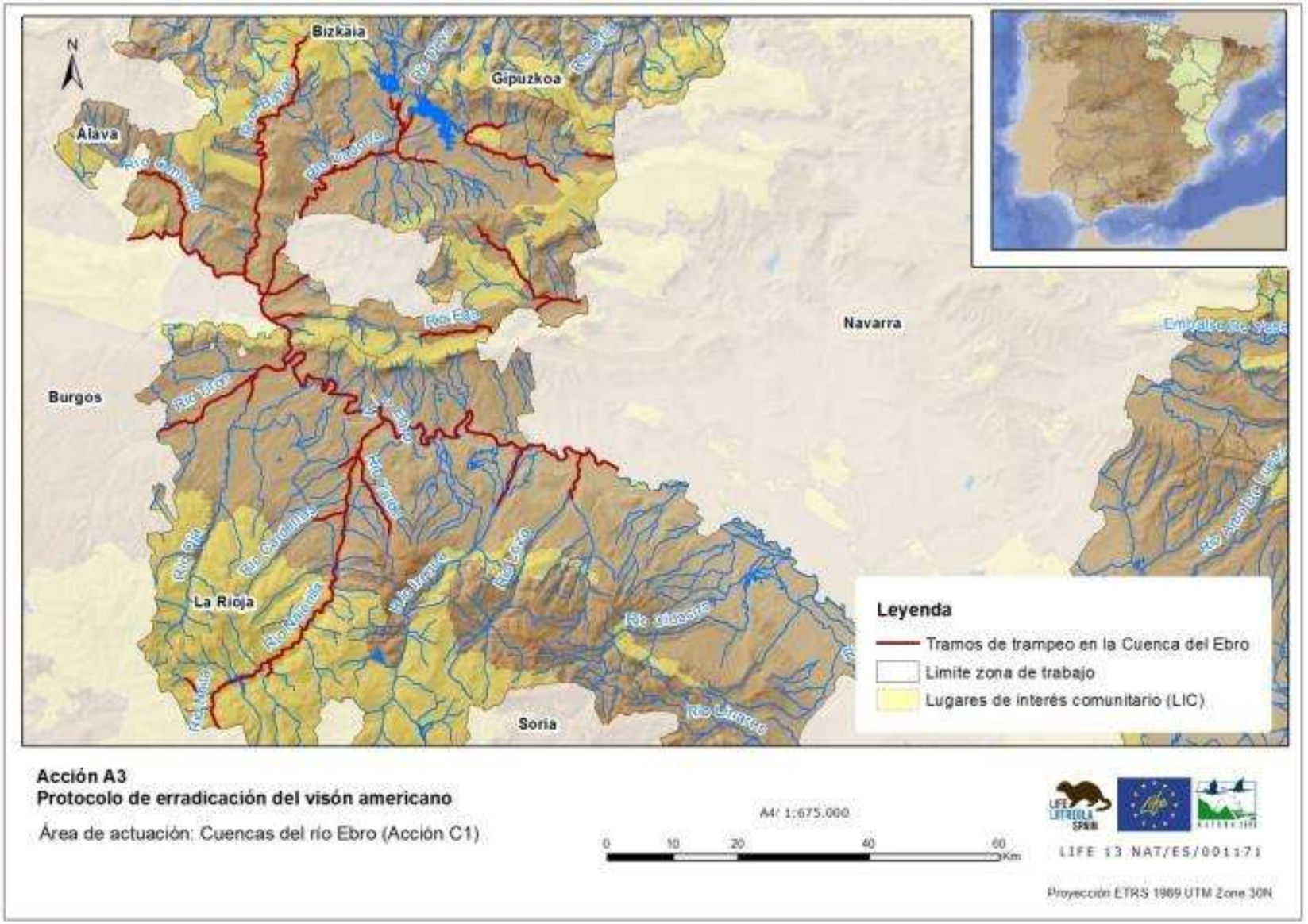
Lengths of Rivers and Number of Floating Rafts for the Development in the Ebro Basin of Action C1 “Eradication of the American Mink Populations in the European Mink Distribution Area”

Sub-basin	River/water bodies	Length of section in km	No of rafts	Location of section	Province
Najerilla	Najerilla	60	60	From the Mansilla reservoir until it flows into the Ebro	La Rioja
	Neila	7	7	From the border with Burgos until Villavelallo	
	Canales	3	3	From Canales de la Sierra until Villavelallo	
	Urbión	3	3	From Viniegra de Abajo until it flows into the Najerilla	
	Cárdenas	5	5	From Badarán until it flows into the Najerilla	
	Yalde	15	15	From the Castroviejo reservoir until it flows into the River Najerilla	
	Tuerto	3	3	From Hormilla until it flows into the Najerilla	
	Mansilla Resevoir	-	5	Mouths of the rivers Calamantío and Portilla	
Total:		**95**	**100**		
Oja-Tirón	Oja	5	5	From Castañares until it flows into the Cihuri.	La Rioja
	Tirón	20	20	From Tormantos until it flows into the Ebro.	
Total:		**15**	**15**		
Iregua	Iregua	10	10	From Albelda de Iregua until it flows into the Ebro	La Rioja
Total:		**10**	**10**		
Leza	Leza	8	8	From the Ebro until the mouth of the river Jubera	La Rioja
Total:		**8**	**8**		
Ebro	Ebro	150	225	From the dam of the Sobrón reservoir up to the border between La Rioja and Navarra (Alcanadre)	Between Álava and La Rioja 82, Álava 38 and La Rioja 105 rafts
	Inglares	5	5	From Ocío until it flows into the Ebro	Álava
Total:		**155**	**230**		
Zadorra	Zadorra	65	65	From Salvatierra until it flows into the Ebro	Álava
	Ayuda	8	8	From the border with Burgos until it flows into the Zadorra	
	Zayas	7	7	From Foronda until it flows into the Zadorra	
	Alegría	7	7	From Oreitia until it flows into the Zadorra	
	St. Engracia	10	10	From the reservoir until it flows into the Zadorra	
	Barrundia	8	8	From Aspuru until it flows into the Zadorra	
	Salburua	-	5		

Sub-basin	River/water bodies	Length of section in km	No of rafts	Location of section	Province
	Ullibarri Reservoir	-	5		
	Urrunaga Reservoir	-	5		
Total:		**105**	**120**		
Bayas	Bayas	50	50	From Murgía until the border with Burgos	Álava
Total:		**50**	**50**		
Ega	Ega	12	12	From the border with Navarra until Azaceta	Álava
Total:		**12**	**12**		
Arakíl	Arakíl	5	5	From the border with Navarra until Albéniz	Álava
Total:		**5**	**5**		

Annex II

Cartography of the Area of Action of Action C1 in the River Ebro Basin



Action A3 American Mink Eradication Protocol

Annex III

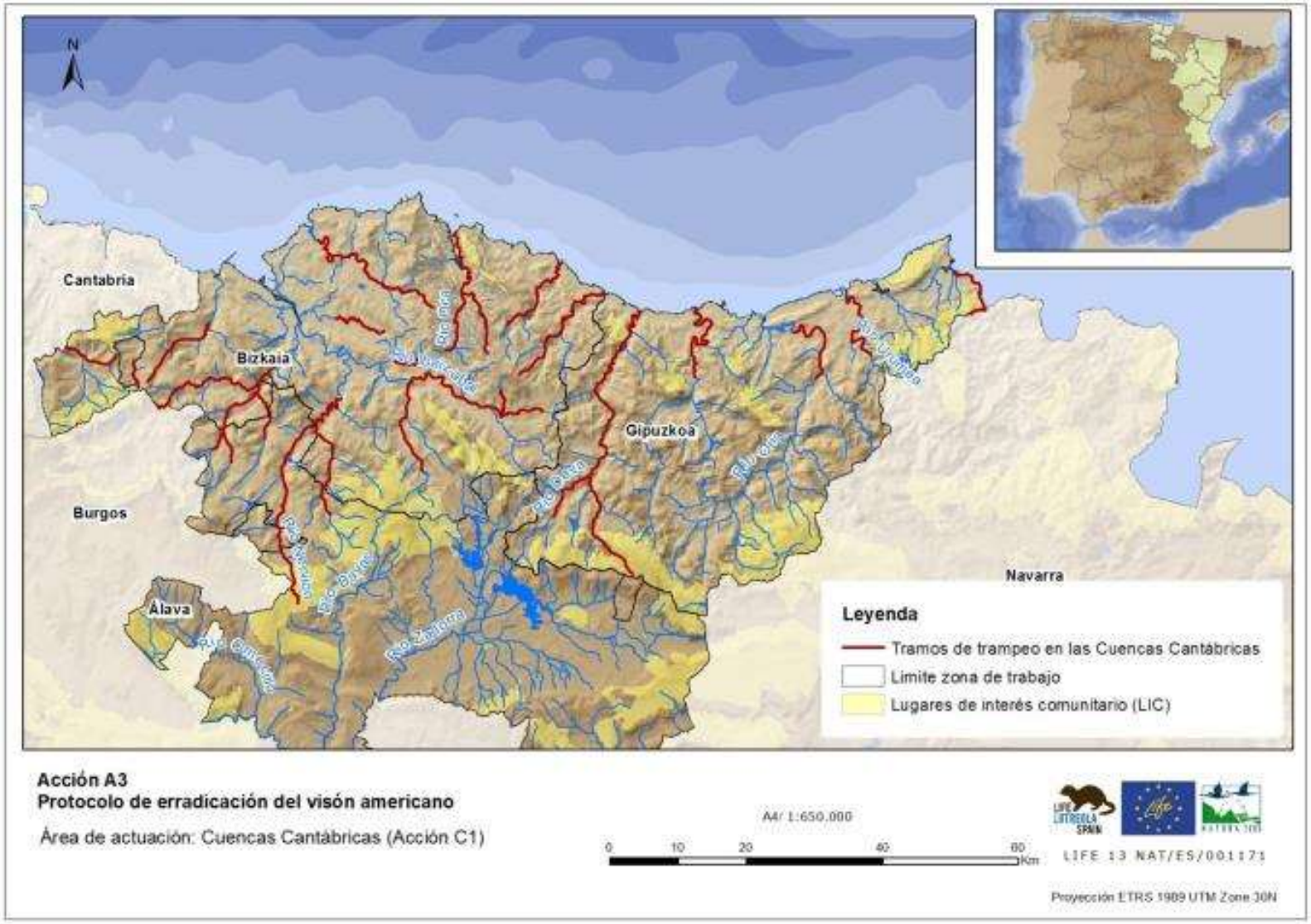
Lengths of Rivers and Number of Floating Rafts for the Development in Cantabrian Rivers of Action C1 “Eradication of the American Mink Populations in the European Mink Distribution Area”

Cuenca	River/water bodies	Length of section in km	No of rafts	Location of section	Province
Karrantza	**Karrantza**	**10**	**10**	**From the border with Cantabria until the mouth of the River Balgerri (Lanzas Agudas)**	**Bizkaia**
Total:		**10**	**10**		
Agüera	Agüera	5	5	The whole section in the province of Bizkaia	Bizkaia
Total:		**5**	**5**		
Río Mayor	Río Mayor	15	15	From San Juan up to Traslaviña	Bizkaia
Total:		**15**	**15**		
Kadagua	Kadagua	24	17	From Balmaseda up to Alonsotegi	Bizkaia
	Herrerías	10	5	From the border with Álava until Álava	Bizkaia
Total:		**34**	**22**		
Nervión	Altube	15	14	From the border with Álava and from Urigoiti until Areta	Bizkaia
	Nervión	3	4	From the border with Burgos until the border with Álava	
	Nervión	9	5	From the border with Álava until Arrigorriaga	
Total:		**27**	**23**		
Ibaizabal	Ibaizabal	26	10	From Elorrio until Lemoa	Bizkaia
	Arratia	16	7	From Undurraga until Lemoa	
	Zaldu	4	2	From Berriz to Matiena	
	Amorebieta	5	3	From Boroa to El Gallo	
	Asua	10	6	From Lezama to Asua	
Total		**61**	**28**		
Butrón	Butrón	35	32	From Errigoiti to Plentzia	Bizkaia
Total:		**35**	**32**		
Oka	Oka	10	7	From Ibarruri to Gernika-Lumo	Bizkaia
Oka	Golako	12	10	From headwaters to Gernika	Bizkaia
Oka	Mashes	10	17	Streams leading into mashes	Bizkaia
Total:		**32**	**34**		
Lea	Lea	17	20	From Munitibar to Lekeitio	Bizkaia
Total:		**17**	**20**		
Artibai	Artibai	23	23	From Bolibar and from Etxebarria to Ondarroa	Bizkaia
Total:		**23**	**23**		
Deba	Deba	45	45	From Eskoriatza until the mouth	Gipuzkoa
	Artixa	15	15	From Arantzazu until the mouth	
Total:		**60**	**60**		
Urola	Urola	20	20	From Zumaia to Azpeitia	Gipuzkoa
Total:		**20**	**20**		
Oria	Oria	15	15	From Orio to Andoain	Gipuzkoa
Total:		**15**	**15**		
Urumea	Urumea	15	15	From bridge GI-131a (San	Gipuzkoa

Cuenca	River/water bodies	Length of section in km	No of rafts	Location of section	Province
				Sebastian) until the Irakurri industrial estate	
Total:		**15**	**15**		
Bidasoa	Bidasoa	7	7	From bridgeA-8 (Irun) until it flows into the River Endara (Endarlatsa)	Gipuzkoa
	Endara	3	3	3 km upstream from the mouth	
Total:		**10**	**10**		
Herrerías	Ibaltzibar	5	5	From the border with Bizkaia until the A-624 bridge	Álava
	Artziniega	3	3	From the mouth until Artziniega	
Total:		**8**	**8**		
Nervión-Ibaizabal	Zaldu (Izalde)	10	10	From the border with Bizkaia until Zuaza	Álava
	Nervión	20	20	From the border with Bizkaia until Orduna	
	Altube	5	5	From the border with Bizkaia until Ziorraga	
Total:		**35**	**35**		

Annex IV

Cartography of the Area of Action of Action C1 in the Cantabrian rivers.


N
Cantabria
Bizkaia
Gipuzkoa
Burgos
Álava
Navarra
Leyenda
Tramos de trampeo en las Cuencas Cantábricas
Limite zona de trabajo
Lugares de interés comunitario (LIC)
Acción A3
Protocolo de erradicación del visón americano
Área de actuación: Cuencas Cantábricas (Acción C1)
A4/ 1:650.000
0 10 20 40 60 Km
LIFE 13 NAT/ES/001171
Proyección ETRS 1989 UTM Zone 30N

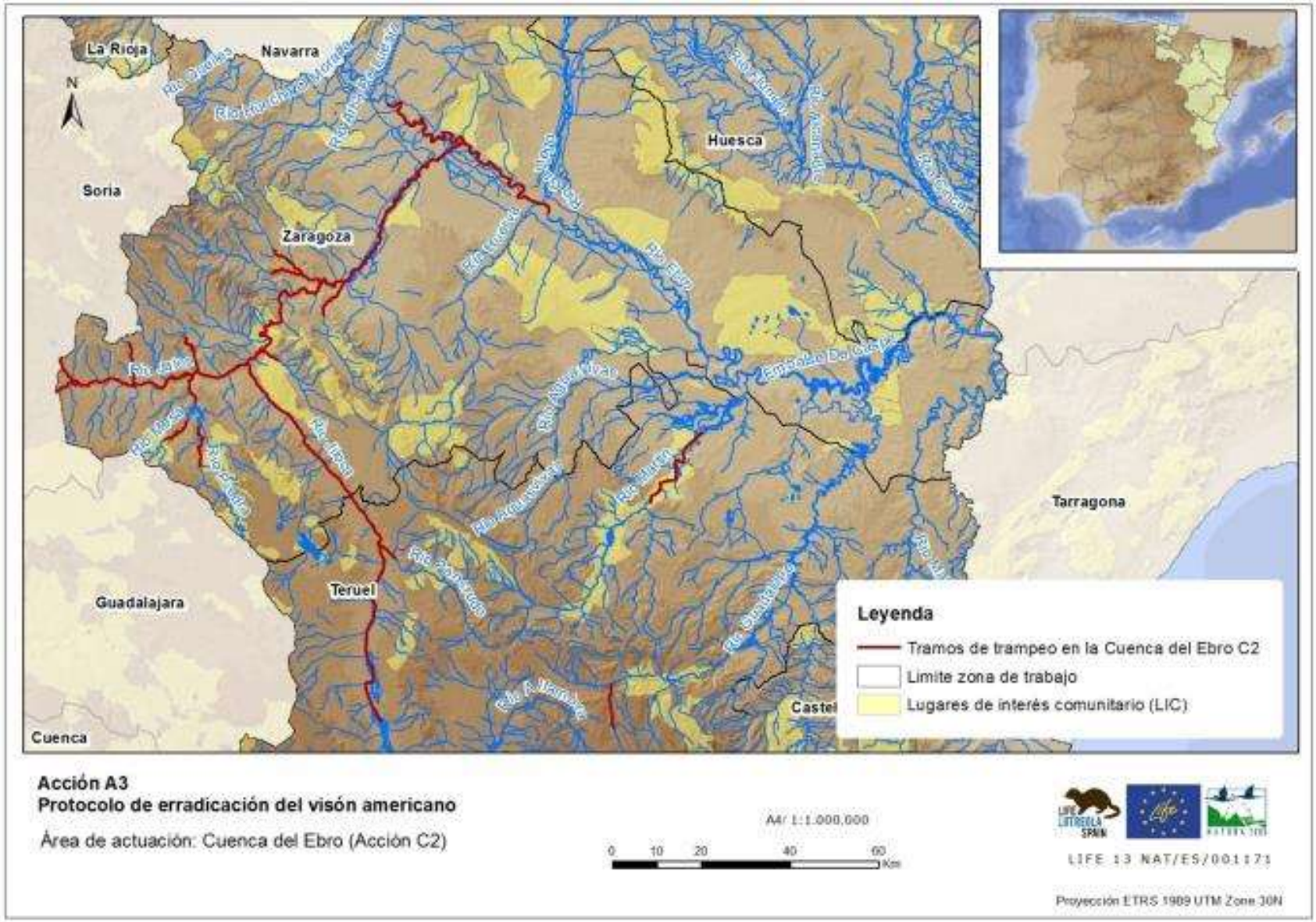
Annex V

Lengths of Rivers and Number of Floating Rafts for the Development of Action C2 “Eradication of the American Mink Populations in the European Mink Areas of Risk” in the Ebro basin

Sub-basin	River/water bodies	Length of section in km	No of rafts	Location of section	Province
Jalón	Jalón	160	160	From the mouth until the border with Soria	Zaragoza
	Aranda	15	15	From the mouth until Brea de Aragón	
	Isuela	10	10	From the mouth until Tierga	
	Grío	10	10	10 km upstream from the mouth	
	Perejiles	5	5	From the mouth until Torres	
	Manubles	10	10	From the mouth until Moros	
	Mesa	15	15	From the mouth until the reservoir (7 km) and from the tail of the reservoir until Jaraba (8 km)	
	Piedra	10	10	From Nuévalos (tail of the reservoir) to Llumes	
	Deza	10	10	From the mouth until Embid de Ariza	
	Náguna	10	10	From the mouth until the border with Soria	
Total:		**255**	**255**		
Jiloca	Jiloca	100	100	From the mouth to Santa Eulalia	Zaragoza 40 and Teruel 60 rafts
	Pancrudo	5	5	From the mouth until Navarrete del Río	Teruel
Total:		**105**	**105**		
Martín	Martín	25	25	Between Hijar and Ariño	Teruel
Total:		**25**	**25**		
Guadalope	Guadalope	10	10	From the Aliaga reservoir until Cobatillas	Teruel
Total:		**10**	**10**		
Authority	Ebro	70	105	From Gallur to Zaragoza (bridge E-90)	Zaragoza
Total:		**70**	**105**		

Annex VI

Cartography of the Area of Action of Action C2 in the River Ebro Basin.


La Rioja
Navarra
Soria
Zaragoza
Huesca
Teruel
Guadalajara
Cuenca
Tarragona
N
Leyenda
Tramos de trampeo en la Cuenca del Ebro C2
Limite zona de trabajo
Lugares de interés comunitario (LIC)
Acción A3
Protocolo de erradicación del visón americano
Área de actuación: Cuenca del Ebro (Acción C2)
A4/ 1:1.000.000
0 10 20 40 60
Km
LIFE 13 NAT/ES/001171
Proyección ETRS 1989 UTM Zone 30N

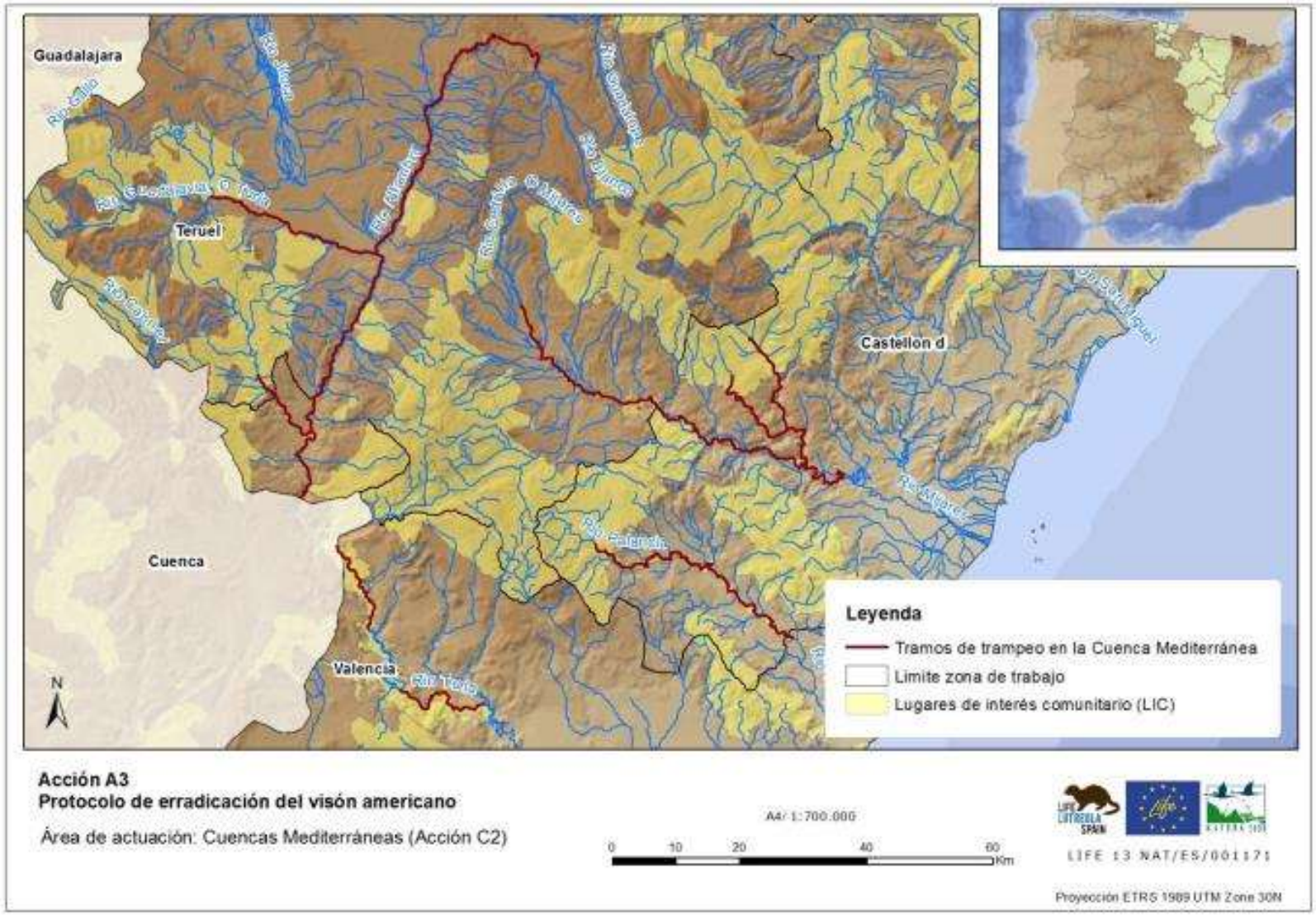
Annex VII

Lengths of Rivers and Number of Floating Rafts for the Development of Action C2 “Eradication of the American Mink Populations in the European Mink Areas of Risk” in the Mediterranean Basins.

Sub-basin	River/water bodies	Length of section in km	No of rafts	Location of section	Province
Turia	Turia	120	120	From the mouth of the River Guadalaviar to the Loriguilla reservoir (15 km between the reservoirs Loriguilla and Benagéber + 105 km upstream from Benagéber).	Valencia 50 and Teruel 70 rafts
	Alfambra	60	60	From the mouth until Aguilar del Alfambra.	Teruel
	Ebrón	15	15	From the mouth until Tormón	Valencia 10 and Teruel 5 rafts
Total:		**195**	**195**		
Palancia	Palancia	50	50	From the mouth of the Rambla ravine (El Molinar) to Algar de Palancia	Castellón
Total:		**50**	**50**		
Mijares	Mijares	70	40	From the Sitjar reservoir (Valencia) to Formiche Alto (Aragón).	Castellón 40 and Teruel 30 rafts
	Ríu de Villahermosa	30	30		Castellón
	Barranc de Santa Ana	10	10	From the mouth to the bridge on road CV-195 (Valencia)	
Total:		**110**	**110**		

Annex VIII

Cartography of the Area of Action of Action C2 in the Mediterranean Basins.


Guadalajara
Teruel
Cuenca
Valencia
Castellon d
Leyenda
Tramos de trampeo en la Cuenca Mediterránea
Limite zona de trabajo
Lugares de interés comunitario (LIC)
N
Acción A3
Protocolo de erradicación del visón americano
Área de actuación: Cuencas Mediterráneas (Acción C2)
A4/ 1:700.000
0 10 20 40 60
Km
LIFE 13 NAT/ES/001171
Proyección ETRS 1989 UTM Zone 30N

Annex IX

Trapping with Mink Rafts Control Sheet

LIFE13 NAT / ES / 001171

LIFE Action:	**Team:**	TTec ☐	Admin. Agents ☐	Others ☐	**Observations of other species/incidents:**
Province:	**Person in charge:**				
Spot:					
River basin:	**Projection used:**				
River:	**ETRS 89** ☐		**Other:**		

Raft No.	Date trap placed	Date trap removed	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Night traps	Coordinates	
														X	AND
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															

CAPTURES AND REMARKS: **X** - not operational due to theft, not being placed or being removed; **0**- reviewed but no capture;
DI - Shot; **VA** - American Mink; **VE** - European mink (add specimen code) ; **GI** - genet; **GA** - beech marten, **R** - rat;
RA – water rat. Specify other species.

Annex X

Monitoring with Mink Rafts Control Sheet

LIFE13 NAT / ES / 001171

LIFE Action:	**Team:**	TTec ☐	Admin. Agents ☐	Others ☐	**Observations of other species/incidents:**
Province:	**Person in charge:**				
Spot:					
River basin: **River:**	**Projection used:** **ETRS 89** ☐ **Other:**				

No. **No.**	**Date raft placed**	**Review date**								**Coordinates**	
		Review 1 Date:	**Review 2 Date:**	**Review 3 Date:**	**Review 4 Date:**	**Review 5 Date:**	**Review 6 Date:**	**Review 7 Date:**	**Review 8 Date:**	**X**	**AND**
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
REMARKS: **Vi** Mink prints; **PVi** probably mink prints; **-** no prints.											