LIFE19 NAT/IT/000851

Part C – detailed technical description of the proposed actions

LIST OF ALL PROPOSED ACTIONS

A. Preparatory actions, elaboration of management plans and/or of action plans

A1 Technical-administrative activities to start the project and conclude agreements between the partners

A2 Development of a user-friendly protocol for easy selection of sexually mature breeders (silver migrant eels) to be released in nature to increase the reproductive potential of wild population

A3 Design of eel specific fish passes to reopen over 1,000 km of habitat for free upstream migration of elvers

A4 Analysis of the Po basin permeability to downstream migration of silver eels and assessment of the best deterrent or guidance systems to prevent their entry into hydro structures

A5 Plans of the priority interventions to restore river connectivity for eel conservation and Guidelines for the compliance of hydro structures with downstream migration of silver eels

B. Purchase/lease of land and/or compensation payments for use rights

C. Conservation actions

C1 Release to the sea of full sexually mature breeders (migrant silver eels) to increase the reproductive potential of wild population

C2 Development of a captive breeding program for eels larvae and release of juveniles into the wild.

C3 Realization of blue infrastructures on behalf of elvers and small eels upstream migration

C4 Realization of a downstream migrating silver eels deterrent/guidance device on Tresa River

D. Monitoring of the impact of the project actions (obligatory)

D1 Monitoring the effectiveness of the selected migrant silver eels of Action C1 to increase the reproductive potential of wild population

D2 Monitoring the effectiveness of the fish ladders built in Action C3 for upstream migration of elvers and of the system installed in Action C4 to protect downstream migrating eels from turbines

D3 Monitoring the results of the captive breeding program for juvenile eel stages (Action C2)

D4 Monitoring of the overall impact of the project

E. Public awareness and dissemination of results (obligatory)

E1 Information and awareness raising activities

E2 Technical dissemination and networking

F. Project management (obligatory)

F1 Project management and After Life activities

DETAILS OF PROPOSED ACTIONS

A. Preparatory actions, elaboration of management plans and/or of action plans

ACTION A.1: Technical-administrative activities to start the project and conclude agreements between the partners

Description and methods employed (what, how, where, when and why):

Realization of all administrative acts for the project activation as preparatory phase of the project management activities carried out in the context of the Action F1 *Administrative and technical management of the project*. RL, as coordinating beneficiary, is in charge of the management of the whole project, while each partner will be responsible for their own activities in the different Actions.

WHAT. The main activities carried out are:

1. **Sign of agreements between coordinating beneficiary and each of the 8 other partners**. The agreement establishes for each partner the acceptance of: the Grant Agreement, the role in the development of the project and its respective responsibilities within the different Actions.

2. **Internal project staff appointmentby each partner** to develop their technical-administrative activities in the project. Every partner staff will be lead by one project leader, supported by one technical and one administrative representative. The RL staff will lead the whole project.

3. **Preparation of tenders for the activities** (purchase of materials, external assistance ...) needed in the first year of the project. It is also foreseen the draw up of the contract for the Project Manager (PM) and for the Financial Manager (FM).

These two figures will assist the Project Leader of RL in:

i) managing the technical (PM) and administrative (FM) activities;

ii) checking and supporting the partners' technical and administrative activities;

iii) contacting the UE Life unit (Monitor, Technical and Administrative Desk Officers);

iv) supervising the development of the periodical project's reports for the UE Life unit.

4. **Steering Committee (SC) establishment**. The SC, lead by RL, is formed by technical and administrative delegates of each partner with the support of the Project and Financial Managers. With at least 5 meetings during the project (one in A1 Action and 4 in F1 Action), this committee is focused on the control and management of all the project activities.

5. **Coordination Committee establishment**its role is the solution of any problem and situation at institutional level (e.g. need to establish new regulations) to reach the project results. It will be established in Italy and Greece and meet at least five times in each area during the project (one in A1 Action and 4 in F1 Action) with the participation of partners and stakeholders with a role at institutional level.

In Italy it will interface with Consulta Po, an institutional body developed by Life project Conflupo, including by Po River basin Authority (technical secretariat) and Emilia-Romagna, Lombardy, Piedmont and Veneto Regions.

In Greece this Committee will include the partner Fisheries Research Institute– Hellenic Agricultural Organization DEMETER, and representatives from: Management Body of the National Park of Eastern Macedonia and Thrace, and Regional Authority of East Macedonia and Thrace.

HOW. 1. The 8 Agreement documents between coordinating beneficiary/Partner will be prepared by RL following the EU Life toolkits and will be signed by the project leaders of both parts. RL will also prepare the "LIFEEL Project Green Commitment" Document, establishing the commitment assumed by all the partners to apply **green procurement** and to prefer products and/or services of **officially recognized eco-labelling schemes** such as the **EU Ecolabel** through a clear delivery mechanism and defined criteria.

2. Each project partner will prepare an official document charging the internal staff working in the project, including a project Leader, who has the responsibility for the partner activities, and a Technician and an Accountant, responsible respectively for the technical and administrative activities.

3. The public tenders to hire the different collaborators and equipment needed in the starting phase of the project will be developed by each partner following the procedures prescribed by national legislation and Life guidelines. The selection for the external collaborators will be advertised maintaining the amounts foreseen by the project (these amounts are computed at a correct level for the requested performance) and will be based on their curricula, documented experience on project topic and Life projects management.

Project and Financial Managers: as for the previous Life projects managed by the Agriculture Department of RL, two specific figures of proven experience in the context of the LIFE program will be contracted as external assistance for the technical and administrative coordination of the project.

This is to ensure a valid contribution to the management of the project, also considering the commitment of the internal staff of RL, coordinating beneficiary, to ensuring the management of the numerous ordinary office activities. For this reason, the PM and the FM are not identifiable, except in very exceptional cases, within the team of employees of public bodies.

Regarding the assignments of PM and FM to external service providers, it should be emphasized that the PM must be entrusted immediately at the start of the project, therefore by October 2020.

This timing is not possible for the coordinating beneficiary (RL), because of the law Decree 50/2016: public administrations have to approve by the month of February of each annuity the annual schedule of purchases and supplies of goods and services that already have the necessary coverage in the financial statements.

So the procedure for the PM should be included in the tender program for February 2021 and would be effective no earlier than September 2021, after almost a year from the start of the project.

For this reason, following indication from EASME, the hiring of this figure will be taken in charge by GRAIA that, as private company, will be able to assure faster procedure, also with respect for EU and Italian legislation and assuring criteria of choice that identify a PM with a strong LIFE management experience.

4 &5.The delegates involved in the Steering Committee and in the Coordination Committees will be selected by the related partner with an internal procedure and assigned to the committees through a specific letter of engagement.

WHERE. The activities for the project management of each partner will be developed at their respective locations, while the meetings of Steering Committee will be mainly done at the headquarter of RL or using platforms (mail, Skype...) by decreasing the project's carbon foot print.

WHEN. In previous Life projects public bodies showed a constant difficulty in the completion of the acts necessary for the assignment of external tasks. Considering this possible gap it is believed that all the activities of Action A1, started at the beginning of the project (1/10/2020), can be completed on 30/06/2021.

WHY. This Action is of fundamental importance assuring both the initial project structure and the agreements for the starting of all the other activities. The management of the whole project will be proceeded in the

context of the Action F1.

Beneficiary responsible for implementation:

RL

RL through its administrative-technical staff leads the organization and guidance of the project management, Steering Committee and Italian Coordination Committee.
Other partners: responsible for their own activities and those of subcontractors; Fisheries Research Institute–Hellenic Agricultural Organization "DEMETER" is also responsible for the Greek Coordination Committee.

Assumptions related to major costs of the action:

As a note that applies to the whole project, we highlight that:

1. for each member of the **internal staff** the number of working days was calculated on the basis of the experience gained during the previous LIFE projects, while the daily rate is calculated on the basis of LIFE guidelines;

2. for **external assistance and equipment** the related costs were estimated with the carrying out of preliminary surveys, and on the basis of quotes and previous experience.

A1's PROJECT DELIVERABLE PRODUCTS

Deliverable name	Deadline
Agreements between Beneficiary coordinator and partners	12/2020
Minutes of the two first meetings of the Coordination Committee	06/2021
Minutes of the two first meetings of the Steering Committee	06/2021

A1's PROJECT MILESTONES

Milestone name	Deadline
Internal staff appointment	12/2020
Coordination Committee establishment	03/2021
Steering Committee establishment	03/2021
Nomination of the Project Manager	12/2020

A. Preparatory actions, elaboration of management plans and/or of action plans

ACTION A.2: Development of a user-friendly protocol for easy selection of sexually mature breeders (silver migrant eels) to be released in nature to increase the reproductive potential of wild population

Description and methods employed (what, how, where, when and why):

WHAT. Actually, the eel breeders moving downstream to reach the sea and migrate to Sargasso sea for spawning, are trapped in the Po (IT) and Nestos (GR) rivers delta by aquaculture farms using traditional downstream traps and are sold on the market, thus reducing the wild stock of breeding animals and the possibility of recovery of the species.

The silvering process - from the yellow resident stage to the silver migrating stage - is linked to morphological and physiological modifications related to the transition between fresh and saltwater, preparing the future spawners for the oceanic reproductive migration to Sargasso Sea (Han et al., 2003; Durif et al., 2005). This process is different between male and female eels:

a) **males** do not have sub-levels of sexual maturation passing directly from yellow to silver with no intermediate stage (Durif et al 2005, 2006; EELREP, 2006; Locatello et al 2018)

b) in **females**, Durif et al (2005) identified for Atlantic eel five stages to describe the silvering process (Fig.1):

- stages I and II: **yellow eels**, a growth phase in which the specimen are **resident**

In females the color shift (maturation from yellow to silver eels) is not a sufficient element for the identification of eels ready to migrate to the sea, so the silver eels are classified in two classes regarding their behavior:

- stages III: **silver eels** in **pre-migrant** phase, corresponding to the beginning of metamorphosis. Some morphological aspects are similar to migrating eels but present an incomplete sexual maturation. Artificial breeding tests (Mordenti et al., 2019) indicate that these individuals only rarely show spontaneous spawning, while they exhibit poor reproductive performance in terms of both eggs production and quality compared to migrant individuals.

- stages IV and V: **silver eels** in **migrant** phase.

Starting from the scientific work of Durif et al (2005, 2006) for Atlantic eels, and the preliminary ones of Mordenti et al. (2012, 2013), Emmanuele et al (2019) for eels of the Po delta lagoons, the aim of this action is to develop a simple and **user-friendly protocol** that can be easily used by fishermen/operators to identify the best migrant breeders (Stages IV and V) – in terms of sexual maturation – to be released into the sea as support to the recovery of wild population through the increase of the number of viable offspring produced.

This protocol will be also used during the LIFEEL project to identify the best migrant broodstock to be released into the sea (C1) as support of wild, as well as to choose the specimen to de used both in the captive breeding program developed within C2, and used at Creva dam (D4) to test and than maximize the efficacy of the first deterrent system positioned in Italy to prevent the entry of eels into the power plant turbines.

HOW. Wild eels caught for commercial purposes in Po and Nestos delta in Autumn 2020 will be selected by UNIBO staff following two modalities:

► after a visual pre-selection of females, excluding all immature (yellow eels) animals, a total amount of 1000 females and 60 silver males will be collected from Italian and Greek areas (half from Italy and half from Greece) and transferred to dedicated facilities. Equipment for sampling will include specific fish-transport tank, diving suits, boots, hand nets, gloves and plastic containers of different dimensions. Oximeters, thermometers and electro-fishing equipment will be also necessary.

All the female eels will undergo biometric analysis to obtain most important external indexes for gonadic maturation (*Silver Index*). Principal morphometric parameters will include body length and weight, eye diameter horizontal and vertical and pectoral fin length. Some additional parameters (head length, vertical and horizontal body diameter) will also be registered, and to better characterize the population, age of all eels will be determined collecting some scales.

Once morphometric indexes will be defined, most of females eels (970) will be released in the original areas, while remaining 30 eels, presenting highest silvering index, will be kept at the University laboratories and used with the 60 males for artificial reproduction; this reproductive test will be used to monitor the effectiveness of the indexes developed to select breeders able to increase the reproductive potential of wild population thanks to the production of viable eggs and larvae.

►From an additional 200 silver eels (100 for each of the two areas)- suppressed by the fish farms for commercial purposes- the same indexes described in previous point will be calculated, and the gonads will be collected for gonado-somatic index (GSI) calculation, that will allow to get to a complete definition of the protocol.

These actions are not necessary for males selection, as it has been widely proved (Durif et al 2005, 2006; EELREP, 2006; Locatello et al 2018) that males do not have sub-levels of sexual maturation, passing directly from yellow to silver with no intermediate stage.

Required material will include not only closed recirculating system, but also scales, ichthyometers, gloves, lab coats, reagents for anesthesia of eels and samples preservation, plastic containers of various dimensions and data carriers for data storing.

Once defined, the **user friendly protocol** will be distributed (Actions E1, E2) to professionals (fishermen, Protected Areas, public entities involved) as a program for laptop; it will be also made downloadable from the project website to increase its diffusion and use.

Training activities for users will be promoted in the Italian and Greek project areas (E1).

WHERE. All fishing campaigns will be performed in the Italian and Greek brackish water lagoons.

The setting of the non-invasive operating protocol aimed at identifying best breeders to be released to the sea and to be included in artificial reproduction will be performed at facilities in Greece and at UNIBO in Cesenatico.

WHEN. From Oct to Jan 2020 fishing campaigns will be performed, to collect broodstock from IT and GR coastal areas.

From January to June 2021 all analyses necessary for the definition of the protocol for migrant breeders identification will be performed at UNIBO.

In August2021 the user friendly protocol will be released and distributed.

WHY **This action counts towards the 25% concrete conservation actions requirement**, because it is necessary for the project considering the high impact for species conservation. The protocol is based on many morphological parameters of wild female silver eels and has therefore a better predictive value with respect to real silvering stage. Therefore, it warrants the identification of subjects reaching full sexual maturation and ready for migration to the sea. The release of best migrant breeders will increase their chance to end seawater spawning migration. Also, breeders with high sexual maturation grade included in artificial reproduction protocol will increase quality and quantity of produced eggs.

Beneficiary responsible for implementation:

UNIBO

PVPO, PDPO and UNIFE will support the activities in Italy, DEMETER in Greece.

Assumptions related to major costs of the action:

For each member of the internal staff the number of working days was calculated on the basis of the experience gained during the previous LIFE projects, while the daily rate is calculated on the basis of LIFE guidelines;

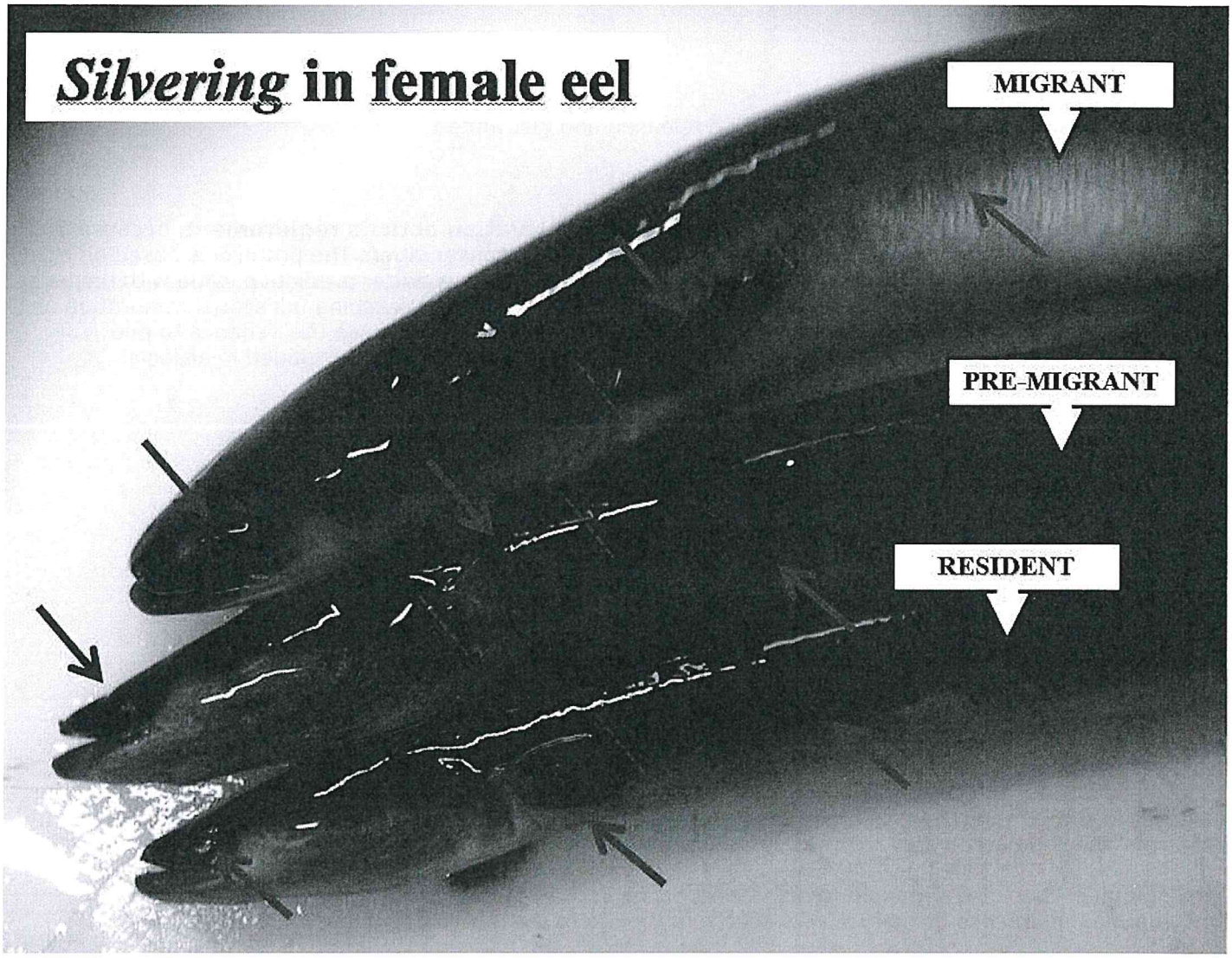
For external assistance, equipment and price for the purchase of part of eel breeders to release, the related costs were estimated with the carrying out of preliminary surveys, and on the basis of previous experience.

PVPO has in charge the purchase of necessary sample of sivler eels. It will buy them through agreement with fish farms: the estimated costs are of about 16 Euro/kg.

DEMETER must purchase a module for fish transport (which will be permanently dedicated to nature conservation), in order to delivery silvers eels from Greece to the laboratory of UNIBO: 4,000 euro

UNIBO will perform its laboratory work without charching the costs for consumables on the LIFE Project.

Name of the picture: Fig. 1 - Silver Index



A2's PROJECT DELIVERABLE PRODUCTS

Deliverable name	Deadline
Protocol for the identification of sexually mature breeders	08/2021

A2's PROJECT MILESTONES

Milestone name	Deadline
Silvering analysis performed	06/2021
End of the sampling phase	01/2021

A. Preparatory actions, elaboration of management plans and/or of action plans

ACTION A.3: Design of eel specific fish passes to reopen over 1,000 km of habitat for free upstream migration of elvers

Description and methods employed (what, how, where, when and why):

WHAT. The definitive-executive designs will be realized and all the necessary authorizations will be obtained for the construction of 7 elver and eel specific passes (Fig. 1): 6 in Italy on Panaro River (3) and in the Po Delta (3) and 1 in Greece on Nestos River. The aim of the action is to restore the natural free upstream migration of elvers from the sea in sites whose location is strategic to reopen the entire Po river catchment basin (in Italy) and the portion of Nestos River naturally suitable to eel (in Greece) to the free upstream migration of elvers.

At the end of the preparatory action A3, on which depends the concrete action C3, the definitive-executive designs of the 7 eel passages will be realized and all the necessary permits to construct them will be obtained.

HOW. A multitask design team (GRAIA) will be constituted, mainly including the following skills: engineers with a long experience on river connectivity restoration and with experience on eel specific passages design; ichthyologists expert in fish fauna and river ecosystems management and eel conservation; engineering draftsman, expert in CAD and GIS design; biologists, expert in freshwater and brackish water ecology; naturalist, expert in environmental and landscape assessment. DEMETER technicians will participate to the design of the Nestos fish pass to acquire the skills in order to replicate this type of intervention in other similar cases in Greece.

The design team leader (senior engineer, CEO of GRAIA) will collaborate with RER and DEMETER in order to perform all the necessary red tape to obtain the permits for these blue infrastructures realization. The Feasibility Study annexed to the proposal (see ANNEX A3) reveals that all the eel passes will be constructed on public land, on property in eminent domain; the territorial Competent Authority for permissions and also the owner of the land involved in the interventions, is the same for all the six Italian blue infrastructures, that is RER, direct responsible for C3; the same situation is in Greece, where DEMETER will work with the local public authorities involved in the permission procedures (the local hydraulic authority supports the project with form A8); that's the reason why we don't foresee any difficulty or delay in this respect. Hydraulic permissions will be also necessary for all the infrastructures; the Italian Competent Authority is AIPO, which already supports the project, as its Form A8 shows. As a regard to any protected areas involved, the Feasibility Study reveals that: 3 intervention sites are located within Nature 2000 sites. The Environmental Implications Assessment under the Habitats Directive 92/43/EEC or, as an alternative, its exclusion procedure, will be performed for these sites, in accordance with the management bodies, which are anywhere coordinated by RER, responsible of this action and which represent the management body of the Nature 2000 sites in all these cases. The Landscape Evaluation procedure will be also performed at all the sites, as it's necessary in order to verify the congruence with the fluvial constraint and other site-specific constraints highlighted in the Feasibility Study. No other permissions are required.

At the 7 impassable obstructions, the definitive-executive designs will be realized, including topographic surveys, environmental and landscape reports. The designs will define, for each eel pass: type of eel pass to be realized, position, materials, slope, total length, width, discharge through the pass, dimensions and accessibility of the monitoring cabin (if foreseen), and the analytical list of costs. Depending on local conditions, the eel pass will be designed including a monitoring cabin: the feasibility study indicates 4 eel passes equipped with a monitoring cabin, but only the definitive designs will definitely decide if and where it will be possible. About the risk of IAS spread upstream the fish passages, the particular and species specific typology of the eel fish passes will avoid the passage of other fish. In the cases of the fish ramps, the ex-ante monitoring will evaluate the fish community composition of the stretches and, if the risk of IAS spread will be

real, the slope of the ramps will be planned in order to be selective for the eel passage only. The decision will be taken in the Steering Committee, following the results of the ex-ante monitoring.

In Greece the planning will be done involving the local technicians to transfer the specific skills in fish pass design and monitoring, as they still generally lack.

For the necessary permissions, please see Picture RP7.

WHEN. In the light of the experience in designing, authorizing and constructing fish passes, it is believed that 1 year and a half is necessary for the different phases of the design process and for the consecutive approval of the project through the obtainment of the compulsory authorizations and the draft of the executive-design.

WHY. The reason why restoring eels and elvers free upstream migration in the selected intervention sites will be explained in C3. Here we explain the reason why restoring longitudinal connectivity must be a key goal for eel conservation. Its relevance is highlighted in the national Eel Management Plans and it's based on (EC) No 1100/2007, Art. 2.8. Moreover, the Po basin, because of its extent and the historical and cultural reasons that bind the eel to the basin, is a particularly critical area for the conservation of the species. Its diadrome nature makes eel compulsorily bound to the connectivity of its entire home range.

To clarify the necessity of building an elver (and small eels) specific fish pass, it has to be taken into account that: eels present a special case in terms of arranging free passage. Elvers and small eels, which are the stages that it is essential to pass upstream, are very poor swimmers compared to the adult stages of other fish that migrate upstream. Eels are not capable of jumping. While elvers can be good climbers in appropriate circumstances, once a vertical barriers is greater than the equivalent of 50-60% of their body length then it becomes impassable (Armstrong et al., 2010). Eels, especially females, can actively migrate for a number of years during which they can occupy a considerable range in size between ≤10 cm to >50 cm.

LITERATURE CITED

Armstrong G. S., Aprahamian M. W., Fewings G. A., Gough P. J., Reader N. A., Varallo P. V. 2010. Environment Agency Fish Pass Manual: Guidance Notes On The Legislation, Selection and Approval Of Fish Passes In England And Wales. 369 pages

Beneficiary responsible for implementation:

GRAIA

GRAIA is responsible for the design; RER is responsible for conducting the project approval procedures in their respective administrative areas; UNIFE gives a scientific support to the design; DEMETER is responsible for conducting the project approval procedures in its administrative areas.

Assumptions related to major costs of the action:

The estimation of the personnel costs are based on the decades of experience on the fish pass desing gained by GRAIA team. The personnel daily rates are calculated on the basis of LIFE guidelines.

The costs for RER personnel (7,946 euro) referes to the necessary administrative work for preparing the authorizing documantation ncecesary for the realization of n. 6 infrastructures;

The costs of GRAIA personnel (44,500) and Ext. Ass (36,000) refer to the designers, who have to design n. 7

eel-passes, one of them in Greece.

That's why travels are relatively high in this action: 5580 Euro for the designers and other technica personnel surveys, inspections, visits on intervention sites.

Also DEMETER charges personnel costs and travels, in order to permit its researchers to follow the work of the designers and learn their skills in designing ee-passes.

Name of the picture: Picture RP7: Necessary permissions.

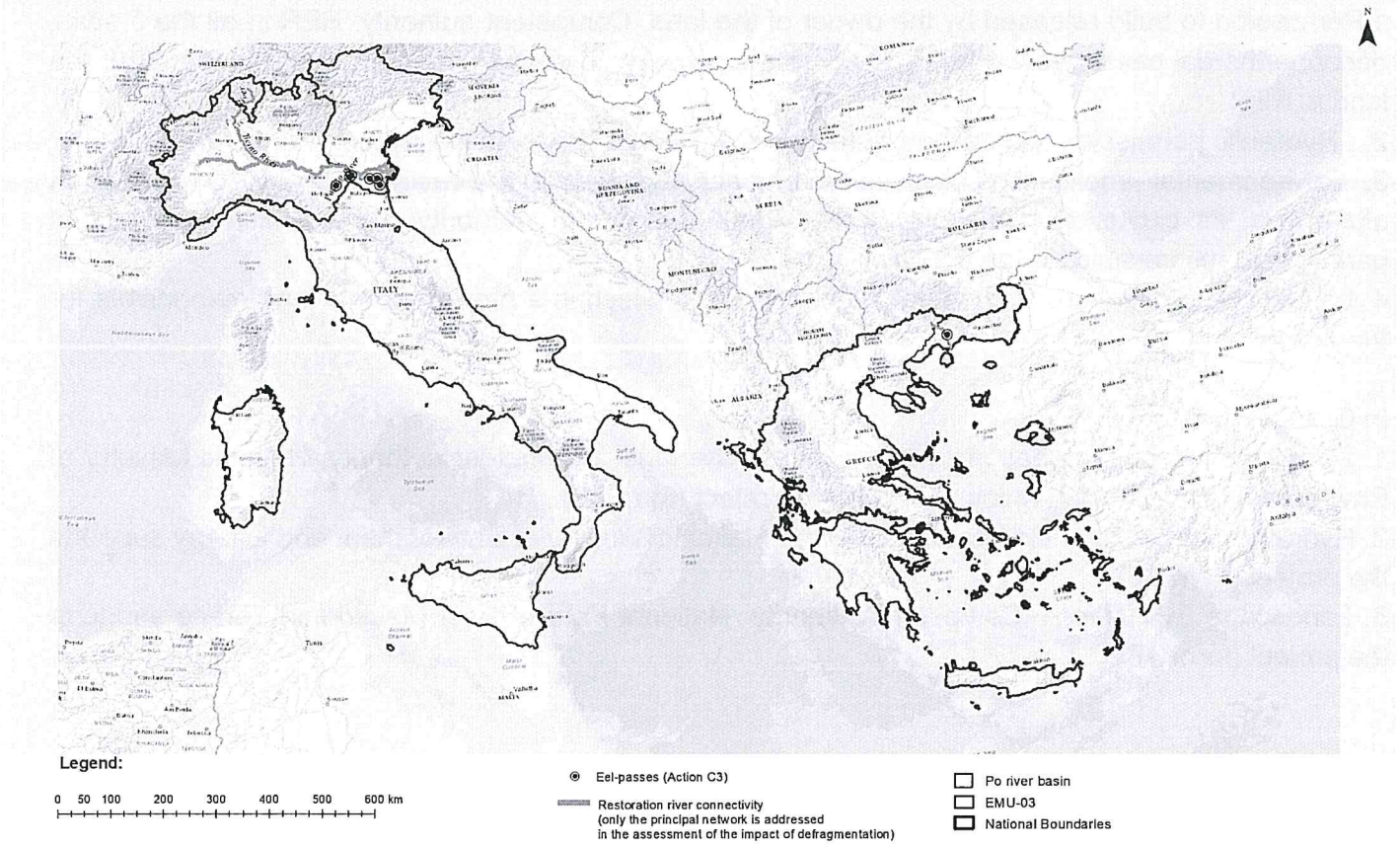
RP 7 - Necessary permissions

To construct the eel passages the following permissions are necessary:
In Italy:
1.Permission to build released by the owner of the land. Competent authority: RER in all the 6 sites, because the eel passages will be realized on the property in eminent domain, thus the owner of the land is RER.
2. . Hydraulic permission. Competent authority is AIPO that supports the project (Form A8)
3. Environmental Implications Assessment under the Habitats Directive 92/43/EEC or, as an alternative, its exclusion procedure (three sites). Competent Authority: RER, which is a project partner and responsible for the action.
4. Landscape Evaluation. Competent Authority: RER, which is a project partner and responsible for the action.

In Greece:
1. Permission to build released by the owner of the land. Competent authority: Hellenic Ministry of Environment and Energy, which supports the project (form A8).
2. Hydraulic permission. Competent authority: Hellenic Ministry of Environment and Energy supports the project (form A8).
3. Landscape Evaluation. Competent authority: National Park of East Macedonia-Thrace supports the project (form A8).

Name of the picture: Sites of intervntion for the realization of n. 7 eels-elvers passes

Action A3. Eel-passes



A3's PROJECT DELIVERABLE PRODUCTS

Deliverable name	Deadline
Definitive-executive designs of the 7 elvers and eels passes	03/2022

A3's PROJECT MILESTONES

Milestone name	Deadline
Design for the 7 elvers and eels passes approved	03/2022

A. Preparatory actions, elaboration of management plans and/or of action plans

ACTION A.4: Analysis of the Po basin permeability to downstream migration of silver eels and assessment of the best deterrent or guidance systems to prevent their entry into hydro structures

Description and methods employed (what, how, where, when and why):

WHAT. Once in a lifetime, eels get mature and become silver eels, ready to spawn at the Sargasso Sea and then to die there, after delivering offspring. Thus, to complete their life cycle silver eels must migrate downstream the rivers to reach the sea. The requirements relating to the safe passage of the European silver eel (Anguilla anguilla) through barriers such as hydros are currently increasing because the eel population has been in dramatic decline in the Po basin and all over its European range. Damage to downstream migrant silver eel passing through turbines at hydroelectric facilities can be high and is mostly due to mechanically-caused injuries because of their elongated morphology (Monten, 1985; EPRI, 2001; Larinier and Travade, 2002; Travade and Larinier, 2006). Various types of physical screening and also behavioural barriers based on light, sound and electricity have been tested, but none of them has proved both biologically effective and economically acceptable (Boubée and Williams, 2006; Travade et al., 2010; Walker, 2015). In order to develop effective technologies, we need to understand better the downstream migration of the eel and its behavioural response at hydroelectric water intakes. We therefore identify, two main operative objectives: 1. Draft a clear frame of the threat in the Po river catchment basin, mapping and characterizing every hydro structure in order to evaluate its damage level for eel and the possible compliance strategies; 2. Collect the main experience gained on deterrent or guidance systems all over the world by other research groups, to realize the first demonstrative intervention in Italy at Creva dam, also effective to reach information about silver eels behaviour (Action D.2).

The action will be performed in two sub-actions:

Sub-action A.4.1 – Drafting of the first "Guidelines for the compliance of hydro structures with downstream migration of silver eels" in the Po basin;

Sub-action A.4.2 – Design of the first demonstrative deterrent/guidance system device to prevent the entry of downstream migrating silver eels into hydro structures.

HOW. A.4.1. This work will be performed by RL and GRAIA. RL will realize the collection of the geographical, territorial and technical data about the hydroelectric facilities (and also other hydro facilities), necessary for the following phases, also through an external assistance. The census of hydro structures will extent to the "Priority fluvial corridor for the conservation of eel" defined under Action A.5.

GRAIA will carry out a reasoned updated review of the deterrent / guidance systems currently available to protect eels from their entry into hydro facilities, highlighting both the good and bad points of each device with particular regard to the dependence on site-specific environmental and technical conditions; GRAIA will also carry out the characterization of the structures detected and described by RL ext.ass., the assessment of their potential damage and the identification of the best strategies of compliance with safe downstream migration of silver eels, on the basis of the site-specific data. All the data will be recorded in the same geodatabase created under Action A.5. all this work will be included in the Po basin first "Guidelines for the compliance of hydro structures with downstream migration of silver eels". RL will activate contacts with hydroelectric farms and other water resource users during the census and then it will involve them in no less than n. 2 meetings (n.1 meeting for the presentation of the work and n.1 meeting for the discussion on the draft of the Guidelines).

WHERE. The sub-action will cover the Po basin in its extent as a whole, referring to the "Priority fluvial corridor for the conservation of eel" defined under Action A. 5.

WHEN. It will be carried on in the first year and a half of the project.

A.4.2 – Design of the first demonstrative deterrent/guidance system device to prevent the entry of downstream migrating silver eels into hydro structures.

The design area will be Creva dam (on the Tresa River, Lake of Lugano emissary and tributary of Lake Maggiore), whose selection is strategic for the reasons explained in the B2 Form, describing the project area.

HOW. While the reasoned review of the deterrent/guidance types of devices for silver eels is carried out under sub-action A.4.1., the characteristics, design and technical data of the dam and hydropower plant will be collected and recorded, in order to establish the site-specific conditions, essential for the design of the device.

EGP, owner of CREVA dam and hydroelectric facility, and cofinancer of the project, has already approved the aim of LIFEEL project (FORM A.6) and will share all the necessary information and give the logistic support and permits to get to the dam and realize the actions A.4 and C.4.

The design will define the best deterrent type (now indicated in barriers based on guidance lights, eventually integrated with other solutions) and a calibration program necessary to define the best settings of the device (e.g. number and distance between lights, their distribution along the water column and/or position over the water surface, the use of particular lights as stroboscopic or led lights; the timing of lighting; and so on...), which will request a specific predisposition of the device to various adjustments.

For the installation of the deterrence device the only authorization needed is from ENEL GREEN POWER, co-financer of LIFEEL, already supporting the action.

WHERE. The design area is Creva Dam (see location in Fig.1).

WHEN. The design of the deterrent/guidance device at Creva dam will be completed and approved by EGP by the end of March 2022.

WHY. European Council Regulation no. 1100/2007 establishes measures for the recovery of European eel stocks that include the requirement for all member states to reduce the anthropogenic mortality factors. Several studies confirm that the downstream migration behaviour of eels is strongly threatened by hydropower facilities, water intakes and outfalls. When water is abstracted from surface water bodies, there is a risk that eels (and other fish and organisms) will be drawn in. This may prevent silver eels from migrating naturally, transfer them to harmful environments and cause death or injury to eels at screens, turbines and pump mechanisms (Haro et al., 2000; Behrmann-Godel and Eckmann, 2003; Brown et al., 2009; Travade et al., 2010). The Guidelines drawn up and the first experience of scientifically design (Action A.4), installation and calibration (Action C.4) of a deterrent system at Creva will set out detailed advise and updated guidance on prevent silver eels mortality at hydro structures and will support governance of the Po river catchment basin.

The action counts towards the 25% concrete conservation actions requirement.

Beneficiary responsible for implementation:

GRAIA

RL will collaborate for the hydroelectric power plant structures surveys and data collection, and to the drafting of the guidelines.

Assumptions related to major costs of the action:

The main costs of the action derive from intellectual work of GRAIA technicians:

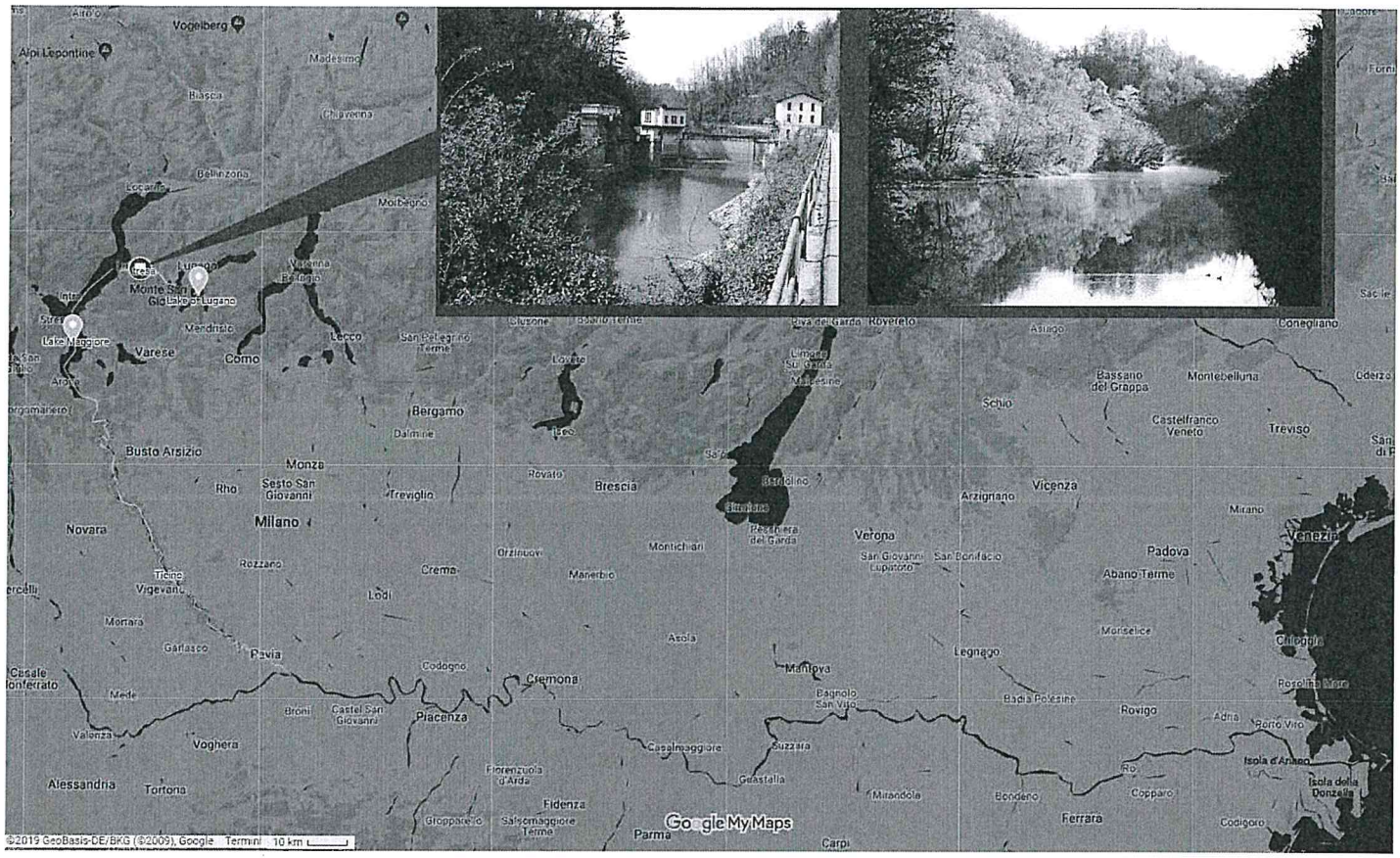
about 53,000 Euro for the costs of n.5 personnel and an additional external asssitance as Advisor for the census and characterization of hydroelectric plants in the study area (40,000 euro).

A great work of contact with Hydropower Agencies, of surveys, of digital archiviation of data, of data collection as been done, considering that the plants present in the study with are potentially critical for eels are hundreds.

Another important work is the design of the deterrent systema.

For all these porposes a multitasking woring group is necessary.

Name of the picture: Fig. 1 - Creva Dam location



A4's PROJECT DELIVERABLE PRODUCTS

Deliverable name	Deadline
Design of the deterrent/guidance device for silver eels at Creva Dam	12/2021
Geodatabase of hydroelectric and other hydro facilities of the "Priority fluvial corridor for the conservation of eel"	12/2021
Guidelines for the compliance of hydro structures with downstream migration of silver eels	12/2021

A4's PROJECT MILESTONES

Milestone name	Deadline
The design of the deterrent/guidance device for silver eels at Creva Dam has been approved by ENEL GP	03/2022

A. Preparatory actions, elaboration of management plans and/or of action plans

ACTION A.5: Plans of the priority interventions to restore river connectivity for eel conservation and Guidelines for the compliance of hydro structures with downstream migration of silver eels

Description and methods employed (what, how, where, when and why):

WHAT. The commitment of the project in the field of restoring the longitudinal connectivity on behalf of elvers and small eels upstream migration is not only about the concrete defragmentation of 7 artificial barriers (however strategic) with Action A.3. Indeed, this action expands its temporal and spatial horizon towards eel long term conservation, designing priority plans of defragmentation of the entire Po river plain catchment basin in IT and of the entire EMU-3 in GR on behalf of elvers and small eels migration, which represents a mandatory behavior in the eel's life cycle.

The action will be performed in two sub-actions:

Sub-action A.5.1 – Plans of the priority interventions to restore river connectivity for eel conservation;

Sub-action A.5.2 – Guidelines for the compliance of hydro structures with downstream migration of silver eels.

HOW. A.5.1. The Plan will be drawn up through a step by step process, starting from a catchment-wide assessment and then coming to detailed studies and surveys of individual sites, in order to identify the priority actions and to draw a detailed plan of the most urgent facilities to be realized. In IT and in GR the activity will be developed in the same way, at first the Po river hydrographical network in IT and EMU-3 river basins in GR of main interest for eel conservation will be defined in detail, on the basis of a deep literature and data research and screening; GRAIA and UNIFE will collaborate to the collection and analysis of data in IT, DEMETER will do the same in GR. All the data about eel historical and current presence will be recorded in a geodatabase, developed in ESRI ArcGIS (and also implemented under Subaction A.5.2, which focuses on the obstacles and threats to downstream migration of silver eels), in order to describe and compare the potential and the current distribution of eel and to define the "Priority fluvial corridor for the conservation of eel" at the scale of the Po basin as a whole.

In a second phase all the data about obstructions to the migration of eel will be recorded within the "Priority fluvial corridor for the conservation of eel", through a literature search and field work, also integrating the data collected within Subaction A.5.2, and taking advantage of the collaboration and mediation of RER and RL in IT with the concessionaires of water transfers for the collection of the necessary data for the study. The overall assessment of obstructions to up- and downstream migration in the catchment context will be then realized. At the following step all the cognitive elements necessary to define a scale of priorities of intervention collected will be elaborated and assessed on the basis of territorial, environmental, ichthyologic, technical and economic information, placing on the balance costs and benefits of each intervention, in terms of the benefit for the conservation of the species. All structures will be classified first according to the level of problem they represent for elvers and small eels migrating (no obstruction, slightly difficult, moderately difficult, very difficult, impassable), the extent of the fluvial corridor potentially re-opened, the territorial and technical constraints, the costs estimated for the construction of an efficient elvers pass or a deterrent/guidance system. This will allow identification of the structures for priority attention (construction of elvers and eels passes or deterrent/guidance systems) as well as a range of other actions that might arise during the study.

Each artificial barrier will be mapped and characterized with a fact-sheet providing the type of solution planned for elvers and eels pass.

Preliminary designs will also be elaborated for the first 5 priority interventions.

When the plan is ready in IT, it will be presented, shared and proposed for approval to the Po river Consulta Pesca (which has already expressed its support to LIFEEL; see Form A8). This body of interregional governance of the Po River was created through an agreement signed in June 2017 by the Po river Basin Authority and the 4 regions of the Po (Piemonte, Lombardia, Emilia-Romagna, Veneto). It started from the activities carried out by the technical table on sustainable fishing carried out within the LIFE Con.Flu.Po LIFE project.

When the plan is ready in GR, it will be presented, shared and proposed for an inclusion in the EMP of the EMU-3.

A.5.2. The "Guidelines for the compliance of hydro structures with downstream migration of silver eels" is a technical guide deriving from the experience coming from the Subaction A.4.2 – Design of the first demonstrative deterrent/guidance system device and mostly from the monitoring of its efficacy (D.2.2). The guidelines will be targeted to the hydro power plants companies, at first Enel Green Power cofinancer of this project, and the major Italian companies too (Edison, A2A, Iren and other). The guidelines, will be a tool for the engineers and biologists involved in the revamping of hydro power plants and in the eventual planning of new ones, giving the necessary attention to eel downstream migration and offering a potential mitigation measure helping the aim at sustainability of the plants. At the same time the guidelines will be a reference tool for the public officials involved in the permit granting, so that the deterrent/guidance systems application will be mandatory. The Guidelines too will be presented, shared and proposed for approval to the Po river Consulta Pesca in IT, and they new skills and experience will be shared with DEMETER researchers, that will participate to the main phases in the drafting of the guidelines.

WHERE. In IT the plan will cover the Po basin in its extent as a whole, in GR it will cover EMU-3.

WHEN. The Plan and the Guidelines will be developed in the first two years of the project (draft). Otherwise the results of the monitoring activities (D2) are crucial for the completion of both the documents, so they will be ready in the final story in October 2024 and approved by the end of the project in December 2024.

WHY. This action is functional to ensure the sustainability of the project in terms of continuity of action towards the river connectivity restoration. The discussion and sharing of the Plan and of the Guidelines by the Po River Consulta Pesca will be the main signal of this sustainability.

This is the reason why the action counts towards the 25% concrete conservation actions requirement.

Beneficiary responsible for implementation:

GRAIA

Every partner will be responsible of the specific parts developed in the Action that are of their own competence. Technical partner will collaborate to the draft of the Guidelines. RL will promote it in institutional contexts
DEMETER will develop its Plan and it will promote it in institutional contexts

Assumptions related to major costs of the action:

The main cost of the action refer to the personnel, considering the extent of the study area and the need of both a hard office and field work.

this action includes an hard work of ricognition, data elaboration and study, it alco foresees the participaticion of all the partners.

A5's PROJECT DELIVERABLE PRODUCTS

Deliverable name	Deadline
"Guidelines for the compliance of hydro structures with downstream migration of silver eels- final rev.	10/2024
Plan of the priority interventions to restore river connectivity for eel conservation in GREECE - final rev.	10/2024
Plan of the priority interventions to restore river connectivity in the Po basin for eel conservation (ITALY) - final rev.	10/2024

A5's PROJECT MILESTONES

Milestone name	Deadline
Plan and Guidelines approved by the competent Authority	12/2024

C. Conservation actions

ACTION C.1: Release to the sea of full sexually mature breeders (migrant silver eels) to increase the reproductive potential of wild population

Description and methods employed (what, how, where, when and why):

WHAT. This action contrasts the fishing impact on mature breeders (migrant silver eels) - that are caught for commercial purpose in the Po delta, in Italy, and in the Nestos delta, in Greece - increasing the reproductive potential of the wild eel population, through the release to the sea of a relevant part of captured fully mature migrant breeders (migrant silver eels), selected with the user friendly protocol developed within Action A2.

This considering that, as described in Action A2, despite the color many silver eels present an incomplete sexual maturation and have to be classified as pre-migrating. The monitoring of the capacity of the migrant eels to support the wild stock will be demonstrated in Action D1 by assessing on a subsample, their capacity to: i) produce viable eggs and vital larvae; ii) begin their migration back to the Sargasso Sea to spawn.

In critically endangered populations like eel (99% decline of European stock since 1980s) a fundamental direct conservation measure is the improvement of their spawning stock to increase the number of viable offspring produced.

It has also to be considered that in some species the adults need a long maturation time to become fully mature breeders, so the importance of these individuals for the conservation of the species is of high "value" as reported by Crouse et al, 1987 for loggerhead sea turtle:

Stage/Value: Egg/1; Hatchling/1; Young small/1.4; Young Big/6; Sub-adult/115.8; Breeder/568.8

The importance of these fully mature migrant breeders is more effective in the case of eel (e.g. Ciccotti, 2007), considering that: i) sexual maturation occurs between 7 and 15 years; ii) only fully mature females produce eggs; iii) they face a long migration (6.000 km) to reach the spawning areas; iv) the breeders death after only one reproduction in the Sargasso sea.

Regarding the release of silver eels:

In Italy the traditional valliculture in the Po River delta identifies the natural development of eels till to silver stage, which takes place within lagoons managed only regarding water handling. These managed lagoons included in the Emilia-Romagna and Veneto Regional Parks of the Po delta maintain the most important stock of wild eels assuring the best growth and sexual maturation for eels (Castaldelli et al., 2013; Dezfuli et al., 2014; Giari et al., 2015; Aschonitis et al., 2017).

The Italian National Management Plan includes different measures to achieve the required target of 40% of emigration of silver eel, level referred to the pristine conditions before 1980. To reach this, Emilia Romagna and Veneto have planned a reduction of fishing effort and restocking.

In Veneto was hypothesized the possibility of letting go the silver eel by opening the traps used in the managed lagoons (Iavorieri), but, to our best knowledge, never adopted.

In Emilia-Romagna the Po Delta Park, under the supervision of UNIFE, began in 2017 and increase in 2018 and 2019 the release of some quintals of silver eel from the Comacchio Lagoon to the sea.

In Greece eel fisheries is limited to the capture of silver eels during their spawning migration to the Sargasso Sea, or yellow eels only in Western Greece as part of the local tradition.

Fisheries is performed by Fishing Cooperatives and the majority of eels are caught in the lagoons with permanent traps of wooden sticks hammered into the lakebed sustaining a net of reeds; most of these were replaced after 1980 with cement installations as the Italian "vallicultura".

Following the Hellenic Eel Management Plan the Fishing Cooperative are releasing the 30% of the annual eel production (Koutrakis et al., 2007; Koutsikopoulos et al., 2009).

Both in Italy, with a gap in the release of the silver eels, and in Greece, where a release of 30% takes place, there is still a lack: till now the released subjects are not chosen on the basis of the sexual maturation stage. This mean that some silver eels, at the pre-migrate stage, could be not yet ready to migrate and contribute directly to the wild stock reproduction.

HOW. in the last 4 years of the project (2021 – 2024):

On the **Italian side** the main goal of this Action will be to spread out the initiative of the Po Delta Park of the Emilia-Romagna with:

a) the release to the sea of 10.000 migrant silver eels chosen of the basis of the protocol developed in Action A2 (***see RP8***). These specimens will be chosen from:

Emilia-Romagna: the eels from Comacchio lagoon, managed by the Po Delta Park, will be obtained free of charge, others from private lagoons Valle Bertuzzi-Valle Nuova will be paid about € 20/kg

Veneto: the 3 involved lagoons (San Carlo, Ca Pisani, Ca Zuliani) are private and the breeders will be purchased for an estimated value of € 16/kg.

A sample of this group will be tagged with external flags and fitted with sonic tags to monitor in Action D1 its capacity to actively migrate and support the reproduction in nature.

b) the creation of a mechanism able to stabilizing this action of liberation of migrant silver eel from both public and private managed lagoons, also thanks to the support provided by the Coordination Committee.

On the **Greek side** the main goal of this Action will be to increase the number of migrant silver eel in the 30% of eel production released. This will be reached thanks to the direct involvement of the local Fishing Cooperative and the spread out of the use of the protocol developed in Action A2.

A quote of about 1.200 eels will be bought for project activities at estimate price of € 16/kg from the Fishing Cooperative of estuarine system of Vistonida and of Mesolongi – Aitoliko lagoons; this group will be tagged with external flags and fitted with pop-up tags to monitor in D1 the capacity of the chosen migrant silver eels to actively migrate and support the reproduction in nature.

WHERE. This action will be carried out for Italy in the involved lagoons of Po Delta Park of the Emilia-Romagna (Comacchio lagoons) and Po Delta Park of Veneto (San Carlo, Ca Pisani and Ca Zuliani lagoons); for Greece actions will take place in Lake Vistonida, which is the main eel productive lagoon in North Greece, but in order to achieve the desired number of eels, tags will be also placed on eels released from lagoons in Western Greece

WHEN. The protocol for the selection of the best migrant eel breeders will be developed by August 2021, so the selection and release at sea will be carried out in the last quarter of each year from 2021 to 2024. The rest of the time will be dedicated to the elaboration of all the data and reporting. The aim of the project is also to extend and increase the release of breeders beyond its term and post-Life activities.

WHY. **This action counts towards the 25% concrete conservation actions requirement**, because the release of mature migrant silver eels to improve the wild eel spawning stock and increase the number of viable offspring produced, represent one of the main goal of the project and of the European and National management plans.

Beneficiary responsible for implementation:

UNIFE

UNIFE for Italian side and Fisheries Research Institute DEMETER for Greek side will lead the silver eels selection and release. PVPO, PDPO and UNIBO will support the activities in Italy

Assumptions related to major costs of the action:

the main costs in this action are due to:

1. personnel costs of UNIFE, scientifical and techincal responsible for the action, PVPO, PDPO and DEMETER;

2. extearnal assistances, to assure a large amount of hte best migrant silver eels to the project:

a. to assist PVPO in purchasing, selecting and handling eels, a biologist expert in fish conservation and fisheries management.

b. to the purchase (PDPO, PVPO, DEMETER) of silver eels to be released in the wild (about 20 Euro/kg in the area of Comacchio and PDPO; for about 16 Euro/kg in the area of PVPO and in Greece).

UNIBO will contribute to this action without charcing any personnel costs on it.

About the difference in costs for purchase of eels, we highlight that this difference from the Comacchio Valleys compared to the ones from Veneto and Mesta-Nestos basin and connected coastal lagoons, in Greece, is indicated on the basis of a market survey carried out in the last five years. The difference is due to the historical, cultural and culinary traditions, entirely site specific, as well as other local factors such as per capita wealth. The culinary traditions of Comacchio Valleys, founded on eel above all, make them a draw for tourists from all over Italy and from around the world

Name of the picture: RP8 - reasoning behind transporting 10,000 migrant silver eels from the lagoons to the sea

RP 8 - reasoning behind transporting 10,000 migrant silver eels from the lagoons to the sea.

The choice to invest resources for releasing eels from traditional extensive aquaculture in the Italian, locally called valliculture, and Greek river delta, was made to ensure the release of the best animals available for breeding purposes. In fact in these areas the eels grown in completely natural conditions and are not affected by parasitosis or exposed to any chemical disturbance, considering that pollutants that can cause endocrine interference, so the eels shown excellent features for their reproductive fitness. Once released, at the mouths of the canals, silver eels will migrate to the Sargasso Sea where, after reproducing, they will die. The positive response expected in subsequent years is an increase of glass eel returning to the Po delta. Therefore, their release is configured as one of the most incisive actions for increasing the reproductive success of the species and therefore a significant increase of the glass eel landing also in the Po Delta.

C1's PROJECT DELIVERABLE PRODUCTS

Deliverable name	Deadline
Photos, videos and miutes of the releases	12/2024
Report on the activities of release of silver eels to increase the wild population migrating quota	12/2024

C1's PROJECT MILESTONES

Milestone name	Deadline
Release in the sea of selected fully mature eel breeders	12/2024
Release in the sea of selected fully mature eel breeders	12/2021
Release in the sea of selected fully mature eel breeders	12/2022
Release in the sea of selected fully mature eel breeders	12/2023

C. Conservation actions

ACTION C.2: Development of a captive breeding program for eels larvae and release of juveniles into the wild.

Description and methods employed (what, how, where, when and why):

WHAT. The aim of this action is to contrast the taking of wild young eels carried out by aquaculture for commercial farming purposes, thanks to the development during the project of a breeding system – diet, methods and growing tanks - able to increase the survival and development of eel larvae obtained in Action D1.

It provides an enormous contribution to the conservation and recovering of eel, because:

i) a large amount of juveniles, at the early developmental stages capable of feeding independently, will be released into the wild, giving a concrete support to wild eel population: the target of this Action is the release at *Leptocephalus* stage (stage I-IV), but a big effort will be done during the whole 4 year of the project and in the Post Life period in order to reach the glass eel stage (Stage V) (Fig. 1) (Tesch, 2003).

ii) the other aim of the action of breeding juveniles till the glass eel stage will assure another fundamental support to the eel conservation, supporting both the wild population with much more viable specimen and also supporting aquaculture demand for farming purpose, without affecting the wild stock of glass eels.

HOW.

For the implementation of the action UNIBO will enhance and optimize its structures for the growth of eel juveniles stages and reach the target production. UNIBO will develop a system composed by 6 large cylindrical tanks, a foam separation tank, a biological filter, with a marine water circulation pump and inlet jets that will produce a circular revolving current assuring both the floating of the leptocephali and of the food provided that remain available to the animals (Fig. 3). To optimize the rearing conditions, the system will be provided with a thermal regulation system to adjust the water conditions, a UV-sterilizer lamp, an ozonizer and an aerator.

After the artificial reproduction of the selected silver eels and the eggs hatching, in about 14 days the eel larvae will open the mouth and reabsorb the yolk sac, starting an autonomous swimming. Between 40 and 60 days post hatching –as reported by data from other eel species– they are expected to start metamorphosis to leptocephali (our objective is of 2,000,000 juveniles produced /year). When independent feeding starts, 1,600,000 juveniles/year will be released into the sea, by choosing sea areas showing environmental characteristics as suitable as possible for the life of larvae (rich in chlorophyll and hydrozoans) as indicated by Munk *et al* (2018). The release of juveniles is justified by the evidence observed by Miller *et al.*, (2015) and Durif *et al.* (2017), who report the detection of leptocephali in the Mediterranean Sea, making it possible to consider deeper areas of the basin as potential suitable areas for the growth of leptocephali.

Every year, 400,000 juveniles will be moved to the larger system for further breeding, in order to enhance the production towards the glass eel stage.

The feeding program will start at UNIBO facilities in the first year and it will be continued during the project and also in the After LIFE period, to get as close as possible to the phase of glass eel, valued in about 2 years from eggs.

This further breeding could have an important demonstrative value, even if the difficulties in defining eel

trophic chain are evident, since so far this result has not yet been achieved internationally. Anyway, starting from the fundamental step reached by UNIBO with the identification of a basic nourishment on which the eel larvae actively feed, the activities will be focused at improving its nutritional power by adding concentrated nutrients of different origin, such as: hydrolyzed aminoacids, algal concentrate with high poly-unsaturated fatty acids content, probiotics, vitamins, etc (Fig. 4).The feeding/rearing protocol will be re-modulated based on the monitoring of survival and growth rate data obtained in Action D2, taking into consideration also the effect of environmental parameters (temperature, salinity, water flow, etc.).

Regarding the feasibility of this activity, we underline that, as it will be described in Action D1, UNIBO has already prepared a solid baseline to this action, thanks to its successful previous efforts:

i) UNIBO is the first team worldwide having developed a standardized protocol for the spontaneous spawning of the eel in a closed recirculating aquaculture system for artificial seed production (Fig. 5), and also succeeded to rear the eel larvae till one month of age.

ii) UNIBO has recently identified a basic nourishment on which the eel larvae actively feed (see Video 1). Improving the nutritional power of this feeding base over the course of the project would support the growth of larvae up to the leptocephali and/or glass eel stage.

In addition to the installations for rearing juveniles eel stages, the required material will include live and inert feed, scales, gloves, lab coats, reagent for water quality control, plastic containers of various sizes and data storage media.

All the results achieved with these activities will be disseminated at the level of the scientific community and the stakeholders, through both the project site, scientific publications and congress participation, and during the final project meeting (E1, E2) and this experience will be put into the context of an integrated species management framework at a regional, interregional (Lombardy, Emilia-Romagna and Veneto) and national level in IT (F1) and will be promoted and shared at all levels in GR also (E1 and E2).

Please, see RP9 for the strategy in case the foreseen actions are not effective.

WHERE. All the process will be developed at UNIBO facilities in Cesenatico.

WHEN. The development of the rearing structures will occur in the first semester of 2021.

The breeding activities foreseen will be carried out from the fourth half of 2021 until the end of the project and continued in the After Life Plan.

WHY. **This action counts towards the 25% concrete conservation actions requirement**, because the reduced rate of upwelling from sea to internal waters of juvenile eels forces scientific community, governmental and conservationist institution to promote the protection of this species by acting at different levels. Obtaining juvenile forms from artificial breeding using wild breeders could warrant important re-introduction programs in public waters not only in Italy, but also all over Europe, also maintaining the aquaculture production without effecting the wild population. Therefore, the action, even if the most experimental part of the project, will bring us closer to completion of the captive life-cycle for this endangered species and could have tremendous applicative impact for protection activities and policies.

In the table attached the compliance with the conditions for translocations established at point d) pag 35 of "Guidelines for Applicants 2019" are discussed and solved.

Beneficiary responsible for implementation:

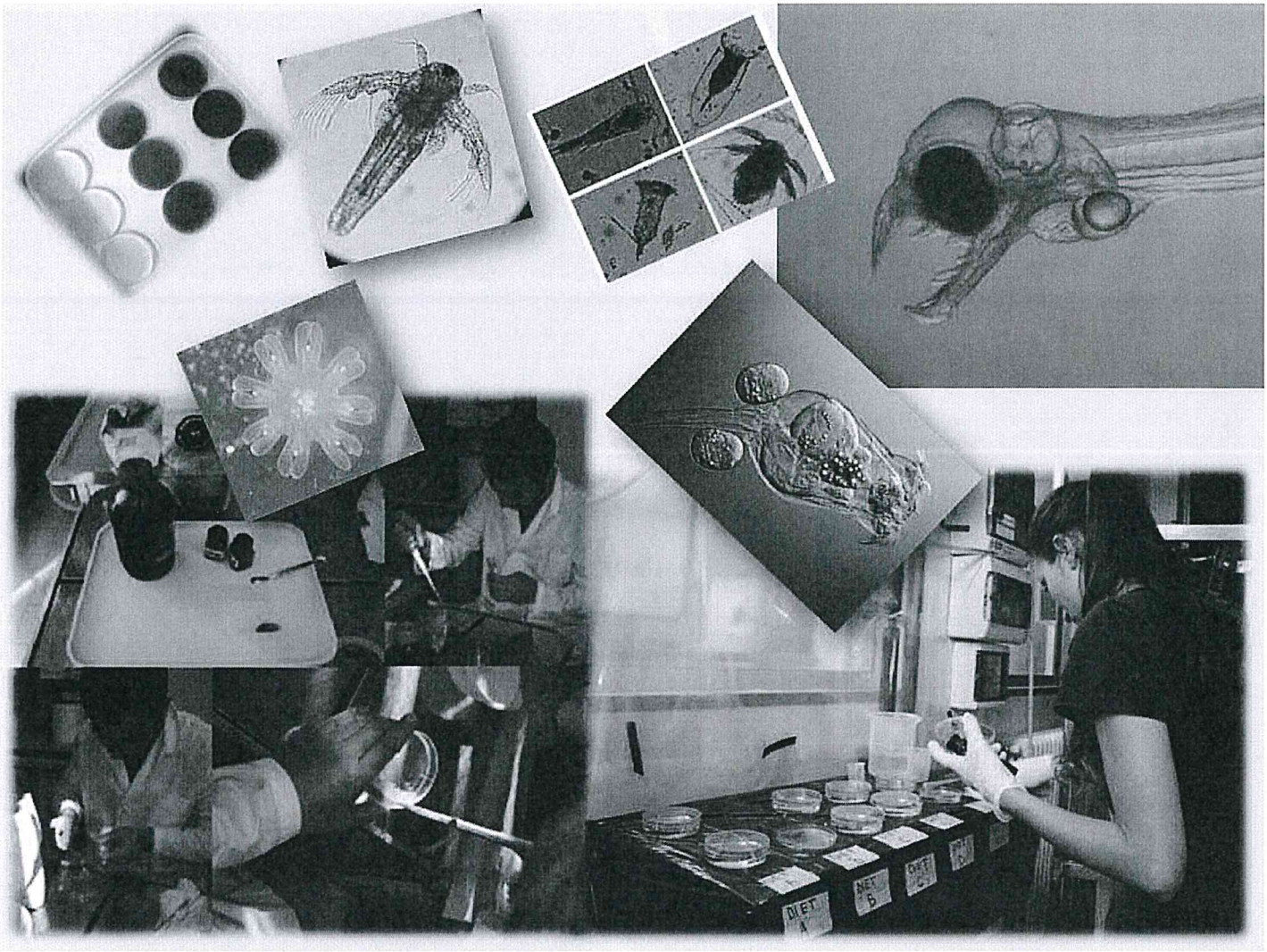
UNIBO

Assumptions related to major costs of the action:

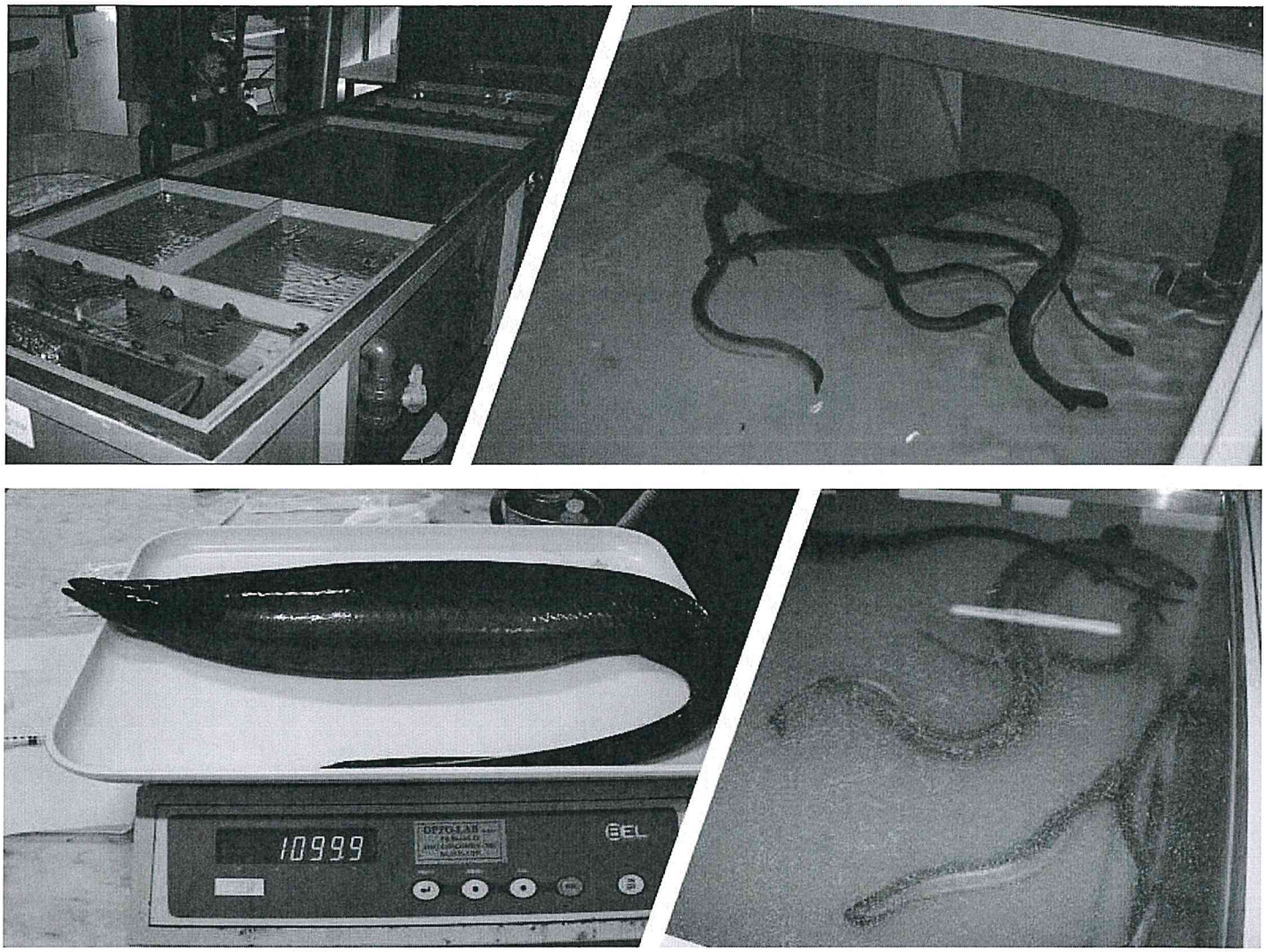
The costs of the activities have been estimated on the basis of previous experience gained at the center in Cesenatico of the University of Bologna.

For each member of the internal staff the number of working days was calculated on the basis of the experience gained by the team in similar activities, while the daily rate is calculated on the basis of LIFE guidelines.

Name of the picture: Fig. 4 - Nourishment



Name of the picture: Fig. 5 - Seed spontaneous production.



Name of the picture: TABLE_ Compliance with the conditions for translocations established at point d) pag 35 of "Guidelines for Applicants 2019"- part 1

Compliance with the conditions for translocations established at point d) pag 35 of "Guidelines for Applicants 2019"

(i) the actions are justified, expected to yield quantitative conservation benefit based on a cost/benefit analysis, and have a high chance of success based on a thorough risk and feasibility analysis;	As a regard to a **cost/benefit analysis, the action is profitable because, despite of a total cost for LIFEEL of 391,730.00 Euro, in 4 years during LIFEEL + 5 additional years after LIFE, we'll release in the wild about n. 14,400,000 juveniles to enrich the wild stock**. The risk and feasibility analysis (IUCN, 2013. *Guidelines for Reintroductions and Other Conservation Translocations*) took into account that: **1. concerning BIOLOGICAL FEASIBILITY**, literature supports us in the choice of releasing juveniles at this life stage into the sea by the evidence observed by Miller et al., (2015) and Durif *et al.* (2017), who report the detection of *leptocephali* in the Mediterranean Sea, making it possible to consider deeper areas of the basin as potential suitable areas for their growth, minimizing the risk related to the **release strategy.** 2. The juveniles will be released into their indigenous range, facing in the Mediterranean Sea favorable environmental conditions for their survival (which aren't a threat for eel), also revealed by Durif, 2017. Their release in the sea meets also the exceptional life cycle of eel and it's **compatible with the "land-use" of the sea,** where their are not of interest for fisheries, because of their too small sizes which make them uncatchable. About the ecological role, the juveniles released are icthyo-plankton and they don't represent a threat for anything; moreover, in nature, eel at a sub-adult and adult stage live in freshwater where they act as a predator, limiting its predation to small fishes, due to its morphology, and thus with a limited predatory capability that makes it not a big predator. So, **the risk of unintended and undesirable impacts is avoided.** About the interaction with climate, we underline that the decline of the species is common in its distribution area as whole, which suggests that there isn't a local climate related threat. Concerning the **founders** of the restocking activity, they will be captured from the wild, in a number really not influent if compared to the current estimated dimension of the wild stock. About the animal welfare, they will be bred in the structures of the University of Bologna - at the Faculty of Veterinary Medicine, that can guaranty for the health of translocated organisms and the minimization of the risk of introducing a new pathogen to the destination area. Anyway, the "Guidelines for Wildlife Disease Risk Analysis" of IUCN (2014) will eventually provide a model process to avoid this risk. **2. Concerning SOCIAL FEASIBILITY**, the "conservation translocation" takes place in a territorial contest that has been deeply analyzed, involving in the project, before it starts, all the Competent Authorities, all the most spread associations and groups of stakeholders present in the project area, obtaining from them a commitment to participate and/or support LIFEEL. The number and quality of the Form A8 and letters of support to LIFEEL attached to the proposal document this social consensus, that will be increased with a solid group of activities and actions of raising awareness, communication, information, participation and so on during the project. **3. as regards to REGOLATORY COMPLIANCE**, eel is protected by the EU adopted Council Regulation (EC) No 1100/2007 and it's listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The repopulation activity foreseen in the project entirely complies with CITES requirements and to current IEMP; in addition the Italian Ministries of Agriculture and Environment support LIFEEL and agree with LIFEEL actions (Forms A8). As regard to the **MONITORING** of the translocation, it has to be

Name of the picture: TABLE_ Compliance with the conditions for translocations established at point d) pag 35 of "Guidelines for Applicants 2019"- part 2

	recognized that assessing the effectiveness of this measure is challenging due to a number of confounding factors, such as a global and shared lack of agreed metrics, the panmictic life history of the species, the wideness of its home range (including Atlantic Ocean, in the deeper waters, and Europe), with the inevitable multiple threats that potentially impact the stock status during it's life cycle and the generation length of the species being greater than implementation of the project, make difficult to exactly relate an observation on the eel stock to this measure (as also discussed in CITES, 2017). A promise of effectiveness derives from the commitment to continue this measure after LIFE, making it sustainable, and to assure an adequate programme of information and communication, both guaranteed by the project.
(ii) the reintroduced/translocated organisms are likely to be able to cope with new pathogen and stresses encountered at the destination site and the risk of reintroducing new pathogens in the destination area are minimised;	The animals translocated will originate from the native wild stock of eel, evolved in the same wild environment where they will be released. Moreover the juveniles will be hatched in sea water, arriving from Mediterranean Sea, where they will be released.
(iii) alternatives to reintroduction/translocation have been assessed as less effective or infeasible as a means to reach the specific and clearly defined conservation objectives of the reintroduction/translocation;	The project also faces and concretely intervenes on the other threats on eel in Italy and Greece, supporting the wild stock through the defragmentation of the freshwater waterways and promoting and concretely enhancing the escapement of silver eels; thus, the translocation of juveniles is an additional and necessary measure for a species which is in CRitical Status of Conservation (IUCN, 2019).
(iv) the actions target areas where the causes of extinction of the species have been eliminated;	The project, at the same time, faces the other threats, restoring the free migration upstream for about 1,000 km in the Po basin and for about 70 km in the Nestos River, significantly reducing this major threat in the project areas. The project also faces the problem of the mortality of silver eels descending rivers for reproduction, with a concrete approach of setting the best strategy of contrast this phenomenon and establish a participate process to minimize this threat. All these threats are spread in a wide area and can create social conflict. The project, for this reason, sa set a strategy of governance and exchange (F1) that is promising (as documented by the co-financing by ENEL GP, the greater hydroelectric society in Italy and the Forms A8 signed by stakeholders)

Name of the picture: RP 9 - strategy in case the foreseen actions are not effective

RP 9 - strategy in case the foreseen actions are not effective.

Based on the critical state of the eel population this is one of the key Actions for a conservation project on this species like LIFEEL is, considering that its success will reduce the gaps toward reaching the full completion of the captive life-cycle for this endangered species and could have tremendous applicative impact for protection activities and policies. UNIBO can warrant the feasibility of the action as it has already achieved the necessary experience and knowledge to warrant eel reproduction and production of leptocephali in the numbers declared in the proposal. Moreover in the past few months an important new step in the development of a successful feeding/rearing protocol was made with the development of a nourishment on which the eel larvae actively feed.

However, in the eventuality that the target developmental stage for this Action could not be achieved during the project lifespan, UNIBO commits itself to continue this development both during the postLife phase and later, considering a different approach: 50% of the oldest possible larvae obtained yearly will be released to the wild, while the remaining 50% will continue on feeding program. In this case, after Life project, UNIBO also commits itself to send to Life unit a yearly report on the progress of the activities.

Name of the picture: TABLE_ Compliance with the conditions for translocations established at point d) pag 35 of "Guidelines for Applicants 2019"- part 3

(v) the removal of individuals from their present habitat for re-introduction is only considered if it does not endanger the captive or wild source populations;	NA
(vi) the actions target areas whose habitats and climate meet, the foreseeable future, the conditions necessary for the survival of a viable population of the species;	As discussed above, the fingerling restocked are produced from native spawners
(vii) a prior agreement between all parties involved (e.g. between the competent authority for the donor population and the manager of the area of reintroduction) has been concluded and documented;	This point is discussed above in the SOCIAL FEASIBILITY, demonstrating that the agreement among involved parties has already established
(viii) the actions target only areas where the attitude of the local population towards the planned reintroduction is favourable or where there is a reasonable expectation that local acceptance can be achieved during the project;	That's true. Literature supports us in the choice of releasing juveniles at this life stage into the sea by the evidence observed by Miller et al., (2015) and Durif et al. (2017), who report the detection of leptocephali in the Mediterranean Sea, making it possible to consider deeper areas of the basin as potential suitable areas for the growth of leptocephali, revealing the suitability of this habitat to the needs of the species and minimizing the risk related to the release area.
(ix) either	
o organisms are only reintroduced in areas where they previously occurred	This is not a re-introduction of an extinct species but it is a repopulation (restocking)
or	
o organisms are deliberately introduced/translocated outside their indigenous ranges in order to	No

Name of the picture: TABLE_ Compliance with the conditions for translocations established at point d) pag 35 of "Guidelines for Applicants 2019"- part 4

(x) the proposal must include a preparatory phase, a re-introduction phase and a follow-up phase, as well as of an exit strategy, in case the translocation/reintroduction does not proceed according to plan.	The uncertainty aspects of the proposal laid in the phase of early hatching of the eel, which has exceptionally already been reached and assessed by UNIBO. Thus the preparatory phases have already been faced by UNIBO before the project.

Name of the picture: Fig. 1 - Larval development of eel.

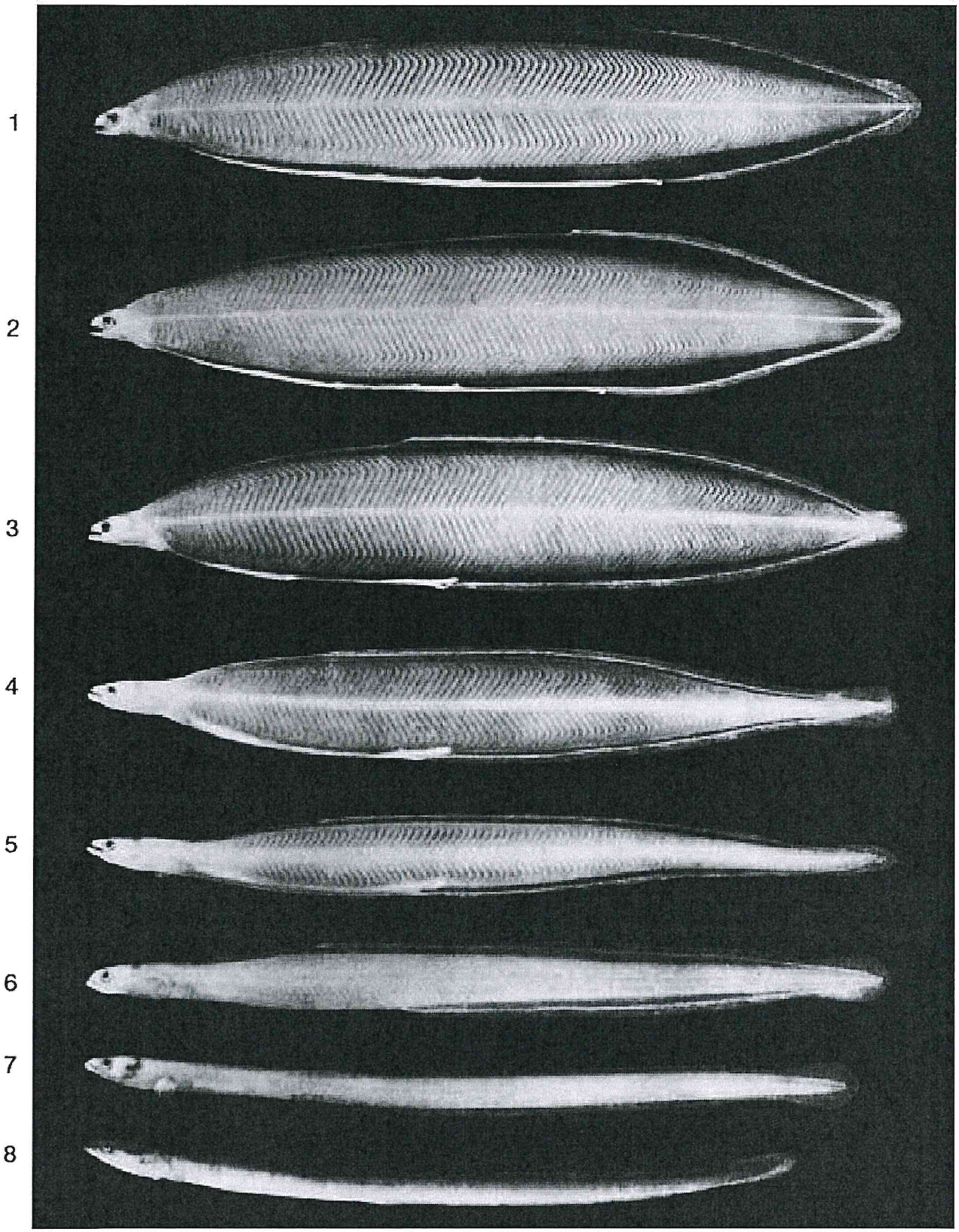
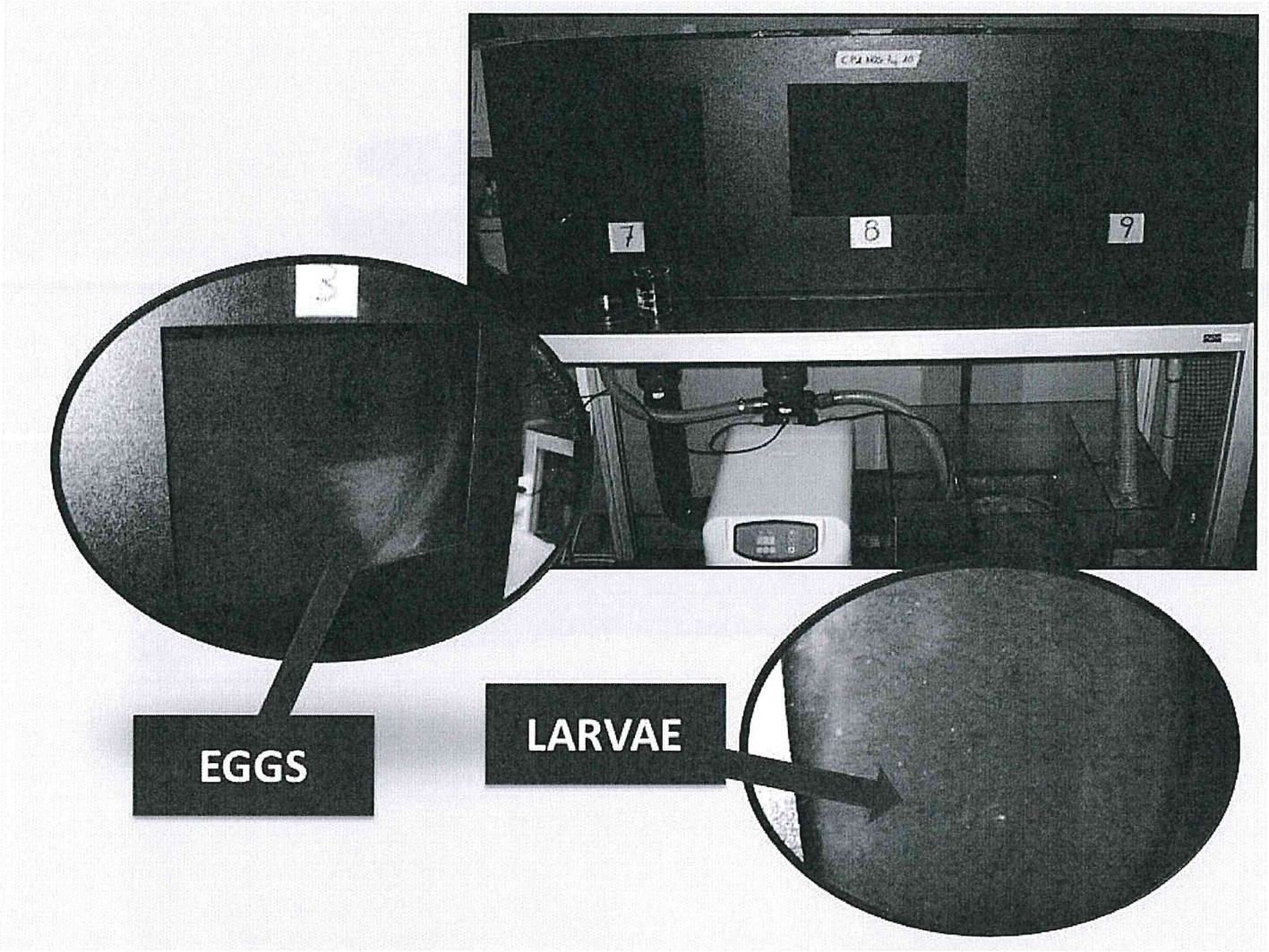


Fig. 2.3 Development of the eel (*A. anguilla*) from the larva (Leptocephalus) to the glass eel (after Schmidt, 1909a)

1 Fully grown larva 75 mm long (Stage I)
2–6 Metamorphosis of the larva into Stage IV, shortly before reaching the typical eel shape
7 Glass eel at its earliest developmental stage (Stage V)
8 Eel at the beginning of pigmentation (Stage VI); on pigmentation during larval development, see Table 1.2

Name of the picture: Fig. 2 - early developmental stages of eel

Name of the picture: Fig. 3 - Cylindrical Tank



C2's PROJECT DELIVERABLE PRODUCTS

Deliverable name	Deadline
Progress report on captive breeding and release	12/2022
Final report on captive breeding and release	12/2024

C2's PROJECT MILESTONES

Milestone name	Deadline
Release of 6,400,000 juveniles into the sea	12/2024

C. Conservation actions

ACTION C.3: Realization of blue infrastructures on behalf of elvers and small eels upstream migration

Description and methods employed (what, how, where, when and why):

WHAT.

The elvers and small eels specific passes, designed with Action A.3 to restore their natural upstream migration, will be constructed under this action at 7 sites (6 in Italy and 1 in Greece):

- In Italy, on Panaro river – 1. weir at Bondeno, 2. weir at Casumaro, 3. weir at Nonantola (see the map "eel-passes in Italy");

- in Italy, in the Po Delta – 4. Valle Lepri sluice, 5. Val Pagliaro sluice, 6. Tieni sluice (see the map);

- in Greece, on Nestos River, Toxotes Dam (see the map "eel-pass in Greece").

The completion of works will be formally sanctioned by CRE (Certificate of Right Execution).

We can estimate that much more than 1.000 linear km will return to be passed through by elvers and small eels migrating upstream: only the Po River, Ticino River and Panaro River principal corridors count 720 linear km re-opened to the free upstream migration of elvers and eels; in addition we have hundreds km in the Po Delta reconnected to the river branches, exceeding the total 1.000 km as above.

HOW. Interventions will be implemented according to the executive projects outlined in Action A4. For more details see the Feasibility Study attached to the proposal (Annex A.4), which identifies the weirs or dams obstructing the natural pathways of eel and in need of restoration; it also select the types of eel pass to be constructed at each obstacle and made a rough estimate of costs.

At each fragmentation point, the sites will be open, according to law procedures, through the construction of the pass.

Supervision: GRAIA, with the scientific support of UNIFE, will carry out the works direction; RER will act as Unique Responsible of the Procedure (URP).

The action will be carried out under the continuous supervision of the Construction Supervisor, in collaboration with the URP, selected inside RER, responsible of the implementation of the action.

At the three Panaro obstacles indicated, the ramps will re-open the fluvial corridor not only to elvers and eels but also to fishfauna as a whole. The ramps will be realized according to the rules, methods and materials of natural engineering. They'll extent on the whole river bed width, assuring the free migration for fish all over the year, in every river discharge condition. All the three ramps will be constructed on land in the public domain on which the Competent Authority is RER, and they will be forever devoted to the function of elvers and eels pass.

In the Po Delta, on the branch known as "Po di Volano" at Tieni (Massa Fiscaglia, FE) and at Valpagliaro (Tresigallo, FE) localities, and on Canale Navigabile Migliarino-Porto Garibaldi at Valle Lepri (Ostellato, FE), three other eel specific passes with anti-predation lids will be positioned along the canal banks in order to let elvers pass through the barriers consisting of flow regulation manufactures. Even these manufacts are a

wholly owned property of RER, and the elvers and eels specific passes realized will be forever devoted to the function of elvers and eels pass. The objective of the eel passes in the Po Delta area is to allow the elvers to reach the natural fluvial branches of the Po Delta and to widespread upstream in the river basin. They come from the sea, enter the very abundant water systems and lagoons connected to the sea in the Po Delta wide area, but are unable to continue their migration along the river branches for the hydraulic manufactures that we are going to provide of the eel passes.

For the hydraulic permissions we have the support (forms A8) of the competent Italian and Greek Authorities.

The four specific eel passes (3 in the Po Delta and 1 in Greece) will be equipped with particular eel traps, allowing to count them and to make a quantitative monitoring of the elvers migration. The traps are situated at the top of the eel pass, and collect the specimens in a tank with circulating water where they can stay for 24-48 hours without any problem, until the technicians involved in the monitoring come, count the elvers, eventually take the total length and/or the weight, and finally release them over the obstacles (see the Feasibility Studies).

WHERE. The habitat defragmentation sites are located in Italy on the Panaro River and in the Po Delta, in Greece on the Nestos river as described in the Annex A3.

WHEN. The realization of the eel passes will take place in 15 months and it will be completed by the end of June 2023 .

WHY.

The Action is necessary to allow the elvers upstream migration, starting from the first important obstacles they find coming from the Adriatic sea and entering the Po river basin. In particular they have a very wide area of canals and lagoons in the Po Delta, colonized by elvers that in part remain for growing and in part swim upstream, but have many difficulties to reach the natural Po river branches. The realization of the three eel passes in the Po delta will allow to the elvers of a very wide area to reach the Po branch, and from there to swim upstream for hundreds of kilometers.

Along the Po river, the first important tributary the elvers meet is the river Panaro, where historically very many elvers had been coming every year. The three fish pass along the Panaro river will allow the elvers to re-colonize the river Panaro. The typology of pass is the “rock ramp”, that is not specific for eels but is suitable for all the fish fauna, including the alien species. This situation has been considered, and actually the alien species have established along all the Panaro course, upstream and downstream the obstacles we are going to solve. At the same time, in the presence of the obstacles, all the migrating fish accumulate under them in the migrating time and are easily predated by aliens, the wels catfish in particular. If we give them the fish pass, any fish will have the chance to escape from this kind of “trap” and continue its race upstream. This is a benefit for all migrating fish present, not only eels (also shad, mullet and others).

The action counts towards the 25% concrete conservation actions requirement.

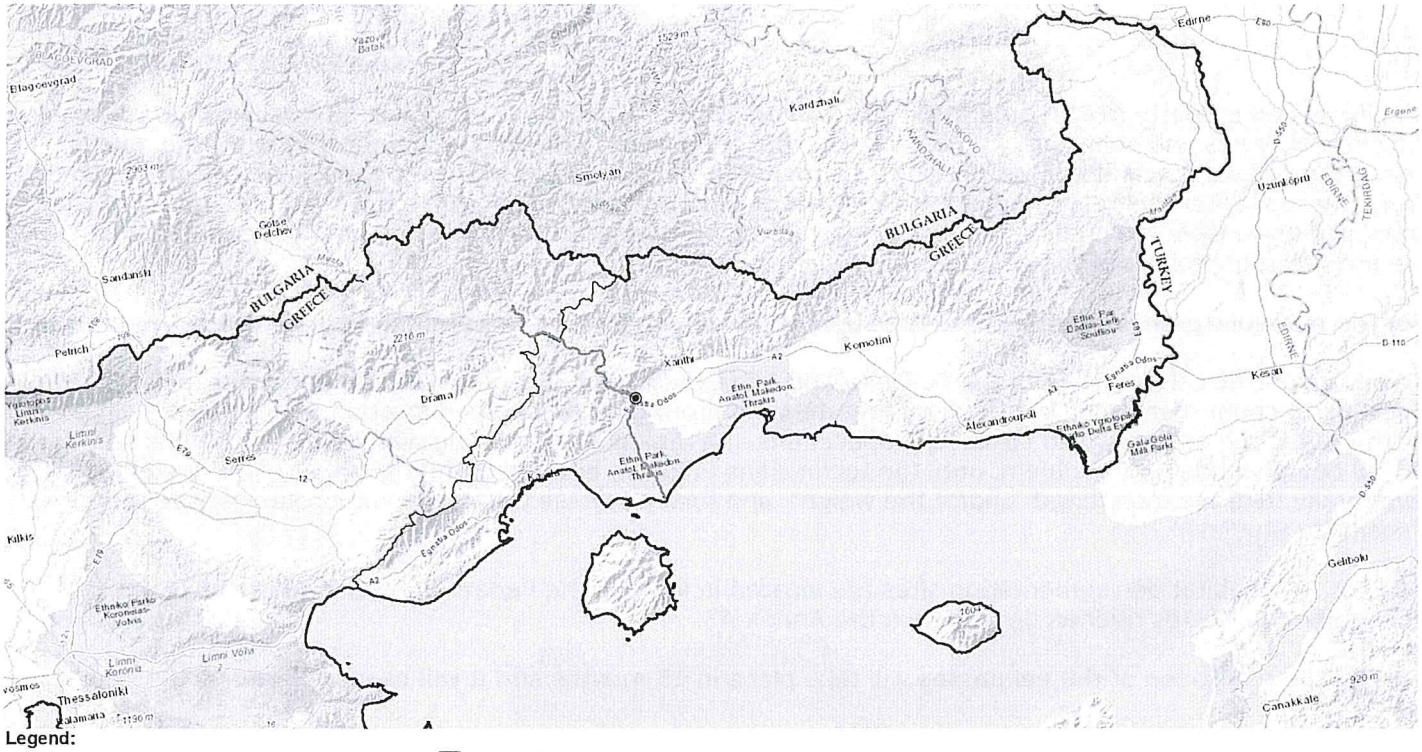
Beneficiary responsible for implementation:

RER

RER, as procurement station for interventions and as Competent Authority, GRAIA for works direction and security manager, UNIFE to support works direction

Assumptions related to major costs of the action:

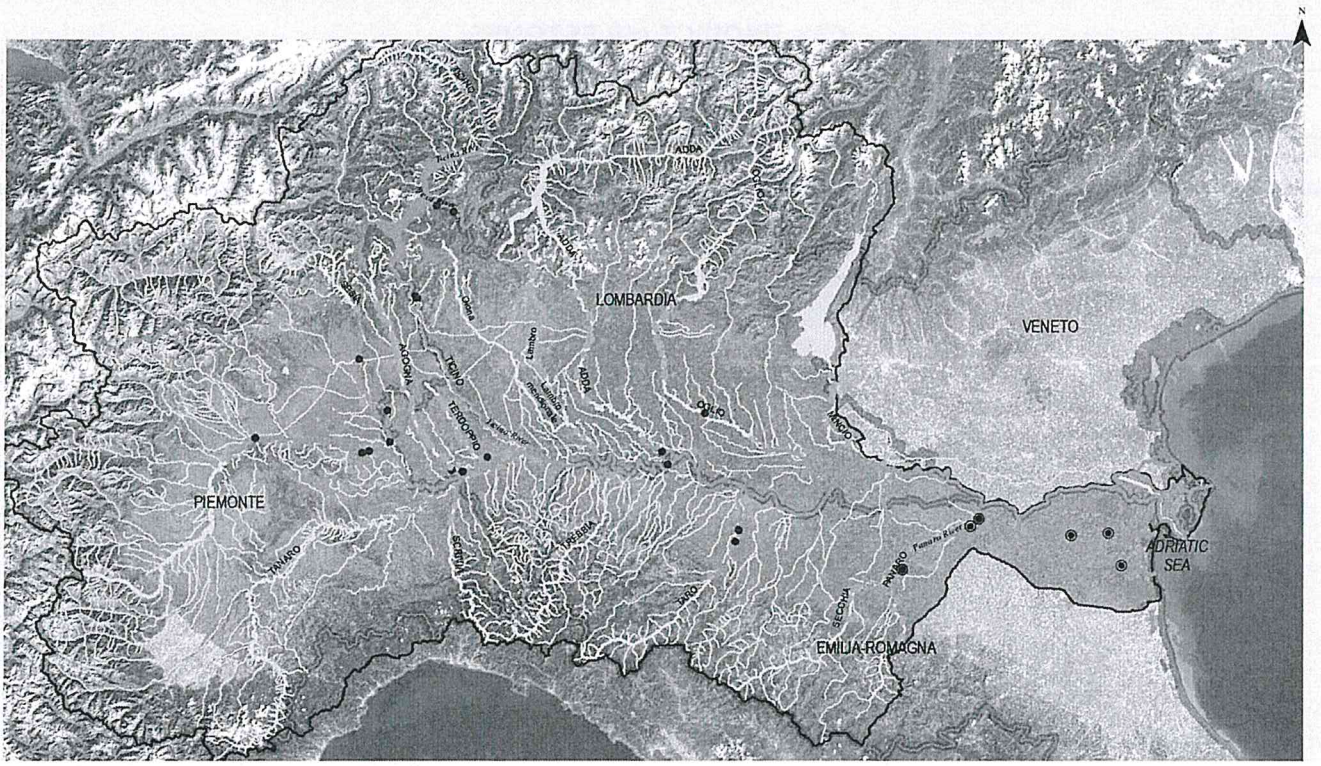
Name of the picture: Map - eel-passes in Greece



Name of the picture: Map - eel-passes in Italy

LIFE19 NAT_IT_000851
LIFEEL
"Urgent conservation measures for critically endangered population of European Eel (Anguilla anguilla) in Po river basin"

Action C3 - Po River connectivity restoration. N 6 eel-passes realized



C3's PROJECT DELIVERABLE PRODUCTS

Deliverable name	Deadline
Certificate of Right Execution of interventions	06/2023

C3's PROJECT MILESTONES

Milestone name	Deadline
n. 7 blue infrastructure for elvers and eels upstream migration built	06/2023
no less than 1000 km river corridor re-opened to the free elvers and small eels upstream migration	06/2023

A. Preparatory actions, elaboration of management plans and/or of action plans

ACTION C.4: Realization of a downstream migrating silver eels deterrent/guidance device on Tresa River

Description and methods employed (what, how, where, when and why):

WHAT. A demonstrative deterrent/guidance system device will be installed and put into service at Creva Dam (Tresa River) to prevent the entry of downstream migrating silver eels into Creva hydro structure.

We expect that at least 50% of the downstream argentine migrating eels will be saved by the deterrent device installed at Creva Dam.

HOW. RL will take care of relations with EGP, while GRAIA will carry out the works direction for the installation of the device. EGP is a cofinancer of the project and in the Form A6 agrees for the realization of this system. This can be considered for Italy the first demonstrative experience of installation and putting into service of a deterrent/guidance device for eels, carried out by a team working for the scientifically based conservation of eel; while it will be based on the work of reasoned review of the methods already developed and implemented all over the world in similar cases, furthermore it will also represent the actual finalization of that work, because it will provide the LIFEEL team the opportunity to test various settings and configurations of the system in order to assess the variance of its efficacy and function in dependence on various parameters, and thus to enrich the Guidelines (Action A.5) with its own direct experience o a hydro structure illustrative for many hydroelectric dams in the project area.

The action will be performed in two phases: 1. Installation of the device. At the end of this phase the device will be installed and put into service for the first time; 2. Testing phase. During this phase several adjustments to the settings and parameters of function of the device will be applied in order to find the best operation pattern, also depending on the environmental conditions. The monitoring Action D.2 planned the installation of three hydrophones: one in the Creva dam basin to record the tagged eel presence; one downstream of the turbines to record possible passages in that direction; one downstream in the fish passage, where there is also a monitoring video-system, to check the eels moving along the suggested route. All this monitoring system will provide useful data also for this testing phase.

WHERE. The demonstrative deterrent/guidance system device will be installed and put into service at Creva Dam (Tresa River).

WHEN. The first installation of the device will be completed by the end of June 2021. The testing phase will be completed by the end of December 2022 (after two seasons of tests).

WHY. Eel is a catadromous species: it spawns in oceanic waters and migrates into coastal and inland waters to grow to adulthood. To complete their life cycle via fresh waters, eels must have unimpeded passage through river networks in order to migrate between spawning grounds and freshwater habitats and viceversa.

The provision of deterrent/guidance systems planned for eels is a relatively new requirement, in particular in Italy, but also in Europe and North America; consequently, research and development in this field are growing and it's time to take the actual best practices as the light guidance system is, to realize them in a representative pilot site and to widespread the results for further application.

The action counts towards the 25% concrete conservation actions requirement.

Beneficiary responsible for implementation:

RL

GRAIA is responsible of the works direction, while RL is responsible for the contacts with the hydro structure (EGP) and for the public tender

Assumptions related to major costs of the action:

The major costs of the action are represented by the RL External Assistance costs for the supply and installation of the deterrent device. The costs are estimated in relation to the dimension of the screen to be realized (about 50 square meters extent), its realization as a metallic frame in (e.g. a steel frame) with predispositions for adjustments and different settings; the predisposition for power supply; the availability of various settings and the costs for the lights (about 100 Euro/light for 100 lights); the realization and installation of a lifting and positioning on the water column of the device.

Concerning the cost item "185000 - RL - C.4 - public tender - Eels deterrent system realization, installation and testing", the cost of the device is calculated as follows:

The deterrence device shall be installed at the intake structure of the hydroelectric power station, along the right orographic bank. This artifact is protected by a grid as spaced as enough to accidentally let the eel to pass through.

The metal structure of the grid is 10 m wide and 15 m deep, to create an opening of the channel of about 150 square meters. This surface must be covered by the device.

The lighting deterrence device shall include these characteristics:

Electrical installations and cabling;

Underwater stroboscopic lights (or similar), about n.100;

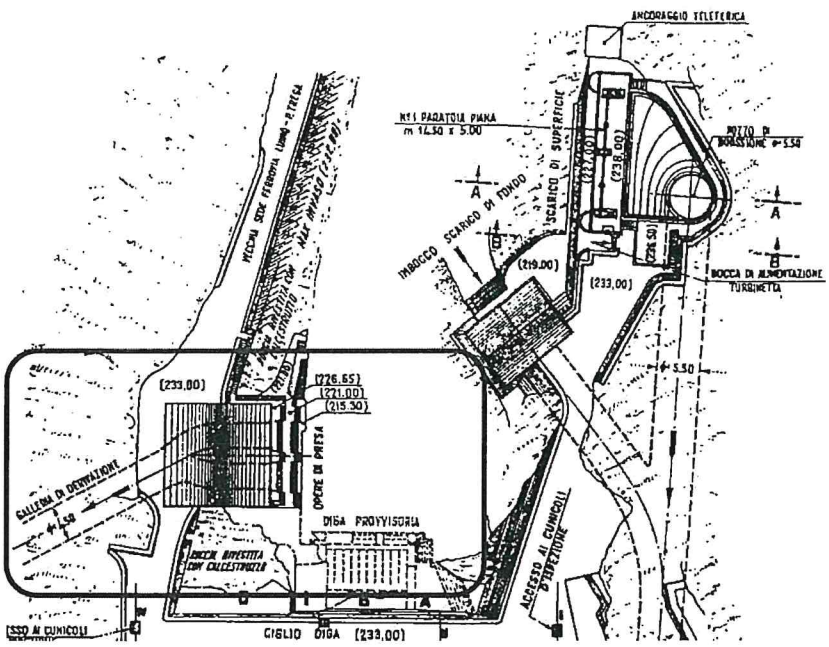
Metal frame designed and sized specifically for this site and necessary for the support and housing of lamps; this structure will have to be easily lifted for maintenance and adjustments during testing and operational phases;

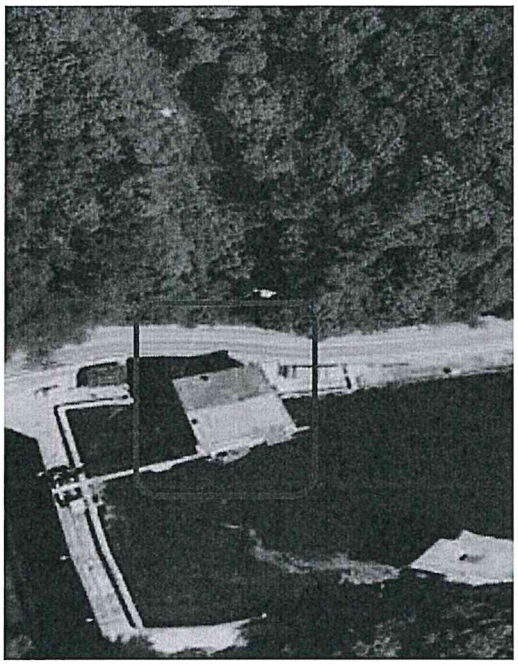
A system of underwater cameras to monitor the device and its effectiveness, equipped with a recording plant to be installed next to the lamps.

In the figure RP22-a: a floor plan of the hydropower plant (on the left) and a recent top view of it (on the right).

The cost estimate for the realization of the deterrence device includes is represented in RP22-b

Name of the picture: RP22a - a floor plan of the hydropower plant and a recent top view of it





Name of the picture: RP22b - The cost estimate for the realization of the deterrence device

RP22-b. The cost estimate for the realization of the deterrence device

	Cost item	Euro
1	Supply and installation of the electric plant and cabling, for the underwater lighting plant.	15.000
2	Supply and installation of about 100 underwater stroboscopic lamps.	37.000
3	Supply and installation of the metal frame designed and sized specifically for this site and necessary for the support and housing of lamps, properly treated to resist underwater.	65.000
4	Supply and installation of a lifting system for the metal frame.	30.000
5	Supply and installation of the control system of underwater cameras.	10.000
6	Supply and installation of the hardware and software recording system to be installed in the monitoring room of the existing fish pass.	5.000
7	Team of diving workers for installation and testing phases.	10.000
8	Connection to the power supply.	4.000
9	Security contributions (about 5 %)	9.000
	TOTAL COSTS (including VAT)	185.000

C4's PROJECT DELIVERABLE PRODUCTS

Deliverable name	Deadline
Report of works direction	12/2022

C4's PROJECT MILESTONES

Milestone name	Deadline
n.1 deterrent/guidance device installed and put into service at Creva Dam	12/2022

A. Preparatory actions, elaboration of management plans and/or of action plans

ACTION D.1: Monitoring the effectiveness of the selected migrant silver eels of Action C1 to increase the reproductive potential of wild population

Description and methods employed (what, how, where, when and why):

WHAT. The aim of this action is to monitoring that the migrant silver eels, selected on the basis of the protocol developed in Action A2 and released to the sea with Action C1, are suitable to increase the reproductive potential of wild population. This will be tested using a different approach in the following 2 sub-Actions:

D1.1 – Monitoring the effective production of fertile eggs and related larvae from selected breeders.

D1.2 – Monitoring that the selected breeders are migrating animals moving back to the Sargasso Sea to spawn.

HOW

Sub-action D1.1 -Monitoring the effective production of fertile eggs and related larvae from selected breeders.

As described previously for critically endangered populations like eel,one of the fundamental direct conservation measures is the improvement of their spawning stock to increase the number of viable offspring produced, as also indicated by different National Plan for eel conservation.

UNIBO is the first team worldwide that have developed a standardized protocol for the spontaneous spawning of the eel in a closed recirculating aquaculture system for artificial seed production.

Starting from the migrant silver eels selected in the Action C1 for the release to the sea, on the basis of the protocol developed within Action A2, in each of the last 4 years of the project (2021- 2024) two sample of 45 migrant silver eels each (15 females and 30 males) will be taken in Italy and Greece (90 breeding animal in total/year) and transferred at UNIBO facilities to perform the reproduction.

The number of viable eggs produced/female and the relative number of good quality larvae obtained (Fig.1) ,will give an indication of the validity of these selected breeders in supporting the wild spawning stock.

After the opening of the mouth and yolk sac resorption, a sample of the larvaeobtained by each reproduction phase will be kept at UNIBO facilities and transferred to the specific structure built with Action C2 to perform the captive breeding activities with the aim to breed the juveniles up to the leptochephali, trying to get to the glass eel stage.

The other part of the larvae obtained by reproduction will be released to the sea by choosing areas with environmental characteristics as suitable as possible for the life of the larvae (rich in chlorophyll and hydrozoans) as indicated by Munk et al (2018).

Sub-action D1.2 - Monitoring that the selected breeders are migrating animals moving back to the Sargasso Sea to spawn.

Considering that, despite the silver color, many silver eels present an incomplete sexual maturation and have to be classified as pre-migrating, the aim of this sub-action is to confirm that the breeding stocks selected in C1 in Italy and Greece on the basis of the protocol developed in A2, and released in the sea, are composed by migrating eels moving back to the Sargasso Sea.

This will be monitored on a sample of the Italian and Greek stocks, according to two different methodologies:

A) Tracking:

In the last 4 years of the project (2021-2024) a total of at least 244 breeders will be fitted with tags (at least 14 with pop-up in Greece, and 230 with sonic internal tags and with an external numerical tag, in Italy) to verify the start of their migration.

The use of two different tag system is related to the different morphology of the seafloor: from the very few information reported in the scientific literature, it seem that eels at the beginning of their migration route in the sea keep the coastline and progressively move to more deep waters.

In the Italian side the coastal seabed below the south of the Po delta has a maximum depth of 200 meters; this allow us to use small acoustic transmitters (about 6-8 mm long, with a life span of 6-10 months). To track the passage of the tagged animals 4 sonic automatic buoys will be positioned beyond the breakwater at Pila, Comacchio, Ravenna and Cesenatico, covering a coastal area of about 100 Km south of the Po Delta (See the map in D2).

In GR the coastal sea bed below the south of the Nestos delta is deeper than 200 m and increase its depth southward; so we have to switch on pop-up monitoring system, that collect the data and at the end of the operating period (maximum 8 months), detaches itself from the eel, comes to the surface and transmits the data collected via the Argos Satellite. In this way it will be possible also to have some indication about the migratory route used by the migrant eels.

B) Monitoring:

Around 3,000 breeders (2,000 in IT and 1,000 in GR) will be tagged using a small but evident flag mark with reference contacts of the project to report any capture by fishermen involved.

In Italy the monitoring of accidental catches of marked eels will be assured by:

i) professional fishermen of the Emilia-Romagna and Veneto Regions, involved in the monitoring by their associations, which have given their full support to the Project and the initiative (Cooperatives League, Federcoopesca and Coldiretti).

ii) The largest Italian association of anglers (FIPSAS) has already given its support (A8) and the Recreational Angling Italian Association of Ravenna, which includes 640 fishing huts ("Capanni") and 2,800 members, has already committed to patrol the coastal area of about 100 km south of Po delta (Fig.2) with the involvement of its associates.

In GR, all fishing cooperatives of professional fishermen including coastal fishermen, trawlers and purse seine net fishermen, will be notified about the tagged eels, and any bycatch will be declared directly to Fisheries Research Institute. Since there is an already established cooperation with the fishermen through the DCF project it will be much easier to get this information.

WHERE. For D1.1 all the process will be developed at UNIBO in Cesenatico. For D1.2 the monitoring area of the released breeders will depend by the system used: for sonic system it will include a coastal area in Italy of about 100 km south from Po delta monitored by sonic buoys and fishermen. In Greece with the pop-up system it could be also possible to follow a part of the one-way migration to Sargasso Sea.

WHEN. The monitoring activities of D1.1 will be realized during the last 4 years of the project (2021-2024), a sufficient period of time to demonstrate the validity of the method for the selection the breeding animals to be released.

The monitoring of the start of migration in the released breeders (D1.2) will be carried out in 2021- 2024; duration for the acoustic telemetry system is estimated considering the short time the breeders spend in the surroundings of the coastal areas monitored by hydrophones and fishermen. For the pop-up the maximum time of monitoring is a part of one-way migration time to Sargasso Sea.

WHY. **This action counts towards the 25% concrete conservation actions requirement**, because the release of fully mature breeders able to reach the spawn areas and support the wild reproductive stock will assure a real benefit to the eel population recovery.

See RP11 about risks.

Beneficiary responsible for implementation:

UNIFE

UNIFE for Italian side and DEMETER for Greek side
PVPO, PDPO will support the monitoring activities for sub-action D1.2 in Italy

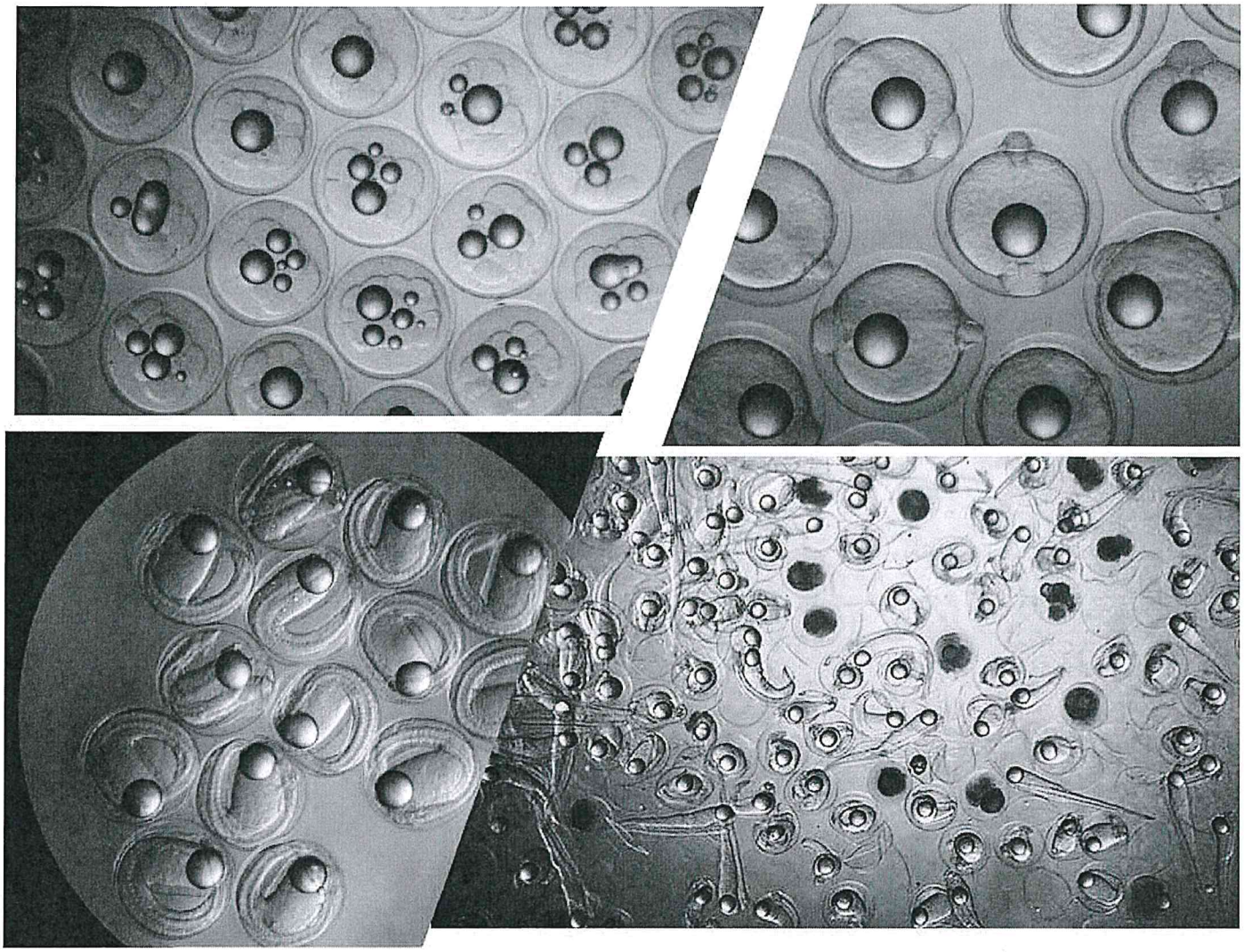
Assumptions related to major costs of the action:

The costs of the activities have been estimated on the basis of previous experience gained at the center in Cesenatico of UNIBO, and for the equipments costs were estimated with the carrying out of preliminary surveys, and on the basis of previous experience.

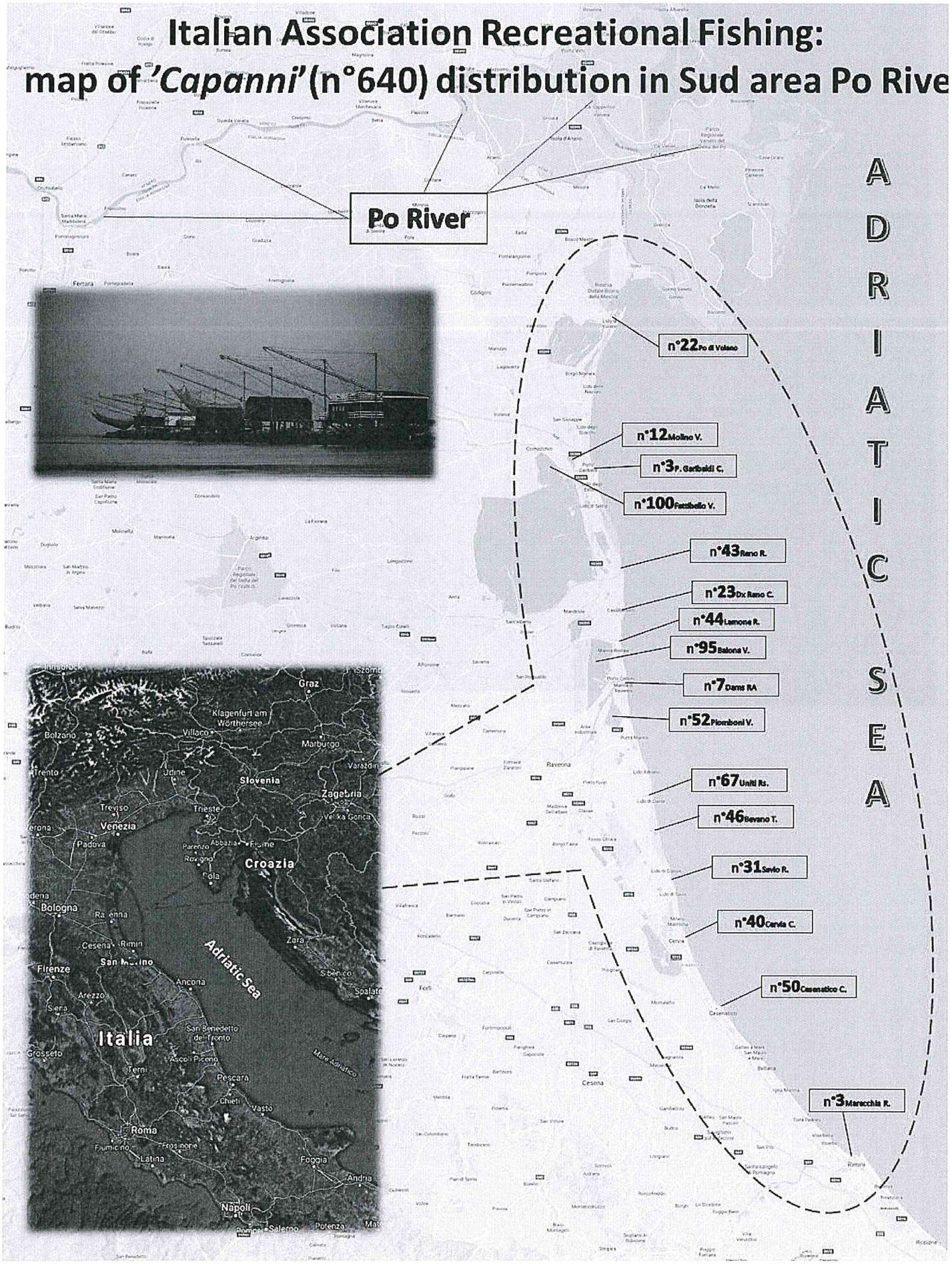
For each member of the internal staff the number of working days was calculated on the basis of the experience gained by the team in similar activities, while the daily rate is calculated on the basis of LIFE guidelines.

Concerning the cost item: "28000 - PVPO - D.1 - Public Procurement - Biologist for marking and control of silver eels". We foresee an employment of an expert biologist for about 100-120 person days.

Name of the picture: Fig 1 - Eggs and larvae



Name of the picture: Fig 2 - IARF fishing Huts



Name of the picture: RP 11 - Possible risk factors

RP 11 - Possible risk factors.

We are sure that the selected full sexually mature silver eels released during the project, will migrate to Sargassi sea to reproduce. The tracking of a small part of these individuals is more related to the possibility to better know the initial migration routes along the coastal areas where a impact from fishing activities is possible. This will support the development of management measure for these areas that will be transferred to the institutional bodies to improve the conservation of eels population.

We are aware of the problems that the pop-up system can generate, and we have carefully evaluated all the different factors such as: the size and autonomy of the transmitter, the impediment to swimming for the animals, the problem of possible deadly injuries caused by the transmitter application and the importance to fit only large size animals.

The shallow seabed along the Italian coast south of the Po delta (about 200 m) allows the use of sonic tags with minimal impact on eels. In the much deeper Aegean Sea (about 1.000 m), the relief of sonic tags is really problematic and so the possible choice is the pop-up use.

With this respect, the Greek partner in recent years has developed a specific experience on the use of pop-up transmitters on eels, and the project staff is already working – in cooperation with tracking system manufacturers - to develop transmitters and fitting systems more suitable for eel and more sustainable for animal well being.

D1's PROJECT DELIVERABLE PRODUCTS

Deliverable name	Deadline
Final report on eggs and larvae production (Sub-action D1.1)	12/2024
Progress report on monitoring activities and results (Sub-action D1.2)	12/2022
Final report on monitoring activities and results (Sub-action D1.2)	12/2024
Progress report on eggs and larvae production (Sub-action D1.1)	12/2022

D1's PROJECT MILESTONES

Milestone name	Deadline

D. Monitoring of the impact of the project actions (obligatory)

ACTION D.2: Monitoring the effectiveness of the fish ladders built in Action C3 for upstream migration of elvers and of the system installed in Action C4 to protect downstream migrating eels from turbines

Description and methods employed (what, how, where, when and why):

WHAT The aim of this action is the monitoring of the concrete actions developed by the project to support the eels in two fundamental moment of their life cycle: upstream migration of the elvers to reach the reopened growing areas (Action C3), and downstream migration of the silver eels to reach the sea (Action C4). For this reason this Action is divided in two specific sub-actions:

Sub-action D2.1-Monitoring the effectiveness of the fish passages built in Action C3 for upstream migration of elvers

Sub-action D2.2-Monitoring the effectiveness the system installed under Action C4 to protect downstream migrating silver eels from turbines

HOW **Sub-action D2.1-Monitoring the effectiveness of the fish passages built in Action C3 for upstream migration of elvers**

With Action C3, the passage of elvers in new areas will be ensured by the construction of 7 fish ladders: 6 in Italy and 1 in Greece.

A) directly on the fish ladders: 4 specific eel ladders (3 in Italy and 1 in Greece) will be equipped with a trap, for the quantitative collection and counting the elvers moving upstream (detailed in C3). The other 3 fish passages are fish ramps on three bridles on the low reach of the Panaro River. Due to their particular shape, which resembles a sequence of small waterfalls that flow over a set of stones, ramps cannot be equipped with specific elvers traps. Thus, monitoring will be done using trap nets, placed along the river bank upstream and downstream the ramps.

This monitoring will give an objective feedback of the effectiveness of each structure an on how to perform its best setup.

B) evaluating the consistence of upstream migration of elvers on the Po River.

These data are of fundamental importance because, through their cross-check with the those collected on the fish ladders, will give an objective feedback of the effectiveness of the eel passes. This monitoring program will be performed with a specifically modified fyke nets, positioned in number of three replicates (n=3) along both side of the River Po, at the Pontelagoscuro section (Ferrara).

Sub-action D2.2-Monitoring the effectiveness the system installed under Action C4 to protect downstream migrating eels from turbines

The focal goal of this Sub-action is to assess the efficacy of the deterrent/guidance system installed at Creva dam under Action C4, to protect downstream migrating eels from turbines.

Before and after the installation of the deterrent/guidance system at Creva dam, a hydroacustic telemetric monitoring activity will be performed during three downstream migration seasons (the first year is the ex ante monitoring) of silver eels both locally at Creva and over a wide area including Lake of Lugano, Lake Maggiore

and downstream Ticino River at Pavia and along the Po river until the Adriatic Sea, covering a linear distance about 580 km. The activity for the local monitoring of the behaviour of eels near the hydrostructure facing the deterrent/guidance system will use the three fixed hydrophones installed (detailed in C.4). It is important to underline that these structures implement an already present monitoring network (created thanks to other 2 Life projects Con.Flu.Po and Biosource, and a Interreg Project SHARESALMO) that extends from Lake of Lugano (Switzerland) up to Po delta at Adriatic sea, with the monitoring video-systems located at: Ponte Tresa dam (upstream at the origin of Tresa River from the Lake of Lugano), Ticino river (Porto della Torre and Panperduto dams) and Po river (Isola Serafini dam); 7 fixed hydrophones receivers, located along the Ticino (Bereguardo and Pavia) and Po river (Isola Serafini, Occhiobello, Papozze, Ferrara and Ro Ferrarese).

Each year 30 silver eels, ready to migrate downstream and selected using the protocol developed in A2 (captured by professional fishermen) will be transferred, equipped with transponders and then released in the artificial basin at Creva for three years. The data recorded by the sounders in the fixed points as above will be collected by an operator expert on telemetry and responsible for the recruitment of eels, their marking with transponders at the PARTIC facilities that allow to check the eels after the transponder implanting and finally released in Tresa River.

WHERE The monitoring activities in **Sub-action D2.1** will be carry out at the different 7 fish ladders built by the project (6 in Italy and 1 in Greece), while the estimation of the volume of the upstream migration of the elvers to compare these data with the number of specimen passing in the different fish ladders will be done in Pontelagoscuro (Ferrara). The Po River section of Pontelagoscuro is the most informative sampling station of a migratory species, such as eel, in the Po, for the following reasons: 1) it is sufficiently far from the delta; 2) it is sufficiently far from the first tributary, the Panaro; 3) it is the narrowest section before the delta; 4) information is available from recent pilot surveys; 5) fish monitoring facilities are available.

For **Sub-action D2.2** the monitoring activity will be performed in the Tresa River at Creva dam and in a wide area covering a linear distance about 600 km linear lenght of Tresa-Ticino-Po River Corridor (Fig. 1).

WHEN the monitoring program of **Sub-action D2.1** will be performed during the last 4 years of the project (2021-2024) in the period of elvers migration. According to a previous pilot sampling, the upstream migration in the Po takes place from the second half of April till the middle of June. Net will be kept in fishing for a variable time, between 24 and 48 hours, according to temperature and flow conditions, during the whole sampling season. The additional acoustic monitoring at Pontelagoscuro, will be performed in accordance with the Sub-action D2.2, as hereafter specified.

For **Sub-action D2.2** the duration is the whole project. The acoustic monitoring of the deterrent/guidance system will start in autumn/winter 2021 (ex ante) and will be repeated in autumn/winter 2022 and 2023 (ex post).

WHY This action **counts towards the 25% concrete conservation actions requirement**, because these monitoring activities secure that the specific concrete actions developed by the project will be able to support the eel conservation in the two fundamental moment of their life cycle: upstream migration of the elvers to reach the reopened growing areas, and downstream migration of the silver eels to reach the sea.

The related output from these data and from the migration behavior of silver eels fitted with sonic tags and migrating downstream along Ticino and Po river and monitored with sonic buoys of other Life projects along the Po corridor, will improve the guideline for the eel management in the Po basin carried out in Action A5

Beneficiary responsible for implementation:

UNIFE

GRAIA, with the collaboration of PARTIC, will be responsible of the implementation of the sub-action D2.2.

Assumptions related to major costs of the action:

Cost item: "30000 - UNIFE - D.2 - direct treaty - Professional fishermen in force to monitor the Po River (an estimate of about 3.000/fisherman) on the basis of previous collaborations". Professional fishing of silver eels in the Po is not performed since the early '80s. This implies that nets, locations and timing will have to be newly designed and set in practice, in a simplified and innovative way, to make it less challenging than in the past, because it requires a lot of manpower. Due to these reasons, which have a large margin of adaptation, a precise number of hours per unit and per season can't be computed and we have indicated as unitary cost the amount of about 3.000 €/fisherman, for a part time involvement in a two months period (October and November), as assessed on the basis of collaborations established in the previous years for other surveys in the river stretch. The number of fishermen involved cannot be accounted now but reasonably will be in the order of two or three.

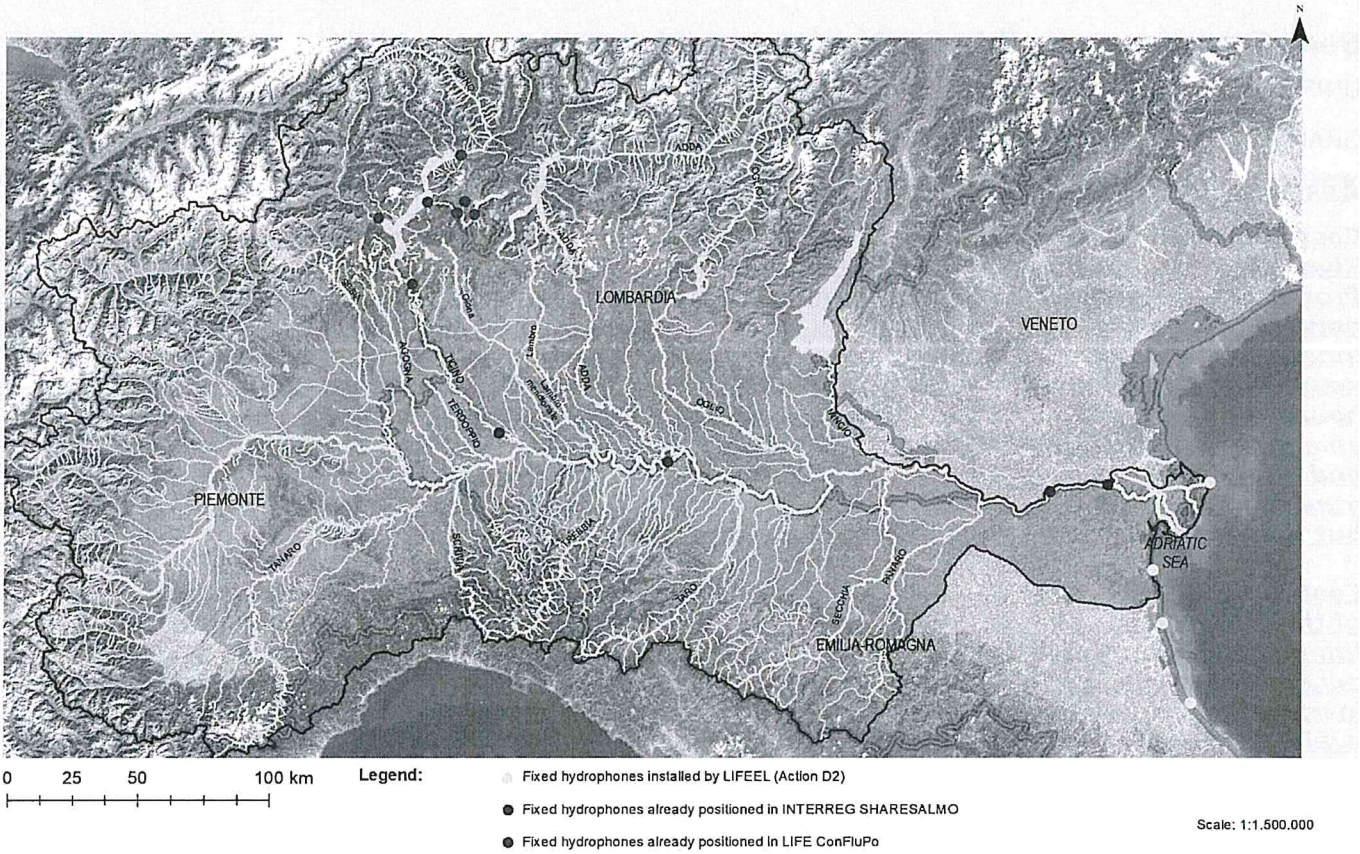
Cost item: "80000 - GRAIA - D.2 - Direct treaty. Selection among at least three offers, on the basis of the criterion of best value for money - Biologist/Naturalist, expert on fishways videomonitoring (almost 1200 days monitored), at Isola Serafini fish pass". It's been calculated on the basis of the experience gained in LIFE Project Con.flu.Po. The monitoring concerns two recording devices installed on the two branches of the passage. Only expert technicians can recognize fish and evaluate type of movements. We foresee an employment of about 320 person days (250 € daily rate, excluded VAT comprehensive of taxes).

Cost item: "24000 - GRAIA - D.2 - Direct treaty. Selection among at least three offers, on the basis of the criterion of best value for money - Biologist, expert on fishfauna acoustic telemetry and marking (almost 100 days telemetry)". It refers to the employment on the field of n.1 expert biologist for for about 100 days and an estimated daily rate of 240 € (excluded VAT).

Name of the picture: Fig. 1 - The telemetric control along Tresa-Ticino-Po River Corridor

LIFE19 NAT_IT_000851
LIFEEL
"Urgent conservation measures for critically endangered population of European Eel (Anguilla anguilla) in Po river basin"

Action D2 - Telemetry in the Po basin



D2's PROJECT DELIVERABLE PRODUCTS

Deliverable name	Deadline
Report on monitoring of eel migration on Po river and management indications	12/2024

D2's PROJECT MILESTONES

Milestone name	Deadline

D. Monitoring of the impact of the project actions (obligatory)

ACTION D.3: Monitoring the results of the captive breeding program for juvenile eel stages (Action C2)

Description and methods employed (what, how, where, when and why):

WHAT. As described in Sub-action D1, UNIBO is the only group that worldwide have developed and standardized the reproductive procedures for European eel, giving the guarantee of obtaining fertile eggs and related larvae able to survive about 1 months so far.

To support the wild stock of eel and to contrast the taking of wild glass eel carried out by aquaculture for commercial farming purposes, this project, with Action C2, will develop a captive breeding program for the growth of larvae to produce: i) leptocephali to be released in the sea as support to the wild stock; ii) to get as close as possible to the phase of glass eel, valued in about 2 years from eggs, to increase the support to wild population and theaquaculture demand for farming purpose without affectingthe wild stock of glass eels.

The monitoring activities carried out during D2 Action will have two aims: i) evaluate the growth levels, survival rate and health status of different juveniles eel stages in Action C2 activities; ii) identify the best diet in the different growth phases trying to reach theglass eel stage.

HOW. All the growth phases will be monitored and periodically a sub-sample of leptocephali will be weighed and measured in order to evaluate growth performances (body weight, body length and condition factors). Survival rate will be recorded as percentage of live eels in relation both to the precedent number of eels and to the number of larvae stocked at the beginning of the feeding trial.

The monitoring action will include the measurement of:

- Larval survival

- Larval growth (weight and length)

- Gut fullness

- Main environmental parameters (temperature, salinity, etc.)

- Water quality (nitrogen, ammonia, phosphates, etc)

- Live and inert food dispersion in water

- Predatory behavior

All these parameters will allow to identify the best diet and environmental conditions in the different growth stages, to reach the phase of glass eel.

A six-monthly report on the results achieved in the various phases will be produced and disseminated among the scientific community and stakeholders.

In addition to the installations for rearing eel larvae and leptocephali as described in Actions D1 and C2, the required material will include video camera (to film young eels behavior), hycthyometers, luximeters, salinometer, precision scales, thermometers, gloves, lab coats, reagent for water quality control, plastic

containers of various sizes.

During the monitoring activity of the captive breeding of eel larvae, we will check the following parameters:

- weekly data on larval survival (%);

- every 2 weeks data on growth (weight in g and length in mm), based on a sub-sample of at least 50 larvae;

- every 2 weeks data on gut fullness (%), based on a sub-sample of at least 200 larvae;

- weekly data on the main environmental parameters (temperature °C, salinity g NaCl/l, nitrogen mgN/l, ammonia mgNH4+/l, phosphates mg P-PO4/l, etc)

- weekly data on the live and inert food dispersion in water (mg/l)

- Predatory behavior (qualitative data), during the activity as a whole.

WHERE. This action will be performedby UNIBO at their facilities in Cesenatico.

WHEN. From 2021, when first larvae will be obtained, and for the whole project (till 2024) to try to grow larvae till glass eel phase. The activities will be also carried out by UNIBO during the After Life period.

WHY. **This action** is necessary to monitor the efficiency of the protocols applied, and **counts towards the 25% concrete conservation actions requirement**, because obtaining juvenile forms from artificial breeding using wild breeders could warrants important re-introduction programs in public waters not only in Italy, but all over Europe, also maintaining the aquaculture production without effecting the wild populations.

Beneficiary responsible for implementation:

UNIBO

Assumptions related to major costs of the action:

The costs of the activities and timings of the action have been estimated on the basis of previous experience gained at the center of the University of Bologna in Cesenatico. For each member of the internal staff the number of working days was calculated on the experience developed at the facility, while the daily rate is calculated on the basis of LIFE guidelines.For external assistance and equipment the related costs were estimated with the carrying out of preliminary surveys, and on the basis of quotes and previous experience.

D3's PROJECT DELIVERABLE PRODUCTS

Deliverable name	Deadline
Six-monthly reports on the results achieved	12/2024

D3's PROJECT MILESTONES

Milestone name	Deadline

D. Monitoring of the impact of the project actions (obligatory)

ACTION D.4: Monitoring of the overall impact of the project

Description and methods employed (what, how, where, when and why):

WHAT. The action will be performed in three sub-actions:

Sub-action D.4.1 - Monitoring of the overall impact of project actions.

Sub-action D.4.2 - Monitoring of the socio-economic impact of the project.

Sub-action D.4.3 - Monitoring of the impact on ecosystem services

HOW.

Sub-action D.4.1 - Monitoring of the overall impact of project actions.

The sub-action is aimed to monitor the progress of the project so that to be able to apport on time adjustments and activate alternative solutions, if necessary, to ensure the final success of the project in the maximum respect of the project timetable.

This action provides the periodic (every six months) review of the results obtained from the project, according to the system of indicators (LIFE Key project level Indicators) provided for each share, as reported in Form C, and according to the model tables of indicators provided by LIFE and, starting from the one attached to the proposal, which will be implemented and as precise as possible fullfilled.The results of the periodic checks of the project will be showed to all the project workgroup, so that to aware everyone to do his best to achieve the goals of the project. In addition, the completed table of indicators will be included in the Progress Reports to the EC and in the Final Report.

Sub-action D.4.2 - Monitoring of the socio-economic impact of the project.

The aim is to to verify the effects of C actions on the local socio-economic sector. The monitoring action will be performed in three ways:
1. by verifying the opinions and the behaviours of the people involved in the project as target audience or as stakeholders;
2. by interviewing the people participating to the LIFEEL events under Action E.1.2.

The expected target audience will be represented by:
- lagoon farmers, fishermen and anglers involved in actions A2, C1, E1.2 (approximately 3,000 units);

- hydroelectric and other hydric resource users companies approached and involved in actions A4, A5, F1, E1 (approximately 5 units);

- students involved in environmental education programmes (E1.3) and their families (about 8,400 units);

- local population aprroached during projects events (E1.2) (almost 2,500 units);

Everyone will be asked to complete the questionnaire on project and its best practices. There will be taken into account even possible doubts, difficulties, disagreements shown.- Students involved on the educational programme.

Every lagoon farmer/fishermen involved will be asked to elaborate a balance with his expectations (even the

economic ones) and the goals achieved.

This activity will be performed during the meetings well defined under action E.1.

3. By recording the number of the visitors of the website and of the FB page and by analyzing the comments and the reactions left on them.

Data will be elaborated and interpreted even by comparing it with the general trends on local socio-economic sector: so it will be possible to draw conclusions on the project impacts and perspectives.

Under this sub-action a review of the action D will be performed in order to verify that they efficacy evaluate the main project findings and outcomes of the pilot/demonstrative actions. An evaluation about their cost-efficient replicability or transferability of the actions and results and the measures taken to ensure the actual replication or transfer of successful pilot/demonstration actions will be performed under this sub-action.

Sub-action D.4.3 - Monitoring of the impact on ecosystem services

The objective is to verify the effects of C actions on the ecosystem services.

This action is focused on the analysis and interpretation of the data resulting from C actions accomplishment. The information will be obtained from each working group and from each report project and it will be enriched and completed by information received
1. from the involved stakeholders;
2. from scientific literature;
3. from national statistical authorities (e.g. ISTAT).

The action will entail a detailed reading of scientific literature. Some of the ecological services which couldbe analyzed are:

- PROVISIONING - wild foods / capture fisheries / Aquaculture / Genetic / Freshwater

- REGULATING - water regulation

- CULTURAL - recreation / aesthetic

The evaluation of the ecosystem services will be done in two ways: directly, by asking an evaluation to the users/stakeholders (D.4.2), and indirectly through their market assessments.

In terms of data collection, we'll proceed as follows:

Sub-action D.4.1. Every 6 months all the partners will be invited by the project manager to update the table of the Key project level Indicators, shared in a Google-Drive folder or similar. The table will have the role of an "alert system" for all the partners to achieve their goals on time.

Sub-action D.4.2 and Sub-action D.4.3 - Monitoring of the socio-economic impact of the project. All the data will be recorded through questionnaires distributed to the audience and to the economic stakeholders at the public events and through social media. The data will be collected in a database in order to be processed.

Where - The action will be undertaken within the whole area of the project and via internet too.

When - The action will be undertaken from 2021 till the end fo the project.

Why - The action is assumed to be necessary in order to evaluate the transposition and the integration of the project's contents in the local socio-economic sector.

Beneficiary responsible for implementation:

RL

RL will direct this action, assisted by the Project Manager and by all the partners responsible of information from their own activities

Assumptions related to major costs of the action:

The costs area related to the minimum employe foreseen for all the partners in this action. All the exciding costs substained for the personnel employed in this action will be on charge of the partners

D4's PROJECT DELIVERABLE PRODUCTS

Deliverable name	Deadline
Final report on the project overall impact	12/2024
Tables of the indicators filled	12/2024

D4's PROJECT MILESTONES

Milestone name	Deadline

E. Public awareness and dissemination of results (obligatory)

ACTION E.1: Information and awareness raising activities

Description and methods employed (what, how, where, when and why):

The dissemination action will be performed with all the necessary approaches and products to assure the best dissemination of the projects objectives and results, as particular regard to its demonstrative/best practice/pilot characters.

The dissemination will be performed in three major ways:

Sub-action E.1.1 Dissemination and promotional products

Sub-action E.1.2 Dissemination events

Sub-action E.1.3 Environmental educational programmes

WHAT, HOW, WHERE and WHEN

Sub-action E.1.1 Dissemination and promotional products (GRAIA coord.). Under this sub-action the following products will be realized and disseminated:

1 **Project branding guidelines**. All the project actions and their deliverables will be provided with the standard elements for branding the project: logo types and template suggestions. The guidelines will help the project (and those responsible for producing its branded material) to properly use the logo and other elements. Project branding will be based on the LIFE branding.

A **website (IT, GR, EN)** and a **Facebook page (in IT and in GR)**, posted and updated every 6 months. Website and FB page will be activated by the first three months of the project. ***At least n. 500.000 people reached***

A **e-newsletter (IT, EN)** (no less than 8 editions) disseminated by e-mail and through the website and the FB page. ***At least 800 people reached***;

Press releases (IT, GR, EN) (no less than 8) disseminated to no less than n. 200 mass media. They will be disseminated to celebrate the achievement of every project milestones, during the LIFEtime. ***At least n. 200 mass media reached*;**

Project noticeboard (no less than 20) to be installed in strategic point of view of the project area in the first year of the project;

Project brochures (in Italy and in Greece) (no less than 20,000 copies,***to at least n.20.000 people***), published in the first year of the project and disseminated in the project area through local Parks sites and personnel, and published digitally on the website and on the FB page of the project.

Project promotional t-shirts (no less than ***1000 people receiving***), produced in the first year of the project and distributed among project team, stakeholders involved, students and people approached during the project's events.

Project promotional gadgets (some like caps, stickers, water bottles, or other) (no less than ***5000 people***

receiving) to be distributed during the projects events and environmental educational programmes. These will be produced in the first year of the project.

Sub-action E.1.2 Dissemination events

This sub-action includes the meetings with stakeholders and the overall project dissemination events.

As a regard to the **meetings with stakeholders:**

At least n. 50 pond farmers involved by PDPO and PVPO and DEMETER.

PDPO will carry out**:** n.2 meetings with fishermen and anglers to increase they awarness, to involve them into the project and to keep them on the best practise developed and promoted by the project (indicatively one in 2021 and the other in 2023); n.3 events of eels release (perfomed under Action C1) publicised under this sub-action (***at least n. 450 participants***).

PVPO will carry out: n.2 workshops with fishermen and anglers aimed to their keeping (indicatively one in 2021 and the other in 2023).

RL will carry out promotional activity with anglers on the topic of eel and the threats araising from it, and with hydro companies on the topic on eels (and fishfauna in general), the hydro structures' impact on them and the potential compliance measures that could be adopted:

- to involve fisherman and anglers (***no less than 240,000)*** in the projects monitoring activities and to araise their awarness, an **HELP DESK (HD)** will be developed (by GRAIA) to be used as a citizen scienze early alert system, to signal the sightings of eels (eventually even marked within the project); it will be presented through specific meetings managed by RL (no less than 2 meetings with representatives of anglers' major associations) and to the *Ministry of Agriculture* for its promotion trhough its ufficial website. The sightings collected with the HD will be endeed also useful for the updating of the National Management Plan of Eel. The HD will also be presented to Po Fishery Consult under Action F1.

- to araise awarness of hydroelectric companies and other hydric resource users (***at least n.15***), RL will also carry out a dissemination activity focused on this topic, approaching the companies during the A6 action and organizing n.2 workshops to discuss about the multiple use of the hydric resource and to share experiences and knowledge over the guidelines drafted under Actions A4, A5.

As a regard to the **overall project dissemination events:**

RL will organise the kick-off meeting of LIFEEL (by the 30/06/2021, ***at least 1,000 people***) and the final conference (by the 31/12/2024, ***at least 2,000 people***) at its headquarter in Milan, two events dedicated to the project and two networking with other projects (Action E.2.2), including also temporary installations or/and attractions for the people visiting the site of the workshop **in the week of the event;**

PDPO will organise the "BIG DAY OF THE EEL" (by the end of 31/12/2023, ***at least 1,000 people***), an event within the Park area, including a project seminar and attractions and games with children.

DEMETER will organize n.2 events to celebrate the project in Greece, targeted one to stakeholders and another to students and population; ***at least 500 people reached***.

Sub-action E.1.3 Environmental educational programmes from 2021 to 2024 (PDPO, PVPO and PARTIC) (*at least 8,000 students involved*)

PVPO will carry out similar environmental educational programme in its territory, including the forniture of a didactic workbook focused on its side of the Delta (indicatively A4, 30-40 pages, n. 3000 copies) and an educational activity consisting of 1 lesson in classroom and 1 lesson outisde in the Delta. Also in this case, no less than ***n.100*** classes of primary and/or secondary I degree school will be involved in the educational training.

PDPO will carry out an environmental educational programme using the didactic the didactic workbook produced by PVPO, an educational activity consisting of 1 lesson in classroom and 1 lesson outisde in the Delta. No less than ***n.100*** classes of primary and/or secondary I degree school will be involved in the educational training.

PARTIC, active for a long time on the environmental education on the topics of fish fauna (Life NAT/IT000188 Conflupo and in the Project Life NAT/IT000989 TICINO Biosource), will create an original booklet (an approximate A4, 50-60 pages, about 4000 copies) on biodiversity and on the long journey of eel to and from the sea with insights on the role of freshwater for eel conservation and on the threats which make it at risk. At least 50 courses will be made, involving ***n.100 classes*** along the Ticino River Corridor.

DEMETER will also perform an educational programme, involving at least ***n. 50*** classes of primary/secondary schools.

Beneficiary responsible for implementation:

GRAIA

DEMETER, PDPO, PVPO and PARTIC will locally perform educational programmes; RL and Po Delta Parks will carry out E.1.2.; all the partners will participate with representatives to the E.1.2 events

Assumptions related to major costs of the action:

E1's PROJECT DELIVERABLE PRODUCTS

Deliverable name	Deadline
LIFEEL t-shirts and other project gadgets	12/2021
LIFEEL website and FB page	12/2020
brochure on the project	12/2021
n. 20 project noticeboards	12/2021
Newsletter, n. 8 editions	12/2024
educational workbooks produced by PDPO, PVPO and PARTIC	12/2024
press releases (N.8)	12/2024

E1's PROJECT MILESTONES

Milestone name	Deadline
first delivery of the LIFEEL Newsletter	12/2020
first publication of LIFEEL website and Fb page	12/2020
first press release of LIFEEL	12/2020
LIFEEL kick-off meeting performed	01/2021
first pubblication of the utility of the HELP DESK of LIFEEL	12/2022
Educational programmes completed	12/2024
LIFEEL final seminary performed	12/2024
n. 2 workshops with hydroelectric and other hydro companies performed	12/2024
n.6 workshops with anglers performed in the project area	12/2024

E. Public awareness and dissemination of results (obligatory)

ACTION E.2: Technical dissemination and networking

Description and methods employed (what, how, where, when and why):

The Action will be coordinated by the Project Manager (GRAIA) and it includes two sub-actions:

Sub-action E.2.1 - technical dissemination

WHAT. No less than n. 2 scientific articles on the protocol/best practices developed under the activity of early breeding of eel (UNIBO) and n.2 scientific articles on the management of eel best practices and on the results of monitoring performed under D1 and D2 actions (UNIFE, DEMETER), will be published in internationale scientific journals.

The publishing of a technical manual of eel's management best practices will be carried out by the partnership and edited by PVPO.HOW. The publications will be realized in electronic form and made also available on the project Web Site. Also they'll be used during the networking activities carried on after their realization.

At least n. 500 people downloading the technical e-manual (we highlight that the text "the manual will be edited by PVPO" has to be cancelled, and we shall cancel it)

WHEN. by the second year of the project till the end.

Sub-action E.2.2 – networking

WHAT. Networking foresees: a preliminary investigation and request of networking of those project developed under EU funds and related to the species and topics targeted by LIFEEL. Some project targeted could be:

LIFE GESTIRE 2020 - LIFE14 IPE IT 018GESTIRE2020, in particular for it's experience on the involvement of stakeholders in biodiversity management topics and for the themes related to the best management of aquatic biodiversity;

LIFE AGUEDA - AGUEDA - CONSERVATION AND MANAGEMENT ACTIONS FOR MIGRATORY FISH IN THE VOUGA RIVER BASIN LIFE16 ENV/PT/000411 - in particular for its activities on eel;

other LIFE project related to LIFEEL will be contacted (no less than 5 projects).

The networking with italian LIFE projects currently active will be a natural consequence of the presence in this partnership of beneficiaries of other LIFE projects, related with this one: e.g. LIFETICINOBIOSOURCE - LIFE15 NAT/IT/000989 , IDROLIFE - LIFE15 NAT/IT/000823.

Contacts will also be activeted with other projects, out of EU funding, developed in Europe on eel, like:

"The ZSL eel monitoring in the Thames", an ongoing project being run by the Zoological Society of London (ZSL) which gained a strong experience on eel conservation and manage a successfull activity of 'citizen science, the "Citizen Science Eel Forum".

HOW. The networking activity will be coordinated by GRAIA (Project Manager) and all the partners will collaborate. a direct e-mail and skype contact will be established with the referents of the projects of interest and conference calls will be realized with all of them. Almost three visits to the project areas of these projects

F. Project management (obligatory)

ACTION F.1: Project management and After Life activities

Description and methods employed (what, how, where, when and why):

WHAT.

Realization of the project management thanks to the administrative and technical structures established in preliminary Action A1, and carrying on of the Post Life activities.

This action will manage the project thanks to three specific sub-actions:

Sub-action F.1.1 – Overall project management

Sub-action F.1.2 – Independent audit

Sub-action F.1.3 –After-Life Plan

HOW.

Sub-action F.1.1 Overall project management

RL will assure the correct management of the project thanks to the structure developed during Action A1 (see picture below: ***RP17 - LIFEEL Management Structure and Chain of Command; RP17bis - Description of responsibilities of the key project's positions***):

the basic level of this structure is formed by the **8 internal staff groups**, one for each partner, in charge to conduct the technical-administrative activities with weekly internal meetings open to external people hired by the project. Each group have a project leader, as well as one technical and one administrative representative; these figures of each partner will form the Steering Committee.

Steering Committee: lead by RL and supported by the Project and Financial Managers hired in Action A1, it will be in charge of the technical and administrative management for the whole project, thanks to at least 5 meetings with related minutes during the project (1 at the beginning of the project with Action A1, and at least other 4 during this Action) generally hold at RL main office or with the use of digital platform to decrease the project's carbon foot print.

Italian and Greek Coordination Committees: established in Action A1 by the institutional partners, will work in the two different areas during all the project with at least 5 meetings each with related minutes during the project (1 at the beginning of the project with Action A1, and at least other 4 during this Action) to solve any problem and situation at institutional level (e.g. need to establish new regulations) reaching the project results.

The Italian Coordination Committee will work in strict synergy with the Po Fishery Consult ("Consulta Pesca Po") an institutional body developed by Life project Conflupo and formed by Po River basin Authority (technical secretariat) and Emilia-Romagna, Lombardy, Piedmont and Veneto Regions to unify the work of the Regions to achieve an effective mitigation of the impacts on Po basin.

The Fishing Consult will have the task to adopt a unique document on Eel Conservation Measures developed by LIFEEL and to forward it to the Italian Ministry of Agriculture (MIPAF supports

LIFEEL, form A8).

An example of the cooperation during the project between these two bodies (Coordination Committee and the Po Fishery Consult) will be to face the threat linked to the withdrawal of water for irrigation, impacting both eel and more in general all the fish fauna. To be solved it is necessary to proceed at institutional level, considering the importance of the agricultural production in all the 4 regions of the Po basin.

The Greek Coordination Committee will work very close with all fishing cooperatives that are involved in eel fisheries in the Region of East Macedonia and Thrace, the Public Electricity Company that manage the two hydroelectric power plants in the mountainous part of River Nestos and regulates the water flow and as results impacting both eel and more in general all the fish fauna.

Additionally, the Committee will seek close cooperation with the local agricultural cooperatives to face the threat linked to the withdrawal of water from the river for irrigation purposes.

Sub-action F.1.2 Independent audit As prescribed by Life regulations, GRAIA (the unique partner requesting more than 750,000.00 Euro of EU contribution) will entrust within the Mid Term Report (30/06/2023) an independent external auditor to audit the eligibility of all the costs incurred by GRAIA respect the Life rules and national laws. In the financial forms, this cost for the audit is under the budget item "Other costs".

Sub-action F.1.3 After-Life Plan

One of the goals of this project is to assure over the project end the maintenance of the conservation measure for the eel carried out both in this project and learned in other ones thanks to the networking activities developed in the Action E2. So in the last quarter of the project RL, in time for its distribution at public Life project final meeting, it will publish an operational document of about ten pages in Italian, Greek and English that will be sent to EU as deliverable.

This After-Life Plan will contain indications related to the **project continuation and replication**, and in particular:

i) the project activities that will continue after its end, and the responsible partners

ii) "best practices" developed in the project or in others projects contacted through the networking activities of Action E2, able to improve the conservation status of the eel in the project areas and similar situations

iii) reduction of the impact of hydroelectric power plant (dam and turbine) on eel movement, with indication of the priority places of intervention, with priority to Natura 2000 sites

iv) reduction of the fishery and aquaculture impact on young and mature eel breeders

v) indication for implementation of regulation at national and EU level for eel.

In the After Life activities will be considered to maintain and increase the release of fully mature breeding stock and the maintenance/management of passages for eels built during the project.

For each activity it will be indicate the priorities, the delegate Institutions for their appointment, as well as indication of usable budget funds or where to apply for.

WHERE. These 3 sub-action activities will be developed by each partner at their respective locations, while the meetings of Steering Committee will be mainly done at the headquarter of RL with also the participation through digital platform.

WHEN. Action F1 will be carried out throughout the duration of the project (1/10/2020 – 31/12/2024) to ensure both the planned activities and their eligibility, as well as the maintenance of the conservation measures over the project end

WHY. Action F1 is a key point to assure the whole governance of the project as well as to ensure the achievement of the different planned objectives for conservation of eel in the project areas on medium and long term.

Beneficiary responsible for implementation:

RL

RL leads the organization and guidance of administrative-technical staff for the project management, Steering Committee and Italian Coordination Committee.
Other partners: responsible for their own activities and those of subcontractors; Fisheries Research Institute – Hellenic Agricultural Organization "DEMETER" is responsible also for the Greek Coordination Committee.

Assumptions related to major costs of the action:

In accordance with Generale Conditions, GRAIA will refer to an independent auditor for the audit to verify the respect of national legislation and accounting rules and also certify that all GRAIA costs incurred respect the General Conditions of the Model LIFE Grant Agreement.

About GRAIA budget: to avoid the risk of delays in arranging the crucial assignment for the most effective managing of the project, it will take in charge the freight to arrange the assignment to the LIFEEL PM: Italian law makes this mechanism much easier for a Private Body. The import is dimensioned as reported in the financial forms in order to guarantee a PM professional with more than a decade of experience in the management of LIFE Projects and employed full time. The selection of the PM will be carried out as an open call, with a selection based on a list titles shared with the Coordinating Beneficiary, RL. A representative of Lombardy Region will be invited to be part of the selection commission (also composed by the CEOs of GRAIA). The accuracy and legalty of the procedure followed for the award will be verifiable, as the whole procedure will be written in a specific resolution of the Board of Directors of GRAIA.

Note: To reduce the carbon foot print of the project, The After-Life document will be printed in only 800 copies on recycled paper and with EuPia inks, favoring the its diffusion in electronic format that can be downloaded from the project web site. The improve the diffusion of project output, printed copies of the After-Life Plan will be sent to the partners, to the stakeholders and organizations involved in the networking, and distributed during the final congress, while on the web site it will be insert the news regarding the availability of this document for the download.

Cost item: "RL-Financial manager": daily rate 440 €/day.

Cost item: "GRAIA -F.1 - Project manager", daily rate 240-250 €/day.

Cost item: "RER - F.1 - Financial manager for RER", daily rate 190-200 €/day.

Name of the picture: RP17 - LIFEEL Management Structure and chain of command

LIFEEL PROJECT MANAGEMENT STRUCTURE AND RELATED CHAIN OF COMMAND AND RESPONSIBILITIES

ITALIAN AND GREEK COORDINATION COMMITTEE

Institutional bodies (partner and external) with planning authority.

Almost 5 meetings during the project

STEERING COMMITTEE

Representatives of the 9 project beneficiaries, under the coordination of RL (beneficiary coordinator) and assistance of the Project and Financial Manager

Almost 5 meetings during the project

9 INTERNAL TECHNICAL/ADMINISTRATIVE GROUPS

(1 for each partner)

Weekly meetings.

The **Coordination Committee** – an open committee with a core group formed by the Project Leaders of all the partners - **represents the institutional round table to interact with the various Institutions** to assure the achievement of specific actions (e.g. granting of authorizations) or to ensure the transposition of project results (e.g. indications for eel management) at institutional level.

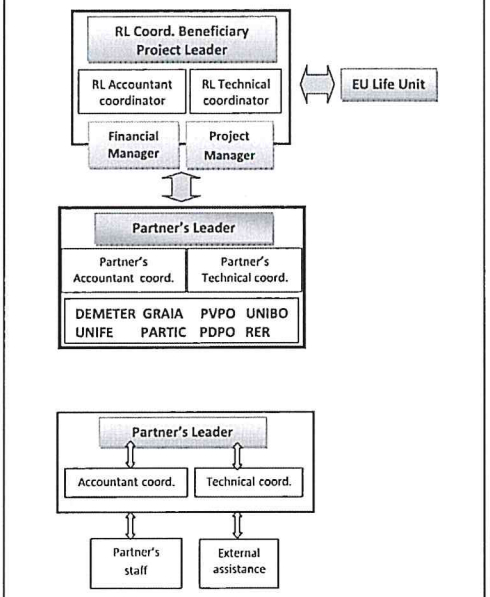
Structure for the management, coordination and technical/administrative control of the whole project

Leaded by RL – beneficiary coordinator that maintain the contact with EU – and supported by Project and Financial Managers, with the involvement of the partners' representatives: Partner Project Leader plus Accountant and Technical coordinators.

Structure for the management, coordination and technical/administrative control of the project activities at level of each partner.

Each of the nine groups is composed by the Partner's Project Leader assisted by an internal Accountant and a Technical coordinator, coordinating and controlling the activities of the internal staff involved in the project and the external personnel hired for the project

KEY PROJECT'S POSITIONS AND RESPONSIBILITIES



Name of the picture: RP17bis - Description of responsibilities of the key project positions

RP17bis - Description of responsibilities of the key project's positions

For the Coordinator Beneficiary and for the whole project:

RL Coord. Beneficiary Project Leader: responsible for the overall implementation of the project and for the partnership. RL C.B. **Project Leader directly controls Financial Manager and Project Manager**

Financial Manager: assists the RL Coord. Beneficiary Project Leader (Coord. Beneficiary) in the financial management of the whole project, collecting, organizing and verifying the financial documentation of all partners, remembering delivery deadlines and assisting partners in the adjustment of their documentation and procedures.

Project Manager: assists the RL C.B. Project Leader in the overall management of the project, in order to guarantee a smooth coordination and implementation of the project. He/she assures a cost-effective implementation, completed in a timely fashion; plays the lead role in planning, executing, monitoring, controlling and closing project actions and assists all the beneficiaries in addressing and resolving any issues that arise during the project.

For each Associated Beneficiary:

Partner's Leader: responsible for the implementation of the project activities and actions involving the partner. Partner's Leader directly controls the Partner's Accountant Coordinator (or Partner Financial Manager) and the Partner's Technical Coordinator (or Partner Project Manager). He/she identifies the working group and its roles, including internal staff and external assistance.

Partner's Accountant Coordinator (or Partner Financial Manager): he/she deals with the financial management of the partner budget, collecting, organizing and verifying its financial documentation and paying attention to respect the delivery deadlines and the procedures.

Partner's Technical Coordinator (or Partner Project Manager): he/she deals with the technical management of the partner activities, assuring their cost-effective implementation, completed in a timely fashion. He/she coordinates the partner's staff and the external assistance.

F1's PROJECT DELIVERABLE PRODUCTS

Deliverable name	Deadline
AUDIT report on GRAIA financial reports	12/2024
Minutes of the meetings of the Steering Committee	12/2024
After Life Plan	12/2024
Coordination Committee minutes	12/2024
Steering Committee minutes	12/2024
Inception report	03/2022
Midterm Report	06/2023
Final Report	03/2025

F1's PROJECT MILESTONES

Milestone name	Deadline
After-LIFE Plan drafted	12/2024