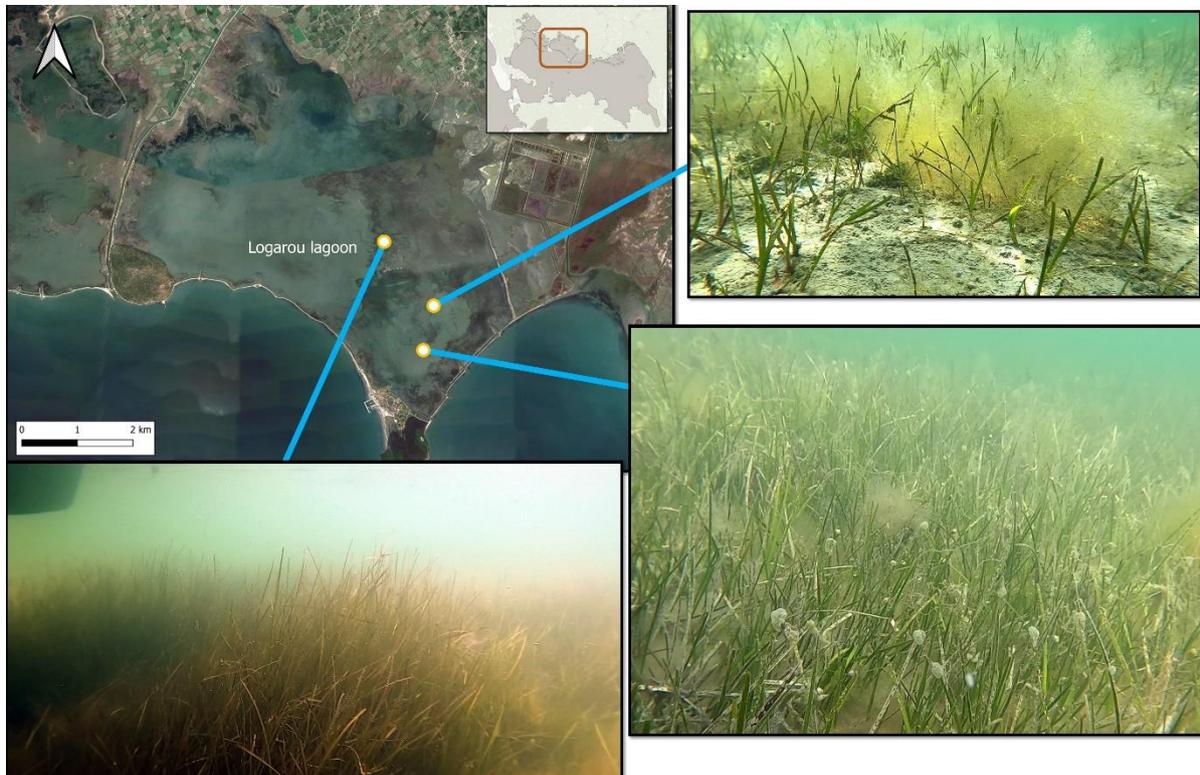


## A.4 Executive Project of sod extraction for transplantation of submerged aquatic angiosperms

### Sub-action A4.4 Executive Project for Amvrakikos



Beneficiary responsible for implementation: HCMR

Responsibilities in case several beneficiaries are implicated: HCMR, ALMA

Athens, 28/09/2021

Status: Final



SEAGRASS TRANSPLANTATION FOR TRANSITIONAL ECOSYSTEM RECOVERY

**LIFE19NAT/IT/000264 LIFE-TRANSFER**

## **Seagrass transplantation for transitional Ecosystem Recovery**





**LIFE19NAT/IT/000264 LIFE-TRANSFER**  
**Seagrass transplantation for transitional Ecosystem Recovery**

**Executive Project for Amvrakikos**

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**Seagrass transplantation for transitional Ecosystem Recovery**

## EXECUTIVE SUMMARY

**Where?** - Both the donor and recipient sites are located within the Amvrakikos lagoon complex a Natura2000 site classified under the Habitats and Birds Directive (GR2110001, GR2110004). Mazoma lagoon has been identified as a suitable donor site, whilst Logarou lagoon is the intended site for habitat restoration activities to be implemented.

**What?** - The action for the Amvrakikos lagoon is oriented around the collection and transplantation of *Zostera noltei* into the Logarou lagoon.

**How?** - *Zostera noltei* will be transplanted by means of 15 cm-diameter sods using a specially designed stainless steel corer. Extraction and transplantation will be done onboard small vessels, by trained local operatives (subaction Action A5.2) and supervised by the technical staff of HCMR. Extracted sods from Maszoma lagoon placed in perforated pots, maintained in storage boxes and covered with water until transplantation, which will occur in under 24hrs. At the transplant site (Logarou lagoon) the same design used for extraction will be utilized and sods will be placed into sediments according to the proposed sampling design. At each site of 10 x 10m, 9 sods will be transplanted into clusters of 3, spaced 1m from each other. The distance from three groups of sods will be approximately 5m. Sites will be appropriately marked to enable future monitoring.

Monitoring of the transplantation sites will include the estimation of sod survival and seagrass angiosperm growth. Several biotic indices (for macrophytes and macrobenthos) will be calculated, and the observations of several physico-chemical variables (including total ammonium, oxidized nitrogen, dissolved inorganic phosphorus, dissolved silicates, Suspended solids (TSS), transparency, temperature, dissolved oxygen, pH, salinity, depth, Chlorophyll-a and phaeopigments of the water column and: total/inorganic/organic carbon, total nitrogen, total/inorganic/organic phosphorus, and the percentage of fine fraction <63µm of the sediments). Monitoring of at least four stations will occur once a year for four years until the end of the project. In the case of partial decay of a transplant site, sods will be replaced with newly extracted sods.

**When?** – The optimal season for *Zostera noltei* transplants is late spring and autumn, which is the natural growth period of *Z. noltei*. Therefore, with an exception of the first year (2021) where only one transplantation in October is foreseen, transplantation campaigns will be executed twice a year (October and April-May) until the end of the project (2025) in order to have the greatest chance of success. The number of transplantation sites will be scaled up each year once assessments of sod survival are made per region to ensure an effective deployment strategy of extracted sods.

## Where?

### Intervention sites

The donor and recipient sites are located within the Amvrakikos lagoon complex a Natura 2000 site classified under the Habitats Directive (GR2110001).

### Donor site

Mazoma lagoon is a small lagoon with a surface area of approximately 3 km<sup>2</sup>. The bottom is mostly muddy, and the eastern part of the lagoon, which is influenced by the marine environment, it is covered by the angiosperm *Zostera noltei* mixed with the green alga *Chaetomorpha* sp. During the Sub-action A2.3 (Ex-ante Monitoring in Amvrakikos Lagoons, Logarou Lagoon) Mazoma lagoon was identified as a suitable donor site as throughout the lagoon meadows of *Z. noltei* were mapped in abundance, making it likely that local populations of *Z. noltei* will only be minimally damaged during the harvesting of sods. The use of 15cm diameter cores will ensure that in total only a maximum surface area of 8.27 m<sup>2</sup> will be harvested (approx. 0.13 % of the current *Z. noltei* meadow in Mazoma lagoon). The distance from the donor site to the recipient site is 50km (by road), meaning that the harvesting and the transplantation will occur on the same day via road transportation.



Figure 1. Mazoma lagoon, identified donor site for *Zostera noltei* transplantation.

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Transplant area

The recipient area is Logarou lagoon, part of a SPA site within the (GR2110004) where a total area of 1000 m<sup>2</sup> will be transplanted during the course of the whole project. Logarou is characterized by a high level of biological diversity and productivity. In addition, it is also subject to an intense confinement gradient due to the limited communication with the sea in the inner part. Due to its size (2750 km<sup>2</sup>) and shallowness (mean depth 1 m), the lagoon is sensitive to abrupt environmental changes. Prolonged periods of droughts, weak surface winds, or frost conditions can deteriorate the ecosystem's oxygen concentration and productivity. Logarou lagoon is part of the Water Framework Directive monitoring network for Greece. In the first cycle of WFD implementation in transitional waters in Greece, Logarou was classified as being of a "Good" ecological status. However, in 2019, Logarou was classified as being of a "Moderate" ecological status, meaning the restoration actions proposed in the LIFE-TRANSFER project are of crucial importance for this ecologically valuable ecosystem as the extent of seagrass meadows have declined in Logarou lagoon over the last decades

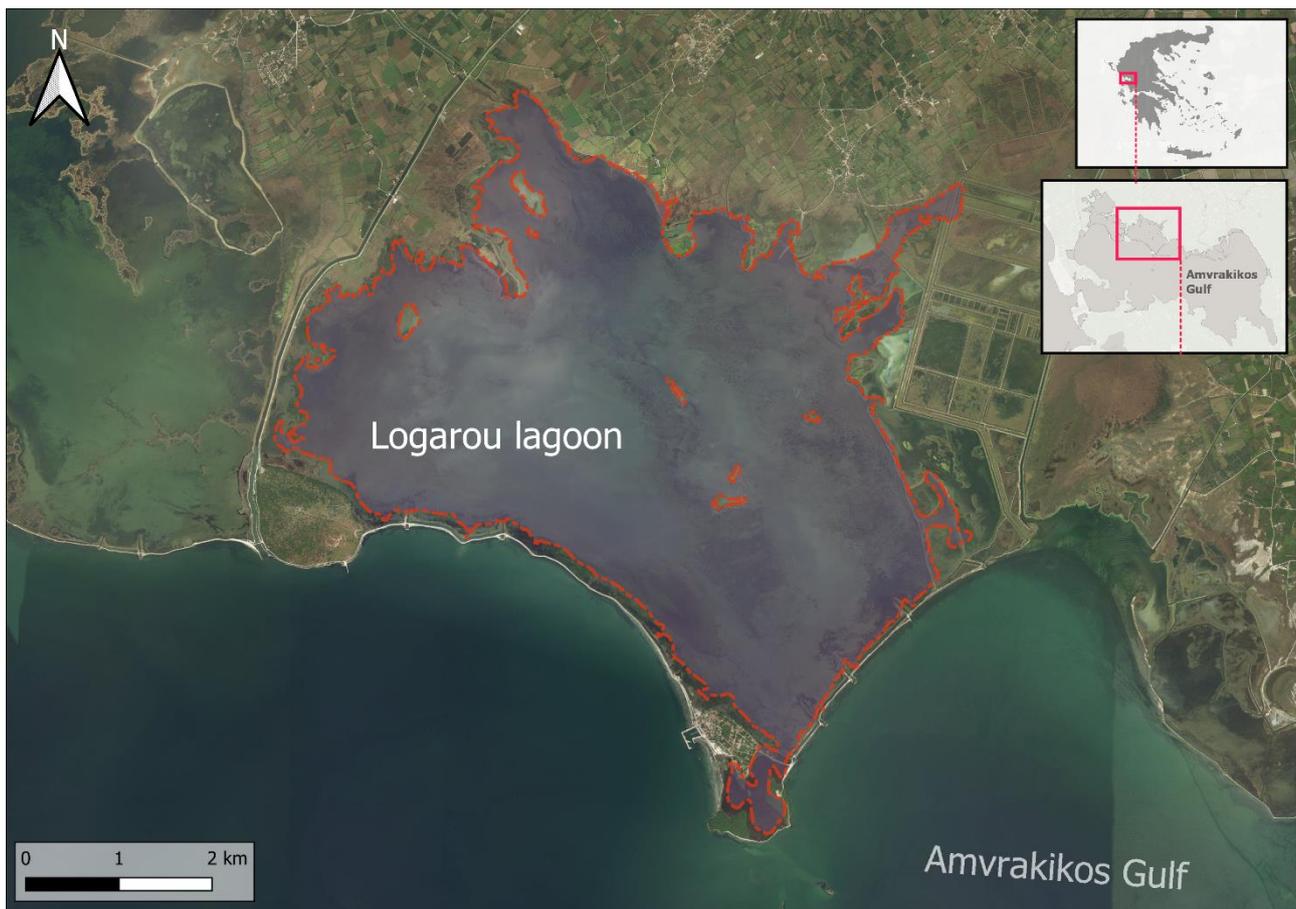


Figure 2. Logarou lagoon, the transplantation lagoon for the Ambrakikos lagoon complex

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## What?

### Target seagrass species

The seagrass that will be used is *Zostera noltei*, a typical species of both the donor and the transplant lagoons, and foreseen as a target seagrass species by the project.

Table 1. Seagrass properties for Amvrakikos transplantation species

Lagoon	Foreseen by Application form	Species	Best time for transplant (season)	Best time for transplant range (°C)	Salinity range (‰)	Sediments texture	Water transparency
Logarou	<i>Zostera noltei</i>	<i>Zostera noltei</i>	Late spring and autumn	26–28	>27	Fine sediments	High (>1m)

## How?

### Sod extraction

Extraction and transplantation of sods require the use of a hand-held corer, which local fishermen will operate from small and flat boats. The size and design of the stainless-steel corers have been modified to fit the requirements for the Amvrakikos target species (*Z. noltei*). The corer has a diameter of 15 cm to enable the extraction of a relatively small sod corresponding to the root system size of *Z. noltei*. The height of the corer (30cm) allows the effortless collection of the first 15-20 cm layer of sediment/rhizomes of the selected species (Figure 3). During extraction, seagrass shoots and leaves of the extracted sods will be checked and carefully inserted vertically inside the corer so that they are not cut, to ensure that sod vitality is maintained. Once the sod is extracted, it will be inserted in an appropriately sized pot, with a pre-cut hole to allow direct water renewal with lagoonal waters, whilst maintaining the physical structure of the extracted sod. Individual sods will be immersed inside a storage box, maintained at a cool temperature, and kept out of direct sunlight. Transportation of the sods to the transplantation site will happen on the same day (i.e., in under 24 hours). The minimum number of personnel needed for each extraction campaign is two local operators (fishermen), trained under sub-action A5.4 and supervised by the technical staff of HCMR.

### Sod transplantation

For each transplant site, nine (9) small sods of 15 cm in diameter (collected on the same day from the donor site) will be transplanted into a site area of 100 m<sup>2</sup> (10m x 10 m) (Figure 3). The same corer used for sod extraction will be used to excavate the required hole for sod implementation (Figure 3). In the same manner

### Seagrass transplantation for transitional Ecosystem Recovery

as sod extraction, transplantation operations will be carried out via boat. Taking care to reduce the level of sediment disturbance, sods will be placed into excavated holes in accordance with the sampling design indicated in Figure 3. The triangular design (three sods separated by 1 m and arranged into three groups separated by 5 m) was vigorously tested during the LIFE SeResto (LIFE12 NAT/IT/000331), and results from the project indicate that this surface area size encourages an extension of the rhizomes to increase the rooting capacity of the sods, especially for *Z. noltei*. The sites will be suitably marked with poles to enable accurate re-location and habitat monitoring of the sites.

Although dependant on the success of the transplantation sites identified by the baseline survey conducted under Sub-action A2.3 (Ex-ante Monitoring in Amvrakikos Lagoons, Logarou Lagoon), the five main restoration areas to prioritise transplantation are displayed below (Sites A-E; Figure 4). During the Ex-Ante monitoring sparse seagrass were recorded in all sites which in total cover a region of 4.5 km<sup>2</sup> (Site A = 0.35 km<sup>2</sup>, Site B = 0.35 km<sup>2</sup>, Site C = 0.81 km<sup>2</sup>, Site D = 0.81 km<sup>2</sup>, Site E = 2.18 km<sup>2</sup>). The transplantation sites (10 x 10 m) where the sods will be planted, will be distributed throughout the five main prioritised restoration areas and by the end of the project will cover a surface area of over 6400m<sup>2</sup> (>64 sites).

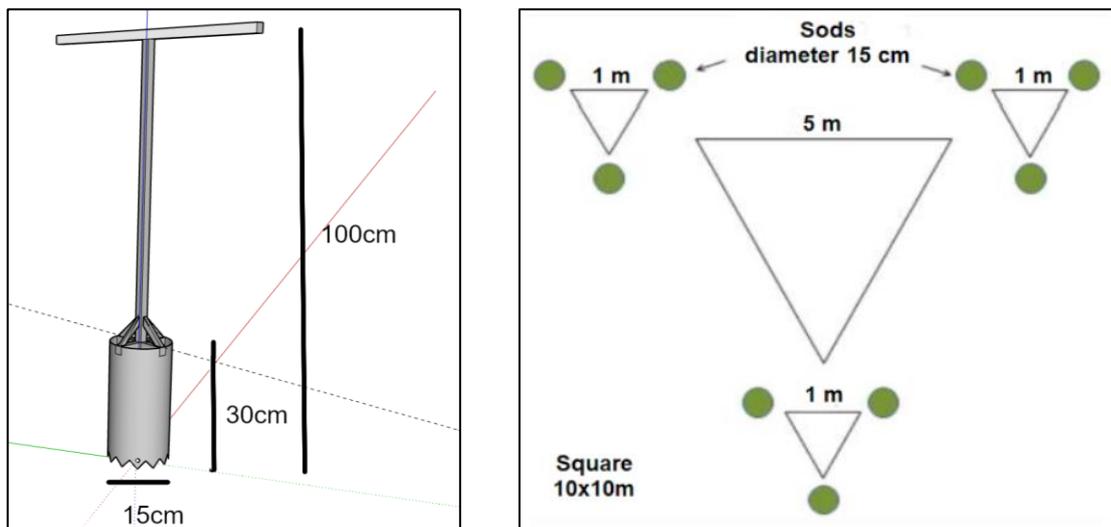


Figure 3. Design of stainless steel corer used to extract and transplant sods, and sampling design of the sod transplantation site (10 x 10m).

## Seagrass transplantation for transitional Ecosystem Recovery

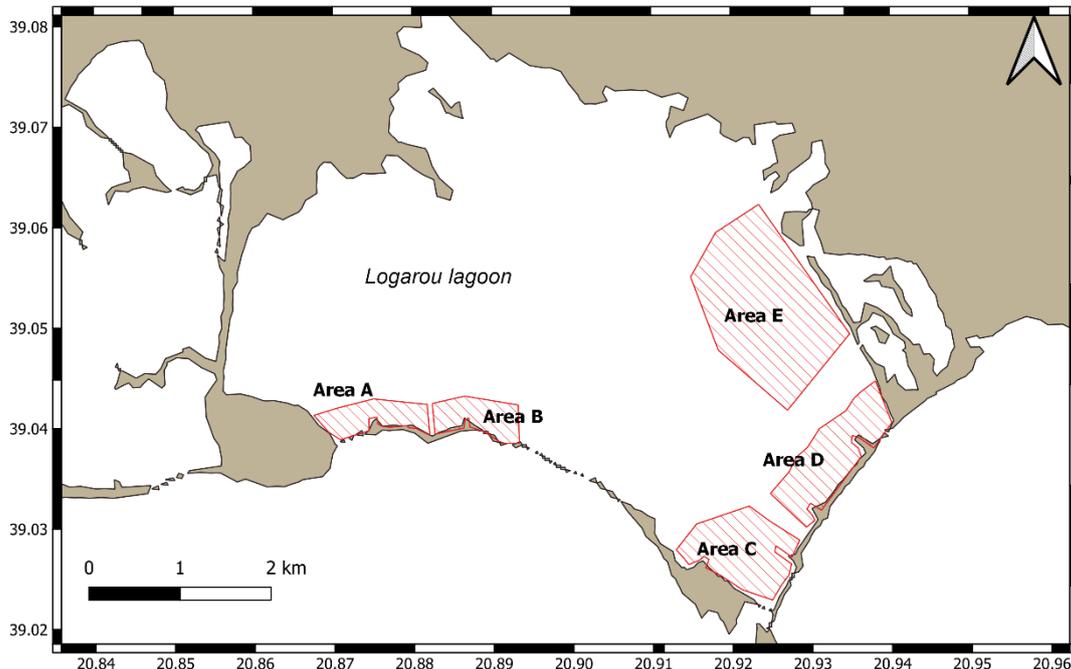


Figure 4. The five main Restorations Areas (Area A-E) of Logarou lagoon, where transplant stations will be located.

### Seagrass meadows and sod transplant monitoring

Monitoring is necessary for quantifying the results in terms of success/failure of sod transplants and verifying the possible need for corrective interventions (i.e., transplantation of new sods). As is the aim of the restoration action, it is expected that following successful transplantation, a natural dispersion of the seeds produced by the transplanted sods will occur in the following. The seeds that will take root increase the habitat extent of seagrass meadows and operate as source populations for natural seed dispersion and meadow repopulation. The progress of the restoration actions (i.e., transplantation trials) will be measured yearly based on the following set of metrics: the survival rate of sods (i.e., % of survived sods), and seagrass growth (i.e., diameter of surviving sods, diameter of patches formed by surviving sods). Each restoration area (Areas A-E) will be mapped via acoustic techniques (i.e., side-scan sonar) at the beginning and end of the project, and transplant sites (10 x 10 m) will be mapped with high-resolution geo-referenced images to monitor changes in habitat extent. Each restoration area (Areas A-E) will be mapped via side-scan at the beginning and end of the project, and transplant sites (10 x 10m) will be mapped with high resolution geo-referenced images to monitor changes in habitat extent.

Monitoring will take place once a year in 4 stations for four years and the following ecological indices will be calculated:

**LIFE19NAT/IT/000264 LIFE-TRANSFER**  
**Seagrass transplantation for transitional Ecosystem Recovery**

- The Seagrass Quality Index (SQI) (following Neto et al. 2013) and ZoNI (ecological quality index based on the seagrass *Z. noltei*, following Garcia-Marin et al. 2013)
- The BITS, M-AMBI and BENTIX indices (macrobenthos) (following Mistri & Munari (2008) ; Muxika et al. (2007); Simboura and Zenetos (2002)).

In addition, the following physic/chemical parameters/variables will also be analysed:

**Water column:** Nutrients: total ammonium (N-NH<sub>4</sub><sup>+</sup>); oxidized nitrogen (N-NO<sub>2</sub><sup>-</sup>, N-NO<sub>3</sub><sup>-</sup>); dissolved inorganic phosphorus (SRP); dissolved silicates (SiO<sub>4</sub><sup>--</sup>); Suspended solids (TSS); Dissolved oxygen (DO); Chlorophyll-a and phaeopigments, Water transparency (Tr); Temperature (T); pH; Salinity (S); depth (D).

**Sediments:** Total, inorganic and organic carbon (TC, IC, OC); - total nitrogen (TN); total, inorganic and organic phosphorus (TP, IP, OP); percentage of fine fraction <63µm (fines).

## When?

The optimal season for *Z. noltei* transplants is late spring and autumn, which is the natural growth period of this species and an unfavourable period for the growth of opportunistic macroalgae (mainly Ulvaceae, Cladophoraceae, Gracilariaceae, Solieriaceae). Therefore, except for the first year (2021) where only one transplantation trial in October is foreseen, transplantation campaigns will be executed twice a year (October and April-May) up until the end of the project in 2025 in order to have the greatest chance of success.

The number of transplantation sites will be scaled up each year once assessments of sod survival are made per region to ensure an effective deployment strategy of extracted sods. The predicted minimum number of sites (each contains 9 sods) per transplantation campaign is described below in Table 1. The location of the sites within the restoration areas will be defined by Sub-action D4 (Monitoring of C4 action).

Table 2. Transplantation schedule for the number of sites defined per year and per season.

Year	Minimum number of sites (minimum number of individual sods)		
	Late Spring	Autumn	Total
2021	-	4(36)	4(36)
2022	6(54)	6(54)	12(104)
2023	8(72)	8(72)	16(144)
2024	8(72)	8(72)	16(144)
2025	8(72)	8(72)	16(144)
		<b>Total</b>	<b>64(576)</b>



## **LIFE19NAT/IT/000264 LIFE-TRANSFER** **Seagrass transplantation for transitional Ecosystem Recovery**

### Permits

The restoration planning in Amvrakikos engaged and involved the various key actors in the area. The operations are covered under the definition of conservation actions defined within the management plan of the National Park Authority, Amvrakikos Gulf - Lefkada Management Agency (ALMA), which already signed the support form A8 (attached below). Moreover, ALMA participates in Life-Transfer as a full partner (form A4 attached below). In February 2020, The Ministry of Environment & Energy signed the support form A8 permitting the restoration actions within the lagoons of Amvrakikos (attached below). The Fisheries Association of Logarou, the recipient site, have also signed support form A8. The environmental acceptability of the proposed restoration solutions are framed within the European environmental legislation and policy ambitions within the EU Green Deal. The project follows the sampling standards, indicators and monitoring plans for ecosystem health developed and implemented in WFD, setting the scene for the ecosystem-based management of EU seas and lagoons.

**LIFE19NAT/IT/000264 LIFE-TRANSFER**  
**Seagrass transplantation for transitional Ecosystem Recovery**

**LIFE19 NAT/IT/000264 - A4**

LIFE19 NAT/ - A4

**ASSOCIATED BENEFICIARY DECLARATION and MANDATE**

I, the undersigned, Konstantinos Koutsikopoulos, representing, Amvrakikos gulf - Lefkada Management Agency (Φορέας Διαχείρισης Αμβρακικού κόλπου-Λευκάδας) ALMA, Public body, Law 3044/2002 (Greek Government Gazett 197'A), Municipal Office Aneza, Aneza - Arta, 47150, Greece, VAT number 999585606, hereinafter referred to as "the associated beneficiary", for the purposes of the signature and the implementation of the grant agreement Seagrass transplantation for transitional Ecosystem Recovery with the Contracting Authority (hereinafter referred to as "the grant agreement") hereby:

1. Mandate Università degli Studi di Ferrara (UNIFE), Public body, regio decreto 2102 del 30/09/1923, via Ariosto 35, Ferrara, 44121, Italy, VAT number 00434690384, represented by Giorgio Zauli..... (hereinafter referred to as "the coordinating beneficiary") to sign in my name and on my behalf the grant agreement and its possible subsequent amendments with the Contracting Authority.
2. Mandate the coordinating beneficiary to act on behalf of the associated beneficiary in compliance with the grant agreement.

I hereby confirm that the associated beneficiary accepts all terms and conditions of the grant agreement and, in particular, all provisions affecting the coordinating beneficiary and the associated beneficiaries. In particular, I acknowledge that, by virtue of this mandate, the coordinating beneficiary alone is entitled to receive funds from the Contracting Authority and distribute the amounts corresponding to the associated beneficiary's participation in the action.

I hereby accept that the associated beneficiary will do everything in its power to help the coordinating beneficiary fulfil its obligations under the grant agreement, and in particular, to provide to the coordinating beneficiary, on its request, whatever documents or information may be required.

I hereby declare that the associated beneficiary agrees that the provisions of the grant agreement, including this mandate, shall take precedence over any other agreement between the associated beneficiary and the coordinating beneficiary which may have an effect on the implementation of the grant agreement.

I furthermore certify that:

1. The associated beneficiary has not been served with bankruptcy orders, nor has it received a formal summons from creditors. My organisation is not in any of the situations listed in Articles 136(1), 136(4) and 141 of the EU Financial Regulation [Regulation (EU, Euratom) 2018/1046 of the European Parliament and of the Council of 18 July 2018 on the financial rules applicable to the general budget of the Union, amending Regulations (EU) No 1296/2013, (EU) No 1301/2013, (EU) No 1303/2013, (EU) No 1304/2013, (EU) No 1309/2013, (EU) No 1316/2013, (EU) No 223/2014, (EU) No 283/2014, and Decision No 541/2014/EU and repealing Regulation (EU, Euratom) No 966/2012, OJ L 193, 30.7.2018, p. 1].
2. The associated beneficiary will contribute to the project in line with the amounts detailed in Form FC. My organisation will participate in the implementation of the project as detailed in this proposal.
3. The associated beneficiary will conclude with the coordinating beneficiary an agreement necessary for the completion of the work, provided this does not infringe on our obligations, as stated in the grant agreement with the Contracting Authority. This agreement will be based on the model proposed by the Contracting Authority. It will describe clearly the tasks to be performed by my organisation and define the financial arrangements.

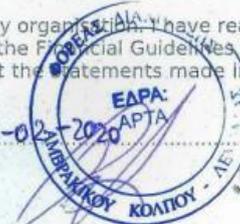
4. I commit to comply with all relevant eligibility criteria, as defined in the LIFE Multiannual Work Programme 2018-2020 and the LIFE Call for Proposals including the LIFE Guidelines for Applicants.

This declaration and mandate shall be annexed to the grant agreement and shall form an integral part thereof.

I am legally authorised to sign this statement on behalf of my organisation. I have read in full the Model LIFE Grant Agreement with Special and General Conditions and the Financial Guidelines (provided with the LIFE application files). I certify to the best of my knowledge that the statements made in this proposal are true and the information provided is correct.

At Aneza, Arta - Greece on 05-02-2020

Signature of the Associated Beneficiary:  
Konstantinos Koutsikopoulos  
Status/function of signatory:



**LIFE19NAT/IT/000264 LIFE-TRANSFER**  
**Seagrass transplantation for transitional Ecosystem Recovery**

LIFE Nature & Biodiversity 2019 - A8

**DECLARATION OF SUPPORT FROM THE COMPETENT AUTHORITY**

**Optional:** in addition to the support of the necessary competent authorities as described in the guidelines for applicants, this form may also be used to indicate any other support to the project by important stakeholder bodies, administrative bodies or individuals that may be concerned by the project.

**Name and legal status:** Ministry of Environment and Energy, Public Body

**Full address:** Villa Kazouli, Kifisias Avenue 241, Kifisia 14561, Attiki

**Tel:** 0030-2105241903 **Fax:** 0030-2106447608 **Email:** [g.protopapas@prv.ypeka.gr](mailto:g.protopapas@prv.ypeka.gr)

**Contact person (name and function):** Mr Georgios Protopapas, NCP for LIFE

Please specify whether, why and how you will support this project:

The Hellenic Ministry of Environment and Energy supports the project proposal entitled "Seagrass transplantation for transitional Ecosystem Recovery" LIFE TRANSFER (LIFE19 NAT/IT/000264). The project targets a crucial environmental problem for the priority habitat 1150, the coastal lagoons, which is the drastic regression of seagrasses due to multiple anthropogenic stressors and unfavourable hydrological conditions. The project further contributes to the implementation of the EU Water Framework Directive.

The study area in Greece is located in the Amvrakikos wetland, in Western Greece, The project is fully supported by the Management Body of Amvrakikos Wetlands and the local fishermen cooperation. The coordinating beneficiary of the project proposal is the University of Ferrara, Italy and the associated beneficiaries are the University of Murcia, Spain; the Hellenic Centre for Marine Research, Greece; the University Ca Foscari Venice, Italy; the Region of Murcia, Spain; the Ente di Gestione per i Parchi e la Biodiversità-Delta del Po, Italy; and Istituto Delta Ecologia Applicata, Italy.

The Hellenic Ministry of Environment and Energy will support the project and will assist facilitating the issue of licenses wherever required. The Ministry will ensure the uptake of the projects' outcomes and will use the knowledge and best practices produced.

Signature and date:

Name and status of signatory:

03/02/2020

ΑΡΑΒΟΣΗΣ ΚΩΝΣΤΑΝΤΙΝΟΣ

**LIFE19NAT/IT/000264 LIFE-TRANSFER**  
**Seagrass transplantation for transitional Ecosystem Recovery**

**LIFE18 NAT/IT/000791 - A8**

**DECLARATION OF SUPPORT FROM THE COMPETENT AUTHORITY**

**Optional:** in addition to the support of the necessary competent authorities as described in the guidelines for applicants, this form may also be used to indicate any other support to the project by important stakeholder bodies, administrative bodies or individuals that may be concerned by the project.

Name and legal status:

Amvrakikos gulf – Lefkadas Management Body, is a non-profit organization of the Public Sector, supervised by the Ministry of Environment & Energy. It is responsible for managing the Natura2000 sites: GR2210001 and GR2110004 of the Amvrakikos Wetlands National Park, which was founded on March 21, 2008 by the Joint Ministerial Decision 11989/2008 (Official Government Gazette 123/D/21-03-2008).

Full address:

Municipal Office of Aneza (1<sup>st</sup> floor), Aneza – Arta, Greece, Postal Code 47150

Tel: 00302681071919

Fax: 00302681042855

Email: [fdyamvra@otenet.gr](mailto:fdyamvra@otenet.gr) & [foreas\\_amvrakikou@yahoo.gr](mailto:foreas_amvrakikou@yahoo.gr)

Contact person (name and function):

Dimitrios Barelos, Director

Please specify whether, why and how you will support this project:

Amvrakikos gulf – Lefkadas Management Body confirms full support to the project LIFE 18 NAT/IT/000791 objectives since are in line with the conservation policies and contribute to the improvement of lagoons conservation status.

Specifically, Amvrakikos gulf – Lefkadas Management Body is about to support this project according to the following topics:

- Will participate to the sampling procedures by using its own boat and staff. The staff has a great knowledge of the whole wetland/lagoon areas and the boat is specialized for such purposes.
- Will provide technical and specialist support to the other partners of the proposal considering the environmental impact of the anthropogenic activities.
- Will communicate and inform the stakeholders (fishermen of the lagoons) about the whole project and its benefits for the wetlands.

At Arta - Greece

on 10<sup>th</sup> January, 2019

Signature of the Competent Authority: .....

Name and status of signatory:

Prof. Konstantinos Koutsikopoulos,  
President of Amvrakikos gulf – Lefkadas Management Body

