



CASTOR
Project

Evrotas River Conservation



**Conservation Actions for Supporting the Threatened freshwater fish of
Evrotas River (CASTOR)**

**«Monitoring and Removal Plan for the non-native Rainbow Trout
Oncorhynchus mykiss in the Evrotas River Basin»**

(a Synopsis)

Kalogianni Eleni & Vardakas Leonidas

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OIKOM ENVIRONMENTAL STUDIES

91 NERANTZIOTISSIS Str, 151 24, MAROUSSI, ATTIKI
+30 210 6107403 • info@oikom.gr • www.oikom.gr
EUID: ELGEMI. 007850601000

Scientific Associate



"HELLENIC CENTRE FOR MARINE RESEARCH - INSTITUTE OF MARINE BIOLOGICAL RESOURCES AND INLAND WATERS" (HCMR - IMBRIW)
ANAVYSSOS, 46.7 km ATHENS – SOUNION AVE., P.O. Box 712, P.C. 190 13
+30 22910 76458 • lvard@hcmr.gr • <https://imbriw.hcmr.gr/>

TEAM MEMBERS

NAME	PARTNER	AFFILIATION	RESPONSIBILITIES
Evangelos Pappas	OIKOM Ltd	Biologist, MSc	Project Manager. Director of OIKOM Ltd.
Evi Alexandropoulou		Environmentalist	Shareholder of OIKOM Ltd. Participation in Stakeholder engagement plans. Organizing and coordinating dissemination actions.
Argyris Boglis		Forester Environmentalist, MSc	Overall supervision of the implementation of all project actions. Responsible for monitoring the project timeline.
Prokopis Gavriil		Environmentalist, MBA	Participation in Stakeholder engagement plans. Organizing dissemination actions.
Nikos Katsimanis		Environmentalist, MSc	Shareholder of OIKOM Ltd. Responsible for the environmental permitting of the nature-based solution actions.
Dr. Areti Gianni		Geologist, PhD	Co-planning and supervision of nature-based solution actions.
Eftychia Vasilakou		Economist, MSc	Financial and administrative supervision of the project.
Dr. Leonidas Vardakas	HCMR / IMBRIW	Ichthyologist, PhD	Project Manager of the third-party organization (HCMR). Research Associate at HCMR. Assessment of the ecological status of inland waters.
Dr. Eleni Kalogianni		Biologist, PhD	Scientific Coordinator. Senior Researcher at HCMR. Contribution to the design and overview of all project activities.
Dr. Nicholas Koutsikos		Ichthyologist, PhD	Research Associate at HCMR. Responsible for the design and overview of the removal actions of the invasive species.
Dr. Elias Dimitriou		Hydrogeologist, PhD	Research Director at HCMR. Responsible for the design and overview of the hydrological assessments of the project.
Dr. Ioannis Karaouzas		Freshwater Biologist, PhD	Senior Researcher at HCMR. Responsible for the biological assessments.
Dr. Nikolaos Skoulikidis		Biogeochemist, PhD	Research Director at HCMR. Responsible for the hydrogeological assessments and nature-based solution actions.
Sofia Laschou		Chemist	Participation in field work (water sample collection for eDNA analysis and preparation of samples).
Petros Kouraklis		Technician	Provision of assistance in field work.

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1. INTRODUCTION

The present document constitutes a synopsis of the “Monitoring and Removal Plan for the non-native Rainbow Trout *Oncorhynchus mykiss*” of the project “CASTOR – Conservation Actions for Supporting the Threatened freshwater fish of Evrotas River.”

The CASTOR Project is funded by the **Donors’ Initiative for Mediterranean Freshwater Ecosystems (DIMFE)** and is implemented by **OIKOM Environmental Studies Ltd. (Coordinator)** in collaboration with the **Hellenic Centre for Marine Research / Institute of Marine Biological Resources and Inland Waters (HCMR/IMBRIW)** as the scientific lead.

The project’s aim is to safeguard the endemic and threatened freshwater fish species *Pelagius laconicus* and *Squalius keadicus* through a combination of **habitat restoration, population management, invasive species control, and stakeholder engagement actions** within the Evrotas River Basin.

1.1. Summary

A technical manual was produced under Project CASTOR to guide the assessment, control, and where feasible, eradication of non-native freshwater fish in Mediterranean inland waters, with a specific application to the non-native rainbow trout *Oncorhynchus mykiss* in the Evrotas River basin (southern Peloponnese, Greece). The document consolidates ecological rationale, regulatory context, decision-support tools, and field protocols into a single, standardised operational framework that can be implemented by trained teams and audited through consistent reporting.

2. RATIONALE FOR THE COMPILATION OF THE MANUAL

Mediterranean river networks combine high endemic biodiversity with strong hydrological intermittency (seasonal drying and fragmentation). In such systems, non-native fishes can persist and spread through a mix of (i) episodic high-flow connectivity windows, (ii) anthropogenic pathways (aquaculture escapes, illegal stocking/translocations, canals/diversions), and (iii) life-history traits that favour establishment (tolerance, flexible habitat/diet, rapid growth, early maturation, high fecundity). Once established, eradication is often difficult; therefore, the manual emphasises structured planning, prioritisation, and verification, rather than *ad-hoc* removal.

Within CASTOR, the manual is explicitly designed to support project delivery by linking invasive-species pressure reduction to native-fish conservation actions and habitat/connectivity improvements. The plan maps directly to project goals by:

- supporting SG1 through removal of a priority potential biotic pressure at candidate native fish release sites as well as in the wider basin and aligning actions with the translocation calendar;
- delivering SG3 through monitoring design, removal operations, success thresholds, and the adaptive management loop for trout;
- supporting SG4 by incorporating stakeholder feasibility and reinvasion prevention as operational requirements.

3. EVROTAS FOCUS: WHERE TROUT OCCUR AND WHY IT MATTERS

The manual compiles the best available evidence on trout occurrence in the Evrotas basin and highlights two key context elements:

- Likely pathway to the intervention sites and then to the Evrotas main stem: repeated escape events associated with a trout farm in Kastorio village (established in the late 1960s) and unrecorded illegal stockings. Local accounts report escape events with fish moving downstream via the Ag. Mamas stream through the Kardaris stream toward the Vivari reach of the Evrotas main stem, where trout have been recorded multiple times in the past.
- Second occurrence area and likely pathway to the Evroptas main stem: juveniles have been captured in the Oinous (Kelefina) tributary draining Mount Parnon in the past, consistent with a localised, potentially self-sustaining population linked to an introduction reported for the 1970s–1980s and/or possibly subsequent illegal stockings. Operationally, this population is treated as demographically/hydrologically isolated from the main stem because of longitudinal barriers and seasonal drying; but trout entering the main stem during heavy flooding cannot be excluded.

4. HOW SITES ARE PRIORITISED AND PREPARED FOR ACTION

Before removal, the manual requires a structured risk/feasibility assessment and reconnaissance to define “operational control segments.” A central idea is that basin fragmentation, while challenging, also creates an opportunity: small, isolated headwater streams can be treated as manageable eradication units, especially if barriers and dry reaches help containment.

Key preparatory steps include:

- **Barrier and habitat assessment:** mapping weirs/culverts and evaluating intermittency; dry reaches may act as natural containment, but recolonisation can still occur during high-flow connectivity periods.
- **Identifying recolonisation sources (“hotspots”):** including (a) the upper part of Ag. Mamas stream (escapees from aquaculture) and (b) the Oinous tributary (past records).
- **Sequencing logic:** where applicable, systematic removal from downstream to upstream is recommended to reduce recolonisation from untreated downstream sections and progressively isolate remaining individuals.

5. MANAGEMENT TOOLS INCLUDED (AND HOW THE MANUAL USES THEM)

The document integrates multiple tools and explains when each is appropriate:

Population Viability Analysis (PVA) and VORTEX

PVA is presented as a decision-support method to evaluate extinction/persistence probabilities under different removal intensities. However, the manual is explicit that in the Evrotas framework, where

evidence suggests trout are not self-reproducing in the system, PVA is not needed to model extinction of a closed population. Instead, modelling is most useful to:

- explore persistence under continued propagule pressure (escapes/illegal stocking),
- support effort planning to reach detection confidence targets, and
- formalise adaptive triggers for reinvasion response.

Control options reviewed

The manual reviews mechanical, chemical, biological and genetic control options, and then operationally prioritises field-based mechanical removal (especially depletion electrofishing) for the Evrotas campaign, supported by containment where justified.

6. FIELD IMPLEMENTATION: ELECTROFISHING REMOVAL PROTOCOL

The operational backbone is a standardised depletion electrofishing protocol, with strong emphasis on safety, welfare, biosecurity, and consistent data capture so that outcomes are comparable across sites and time.

Equipment and technical parameters:

- The manual notes that generator-powered DC units (3–7 kW) are used in deeper/higher-conductivity waters; backpack units can be used in wadable headwaters. It also references standard voltage/current ranges (e.g., 300–600 V DC and ≤ 6 A aligned with FAME standards as cited in the manual).
- Within CASTOR, the team equipment includes:
 1. Two (2) generator-powered, shore-based DC power units (continuous/unpulsed DC):
 - Unit A: 3 kW output power, 150–600 V DC
 - Unit B: 7 kW output power, 150–600 V DC
 - Supplied with one (1) anode cable, 200 m length.
 2. One (1) generator-powered, portable DC power unit (continuous/unpulsed DC):
 - 1.5 kW output power, 150–500 V DC
 - Supplied with one (1) anode cable, 3 m length.

Operational design features:

- Reach subdivision (commonly ~50 m units) to standardise effort and documentation.
- Repeated passes to increase capture efficiency and quantify suppression.
- Containment (temporary barriers/stop nets) where hydrology and site conditions justify it and where removal efficiency is otherwise insufficient.



- Standardised recording of settings, effort, habitat conditions, and catches, enabling evaluation of effectiveness and cost.

Fish handling and welfare:

Captured fish are identified and processed under defined welfare procedures, including euthanasia (or a return-to-farm pathway where legally/logistically appropriate). The manual requires clear documentation of welfare methods and disposal chain.

Biosecurity:

Disinfection and cross-site contamination prevention are treated as mandatory to avoid transferring organisms/pathogens between waterbodies.

Permits and auditability:

The manual stresses that campaigns must secure the necessary permits in advance and be accompanied by detailed methodological documentation (sites, effort, gear settings, welfare procedures, disposal, biosecurity) and standardised reporting suitable for authority submission and long-term archiving.

7. MONITORING, SUCCESS CRITERIA, AND ADAPTIVE MANAGEMENT

Removal actions are framed as incomplete without verification. The manual defines monitoring designs and measurable success criteria, combining electrofishing surveys with complementary tools such as eDNA where appropriate.

Overarching indicators of success include:

- Eradication: no individuals detected in three consecutive annual surveys.
- Suppression: abundance consistently < 5% of baseline (using density or CPUE metrics).
- Recovery: longer-term increases in native species abundance/diversity (where feasible, evaluated with appropriate statistical tests).

Operational performance target for the Evrotas trout campaign:

- A minimum 70% reduction in trout densities at the post-removal phase in treated reaches.

Adaptive management loop:

Actions are designed to be iterative: if monitoring shows persistence or reinvasion, the protocol escalates (e.g., increased effort, additional passes, enhanced containment, follow-up extending beyond one year). Timing is emphasised, i.e., removal should coincide with low-flow periods immediately preceding the spawning season, while acknowledging that single-year interventions often deliver only temporary suppression; multi-year repetition may be required.

A practical lesson incorporated from prior Evrotas experience is that even strong within-year suppression (e.g., >70% in past campaigns targeting small-bodied invaders) may not equal eradication due to

recruitment dynamics and inaccessible microhabitats, hence the manual's insistence on follow-up monitoring and pre-defined triggers for repeating or intensifying actions.

8. HOW THIS SUPPORTS WIDER RESTORATION OUTCOMES IN CASTOR

Finally, the manual positions invasive-fish suppression as a precondition for successful native-fish recovery. In the CASTOR workflow, suppression of non-native trout in selected Evrotas tributaries and in the wider is intended to be followed by:

- Evrotas chub reintroduction and Evrotas minnow translocation in some of the treated tributaries (where planned), and
- restoration of critical habitats and improvement of habitat connectivity, so that benefits persist beyond the removal campaign and support drought-period refugia and movement.



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91 NERANTZIOTISSIS Str, 151 24, MAROUSSI, ATTIKI
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ANAVYSSOS, 46.7 km ATHENS – SOUNION AVE., P.O. Box 712, P.C. 190 13
+30 22910 76458 • lvard@hcmr.gr • <https://imbriw.hcmr.gr/>

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