

AFTER-LIFE CONSERVATION PLAN

LIFE19 NAT/IT/000264 – LIFE TRANSFER

Site: Logarou lagoon, Amvrakikos Gulf (GR2110001, GR2110004)

1. Introduction

The LIFE TRANSFER project (Seagrass transplantation for transitional ecosystem recovery) aims to restore and enhance the conservation status of priority habitat 1150* “Coastal lagoons” through large-scale transplantation of submerged angiosperms in selected Mediterranean lagoons (Italy, Spain, Greece).

In Greece, actions focused on Logarou lagoon within the Amvrakikos Gulf, a Ramsar wetland and part of the Amvrakikos Wetlands National Park, designated as Natura 2000 sites GR2110001 and GR2110004. The site has experienced a long-term decline of seagrass meadows and a deterioration of ecological status from “Good” to “Moderate” under the Water Framework Directive (WFD).

This After-LIFE Plan describes how the Natural Environment and Climate Change Agency (NECCA), through the Management Unit of Acheloos Valley and Amvrakikos Gulf Protected Areas, together with the Hellenic Centre for Marine Research (HCMR) and local stakeholders (fishers’ cooperatives, municipalities), will continue and further develop the actions initiated by LIFE TRANSFER after the end of the project.

2. Site description and institutional framework

2.1 Site overview

- Name: Amvrakikos Gulf – Logarou/Mazoma lagoon
- Natura 2000 codes: GR2110001 (pSCI), GR2110004 (SPA)
- Surface area: approx. 23,185 ha (entire project area)
- Habitat type targeted: 1150* Coastal lagoons and associated seagrass meadows (*Zostera noltei*, *Ruppia cirrhosa*).

Logarou is a large (≈ 2750 ha), shallow (mean depth ~ 1 m) coastal lagoon with restricted exchange with the open Amvrakikos Gulf, making it sensitive to eutrophication, extreme temperature events and oxygen depletion.

2.2 Governance – role of NECCA and the Management Unit

Since 2020, the management of Greek protected areas has been coordinated by NECCA (Natural Environment and Climate Change Agency), which functions as the national body for protected

area governance and biodiversity policy implementation. The former Amvrakikos Gulf–Lefkada Management Agency (ALMA), associated beneficiary of LIFE TRANSFER, has been integrated into NECCA as the Management Unit of Acheloos Valley and Amvrakikos Gulf Protected Areas. This Management Unit is responsible for the administration and management of the Amvrakikos Wetlands National Park and the relevant Natura 2000 sites, including GR2110001 and GR2110004.

The Management Unit:

- coordinates conservation and monitoring actions,
- provides opinions on projects and activities within the protected areas,
- implements environmental awareness and stakeholder engagement activities,
- participates in and manages national and EU-funded projects relevant to Amvrakikos.

After LIFE, NECCA and its Management Unit will be the main authorities responsible for maintaining and expanding the outcomes of LIFE TRANSFER in Logarou, with scientific guidance from HCMR.

3. Summary of LIFE TRANSFER actions and results at Logarou

3.1 Key actions implemented

C4 – Transplantation of submerged aquatic angiosperms in Amvrakikos lagoon

- Design of transplantation protocol (A4.4) tailored to local conditions, including donor site survey in Mazoma and selection of recipient plots in Logarou.
- Large-scale transplantation of *Zostera noltei* sods from Mazoma lagoon to Logarou (pilot in 2021; expanded in 2022–2024; hand-placement optimization in 2024).

D4 – Monitoring of C4 action

- Monitoring of transplanted sod survival, rooting and expansion at multiple stations in Logarou.
- Monitoring of biodiversity (benthic macrofauna, macroalgae, fish) and environmental quality (water column parameters, sediment characteristics) at donor and recipient sites.
- Installation of a permanent multi-parameter logger at the sluice/bridge area to record water level, temperature and other key variables at high frequency.

A2/A6 – Ex-ante monitoring and GIS for Amvrakikos site

- Baseline ecological status assessment under WFD and habitat mapping.

E1/E2 – Dissemination and capacity building

- Local workshops and stakeholder meetings in Greece, Italy and Spain.
- Training of operators and fishers in transplantation and monitoring techniques.

3.2 Main results relevant for After-LIFE

From the draft final D4 monitoring report and interim reports:

Restoration success:

- Initial pilot plots (2021–2022) had low survival due to macroalgal blooms and environmental stress.
- After adaptive re-design (new planting tools, relocation of plots closer to existing meadows, hand-planting), survival increased substantially, reaching >37% in 2025, with clear net gains in *Zostera noltei* coverage in several plots.

Environmental quality:

- Donor site (Mazoma) remains generally in “Good” ecological status, while recipient Logarou sites improved or maintained status, with some central monitoring stations achieving “Good” class by 2024–2025 (M-AMBI, MaQI).

Biodiversity response:

- Restored plots support richer and more structured benthic communities, with higher abundance of sensitive taxa compared to unvegetated controls.

Knowledge and tools:

- A robust transplantation protocol for *Zostera noltei* in Mediterranean lagoons was developed, together with custom tools for sod extraction and planting.
- A long-term dataset exists (2021–2025) on water/sediment quality and biotic indices at donor and recipient sites.

Infrastructure:

- A fixed multi-sensor station (logger) installed at the lagoon-sea connection provides continuous data that can be integrated into national monitoring programmes.

These outcomes create a strong basis for continuation and upscaling after LIFE.

4. Conservation status at the end of the LIFE project

4.1 Habitat 1150* and seagrass meadows

Historical decline of *Zostera* meadows has been documented prior to LIFE, associated with eutrophication and hydrological changes in Logarou. By 2025, the project has:

- restored 0.03 ha of *Zostera noltei* meadow in Logarou through transplantation;
- improved connectivity between remnant natural meadows and restored patches;

Overall, the conservation status of habitat 1150* at the restored sites is assessed as stable based on seagrass coverage, shoot density and trend indicators.

4.2 Ecological status (WFD)

According to WFD multi-metric indices (M-AMBI, MaQI), Logarou transitioned from Moderate status prior to LIFE to Good for stations LOG_MON_0 and LOG_MON_B.

Environmental parameters (oxygen, temperature, turbidity, nutrients) remain variable and indicate that the system is still vulnerable to extreme events, underlining the need for continued monitoring and adaptive management beyond LIFE.

4.3 Socio-economic context

The lagoon continues to support extensive lagoon fishery with approx. 80 fishers relying on the system. LIFE TRANSFER strengthened collaboration between scientists, the Management Unit and fishers, who were actively involved in transplantation and monitoring and can play a key role in future stewardship.

5. After-LIFE objectives

The main After-LIFE objectives for the Amvrakikos/Logarou site are:

1. Maintain and further improve the conservation status of habitat 1150* in Logarou lagoon by safeguarding and expanding restored *Zostera noltei* meadows.
2. Integrate LIFE TRANSFER methods and data into routine management and monitoring of the Amvrakikos Wetlands National Park and national WFD programmes.
3. Strengthen long-term environmental monitoring (seagrass, biodiversity, physico-chemical parameters) using the infrastructure and protocols developed in LIFE.
4. Promote replication and upscaling of seagrass restoration in other suitable lagoons of the Amvrakikos complex and, where appropriate, other Greek transitional waters.
5. Consolidate stakeholder engagement and awareness, in particular among local fishers, schools and municipalities, to ensure long-term support for restoration actions.

6. Actions and organisations in charge of implementation

In line with the Application Form, the Amvrakikos Management Body (now NECCA's Management Unit) is expected to be in charge of project continuation with its own resources.

6.1 Continued ecological monitoring

Action A1 – Continuation of C4/D4 monitoring at key stations

Description:

- Maintain a reduced but representative network of monitoring stations in Logarou and Mazoma (e.g. 2–3 donor stations, 4–6 recipient stations).

- Annual surveys of seagrass cover, shoot density and patch expansion following simplified D4 protocols.
- Annual or biennial benthic macrofauna and macroalgae sampling at selected stations to calculate MaQI and M-AMBI indices.
- Integration of logger data from the poly-sensor station (water level, temperature, salinity, oxygen) into NECCA's monitoring database.

Responsible: NECCA Management Unit (overall coordination); HCMR (scientific supervision, data analysis).

Timing: 2026–2030 (minimum), with review in 2030.

Estimated costs: Current restoration costs from the LIFE TRANSFER project are estimated at 50-60000 € per year including labor, materials, sample analyses, and travel costs).

Potential funding sources: NECCA core budget for protected areas; national WFD monitoring contracts; Operational Programme “Environment and Climate Change”; future LIFE or Interreg projects focusing on wetlands/blue carbon.

Action A2 – Maintenance and upgrade of the fixed multi-parameter station

Description:

- Ensure regular maintenance and calibration of the logger installed at the sluice/bridge.
- Evaluate the possibility of adding parameters (e.g. turbidity, chlorophyll-a) and integrating data in real time into NECCA's environmental information system.

Responsible: NECCA Management Unit technical staff; Agreement with HCMR or equipment supplier.

Timing: Continuous from 2026.

Costs & funding: Approximate cost for routine maintenance, factory calibration, discounts on parts, priority service, and loaner equipment during repairs is 5.000 € per year; potential support through national digital monitoring initiatives or follow-up LIFE project.

6.2 Consolidation and expansion of restoration

Action B1 – Protection and stewardship of restored meadows

Description:

- Mark restored plots in cooperation with fishers' cooperatives to avoid physical disturbance (anchors, gear).
- Include seagrass protection provisions in local fisheries management arrangements where possible.
- Establish a simple incident reporting system (e.g. phone/online) for damage to meadows.

Responsible: NECCA Management Unit (coordination, signage); Fishers' cooperative of Logarou; Fisheries authorities.

Timing: 2026–onwards.

Costs & funding: Low; mostly staff time and small materials; covered by NECCA and local partners.

Action B2 – Targeted infill and expansion planting (if needed)

Description:

- Based on monitoring results, plan small-scale infill transplantations in underperforming plots or along edges of successful meadows to enhance connectivity and resilience.
- Use the optimized hand-planting technique and tools developed in LIFE TRANSFER; donor sods to be taken from robust meadows within Mazoma/Logarou, following strict sustainability criteria.

Responsible: NECCA Management Unit; HCMR; fishers trained during LIFE.

Timing: 2027–2029, subject to monitoring results and permits.

Costs & funding: Potential funding via small national projects, LIFE follow-up or EAFRD/EMFAF measures supporting habitat restoration. Estimated total cost of €11,500 per year for 2027–2029, based on 51 person-days annually (researchers, technicians, and trained fishers), fieldwork (sod collection and transplanting), equipment maintenance and rental, travel, subsistence, and minor administrative costs. Total cost for two years of infill and expansion campaigns is €22,000–23,000. Funding may be drawn from NECCA's core protected area resources, national/EU restoration project budgets (LIFE, EAFRD/EMFAF), and support from local stakeholders.

Action B3 – Feasibility study for replication in other lagoons

Description:

- Use the GIS developed under A6 and LIFE datasets to identify other lagoons of Amvrakikos (e.g. Tsoukalio, Rodia, Mazoma fringe areas) where seagrass restoration could be beneficial and feasible.
- Perform a desk-based assessment of hydrology, pressures and socio-economic context and prioritise candidate sites.
- Prepare a concept note for a follow-up project (e.g. LIFE, Interreg, national) targeting large-scale restoration and blue-carbon valuation.

Responsible: NECCA Management Unit (lead); HCMR; University of Ioannina.

Timing: 2026–2027.

Costs & funding: Mainly staff time; can be integrated into NECCA’s planning mandate or funded under preparatory actions of new programmes. Estimated total cost of approximately €16,000–17,000 over 2026–2027, comprising 75 person-days of staff effort (senior researchers and NECCA personnel), 9 field days for site verification and stakeholder consultation, and minor equipment/consumable costs. This can be integrated into NECCA’s planning mandate or funded under preparatory actions for new LIFE/Interreg programmes. Potential co-funding may also be available through regional environmental planning budgets or university partnerships (to be confirmed).

6.3 Integration into management planning and policy

Action C1 – Integration of LIFE results into NECCA management plans

Description:

- Incorporate LIFE TRANSFER outcomes (maps, monitoring results, restoration protocol) into the revised Management Plan of the Amvrakikos Wetlands National Park and relevant Natura 2000 conservation objectives.
- Ensure that seagrass meadows in Logarou are explicitly recognised as priority conservation features with specific targets and measures (e.g. “no net loss of *Zostera* cover”, “improvement from Moderate to Good status by 2030”).

Responsible: NECCA central directorates (Protected Areas & Biodiversity) together with the Management Unit; Ministry of Environment and Energy.

Timing: Next revision cycle of Management Plan 2030.

Costs & funding: Included in national planning budget.

Action C2 – Contribution to WFD and MSFD reporting

Description:

- Use D4 datasets and continued monitoring to refine WFD classification of Logarou and support programme-of-measures updates.
- Explore opportunities to use restored seagrass meadows as blue-carbon and ecosystem-service indicators in MSFD and climate-related reporting.

Responsible: HCMR (national WFD contractor); NECCA; Ministry of Environment and Energy.

Timing: In line with next WFD/MSFD reporting cycles.

Costs & funding: Through WFD/MSFD monitoring contracts and research projects.

6.4 Communication, education and stakeholder engagement

Action D1 – Continuation of awareness and education activities

Description:

- Maintain and update communication materials (panels, leaflets, website, social media) produced during LIFE TRANSFER, highlighting restoration success and citizen actions.
- Integrate Logarou restoration into NECCA's environmental education programmes for local schools (field visits, citizen-science observation of seagrass and fauna).

Responsible: NECCA Management Unit (communication team); local schools, NGOs.

Timing: 2026–2030.

Costs & funding: Low to moderate; can be covered by NECCA communication budget and small grants.

Action D2 – Stakeholder platform for Amvrakikos lagoon management

Description:

- Use and expand existing collaborations (e.g. Amvrakikos Alliance) to create a permanent platform where fishers, municipalities, NGOs, scientists and NECCA discuss lagoon management, restoration and pressures (eutrophication, fishing practices, water management).
- Organise at least one multi-stakeholder meeting per year focusing on seagrass and lagoon health, using LIFE TRANSFER results as reference.

Responsible: NECCA Management Unit; partners of the Amvrakikos Alliance; Municipalities of the wider area.

Timing: Annual from 2026 onwards.

Costs & funding: Meeting logistics and facilitation – to be covered by NECCA and project-based funding where available.

7. Costs and funding sources

A concise budget table will be prepared once NECCA and HCMR finalise the internal allocation of resources. At this stage, the indicative structure is:

Action group – Estimated annual cost (€) – Main funding sources

- A1–A2 Monitoring and logger – 5000€ per year – NECCA baseline; WFD contracts; future LIFE/Interreg
- B1–B2 Restoration consolidation – 11,500 € per year r – NECCA; EMFAF/fisheries funds; new projects
- B3 Replication study –16,000–17,000 € per year – NECCA planning; new LIFE proposal

- C1–C2 Integration into plans & policy – Mainly staff time – National budgets (MEEN, NECCA)
- D1–D2 Communication & stakeholder platform – [Low to Moderate] – NECCA; local authorities; small grants

8. Timetable for implementation

Proposed overall timetable (to be adapted to actual funding cycles):

2026–2027

- Maintain monitoring at core stations (A1, A2).
- Complete feasibility study for replication (B3).
- Start integration of results into NECCA management planning (C1).
- Continue awareness activities and stakeholder meetings (D1, D2).

2028–2030

- Continue and, if possible, expand monitoring (A1).
- Implement targeted infill planting where needed (B2).
- Use data in WFD/MSFD reporting cycles (C2).
- Evaluate progress towards conservation targets and decide on next restoration phase.

Beyond 2030

- Long-term maintenance of monitoring infrastructure and management provisions for seagrass protection.
- Potential large-scale replication in additional lagoons, depending on feasibility and funding.

The table below summarises the indicative schedule of the main After-LIFE actions. “X” indicates the years when each action is active; the timetable may be refined as funding and priorities evolve.

Gantt-type timetable (overview)

Action / Year	2026	2027	2028	2029	2030	Beyond 2030
A1 – Core ecological monitoring (C4/D4 stations)	X	X	X	X	X	X
A2 – Maintenance of multi-parameter station	X	X	X	X	X	X
B1 – Protection & stewardship of restored meadows	X	X	X	X	X	X

Action / Year	2026	2027	2028	2029	2030	Beyond 2030
B2 – Targeted infill & expansion planting (if needed)			X	X	X	
B3 – Feasibility study for replication in other lagoons	X	X				
C1 – Integration into NECCA management plans	X	X				
C2 – Contribution to WFD/MSFD reporting			X	X	X	
D1 – Awareness & education activities	X	X	X	X	X	
D2 – Stakeholder platform (Amvrakikos lagoon)	X	X	X	X	X	X

9. Monitoring of After-LIFE Plan implementation

To track progress, the following indicators are proposed:

Ecological indicators

- Area (ha) and percentage cover of *Zostera noltei* in restored plots and natural meadows.
- WFD ecological status class for Logarou (benthic and macrophyte indices). Threshold level for the indicator is the “Good” ecological status
- Trends in key physico-chemical parameters from the logger (frequency of hypoxic events, extreme temperatures).

Management and process indicators

- Number of monitoring campaigns completed per year.
- Number of stakeholder meetings and participants.
- Inclusion of seagrass targets and measures in updated Management Plans and NECCA strategies.
- Number of schools and citizens reached through awareness actions.

Replication indicators

- Number of new lagoons where seagrass restoration is piloted.
- Amount of external funding secured for follow-up projects.

10. Risks and assumptions

Key assumptions for successful After-LIFE implementation:

- NECCA and HCMR retain adequate core funding and staff capacity to carry out monitoring and management tasks.
- No major negative change in hydrological regime or pollution loads beyond current levels.

- Continued cooperation of local fishers and municipalities.

Main risks include budget constraints, extreme climatic events (heatwaves) and potential conflicts with other uses (e.g. changes in fisheries practices or water management). These will be addressed through adaptive management and stakeholder dialogue within Action D2.

11. List of abbreviations

Abbreviation	Meaning
ALMA	Amvrakikos Gulf–Lefkada Management Agency (former management body, now integrated into NECCA)
EMFAF	European Maritime, Fisheries and Aquaculture Fund
EU	European Union
HCMR	Hellenic Centre for Marine Research
LIFE	EU funding instrument for environment and climate action
MEEN	Ministry of Environment and Energy – Greece
MSFD	Marine Strategy Framework Directive (2008/56/EC)
NECCA	Natural Environment and Climate Change Agency (Greece)
Natura 2000	EU-wide network of protected sites designated under the Birds and Habitats Directives
pSCI	Proposed Site of Community Importance
SPA	Special Protection Area (Birds Directive)
WFD	Water Framework Directive (2000/60/EC)
WFD QoE	Water Framework Directive – Ecological Quality Status
MaQI	Macrophyte Quality Index (Mediterranean coastal and transitional waters)
M-AMBI	Multivariate-AZTI Marine Biotic Index
D4	LIFE TRANSFER monitoring action for restoration (Amvrakikos site)
C4	LIFE TRANSFER conservation/restoration action (transplantation in Amvrakikos)

12. References

European Commission. 2000. Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy (Water Framework Directive).

European Commission. 2008. Directive 2008/56/EC of the European Parliament and of the Council establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive).

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LIFE TRANSFER (LIFE19 NAT/IT/000264). Project Application Form and annexes for Amvrakikos site (A2, A4, C4, D4, E actions).

LIFE TRANSFER (LIFE19 NAT/IT/000264). Action D4 Monitoring reports for Amvrakikos (First, Second, Third and Final monitoring reports, 2021–2025).

NECCA – Natural Environment and Climate Change Agency. Management Unit of Acheloos Valley and Amvrakikos Gulf Protected Areas. Official website and management information.