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LIFE Project Number  
**< LIFE16 NAT/IT/000663 >**

**Final Report**  
**Covering the project activities from 01/09/2017 to 31/08/2022**  
*(New version with only technical part)*

Reporting Date  
**<28/02/2023>**

LIFE PROJECT NAME or Acronym  
**LIFE LAGOON REFRESH**

Data Project

<b>Project location:</b>	Lagoon of Venice, Venice, Veneto, Italy
<b>Project start date:</b>	01/09/2017
<b>Project end date:</b>	31/08/2022
<b>Total budget:</b>	€ 3,315,130
<b>EU contribution:</b>	€ 2,436,286
<b>(%) of eligible costs:</b>	74.13% of the total eligible budget

Data Beneficiary

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## 2. List of key-words and abbreviations

ISPRA: Institute for Environmental Protection and Research

RV: Regione Veneto – Direzione Ambiente

OO.PP.: Provveditorato Interregionale per le Opere Pubbliche del Veneto, Trentino Alto Adige, Friuli Venezia Giulia

UNIVE: Università Ca' Foscari di Venezia

IPROS: Ipros Ingegneria Ambientale s.r.l.

AB: Associated Beneficiary

CB: Coordinating Beneficiary

KOM: kick off meeting

MBM: Management Board Meeting

Project: LIFE Lagoon Refresh

EIA: Environmental Impact Assessment

KPI: Key Project Indicators

IPR: First progress report

IIPR: Second Progress Report

MTR: Mid Term Report

WFD: Water Framework Directive, Directive 2000/60/EC

### 3. Executive Summary

The Project involves the restoration, in the northern Venice Lagoon, SCI IT3250031, of the ecotonal environment, typical of microtidal lagoons. This environment is characterized by a marked salt gradient and large intertidal areas vegetated by reedbeds (mainly *Phragmites australis*), whose presence has been greatly reduced by historic human intervention. The objectives of the project are:

- 1) to improve the degree of Conservations of habitat 1150\* - Coastal Lagoon by a restoration of salinity gradient, and consequently to improve the water quality thanks to expansion of reedbeds and improvement function of habitat for aquatic fauna;
- 2) to improve the status of bird species included in annex 1 of Dir. 2009/147/EC, that use the reed environment during the winter period and / or for breeding, foraging or nesting;
- 3) to increase the presence of the fish species *Ninnigobius canestrinii* (previously classified as *Pomatoschistus canestrinii*) species, included in the annex II of Dir. 92/43/EEC, attracted by the presence of low-salinity environments.

To achieve the objectives, key deliverables and outputs are the completion of conservation actions preceded by preparatory actions.

All preparatory actions were completed successfully. The Project received all required permission by Competent Authorities (action A.1) for carrying out the hydraulic (action C.1) and morphological (action C.2) works and for transplanting activities (action C.3 and C.4), in the framework of EIA procedure. The EIA procedure was not foreseen in the Proposal. The Milestone to have all the authorizations by 08/2018 was postponed to 12/2018. The survey and modelling activities for final design of hydraulic and morphologic works (action A.2) were completed in time. Design of hydraulic work (action A.3) and morphological work (action A.4) were completed successfully with a delay due to EIA procedure.

All conservation actions were completed successfully. The realization of a fresh water input from the Sile river to the Lagoon, through the construction of an uptake along the bank of the river (action C.1), originally foreseen in August 2019, was completed in February 2020. The implementation of morphological interventions, by means of biodegradables modular bags, positioned on the lagoon shallow bottom in front of the freshwater intake area (action C.2), originally foreseen in August 2019, was completed in May 2020. The delays in C.1 and C.2 actions were due to not foreseen EIA procedure, the bad weather conditions and high tide events, which lasted throughout the end of 2019 and the restriction of pandemic in 2020. The conservation actions of reed and seagrass transplantation (action C.3 and C.4) were preceded by preparatory action A.5.2. The foreseen “Guideline for reedbed and seagrass transplantations” and training course for reedbed and seagrass transplantation were completed in delay but perfectly integrated with C.3 and C.4 activities. Considering the delays of completion of C.1 and C.2 and taking into consideration seasonal and phenological factors related to the reedbed development, transplantation activities started in 06/20 instead of 09/19 and ended in 06/22 instead of 06/21. As a measure to mitigate the effects of the delay in the start of transplants, the number of sods transplanted was increased and the period of field activity was extended. For the same reasons, the time schedule foreseen in the proposal for transplantation of seagrasses (C.4) was rescheduled. In particular, the start of the seagrass transplantation activities, foreseen in Proposal for September 2019, has been postponed to October 2020. However, such a delay did not entail a modification of the expected number of clumps and rhizomes that have been transplanted during the project. The concrete action C.5 “Identifying specific hunting and fishing rules and better practices” was preceded by action A.5.1 with several meeting with stakeholders to discuss the possible modification of hunting and fishing activities. The output to modify the hunting regulation was achieved during the revision of the Wildlife Hunting Plan and Fishing Plan. Concerning the fishing activities, the

milestone to prevision regulating fishing was not completed because Fishing Office of Veneto Region rejected the Project request in the context of the revision of Fishing Plan.

All the activities foreseen in “Monitoring activities”, performed to evaluate the impact of conservation actions, were completed successfully with some adjustment in timetable and in most cases additional surveys were added without additional costs. To improve the robustness of assessments, monitoring activities did not stop as foreseen in proposal, but they continued also in 2022. On 31<sup>st</sup> August and 28<sup>th</sup> November 2022, respectively the last project day and after the end of the Project, water samples were gathered, to calculate the annual average of chemical water parameters for the year 2022. Indeed, these data allowed updating the evaluation of the eutrophication risk and of the conservative status in habitat 1150\*. The overall results were not available for the final Deliverable of D.1, dated August 2022 and therefore are discussed and provided as an addendum in this Final Report.

Comparing the environmental expected results with achievements at the end of the project, the restoration of the salinity gradient was reached in the intervention area of 70 ha as planned, and the outcomes of fish fauna assessments indicated an improvement of fish fauna as expected. The macrophytic community improved in ecological quality status as well as coverage of seagrasses meadows, while macrozoobenthos community needs more time as usually expected. Conservative status of ecosystemic structures of habitat 1150\* in the Project area was assessed by quantitative method that integrates aquatic vegetation parameters and data of chemical-physical elements in waters. The status resulted excellent, considering the mean values of the whole project site. Within the Project site, some differences resulted, showing heterogenic characteristics with lower and more degraded status in *ante operam* rather than in *post operam*, especially in the inner part of the lagoon. Conservative status of ecosystemic functions showed an improvement when considering fish fauna community, while macrozoobenthic community needs more time, as usually expected. Taking into account the short time passed between the full discharge of fresh water inlet and the transplants, reedbed mapping showed encouraging results. The reedbed was found in a lagoon area of about 11 hectares and nearest the freshwater input resulted abundant (cover > 75%) in an area of about 1.1 hectares. Clumps in a good state of rooting and areas with less coverage were found in the remaining surface. Compact populations require at least 5-10 years for their formation. Consequently, the reduction of the degree of eutrophication due to the phytoremediation function of reed beds and the improvement of the status of birds closely linked to reedbeds, is expected in the same time frame. On the other hand, among the numerous species of water birds, some have given important positive responses to freshwater input into the lagoon. Some species like *Larus ridibundus*, *Calidris alpina*, and *Larus melanocephalus* have increased their presence in the intervention area. Among the target species, *A. atthis* and *Ixobrychus minutus* showed some positive signal after the freshwater input.

All dissemination materials to general public of action E.1 were produced (e.g. Flyer, Brochure, Web site, Roll up, notice boards, short and long videos, Layman’s report). The general public attention to the project exceeded expectations with 9000 user views on the website, 700 newsletters downloads, more than 50 articles on various Italian and several languages newspapers and magazine; many journalistic reports. The bike path near the intervention area is a strength for the visibility of the project. The two courses for recognition of bird life and photographic hunting were held successfully. The Dissemination to technical public and networking activities (action E.2) were completed. Start and final Conferences were successfully done. Over 100 university students participated to several seminars organized by ISPRA and UNIVE. The project was presented in many occasions to a specialist public (conferences, workshops, and seminars). Scientific articles were published. More than twenty LIFE projects, other five European projects and about twenty associations/public entries were engaged in networking activities. The transferability activities were implemented and

completed. The initiative of “Call for Interest” and the following activities, despite the pandemic restrictions, have guaranteed a concrete transferability in six sites (three Italian: the Apulian Acquatina di Frigole, lagoons in the Delta Po River Barbamarco-Busiura, Basson-Canarin, and Sacca of Scardovari at Veneto Region, and Pialassa Baiona, Valle Mandriole and Punta Alberete at Emilia-Romagna Region. Three European: the Spanish lagoon of l’Albufera de Valencia, the French salt marshes of Hyeres, and the Greek Nestos Delta lagoons and Porto Lagos.).

## 4. Introduction

The **overall objective** of the project is the restoration, in an area of the Northern Lagoon of Venice, SCI IT3250031, of the ecotonal environment, typical of microtidal lagoons, characterized by a marked salt gradient and large intertidal areas vegetated by reeds (mainly *Phragmites australis*). This kind of environment has been greatly reduced by historic human intervention (e.g. river diversion and inlet construction). The project aims at restoring these ecosystems and their services, in order to achieve the following **specific objectives**:

1. to improve the Degree of Conservation of Habitat 1150 \*- Coastal lagoons:
  - a. recreating the typical oligo-mesohaline environments of estuarine type, in order to counteract the depletion of macrobenthic and fish communities that occurred in the lagoon. In fact, during last years the brackish species have been replaced by marine ones;
  - b. reducing the degree of eutrophication, thanks to reed phytoremediation function, favouring the presence of sensitive species and aquatic plants of high ecological value. These characteristics are typical features of habitat 1150\* in good/high level of preservation;
2. to improve, within the Lagoon of Venice-SPA IT3250046, the status of bird species included in annex I of Dir.2009/147/EC, that use the reed environment during the winter period and/or for breeding, foraging or nesting: *Microcarbo pygmeus\** (previously classified as *Phalacrocorax pygmeus\**), *Botaurus stellaris\**, *Ardea purpurea*, *Ixobrychus minutus*, *Circus aeruginosus*, *C. cyaneus*, *Alcedo atthis*;
3. to increase the presence of the fish species *Ninnigobius canestrinii*, included in the annex I of Dir. 92/43/EEC, attracted by the presence of low-salinity environments. The improvement of the trophic state of the habitat 1150\* contributes to the achievement of a good environmental status (Dir.2000/60/EC) for the area. The restoration of salt gradient and reedbed surfaces contributes to the increase of biodiversity in the SCI, accordingly with the 2020 Biodiversity Strategy. In addition to the already mentioned species, the increasing of other bird species of special conservation interest (such *Locustella luscionioides*, *Acrocephalus arundinaceus*, *Panurus biarmicus*, *Emberiza schoeniclus*) and fish species, such as bass (*Dicentrarchus labrax*), eel (*Anguilla anguilla*), gray mullets (gen. *Mugil*, *Liza*, *Chelon*), the smelt (*Atherina boyeri*), the flounder (*Piatichthys flesus*), juveniles of various species and Decapoda (*Palaemon spp.* and *Palemonetes spp.*), also of commercial interest, are expected.

The **project area is located** in the northern Venice Lagoon in Italy (NATURA 2000 network codes: Sites for Community Importance, SCI, IT3250031 and Special Protection Area, SPA, IT3250046). The Project Site has an extension of 1,900 ha and include the Valle Lanzoni and Valle Ca’ Zane sites, delimited at south-west by Santa Cristina Island. The Area of Interventions, about 70 ha, is located in Trezze site. It is delimited by Sile river in the north, Valle Cesaro in the west, Valle Lanzoni in the east and Valle Ca’ Zane in the south.

**The threats** in the project area were: the increase of salinity and the reduction of the typical salinity gradient in the inner part of the lagoon; the reduction of intertidal areas vegetated by reeds; the replacement of lagoon species with predominantly marine species, and a shift

toward assemblages with more tolerance to eutrophic conditions; bird species linked the reed environment decline; the alteration of habitat 1150\* due to eutrophication; fishing and hunting activities.

Human presence has constantly modified the original morphology and hydrology since the city's foundation and the Venetians tried to modify the environment in the attempt to preserve economic interests, human health and for defence purposes. The main intervention realized from the second half of the 16<sup>th</sup> century was the diversion of main rivers that flowed into the lagoon (Piave and Sile rivers in the northern lagoon, Brenta and Bacchiglione rivers in the southern lagoon). Those hydrological modifications caused profound changes in morphology and ecology of the lagoon. The reduction of hundreds of cubic meters per second of freshwaters flowing into the lagoon resulted in an increase of salinity in the inner parts and a loss of the typical salinity gradient of that environment. The increase of salinity heavily modified habitats and ecology of those areas, leading to expansion of mudflats instead of typical lagoon oligohaline habitats. Alterations of geomorphological and physical properties clearly affected spatial distribution, structure, and composition of vegetation and fauna communities. The reedbed of *Phragmites australis* disappeared almost everywhere. These changes heavily affected biological communities, leading to a replacement of lagoon species with predominantly marine species, and a shift toward assemblages with more tolerance to eutrophic conditions. In the northern Venice Lagoon, there are about twenty-two fishermen's and hunters' organisations for a total of about 4000 people. In the Venice Lagoon, fishing and hunting activities are regulated by a Regional fishing plan and a wildlife-hunting plan, respectively. Hunting activities in the Venice Lagoon are very intense and there are about 600 hunting posts; three of them were placed within the Intervention Area. About the fishing activities, the intervention area of the Life Lagoon Refresh project has a low bathymetry and is navigable only in suitable tidal conditions even with small boats. The fishing pressure is mainly due to amateur fishing.

In this context, LIFE Lagoon Refresh was the first project aimed at restoring salinity gradient and intertidal areas vegetated by reeds in the Venice Lagoon improving conservation status of habitat 1150\* and birds and fish species as reported above. To restore habitats and biodiversity of the area, the LIFE Lagoon Refresh project realized five typologies of conservation actions. These included the diversion of a freshwater flow from the Sile River into the lagoon; the restoration of intertidal morphology, through biodegradable structures; the reed and aquatic angiosperm transplantations with the involvement of local fishermen and hunters, and the reduction of hunting and fishing pressures in the intervention area.

In the project area, the **socio-economic activities** are fishing, hunting, and tourism. The increasing of fish stock productivity of species of commercial interest, linked to areas with low salinity, would provide a direct benefit for traditional fishing, which involves both professional and recreational ones. The revival of traditional fishing in the lagoon is a virtuous example of synergy between environmental quality and the socio-economic benefits for the territory.

The increase of the avifauna, related to the reed environment, would directly benefit leisure activities in the Lagoon, such as bird watching and naturalistic photography. The improvement of habitat, landscape diversity and the increase in ornithic abundance and species, would also promote the growth of professional activities related to ecotourism in Venice Lagoon, a sector, growing in recent years, carried out by several cooperatives that offer visits to Lagoon, off major conventional tourist routes, with traditional boats.

**Expected longer-term results** are listed below.

HABITAT 1150 \*: IMPROVEMENT OF CONSERVATION DEGREE

- Consolidation and restoration of a Good (B) conservation degree (CD) on a portion of 1250 ha of habitat 1150\*, equivalent to 34% of habitat 1150\* area within SCI IT3250031, part of which (about 30%) is currently in a reduced status (C):

#### Habitat Structure:

- Restoration of salinity gradient: average salinity <5 of 5 ha; <15 of 25 ha; <25 of 70 ha;
- Reduction of the eutrophication degree: increasing of trophic state index TWQI and increasing of seagrass coverage (after 4 years, presence of seagrass patches with diameter of 2-4 m; after 10 years, coverage of 15-25%)

#### Habitat Functions:

- Improvement of benthic and fish community status (increase of MaQI, HFBI and M-AMBI indices);
- Decrease of yearly average concentration of nutrients during overflow events (up to 50%).

#### IMPROVEMENT OF CONSERVATION STATUS OF SPECIES (DIR. 2009/147/EC and DIR. 43/92/EEC)

- Creation of habitat for species (reedbed) on an area of approximately 20 ha (+ 67% of the current SCI IT3250031 surface);
- Increasing of bird species typical of the reeds, in particular: *Microcarbo pygmeus\** (previously classified as *Phalacrocorax pygmeus\**) (100 to 200 ind.), *Botaurus stellaris\** (7 to 12 ind.), *Ardea purpurea*, *Ixobrychus minutus*, *Circus aeruginosus*, *C. cyaneus*, *Alcedo atthis*, with progressive structuring of the community;
- Increasing of fish species abundance: *N. canestrinii* (0.1 ind /100 sqm to 12-20 ind/100 m<sup>2</sup>, annual average values);
- Establishment of protection area of about 70 ha with banning of all mobile hunting methods and controlling of fishing pressure.

#### ECOLOGICAL STATUS and BIODIVERSITY

- Improving the ecological status (Dir. 2000/60/EC) for the water body EC "Palude Maggiore" and for water body PC1 "Dese".
- Increasing of bird species typical of the reedbeds not included in the Annex 1 of Birds Dir. but of particular conservation interest, and fish species, of commercial interest.

**Replicability and transferability** of the proposed solution are expected in relation to activities done in Action E.3. The call for interest selected three sites in Italy (Sacca of Scardovari in the Delta Po river of Veneto, some lagoons near Ravenna in Emilia Romagna, and the Apulian Acquatina di Frigole) and three European sites (the Spanish lagoon of l'Albufera de Valencia, the French salt marshes of Hyeres, the Greek Nestos Delta lagoons and Porto Lagos). Workshop, survey and site visits allowed to develop proposal of scenarios to replicate Life Lagoon activities. RV e OO.PP. associated beneficiaries of the project, have competence in the management of Venice Lagoon and river basin. Their role ensures the transferability of the proposed solution in other sites of Venice Lagoon. ISPRA, as National Institute, is part of a network known as National System for Environmental Protection, which is made up of 21 Territorial Environmental Protection Agencies, and can transfer the project information to the Agencies with transitional waters in their regional territory. ISPRA and UNIVE, as institutes of research, can apply to different projects to transfer the know-how to other European areas.

## 5. Administrative part

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## 6. Technical part

### 6.1. Technical progress, per Action

#### **ACTION A – PREPARATORY ACTIONS, ELABORATION OF MANAGEMENT PLANS AND/OR OF ACTION PLANS**

##### **Action A.1 - Permission from competent authorities**

Foreseen start date: *September 1<sup>st</sup>, 2017*      Actual start date: *September 1<sup>st</sup>, 2017*

Foreseen end date: *August 31<sup>st</sup>, 2018*      Actual end date: *April 30<sup>th</sup>, 2019*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Agreement between RV and OO.PP. for the management of the hydraulic structure	02/2018	D	08/2018	31 in MTR
Authorizations	08/2018	M	04/2019	32 in MTR

##### **Progress achieved: what and how and the interaction with other actions**

All foreseen activities were carried out.

##### **Agreement between RV and OO.PP.**

The Deliverable “Agreement between RV and OO.PP. for the management of the hydraulic structure during and after the project duration” (ANNEX 31 in MTR) was signed in August 2018.

The goal was achieved through a series of meetings between RV and OO.PP. for the definition of the text of the Agreement. The agreement ensures the maintenance and management of the hydraulic structure (action C.1) during the project and after the end of the project. In the Agreement it is clarified that at the end of the project RV and OO.PP. will use funds from their own Institutional budget. This Agreement is related to action C.1 with regards to the maintenance and management of the hydraulic structure during the project and it is necessary for the action F.2 for *After-LIFE* activities.

##### **Authorization by Competent Authorities**

The Project received all required permission by Competent Authorities (Milestone, ANNEX 32 in MTR) for carrying out the hydraulic (action C.1) and morphological (action C.2) works and for transplanting activities (action C.3 and C.4), in the framework of EIA procedure.

In order to carry out the activities to obtain the authorizations (action A.1) for conservation actions (action C.1, C.2, C.3 and C.4), considering the administrative and management complexity of the Venice Lagoon, numerous meetings with the Competent Authorities (Genio Civile, Venice Municipality, Quarto d’Altino Municipality, Regional Office - EIA Unit, Eastern Alps River Basin District) were held with the participation of different partners to explain the Project and the reasoning within. During these meetings the need to proceed with an EIA procedure arose. The EIA procedure involved the drafting of the Environmental Impact study and the VINCA, based on the final design of hydraulic and morphological works (action A.3 and A.4). The drafting of EIA and VINCA documents were coordinated by ISPRA. The RV was responsible of EIA procedure and UNIVE was responsible of VINCA. IPROS supported the processing and drafting of documents, strongly linked to the design (action A.3, A.4) and modelling (action A.2) activities. The Milestone (ANNEX 32 in MTR) of acquiring all the authorizations was completed in April 2019 including: favourable environmental compatibility authorization by the V.I.A. Regional Technical Committee; favourable VINCA authorization by the VINCA Regional Technical Committee; favourable opinion of Office of Safeguarding of Venice; favourable opinion of Superintendence for Archaeology, fine arts and



landscape; favourable opinion of Venice and Quarto d'Altino Municipality. This Milestone was necessary for the realization of the conservation actions C.1, C.2, C.3 and C.4.

Free transfer of land

The need to start an expropriation procedure for a small surface (about 300 mq) necessary to realize hydraulic structure (action C.1) arose during a meeting with RV Competent office. The owner Drago Jesolo wrote a PEC to RV, OO.PP. and ISPRA on May 9, 2019 with the intention of giving the land free of charge (ANNEX 33 in MTR). Free transfer of land for the construction of hydraulic work by the owner Drago Jesolo srl to State property was concluded.

Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions

Agreement between RV and OO.PP.

The Deliverable “Agreement between RV and OO.PP. for the management of the hydraulic structure during the project and for the After-Life program” expected in February 2018 was postponed to August 2018 in order to have a more reliability assessment of long-term costs for the maintaining of the hydraulic structure. These variations were communicated to NEEMO Monitor on 13/10/2017 and in the I Progress Report.

Authorization by Competent Authorities

For the Preparatory action A.1, the EIA procedure was not foreseen in the Proposal (the VINCA procedure was supposed to be the only mandatory environmental authorization). The Milestone of acquiring all the authorizations by 08/2018 was postponed to 12/2018 in the Progress Report. Actually, it was completed in April 2019. The authorization was necessary to start conservation Actions C.1, C.2, C.3 and C.4. In the proposal a sufficient safety time was included to deal with any unforeseen event. The end of the Hydraulic and Morphological works foreseen in August 2019 was postponed to December 2019, only 4 months later than expected and with no expected impact on project results.

Free transfer of land

The transfer of land property was not foreseen in the Proposal. However, it was concluded by free transfer to the State property.

**Action A.2 – Surveys and modelling for final design of hydraulic and morphologic works**

**A.2.1 - A.2.2 - A.2.3**

Foreseen start date: *September 1<sup>st</sup>, 2017*      *Actual start date: September 1<sup>st</sup>, 2017*  
 Foreseen end date: *August 31<sup>st</sup>, 2018*      *Actual end date: April 30<sup>th</sup>, 2019*

**A.2.4 - A.2.5**

Foreseen start date: *September 1<sup>st</sup>, 2017*      *Actual start date: September 1<sup>st</sup>, 2017*  
 Foreseen end date: *June 30<sup>th</sup>, 2022*      *Actual end date: June 30<sup>th</sup>, 2022*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Lagoon Refresh GIS (action A.2.1)	08/2018	D	08/2018	34 in MTR
Final Report of modelling results supporting actions A.3, A.4, C.1 (action A.2.5)	06/2022	D	06/2022	61 in FR
DTM - topo-bathimetric survey (action A.2.3)	12/2017	M	12/2017	7 in IPR
Brief description of modelling activity IPROS (action A.2.5)	08/2018	M	08/2018	8 in IPR

Progress achieved: what, how and the interaction with other actions

All foreseen activities were carried out.

As stated in the proposal and reported in MTR, all existing (A.2.1), observed (A.2.2, A.2.3, A.2.4) and modelled (A.2.5) data, useful for project design (A.3, A.4), Environmental Impact Assessment (A.1) and monitoring (D.1, D.2), were collected.

Sub-action A.2.1 - All existing data, useful for supporting the final design of hydraulic and morphologic works (actions A.3; A.4) and to carry out the EIA (action A.1), were collected. The implementation of the structure of the database and Geographical Information System was completed (ANNEX 34). An operative version of GIS was shared by partners and used as a tool for supporting the project implementation. All data collected during the project were included in the Project's GIS.

Sub-action A.2.2 - The expected measurement activity of salinity using continuous probes, originally distinguished in: 1) continuous measurements, lasting approximately 7 days, repeated over time with two mobile probes; 2) continuous measurements with the installation of a fixed station, was reformulated with the acquisition of three identical probes to be used for continuous measurements at fixed stations. The probes, capable of transmitting data remotely, allowed a spatially distributed continuous monitoring of salt gradient. They were repositioned in the Project area in different stages of progress.

Two probes were installed *in situ* in September 2018 and they acquired data until December 2018. Maintenance procedure was carried out and probes were operational again in April 2019. Since April 2019 the salinity data acquisition was in charge of action D.1. The third probe was installed at the end of realization of hydraulic works (Action C.1).

A tide level gauge was installed for 1 week at the Project site for model calibration: tidal level at Project site resulted matching with data measured by ISPRA's station (Grassabò), which was used as a reference in the following of the Project. Two more level gauges were installed for short times, contemporaneously at Sile River and at the Project site, in order to better quantify the instantaneous differences of water level and validate the design of hydraulic project (action A.3, ANNEX 35).

Sub-action A.2.3 - Bathymetric and topographic surveys were carried out in October 2017 and November 2017, respectively. In November 2017, OO.PP. carried out works for cutting the embankment vegetation in the small area selected for hydraulic work. This latter activity was not foreseen in the proposal, but it resulted necessary in order to carry on with topographic surveys. The activity of surveys benefited from external topo-bathymetric survey (acquired by drone) that OO.PP. was carrying out at Venice Lagoon scale in the framework of institutional commitments; these additional data, coupled with field data collected within the Project, made available a high resolution DTM for the Project area (ANNEX 7).

Sub-action A.2.4 - Campaigns of CTD and ADCP were carried out in Venice lagoon as foreseen in the proposal. Besides, additional campaigns were carried out at Sile River, as introduced in the Progress report, for monitoring the salt intrusion in the framework of the EIA study. From June 2020 the salinity data acquisition with CTD campaigns was in charge of action D.1. ADCP campaigns were carried out in relation to changes in fresh water discharge (see Action C.1).

Sub-action A.2.5 - Five different numerical models were set up and used to support actions A.3, A.4, C.1, C.2: 2D hydrodynamic model in the whole Venice Lagoon; 3D hydrodynamic and salinity model focused on the Project site within the lagoon area; 1D model to simulate the freshwater input discharge from the Sile river to the lagoon when the Project works were completed; 2D hydrodynamic model of Sile river at river basin scale; 3D hydrodynamic and salinity model of Sile river mouth.

Modelling simulation in support to design phase (A.1, A.3 and A.4), as expected in proposal to last until August 2018, was completed in February 2019 because of EIA and final design requirements.

IROS produced a detailed description of modelling activity, during the design phase of both hydraulic (Action A.3, ANNEX 35) and morphological (Action A.4, ANNEX 36) works. Further model calibration and simulation were implemented for supporting the freshwater discharge regulation during the project. Freshwater input was increased gradually from an initial discharge of 300 l/s up to a maximum of 1000 l/s, in support to Actions C.1. Further model calibration and simulation were implemented for supporting the different phases of the morphological works (action C.2).

**Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

The progress of action A.2 was consistent with activities and time schedule foreseen in the proposal. The database structure, GIS (action A.2.1) and topo-bathimetric survey (action A.2.3) were completed within the deadline stated in the proposal.

The purchase of the salinity probe (action A.2.2) required more time than expected (even if no deadline was stated in the proposal). However, this delay had no effect on Project results, as the duration of the Project allowed to collect huge amount of *ante* and *post operam* data.

Additional campaigns of salinity and water discharge were performed (A.2.4) to support the EIA procedure and they were included in the EIA monitoring plan, with no additional costs for the Project.

Modelling simulation (A.2.5) in support to design phase, as expected in proposal to last until August 2018, was completed in February 2019 (see A.3 and A.4), with no negative impact on the Project results. Modelling continued during all Project time with a number of activities higher than foreseen in the proposal and no additional costs for the Project. In particular, the lagoon models were used for the preparation of the executive projects, for the realization of the works (hydraulic in action C.1 and morphological in action C.2), for the management of the works once operating, for the support of monitoring activities and for the study of specific events such as that of November 2019. The Sile models were used in the drafting of the EIA (Environmental Impact Assessment procedure), to support the environmental monitoring program provided by the EIA itself, and for the management of the works once operating.

**Action A.3 - Design of Hydraulic work**

Foreseen start date: *September 1<sup>st</sup>, 2017*      Actual start date: *September 1<sup>st</sup>, 2017*  
 Foreseen end date: *August 31<sup>st</sup>, 2018*      Actual end date: *April 30<sup>th</sup>, 2019*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Folder containing detailed design documents for hydraulic works	08/2018	D	04/2019	35 in MTR
Final Design maps	09/2017	M	04/2018	9 in IPR
Folder containing detailed design documents for hydraulic works	08/2018	M	04/2019	35 in MTR

**Progress achieved: what, how and the interaction with other actions**

Final Design of Hydraulic works was completed in April 2018 and submitted to Competent Authorities in June 2018 for approval in the framework of the EIA procedure. Final design maps were reported in Progress Report as Annex 9.

Different informal meetings with Regional Authority, competent for Hydraulic works (Veneto Region – Venice Civil Engineering Office), were organized, in order to share the technical issues and facilitate a smooth approval response.

Penetrometer tests (CPT) and surveys functional to design of hydraulic works were carried out by external assistance. Geological and geotechnical report is an integral part of the Design documents. After obtaining all authorizations in the framework of EIA (action A.1), the

Detailed Design of Hydraulic works was verified, validated and finally signed in April 2019 (ANNEX 35).

RV obtained all the authorizations in April 2019 (action A.1) with the completion of Design of Hydraulic works (ANNEX 35).

**Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

All activities foreseen in the proposal were carried out. The expected date for Detailed Design, as reported in the proposal, was August 2018. Due to the EIA procedure (see action A.1), the Detailed Design was completed and finally signed in April 2019, including all recommendations by Competent Authorities.

During design activities some technical unforeseen issues emerged:

- The need to have assistance for archaeological investigations during works. In the proposal only an archaeological report was foreseen;
- The need to have an ordnance clearance activity; this cost was not supposed in the proposal;
- The need to start an expropriation procedure for a small surface (about 300 m<sup>2</sup>) necessary for hydraulic structures (action C.1) (see details in action A.1);
- Due to longer duration of action A.3, IPROS supported higher personnel costs, covered by saving from other activities.

All these small delays and unforeseen activities have been already communicated in the Progress Report and during the monitoring visits. No impact on the Project’s results was reported.

**Action A.4 - Design of Morphological work**

Foreseen start date: *September 1<sup>st</sup>, 2017*      *Actual start date: September 1<sup>st</sup>, 2017*

Foreseen end date: *August 31<sup>st</sup>, 2018*      *Actual end date: February 28<sup>th</sup>, 2019*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Folder containing detailed design documents for morphological works	08/2018	D	02/2019	36 in MTR
Final Design maps	09/2017	M	06/2018	10 in IPR
Folder containing detailed design documents for morphological works	08/2018	M	02/2019	36 in MTR

**Progress achieved: what, how and the interaction with other actions**

Final Design of Morphological works was completed in May 2018 and was formally submitted by OO.PP. to Competent Authorities in June 2018 for approval in the framework of the EIA procedure. It was reported in the first Progress Report as ANNEX 10.

Several meetings among OO.PP., IPROS and ISPRA were organized in order to define the details of the configuration of structures and the choice of materials. Materials and technical solutions for morphological structures were investigated, identifying solutions compatible with the characteristics of the seabed and with the expected hydrodynamic forcing (based on modelling results A.2.5), and functional to the reed transplanting objectives (action C3). Long time was spent investigating solution available on the market, for bio-degradable materials. The final choice was to use light and bio-degradable materials, with modular bags placed manually from small boats, without the need to dredge channels to reach the site by heavy equipment.

Penetrometer tests (CPT) and surveys functional to design of morphological works were carried out by external assistance. Geological and geotechnical report is an integral part of Design documents

After obtaining all authorizations in the framework of EIA (A.1), the Detailed Design of Morphological works was verified, validated and finally signed in February 2019 (ANNEX 36). The Detailed Design was presented for authorization to the Technical Commission of OO.PP. in February 2019.

**Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

All activities foreseen in the Proposal were carried out. The expected date for Detailed Design, as reported in the proposal, was August 2018. Due to the EIA procedure (see action A.1), the Detailed Design was completed and finally signed in February 2019, including all recommendations from Competent Authorities.

During design activity some technical unforeseen issues emerged:

- it was decided to carry out the morphological works in two phases, to allow an adaptive management strategy. Due to the large use of biodegradable materials (chosen as most environmentally and friendly solution), in order to evaluate the stability of the structures and their degradation rate (also with reference to the function of preventing the fresh water dispersion and the function of reed substrate), the second line of structures was postponed. It was decided to place the second order at greater distance from freshwater input (2<sup>nd</sup> phase), waiting the fulfilment of increased freshwater input and decreased salinity on a larger area.
- the fascines of brushwood (C.2.2), originally proposed, were replaced by biodegradable structures, more suitable for project aims;
- due to longer duration of action A.3, IPROS Ingegneria s.r.l. supported higher personnel costs, covered by saving from other activities (see Cap. 8).

All these small delays and unforeseen activities were communicated in the Progress report and during the monitoring visits. No impact on the Project results emerged.

**Action A.5 - Stakeholder involvement**

**A.5.1**

Foreseen start date: *October 1<sup>st</sup>, 2017*      Actual start date: *October 1<sup>st</sup>, 2017*  
 Foreseen end date: *March 31<sup>st</sup>, 2018*      Actual end date: *April 30<sup>th</sup>, 2018*

**A.5.2**

Foreseen start date: *September 1<sup>st</sup>, 2018*      Actual start date: *November 1<sup>st</sup>, 2018*  
 Foreseen end date: *August 31<sup>st</sup>, 2019*      Actual end date: *October 31<sup>st</sup>, 2020*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Guideline for reedbed and seagrass transplantations	08/2018	D	05/2019	38 in MTR
Ending meetings with stakeholders	03/2018	M	04/2018	37 in MTR
Training course reedbed seagrass transplantation	08/2019	M	07/2019 (in room) 10/2020 (in field)	39 in MTR 62 in FR

**Progress achieved: what, how and the interaction with other actions**

Sub-Action A.5.1 – All foreseen activities for Sub Action A.5.1 were carried out.

The Sub Action started in October 2017, with the organization of a preliminary meeting with representatives of fishermen and hunters (ANNEX 11 in IPR) and the definition of a tentative program for stakeholder involvement. Three main meetings with stakeholders were held:

- on 14<sup>th</sup> November 2017, meeting with presidents of Fishing and Hunting associations, representing the main stakeholders related to the project (ANNEX 12 in IPR);
- on 16<sup>th</sup> April 2018, meeting with exponents of Veneto Region and Metropolitan Town of Venice offices competent for Hunting and Fishing activities, in preparation to the meeting with stakeholder of 19<sup>th</sup> of April 2018 (ANNEX 13 in IPR);
- on 19<sup>th</sup> April 2018, meeting with the board of Hunting Area (ATC) Ve05, which includes all hunters acting in Venice lagoon area. Milestone “Ending meetings with stakeholders (ANNEX 37 in MTR).

All these meetings involved ISPRA and RV. During the meetings, ISPRA and RV explained the project objectives, the conservation actions and the needs of the project by sharing the possible forms of fish fauna and bird protection. The Sub-Action A.5.1 is closely connected with the action C.5 “Identifying specific Hunting and fishing rules and better practices for project area”.

Sub-Action A.5.2 - All foreseen activities for Sub Action A.5.2 were carried out.

The Deliverable “Guideline for reedbed and seagrass transplantations”, arranged by UNIVE and ISPRA, was delivered to the attendees of the training course and completed in May 2019 (ANNEX 38 in MTR). The Guideline includes a description of the project, the methodology of reed and seagrass transplantation and explant, and a description of donor sites. On 12<sup>th</sup> July 2019, ISPRA and UNIVE held the training course at a conference room in the Natural History Museum of Venice (ANNEX 39 in MTR). Rent of the conference room was free of charge. The course concerned 17 operators, selected by C.3 e C.4 procedures, who were involved in the reed and seagrass transplantation actions (ANNEX 39 in MTR). The selection involved local stakeholder, associations or local cooperatives/companies whose activities were based on the lagoon’s products (mostly hunters, and fishermen). The course (total amount of 11 teaching modules) dealt with a first introduction to the project; biology, ecology and transplantation strategies of *P. australis*; and biology, ecology and transplantation strategies of aquatic phanerogams (ANNEX 39 in MTR). The training activities included both a theoretical course and a field activity. The field courses were carried out directly at the area of interventions, when hydraulic and morphologic interventions were implemented, and suitable season was available for transplanting. On May 2020, ISPRA and UNIVE held a field training to the company in charge for reedbed transplanting activity; on October 2020, a field course was held to fishermen and hunters for reed and seagrass transplantations (ANNEX 62 in FR). The Sub Action A.5.2 was preparatory to the actions C.3 and C4.

**Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

Sub-Action A.5.1 - The Milestone “Ending meetings with stakeholders for Sub Action A.5.1, 03/2018” was postponed for only one month but respected. Considering the complexity and multiplicity of Fishing and Hunting associations, further meetings with stakeholders were organized in April 2018 (expected end of sub-action A.5.1 was March), jointly with the action C.5, in order to maintain a constant contact with stakeholders in defining measures to protect fish fauna and birds. Additional meetings did not cause additional costs.

Sub-Action A.5.2 -The foreseen starting date of the activity was postponed from August 2018 to November 2018 without any negative effects on the progression of the project. The Deliverable “Guideline for reedbed and seagrass transplantations” was postponed from August 2018 to May 2019 without negative consequences on the scheduled activity. In fact, the guideline was available for the course to local stakeholder, associations or local cooperatives/companies, selected into C.3 and C.4 procedures. The course was completed in July 2019 for the theoretical part and in October 2020 for field part. The field training activities were possible when hydraulic and morphologic interventions were implemented and the season suitable for transplants just before the start of the actions C.3 “Reedbed transplantation” and

C4 “Seagrass transplantation”. The postponement of field training was perfectly integrated with C.3 and C.4 activities and did not affect the progression of the project.

## C. CONSERVATION ACTIONS

### Action C.1 – Hydraulic work

Foreseen start date: *September 1<sup>st</sup>, 2018*

Actual start date: *February 1<sup>st</sup>, 2019*

Foreseen end date: *August 31<sup>st</sup>, 2019*

Actual end date: *February 29<sup>th</sup>, 2020*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Certificate of completion of hydraulic work	08/2019	D	11/2020	63 in MTR
Completion of hydraulic work	08/2019	M	02/2020	64 in MTR
Final regulation of freshwater discharge	01/2022	M	02/2021	65 in MTR

### Progress achieved: what, how and the interaction with other actions

The activity consists in the construction of a fresh water input from the Sile River to the lagoon, through the construction of an uptake along the bank of the river (C.1.1), in the Trezze area (Northwest Venice Lagoon) and the management of fresh water inflows (C.1.2).

RV assigned the tender procedure for ordnance clearance to Biotto S.r.l., and the activity for ordnance clearance was done (April-August 2019).

The subscription of a contract by RV for archaeological investigations activity in the form of a business letter with the company Ar.Tech S.r.l was completed in July 2019.

The hydraulic works’ commitment to Somit S.r.l was completed at the beginning of August 2019. RV completed the hydraulic works (action C.1.1) in February 2020 (ANNEX 64). The certificate of completion of hydraulic works was released in November 2020 (ANNEX 63).

The regulation of freshwater input (C.1.2) continued for the entire project life. The discharge was gradually increased from an initial discharge of 300 l/s up to a maximum of 1000 l/s (ANNEX 65). During the extreme drought, occurred in the summer 2022, the discharge was temporarily reduced to 500 l/s, as foreseen in the framework of EIA procedure.



Figure 1. Aerial overview by drone of hydraulic works

**Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

The start of the activity (Action C.1.1) was postponed for four months (from September 2018 to February 2019). This change was due to EIA procedure, not foreseen in the proposal and needed to obtain all the authorizations to start with Conservation Actions (see action A.1). The end of the Hydraulic works, originally foreseen in August 2019, was initially postponed to December 2019, with no impact on the project results.

During the planning activity (Action A.3), some technical unforeseen issues emerged:

- The need to build a by-pass for the trucks passage in order not to interrupt an existing new bicycle line, active since spring 2017, after proposal presentation;
- The need to have assistance for eventual archaeological investigations during works. In the proposal only an archaeological report was foreseen;
- The need to have an ordnance clearance activity; this cost was not supposed in the proposal, since this activity was deemed necessary following the National Council of Engineers document on May 26<sup>th</sup> 2017 entitled “Guidelines for the CSP relating to the evaluation of the risk of discovery of unexploded ordnance and risk assessment in case of explosion”.

These unforeseen activities did not entail higher costs for action C.1.

As reported in the Mid-Term report, the conclusion of the hydraulic works (Action C.1.1) was rescheduled to December 2019. Due to the bad weather conditions and high tide events, which lasted throughout the end of 2019, this milestone was again postponed and achieved in February 2020. Although the work completion in February 2020, the effective opening of the fresh water input (C.1.2), started only 3 months later, as the monitoring and site inspection could not be guaranteed until the end of May 2020, due to the Covid restrictions.

The management of fresh water flows (C.1.2) with a final regulation of freshwater discharge was completed in February 2021.

**Perspectives for continuing the action after the end of the project**

The Deliverable “Agreement between RV and OO.PP. for the management of the hydraulic structure during and after the project duration” (ANNEX 31 in MTR) was subscribed in August 2018. “This Protocol regulates relations between the Veneto Region and the Interregional Superintendency for Public Works for the Veneto - Trentino Alto Adige and Friuli Venezia Giulia for the purposes of maintenance, management and regulation of diversion works in the Lagoon of a planned water flow derived from the Sile river, realized within the LIFE 16/NAT/IT/000663 “Lagoon ReFresh” project, with reference to both the implementation period of the European project and the management period, after the expiry of the contractual period of the above mentioned project.” This agreement is valid not only for the entire duration of the project but for 10 years after the end of the Project. The details are reported in After LIFE Conservation Plan.

**Action C.2 – Morphologic work**

Foreseen start date: *September 1<sup>st</sup>, 2018*

Actual start date: *February 1<sup>st</sup>, 2019*

Foreseen end date: *August 31<sup>st</sup>, 2019*

Actual end date: *December 20<sup>th</sup>, 2021*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Certificate of regular execution of morphological works	08/2019	D	12/2021	66 in FR
Certificate of completion of morphological works	08/2019	M	05/2021	67 in FR



### **Progress achieved: what, how and the interaction with other actions**

Action C.2 consists of the implementation of morphological interventions, by means of biodegradable modular bags (action C.2.1) and fascines of brushwood (action C.2.2), positioned on the lagoon shallow bottom in front of the freshwater intake area (action C.1), in order to slow down the dispersion of freshwater introduced into the lagoon and to allow the establishment of suitable salinity conditions for the development of the reedbeds. Design requirements and details were defined in the action A.4. In the Final Design, the fascines of brushwood (C.2.2, in charge of UNIVE) were replaced by biodegradable structures, implemented by the OOPP in C.2.1, more suitable for the project aims. The morphological reconstruction was realized by OO.PP. in two phases.

The tender procedures and assignments for archaeological investigation and works were completed respectively in May and June 2019. The archaeological investigation was completed. The morphological work started at the end of June (21/06/2019).

As reported in the Mid-Term report, due to the bad weather conditions and high tide events, which lasted throughout the end of 2019, the conclusion of the first phase of morphological works was postponed and achieved by OO.PP. in 02/2020. The Certificate of completion of first phase was provided by OO.PP. on 28/02/2020.

Based on results of the first phase, the second phase of morphological reconstruction was optimized. It started in 11/2020 and completed in 05/2021. The Certificate of completion of the morphological works (Milestone, ANNEX 67 in FR) was provided on 05/2021. The Certificate of regular execution (Deliverable, ANNEX 66 in FR) was provided on 12/2021.



Figure 2. Aerial overview by drone of morphologic works

### **Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

The starting of the activity was postponed by four months (from September 2018 to February 2019). This change of starting date was due to EIA procedure, not foreseen in the Proposal and it was necessary to obtain all the authorizations to start with Conservation Actions (see action A.1).

Superintendence for Archaeology required an archaeological investigation activity, not foreseen in the Proposal, to be performed along the lines of wooden pipes positioned to contain the biodegradable structures.

Iron thin rods were used to probe the lagoon bottom palm by palm in the area affected by the morphological work, in order to control that no archaeological objects could be damaged by the wooden poles. The survey was done along a bend 3 m wide and 1700 m long.

During the design activity, as already detailed in the Progress report, it was decided to carry out the morphological works in two phases, to allow an adaptive management strategy. Indeed, due to the large use of biodegradable materials (chosen as most environmentally friendly solution), in order to evaluate the stability of the structures and their degradation rate (also with reference to the function of preventing the fresh water dispersion and the function of reed substrate), the second line of structures was postponed. It was decided to place the second order at greater distance from freshwater input (2<sup>nd</sup> phase), waiting the fulfilment of increased freshwater input and decreased salinity on a larger area.

The first phase of morphological works was initially foreseen to be completed in August 2019. Due to four months of delay in the authorization procedure (action A.1), the end of the first phase was postponed again to December 2019.

In the Final Design of the morphological structures, the fascines of brushwood (C.2.2) were replaced by biodegradable structures, more suitable for the project aims. The saving of money related to the fascines construction (C.2.2, in charge of UNIVE) was used for other activities in the framework of conservation actions (action C.3). This variation was communicated in the MTR and accepted in Comments from EASME to forth monitoring visit (Ref. Ares(2020)6973953 – 20/11/2020).

As reported in the Mid-Term report, due to the bad weather conditions and high tide events, which lasted throughout the end of 2019, the conclusion of the first phase of morphological works was postponed and achieved by OO.PP. in February 2020.

Based on results of the first phase, the second phase of morphological reconstruction was optimized. It started in 11/2020 and completed in 05/2021.

Overall, 1180 m of morphological structures were implemented. The number of modules resulted 3 times greater than in Proposal (5360 vs 1731), due to the optimization of the section typologies (topography higher than initially foreseen), in order to improve the function of preventing the fresh water dispersion and provide substrate for vegetation colonization. Finally, approx. n.80 modules were needed to restore the structure after the extreme meteo-marine event of 12<sup>th</sup> of November 2019.

Despite the above-mentioned delays, the action was successfully completed.

Monitoring of integrity of structures continued during the entire project duration.

**Perspectives for continuing the action after the end of the project**

For the *After LIFE* period, OO.PP. will ensure continuity in the maintenance of the morphological structures, with resources that will be made available from the Ministry of Infrastructure and Transport budget, particularly from the funds allocated to “*Safeguard of Venice and its Lagoon*”, as reported in The “Agreement between RV and OO.PP. for the management of the hydraulic structure during and after the project duration” (ANNEX 31 in MTR) subscribed in August 2018. The details are reported in After Life Conservation Plan.

**Action C.3 – Reed transplanting**

Foreseen start date: *June 1<sup>st</sup>, 2018*

Actual start date: *June 1<sup>st</sup>, 2018*

Foreseen end date: *June 30<sup>th</sup> 2022*

Actual end date: *August 31<sup>st</sup>, 2022*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Operative Protocol	06/2018	D	06/2018	40 in MTR
Intermediate Report (III year)	12/2020	D	02/2021	68 in FR
Final Report	06/2022	D	09/2022	69 in FR
Start of transplanting activities	09/2019	M	06/2020	70 in FR
End of transplanting activities	06/2021	M	06/2022	71 in FR

**Progress achieved: what, how and the interaction with other actions**

All foreseen activities were carried out. The Operative Protocol of reedbed transplanting was completed in June 2018 (ANNEX 40 in MTR). Transplants were carried out both along the borders of the existing salt marshes and on biodegradable bags implemented in the framework of Action C.2. Reed sods have been collected in appropriately selected areas of the inner northern part of Venice lagoon, along the course of the Siloncello river, after previous authorization by competent local authority (OO.PP.).

The procedure for assigning the transplanting activities to local stakeholders (individual local fishermen and hunters) and to the small enterprise was completed by UNIVE. N.8 individual operators and the “Marchesi Andrea Tito Lara F.lli ed Elisabetta S.D.F.” enterprise were selected by DAIS-UNIVE and trained in the framework of Action A.5.2.

The transplantation area included 13 sub-areas eight of which are placed along the salt marshes closest to the lagoon edge, three in the more distant band of salt marshes and two in the rows of containment bags that join the two salt marsh strips. The transplants of *Phragmites australis* started in June 2020, after the opening of the diversion canal from the Sile River with an initial water inlet of 300 l/s (May 2020), brought to a regime inlet of 1000 l/s in February 2021. During 2020, a total of 550 sods of *P. Australis* were transplanted (ANNEX 68 in FR). Considering the flow rate of freshwater from the Sile river in this period, the transplanting activity was mainly focused in the saltmarsh area closest to the point of freshwater intake. Another 1439 clods were transplanted in 2021 for a total of 1759 sods. All additional transplants were performed with no change in budget. Finally, another 800 sods were transplanted in spring 2022 using funds from action C.2, previously allocated for fascines of brushwood. Therefore, the total number of sods transplanted within Action C.3 (2020–2022) was 2789 (ANNEX 69 in FR), higher than the 1000 sods indicated in the Proposal (Table 1). The sods were explanted from near river mouth without compromising the donor sites and transferred to intervention area as soon as possible.

Table 1. Summary of the *P. Australis* transplantations done within the Project.

Transplanted sods	Enterprise	Local Stakeholders	Tot
2020	350	200	550
2021	472	967	1439
2022		800	800
Total 2020-2022	822	1967	2789

The transplants were successful in the sub-areas where the salinity was very low both along the lagoon margin and in the first band of salt marshes. In these areas, in about 1 year and a half, sods took root and started to expand both by emitting new shoots from the growing rhizomes and by the germination of the seeds produced by the transplanted sods themselves. It should be noticed that a good distribution of the plants requires, at least, 3-4 years from the transplant so that rhizomes can colonize the areas and emit new shoots. Therefore, it is expected that the reedbed will progressively colonize the largest parts of these areas.

The results of reedbeds mapping are reported in the Deliverable D.2.4 and summarized in this Report, in the section dedicated to Action D.2

**Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

The time schedule foreseen in the proposal has been revised in consideration of different, unexpected and unpredictable factors. The delay in the completion of both the hydraulic works (Action C.1) and the first phase of the morphologic work (Action C.2) due to EIA procedure,

the bad weather conditions and high tide events, which lasted throughout the end of 2019 and the restriction of pandemic in 2020 postponed the completion of the field operator training course and the start of transplant activities. Taking into consideration seasonal and phenological factors related to the reedbed development, transplantation activities started in 06/20 instead of 09/19 and ended in 06/22 instead of 06/21. These delays caused also a postponement of the deliverable submission date: intermediate report was postponed from 12/20 to 02/21; final report from 06/22 to 08/22. As a measure to mitigate the effects of the delay in the start of transplants, the number of sods was increased and the period of field activity was extended.

**Perspectives for continuing the action after the end of the project**

The Action of *P. australis* transplanting has been successfully carried out within the framework of the project and further transplanting activities in the project area are not scheduled. However, the evolution of reedbed surfaces and of halophytic vegetation will be assessed in the next five years by ISPRA and UNIVE researchers within the After Life activity (Action F.2). The coverage of the expenses will be borne by each institution.

**Action C.4 - Seagrass transplanting**

Foreseen start date: *June 1<sup>st</sup>, 2018*  
 Foreseen end date: *June 30<sup>th</sup>, 2022*

Actual start date: *June 1<sup>st</sup>, 2018*  
 Actual end date: *June 30<sup>th</sup>, 2022*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Operative Protocol	06/2018	D	06/2018	41 in MTR
Intermediate Report (I year)	12/2019	D	02/2021	72 in FR
Final Report	12/2021	D	06/2022	73 in FR
Start of transplanting activities	09/2019	M	10/2020	74 in FR
End of transplanting activities	12/2021	M	12/2021	75 in FR

**Progress achieved: what, how and the interaction with other actions**

All foreseen activities were carried out. As scheduled in the proposal, in June 2018 the Operative Protocol of aquatic angiosperm transplanting was completed (ANNEX 41 in MTR). Transplantation activities were carried out on 26 stations located 6 macro-areas of the project area and concerned 3 species (*Ruppia cirrhosa*, *Zostera noltei*, *Z. marina*). Transplanting strategies both included the use of small clumps of aquatic angiosperm (size 15 cm approx.) and the spread of single rhizomes. Transplants were carried out selecting the stations with the most suitable sediment and environmental conditions for each species.

Aquatic angiosperm clumps and rhizomes were collected, after previous authorization by competent local authority (OO.PP., partner of the Project), from appropriately selected areas of the northern part of Venice lagoon, where the meadows of the three species are consistent and stables.

The procedure for assigning the transplanting activities to local stakeholders (individual local fishermen and hunters) was completed. N.8 individual operators were selected by DAIS-UNIVE and trained in the framework of action A.5.2. Transplants activities started with some delay, as explained in IIPR, in 10/2020 and ended in 12/2021. Over this period 1757 clumps of the three species have been transplanted (336 clumps in 2020 and 1441 in 2021, ANNEXES 72 and 73 in FR), exceeding the amount expected in the proposal (1560 clumps) (Figure 3).



Area	Stations n°	ZM	ZN	RC	Tot
A	2		30	90	120
B	4	91	79		170
C	5	168	242		410
D	5	10	150		160
E	4	42	199	60	301
F	6		208	388	596
Tot	26	311	908	538	<b>1757</b>

Figure 3. Map of the macro-areas and stations object of seagrass transplanting (left) and summary of seagrass transplanted clumps per macro-area (right).

Despite the short period from transplants, clumps generally take roots forming patches, which, in the next few years, will converge to form extensive and well-structured meadows. According to the most recent mapping activity (spring 2022), the greatest success has been achieved with *Z. marina*, whose greatest development occurs in spring, having two favorable seasons to take root. *Z. noltei* and *R. cirrhosa*, with various exceptions, showed a minor development since their maximum growth occurs in summer, not detectable in the last mapping activity.

**Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

The time schedule foreseen in the proposal was revised in consideration of different, unexpected and unpredictable factors. The delay in the completion of both the hydraulic works (Action C.1) and the first phase of the morphologic work (Action C.2) due to EIA procedure, the bad weather conditions and high tide events, which lasted throughout the end of 2019 and the restriction of pandemic in 2020 postponed the completion of the field operator training course and the start of transplant activities. In particular, the start of the seagrass transplantation activities, foreseen by Proposal for September 2019, was postponed to October 2020. However, such delay did not entail a modification of the expected amount of clumps and rhizomes that were transplanted during the project. These delays caused also a postponement of the deliverables submission date: intermediate report from 12/19 to 02/21; final report from 12/12 to 06/22. For administrative reasons, the assignment of transplanting activities was addressed to individual fisherman / hunter (public procedure) and not to an association of fishermen / hunters, as already communicated to EASME. However, budget, action and cost categories did not change.

**Perspectives for continuing the action after the end of the project**

The Action of seagrass transplanting were successfully carried out within the framework of the project and further transplanting activities in the projects area are not scheduled. However, the After LIFE phase of Action D.1 includes: the monitoring of habitat 1150\* status, in which seagrass meadows play a key role, in the next three years; the assessment of ecological status of macrophytes (*sensu* WFD) in the next five years. The expenses will be covered by ISPRA and UNIVE.

**Action C.5 - Identifying specific Hunting and fishing rules and better practices for project area**

Foreseen start date: April 1<sup>st</sup>, 2018

Actual start date: April 1<sup>st</sup>, 2018

Foreseen end date: December 31<sup>st</sup>, 2019

Actual end date: August 31<sup>st</sup>, 2022

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Report of Hunting and Fishing regulation	12/2019	D	12/2019	76 in FR
Provision regulating hunting and fishing	12/2019	M	12/2019 – 05/2021	42 in MTR/77 in FR

### **Progress achieved: what, how and the interaction with other actions**

All foreseen activities were carried out. In Action A.5 ISPRA and RV met several times representatives of Veneto Region offices competent for Hunting and Fishing activities for discussing about the specific hunting and fishing rules and the best practices to adopt at the project area. A good occasion to propose modification of hunting activities at the Project area was represented by the Strategic Environmental Assessment procedure (SEA) procedure related to the update of the Wildlife Hunting Plan of the Veneto Region (2019-2024), cited as WHP in the following. On 2<sup>nd</sup> of April 2019 a meeting took place between ISPRA, RV, and the Hunting Territorial Office “VE5 Lagunare – Venice” (which includes the hunters acting on Venice lagoon). The meeting was aimed at presenting the implementation of the project within the SEA procedure relating to the WHP, and at sharing the respective observations to the WHP. On 8<sup>th</sup> of April 2019, ISPRA sent an official technical advice to Veneto Region, related to the SEA, concerning the WHP; the advice contained management suggestions, such as moving the three existing hunting posts outside the site (ANNEX 42 in MTR). Updates were presented to hunters on 22<sup>nd</sup> of May 2019 (action E.1). In August 2019, the Veneto Region published on B.U.R. 092\_2019, DGR n. 1135/2019, accepting the observations made by ISPRA during the SEA phase of WHP, about moving the three existing hunting posts outside the project site (ANNEX 43 in MTR). The WHP was approved by SEA Commission and Veneto Regional Council on BUR n. 66/2021 (ANNEX 77 in FR).

Concerning the fishing activities, on July 4<sup>th</sup> 2019, ISPRA exposed the project during a meeting with the Regional Advisory Committee on Professional Fisheries and Aquaculture (ANNEX 44 in MTR). In 2020/2021 other contacts with Head of Hunting and Fishing Office of Veneto Region and with President of the non-professional fishermen association for identifying specific fishing rules and better practices for project area were done. To quantify the effective fishing pressure in the interventions area, special interviews, as a part of the project, were carried out in 2020 by phone (during COVID pandemic) to President of the non-professional fishermen association. Collected information raised the awareness that currently the fishing pressure in the area of the project interventions is rather low due to low bathymetry that allows navigation, with small boats, only during suitable tidal conditions, even. Moreover, only 10 of the 625 fishermen in the Northern lagoon usually attend the project area of interventions; considering the characteristics of the area, the number of useful fishing sessions is about 2/3 times a year per fisherman. Nevertheless, considering the improvement of fish abundance as a result of restoration of the project area (see Action D1), on 8<sup>th</sup> of June 2022, RV and ISPRA sent an official technical note to Hunting and Fishing Office of Veneto Region related to the SEA, concerning the revision of Fishing Plan (OTHER ANNEX 109 in FR). The request was to exclude in the project area, an area of 30 hectares from fishing by stationary nets. In July 2022, the Veneto Region published DGR n. 881/2022, rejecting the request (observations n. 75, OTHER ANNEX 110 in FR). All activities until December 2019 are reported in the Deliverable “Report of Hunting and fishing regulation” (ANNEX 76 in FR).

### **Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

The C.5 activities were completed but with some differences concerning what scheduled in the proposal. The extension of the duration of the action respect to the proposal was necessary to adequate the project goals with administrative processes of Hunting and Fishing Office of Veneto Region. One possible way to modify the regulation of hunting and fishing in the area of the project was to intervene during the revision of the Wildlife Hunting Plan and Fishing Plan. The revision of both Plans was in the 2019-2022 period. The milestone of prevision regulating hunting was completed. Concerning the fishing activities, the milestone of prevision regulating fishing was not completed even though all the partners did what it could be done. As explained in Answer to ISSUE 15 during fifth monitoring visit (Annex to Letter of

20/11/2020 Ref. Ares(2020)6973953 “LIFE16 NAT/IT/000663 - LIFE LAGOON REFRESH – Fourth monitoring visit”), ISPRA gathered information about the fishing pressure in the area of the project interventions through special interviews to President of the non-professional fishermen association. The fishing pressure in the area of the project interventions is rather low as reported above. Nevertheless, considering the improvement of fishes abundance as a result of restoration of the project area (see Action D1), on 8<sup>th</sup> of June 2022 RV and ISPRA sent an official technical note to Hunting and Fishing Office of Veneto Region related to the SEA concerning the revision of Fishing Plan (OTHER ANNEX 109 in FR). The request to exclude, in the project area, an area of 30 hectares from fishing by stationary nets, was sent. In July 2022, the Veneto Region published DGR n. 881/2022, rejecting the request (observations n. 75, OTHER ANNEX 110 in FR).

**Perspectives for continuing the action after the end of the project**

As reported in After LIFE Conservation Plan, the Office of Veneto Region, partner of the project, will work with the Hunting and Fishing Office of Veneto Region to introduce the regulation of fish activities in the next revision of the Fish Plan.

**ACTION D – MONITORING ACTIVITIES**

**Action D.1 – Monitoring of the habitat Coastal lagoon**

Foreseen start date: *September 1<sup>st</sup>, 2017*      Actual start date: *September 1<sup>st</sup>, 2017*  
 Foreseen end date: *April 30<sup>th</sup>, 2022*              Actual end date: *January 31<sup>st</sup>, 2023*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Monitoring protocol – habitat coastal lagoon	10/2017	D	10/2017	14 IPR
Mid-term report – habitat coastal lagoon	02/2021	D	02/2021	78 in FR
Monitoring report - <i>ante operam</i> – habitat coastal lagoon	04/2019	D	04/2019	45 in MTR
Final report – habitat coastal lagoon	04/2022	D	08/2022 01/2023	79 in FR Addendum 79 in FR
Start of monitoring activities D.1	11/2017	M	11/2017	Section 3.1 pg. 3 and Sect-5.1 pg. 12- in IPR
End of monitoring activities D.1	10/2021	M	12/2022	80 in FR

**Progress achieved: what and how and the interaction with other actions**

All foreseen activities were carried out.

The aim of Action D.1 was to assess some general Project objectives and the expected results, through the application of quality indices and integrative methods of assessment.

This Action was subdivided in three sub-actions, according to specific objectives:

- D.1.1 Monitoring of the Habitat 1150\* conservation degree;
- D.1.2 Monitoring of target fish species;
- D.1.3 Monitoring of the Ecological Quality of Water Bodies (*sensu* WFD EC/2000/60/) and of biodiversity (*sensu* BIODIVERSITY STRATEGY 2020).

Monitoring protocol, describing measures, sampling and analyses of abiotic and biotic parameters in sediments and waters, as well as Biological Quality Elements, such as macroinvertebrates, macrophytes and fish fauna, was completed on October 2017 (ANNEX 14 in IPR). Monitoring activities started on November 2017 and ended on December 2022 (ANNEX 80 in FR). Results achieved in *ante operam*, in the mid-term report and at the end of the project are reported, respectively, in ANNEX 45 in MTR, ANNEX 78 and ANNEX 79 in FR. These documents also describe objectives and timetables of monitoring activities.

### Sub-action D.1.1

The results in term of restoration of salinity gradient are good. The monitoring of salinity was carried out at two different scales: intervention site and Project area. According to Final report, restoring of saline gradient was met, as expected, with salinity of 5 at an area of 5 ha, less than 15 at an area of 25 ha, and less than 25 at an area of 70 ha (Figure 4). A preliminary indicator to quantify the Conservation Degree of habitat 1150\* Coastal Lagoons, improving the methodology built within the framework of the Life SERESTO project, was developed.

The evaluation method includes parameters usually collected by WFD monitoring network. To evaluate the degree of conservation of the habitat structure, the aquatic phanerogams cover and the eutrophication risk assessment are considered, being the former as a percentage, and the latter by the application of the Transitional Water Eutrophication Assessment Index, TWEAM (SNPA, 2022). Furthermore, structure conservation degree is also assessed through the restoration of the salinity gradient. To assess the degree of conservation of habitat functions, fish fauna and macrozoobenthos communities are considered, respectively applying HFBI and M-AMBI indices, as required by the WFD. Conservative status of ecosystemic structures in habitat 1150\* of the Project area was assessed by aquatic phanerogams and chemical-physical elements in waters, resulting excellent considering the mean values of the whole area. Within the Project site, some differences resulted, showing heterogenic characteristics with lower and more degraded status in *ante operam* rather than in *post operam*, especially in the inner part of the lagoon. The conservative status' improvement was mostly due to macrophytic community, which definitely improved in ecological quality status, as well as in coverage of prairies. Trophic condition of the site was not as good as in macrophytes, due to a moderate increase of DIN concentrations. However, dystrophic and hypoxic conditions, observed several times before the opening of freshwater input from Sile River, were never observed after that.

Conservative status of ecosystemic functions showed an improvement when considering fish fauna community, while macrozoobenthic community needs more time, as usually expected.

To improve the robustness of assessments, monitoring activities did not stop in October 2021 as foreseen in proposal, but they continued also in 2022 (ANNEX 80 in FR), even though with a lower frequency, as reported in Figure 6. On 31<sup>st</sup> August and 28<sup>th</sup> November 2022, respectively the last project day and after the end of the Project, samples to analyse DIN, P-PO<sub>4</sub>, dissolved oxygen, and chlorophyll concentrations in waters were gathered, to calculate the annual average of these parameters for the year 2022. Indeed, these data allowed updating the TWQI and TWEAM results (Figure 5) used for the evaluation of the eutrophication risk and of the conservative status in habitat 1150\*. The updated results confirmed the overall excellent conservation degree of the structure of habitat 1150\* at the project site scale, as already observed and discussed for the 2021 (ANNEX 79 in FR).

Results of chemical data collected in August and November 2022 were not available for the final Deliverable of D.1, dated August 2022 (ANNEX 79 in FR) and therefore are provided as an addendum (Addendum of ANNEX 79 in FR).

### Sub-action D.1.2

Fish fauna results showed also an increase of species of Community interest, as well as of commercial concern. As expected, *Ninnigobius canestrinii* (previously classified as *Pomatoschistus canestrinii*), the fish target species of the Project, increased from 0.1 ind/100 m<sup>2</sup> in *ante operam* up to 18-20 ind/100 m<sup>2</sup> right after the opening of the fresh water input up to 1000 l/s. Moreover, the restoration of salinity gradient has led an increase of the abundance of juveniles of migratory species with commercial interest (e.g. mullets).

### Sub-action D.1.3

Assessing ecological quality status by the WFD indices in the Project area, at the beginning and at the end of the Project, Fish fauna resulted from Moderate/Good to Good/High, as



assessed by HFBI; Macrozoobenthos resulted from Poor to Moderate, as assessed by M-AMBI; Macrophytes resulted from Moderate to Moderate, as assessed by MaQI.

Regarding biodiversity, fish fauna community showed significant differences between years and between sites in terms of species composition. Generally, freshwater input contributed to differentiate the monitoring sites, through the establishment of a more structured environmental gradient than before the opening of the freshwater inflow and the ecological restoration interventions. Macrozoobenthos showed an increase in abundances and a decrease in diversity, especially in sites closest to freshwater inflow. Although these parameters negatively influence the indexes for the ecological classification, at the ecosystem level, variations in the benthic community may have created the ideal conditions that indirectly determined an increase in the biodiversity of the communities with species of Community interest such as fishes and birds. Regarding vegetation biodiversity, at the end of the Project, coverage of phanerogams was higher with presence of sensitive species, as well as sensitive species of algae with high ecological value.

Generally, other positive effects and the complete improvement of the ecological quality status of the area will come with the full development of reed bed, which needs more time, after the end of the project.

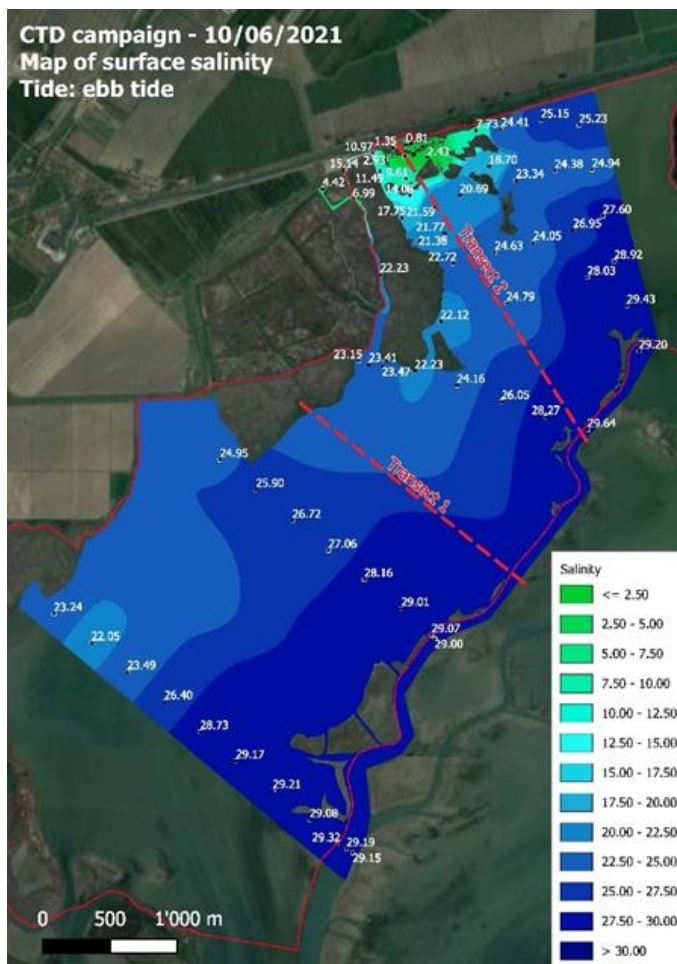


Figure 4. Map of distribution of salinity in Project area after interventions.

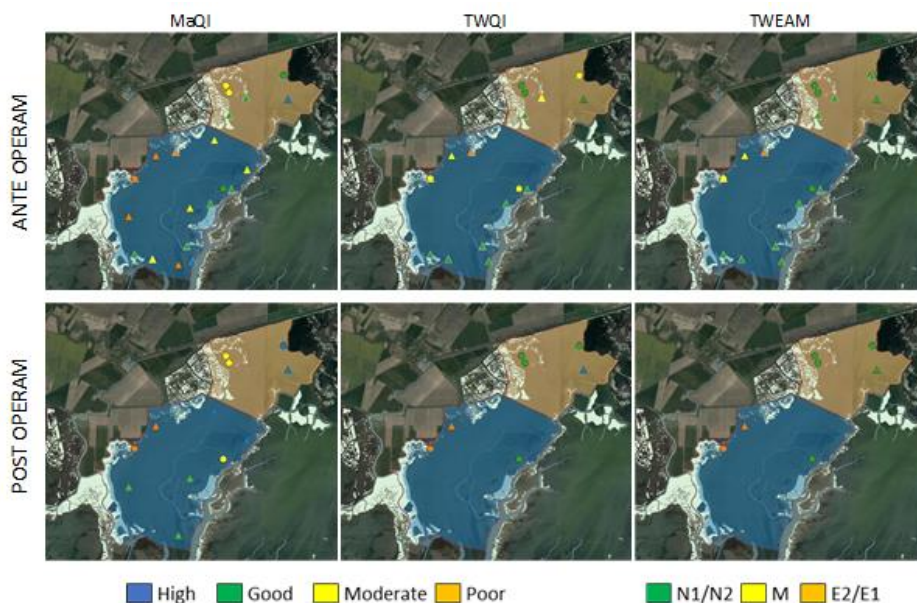


Figure 5. Map of distribution MaQI, TWQI and TWEAM indices for the assessment of the macrophyte and trophic status in the project sites. All these indices are used for the assessment of the Conservation Degree of the habitat 1150\*. For the calculation of TWQI and TWEAM, all data collected in 2022 were used, including the samplings carried out after the 31<sup>st</sup> of August 2022.

### **Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

All monitoring activities (D.1.1, D.1.2 and D.1.3) were done as foreseen in the proposal, even though the timetable changed several times due to delay of works, stop for pandemic's restrictions and adverse weather conditions. Moreover, new surveys were added during Project. Monitoring activities, concerning sub-actions D.1.1, D.1.2 and D.1.3, continued after the deadline foreseen in the proposal (i.e., October 2021, ANNEX 80 in FR), with a reduced panel of matrices and parameters, as reported in Figure 6. They will last until 2024, as detailed in the After-LIFE plan.

Other integrations occurred during Project are listed as following. In 2020, right after the end of the works, the monitoring of waters (D.1.1) was intensified at monthly rate rather than quarterly intervals, in order to make *post operam* monitoring more robust. From 2022, it became seasonally (four times a year). Considering that works started on October 2019 and ended on December 2019, in the spring of the same year, further samplings of macrozoobenthos (only at the 2 external sites) and macrophytes (at all foreseen sites, also in autumn) were achieved (D.1.1 and D.1.3). In addition, for macrozoobenthos' sampling, two spring campaigns were added in 2020 and 2022 (at all foreseen sites), although not provided on the proposal. Sediment samplings were remodelled according to those foreseen for macrozoobenthos (D.1.1 and D.1.3).

On May 2022, coverage of macrophytes needed an integrative survey for better mapping them (D.1.1 and D.1.3). A CTD survey was added in summer 2022 (D.1.1).

The remodulation of the timing of monitoring activities and the minimal changes in overall effort did not entail additional costs for the project.

### **Perspectives for continuing the action after the end of the project**

Since some environmental parameters and biotic components need more time to totally meet expected results, it is important to continue to monitor in order to keep them under control, analysing their long-term evolution. The full-time schedule of D.1 activities with also those planned for the *After LIFE* is reported in Figure 6.

Briefly, monitoring activities will last until December 2024 at the internal sites, and they will be: 1) Maintenance of monitoring of salinity through fixed moored probes (D.1.1); 2) Seasonal

samplings (generally on a quarterly basis) of the chemical-physical parameters of waters at 3 sites (D.1.1); 3) spring samplings of the chemical-physical parameters of sediments at two sites (D.1.1); 4) spring samplings of the macrozoobenthos at two sites (D.1.1 and D.1.3); 5) Half-yearly samplings (generally in spring and autumn) of submerged vegetation at all sites (D.1.1 and D.1.3).

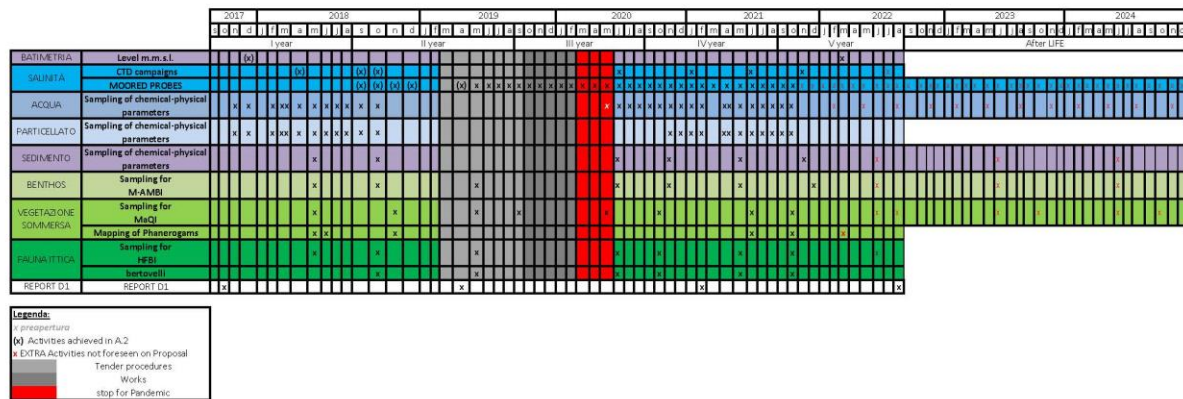


Figure 6. Timetable of D.1 Action

The following activities will protract for five years beyond the end of the Project. As external sites are very close to those monitored by WFD monitoring network, information will be achieved through acquisition and analysis of those data. The WFD network is headed by RV, implemented by ARPA Veneto in collaboration with ISPRA, and it foresees: annual sampling of waters on a seasonal basis (approximately quarterly); yearly samplings of sediments every three years, when macrozoobenthos (every 3 years, in spring); half-yearly samplings of macrophytes and fish fauna, approximately in spring and autumn, every three years.

### Action D.2 - Monitoring of halophytic habitats and target species

Foreseen start date: April 1<sup>st</sup>, 2018

Actual start date: April 1<sup>st</sup>, 2018

Foreseen end date: March 31<sup>st</sup>, 2018

Actual end date: August 31<sup>st</sup>, 2022

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Operative Protocol	04/2018	D	05/2018	15 in IPR
<i>Ante Operam</i> monitoring Report	04/2019	D	04/2019	46 in MTR
Intermediate Report	01/2021	D	12/2021	81 in FR
Final monitoring Report	04/2022	D	08/2022	82 in FR
Start of monitoring Action D.2	04/2018	M	06/2018	15 in IPR
End of monitoring Action D.2	10/2021	M	07/2022	83 in FR

### Activities undertaken, outputs achieved and the interaction with other actions

The Action include two sub-actions: D.2.1 mapping of halophytic habitats; D.2.2 monitoring of the reedbed development.

All foreseen activities were carried out. The Monitoring protocol was produced on 05/2018 and annexed in the First Progress Report (ANNEX 15). The *ante operam* report was produced on 04/2019 and annexed in MTR (ANNEX 46); the intermediate report was produced on 12/2021 and annexed in FR (ANNEX 81); the final report was produced on 08/2022 and annexed in FR (ANNEX 82).

Sub-Action D.2.1. Mapping activity was focused on the saltmarshes located in the project intervention area (n=31). Field surveys were carried out by UNIVE and ISPRA. Surveys were performed by circumnavigating saltmarshes by boat and, where possible, by walking following transects using the "Step-Point Intercept Technique" method. Different satellite images (Landsat 8 Collection 1 Tier 1, with TOA Reflectance, Sentinel 2A ESRI basemaps) and

previous vegetation mapping (collected in A.2.1) were also used for supporting the surveys and the post processing of field data. Halophyte mapping was also supported by drone surveys carried out by ISPRA operators, with different aims: supporting the field activity; verifying seasonal phenological variation of halophytes; increasing the resolution of boundaries between emerged land and submerged areas; supporting the identification of plant associations and habitats in not accessible areas. Even if not foreseen in the Proposal, the use of drone did not entail additional costs.

Elaborated data of the surveys were used for the construction of a digital cartographic database working on the open source QGIS environment.

The *ante operam* mapping of halophytic vegetation (spring 2018 - autumn 2018) indicated the prevalence of mosaic of halophytic vegetation with limited patches of monospecific vegetation. The main halophytic species found in this phase included *Sarcocornia* spp. *Salicornia* spp. and *Juncus* sp.. Monitoring data collected in action D.2 was used in the framework of EIA procedure of Environmental Impact Assessment study (Action A.1).

The *post operam* surveys carried out in autumn 2021 and in summer 2022 indicated some changes in terms of coverage and composition. In particular, in autumn 2021 a massive development of *Aster tripolium* was observed. This species, previously present only with a few sporadic plants, was found in all the salt marshes interested by a decrease, even slight, in salinity (Figure 7). In the areas more influenced by the salinity decrease, other changes included a decrease of *Puccinellia* spp., *Salsola* spp., *Salicornia* spp., *Sarcocornia* spp. and an increase of *P. Australis*, *Agropyron repens* and *Juncus* spp.. In the more external saltmarshes, the variations were minimal and often due to interannual variations.



Figure 7. Sub-action D.2.1. Post operam. Saltmarsh vegetated by *A. tripolium* flowering plants and by *P. australis* (2021)

Sub-Action D.2.2. In *ante operam*, the existing surface of reedbed in the project Area was evaluated by UNIVE by a specific survey carried out in June 2018 and supported by the mapping of halophytic vegetation, realized in the period spring 2018 - autumn 2018. The results indicated the presence of *P. australis*, in association with other species, in a limited area (4600 m<sup>2</sup>) including saltmarshes 1, 2, 3 and 7 (Figure 8). In *post operam*, specific surveys for the mapping of reedbed were carried out in July 2021 and July 2022. The reed transplantation began in late spring 2020 and continued until June 2022. The reedbed took root along the

lagoon margins and the salt marshes located near the fresh water inlet, where monitoring of salinity (Action D.1) confirmed the achievement of a stable condition suitable for the reed bed growth. In these areas, almost all the transplanted sods have taken root and developed new shoots and rhizomes. The map of July 2022 showed that the presence of the reed bed is significant in the lagoon border and in the salt marshes closest to the inlet canal (Figure 9). The reedbed was found in a lagoon area of about 11 ha including saltmarshes 1-17, resulting abundant (cover > 75%) in an area of about 1.1 ha, while sods in a good state of rooting and areas with less coverage were found in the remaining area. In the more external salt marshes, where the salinity is higher, the rooting of the sods was modest or absent.

A broader development of the reedbed in the area is expected in the following years considering the short time passed since the full capacity of water inlet and the transplants, which took place mainly in April-July 2021 and June 2022. In fact, a good colonization of the reed requires at least 3-4 years since the transplants, so that rhizomes can colonize the areas and emit new shoots. Compact populations require at least 5-10 years for their formation.

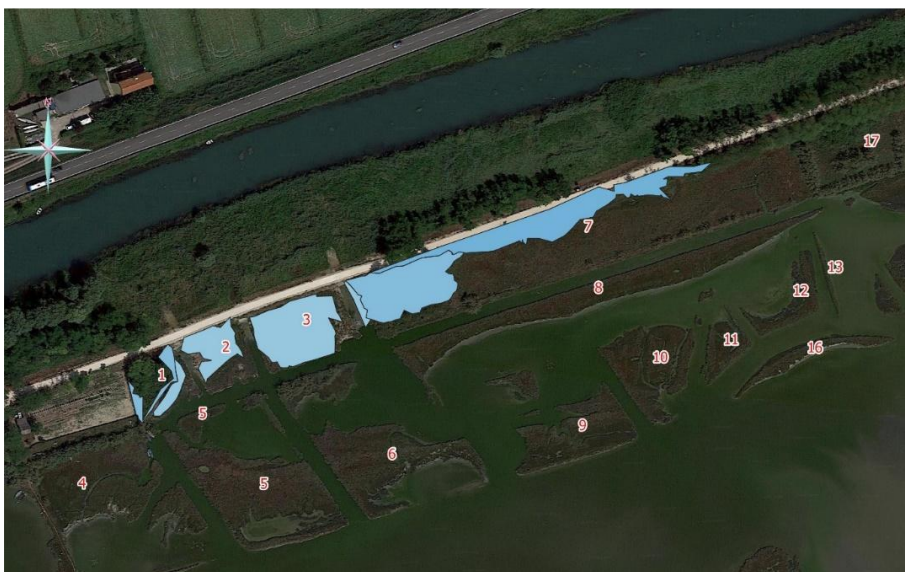


Figure 8. Sub-action D.2.2. Maps of the reedbed in ante operam (2018)



Figure 9. Sub-action D.2.2. Maps of the reedbed in post-operam (2022)

The Action also includes the monitoring of chemical-physical parameters of sediment (pH, Eh, Pelite, Density, Humidity, Nitrogen, Phosphorous and Carbon compounds) in 4 stations located on the sandbanks, in areas where the development of the reed bed was expected after the implementation of the Project actions and in proximity of the freshwater input. In addition to the campaigns indicated in the proposal (2 in *ante operam*, 2 in *post operam*), further 2 intermediate campaigns were carried out, in October 2019 and September 2020, with no changes in budget. The results showed some significant variations especially in the intermediate phase, when the realization of the hydraulic structure was still in progress (October 2019) or the inflow of fresh water was still reduced (September 2020). At the end of the works (*post-operam*), the various monitored parameters generally showed values similar to those monitored in the *ante-operam* phase. However, the variations observed are not due to the development of the reeds, which is still too small to influence the physical-chemical characteristics of the sediments but, rather, to the impact of the morphological structures and variations in salinity.

Different topographic surveys of the emerged morphology were carried out, respectively, at the end of the construction site activities (July 2020, February 2021) and at the conclusion of the monitoring activity (August 2022). They were compared with the results obtained during the *ante-operam* survey (sub-action A.2.3, October-November 2017). From the comparison of results a clear erosive / depositional trend did not emerge. For the verification of this trend, it is necessary to wait for adequate (5-10 years at least) time of evolution of the shallow waters on which the morphological structures of the project were realized. An additional activity, carried out as part of the 2022 campaign, concerned the investigation of possible relationship between the quota and the rooting and development of the reeds, without changes in the budget. The results, indicative of a limited area, showed that the altitude of 0.4 m a.s.l. can be identified as favorable for the presence of reeds; especially in the case of salt marshes farthest from the freshwater input.

#### **Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

The Monitoring protocol was completed in May 2018 instead of April 2018, but this delay had no effect on operational activities, which started in June 2018.

The *ante operam* Report was completed in April 2019, as scheduled in the proposal.

The time schedule foreseen in the proposal for *post operam* has been revised in consideration of different, unexpected and unpredictable factors: the delay in the EIA procedure (Action A.1); the bad weather conditions and high tide events, which lasted throughout the end of 2019. Both these events caused the consequent delay in the completion of hydraulic (Action C.1) and morphologic works (Action C.2) and in the transplanting activities. Moreover, the start of COVID19 health emergency blocked part of the field activities. These delays caused a shift in the execution of the monitoring activities. The *post-operam* monitoring campaigns of Sub-action D.2.1, initially planned in June and October 2021, were carried out in December 2021 and July 2022. The *post-operam* monitoring campaigns of Sub-action D.2.2, initially planned in June 2020 and June 2022, were carried out in July 2021 and July 2022. The sediment campaign, planned in June 2021, was carried out in June 2022.

The topo-bathymetric surveys, planned at the end of hydraulic (Action C.1) and morphological (Action C.2) works scheduled for October 2019, were carried out in July 2020 (end of Action C.2 first phase) and February 2021 (end of Action C.2 second phase). The topo-bathymetric surveys, planned at the end of monitoring activities for February 2021, were carried out in 2022. All these time shifts allowed to give the most updated information of halophytic habitats and reedbed at the end of the project.

These delays caused also a postponement of the deliverable's submission date: intermediate report from 01/21 to 12/21; final report from 04/12 to 08/22.

### **Perspectives for continuing the action after the end of the project**

In the coming years an expansion of the reedbed and a further modification of the halophytic vegetation are expected. For this reason, the monitoring activities of the vegetation and reeds will continue for the five years within the After Life activity. In particular, the qualitative assessment of halophytic vegetation will be carried out on a yearly basis (summer – autumn) by UNIVE researchers, while field activities for the mapping of reedbeds will be carried out on a yearly base (late spring-summer) by UNIVE and ISPRA researchers. The coverage of the expenses will be covered by each institution.

#### **Action D.3 - Monitoring of target bird species**

Foreseen start date: *December 1<sup>st</sup>, 2017*

Actual start date: *December 1<sup>st</sup>, 2017*

Foreseen end date: *June 30<sup>th</sup>, 2022*

Actual end date: *August 31<sup>st</sup>, 2022*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Operative Protocol	01/2018	D	01/2018	16 in IPR
<i>Ante operam</i> Report	06/2019	D	06/2019	47 in MTR
Upgrade of Operative Protocol	-	D	10/2019	48 in MTR
Intermediate Report	06/2021	D	06/2021	84 in FR
Final Report	06/2022	D	08/2022	85 in FR
Start of monitoring activities on field	01/2018	M	01/2018	par. 3.1 in IPR
End of monitoring activities on field	12/2021	M	06/2022	86 in FR

### **Activities undertaken, outputs achieved and the interaction with other actions**

All foreseen activities were carried out. The activity started in 12/2017 with a visit to the project site aimed at identifying the location of monitoring stations and developing monitoring criteria. The preliminary Monitoring protocol (ANNEX 16 in IPR) was produced on 01/2018. The *ante operam* report was produced on 06/2019 and annexed in MTR (ANNEX 47); a new version of the Operative Protocol was produced on 10/2019 (ANNEX 48 in MTR); the intermediate report was produced on 06/2021 and annexed in FR (ANNEX 84); the final report was produced on 08/2022 and annexed in FR (ANNEX 85).

*Ante operam* monitoring activity was regularly carried out by ISPRA as scheduled in the proposal. Monthly sampling surveys of task 1 (surveys of passerine species) and 2 (census of waterbirds) were carried out in the period January 2018 - December 2018. Annual monitoring campaigns (n=4) related to task 3 (crepuscular surveys for the Eurasian bittern *Botaurus stellaris*) were carried out in March 2018, as previously planned. A new version of the Monitoring protocol, representing an update of methods after the execution of *ante operam* monitoring activities was released (ANNEX 48 in MTR). Monitoring methods described in the two versions of the Protocol are totally coherent and the results are comparable among the different monitoring phases.

Additional campaigns were carried out, without any changes in budget, during the first three months of the year 2020. They represented a follow up of the status "0" given that the hydraulic work was still not completed and functioning.

*Post operam* monitoring was carried out, with some delay explained in the next section, in the period June 2020 – June 2022.

A total of 66 species (51 passerines) were identified during the whole period covered by Action 1, with 1548 record and 3347 individuals contacted. Among the target species associated to the reed, only *Emberiza schoenicus* was regularly found in the area (Figure 10).

During all surveys carried out for Action 2, a total of 62 species were identified and 2568 records and 29290 individuals contacted. Among them, 25 species of conservation interest and 6 target species (*Ardea purpurea*, *Circus cyaneus*, *C. aeruginosus*, *Microcarbo pygmeus*, *Alcedo atthis*) were contacted (Figure 11).

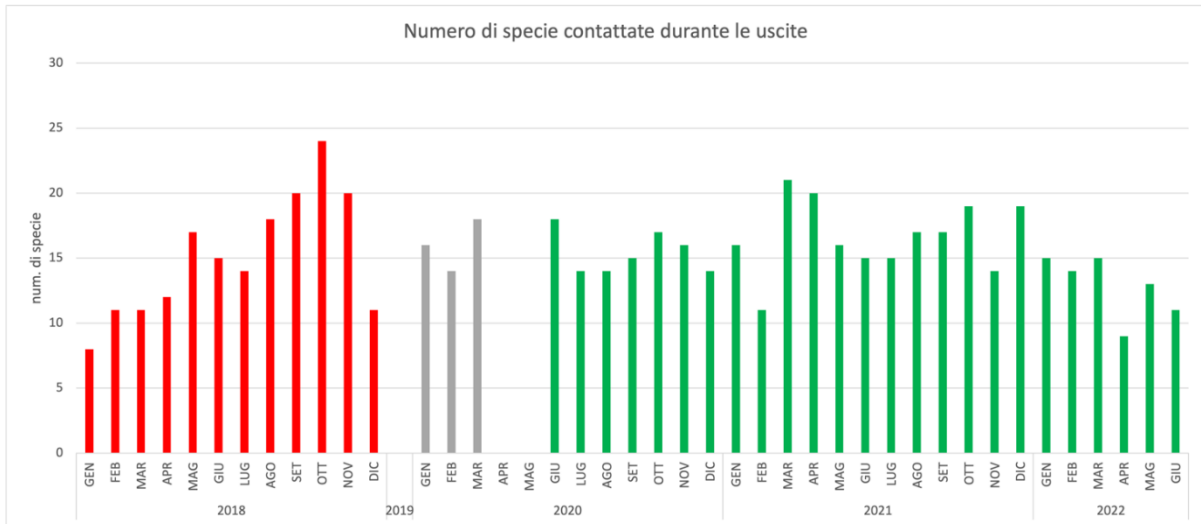


Figure 10. Action 1. Number of total species detected during the project (red= ante operam; grey= additional intermediate surveys; green= post operam).

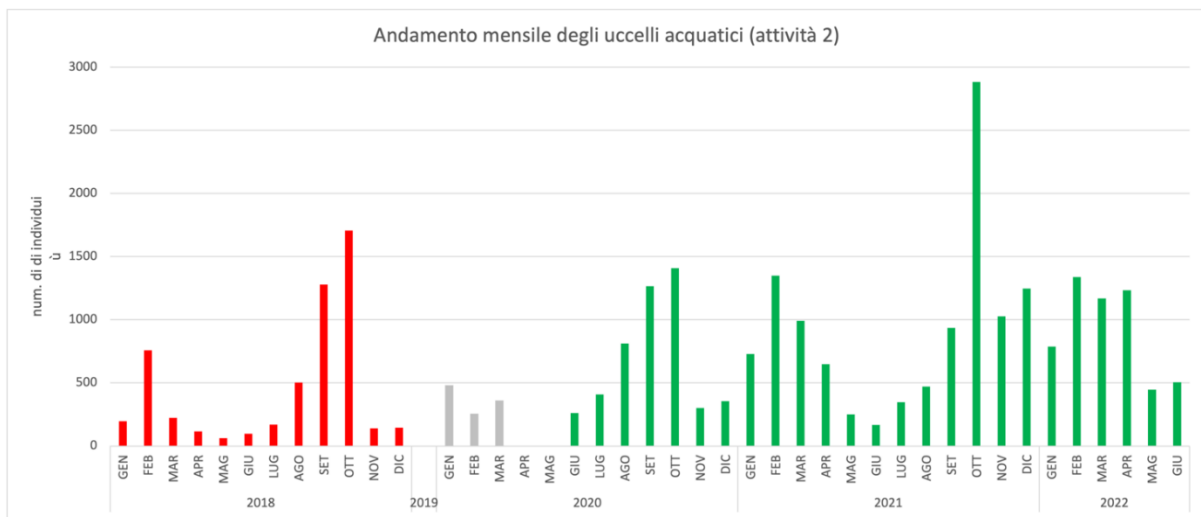


Figure 11. Action 2. Number of species of waterbirds detected during the project (red= ante operam; grey= additional intermediate surveys; green= post operam).

The Eurasian bittern within its specific activity (Action 3) has never been contacted during the 16 specific campaigns carried in the period 2018- 2021. In the same period, the results of the International Waterbird Census in Italy assessed zero *Botaurus stellaris* in the SCI IT3250031. Two additional monitoring activities, not foreseen in the Project Proposal, were also carried out without any changes in budget. 1) A bimonthly survey in the period September 2020 – January 2021, to assess the use of the morphological structures, realized within Action C.2, as a stopover, rest and plumage cleaning area for aquatic birds. A consistent number of waterfowl species and individuals were contacted on these structures; the list of the species observed on included two species target of the Project (*Microcarbo pygmeus*, *Alcedo atthis*) and other seven species of conservation interest. 2) When monitoring the presence of birds frequenting these morphological structures, there was the opportunity to find and read the bird leg ring, reconstructing their history. This kind of activity was carried out in the period April 2020 - June 2022 and led to the identification of 72 different individuals (41 *Larus melanocephalus*, 21 *L. ridibundus*, 9 *Phoenicopterus roseus*, 1 *Platalea leucorodia*\*).

At the end of the project, the reeds have not yet fully developed in the project area in the expected timeframe because of delays in the finalization of hydraulic and morphological works



and in the reedbed transplantation. Accordingly, the responses of the target species are mainly expected later in time. Passerines have not increased their presence and range, and waterfowl species related to reeds have not given positive responses either.

However, among the numerous species of water birds, some gave important positive and, sometimes, unexpected responses to freshwater input into the lagoon, even before the effects were apparent on the vegetation. The most contacted species is the black-headed gull (*L. ridibundus*) followed by the sandpiper (*Calidris alpina*) and the Mediterranean gull (*L. melanocephalus*). In addition, there are two species contacted in all the months involved in the monitoring: the herring gull (*L. michahellis*) and the lesser shag (*Microcarbo pygmeus*, target species). Among the target species, *A. atthis* and *Ixobrychus minutus* showed some positive signal after the freshwater input. Other non-target species that benefited from environmental changes, included *Pheonicopterum roesus* and *Tadorna tadorna*.

**Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

All Activities and Deliverables foreseen in the proposal for the period covered by the Mid-Term Report were regularly carried out.

Thereafter, the time schedule foreseen for the monitoring has been revised in consideration of different, unexpected and unpredictable factors. The 4 months delay in the authorization procedure by Competent Authorities (Action A.1), the "Aqua granda" phenomenon (big flood) at the end of 2019 and the first COVID 19 lock down in 2020 caused a postponement in the completion of hydraulic and morphologic works (Action C.1 and C.2, respectively) and in the reedbed transplanting activities. As a consequence, the expected *post operam* monitoring, foreseen for the period January 2020 – December 2021, was carried out in the period June 2020 – June 2022 in order to dispose of two complete years of monitoring after the completion hydraulic and morphological works and the start of freshwater flux from Sile.

Further activities without changes in the budget included: three monthly supplementary surveys for Tasks 1 and 2 in the period January-March 2019; ten supplementary surveys for Task 3 carried out in March 2019 and 2021; bimonthly surveys in the period September 2020 – January 2021 to assess the use of the morphological structures; reading of the bird leg ring; an implementation of the monitoring protocol, delivered in October 2019 and annexed in MTR.

**Perspectives for continuing the action after the end of the project**

The environmental changes caused by the project actions are still ongoing and it is expected a broader development of the reedbed (and of the associated faunal communities) in the next years.

Therefore, a monitoring activity will be carried out in the next five years within After LIFE action. In particular, it is envisaged to maintain an annual date (mid-January, consistent with IWC surveys, or mid-May, for nesting birds) in order to carry out the following activities: census of wintering aquatic birds in the project area; transept on the bank of the Sile as carried out during the years of the project, for the wintering passerines; the repetition of the transept in May, for nesting birds.

**Action D.4 – Ecosystem services assessment**

Foreseen start date: *January 1<sup>st</sup>, 2020*

Actual start date: *January 1<sup>st</sup>, 2020*

Foreseen end date: *August 31<sup>st</sup>, 2022*

Actual end date: *August 31<sup>st</sup>, 2022*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Estimation of ecosystem services final report	31/12/2021	D	31/08/2022	87 in FR
End of stakeholders consultation	31/12/2020	M	31/03/2022	88 in FR

### **Progress achieved: what and how and the interaction with other actions**

All foreseen activities were carried out. The evaluation of ecosystem services initially provided an in-depth analysis and summary of the evaluation methodologies of ecosystem services available in the literature, with particular reference to lagoon habitats. It was completed in October 2020. Data from the monitoring activities, carried out in Action D.1, D.2 and D.3, were used for the evaluation of ecosystem services. For the estimation of cultural services, data from Action E.1 and E.2 were also analyzed. Exchange of information and best practices for ecosystem services evaluation with LIFE VIMINE and LIFE SERESTO took place in February 2021 and with LIFE FORESTALL in March 2022. Two types of questionnaires or stakeholder consultation, were prepared and completed in November 2020 and June 2021. Interviews, conducted with operators specialized in tourism and educational activities in lagoon environments, were also performed (All. 2-3-4 ANNEX 87 in FR). The identified targets, for stakeholder consultation, are general public, including also didactic/ecotourism/environmental associations and amateur fishermen and hunters. For the implementation of the benefit transfer approach, sites with similar habitats and uses were identified. A database with a list of entities/associations to contact for interviews was created (OTHER ANNEX 111 in FR). Due to COVID restrictions the distribution of questionnaires for general public, amateur fishermen and hunters began in June 2021 taking advantage of all opportunities for direct meeting with stakeholders. Tourism operators' interviews began in January 2022. All stakeholders' consultation ended in March 2022 (ANNEX 88 in FR). Until August 2022 the results of the questionnaires/interviews were analysed and the final report of the evaluation of the ecosystem services produced (ANNEX 87 in FR). Results indicate that the main ecosystem services concern the increase of fish species of commercial and community interest (provisioning, regulation and maintenance services), due to the restoration of the salt gradient, and site potentiality for ecotourism services (cultural services).

### **Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

The activities were completed but with some differences from what scheduled in the proposal. Both the estimation of ecosystem services' final report, scheduled for December 2021, and the end of the stakeholders' consultation, scheduled for December 2020, were postponed in order to meet stakeholders in person and to resume tourist activities due to COVID restrictions. Moreover, results of D.4 depend on results of D.1, D.2 and D.3.

### **Perspectives for continuing the action after the end of the project**

The continuation of the monitoring of D.1, D.2, D.3 actions, planned in the after LIFE, will confirm the observed increases of fish species of commercial interest (*provisioning services*), of conservation interest (*regulation and maintenance services*) and of aquatic birds. Moreover, from the development of the reeds, positive responses from other bird target species are also expected. The continuation of dissemination activities to spread project results, as well as the presence of the cycle path along the embankment that separates the Sile river from the lagoon, which favors high visibility for the project, will increase the potential of the intervention site to be as a recreational and educational service.

### **Action D.5 – Socio-economic evaluation**

Foreseen start date: *September 1<sup>st</sup>, 2017*      Actual start date: *September 1<sup>st</sup>, 2017*  
Foreseen end date: *August 31<sup>st</sup>, 2022*      Actual end date: *August 31<sup>st</sup>, 2022*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Final report on the estimate of the economic impact of the project	30/06/2022	D	31/08/2022	89 in FR
End of stakeholders consultation	31/12/2020	M	31/03/2022	90 in FR

### **Progress achieved: what and how and the interaction with other actions**

All foreseen activities were carried out. Initially, exchange of information and best practices for socio-economic evaluation with LIFE VIMINE and LIFE SERESTO took place in February 2021 and with LIFE FORESTALL in March 2022. The action included the socio-economic assessments related to the Project implementation in terms of estimation of the contribution to the employment growth of local communities. The Full Time Employment (FTE) of (not permanent) Personnel involved in the Project (directly in the partnership and indirectly by external services) was assessed in 23 FTE. The FTE related to external services include the involvement of fishermen, hunters and other stakeholders in seagrass and reed transplanting, the operator involved in the morphological works and external expertise for monitoring activities.

The values of the ecosystem services were assessed, selecting the most representative results from those of action D.4. For the estimation of the increase of commercial fish fauna, the economic value of both provisioning and nursery functions (regulation and maintenance) were assessed, resulting in 336 €/year and 5,271 €/year, respectively. For the economical assessment of educational and ecotourism uses, the information deriving from the interviews to tourism operators, carried out in January-March 2022 (ANNEX 90 in FR), was used to assess the potential use of the site (200 visit/day, 24 days/year) and the economic mean value of each visit (120 €/visit), resulting in a total value of 570,000 €/year (estimation to consider with caution, representative of ecotourist use on larger scale and potentially affected by several sources of error in travel cost estimation) (All. 1 ANNEX 89). A database with a list of entities/associations for interviews was created (OTHER ANNEX 111 in FR).

### **Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

The activities were completed, even though some deviations from schedule foreseen in the proposal occurred. Either the estimation of economic impact of the project final report, scheduled for June 2022, either the end of the stakeholders' consultation, scheduled for December 2020, were postponed in order to meet stakeholders in person and to resume tourist activities due to Covid restrictions. Moreover, results of D.5 depended on results of D.4, which in turn depended on those of D.1, D.2 and D.3.

### **Perspectives for continuing the action after the end of the project**

The results of the action D.5 provide preliminary assessment of the potential uses and values of ecosystem services supported by the restoration actions. The monitoring results in the after LIFE period will provide information to increase the robustness of the present results. Moreover, the development of the reedbed could enhance the evaluation of additional ecosystem services, as the CO<sub>2</sub> sequestration.

### **Action D.6 – KPI**

Foreseen start date: *September 1<sup>st</sup>, 2017*      Actual start date: *September 1<sup>st</sup>, 2017*  
Foreseen end date: *August 31<sup>st</sup>, 2022*      Actual end date: *August 31<sup>st</sup>, 2022*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Annex to I Progress Report	05/2018	D	11/2019	49 in MTR
Annex to Midterm Report (KPI update – Sept2019)	11/2019	D	11/2019	49 in MTR
Annex to II Progress Report	05/2021	D	05/2021	108 in FR
Annex to Final Report	11/2022	D	02/2023	Uploaded online on KPI database
Definition of indicators used	05/2018	M	05/2018	Uploaded online on KPI database

Final update of KPI and forecasting beyond 5 years of the end of the project	11/2022	M	02/2023	Uploaded online on KPI database
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**Progress achieved: what and how and the interaction with other actions**

All foreseen activities were carried out.

Definition of KPIs was done by uploading them at KPI database (<https://webgate.ec.europa.eu/eproposalWeb/kpi>), on May 2018.

On 13rd May 2019, during the second Monitoring visit, the table of D.6 action's indicators "LIFE Project Specific Indicators Call 2016" (submitted with the Proposal) updated to April 2019 was depicted to the Monitor. As suggested by the Monitor, information and data collected by D.6 action's indicators table were joined with the KPI project data snapshot exported by <https://webgate.ec.europa.eu/eproposalWeb/kpi/module>. Deliverable D6\_1 (Annex 49 in MTR) reports the results of the above-mentioned merging, updated to September 2019.

Merging the two tables, new indicators were added to the KPI exported excel file: four of them were strictly connected with the Project, whilst the others were concerning social media influence of the Project. A further update, named Deliverable D.6\_2 (Annex 108 in FR), provides KPI values updated up to 30.04.2021 on excel file. The Final update up to August 2022 (end of the Project) was submitted online on KPI database. Forecasting of values beyond 5 years are also updated and provided on the KPI database submitted online.

Since the first "LIFE Project Specific Indicators Call 2016" table submitted with the Proposal and updated with online KPI database, several KPIs or units have been deprecated. According to indications in online KPI GUIDANCE FOR A. BASIC INFORMATION, Specific Project indicators that do not fit in the LIFE KPI Database were abandoned here, but monitored via tools set by the Project and reported via each written reports and/or specific deliverables.

Apart from deprecation of some KPIs and/or their units, some deviations occurred since first forecasting. All deviations from foreseen values at the beginning of the Project are fully commented on KPI database, available online. The deviations refer to KPI 7.1, 7.4, 11.1, 11.2, 11.3, 12.1, 12.2, 13, 14.1, 14.2.2 and 14.3 (see Section 7 for details).

**Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

All foreseen activities were completed, although a first delay due to a misunderstanding on the way to deliver the first updates. As reported in Technical Issue 5, Ref. Ares(2020)1552150 - 13/03/2020, first online upload was in May 2018 at KPI database (<https://webgate.ec.europa.eu/eproposalWeb/kpi>), without providing an actual deliverable as an annex of IPR. Since then, updates were provided as excels files, fully detailed and attached to each Report as annexes.

The final update of KPI is available online at KPI database (<https://webgate.ec.europa.eu/eproposalWeb/kpi>). Although it was scheduled for November 2022, it is contextually submitted with FR, which was postponed to February 2023, and it provide data gathered until August 2022 (end of the Project). According to last Monitor's suggestions, KPI database will not be attached anymore as an annex to the Final Report.

All deviations from foreseen values at the beginning of the Project are fully commented on KPI database, available online.

**Perspectives for continuing the action after the end of the project**

An estimation of values beyond 5 years by the end of the project was provided on online KPI database (<https://webgate.ec.europa.eu/eproposalWeb/kpi>).

## ACTION E – DISSEMINATION ACTIVITIES

### Action E.1 – Dissemination – generic public

Foreseen start date: *September 1<sup>st</sup>, 2017* Actual start date: *September 1<sup>st</sup>, 2017*

Foreseen end date: *August 31<sup>st</sup>, 2022* Actual end date: *August 31<sup>st</sup>, 2022*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Project logo and graphical materials	02/2018	D	02/2018	17, 19, 20, 21, 22, 23, 24, 25 in IPR
Flyer/Brochure	03/2018	D	03/2018 (flyer) 05/2020 (brochure)	18 in IPR; 91 in FR
Web site	03/2018	D	03/2018	Par. 5.1 in IPR
Roll up	05/2018	D	03/2018 (5) 07/2022 (3)	26 in IPR I
Notice boards	06/2018	D	09/2019 (temporary) 10/2020 (final)	56 in MTR; 92 in FR
Project video (20' duration and 5' Extract)	09/2021	D	07/2022	93 in FR
Layman's report	02/2022	D	06/2022	94 in FR
Course for recognition and amateur monitoring of bird life organization	02/2019	M	02/2019	54 in MTR
"Photo hunt" course organization	02/2020	M	10/2020	95 in FR

#### **Progress achieved: what and how and the interaction with other actions**

All foreseen activities were carried out. The Project's Logo was achieved in several versions (ANNEX 17 in IPR). Several Graphical products were produced: poster, initial conference programme, \*.ppt template, layouts for pens, block notes, folders, and tote bags (from ANNEX 19 to ANNEX 25 in IPR). The brochure with general information on Project's activities, initially replaced by a flyer (ANNEX 18 in PR-I), was produced in May 2020 (ANNEX 91 in FR). The web site ([www.lifelagoonrefresh.eu](http://www.lifelagoonrefresh.eu)) (both IT/ENG versions), with more than 9000 users and around 54000 page views, and 4 social media channels (Facebook [503 followers], Twitter [219 followers], Instagram [420 followers], ResearchGate [21 followers]) were activated in 2018 and they are continuously updated with information about the Project. Roll up was achieved (ANNEX 26 in IPR) and printed in 5 copies in 2018 and other 3 were printed in 2022 for the Project's final conference. A mailing list of the Project with 269 e-mail addresses was prepared and used for main updates. In September 2019, two temporary notice boards with the description of Project and conservative actions were installed within the hydraulic (C.1) and morphological (C.2) work area (ANNEX 56 in MTR). Four final notice boards were installed in the cycle path next to the Project Area in 2020 (ANNEX 92 in FR): 2 with general information on the Project (objectives, conservation actions, expected results), and 2 with insights on the typical habitats and fauna of the Project area. It was estimated that the boards were viewed by more than 16.000 people thank to the nearby bike path.

Six videos in Italian language and six videos in English language for Project's dissemination were achieved from November 2018 to July 2022. Five of them are short videos, regarding: 1) launching video (November 2018), 2) hydraulic and morphological works (July 2020), 3) stakeholder involvement (May 2021), 4) monitoring activities (December 2021) and 5) summary of the project (June 2022). A further video is the Project's documentary of 20 minutes (July 2022) that reports the shoots and interviews of the entire Project's history (OTHER

ANNEX 112 in FR; ANNEX 93 in FR). The overall views of the Italian language videos were almost 7000, those of the English language videos were almost 1000.

Eight Newsletters were achieved during the project, dealing with the design of the works, the implementation of the interventions, the monitoring activities, and the dissemination and networking activities carried out throughout the Project; there is also an in-depth information sheet concerning various topics related to the project (ANNEX 52 in MTR and OTHER ANNEX 113 in FR). Newsletters were sent to the mailing list (269 e-mail addresses) and uploaded online to the Project's website with more than 700 downloads. All the above activities were carried out by ISPRA.

Many journalistic reports were achieved (AFP, TG1, TG3, RAI SCUOLA, Adaptation), as well as many web news and with an overall view of about 4000000; more than 50 articles were published on various Italian and several languages newspapers and magazine (OTHER ANNEX 114 in FR).

Three news releases were published by ISPRA on November 2018 (ANNEX 51 in MTR), June 2020 and July 2022 (OTHER ANNEX 115 in FR).

The Layman's report, a bilingual document dedicated to "non-experts" to help understanding the Project's objectives, actions and results in just a few pages, was realized by ISPRA in the final phase of the Project (June 2022) (ANNEX 94 in FR).

Two courses were organised by ISPRA as tools to raise awareness of the general public about the typical aquatic birdlife in the Venice Lagoon: the course for recognition and amateur monitoring of birdlife held in October-November 2019 (ANNEX 54 in MTR) and the basic course of naturalistic photography ("Photo hunt course") with final photo hunting contest held in November-December 2021, in partnership with the Venice Natural History Museum and the World Biodiversity Association (WBA) (ANNEX 95 in FR). Sixty people attended the courses. Updates on possible ways of birds' protection (action C.5) were presented by ISPRA, RV and IPROS to hunters on May 2019 (ANNEX 53 in MTR); further meetings with representatives of fishermen and hunters were held during the Project (see action A.5 and C.5). Around 2500 hunters and amateur fishermen were involved in the different phases of the Project.

Several meetings were held with citizens in the municipalities of Venice, Chioggia and Quarto d'Altino, in order to introduce the Project: the World Ocean Day in June 2018, event organized by ISMAR-CNR, in collaboration with the Museum of Natural History in Venice (ANNEX 50 in MTR); in September 2018, the project was presented to public at Quarto d'Altino municipality (ANNEX 50 in MTR) (about 15 persons); in September 2019, the project was presented at EDU DAY, event organized by the Venice Civic Museums Foundation (VCMF) for teachers of primary and secondary schools, with advertisement of activities and didactic laboratories offered by the Project (ANNEX 55 in MTR) (40 teachers). In September 2019 and in September 2021, the Project was also presented to citizens during the open event "European Researchers' night" organized by ISPRA in Chioggia, with laboratories and public speeches (45 persons) (ANNEX 50 in MTR; OTHER ANNEX 116 in FR).

Forty students' labs and five family labs were carried out in collaboration with the Venice Natural History Museum mainly before COVID restrictions (more than 900 students). On May 2022, the Project was introduced to high school students (24 students) in Mogliano Veneto (VE) and in early 2022 a practical training course for high school students (25 students) in Chioggia, named "Monitoring of lagoon environments undergoing restoration works within the LIFE Lagoon Refresh project" started within the Italian PCTO program (Percorsi per le competenze trasversali e l'orientamento – Pathways for Transversal Skills and Orientation). The proposed activities included frontal lessons, visits at the Project site with sampling of various environmental matrices, laboratory activities and final data processing (OTHER ANNEX 117 in FR).

The distribution of all produced dissemination materials, as part of the activities carried out for the E.1 Action, specifying on what occasion and to what kind of public each product was distributed, as requested in Annex to Letter of 20/11/2020 Ref. Ares(2020)6973953 “LIFE16 NAT/IT/000663 - LIFE LAGOON REFRESH – Fourth monitoring visit” and in Annex to Letter of 12/01/2022 Ref. Ares(2022)193891 “LIFE16 NAT/IT/000663 - LIFE LAGOON REFRESH – Fifth monitoring visit and second progress report”, was reported in OTHER ANNEX 118 in FR.

The Project, especially the seagrass and reed transplanting, the approach related to the Venice lagoon and the restoration of transitional environments, inspired some artists who shot videos and achieved creative projects for specific events: the artist Sonia Levy, the 2022 recipient of the S+T+ARTS4Water’s “The Future of High Waters” residency hosted by TBA21, and the creative project “AMPHIBIA - Water coexistence 2018-2021” presented at the 17<sup>th</sup> International Architecture Exhibition – Biennale Architettura 2021 and produced as part of an European Master in Urban Planning of the IUAV (OTHER ANNEX 119 in FR).

#### **Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

The activities were completed but with some differences concerning what scheduled in the proposal. The Roll up was anticipated in 03/2018 (Deliverable foreseen in 05/2018) for the initial project conference; other 3 roll ups were printed in July 2020 for the final project conference. It was expected a brochure of 8 pages but a six-sided flyer was made instead in March 2018; an extended brochure (16 pages, It/En versions) was completed in May 2020. Temporary Notice boards (06/2018) were installed in work area in September 2019 due to the delay in starting the works; final notice boards were installed in the cycle path next to the project area in October 2020. The delay in project videos (20’ duration and 5’ Extract), as expected in September 2021, but achieved in June 2022, was due to the COVID-19 restrictions on National Travel (mostly for the video maker). A further delay was also due to waiting for the end of works and expected changes in the habitat after interventions. However, the five achieved short videos (November 2018 – December 2021) deepened the various aspects of the project. Layman’s report delay (June 2022 rather than February 2022) was due to delay in laboratory analyses and result processing of monitoring data. The preparation of the course for recognition and amateur monitoring of bird life started on February 2019; the course was held on 18<sup>th</sup>-25<sup>th</sup> October and 8<sup>th</sup> November 2019. The preparation of the course for “Photo hunt” started on October 2020 (scheduled for February 2020) due to evolution of the pandemic situation; the course was done in 19<sup>th</sup>-26<sup>th</sup> November and 3<sup>rd</sup> December 2021.

#### **Perspectives for continuing the action after the end of the project**

The communication and dissemination of results will continue by all partners with the participation in public events for citizens and with the continuation of the PCTO (Percorsi per le competenze trasversali e l’orientamento – Pathways for Transversal Skills and Orientation) program for schools. The website and social media channels will remain active and will be updated with the most important events held during the After LIFE period. Whenever it is possible, the distribution of all material produced will also continue.

#### **Reactions and feedbacks obtained**

Feedbacks and reactions have been positive. Indeed, the generic public reached by the Project has been increasing in the years. This evaluation was done through the increase of web site visits, social media interactions, number of the press reviews, the estimated display of the final notice boards and consequently the attention by users of the cycle path and of the Project area, interest in participating to events organized by the Project. The requests to participate to the courses (no.2) organized by the Project were much greater than the available room. Moreover, the availability of both courses and the didactic laboratories offered by the project (no.40), in collaboration with the Venice Natural History Museum, were sold out after few days. To obtain

more quantitative feedbacks, customer satisfaction questioners were distributed for the course for recognition and amateur monitoring of bird life (October-November 2019) and for the basic course of naturalistic photography (November-December 2021). At both cases, the general course satisfaction was high (scores 4-5 in a scale 0-5). The trainees positively evaluated the organization of the courses, the covered topics, the degree of in-depth analyses of the topics and the increase in personal knowledge.

The project was also hot-topic of interest by artists who shot videos inspired by the approach and techniques of the Project.

### **Action E.2 – Dissemination to specialistic public and networking**

Foreseen start date: *September 1<sup>st</sup>, 2017*      Actual start date: *September 1<sup>st</sup>, 2017*

Foreseen end date: *August 31<sup>st</sup>, 2022*      Actual end date: *August 31<sup>st</sup> 2022*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Scientific publication	02 /2022	D	02/2018; 06/2019; 01/2022; 06/2022	59 in MTR; 96 in FR
Initial conference organization	02/2018	M	03/2018	28 in IPR
Definition networking	06/2018	M	06/2018; 11/2019	29, 30 in IPR; 60 in MTR
Seminar UNIPD	01/2019	M	01/2018	27 in IPR
First visit intervention sites organization	06/2020	M	01/2020	97 in FR
Networking final evaluation	06/2022	M	06/2022	99 in FR
Final conference organization	07/2022	M	07/2022	98 in FR

#### **Progress achieved: what and how and the interaction with other actions**

All foreseen activities were carried out.

Sub-action E.2.1: Dissemination to specialistic public - The first Seminar for project presentation was organized by ISPRA at University of Padua, Biology Department in January 2018 (ANNEX 27 in IPR). Fifteen students and two professors attended the seminar; the project attracted great interest, and a student decided to attend her University internship and elaborate her Master's degree thesis on LIFE Lagoon Refresh. Successfully discussion of the thesis was in September 2019. Other six seminars for project presentation were organized: two with University of Padua and four with Ca' Foscari University of Venice. Some seminars were held on-line due to the COVID-19 restrictions. In 2021 and 2022, after holding a classroom lesson, a visit to the project site was also organized (ANNEX 57 in MTR; OTHER ANNEX 120 in FR). Over 100 students participated to the seminars. Other three students, from University of Padua and Ca' Foscari University of Venice, decided to attend internship and/or elaborate their degree thesis about LIFE Lagoon Refresh with successfully discussions of the thesis in October 2018, July 2021 and February 2022.

The initial project conference organized by ISPRA was held in March 2018 (ANNEX 28 in IPR), there were 80 participants. The final project conference organized by ISPRA was held in July 2022 (ANNEX 98 in FR), there were about 85 participants (including speakers and round table participants). During the conferences, each partner presented the activities; after the presentations, a very interesting discussion emerged, especially when 4 roundtables took place with stakeholders, technicians and water managers.

Moreover, the project was presented by ISPRA and UNIVE in 26 occasions to a specialistic public including conferences, workshops, and seminars. The complete list is in (ANNEX 29, 30 in IPR), ANNEX 58 in MTR and in OTHER ANNEX 121 in FR. About 2500 researchers



and technicians arisen awareness about the project by attending these national and international conferences.

In January 2020, experts from University of Cambridge, Univ. of Padua, Ca' Foscari Univ. of Venice, Veneto Region, International Emissions Trading Association, students, associations and professionals, attending the Workshop "Venice Salt Marshes as a Carbon Sink" organized by "We are here Venice", visited the project site (ANNEX 97 in FR).

The project was promoted on Reticula 2018, a periodical technical report published by ISPRA (ANNEX 59 in MTR). Preliminary results of the nekton community were published on the scientific article "Expected Shifts in Nekton Community Following Salinity Reduction: Insights into Restoration and Management of Transitional Water Habitats", Water 2019, 11, 1354 (doi:10.3390/w11071354, ANNEX 59 in MTR). Other two scientific articles were published on peer reviewed journals in 2022: "An integrated approach for evaluating the restoration of the salinity gradient in transitional waters: monitoring and numerical modelling in the LIFE Lagoon Refresh case study", Environments 2022, 9, 31. <https://doi.org/10.3390/environments9030031>; and "Conservation actions for restoring the coastal lagoon habitats: strategy and multidisciplinary approach of LIFE Lagoon Refresh", Frontiers in Ecology and Evolution 2022, 10:979415.doi: 10.3389/fevo.2022.979415 (ANNEX 96 in FR).

The distribution of all dissemination materials, produced as part of the activities for E.2 Action, specifying on which occasion and to what kind of public each product was done, as requested in Annex to Letter of 20/11/2020 Ref. Ares(2020)6973953 "LIFE16 NAT/IT/000663 - LIFE LAGOON REFRESH – Fourth monitoring visit" and in Annex to Letter of 12/01/2022 Ref. Ares(2022)193891 "LIFE16 NAT/IT/000663 - LIFE LAGOON REFRESH – Fifth monitoring visit and second progress report", was reported in OTHER ANNEX 118 in FR.

Sub-action E.2.2: Networking - A definition of a networking draft was completed in June 2018 by ISPRA (ANNEX 60 in MTR), first through joint communication events, sharing methods and monitoring stations (ANNEX 29, 30 in IPR), and then through contacts with leaders of European projects for networking activity. Every different kind of activities allowed sharing and enrichment of knowledge useful for the project. During the project, we kept in touch with other leaders of European projects and with associations and public entities. At the end of the project, more than twenty LIFE projects, other five European projects and about twenty associations/public entries were engaged in networking activities (ANNEX 99 in FR). Several projects/entities were involved: some of them through meetings and direct sharing (e.g LIFE AGREE, LIFE FORESTALL, LIFE SERESTO, LIFE SEPOSSO, LIFE CONVIVE, LIFE VIMINE, LIFE ALBUFERA, LIFE PRIMED, LIFE FOR POMORIE LAGOON, Inrerreg ADRION, WETNET, LIFE BARGE, LIFE EBRO-ADMICLIM, LIFE CoHaBit, LIFE TRANSFER, CIRF and others by performing courses (e.g. WBA, Venice Natural History Museum, IWC). The definition of the Networking and all the activities carried out were also fundamental for Action E.3 "Actions to promote the transferability and replicability of the project".

### **Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

Sub-action E.2.1: Dissemination to specialist public - Time schedule foreseen in the proposal was met. All deliverables were met. Initial Conference Milestone foreseen at 02/2018 was delayed to March 2018 because of overlapping with Final Conference of LIFE SERESTO organized in February 2018 in Venice. The first University Seminar was organized before the expected deliverable (January 2019). The first visit to the project site with experts was held before the expected time of the milestone (June 2020).

Sub-action E.2.2: Networking - Time schedule foreseen in the proposal was met.

Due to the COVID-19 health emergency's restrictions, some seminars, participation at conferences and networking meetings were made in on-line mode.

**Perspectives for continuing the action after the end of the project**

**Sub-action E.2.1: Dissemination to specialist public** - Attendances to other conferences on the lagoon environments topics and on restoration interventions are planned by ISPRA and UNIVE.

**Sub-action E.2.2: Networking** – Networking activities with the sites selected for the transferability and replicability of the project will continue by ISPRA and IPROS.

**Reactions and feedbacks obtained**

Feedbacks and reactions are positive. A customer satisfaction questioner was distributed both for the initial and the final Project Conferences with positive feedbacks. Other questioners were completed during university seminars highlighting a general high interest on the topics covered. The presentation of the project at university seminars attracted great interest of students and four students decided to attend internships and develop their thesis on the project. Increasing scientific interest for the project was monitored by contacts and downloads through ResearchGate and Journals' statistics. Interaction with interesting questions and discussion occurred after each presentation at conferences, workshops and seminars. This interaction resulted in invitation to present the project at other events. The involvement of researchers, water managers and technicians dealing with monitoring, assessment and conservation of EU lagoon and estuarine sites was increased also through the expanding network of contacts.

**Action E.3 – Project replication**

Foreseen start date: *September 1<sup>st</sup>, 2017*      Actual start date: *September 1<sup>st</sup>, 2017*  
 Foreseen end date: *August 31<sup>st</sup>, 2022*      Actual end date: *August 31<sup>st</sup>, 2022*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Selection of sites for replicability and transferability of the LIFE Lagoon Refresh project	06/2020	D	06/2020	100 in FR
Replicability of Project's actions. Descriptions and simulations of intervention scenarios at selected sites	08/2022	D	08/2022	101 in FR
Start of searching for potential sites for replicability and transferability of LIFE Lagoon Refresh actions and first contacts with local referents	09/2018	M	09/2018	Section 3 of page 4 in MTR
Start of activities for final selection of 6 sites for replicability and transferability	09/2019	M	09/2019	102 in FR
Start of visits in LIFE Lagoon Refresh area and selected sites	03/2020	M	07/2021	103 in FR
Start of development of scenarios at selected sites to replicate LIFE Lagoon Refresh actions	09/2021	M	09/2021	104 in FR

**Progress achieved: what and how and the interaction with other actions**

All foreseen activities were carried out. The Replicability and Transferability (R&T) strategy consisted of: i) selection of potential sites; ii) call for interest at European level to identify potential R&T sites; iii) selection of sites for R&T; iv) visits to the Project intervention site (costs covered by the Project); v) visits to each site selected for R&T (costs covered by the Project); vi) preparation of scenarios for R&T of the project strategy/actions/methods in the selected sites; vii) After-LIFE R&T activities.

Contacts with researchers, national and international Authorities, water managers and other project leaders, as people involved in the lagoon and estuarine environment management, for networking (action E.2), transferability and replicability (action E.3) started on September 2018 (Milestone cited in Section 3 in MTR) and were kept also all over the Project. After one year, preparatory activities for the final selection begun, too. On 1<sup>st</sup> December 2019, the Project (ISPRA) called for interest to select six sites where to transfer and replicate strategy, actions and methods of the Project. Announcement and application forms were published on the website, sent by mailing lists, advertised by the social media channels of the Project. Furthermore, the call was promoted during conferences, workshops, seminars and networking meetings (E.2.1 dissemination to specialist audience). The call closed on 15<sup>th</sup> February 2020 and fourteen applications responded. Nationally, the selected Italian sites were: the Apulian Acquatina di Frigole, lagoons in the Po River Delta (Barbamarco-Busiura, Basson-Canarin and Sacca of Scardovari) at Veneto Region, and Pialassa Baiona, Valle Mandriole and Punta Alberete at Emilia-Romagna Region. The selected European sites were: the Spanish lagoon of l'Albufera de Valencia, the French salt marshes of Hyeres, and the Greek Nestos Delta lagoons and Porto Lagos (ANNEX 100).

On 7<sup>th</sup> July 2021, a remote presentation was held to introduce the Project to Italian winners. On 15<sup>th</sup> September 2021, representatives of Italian sites visited the Project area. On 7<sup>th</sup> October 2021, selected sites' representatives introduced their own sites by remote meeting. 12<sup>th</sup>, 19<sup>th</sup> and 20<sup>th</sup> October the Project's Staff visited lagoons in Ravenna, in Po Delta River and Acquatina di Frigole, respectively. On 8<sup>th</sup> April 2022, remote presentations were held to European winners, both about the Project and their sites. On 31<sup>st</sup> May 2022, representatives of European sites surveyed the Project area. 19<sup>th</sup>-20<sup>th</sup>, 29<sup>th</sup> July, and 8<sup>th</sup>-9<sup>th</sup> August 2022, the Project's staff visited Hyeres salt marshes, l'Albufera de Valencia and lagoons in Nestos Delta River and Porto Lagos, respectively. Italian and European winners were especially interested in R&T of the following Actions: A.5, C (all), D1, D.2 and D.3 (ANNEX 101).

The application forms and information gathered during remote meetings, as well as surveys *in situ* allowed providing a "Descriptions and simulations of intervention scenarios at selected sites", specifying, for each site, the further technical investigations needed to plan the interventions (list of lacking data and/or preliminary actions needed to develop future proposals), and hypothesis of intervention (ANNEX 101).

Among lagoons in Po River Delta, Sacca of Scardovari was identified as the one in need of priority interventions, due to critical issues related to the regression of the reeds, the lack/absence of aquatic phanerogams, the reduction/disappearance of species' habitats and the deterioration of quality status of the 1150\* Habitat, threatened in particular by erosion/depositional phenomena linked to the floods of the Po river. The especially critical state of the sandy cordon, which separates the Sacca of Scardovari from the final stretch of the Po di Gnocca branch of the Po River, was actually verified during the visit of 19<sup>th</sup> October 2021. Indeed, during the survey, the Project's staff could observe the elevation of the land is slightly higher than the average sea level and numerous openings/breaches allow the uncontrolled outflowing of river waters into the lagoon. Technical investigations, needed to plan interventions, include an implementation of a modellistic tool (as performed for the Project) to simulate the effect of morphologic reconfiguration of sandy cordon which separates the Sacca of Scardovari from the final stretch of the Po di Gnocca branch of the Po River.

Among Ravenna's lagoons, Pialassa Baiona was identified as the one in need of priority interventions. During the survey on 12<sup>th</sup> October 2021, the Project's Staff could actually verify that the lagoon needs to restore the salinity gradient and to improve a renewal of water in the lagoon. The representatives proposed, as a hypothesis of intervention, to open connections with sea and to inflow freshwater from Lamone River. However, outcomes achieved by the survey suggested there is a need to perform a preliminary modelling before interventions.

Regarding Acquatina of Frigole, during the visit on 26<sup>th</sup> October 2021, the Project's staff could actually verify that the lagoon has very low water renewal from sea, as mouths are obstructed by waste of *Posidonia oceanica* mixed with sand; the outlet into the sea of the Giammatteo canal is completely clogged with compacted sand; near the inlet of the Giammatteo canal and the central mouth there are grates, sluice gates and other artefacts, which currently avoid the natural recirculation of the water, since they are obstructed, or not functioning, or in a position that does not allow the hydrodynamic flow; along the dune belt, between the outlet of the Giammatteo canal and the central mouth, there is an area at a lower altitude, which could be affected by overwash phenomena during the most intense storm surges. Outcomes by the visit showed data collecting and implementing of a modelling tools to forecast the effects of freshwater and sea water inflow are needed as technical investigations to plan interventions. The hypothesis of intervention has been made to renewal waters by opening the mouth connecting the sea to the lagoon, as well as to connect back Giammatteo canal for freshwater inflow.

During the visit on 29<sup>th</sup> July 2022, the Project's Staff could actually verify and investigate the problems in l'Albufera de Valencia, which are mostly regarding the quality and quantity of waters in the lagoon. Over the years, the natural contributions of freshwater have decreased and there has been an intensification of rice crops, the main resource of the area, which produces a large quantity of nutrients, which flows directly into the lagoon. In some areas of the lagoon there are marine intrusions and salinization of the substrate with consequent reduction of vegetation (mainly reeds), and of the survival of submerged macrophytes. Water oxygenation and transparency have worsened over the years and there are few and limited areas with still aquatic plants that favour an improvement in water quality. Furthermore, in some parts of the lagoon the reduction of the reeds has been occurred, due to the erosive action of the waves, mostly next to the island called "Manseguerota" which is located in the middle of the lagoon. Outcomes by the visit showed that, first of all, the implementation of a properly monitoring network is needed to assess the environmental quality status in the lagoon. Moreover, data will allow to implement a modellistic tool as performed by the Project. Both monitoring network and modelleistic tools are technical investigations needed to plan interventions. At the end of the visit a hypothesis of intervention was made of adopting morphological structures, similar to those adopted by the Project on C2 action, to help avoiding erosion in the small islands inside the lagoon, which are very important for birdlife.

Regarding Hyeres saltmarshes, during the visit on 19<sup>th</sup>-20<sup>th</sup> July 2022, the Project's staff could actually verify that the sites are completely surrounded by residential settlements and the coastline is heavily exploited by tourism. The absence of a buffer area between saltmarshes and the sea was also observe *in loco*. Furthermore, it was also clear that restore full functions of sluice gates to regulate fresh/sea waters and to thoughtfully balance fluxes of those waters are needed. However, before planning any intervention, to verify the feasibility of any measure, it is first necessary to start a continuous monitoring of the hydrometric level in the district canal, at the two peripheral ends of the area (north side and south side), in order to verify the existence of a possible difference in instantaneous level in case of extreme weather situations. Finally, regarding Thracian lagoons, during the visit on 8<sup>th</sup> and 9<sup>th</sup> August 2022, the Project's Staff could actually verify and observe the condition and issues of Eratino, Agiasma and Porto Lagos lagoons. The area is surrounded by extensive agricultural crops that dispose of water outflows through a drainage network that flows into the present wetlands. The Porto Lagos lagoon is characterized by little/no water exchange with the sea and presumably by high exchange, times which cause a lack of oxygen and the enrichment of nutrients in the lagoon system. In addition, fish mass mortality phenomena are often recorded following exceptional water eutrophication events. Either lagoons in Nestos Delta River, Vistonida lakes and Porto Lagos are exploited for fish farming, as actually confirmed by fishermen and the head of the

fishery Office of the Region, both met during the visit. Outcomes by the visits showed that first more complete and lasting in time monitoring plans are needed. The hypothesis of intervention is to open again flows between Porto Lagos with Vistonida Lake by a hydraulic structure similar to that build within C.1 action of the Project. In addition, the Project's Staff also suggested to improve the renewal of waters by morphological structures similar to those used within C.2 action of the Project.

**Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

Deviation from the time schedule foreseen, just for the milestone regarding start of visits to selected sites, was due to pandemic's restrictions on travels, both for Italian (in 2020) and European (2020-2021) sites.

**Perspectives for continuing the action after the end of the project**

Among selected sites, Po River Delta area has already been identified to continue with the R&T activities beyond the end of the Project, involving ISPRA and IPROS. Indeed, an advanced proposal of scenario was developed for Sacca of Scardovari and an implementation scenario of the project strategy is under preparation (OTHER ANNEX 122 in FR). The Civil Engineers of the Po Delta River considered including the proposed activities in the context of environmental engineering interventions scheduled for 2023.

**ACTION F- PROJECT MANAGEMENT**

**Action F.1 - Project management**

Foreseen start date: *September 1<sup>st</sup>, 2017*  
Foreseen end date: *August 31<sup>st</sup>, 2022*

Actual start date: *September 1<sup>st</sup>, 2017*  
Actual end date: *August 31<sup>st</sup>, 2022*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
Audit Report	11/2022	D	02/2022	105 in FR
Kick-off meeting	09/2017	M	09/2017	1 in IPR
Intermediate financial reporting	11/2019	M	11/2019	Folder Administrative documents in MTR
Final financial reporting	11/2022	M	02/2022	Folder Administrative documents in FR

**Progress achieved: what, how and the interaction with other actions**

Before the start of the project, on 10 July 2017, the CB organized a preparatory meeting with all the technical and administrative representatives of the beneficiaries.

Partnerships agreements were signed at the beginning of the project. An ftp space was set up, accessible to all partners for writing/reading with different permission.

The project kick off meeting (KOM) was held on 25th September 2017 at OO.PP. premises in Venice (ANNEX 1 in IPR). Representative of Lagoon Refresh attended to LIFE16 KO Meeting in Brussels. The First Progress report was delivered in May 2018, as foreseen in the Proposal. Mid Term Report, compressive of Intermediate financial reporting, was delivered in November 2019 as foreseen in the Proposal and an integration was delivered in January 2020. Second Progress Report was delivered in May 2021 as foreseen in the Proposal. This Final Report, compressive of final financial reporting, was scheduled for November 2022; Project Leader (Ms. Rossella Boscolo Brusà) sent by mail to Project Officer (Ms. Manuela Osmi) on 1 August 2022 the request to postpone Final report scheduled for November 2022 to February 2023. Project Officer (Ms. Manuela Osmi) accepted the request with the e-mail of 02 August 2022. The Audit Report, under Article II.23.2 (d) – *Certificate on the financial statement* of Letter Amendment N.1 to Grant Agreement (EASME b.3 16/08/2018 3792965), is expected for

beneficiaries for which the total contribution in the form of reimbursement of actual costs is at least 750,000 €. The Audit Report for OO.PP. was postponed to 02/2023 with the Final report. Contacts with all beneficiaries were organized to follow the administrative and financial development of the project. Contacts between ISPRA Project Leader, Project Manager, Administrative Manager and Beneficiaries' Technical and Administrative Managers occur daily by telephone, skype and e-mail in order to guarantee the smooth implementation of the project. Recurring management boards and technical meetings were organized. Details on management processes and communication with the EASME and Monitoring team are reported in Cap.5.

**Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

Activities and time schedule foreseen in the proposal were completed. During the five years of the project we met some exceptional events: the ‘Acqua grande’ (High water) event in November 2019 completely flooded the construction site causing difficulties to the Project realization, and the arrival of the Covid 19 pandemic also stopped, for a period of time, the ongoing works. These events delayed the conclusion of concrete actions and consequently the monitoring activities to evaluate the impact of the project have been prolonged comparing to the schedule (Action D.1, D.2, D.3). For this reason, we asked to postpone Final Report scheduled from November 2022 to February 2023 and Deliverable Audit report and Milestone Final financial reporting are postponed to February 2023.

**Action F.2 – After LIFE Conservation Plan**

Foreseen start date: *April, 2022*

Actual start date: *April, 2022*

Foreseen end date: *August 31<sup>st</sup>, 2022*

Actual end date: *August 31<sup>st</sup>, 2022*

Name of the Deliverable/Milestone	Deadline	D/M	Completion	N. ANNEX
After LIFE Conservation Plan	11/2022	D	02/2022	106 in FR
Starting After LIFE Conservation Plan	04/2022	M	04/2022	107 in FR

**Progress achieved: what, how and the interaction with other actions**

All foreseen activities were carried out. The After LIFE Conservation Plan (ALCP) is in ANNEX 106. The ALCP focuses on three main aspects: i) the maintenance of the hydraulic and morphologic works (C.1, C.2); ii) the continuation of monitoring activities (D.1, D.2, D.3) to verify the impact of the Conservative Actions; iii) the continuation of dissemination of results to generic and specialist public (E.1, E.2) and of replicability and transferability (R&T) (E.3). In addition, considering that Hunting and Fishing Office of Veneto Region rejected the request of excluding from fishing by stationary nets an area of 30 hectares in the Project area (C.5), during the ALCP, the Office of RV, as a partner of the project, will work with the Hunting and Fishing Office of Veneto Region to edit the regulation of fishing activities in the next revision of the Fishing Plan. The maintenance of C.1 e C.2 works are regulated by the “Agreement between RV and OO.PP. for the management of the hydraulic structure during and after the Project duration” (ANNEX 31 in MTR). The continuation of monitoring activities will concern the ecological quality status of habitat 1150\*, reedbeds, halophytic habitats and birds with a specific timetable for the five years after the end of the Project. UNIVE and ISPRA will perform those monitoring activities. All partners will perform dissemination and R&T activities. ISPRA and UNIVE will attend Conferences and will prepare scientific articles. ISPRA will maintain the website and social media channels. RV and OO.PP. will transfer the experience of the project to other areas of Venice Lagoon; ISPRA, UNIVE, and IPROS also in other national and international areas.

In the ALCP is reported an estimate of costs for each activity. The total amount is 89.300,00 €. Some activities are free of charge because the only cost is referred to the cost of personnel and they will be conducted by Partners' staff.

**Comparison with activities and time schedule foreseen in the proposal; problems occurred and solutions**

There were no deviations and problems.

## 6.2. Main deviations, problems and implemented corrective actions

The conclusion of the hydraulic work (C.1) was in 02/2020 instead of 08/2019 and morphologic work (C.2) was in 05/2021 instead of 08/2019. Delays were due to unforeseen EIA procedure (Action A.1), the bad weather conditions and high tide events, which lasted throughout the end of 2019, the restrictions of COVID pandemic in 2020. The freshwater input was possible only in May 2020. Freshwater input was increased gradually from an initial discharge of 300 l/s (May 2020) up to a maximum of 1000 l/s (February 2021).

Taking into account the delay in C.1 and C.2 actions and taking into consideration seasonal and phenological factors related to the reedbed development, transplantation activities (C.3) started in 06/20 instead of 09/19 and ended in 06/22 instead of 06/21. As a measure to mitigate the effects of the delay in the start of transplants, the number of sods were increased, and the period of field activity was extended. The total number of transplanted sods was 2789, a higher number than the 1000 sods indicated in the Proposal. For the same reasons, the time schedule foreseen in the proposal for transplantation of seagrasses (C.4) was rescheduled. In particular, the start of the seagrass transplantation activities, foreseen by Proposal for September 2019, has been postponed to October 2020. However, such delay did not entail a modification of the expected number of clumps and rhizomes that were transplanted during the project.

All monitoring activities (D.1, D.2 and D.3) were done as scheduled in the proposal, even though the timetable changed several times due to delay to works, stop for pandemic's restrictions and adverse weather conditions. Moreover, new surveys were added during Project. The remodulation of the timing of monitoring activities and the minimal changes in overall effort did not entail additional costs for the project.

The completion of D.4 and D.5 actions were postponed in relation to COVID restrictions and to the end of monitoring activities.

All foreseen activities for Action D.6 – KPI were completed, although a first delay due to misunderstanding on the way to deliver the first updates (see Technical Issue 5, Ref. Ares(2020)1552150 - 13/03/2020). The final update of KPI was submitted contextually with FR, which was postponed from November 2022 to February 2023.

All foreseen dissemination activities (E.1 and E.2) were completed even if with some delay due to the COVID-19 restrictions which did not allow face-to-face activities for some time. Where and when it was possible, the various activities were carried out on-line.

All foreseen project replication activities (E.3) were completed despite the delay on start of visiting sites due to pandemic's restrictions on national and international travels.

## 6.3. Evaluation of Project Implementation

Generally, the project management methodology ensured the smooth implementation of the project (administrative, financial and technical issues). The project coordination activity required daily work to maintain a permanent flow of information and to take measures to overcome any (even small) occurred problem, in order to achieve the objectives.

LIFE Lagoon Refresh is a project of active ecological restoration by using in situ eco-engineering. It used two types of approaches: an approach that consists on restoring the

hydrological processes and physico-chemical conditions necessary to a natural Self-improving of ecological structure and functioning (Action C.1 and C.2), and an approach that consists on a direct intervention on biota with transplanting actions (Action C.3 and C.4). In addition, the project focused in socio-economics uses of the area and in a reduction of hunting and fishing pressure (Action C.5).

The preparatory actions were planned in order to ensure smooth implementation of conservation actions. The Project received all required permission by Competent Authorities in the framework of EIA procedure. The EIA procedure, not foreseen, led to a delay on completion of authorizations but the Project received all required permission by Competent Authorities with a robust and transparent procedure. The multidisciplinary approach using survey and modelling for the final design of hydraulic and morphologic works was a point of strength to realize C.1 and C.2 actions and to reach the goal of restoration of salinity gradient as expected. The potential conflict between hunters and nature conservation (C.5) was managed with several meetings and discussions between LIFE Partners and stakeholder focal points (President of hunters associations, Management Board of hunters associations, Presidents of fishermen and hunters associations) with a participative consultation approach. Despite the problems that occurred during the project (exceptional weather conditions in 2019 and COVID pandemic restrictions in 2020/2021), all conservation actions were completed thanks to the strong collaboration between partners. The adaptive approach used for morphological works between the first and second phases was a successful methodology. The C.5 action was undervalued during the writing of the proposal. To modify the provisions regulating hunting and fishing, the need of being in the revision process of Plans emerged during the project. Those revisions take time apart from the Project's time schedule. Moreover, Authorities usually make a decision taking into account political aspect, not only those arising from environmental issues. While it was possible to change hunting regulations with a positive feedback, fishing regulations were not allowed to be changed as well, due to rejections on edits by the fishing's relevant Authority.

Another point of strength of the project was the methodology to verify the impact of the actions (action D). Monitoring methods to analyse the environmental conditions are coherent with National and European protocols and the results were comparable with other monitoring activities (Institutional and other project monitoring activities). The project had clear goals and objectives and specific indicators to measure expected results. Comparing the environmental expected results with achievements at the end of the project, the restoration of the salinity gradient was reached in the intervention area of 70 ha as planned, and the outcomes of fish fauna assessments indicated an improvement as expected. The macrophytic community improved in ecological quality status as well as coverage of seagrasses meadows, while macrozoobenthos community needs more time as usually expected. Taking into account the short time passed between the full discharge of fresh water inlet and the transplants, reedbed mapping showed encouraging results. The reedbed was found in a lagoon area of about 11 hectares and resulted abundant (cover > 75%) in an area of about 1.1 hectares, while clumps in a good state of rooting and areas with less coverage were found in the remaining surface. Compact populations require at least 5-10 years for their formation. Consequently, the reduction of the degree of eutrophication due to the phytoremediation function of reed beds and the improvement of the status of birds closely linked to reedbeds, is expected in the same time frame. On the other hand, among the numerous species of water birds, some have given important positive responses to freshwater input into the lagoon. Some species like *Larus ridubundus*, *Calidris alpina*, and *Larus melanocephalus* have increased their presence in the intervention area. The evaluation of ecosystem services and socio economic assessment was based on a massive sets of data of D.1, D.2, D.3 actions as well as two kind of questionnaires (general public, including also didactic/ecotourism/environmental associations and amateur



fishermen and hunters) and interviews conducted with operators specialized in tourism and educational activities in lagoon environments.

The methodology applied to Public awareness and dissemination of results was satisfactory despite the COVID restrictions. All activities for generic public were done. The presence of a cycle path adjacent to the Project Area was and will be a strength for the visibility of the notice boards and the project. The format of the Newsletter was very appreciated with more than 700 downloads. The project attracted many reporters with six video services and more than 40 articles in several languages. The two foreseen courses were done with success. An intense activity with the school was done thank to the collaboration with Venice History Natural Museum. Many activities for specialist public were done (Conferences, lessons in the University, scientific papers, networking activities).

The methodology applied for Transferability in E.3 was successful. The initiative of “Call for Interest” and the following activities, in spite of the pandemic restrictions, have guarantee a concrete transferability in six sites (three Italian: the Apulian Acquatina di Frigole, lagoons in the Delta Po River Barbamarco-Busiura, Basson-Canarin, and Sacca of Scardovari at Veneto Region, and Pialassa Baiona, Valle Mandriole and Punta Alberete at Emilia-Romagna Region. Three European: the Spanish lagoon of l’Albufera de Valencia, the French salt marshes of Hyeres, and the Greek Nestos Delta lagoons and Porto Lagos).

Hydraulic work (C.1) resulted a high cost-efficiency action. It is a hydraulic infrastructure functioning with no mechanical control, with advantages in terms of maintenance costs and no energy consumption. The flow is due to the difference of the water level between the Sile river and the lagoon. The cost of morphologic works (C.2) resulted higher than the budgeted in the Proposal, due to technical choices assumed in order to maximizing the eco-friendly approach. Considering the low bathymetry and vulnerability of the project area, all constructions were carried out manually avoiding dredging temporary channels and using light and biodegradable material (modular bags made of coconut fibbers and jute). The C.3 and C.4 actions were high cost-efficiency. The transplant activities were carried out by fishermen and hunters trained during the project, strengthening their awareness. All activities were conducted manually with a very low impact to donor and transplant sites. The cost-efficiency of monitoring activities were optimized thanks to the proximity of partners to the Venice lagoon. Moreover, all analysis were done by ISPRA and UNIVE. The dissemination actions resulted in high cost-efficiency considering most of the activities were realized by ISPRA (e.g. logos, web sites, graphical products, videos, and social media). The start and final Projects Conference were organized by ISPRA and conference hall was made available by UNIVE free of charge.

*Table of comparison through quantitative and qualitative information of the results achieved in the project against the objectives of the proposal. Successes and lessons learned*

Action	Foreseen in the revised proposal	Achieved	Evaluation
A.1 Permission from competent authorities	<p><b>Objectives:</b> To obtain all authorizations for conservation action implementation and guarantee the After Life management of infrastructures.</p> <p><b>Expected results:</b> Final permission. Agreement between OO.PP. and RV for infrastructure</p>	Fully achieved	<p>The EIA procedure was not foreseen in the Proposal. Action concluded in April 2019 instead in August 2018, due to longer time for the unforeseen EIA procedure. With EIA procedure the Project received all required permission by Competent Authorities with a robust and transparent procedure.</p> <p>The Agreement between OO.PP. and RV, for the management of the hydraulic structure during the project and for the After LIFE period, was a</p>

	management and maintenance.		pillar of the After LIFE Conservation Plan.
A.2 Surveys and modelling for final design of hydraulic and morphologic works	<p><b>Objectives:</b> Provide data and modelling for hydraulic and morphological works design and management</p> <p><b>Expected results:</b> Existing data collection; acquisition of new salinity, water level, tidal current data; topo-bathymetric survey; GIS system; hydrodynamic modelling.</p>	Fully achieved	All data for supporting the hydraulic and morphological works design were collected and organized in GIS system. The acquisition of data of current and salinity and hydraulic modelling activities was consistent to complete the flow regulation of C.1 Action. The multidisciplinary approach using survey and modelling for the final design of hydraulic and morphologic works was a point of strength to realize C.1 and C.2 Actions and to reach the goal of restoration of salinity gradient as expected.
A.3 Design of Hydraulic work	<p><b>Objectives</b> Design of Hydraulic works</p> <p><b>Expected results</b> Detailed Design</p>	Fully achieved	Detailed Design of Hydraulic works was verified, validated and finally signed in April 2019. Action concluded in April 2019 instead in August 2018, due to longer time for the unforeseen EIA procedure.
A.4 Design of Morphological work	<p><b>Objectives</b> Design of Morphological works</p> <p><b>Expected results</b> Detailed Design</p>	Fully achieved	Detailed Design of Morphological works was verified, validated and finally signed in February 2019. Action concluded in April 2019 instead in August 2018, due to longer time for the unforeseen EIA procedure. Considering the innovation of the bags used, it was decided to carry out the morphological works in two phases, to allow an adaptive management strategy. The fascines of brushwood originally proposed, were replaced by biodegradable structures, more suitable for the aims of the project.
A.5 Stakeholder involvement	<p><b>Objectives</b> Stakeholder involvement for identifying possible forms of fish fauna and birds protection. Stakeholder involvement in reed and seagrass transplanting</p> <p><b>Expected results:</b> Meeting with stakeholders dealing with hunting and fishing issues (fishermen, hunters and Institutions) to share the possible forms of fish fauna</p>	Fully achieved	Several meetings were organized with presidents, boards, and associates of Fishing and Hunting associations and possible forms of protection were identified. Preparatory action for C.5 Action. A theoretical of 11 teaching modules and three field lessons were done to 17 operators and company who were involved in the reed and seagrass transplantation actions (C.3 and C.4). The Deliverable “Guideline for reedbed and seagrass transplantations”, arranged by UNIVE and ISPRA, was delivered to the attendees of the training course

	and birds' protection. To produce a Guideline for reedbed and seagrass transplantations. Training course of 10 teaching modules and 4 field lessons for transplanting activities.		
C.1 Hydraulic work	<b>Objectives</b> Realization of Hydraulic work <b>Expected results</b> Tender procedure, work assignment, hydraulic infrastructure implementation and maintenance, water flow management	Fully achieved	The certificate of completion of hydraulic work was released in November 2020. The starting of the activity was postponed by four months due to EIA procedure, not foreseen. The conclusion of the hydraulic works was on 02/2020 instead of 08/2019 due to EIA procedure, the bad weather conditions and high tide events, which lasted throughout the end of 2019. Freshwater input was increased gradually from an initial discharge of 300 l/s (May 2020) up to a maximum of 1000 l/s (February 2021).
C.2 Morphologic work	<b>Objectives</b> Realization of Morphologic work <b>Expected results</b> Tender procedure, work assignment, morphological work implementation. Implementation of 1658 m of morphological structures (1.404 modules) and 655 m of fascines of brushwood and maintenance (327 modules).	Fully achieved with adjustments	The morphological work was realized in two phases and started at the end of June (2019). The conclusion of the first phase of morphological works was achieved in 02/2020. Based on results of the first phase, the second phase of morphological reconstruction was optimized. The conclusion of works was on 05/2021 instead of 08/2019 due to EIA procedure, the bad weather conditions and high tide events, which lasted throughout the end of 2019 and the restriction of pandemic in 2020. The fascines of brushwood (C.2.2) were replaced by biodegradable structures, more suitable for the aims of the project. Overall, 1180 m of morphological structures were implemented. The number of modules resulted 3 times greater than in Proposal (5.360 vs 1.404), due to the optimization of the section typologies (topography higher than initially foreseen), in order to improve the function of preventing the fresh water dispersion and provide substrate for vegetation colonization.
C.3 Reed transplanting	<b>Objectives</b>	Fully achieved	The Operative Protocol of reedbed transplanting was completed. The

	<p>Enhancing the reed rooting of <i>Phragmites</i> in the project area</p> <p><b>Expected results</b> To realize an Operative Protocol of reedbed transplanting. Transplantation of 1000 small clumps of <i>P. australis</i></p>		<p>total number of sods transplanted was 2789, a higher number than the 1000 sods indicated in the Proposal. As a measure to mitigate the effects of the delay in the start of transplants, the number of sods was increased, and the period of field activity was extended.</p>
C.4 Seagrass transplanting	<p><b>Objectives</b> Enhancing the rooting of seagrasses in the project area</p> <p><b>Expected results</b> To realize an Operative Protocol of seagrasses transplanting. Transplantation of 1560 small clumps of <i>Ruppia cirrhosa</i>, <i>Zostera noltei</i>, <i>Z. marina</i></p>	Fully achieved	<p>The Operative Protocol of seagrasses transplanting was completed. The total number of clumps transplanted was 1757, a higher number than the 1560 sods indicated in the Proposal. Transplanting strategies both included the use of small clumps of aquatic angiosperm (size 15 cm approx.) and the spread of single rhizomes. The used technique, an implementation of the one used in Life Seresto, was successful.</p>
C.5 Identifying specific Hunting and fishing rules and better practices for project area	<p><b>Objectives</b> to reduce the hunting and fishing pressures in the project site</p> <p><b>Expected results</b> Implementation of specific hunting and fishing rules to increase the level of protection in the project site</p>	Fully achieved with adjustments	<p>About Hunting, ISPRA sent an official technical advice to Veneto Region, related to the SEA, concerning the WHP; the advice contained management suggestions, such as moving the three existing hunting posts outside the site. The RV accepted the observations and WHP was approved by SEA Commission and Veneto Regional Council. About fishing activities, a quantification of the effective fishing pressure was carried out. It resulted rather low due to low bathymetry that allows navigation only during suitable tidal conditions, even with small boats. Nevertheless RV and ISPRA sent an official technical note concerning the revision of Fishing Plan to Hunting and Fishing Office of Veneto Region related to the SEA, RV rejecting the request.</p>
D.1 Monitoring of the habitat Coastal lagoon	<p><b>Objectives</b> Monitoring the effectiveness of implemented ecological restoration measures.</p> <p><b>Expected results</b> <i>Ante operam</i> (and <i>post operam</i> monitoring to</p>	Fully achieved	<p>The monitoring of salinity was carried out at two different scales: intervention site and Project area for all project duration. All monitoring activities of abiotic and biotic parameters in sediments and waters, as well as BQE, such as macroinvertebrates, macrophytes and fish fauna were completed during the different phases of the project. The timetable changed</p>

	<p>evaluate the impact of the project on abiotic and biotic parameters, conservation status of habitat and species target and in ecological status by 2000/60/EC indicators.</p> <p>Monitoring protocol. Sampling and analyses of abiotic and biotic parameters in sediments and waters macroinvertebrates, macrophytes and fish fauna.</p> <p>Monitoring salinity by probes and CTD campaigns.</p>		<p>several times due to delay to works, stop for pandemic's restrictions and adverse weather conditions. Moreover, new surveys were added during Project without additional costs (Figure 5 in Cap. 6.1). Monitoring methods to analyse the environmental conditions are coherent with national and European protocols. The results are comparable with other monitoring activities (Institutional and other project monitoring activities).</p>
D.2 Monitoring of halophytic habitats and target species	<p><b>Objectives</b> Monitoring the effectiveness of reed restoration and changes in saltmarsh halophytic vegetation</p> <p><b>Expected results</b> <i>Ante operam</i> and <i>post operam</i> vegetation comparisons. Evaluation of reed cover. Monitoring Protocols. 2 ante e post sediment sampling in 4 stations. 2 ante and 2 post operam survey of mapping halophytic vegetation and reed bed. 2 The topo-bathymetric surveys</p>	Fully achieved	<p>All sediment and mapping survey were done. Mapping activity was focused on the saltmarshes located in the project intervention area in ante e post operam by field activities and using satellite and drone images. The post operam surveys indicated some changes in terms of coverage and composition of halophytic species and a significant presence of the reed bed in the lagoon border and in the salt marshes closest to the inlet canal. <i>Post operam</i> monitoring activities have been delayed in order to obtain the most updated monitoring results within the project time frame. Ante e post operam topo-bathymetric surveys were completed</p>
D.3 Monitoring of target bird species	<p><b>Objectives</b> Monitoring the target bird species status and trend after the reedbed development</p> <p><b>Expected results</b> <i>Ante operam</i> and <i>post operam</i> bird species comparisons for task 1 (surveys of passerine</p>	Fully achieved	<p>All monitoring activities were done and focused on intervention area in <i>ante</i> and <i>post operam</i> phases. Additional campaigns for three months were carried out as a follow up of the status "0" given that the hydraulic work was still not completed and functioning. Two additional monitoring activities were also carried out. 1) A bimonthly survey in the period September 2020 – January 2021, to assess the use of</p>

	<p>species), task 2 (census of waterbirds), task 3 (crepuscular surveys for the Eurasian bittern <i>Botaurus stellaris</i>). 12 ante operam surveys for task 1 and 2. 4 survey for task 3. 24 post operam surveys for task 1 and 2. 8 survey for task 3</p>		<p>the morphological structures, realized within Action C.2, 2) Read the bird leg ring. All additional activities were carried out without any changes in budget.</p> <p>At the end of the project, the reeds were not fully developed in the project area in the expected timeframe. Passerines have not increased their presence and range, and waterfowl species related to reeds have not given positive responses either. The <i>Botaurus stellaris</i>* has never been contacted in the entire SCI IT3250031. <i>Microcarbo pygmeus</i>* was always present in the area. Among the target species, <i>Alcedo atthis</i> and <i>Ixobrychus minutus</i> showed some positive signals after the freshwater input. Further activities (without changes in the budget) to assess the use of the morphological structures and reading of the bird leg ring showed that some species, like gulls and scythers, gave important positive responses to freshwater input into the lagoon.</p>
D.4 Ecosystem function assessment	<p><b>Objectives</b> To evaluate the increase of ecosystem services with realization of the project</p> <p><b>Expected results</b> Quantification of ecosystem services considering monitoring results and questionnaires</p>	Fully achieved	<p>All results of Monitoring Actions and Dissemination Actions were considered. In total 113 people from generic public, 25 touristic centres/companies/etc., 7 non-professional fishermen were surveyed. The main ecosystem services concern the increase of fish species of commercial and community interest (provisioning, regulation and maintenance services), due to the restoration of the salt gradient, and site potentiality for ecotourism services (cultural services)</p>
D.5 Socio-economic assessment	<p><b>Objectives</b> To evaluate the socio-economic impact of the project</p> <p><b>Expected results</b> Assessment of the contribution of the project to: the local economy, the supporting of traditional activities. Evaluation of economic value of the ecosystem</p>	Fully achieved	<p>The assessment of socio-economic value of the restoration action was provided. The FTE directly supported by the project was estimated. The economic value of ecosystem services was assessed for the most relevant services provided for the restored habitat, as discussed in D.4 also considering the availability of quantitative data. The value related to the increasing of fish species of commercial interest is assessed both as <i>provisioning</i> and <i>regulation and maintenance services by input/output approach</i>. The value of recreational and educational use of the site (<i>cultural services</i>) was</p>

	services provide by restored habitats.		assessed by data from benefit transfer, for the estimation of the potential number of visit/day and the value of each visit (travel costs and complementary cost).
D.6 KPI	<b>Objectives</b> Monitoring of achievement of project results <b>Expected results</b> KPI webtool updated with project data	Fully achieved	Indicator table was developed and updated as part of Project Report. A first delay in First Progress Report was due to a misunderstanding on the way to deliver the first updates. The final update of KPI is available online at KPI database
E.1 Dissemination to general public	<b>Objectives</b> Dissemination to general public <b>Expected results</b> Project's Logo, Graphical products, brochure, 10 Roll up, Web site, social network, 6 notice boards, three short videos, Project's documentary of 20 minutes and an extract of 5 minutes, 10 newsletters, a mailing list, gadgets, 6 public meeting, 2 seminar for teachers, 2 field visit with students, Layman's report, 5 journalistic reports, 1 course for recognition and amateur monitoring of birdlife basic; 1 course of naturalistic photography	Fully achieved	All activities were done and all products were realized as expected results with small adjustment described below. 8 Roll up instead of 10; 8 long newsletter instead 10 short newsletters. In addition: a flyer initially replaced brochure; more than 50 articles were published on various Italian and several languages newspapers and magazine; 1 short video more than expected; 4 social media channels in total; The general public attention to the project exceeded expectations with 9000 user views on the website, 700 newsletters downloads. The bike path near the intervention area was a strength for the visibility of the project. Two training courses were held successfully. Forty students' labs and five family labs were carried out in collaboration with the Venice Natural History Museum mainly before COVID restrictions (more than 900 students).
E.2 Dissemination technical public and networking	<b>Objectives</b> Dissemination technical public and networking <b>Expected results</b> Start and final conference; 10 participation to meeting and conference; 1 scientific technical publication; 4 university seminar; 3 field visit; networking with project and associations	Fully achieved	Start and final Conferences were done successful. 26 participation to meeting and conference; 3 scientific technical publication; over 100 university students participated to 7 seminars organized by ISPRA and UNIVE; 3 field visit with technician and university students. More than twenty LIFE projects, other five European projects and about twenty associations/public entries were engaged in networking activities.

E.3 Project replication	<p><b>Objectives</b> Enhance Transferability and Replicability of the project</p> <p><b>Expected results</b> Identification of n.6 site where to focus the activities. Contacts with representative of these site and definition of scenarios of replicability of project strategies, methods, actions.</p>	Fully achieved	The methodology applied for Replicability and Transferability (R&T) strategy was successful. The initiative of “ <i>Call for Interest</i> ” and the following activities, in spite the pandemic restrictions, have guarantee a concrete transferability in 6 sites (3 Italian and 3 European states).
F.1 Project management	<p><b>Objectives</b> Ensuring the smooth implementation of the project (administrative, financial and technical issues).</p> <p><b>Expected results</b> Robust project management framework</p>	Fully achieved	Financial audit completed, and financial statement produced. Despite the problems that occurred during the project (exceptional weather conditions in 2019 and COVID pandemic restrictions in 2020/2021), the delivery of all project outcomes was ensured thanks to the strong collaboration between partners.
F.2 After Life Conservation Plan	<p><b>Objectives</b> To guarantee the maintenance and increase of the results obtained from the project beyond the end of the project itself</p> <p><b>Expected results</b> The After LIFE conservation plan</p>	Fully achieved	The After Life Conservation plan was produced in Italian and English language. The following activities are expected to continue: the maintenance of intervention works; the maintenance of the modification of the hunting regulation and the activities to modify and improve the fishing regulation will continue; continuation of monitoring activities; dissemination activities; the transferability and replicability of the actions envisaged by the project.

The project results immediately visible are: the hydraulic and morphologic works (C.1 and C.2), and the consequently restoring of salinity gradient (D.1), the expansion of reedbeds in the lagoon border and in the salt marshes closest to the inlet canal (C.3 and D.2) and changes in terms of coverage and composition of halophytic species, the increasing of fish fauna in intervention site (target and commercial species) (D.1), positive response of some species of waterbirds like gulls and scythers (D.3), the displacement of three hunting posts outside the intervention area (C.5). Results that will only become apparent after a certain time period are: reedbed mapping showed encouraging results but compact populations require at least 5-10 years for their formation. Consequently, the reduction of the degree of eutrophication due to the phytoremediation function of reed beds and the improvement of the status of birds closely linked to reedbeds, is expected in the same time frame.

Policy impacts are reported in Cap 6.4, point 7.



## 6.4. Analysis of benefits

### 1) Environmental benefits

#### a) Direct / quantitative environmental benefits:

##### i. LIFE Nature & Biodiversity

The LIFE Lagoon Refresh project is an example of integration between the Habitat and Bird Directives (HBD) and the implementation of the Water Frame Directive (WFD - 2000/60/EC). The project area falls within the Transitional Water Bodies EC “Palude Maggiore” and PC1 “Dese”, according to the WFD management units, and within the SCI IT3250031 “Laguna Superiore di Venezia”, according to the HBD.

Below we provide an assessment of project delivery against three main project objectives.

#### Objective 1: to improve the degree of Conservations of habitat 1150\* - Coastal Lagoon

Total area improved: 1250 ha of habitat 1150\*, from C/B conservation status to B/A status within SCI IT3250031 due to:

- Restoration of salinity gradient. Salinity gradient restoration was achieved as foreseen: <5 of salinity (5 ha); <15 of salinity (25 ha); <25 of salinity (70 ha)
- Improvement of function of habitat for aquatic fauna. From Poor to Moderate ecological quality status, with more improvement assessed especially in macrophyte and fish fauna assemblages. Macrozoobenthos M-AMBI: from poor to Moderate, Fish fauna HFBI: from Moderate/Good to Good/High
- At the end of the project the mapping activities showed a significant presence of the reed bed in the lagoon border and in the salt marshes closest to the freshwater input, in a lagoon area of about 11 hectares including salt marshes. In particular, it resulted abundant (cover > 75%) in an area of about 1.1 hectares, while clumps in a good state of rooting and areas with less coverage were found in the remaining surface. Compact populations require at least 5-10 years for their formation. Consequently, the reduction of the degree of eutrophication due to the phytoremediation function of reed beds and the improvement of the status of birds closely linked to reedbeds, is expected in the same time frame. On the other hand, the % of Coverage of phanerogams was high. No eutrophic conditions were monitored and oxygen condition resulted better than before interventions in the inner sites more influenced by the new freshwater input.

#### Objective 2: to improve the status of bird species included in annex 1 of Dir. 2009/147/EC, that use the reed environment during the winter period and / or for breeding, foraging or nesting: *Micocarbo pygmeus\**, *Botaurus stellaris\**, *Ardea purpurea*, *Ixobrychus minutus*, *Circus aeruginosus*, *C. cyaneus*, *Alcedo atthis*.

*Botaurus stellaris*: considering the SCI IT3250031, in relation to new available data not foreseen in the proposal, the start value was 2 assessed as the mean value of 2015-2017; the end value was 0 assessed as mean value of 2018-2020. (Data by Baccetti N., Luchetta A., Melega L., Zenatello M. (in press) - Results of the International Waterbird Census in Italy. Distribution, numbers and trends in 2011-2020. ISPRA, Serie Rapporti). The deviation of data given at the beginning of the project is due to an update of data. The no. of specimens in the intervention area (70 ha) was 0 and it is still 0 as reported in the Deliverables of Action D.3.

*Microcarbo pygmeus*: considering the SCI IT3250031, in relation to new available data not foreseen in the proposal, the start value was 931 assessed as the mean value of 2015-2017; the end value was 939 assessed as mean value of 2018-2020. (Data by Baccetti N., Luchetta A., Melega L., Zenatello M. (in press) - Results of the International Waterbird Census in Italy. Distribution, numbers and trends in 2011-2020. ISPRA, Serie Rapporti). The deviation of data given at the beginning of the project is due to an update of data. The no. of specimens in the

intervention area (70 ha) was 372 in 2018, and 195 in 2021, as reported in Action D.3. The intervention area is smaller than the home range of the species. Compact populations of reedbed require at least 5-10 years for their formation and the improvement of the status of birds closely linked to reedbeds is expected in the same time frame. On the other hand, some species like *Larus ridibundus*, *Calidris alpina*, and *Larus melanocephalus* have increased their presence in the intervention area.

Objective 3: to increase the presence of the fish species *Ninnigobius canestrinii*, included in the annex II of Dir. 92/43/EEC, attracted by the presence of low-salinity environments.

Results of the monitoring of fish fauna show an increase of *N. canestrinii* from 0.1 ind/100sqm to 18 ind/100sqm as expected.

b) *Qualitative environmental benefits:*

i. *LIFE Nature & Biodiversity*

All environmental benefits are closely linked to restoration of salinity gradient and the lagoon oligohaline habitats. This target was reached within the project duration time once hydraulic and morphological works were completed and regime water discharge reached (February 2021). The reed transplantation began in late spring 2020, shortly after the introduction of fresh water from the Sile River which took place gradually from May 2020 (initial flow approx. 300 l/s. increased up to 1000 l/s starting from February 2021) and continued until June 2022. Due to the short time between the full discharge of fresh water inlet and the transplants, reedbed mapping showed encouraging results. To have a good distribution of the plants, at least 3-4 years should pass after the transplant so that rhizomes can colonize the areas and emit new shoots. Compact populations require at least 5-10 years for their formation. The trend of conservation status of habitat I150\* is positive thanks to the restoration of salinity gradient and the increase in % of Coverage of phanerogams, presence of sensitive species and aquatic plants of high ecological value and improvement of fish community. The trend of presence of *N. canestrinii* in the intervention area is improving and the abundance of migratory species' juveniles of commercial interest is increasing. As a result, the reeds were not fully developed within the project timeframe. The responses of the target species will occur later in time. Passerines have not increased their presence and range, and waterfowl species related to reeds have not given positive responses either. The Eurasian bittern within its specific activity has never been contacted, as well as in the SCI IT3250031. Pygmy cormorant was constantly present in the intervention area and the trend is increase in SCI IT3250031. Among the numerous species of water birds, some species like gulls and scythers have given important positive responses to freshwater input into the lagoon. Waterbirds have perceived and exploited this first change in the salt gradient for their needs. For the rest of the community, it is necessary that the reedbeds grow and develop.

At the end of the project, the C.1 and C.2 actions will continue thanks to an agreement between RV and OO.PP. subscribed in August 2018, which ensures the maintenance and management of the hydraulic structure during the project and after the end of it. In the Agreement is clarified that, at the end of the project, RV and OO.PP. will use funds from their own Institutional budget. The monitoring activities to survey the ecological status of habitat and species will continue thanks to the activities of RV, ISPRA and UNIVE foreseen for the Venice lagoon within the WFD and thanks to the ISPRA's national monitoring activities of birds. Threats defined in Form B2d of the Grant Agreement (historical deviation of the rivers from the lagoon, loss of reedbeds, progressive increase in euhaline areas and a decrease in oligo- and mesohaline areas in the inner part of the lagoon, eutrophication) are currently reduced in the interventions area. These threats remained in the Venice lagoon also in relation to climate change and the alteration of hydrology.

## 2) *Economic benefits.*

The conservation actions of Life Lagoon Refresh create economic benefits as follows:

- C.2 - the Morphologic work includes the use of modular elements, bags in degradable coconut fibre, anchored to lines of wooden poles, positioned on the shallow lagoon bottom in front of the fresh water input area. The bags must be suitable for the transplanting of reedbeds and the processing methods environmentally friendly in a shallow lagoon, without the use of big and impactful machinery, privileging work by hand. The results are business opportunities for companies with new environmental engineering techniques.
- C.3 - Reedbed transplantation is carried out using small sized clumps harvested in lagoon areas or along freshwater courses and transplanting them on the degradable bags or along the margins of the existing salt marshes. This technique is new for lagoon area and could be a business opportunity for company working with environmental awareness.
- C.4 - Seagrass transplantation consists of transplanting of small clumps of *Ruppia cirrhosa*, *Zostera noltei* and *Z. marina* in the lagoon area. The transplantation techniques took advantage from the experiences gained in the LIFE SERESTO project. This technique is new and it could be a business opportunity for company working with environmental awareness.
- Jobs created is 3.58 FTE calculated as Additional Staff employed in the project. They corresponded to 11 individuals, all employers were qualified staff.

## 3) *Social Benefits.*

The involvement of fishermen and hunters in reed and seagrass transplantation was an important way to increase awareness of environmental conservation amongst stakeholders. The project provided opportunities for people to join field guided visit and courses and therefore benefited from the feeling of well-being. Moreover, the analysis of ecosystem services highlighted the support of the restoration of habitats to the traditional fishing in Northern Venice Lagoon and the use of the intervention site for recreational and educational activities.

## 4) *Replicability, transferability, cooperation.*

The replication of the Life Lagoon Refresh project was high because of the presence of several EU lagoon and estuarine sites with pressures, threats and conservation issues similar to the ones faced by our project: loss of oligo/mesohaline environment; reed regression; eutrophication and need to increase the self-purification functions within estuarine environments; seagrass regression. In fact, fourteen applications responded to the “Call for Interest” organized in the framework of Action E.3. From the applications emerged that Several EU lagoon and estuarine sites need conservation measures for the same target habitat and species of the Life Lagoon Refresh. Some applicants were interested to Conservation actions (reed or seagrass transplantations; hydraulic and morphological works) others to the methods and approaches (e.g. hydrodynamic modelling; hunter and fishermen involvement). A quantitative assessment of replicability, transferability and cooperation of the Project is describe in Cap. 6.1 - Action E.3.

## 5) Best practice measures used within the project are:

- To realize a project of active ecological restoration by using two types of approaches: an approach that consists on restoring the hydrological processes and physico-chemical conditions necessary to a natural Self-improving of ecological structure and functioning, and an approach that consists on a direct intervention on biota with transplanting actions;

- To adopt a multidisciplinary approach using survey and modelling for the final design of hydraulic and morphologic works;
  - To realize hydraulic infrastructure functioning with no mechanical control and exploiting the tidal oscillation to minimize energy consumption and maintenance costs;
  - To involve stakeholders, such as hunters and fishermen, for the activities of transplanting of reedbeds and seagrasses to raise awareness on environmental protection;
  - To use low environmental impact methods during the implementation of conservation actions in the lagoon, favouring manual methods instead of mechanical means;
  - To prefer neighbouring donor sites for reedbeds and seagrass transplanting with few invasive methods;
  - To monitor the impact of the project taking into account the institutional monitoring activities;
  - To create a monitoring network complementary to the institutional already in place in the project area;
  - To disseminate the project through teachers to reach more students than the project could reach.
- 6) Innovation and demonstration value. New technologies: modular elements, bags in degradable coconut fibre, anchored to lines of wooden poles, positioned on the shallow lagoon bottom, suitable for the transplanting of the reedbeds (C.2). New methods: Reedbed transplantation will be carried out using small sized clumps harvested in lagoon areas or along freshwater courses, and transplanting them in the degradable bags and along the margins of the existing salt marshes (C.3). Seagrass transplantation consists of transplanting of small clumps of *Ruppia cirrhosa*, *Zostera noltei* and *Z. marina* in the lagoon area of the Life Lagoon Refresh. The transplantation techniques took advantage from the experience gained in the LIFE SERESTO (C4). Models for stakeholder involvement: Project partners share the project objectives and actions with spokesperson and “influencers” of different stakeholder category (hunters and fishermen); the spokesperson and “influencers” share the information with stakeholder category obtaining in this way a “cascade involvement”. The stakeholders were encouraged to collaborate with the Project. The involvement of fishermen and hunters in reed and seagrass transplantation, after a training course, was an important way to increase awareness of environmental conservation amongst stakeholders.
- 7) At the present, the project targeted three issues concerning the policy implementation:
- a. The development of a preliminary indicator to quantify the Conservation Degree of habitat 1150\* Coastal Lagoons, improving the methodology built within the framework of the Life SERESTO project. The evaluation method includes parameters usually collected by WFD monitoring network, and therefore it could be applied also to existing data since past 10-15 years. Furthermore, structure conservation degree is also assessed through the restoration of the salinity gradient. It will be delivered to the competent N2K Office of Veneto Region, to assess its suitability in all Veneto lagoons. It will also be shared with the National Agencies by SNPA network, in order to publish a specific Guideline for the application of the method. Moreover, it could be exported as a baseline for testing similar approaches at EU-level. The documentation containing the results of the verification and updating of the current habitat cartography for the project site, prepared on the basis of available previous information and monitoring conducted as part of the LIFE Lagoon

Refresh project updated to 2022 will be transmitted to Veneto Region - Organizational Unit of the SEA as requested in SEA authorization phase.

- b. The Veneto Region is using the LIFE Lagoon Refresh as one of the first trials for testing the methodology proposed by Eastern Alps Authority for the ecological flow calculation. In 2015, the WFD Common Implementation Strategy finalized the Guidance Document n.31 “*Ecological flows in the implementation of the Water Framework Directive*”. In Italy this Guidance was implemented by the Italian Environment Ministry Regulation no. 30/STA of the 13<sup>th</sup> of February 2017. The Eastern Alps River Basin Authority adopted this Regulation by no. 2 of the 14<sup>th</sup> of December 2017, defining the methodology for ecological flow calculation at River Basin level that was supposed to be subjected to a trial period. In the framework of the EIA procedure, the above-mentioned methodology was applied for assessing the ecological flow of the Sile River downstream the project cross section.
- c. LIFE Lagoon Refresh has been entered as a measure in the National Climate Change Adaptation Plan 2022.

## 7. Key Project-level Indicators

Text removed with respect to official version sent to CINEA.

## 8. Comments on the financial report

Text removed with respect to official version sent to CINEA.

## TECHNICAL ANNEXES LIST

Annex N	Annex old number	Action	Document Content	Annex file name	DELIVERABLE	MILESTONE	OTHER ANNEX	Report
ANNEX 1	ANNEX I	F.1	KOM minutes and signature sheet	ANNEX I-F.1-KOM minutes and signature sheet		X		IPR
ANNEX 2	ANNEX II	F.1	MBM minutes and signature sheet_11_20_2017	ANNEX II-F.1-MBM minutes and signature sheet_11_20_2017		X		IPR
ANNEX 3	ANNEX III	F.1	MBM minutes and signature sheet_01_19_2018	ANNEX III-F.1-MBM minutes and signature sheet_01_19_2018		X		IPR
ANNEX 4	ANNEX IV	F.1	MBM minutes and signature sheet_04_18-19_2018	ANNEX IV-F.1-MBM minutes and signature sheet_04_18-19_2018		X		IPR
ANNEX 5	ANNEX V	F.1	Appointment letter of project staff	ANNEX V-F.1-Appointment letter of project staff		X		IPR
ANNEX 6	ANNEX VI	F.1	Partnership agreements	ANNEX VI-F.1-Partnership agreements		X		IPR
ANNEX 7	ANNEX VII	A.2	DTM	ANNEX VII-A.2-DTM		X		IPR
ANNEX 8	ANNEX VIII	A.2	Brief description of modelling activity IPROS	ANNEX VIII-A.2-Brief description of modelling activity IPROS		X		IPR
ANNEX 9	ANNEX IX	A.3	Final Design map	ANNEX IX-A.3-Final Design map		X		IPR
ANNEX 10	ANNEX X	A.4	Final Design map	ANNEX X-A.4-Final Design map		X		IPR
ANNEX 11	ANNEX XI	A.5.1	Minute of the stakeholder meeting_10_12_2017	ANNEX XI-A.5.1-Minute of the stakeholder meeting_10_12_2017		X		IPR
ANNEX 12	ANNEX XII	A.5.1	Minutes signature sheets and pictures of stakeholder meeting_11_14_2017	ANNEX XII-A.5.1-Minutes signature sheets and pictures of stakeholder meeting_11_14_2017		X		IPR
ANNEX 13	ANNEX XIII	A.5.1	Minutes signature sheets and pictures of stakeholder meeting_04_16_2018	ANNEX XIII-A.5.1-Minutes signature sheets and pictures of stakeholder meeting_04_16_2018		X		IPR
ANNEX 14	ANNEX XIV	D.1	Monitoring protocol – habitat coastal lagoon	ANNEX XIV-D.1-Monitoring protocol – habitat coastal lagoon	X			IPR
ANNEX 15	ANNEX XV	D.2	Monitoring protocol – intertidal saltmarsh habitats	ANNEX XV-D.2-Monitoring protocol – intertidal saltmarsh habitats	X			IPR
ANNEX 16	ANNEX XVI	D.3	Monitoring protocol – avifauna	ANNEX XVI-D.3-Monitoring protocol – avifauna	X			IPR
ANNEX 17	ANNEX XVII	E.1	Project Logo	ANNEX XVII-E.1-Project Logo	X			IPR

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Annex N	Annex old number	Action	Document Content	Annex file name	DELIVERABLE	MILESTONE	OTHER ANNEX	Report
ANNEX 18	ANNEX XVIII	E.1	Flyer A4 layout	ANNEX XVIII-E.1-Flyer A4 layout	X			IPR
ANNEX 19	ANNEX XIX	E.1	Poster layout	ANNEX XIX-E.1-Poster layout	X			IPR
ANNEX 20	ANNEX XX	E.1	Initial Conference Programme	ANNEX XX-E.1-Initial Conference Programme	X			IPR
ANNEX 21	ANNEX XXI	E.1	Project ppt template	ANNEX XXI-E.1-Project ppt template			X	IPR
ANNEX 22	ANNEX XXII	E.1	Pen layout	ANNEX XXII-E.1-Pen layout	X			IPR
ANNEX 23	ANNEX XXIII	E.1	Block note layout	ANNEX XXIII-E.1-Block note layout	X			IPR
ANNEX 24	ANNEX XXIV	E.1	Folder A4 layout	ANNEX XXIV-E.1-Folder A4 layout	X			IPR
ANNEX 25	ANNEX XXV	E.1	Shopper layout	ANNEX XXV-E.1-Shopper layout	X			IPR
ANNEX 26	ANNEX XXVI	E.1	Roll up layout	ANNEX XXVI-E.1-Roll up layout	X			IPR
ANNEX 27	ANNEX XXVII	E.2.1	Seminar UNIPD_01_16_2018	ANNEX XXVII-E.2.1-Seminar UNIPD_01_16_2018		X		IPR
ANNEX 28	ANNEX XXVIII	E.2.1	Initial Conference	ANNEX XXVIII-E.2.1-Initial Conference		X		IPR
ANNEX 29	ANNEX XXIX	E.2.1	Presentation at LIFE REDUNE Initial Conference	ANNEX XXIX-E.2.1-Presentation at LIFE REDUNE Initial Conference		X		IPR
ANNEX 30	ANNEX XXX	E.2.1	Presentation at LIFE SERESTO Final Conference	ANNEX XXX-E.2.1-Presentation at LIFE SERESTO Final Conference		X		IPR
ANNEX 31		A.1	Folder containing documents related to Agreement between RV and OOPP for management during and after life	ANNEX 31 - A.1-Agreement RV-OOPP management during after	X			MTR
ANNEX 32		A.1	Folder containing all authorizations (EIA procedure - favourable environmental compatibility)	ANNEX 32 - A.1 - All Authorizations (EIA)		X		MTR
ANNEX 33		A.1	Intention for free transfer of land by Drago Jesolo	ANNEX 33 - A.1 - Free transfer of land Drago Jesolo_05_2019			X	MTR
ANNEX 34		A.2.1	Lagoon Refresh Gis	ANNEX 34 - A.2.1_Lagoon_Refresh_Gis	X			MTR

## TECHNICAL ANNEXES LIST

Annex N	Annex old number	Action	Document Content	Annex file name	DELIVERABLE	MILESTONE	OTHER ANNEX	Report
ANNEX 35		A.3	Folder containing detailed design documents for hydraulic works	ANNEX 35 - A.3 - Hydraulic works - Detailed design documents	X	X		MTR
ANNEX 36		A.4	Folder containing detailed design documents for morphological works	ANNEX 36 - A.4 - Morphological works - Detailed design documents	X	X		MTR
ANNEX 37		A.5.1	Folder containing minutes, signature sheets and pictures of stakeholder meeting of 19 <sup>th</sup> April 2018	ANNEX 37 - A.5.1 - Stakeholder meeting_04_19_2018		X		MTR
ANNEX 38		A.5.2	Guideline for reedbed and seagrass transplantations	ANNEX 38 - A.5.2 - Guideline for reedbed and seagrass transplantations	X			MTR
ANNEX 39		A.5.2	Training course for reedbed and seagrass transplantation activities (program, signature sheets, presentations)	ANNEX 39 - A.5.2 - Training course reedbed seagrass transplantation		X		MTR
ANNEX 40		C.3	Protocol for reedbed transplantation	ANNEX 40 - C.3 - Protocol for reedbed transplantation	X			MTR
ANNEX 41		C.4	Protocol for aquatic angiosperm transplantation	ANNEX 41 - C.4 - Protocol for aquatic angiosperm transplantation	X			MTR
ANNEX 42		C.5	ISPRA observations to Wildlife Hunting Plan of the Veneto Region within SEA procedure	ANNEX 42 – C.5 - ISPRA observations to WH Plan RV - SEA procedure			X	MTR
ANNEX 43		C.5	Veneto Region (B.U.R. 092_2019) acceptance of ISPRA observations within SEA of WHP	ANNEX 43 - C.5 - RV - B.U.R. 092_2019_acceptance ISPRA observations			X	MTR
ANNEX 44		C.5	Meeting for project presentation to Regional Advisory Committee on Professional Fisheries and Aquaculture - 07_04_2019	ANNEX 44 - C.5 -Meeting_RACPFA - 07_04_2019			X	MTR
ANNEX 45		D.1	Monitoring report - ante operam – habitat coastal lagoon. Results of monitoring activities before interventions.	ANNEX 45 - D.1 – Monitoring report - ante operam – habitat coastal lagoon	X			MTR
ANNEX 46		D.2	Monitoring report - ante operam - halophytic habitats	ANNEX 46 - D.2 - Monitoring report - ante operam - halophytic habitats and target species	X			MTR
ANNEX 47		D.3	Monitoring report - ante operam - target bird species	ANNEX 47 - D.3 - Monitoring report - ante operam - target bird species	X			MTR
ANNEX 48		D.3	Monitoring protocol – target bird species - new release	ANNEX 48 - D.3- Monitoring protocol – target bird species – new release	X			MTR
ANNEX 49		D.6	KPI update – Sept2019.	ANNEX 49 - D.6 – KPI update – Sept2019	X			MTR



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Annex N	Annex old number	Action	Document Content	Annex file name	DELIVERABLE	MILESTONE	OTHER ANNEX	Report
<b>ANNEX 50</b>		E.1	Public Presentations (Word Ocean Day, Quarto d'Altino, ScienzaInsieme in Chioggia)	ANNEX 50 – E.1 - Public Presentations			X	MTR
<b>ANNEX 51</b>		E.1	Press release	ANNEX 51 – E.1 - Press release			X	MTR
<b>ANNEX 52</b>		E.1	Newsletters (N1 03_2019)	ANNEX 52 – E.1 – Newsletter 1 -03_2019			X	MTR
<b>ANNEX 53</b>		E.1	Meeting of 22 <sup>nd</sup> May 2019 with stakeholders for updates on possible forms of birds protection – signature sheet and photos	ANNEX 53 – E.1 – Stakeholder meeting - updates birds protection – 05_22_2019			X	MTR
<b>ANNEX 54</b>		E.1	Registration procedure – advertising of the course for recognition and amateur monitoring of bird life	ANNEX 54 – E.1 - Registration procedure course monitoring of bird life		X		MTR
<b>ANNEX 55</b>		E.1	EDU DAY, event for teachers of primary and secondary schools - 09_2019	ANNEX 55 – E.1 – EDU Day – teachers			X	MTR
<b>ANNEX 56</b>		E.1	Notice boards	ANNEX 56 - E.1 – Notice boards	X			MTR
<b>ANNEX 57</b>		E.2.1	Seminar UNIVE_03_04_2019	ANNEX 57 – E.2.1 - Seminar UNIVE_03_04_2019			X	MTR
<b>ANNEX 58</b>		E.2.1	List of conferences, workshop, seminars where the project was presented	ANNEX 58 – E.2.1 – Dissemination events			X	MTR
<b>ANNEX 59</b>		E.2.1	Scientific publications (Reticula 2018, Water 2019)	ANNEX 59 - Scientific publications			X	MTR
<b>ANNEX 60</b>		E.2.2	Definition and updated list of networking	ANNEX 60 – E.2.2 - Networking		X	X	MTR
<b>ANNEX 61</b>		A.2	Final Report of modelling results supporting actions A.3, A.4, C.1, C.2: five different numerical models were set up and used. The lagoon models were used for the preparation of the executive projects, for the realization of the works (actions C.1 and action C.2), for the management of the works once operating, for the support of monitoring activities and for the study of specific events. The Sile models were used in the drafting of the EIA to support the environmental monitoring program and for the management of the works once operating.	ANNEX_61_A_2-Modelling_results_FR	X			FR
<b>ANNEX 62</b>		A.5.2	Training course for reedbed and seagrass transplantation activities	ANNEX_62_A_5_2-Reedbed_seagrass_transplantation_course		X		FR

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Annex N	Annex old number	Action	Document Content	Annex file name	DELIVERABLE	MILESTONE	OTHER ANNEX	Report
ANNEX 63		C.1.1	Certificate of completion of hydraulic work: the document certifies the works commissioned by the Veneto Region and regularly carried out by SOMIT as required by the contract.	ANNEX_63_C_1-Hydraulic_work_CRE_16_11_2020	X			FR
ANNEX 64		C.1.1	Completion of hydraulic work	ANNEX_64_C_1_1-Hydraulic_work_completion		X		FR
ANNEX 65		C.1.2	Final regulation of freshwater discharge	ANNEX_65_C_1_2-Freshwater_discharge_final_regulation		X		FR
ANNEX 66		C.2	Certificate of regular execution of morphological works: the document certifies the works commissioned by the OOPP and regularly carried out by Rossi Costruzioni as required by the contract.	ANNEX_66_C_2-Morphologic_work_CRE_12_2021	X			FR
ANNEX 67		C.2	Certificate of completion of morphological works	ANNEX_67_C_2-Certificate_completion_05_2021		X		FR
ANNEX 68		C.3	Reedbed transplanting activities report (III year) with map and description sites: the deliverable refers to the transplantation activity carried out in the first year of transplanting (2020) in which 550 sods of <i>Phragmites australis</i> were transplanted	ANNEX_68_C_3_3-Reedbed_IR_III_year	X			FR
ANNEX 69		C.3	Reedbed transplantation activities final report: the deliverable refers to the transplantation activity carried out in the period 2020-2022 in which 2789 sods of <i>Phragmites australis</i> were transplanted	ANNEX_69_C_3_4-Reedbed_FR	X			FR
ANNEX 70		C.3	Start of transplanting activities	ANNEX_70_C_3-Reedbed_transplanting_activities_start		X		FR
ANNEX 71		C.3	End of transplanting activities	ANNEX_71_C_3-Reedbed_transplanting_activities_end		X		FR
ANNEX 72		C.4	Seagrass transplanting activities report (I year) with map and description sites: the deliverable refers to the transplantation activity carried out in the first year of transplanting (2020) of <i>Zostera marina</i> , <i>Z.noltei</i> in which 328 clumps and 550 of were transplanted	ANNEX_72_C_4_2-Seagrass_IR	X			FR

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Annex N	Annex old number	Action	Document Content	Annex file name	DELIVERABLE	MILESTONE	OTHER ANNEX	Report
ANNEX 73		C.4	Seagrass transplanting activities final report with map and description sites: the deliverable refers to the transplantation activity carried out within the project. In the period 2020-2022. 311 clumps of <i>Zostera marina</i> , 908 of <i>Z.noltei</i> and 538 of <i>Ruppia cirrhosa</i> were transplanted.	ANNEX_73_C_4_3-Seagrass_FR	X			FR
ANNEX 74		C.4	Start of transplanting activities	ANNEX_74_C_4-Seagrass_transplanting_activities_start		X		FR
ANNEX 75		C.4	End of transplanting activities	ANNEX_75_C_4-Seagrass_transplanting_activities_end		X		FR
ANNEX 76		C.5	Report of Hunting and Fishing regulation: the deliverable refers to all activities and meeting carried out with hunters and fishermen stakeholder to review the hunting and fishing regulations	ANNEX_76_C_5-Deliverable	X			FR
ANNEX 77		C.5	Provision regulating hunting and fishing	ANNEX_77_C_5-SEA_request_approved		X		FR
ANNEX 78		D.1	Intermediate report – habitat coastal lagoon: preliminary results of monitoring activities of the period 2019-2020	ANNEX_78_D_1-Habitat_coastal_lagoon_IR	X			FR
ANNEX 79		D.1	Final report – habitat coastal lagoon: results of all monitoring activities.	ANNEX_79_D_1-Habitat_coastal_lagoon_FR	X			FR
ANNEX 79 addendum		D.1	Final report – habitat coastal lagoon: results of all monitoring activities including those obtained after the drafting of the Deliverable dated August 2022.	ANNEX_79_Addendum_D_1-Habitat_coastal_lagoon_FR	X			FR
ANNEX 80		D.1	End of monitoring activities D.1	ANNEX_80_D_1-Habitat_coastal_lagoon_monitoring_end		X		FR
ANNEX 81		D.2	Intermediate report – halophytic habitat: the report contains part of the results relating to the <i>post operam</i> monitoring activities of halophytic vegetation (survey in 12/21), reedbed (survey in 07/21) and chemical-physical parameters of sediment (survey in October 2021).	ANNEX_81_D_2_3-Halophytic_habitat_IR	X			FR
ANNEX 82		D.2	Final report – halophytic habitat: the report contains the results ( <i>ante operam, post operam</i> ) of all monitoring activities: halophytic vegetation and reedbed mapping,	ANNEX_82_D_2_4-Halophytic_habitat_FR	X			FR

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Annex N	Annex old number	Action	Document Content	Annex file name	DELIVERABLE	MILESTONE	OTHER ANNEX	Report
			chemical-physical parameters of sediment and topobathymetric surveys					
ANNEX 83		D.2	End of monitoring Action D.2	ANNEX_83_D_2-Halophytic_habitat_monitoring_end		X		FR
ANNEX 84		D.3	Action D.3 first year monitoring report: the report contains part of the results relating to the monitoring activities of bird community present in the project area, carried out during the period 01/20 - 05/21. Additional monitoring activities, not foreseen in the Project Proposal, were also carried out.	ANNEX_84_D_3_3-Target_bird_species_IR	X			FR
ANNEX 85		D.3	Final report – target bird species: the report contains the results ( <i>ante operam, post operam</i> ) of all monitoring activities: passerine surveys, waterbird census, specific surveys for <i>Botaurus stellaris</i> , additional monitoring activities not foreseen in the Project proposal	ANNEX_85_D_3_4-Target_bird_species_FR	X			FR
ANNEX 86		D.3	End of monitoring activities on field	ANNEX_86_D_3-Birds_field_monitoring_activities_end		X		FR
ANNEX 87		D.4	Estimation of ecosystem services final report: the deliverable describes the activities carried out in order to evaluate the services provided by the target ecosystems of the LIFE Lagoon Refresh and their variation, as a result of the restoration actions carried out within the project.	ANNEX_87_D_4-Ecosystem_services_FR	X			FR
ANNEX 88		D.4	End of stakeholders consultation	ANNEX_88-D_4-Stakeholders_consultation_end		X		FR
ANNEX 89		D.5	Final report on the estimate of the economic impact of the project: the deliverable describes the socio-economic assessments related to social impact of the project, the contribution in terms of relaunching the traditional small scale fishery activity in the lagoon and the economic value of the main ecosystem services identified in Action D.4.	ANNEX_89_D_5-Socio_economic_evaluation_FR	X			FR
ANNEX 90		D.5	End of stakeholders consultation	ANNEX_90_D_5-Stakeholders_consultation_end		X		FR

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Annex N	Annex old number	Action	Document Content	Annex file name	DELIVERABLE	MILESTONE	OTHER ANNEX	Report
<b>ANNEX 91</b>		E.1	Brochure A5 layout: a project presentation brochure	ANNEX_91_E_1-Brochure	X			FR
<b>ANNEX 92</b>		E.1	Notice boards: 4 notice boards installed in the cycle path adjacent to the Project Area, 2 with general information on the project (objectives, conservation actions, expected results) and 2 with insights on the typical habitats and fauna of the project area	ANNEX_92_E_1-Notice_boards	X			FR
<b>ANNEX 93</b>		E.1	Project video (20' duration and 5' Extract): a video that summarizes the project in 5-minutes and a 20-minute video project documentary that reports the shoots and interviews of the entire project history	ANNEX_93_E_1-Project_video	X			FR
<b>ANNEX 94</b>		E.1	Layman's report A5 layout: a bilingual (IT and ENG) report for a "non-expert" audience and allows to know the project's objectives, actions and results in just a very few pages	ANNEX_94_E_1-Layman's_report	X			FR
<b>ANNEX 95</b>		E.1	"Photo hunt" course organization	ANNEX_95_E_1- Photo_hunt_course_organization		X		FR
<b>ANNEX 96</b>		E.2.1	Scientific publication: 1. LIFE Lagoon Refresh as a case study for evaluating the restoration of the salinity gradient in transitional waters; 2. LIFE Lagoon Refresh as a case study for the implementation of the multidisciplinary approach for restoration ecology in transitional waters	ANNEX_96_E_2_1-Scientific_publication	X			FR
<b>ANNEX 97</b>		E.2.1	First visit intervention sites organization	ANNEX_97_E_2_1- First_visit_intervention_sites_organization		X		FR
<b>ANNEX 98</b>		E.2.1	Final Conference organization	ANNEX_98_E_2_1- Final_conference_organization		X		FR
<b>ANNEX 99</b>		E.2.2	Networking final evaluation	ANNEX_99_E_2_2- Networking_final_evaluation		X		FR
<b>ANNEX 100</b>		E.3	Selection of sites for replicability and transferability of the LIFE Lagoon Refresh project: the document describes the activities undertaken to identify sites for the replicability of project actions. A list and a brief description of the	ANNEX_100_E_3_1-R&T_sites_selection	X			FR

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Annex N	Annex old number	Action	Document Content	Annex file name	DELIVERABLE	MILESTONE	OTHER ANNEX	Report
			selected sites are also provided, as well as documents provided during selection.					
<b>ANNEX 101</b>		E.3	Replicability of Project's actions. Descriptions and simulations of intervention scenarios at selected sites: final report of Action E.3 with a description, for each selected site, and further information gathered during meetings and surveys in situ, a proposal of scenarios when possible, and/or a list of lacking data or preliminary actions needed to develop future proposals.	ANNEX_101_E_3_2-R&T_selected sites_intervention_scenarios	X			FR
<b>ANNEX 102</b>		E.3	Start of final selection of 6 sites for replicability and transferability	ANNEX_102_E_3-Call_for_Interest_R&T_selection_Start		X		FR
<b>ANNEX 103</b>		E.3	Start of visits in LIFE Lagoon Refresh area and selected sites	ANNEX_103_E_3-Sites_visits		X		FR
<b>ANNEX 104</b>		E.3	Start of development of scenarios at selected sites to replicate LIFE Lagoon Refresh actions	ANNEX_104_E_3-Scenarios'_developments		X		FR
<b>ANNEX 105</b>		F.1	Audit Report: the document includes an independent report on factual findings on costs declared under the grant agreement	ANNEX_105_F_1-Audit_Report	X			FR
<b>ANNEX 106</b>		F.2	After LIFE Conservation Plan: the document describes the activities planned after the end of the project functional maintenance and increase the results achieved.	ANNEX_106_F_2-After_LIFE_Conservation_Plan	X			FR
<b>ANNEX 107</b>		F.2	Start of preparation of the After LIFE Conservation Plan	ANNEX_107_F_2-After_LIFE_Conservation_Plan_start		X		FR
<b>ANNEX 108</b>		D.6	Annex to II Progress Report: Uploaded online on KPI database	ANNEX_108_D_6-KPI_values_30_04_2021	X			FR
<b>ANNEX 109</b>		C.5	RV-ISPRA Note Fishing Plan	OTHER_ANNEX_109_C_5-RV_ISPRA_NoteFishingPlan			X	FR
<b>ANNEX 110</b>		C.5	DGR_881_2022 RV	OTHER_ANNEX_110_C_5-RV_request_rejecting			X	FR
<b>ANNEX 111</b>		D.4	Database benefit transfer	OTHER_ANNEX_111_D_4-Database_benefit_transfer			X	FR

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Annex N	Annex old number	Action	Document Content	Annex file name	DELIVERABLE	MILESTONE	OTHER ANNEX	Report
ANNEX 112		E.1	Project video list	OTHER_ANNEX_112_E_1-Project_video_list			X	FR
ANNEX 113		E.1	Newsletter n.2-8	OTHER_ANNEX_113_E_1-Newsletter_n.2-8			X	FR
ANNEX 114		E.1	Press release	OTHER_ANNEX_114_E_1-Press_release			X	FR
ANNEX 115		E.1	News release n.2-3	OTHER_ANNEX_115_E_1-News_release			X	FR
ANNEX 116		E.1	Public presentation	OTHER_ANNEX_116_E_1-Public_presentation			X	FR
ANNEX 117		E.1	School activities	OTHER_ANNEX_117_E_1-School_activities			X	FR
ANNEX 118		E.1	Distribution dissemination materials	OTHER_ANNEX_118_E_1-Distribution_dissemination_materials			X	FR
ANNEX 119		E.1	LIFE Lagoon Refresh and...art	OTHER_ANNEX_119_E_1-LIFE_Lagoon_Refresh_art			X	FR
ANNEX 120		E.2.1	University seminars	OTHER_ANNEX_120_E_2_1-University_seminars			X	FR
ANNEX 121		E.2.1	Specialistic public events	OTHER_ANNEX_121_E_2_1-Specialistic_public_events			X	FR
ANNEX 122		E.3	Sacca of Scardovari implementation scenario	OTHER_ANNEX_122_E_3-Sacca_of_Scardovari_scenario			X	FR

IPR = I° Progress Report

IR = Intermediate Report

R&T = Replicability and Trasferibility

MTR = Mid Term Report

CRE = Certificate Regular Execution

RV = Veneto Region

FR = Final Report