

**Work Package 1**

Work Package 1: Project Management			
Duration:	M1 - M84	Lead Beneficiary:	UAveiro
Objectives and results			
<ul style="list-style-type: none"> <li>▪ Efficiently coordinate and manage all technical aspects (e.g., deadlines, objectives, financial aspects)</li> <li>▪ Facilitate and manage communication flow and information exchange between the consortium partners</li> <li>▪ Keep deadlines and ensure optimal implementation and reporting, within the allocated budget.</li> <li>▪ Provide data management plan (FAIR principles, resources allocation, data security, ethical aspects)</li> <li>▪ Develop an After-LIFE Conservation Plan to assure action continuity after project end</li> <li>▪ Compilation and analyses of key performance indicators (KPI)</li> </ul> <p><i>Expected results encompass the efficient management and coordination of the scientific and financial project activities, meetings and reports.</i></p>			
Activities and division of work (WP description)			
<p><b>T.1.1 Management and Cross WP Coordination</b> (Lead <b>UAveiro</b>, All):</p> <p>This task involves the development and implementation of the Project Management Plan (PMP). This will be an operational document that will outline the main steps and procedures to ensure and improve the quality of the project outputs. The management structure consists of the <b>Project Office</b> that includes the project coordinator, the project manager and administrative staff; the <b>General Assembly</b> that includes the project coordinator and all partners in the consortium, including the affiliated partners; and the external <b>Practitioners and Stakeholders Advisory Board (PSAB)</b> that gathers established practitioners and recognised experts from across Europe that will provide advice and consultation to <b>LIFE SeagrassRIAwild</b> on key questions ensuring relevance and accuracy of the project's</p>			

results. The PMP will be discussed with members of the consortium at the first management meeting (kick-off meeting) and will include the final list of the five PSAB members. The core of PSAB will be based on four already engaged associated partners (CIRA, APA, ICNF and SDU). Input to D1.1

### **T.1.2 Data Management Plan (Lead UAveiro, All):**

This task involves a data curation team (All WP leaders) and the development and implementation of the Data Management Plan (DMP). This will be an operational document that will outline the main steps and procedures to ensure FAIR data (making data findable, including provisions for metadata, openly accessible, interoperable and increase data re-use, through clarifying licenses), data security and ethical aspects (supported by The Ethics and Deontology Committee from the University of Aveiro that gathers academic and non-academic members). This document will detail the data management life cycle for the data to be collected, processed and/or generated, detailing which methodology and standards will be applied, the handling of research data during and after the end of the project, and how data will be curated and preserved (including after the end of the project). The DMP is a living document and will be updated at the end of the project to reflect the actual research data generated and include updated instructions for how to access open data. Input to D1.2

### **T.1.3 After-LIFE Conservation Plan (Lead UAveiro, All)**

An After-LIFE Conservation Plan will be drawn up at the end of the project in order to plan how the actions will continue after the project, both technically and financially. This plan will provide the policy and steps for the continuation of the project's main activities, their maintenance, monitoring, and evaluation in the long term in close collaboration with the identified end-user groups and communities. It will also contain opportunities for identifying and avenues for further development of project innovations. The Implementation of the Sustainability Plan, as part of the project legacy, will be supported with the outputs from WP2 (Seagrass Mariculture) and through engagement and environmental education actions (WP2 and WP7). Input to D1.3

### **T.1.4 Compilation and analysis of key performance indicators (KPI) (Lead UAveiro, All)**

reporting of (estimated and actually achieved) key-performance indicators (KPIs) in the LIFE KPI web tool within the first 9 months from grant signature and at the end of the project. Input to D1.2 and D1.5

### **Milestones and deliverables (outputs/outcomes)**

Milestone No	Milestone Name	WP No	Lead Beneficiary	Description	Due Date	Means of Verification
MS1		1				

(LIFE SAP and OAG):

MS2		1					
Deliverable No	Deliverable Name	WP No	Lead Beneficiary	Type	Dissemination Level	Due Date	Description (including format and language)
D1.1	Project Management Plan	1	UAveiro	R	PU	3	Project Management Plan, Electronic format, English
D1.2	Initial KPI indicators	1	UAveiro	DATA	PU	9	First report on Key Performance Indicators, Electronic format, English
D1.3	Data Management Plan	1	UAveiro	DMP	PU	81	Data Management Plan, Electronic format, English
D1.4	After-LIFE Conservation Plan	1	UAveiro	R	PU	84	Sustainability plan, Electronic format, English
D1.5	Final KPI indicators	1	UAveiro	DATA	PU	84	Final report on Key Performance Indicators, Electronic format, English

## Work Package 2

Work Package 2: Ria de Aveiro Stakeholders Forum			
Duration:	M1 - M84	Lead Beneficiary:	UAveiro
Objectives and results			

- Develop a Stakeholder Forum
- Mobilize and engage local and regional stakeholders
- Co-develop strategies and solutions for restoration
- Mobilize and train volunteers

*It is expected that stakeholders are mobilized, and restoration solutions co-developed to account for the needs and expectations of end-users. Volunteer engagement and training will develop a shared responsibility attitude and result in a sustained available work force for restoration activities.*

#### Activities and division of work (WP description)

##### **T.2.1 Stakeholder Forum (UAveiro, CIRA, APA, ICNF):**

An informal thematic, open network, firstly driven by members of the PSAB, will be established that lives on after the project implementation period to include members outside the consortium in a community of practice (CoP) philosophy. It will be made up of relevant practitioners and decision makers, and will fundamentally be a capacity building mechanism. A facilitator for the community will be identified, a participatory stakeholder mapping exercise conducted, and activities, processes and legacy plan developed. A space for collaboration, e.g., LinkedIn social media group will be setup and data collection plan will be agreed upon. Input to D2.1

##### **T.2.2 Solution Co-design (UAveiro, CIRA, APA, ICNF):**

The Stakeholder Forum will gain insight into current practices and challenges in the application of restoration actions demonstrated at different scales. It identifies the potential demands of restoration implementers and relevant authorities in terms of requirements, limitations, application (dimensions and areas considered with relevant conditions) and attributes (application criteria and expected societal benefits), in a solution co-design process. This takes the form of: (i) surveys (for the main types of private and public users and implementors of restoration actions) and (ii) the (co-)organisation and facilitation of workshops to present Restoration plans and their likely benefits (through e.g., collaborative choice of metrics of success), which help building an effective upscaling strategy while contributing to identifying adaptations in suggested strategies to account for implementation conditions. Input to D2.2

##### **T.2.3 Engagement (UAveiro, CIRA, APA, ICNF, Ocean Alive):**

Through awareness actions emanating from the stakeholder forum meetings and members, **LIFE SeagrassRIAwild** will strive to engage Ria de Aveiro end-users and citizens in the developed restoration program. Volunteers will undergo training before participating in any activities, and will be asked to provide feedback at the end of each action, to improve this iterative process. Volunteers will be invited to learn and share experiences with “Guardians of the Ria” network (link to T7.1) and to disseminate the knowledge and information acquired in the training and restoration actions, to expand the volunteer database. Input to D2.3

(LIFE SAP and OAG):

Milestones and deliverables (outputs/outcomes)							
Milestone No	Milestone Name	WP	Lead Beneficiary	Description		Due Date	Means of Verification
MS1	Stakeholder Forum	2	UAveiro	Stakeholder forum is formed and running		3	Report
Deliverable No	Deliverable Name	WP	Lead Beneficiary	Type	Dissemination Level	Due Date	Description (including format and language)
D2.1	Stakeholder Forum member directory	2	UAveiro	R	PU	84	A directory of members of the Ria de Aveiro Stakeholder Forum, Electronic format, English
D2.2	Report on restoration solutions and priorities co-development	2	UAveiro	R	PU	18	Report on the iterative process of restoration solution co-design, Electronic format, English
D2.3	Report on volunteer feedback	2	UAveiro	R	PU	84	Compilation of feedback provided by volunteers regarding participation in training and restoration activities, Electronic format, English

**Work Package 3**

Work Package 3: Mariculture Development			
Duration:	M1 - M36	Lead Beneficiary:	UAveiro
Objectives and results			
<ul style="list-style-type: none"> <li>▪ Develop the mariculture infrastructure</li> <li>▪ Characterize the <i>Z. marina</i> potential donor meadows</li> <li>▪ Harvest donor meadows and colonize the mariculture infrastructure</li> <li>▪ Monitor and expand the mariculture population</li> </ul> <p><i>Expected results encompass the construction of the mariculture infrastructure, the characterization and choice of donor populations and the onset of mariculture colonization and monitoring. Expected colonized area by end of project is 8 Ha.</i></p>			
Activities and division of work (WP description)			
<p><b>T.3.1 Infrastructure (UAveiro):</b></p> <p>This task will consist of the repair and repurpose of a UAveiro owned salt pan (40°37'16.42"N, 8°40'33.18"W) to a <i>Z. marina</i> mariculture. All engineering interventions will follow traditional salt pan building methods. Retention walls will consist of dried sediment extracted from the salt pan floor. These will be colonised by autochthonous marsh plants for wall structural support, grown in hydroponic life support systems in ECOMARE UAveiro facility. Water circulation will be promoted inside the tanks through a combination of pumps, pipes and sluices which will also allow for water height regulation according to the <i>Z. marina</i> species-specificities. Conditions within the mariculture will be monitored continuously through a real time remote multiparametric station which will transmit data wirelessly to a workstation at UAveiro.</p>			

The available area (26 Ha) will be divided into 6 independent tanks (4-5 Ha), to allow isolation between plants from distinct sources and support an incremental colonization process. Input to MS2.

### **T.3.2 Characterization of donor meadows and colonization (UAveiro, UVigo, Ocean Alive, GEOMAR, ICNF):**

This task will encompass the initial characterization of the potential donor meadows from the North (Vigo, ES) and south (Óbidos lagoon and Sado Estuary, PT). Seagrass area and % coverage will be assessed through aerial photography using UAV, shoot density and biomass through the collection of replicate cores. Plant biomass in the cores will encompass further characterization, namely the associated microbiome composition through DNA sequencing of Prokaryote and Eukaryote communities to screen for potential plant infections and plant genetic diversity. Using a suite of custom made neutral and adaptive genetic markers, potential donor meadows will be genotyped to assess clonal diversity and adaptive genetic diversity among populations. *In situ* characterization of the photosynthetic activity and performance in *Z. marina* leaves will be performed through measurements of the maximum quantum yield of PSII (Fv/Fm) and rapid light-response curves (RLC) using a Pulse Amplitude Modulation (PAM) fluorometer (Junior-PAM, Walz), as a rapid and non-invasive method for assessing the well-being of the donor populations. The choice of the most suitable donor meadows (and system) will rely on this initial evaluation (D3.1), and will determine harvest permits in Portugal (MS2) by the competent authority (associated partner ICNF). In case no viable donor meadow from adult plants is identified South from the Ria de Aveiro, the contingency plan will be to collect seeds in the healthiest system and proceed with the mariculture colonization through this method only. Also, this initial characterization will provide a baseline for temporal monitoring of the mariculture and actual restoration sites over the full project time. Upon donor selection, plants will be harvested and transported to the mariculture maintaining the in-situ temperature and water conditions to minimize the transplant risks. In each donor site, 10 m<sup>2</sup> (10 x 1m<sup>2</sup> patches, separated to minimize the donor meadow disturbance) will be harvested, corresponding to approximately 50000 shoots per donor site. Mariculture colonization will occur through planting individual shoots with a density of  $\pm 5$  shoots per m<sup>2</sup>, following the validated and successful methods of the associated partner (SDU), for which team members not yet familiar with these techniques will be trained at SDU. Different patterns of transplantation will be tested/implemented to maximize survival and growth, namely grouped and evenly dispersed transplants. Input to MS3, MS4, D3.1.

### **T.3.3 Monitoring and expansion (UAveiro, UVigo, Ocean Alive, GEOMAR):**

Standard Monitoring protocols (D3.2) will be developed to homogenize and systematize procedures as part of the regular Mariculture operational conditions, and will define the set of parameters to evaluate, the frequency and corrective measures for deviations from normal conditions. The success of transplanted mariculture populations will be monitored through the same approach as initial characterization (detailed in T3.2). Mariculture populations will be compared with the baseline information (D3.1) of corresponding donor sites, distinct mariculture populations will be compared with each other and with native meadows of the Ria de Aveiro to evaluate their adaptation to local conditions and assure successful (Link to T3.2). Donor meadows will be monitored every three months for two years to assure the recovery of harvested areas in terms of coverage, shoot density and biomass. Mariculture population expansion will occur both passively, through vegetative growth and seed dispersal within each tank, and actively, through yearly self-feeding transplantation measures from the mariculture populations.

### **Milestones and deliverables (outputs/outcomes)**

(LIFE SAP and OAG):

Milestone No	Milestone Name	WP No	Lead Beneficiary	Description		Due Date	Means of Verification
MS2	Infrastructure	3	UAveiro	The mariculture facility is ready for colonization		18	Photographic record
MS3	Harvest licensing	3	UAveiro	Harvest permits granted by ICNF based on D3.1.		16	License
MS4	Mariculture colonization	3	UAveiro	The initial colonization of the mariculture infrastructure is finalized		21	Photographic record
Deliverable No	Deliverable Name	WP No	Lead Beneficiary	Type	Dissemination Level	Due Date	Description (including format and language)
D3.1	characterization of donor meadows	3	UAveiro	R	PU	16	Report on the initial characterization of potential donor meadows, Electronic format, English
D3.2	Infrastructure	3	UAveiro	DEM	PU	18	Mariculture finalized;
D3.3	Standard Monitoring protocol (SMP)	3	UAveiro	R	PU	24	Protocols for mariculture monitoring, Electronic format, English

*Work Package 4***Work Package 4: Nursery optimization**



<b>Duration:</b>	M31 - M60	<b>Lead Beneficiary:</b>	UAveiro
<b>Objectives and results</b>			
<ul style="list-style-type: none"> <li>▪ To optimize processes of seed harvest, maturation and storage</li> <li>▪ To maximize germination success, quantify the level of genetic change and of inadvertent selection on “domesticated” <i>Z. marina</i></li> <li>▪ To develop standard operational procedures for seagrass nursery</li> </ul> <p><i>We expect to develop optimized standard operational procedures for nursery processes (seed harvest, maturation, storage and germination), and assess the effect of domestication on the genetic pool of mariculture populations.</i></p>			
<b>Activities and division of work (WP description)</b>			
<p><b>T.4.1 Seed harvest, maturation and storage (UAveiro, GEOMAR):</b></p> <p>This task will develop and optimize standard operational procedures (SOP) for the harvest, maturation and storage of eelgrass seeds collected in the mariculture. Seagrass seed harvest methods will be tested and optimized (manual and mechanical collection, from a floating platform or snorkelling through the meadow to avoid stamping, various water depths). Mature flowering shoots and seed maturation (e.g water salinity and temperature, water circulation and aeration) and storage (e.g. temperature, salinity, desiccation, the need for sterilisation or use of antibacterial agents) conditions will be optimized at ECOMARE UAveiro facility (wherein a nursery infrastructure with flowthrough water circulation will be built), building up on the team expertise and the state-of-the-art methodologies. Distinct solutions for these steps, taking into account donor plants and site-specificities will be evaluated, and their effect on seed germination and viability assessed through laboratory/mesocosms experiments, to maximize the viable annual seed crop of the mariculture. Input to D4.1</p> <p><b>T.4.2 Germination and genetic selection (GEOMAR, UAveiro):</b></p> <p>This task will develop and optimize standard operational procedures (SOP) for the germination of seeds collected in the mariculture. Variables such as water temperature, salinity, oxygen, light availability, seed burial depth, seed density will be optimized in for the maximization of germination success. Moreover, and based on baseline data collected under WP2, non-destructive subsamples will be taken over time (yearly) to examine the genotype composition of nursery individuals. Data will be analysed for genetic diversity change over time and signs of selection; recommendations will be made as to how to best set up a nursery to maintain and maximize the adaptive genetic variation, in order to maximize transplant success. Input to D4.1 and D4.2.</p>			

(LIFE SAP and OAG):

Milestones and deliverables (outputs/outcomes)							
Milestone No	Milestone Name	WP No	Lead Beneficiary	Description		Due Date	Means of Verification
MS5	SOP optimization finalized	4	UAveiro	Standard Operational Procedures for nursery processes are available		42	Report
MS6	Temporal Monitoring Nursery	4	GEOMAR	Data from nursery monitoring available		60	dataset
Deliverable No	Deliverable Name	WP No	Lead Beneficiary	Type	Dissemination Level	Due Date	Description (including format and language)
D4.1	Nursery SOP	4	UAveiro	R	PU	42	A Report on Standard Operational Procedures for nursery processes, Electronic format, English
D4.2	Nursery Genetic Monitoring	4	GEOMAR	R	PU	60	Report on best practices in seagrass nurseries from a genetic viewpoint, Electronic format, English

### Work Package 5

Work Package 5: System-wide ecosystem restoration			
Duration:	M25 - M84	Lead Beneficiary:	HAEDS

## Objectives and results

- Develop numerical model simulations to support restoration activities and maximize success.
- Develop a system-wide Citizen Science seagrass rewilding program
- Deploy a Nature-Based Solution (NbS) based on seagrass green infrastructures for channel navigability

*Expected results of WP5 encompass potential transplant area maps for transplantation, social engagement by local populations and successful implementation of restoration efforts, both in classic restoration actions and NbS deployment, with a total restored area aim of 4 Ha.*

## Activities and division of work (WP description)

### **T.5.1 Hydrodynamic modelling (HAEDES, UAveiro):**

This task will be a pre-operational step towards field restoration efforts, aiming to optimize conditions and minimize risks of failure, using the numerical model Delft3D. In support of T.5.2, modelling will be used to develop a map of potential restoration areas, based on a series of objective risk evaluation criteria (Currents, water depth, turbidity). Potential locations will be ranked according to the model results, with restoration efforts prioritized in sites with the highest success probability. In support of T.5.3, hydrodynamic and morphodynamic modelling will provide support to the design of the NbS through the definition of different seagrass vegetation layouts. Moreover, and after the NbS implementation at the project, a comparison and further calibration of numerical modelling results against field data, to understand current numerical modelling capabilities and limitations. MS7, Input to T.5.2 and T.5.3; input to D4.1

### **T.5.2 Citizen Science based restoration (UAveiro):**

This task will consist of the seagrass rewilding efforts, outside the mariculture infrastructure and across the Ria de Aveiro most suitable sites, occurring yearly, from June to late September. Restoration actions will be co-implemented with local communities, through citizen science and capacity building activities focused on seagrass restoration. This will guarantee awareness of seagrasses relevance for biodiversity, and assure the sustainability of restoration actions. Based on D4.1 maps, transplants will occur from mid ebb to mid flood of Spring tides in shallow (< 50 cm water depth at low tide) areas. Individual anchored shoots (with nails or bamboo sticks) will be transplanted in plots of 2 x 2 m (5 shoots m<sup>2</sup>), with bare stretches of 4 m between them to allow for expansion, in a total transplanted area of around 4000 m<sup>2</sup> (50 X 80 m) per transplant location. The amount of transplant locations will depend on shoot and volunteer availability, which will potentially increase towards the end of the project. Upon nursery processes optimization, restoration actions through seeding or a combination of seeding and shoot planting will be tested for better performance. Input to D4.2

### **T.5.3 Seagrass Green infrastructure for system management (HAEDES, UAveiro, Subcontracter AtlanticLand Company):**

In T.5.3, the methodology for seagrass vegetation transplants, together with different disposal layouts and meadow density of the NbS will be defined, based on model results (MS7). Based on model simulations and methods described in T.5.2, a section of 100 m of the Bestida navigation channel (both margins, 5 m wide) will be colonized with *Z. marina*. Depending on low-tide water depth, transplantation will occur on foot or snorkeling. Shoot density will follow optimal model simulations, and distinct distribution patterns tested for optimal efficiency. The vegetation transplanting procedure will begin in late spring of the fourth year of the project to enhance the success of the transplantation and growth of the planting material. Bathymetric surveys (subcontracted to AtlanticLand) will be performed before the implementation of the project (reference situation) and immediately after the field experiment implementation (pos-implementation) to evaluate the evolution of channel bathymetry. Input to D4.3

#### Milestones and deliverables (outputs/outcomes)

Milestone No	Milestone Name	WP No	Lead Beneficiary	Description		Due Date	Means of Verification
MS7	Model results available	5	HAEDS	All model results are available for interpretation		37	Datasets available
MS8	Onset of system rewilding	5	UAveiro	The start of <i>Z. marina</i> rewilding efforts in Ria de Aveiro		39	Photographic record
Deliverable No	Deliverable Name	WP No	Lead Beneficiary	Type	Dissemination Level	Due Date	Description (including format and language)
D5.1	Potential restoration areas map	5	UAveiro	R	PU	37	Maps with potential transplant sites; Electronic format, English
D5.2	Report on Citizen-Science restoration actions	5	UAveiro	R	PU	81	Report on Citizen Science activities, with areas transplanted, number of volunteers involved, estimated costs; Electronic format, English

D5.3	Report on NbS implementation	5	HAEDS	R	SEN	40	Report describing all the works undertaken during the implementation phase of the NbS. Electronic format, English
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**Work Package 6**

Work Package 6: Monitoring and Evaluation of Ecosystem Services			
Duration:	M31 - M84	Lead Beneficiary:	UC
Objectives and results			
<ul style="list-style-type: none"> <li>▪ Evaluate the success of restoration actions</li> <li>▪ Assess the impact of restoration actions on benthic communities</li> <li>▪ Assess the impact of restoration actions on ichthyofauna</li> <li>▪ Evaluate the carbon storage of restored seagrass meadows</li> <li>▪ Evaluate the effect of NbS on sedimentary processes and estimate the cost-benefit relationship comparing to traditional dredging operations</li> </ul> <p><i>Expected results encompass the success of transplant efforts and positive effects on several of the ecosystem services they provide, which will reflect on the evolution of several Key Performance Indicators (KPI) of the project;</i></p>			
Activities and division of work (WP description)			
<p><b>T.6.1 Monitoring Restoration (UAveiro, SDU, UVIGO, GEOMAR):</b></p> <p>Evolution of Transplanted areas will be monitored through UAV-based analytical methods, aiming to quantify <i>Z. marina</i> coverage, obtain area-specific biomass estimates and monitor and quantify vegetative growth of <i>Z. marina</i> transplanted meadows (both traditional and NbS solution meadows). Team members will be trained by SDU specialists for this purpose. High resolution images obtained with a 4-engine drone with multispectral camera [RGB sensor resolution of 16mp</p>			

and 4 spectral bands (Green (550 BP 40) Red (660 BP 40) Red Edge (735 BP 10) and Near Infra-red (790 BP 40)), with Built-in GPS Resolution of RGB images: 4608x3456 (16mp) and images of single bands: 1280x960] will be imported into a GIS mapping software (ArcGIS). The High-resolution drone aerial images will be combined with Object-Based Image Analysis (OBIA-workflow) under a supervised machine-learning classifier, to create predictive and classification tool. Monitoring of transplanted areas will occur every 3 and distribution maps updated accordingly. Transplanted and seeded seagrass meadows will also be characterized every year according to the methodology developed in T.3.2, and compared with mariculture and native populations to assess overall health status of the plants. Input to D6.1

#### **T.6.2 Impact on benthic communities (UAveiro, CIIMAR, UC):**

Samples will be washed through a 500 µm mesh, and the remainder (plants and macrofauna) frozen or preserved in 4% formalin. At each site and sampling date, physical-chemical parameters (e.g., salinity, pH, O<sub>2</sub>) will be measured in situ, water samples collected for nutrient analyses and sediment collected for characterization (grain size distribution, Organic Matter content, C-content). Temperature data loggers will also be placed in the field for continuous data records. These data will be analysed as supporting environmental information for the benthic communities' patterns to aid in the identification of state-pressure relationships. In the laboratory, all individuals will be sorted, identified to the species level, counted, dried and weighted. Ash-free dry biomass will be measured after combustion for 8h at 450 °C. The community will be analysed for taxonomical and functional biodiversity based on pre-selection of the most relevant functional traits. We will use different taxonomic and functional diversity indices that tackle richness, evenness, and dispersion. In addition, functional diversity will be assessed through community-weighted means for functional identity patterns characterization. The annual production will be estimated with empirical models, namely, Brey's method (details in and community production evaluated as the sum of each species' production. The mean biomass and P/B ratios (i.e., turnover rates) will also be analysed for the main species. All these biological data will also be analysed as a function of the environmental one through mixed effect and generalized models multivariate techniques such as canonical analyses, RLQ and Hierarchical Modelling of Species Communities

#### **T.6.3 Impact on ichthyofauna (UAveiro, UC):**

The evaluation of the effect of restoration actions on ichthyofauna will occur in two sites with unvegetated bottom and two transplanted meadows. A high temporal resolution (3 years), including sampling at all sites before seagrass transplants (first year), will ensure that the expected increase in ecological complexity in transplanted sites will be consistently measured (2 years). Sampling will be performed seasonally to encompass the natural variability in species abundance and population dynamics typical of temperate estuarine ecosystems, using a combination of fyke nets and video sampling. Seasonal sampling at each site will be performed in consecutive days and during the same phase of the lunar cycle to avoid any bias due to changing dominant environmental conditions such as tidal cycle, depth and river runoff.

At each site, 2 fyke nets (1m diameter, 7 hoops, 10-14mm mesh, 5m long) will be deployed with the same orientation to current direction for 6-12 hours to maximize captures and minimize fish mortality due to predation and/or damage with contact with the nets. All individuals caught will be identified to species level, counted, measured, and determined the respective catch per unit effort (CPUE), which will be a proxy for species abundance. Whenever possible, fish will be released back to the water to avoid undue mortality. Additionally, two underwater cameras (GoPro Hero 11 Black) will be positioned at each site to record 30s video sequences at each hour between dawn and dusk. Each camera will be mounted to an anchor to ensure stability and with a surface float. Video analyses

will be performed to identify each species (or families) and count the number of times each taxon appears in the 30 seconds video sequences (MaxN metric). This conservative method avoids multiple counts of the same individuals appearing in the videos Data loggers will be deployed during all fishing operations (fyke nets + video) to record temporally resolved temperature and salinity variations. Input to D6.3

#### **T.6.4 Blue Carbon storage (UAveiro):**

The impact of seagrass restoration on the blue carbon storage will be assessed in the mariculture and at the restored sites at Ria de Aveiro. Three restored areas in the lagoon (geographically distant), three restored areas within the mariculture, plus three reference sites (bare bottom, adjacent to three restored areas in the lagoon) will be selected for blue carbon storage assessment. Sediment cores (1 m depth) will be sampled (before the restoration and at M70 (end of year 6) using a “russian corer” and will be analysed for % Corg and  $d^{13}C$  using an Isotope Ratio Mass Spectrometry–EA. Corg will be calculated at each 1 cm depth intervals and data integrated for 1 m depth. Total sediment C stocks and Corg will be calculated. Sedimentation rates and vertical accretion will be assessed through  $^{210}Pb$  sediment aging (1m depth) in the cores sampled at year 6, Corg sequestration rates will be estimated based on sedimentation rates, density and sediment accretion rates, allowing to estimate the effects of seagrass restoration on the blue carbon sequestration. Results will allow to extrapolate for the total restored seagrass area in the Ria de Aveiro and mariculture. Input to D6.4

#### **T.6.5 Sediment accretion (HAEDS, UAveiro, Subcontracter AtlanticLand Company):**

The effect of NbS deployment on sediment accretion and channel navigability will be evaluated after the implementation of the solution to monitor the evolution of the NbS behaviour and performance and evaluate its impacts regarding the objectives of T.5.3. The third phase will occur continuously until the end of the project. The field monitoring activities will concern: 1) monitoring of the bed evolution through bathymetric surveys (subcontract of AtlanticLand); 2) monitoring of hydrodynamic parameters (subcontract of AtlanticLand); 3) integrate data on the vegetation status (Link to T.6.1, D.6.1). HAEDS will implement a success evaluation matrix to assess the NbS performance based on field observations. This success evaluation matrix aims to be generic to be applicable in future NbS projects performed elsewhere. Input to D6.5

#### **T.6.6 Cost-Benefit analysis of Restoration actions (UAveiro, All)**

This task will integrate all the information gathered, to evaluate and quantify the rehabilitation of ecosystem services provided by the re-colonization program. A cost-benefit analysis will consider not only operational costs but also environmental costs, through the evaluation of ecosystem services recovery. Restoration costs will be gathered through data collection, and ecosystem restoration benefits (C-storage, navigability management effects, biodiversity) valued in conjunction with CoP perceptions and completed by application of economic valuation methods (e.g. Ecosystem Service Value Database (ESVD)). Benefit:Cost ratios will be determined for end-of-project and 5-years-after project scenarios, taking into consideration expected KPI indicators at each time, to evaluate possible cost dilution effects over time. Input to D6.6.

#### **Milestones and deliverables (outputs/outcomes)**

(LIFE SAP and OAG):

Milestone No	Milestone Name	WP No	Lead Beneficiary	Description		Due Date	Means of Verification
MS9	End of field monitoring	6	UAveiro	The end of all monitoring efforts on restored areas		78	datasets
Deliverable No	Deliverable Name	WP No	Lead Beneficiary	Type	Dissemination Level	Due Date	Description (including format and language)
D6.1	Report on seagrass restoration	6	UAveiro	R	PU	84	Synthesis report on evolution of transplant actions, with overall seagrass area restored; Electronic format, English
D6.2	Report on benthic communities	6	CIIMAR	R	PU	84	Synthesis report on evolution of benthic community structure, biodiversity and biomass in restored areas; Electronic format, English
D6.3	Report on ichthyofauna communities	6	UC	R	PU	84	Synthesis report on evolution of fish community structure, biodiversity and biomass in restored areas; Electronic format, English
D6.4	Report on Blue Carbon storage	6	UAveiro	R	PU	84	Synthesis report on blue carbon storage in restored areas; Electronic format, English
D6.5	Report on NbS implementation	6	HAEDS	R	SEN	84	Synthesis report on NbS implementation, effect and cost-benefit analysis; Electronic format, English



D6.6	Cost-Benefit Analysis	6	UAveiro	R	PU	84	Synthesis report on Cost-Benefit analysis of restoration actions; Electronic format, English
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**Work Package 7**

Work Package7: Environmental Education and training			
Duration:	M13 - M84	Lead Beneficiary:	Ocean Alive
Objectives and results			
<ul style="list-style-type: none"> <li>Develop a capacity-building network of system end-users to monitor seagrass meadows and increase people awareness</li> <li>Develop Environmental Education activities to maximize awareness and engagement</li> <li>Develop training courses to maximize replication and upscaling</li> </ul> <p><i>Expected results encompass the establishment of a network of restoration effort monitors comprised by Ria de Aveiro end-users (fishermen, shellfish harvesters) to protect and increase awareness on implemented actions; mobilize students and citizens for restoration actions through environmental education actions; train up to 50 restoration practitioners for potential replication and upscaling activities.</i></p>			
Activities and division of work (WP description)			
<p><b>T.7.1 Guardians of the Ria network (Ocean Alive, UAveiro):</b></p> <p>A capacity building program “<b>Guardians of the Ria</b>” will be developed and implemented at Ria de Aveiro, building up on the successful and ongoing program “Keepers of the Sea” at Sado estuary, and in close connection with the guardians from Sado. A local community leader (fishing women or bait digger) will be recruited and trained at Ria de Aveiro, and will then recruit five more “Sea guardians”, building a network. Three different roles will be implemented in this network: 1) seagrass monitors, contributing to the ground truth mapping of seagrass meadows (using a GPS); 2) awareness agents, acting directly within the fishing communities; and 3) marine guides, participating in education and training activities of <b>LIFE SeagrassRIAwild</b>. These activities will provide a multiplier effect on</p>			

seagrass awareness in the local communities, integrate the Community of Practice (CoP) philosophy (link to T2.1 and 2.3) while being a crucial part of the project legacy and After-LIFE sustainability plan. Input to D7.1

#### **T.7.2 Environmental education (UAveiro, all partners):**

Aiming to attract and engage local students with the project targets and works, LIFE SeagrassRIAwild will design and implement specific activities targeting school students, through informal education and learning by doing approaches stimulating them to learn more about ecosystems, their role for the well-being of society and the importance of restoration actions; Ciência Viva actions, namely Summer Science visits to the Mariculture infrastructure and integration in restoration activities; National Science and Technology week activities;

In addition, team building events will be organized targeting private companies, comprising visits and restoration activity participation;

Participation in informal educational events e.g., local “Nights of Research”, “European Night of Researchers”, “Pint of Science, Ocean Literacy events (EU4OCEAN Platform). Input to D7.2

#### **T.7.3 Training (UAveiro, all partners):**

Targeting external capacity building on replication, LIFE SeagrassRIAwild foresees to promote a specific technical training, under the topic "Mariculture for seagrass Rewilding".

The training works will take place on the last year of the project. The full program will account not only with know-how from the project team, but also with invited experts from abroad. Training will be open for participation of any interested person, having as main target audience those that can better contribute to use the acquired knowledge and replication, up to a maximum of 50 participants. In addition to presentations and practical work, the training will include field visits to project sites. Input to D7.3

#### **Milestones and deliverables (outputs/outcomes)**

Milestone No	Milestone Name	WP No	Lead Beneficiary	Description	Due Date	Means of Verification
MS10	Mariculture visits	7	UAveiro	Environmental education events	60, 72, 84	Project website agenda
MS11	Training	7	UAveiro	Training event towards outreach	72	Project website agenda

(LIFE SAP and OAG):

Deliverable No	Deliverable Name	WP No	Lead Beneficiary	Type	Dissemination Level	Due Date	Description (including format and language)
D7.1	Guardians of Ria	7	Ocean Alive	R	PU	84	Synthesis report on the structure, number of members and activities of the network; Electronic format, English
D7.2	Environmental education report	7	UAveiro	R	PU	84	Synthesis report on the environmental education activities; Electronic format, English
D7.3	Training report	7	Uaveiro	R	PU	84	Synthesis report on the training events; Electronic format, English

### Work Package 8

Work Package 8: Sustainability, replication and exploitation of project results			
<b>Duration:</b>	M1 - M84	<b>Lead Beneficiary:</b>	UAveiro
Objectives and results			
<ul style="list-style-type: none"> <li>Project website development</li> <li>Networking and synergies with other LIFE projects</li> <li>Dissemination and communication of project results</li> <li>Optimize replication, upscaling and sustainability of actions after project ends</li> </ul>			

*The website will be online by M6; networking events with two LIFE projects of interest, both national and abroad; promotional video and other multimedia material will maximize project result dissemination; The Exploitation Plan will, together with the After-LIFE Conservation Plan, define the agenda for replication and upscaling of project results.*

#### Activities and division of work (WP description)

##### **T.8.1 Networking with other LIFE projects (UAveiro, all):**

Networking with other teams and LIFE projects is considered by LIFE SeagrassRIAwild partners as a core task, necessary to critically discuss and exchange useful information for the project development as well as for increasing the replication potential of its outputs. Networking actions are therefore foreseen by most partners, in specific subject areas that are seen as priority for the applicable partners, while useful for the whole partnership and project activities. Networking may occur either electronically or by promotion of direct visits to other projects and/or inviting external teams to visit the project implementation, aiming to establish synergistic efforts with ongoing related projects, such as LIFE Recreation ReMEDIES (LIFE18 NAT/UK/000039). Input on D8.2

##### **T.8.2 Dissemination and communication (UAveiro, all):**

The project's communication will be mostly digital (website, social networks, video) but printed material are also foreseen for support in external events.

A package of branded (corporate design and logo) information materials (multi-media) and tools will be developed targeting various audiences. The project's website and social media outlets, e.g., Twitter, LinkedIn will be launched early in the project. Project partners will contribute editorials, articles and bulletins for the website news feed and updates for social media posts. They will promulgate timely information in national and international press, incl. newsletters, dedicated issues of popular magazines, printed/online press, and radio / TV.

A **layman report** will be aimed at wider society in attractive format summarising the project's work to make LIFE SeagrassRIAwild technologies and vision for social ecological transformation accessible and widely visible.

Project deliverables and results will be disseminated at relevant national, regional, and international events and on international days with the support of short presentations, brochure handouts, information booths or bilateral meetings to demonstrate the solutions produced and their potential for scalability at the different levels.

Realisation and production of a video documentary designed to tell the success story of the project through the voices of the stakeholders and key players involved. Input to D8.1 D8.3 and D8.4.

##### **T.8.3 Exploitation/uptake of the results and Sustainability Plan (UAveiro, all):**

A follow-up Exploitation Plan and Factsheet will be developed, in combination with the After-LIFE Conservation Plan (D1.3), to foster uptake of the results, as an impact-driven design towards maximising the effects of investments, ensuring their contribution to the LIFE Program's objectives and Commission's policy priorities.

Consequently, it will contain the guidelines to replicate and upscale implemented actions, to ensure the utilization of the project outcomes by relevant end- users, and the establishment of long-lasting research collaborations with the partner institutions and synergistic projects beyond the timeframe of the project (focusing on the expected impacts). A comprehensive feasible strategy for the management of the intellectual property and definition of results ownership (main outputs from WP3, WP4, WP5 and WP6) will be included. The ExSP will be linked to the Data Management Plan (D1.2). Input on D8.4

#### Milestones and deliverables (outputs/outcomes)

Milestone No	Milestone Name	WP No	Lead Beneficiary	Description		Due Date	Means of Verification
MS12	Website	8	UAveiro	The website is online		6	Website URL
Deliverable No	Deliverable Name	WP No	Lead Beneficiary	Type	Dissemination Level	Due Date	Description (including format and language)
D8.1	Website	8	UAveiro	DEC	PU	6	Project website; PT and ENG
D8.2	Report on networking	8	UAveiro	R	PU	84	Report on networking events; Electronic format, English
D8.3	Layman Report	8	UAveiro	R	PU	84	Report on networking events; Electronic and paper format (500 copies), PT and ENG
D8.4	Project Video	8	UAveiro	OTHER	PU	78	Project video; PT and ENG
D8.5	Exploitation Plan	8	UAveiro	R	PU	84	Report on Exploitation measures; Electronic format, English