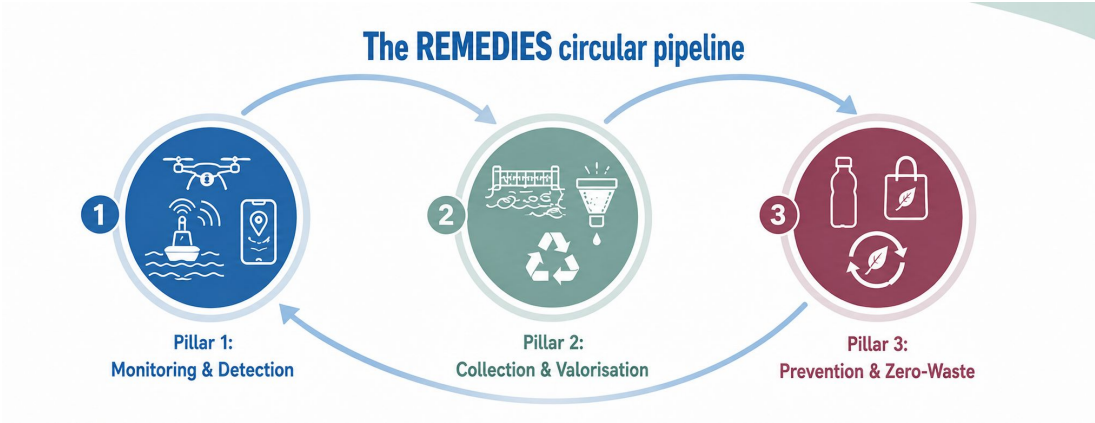
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MEDITERRANEAN SEA BASIN LIGHTHOUSE

Three Pillars for a Plastic Litter Free Mediterranean

To tackle the systemic crisis of marine plastic pollution across the Mediterranean basin, the REMEDIES project structured its technical and social interventions around three interconnected operational pillars.



Pillar 1 | Monitoring & Detection

We generate and share real-time data using drones, smart buoys, mobile apps and satellites to map plastic litter flows and identify pollution hotspots.

Pillar 2 | Collection & Valorisation

We intercept plastic before it reaches the sea through river barriers and wastewater filtration, then recover materials for circular uses.

Pillar 3 | Prevention & Zero-Waste

We reduce plastic at the source with reuse systems, zero-waste supply chains and behaviour change, eliminating single-use plastics from daily life.

Why was REMEDIES implemented this way?

To stop plastic pollution at every stage:

Cleaning up beaches isn't enough if plastic keeps flowing in, and preventing single-use plastic takes time. By combining Monitoring & Detection, Collection & Valorisation, and Prevention & Zero-Waste, REMEDIES tackles plastic before, while, and after it enters our waters.

To match the specific needs of every community:

Every region faces different challenges. REMEDIES 3-pillar setup allows local actors to pick and deploy the exact, field-tested technologies suited to their territory.

To turn emergency clean-ups into long-term local economies:

By combining smart monitoring, passive collection, and local zero-waste businesses, the REMEDIES 3-pillar structure allows regional leaders to turn marine waste into a complete, self-sustaining regional economy.

Co-creating a Plastic Litter Free Future

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Factsheet: Monitoring & Detection

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Pillar 1

1. The challenge solved:

Overcomes fragmented environmental datasets, unmapped underwater "blind spots", and slow, expensive manual surveys.

2. Pan-European interoperability:

Standardises survey protocols and builds digital feedback loops fully integrated with EMODnet and the European Marine Litter Database (MLDB).

3. Integrated technological toolkit:

Combines AI, autonomous aerial and underwater drones, satellite GPS buoys, and citizen science mobile apps to deliver real-time hotspot tracking , automated litter classification, and dynamic plastic drift mapping across river, coastal, and deep-sea environments.

METHODOLOGY AT A GLANCE

Want to understand the data behind this pillar?

Every Life Cycle Assessment metric, environmental indicator, and cost benchmark on this factsheet is defined in our REMEDIES Master User Guide & Methodology Manual. Use the guide to navigate the evaluation criteria, interpret the underlying metrics, and gain full transparency into how these REMEDIES solutions were measured.

Scan to access the methodology guide

INNOVATION / TECHNOLOGY UNDER PILLAR 1

Underwater Drone for Marine Litter Detection



ROV for detecting underwater litter and collecting sensor data on floating waste column microplastics.

Aerial Drone & AI



AI-enabled multisensor drone for rapid coastal plastic hotspot mapping.

Impact Evaluation Dashboard



Centralized platform for tracking KPIs, impacts, and policy progress in real time.

Nautiloc



Floating tracking box for real-time monitoring of currents and debris flow.

REMEDIES Shoreline Marine Litter App v.1.0



Citizen science app for reporting, geo tagging, and litter classification.

Pillar 1 | Monitoring & Detection

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Aerial Drone & AI

Innovation owner: MOH

Multirotor UAVs combined with deep-learning AI models provide rapid, high-resolution mapping and automated detection of plastic litter along coastal areas. The technology is designed to complement and progressively reduce reliance on time-consuming manual surveys, particularly over large or difficult-to-access coastal zones, while enabling faster and more systematic monitoring.



156 flights across 5 Mediterranean countries

23+ hours of flight time

3,247 annotated images

14 km of coastline mapped in Saïdia

Operational results

- **156 flights** across **5 Mediterranean countries** (Greece, Morocco, Albania, Italy, Slovenia), logging over **23 hours** of flight time.
- Processed **78 hours** of coastal video footage across **3,247 annotated images** aligned with EMODnet classification standards.
- Mapped **14 km of coastline** in Saïdia (Morocco) and surveyed more than **50 beaches** across Greece (Cyclades and Dodecanese) and **12 coastal locations** in Albania.

Performance

- Achieved a **73%** overall AI detection accuracy across diverse coastal terrains, identifying **2,847** individual plastic litter items in real time.
- **81%** accuracy on sandy beaches.
- **75%** accuracy on mixed sand/pebble coastlines.
- **68%** accuracy on complex rocky/cliff environments.

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Pillar 1 | Monitoring & Detection

Underwater Drone for Marine Litter Detection

Innovation owner: CLERA
Sampling and laboratory partner: CNR



CLERA developed and integrated a custom microplastic sampling module for remotely operated underwater vehicles. The system combines a seawater intake, pump, in-line flow meter and sequential filtration stages with nominal mesh sizes of 300, 100 and 50 µm. Underwater cameras support visual observation of submerged macro- and mega-litter, while the filtration module collects suspended material for laboratory analysis. Platform integration included the FIFISH V6 Expert, and CNR deployed the module on a Chasing M2 during the Sinis field campaign.

4
ROV deployments
at Capo San Marco, Sinis

240 litres
of seawater filtered (≈ 60 litres each)

23
items recovered
14 fragments and 9 fibres

3
WP2 plankton net deployments
for exploratory comparison

Operational results

- At Capo San Marco, Sinis, four ROV deployments filtered approximately **60 litres** of seawater each, totalling **240 litres**.
- CNR recovered **23 items**, comprising **14 fragments** and nine fibres.
- Three complementary deployments of a vertically operated WP2 plankton net collected a separate sample set for exploratory comparison.

Demonstrated functionality

- Controlled laboratory tests recovered PET particles and PA microfibres, demonstrating the mechanical functionality of the pumping and filtration system under the test conditions.
- Field samples underwent laboratory processing, microscopy and µ-FTIR analysis for material identification.
- The work demonstrated an integrated workflow connecting underwater deployment, measured-volume sampling, particle recovery and laboratory

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Pillar 1 | Monitoring & Detection

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Nautiloc

Innovation owner: CG



Autonomous, IP67-rated GPS tracking buoys engineered with a 5-year battery life to mimic the drift characteristics of plastic debris. Transmits real-time coordinates via GSM/AIS networks to map complex plastic drift pathways.

201 buoys deployed across the Aegean Sea and Northern Greek river mouths

15,000+ km of drift pathways tracked

100+ citizens, fishers and volunteers engaged

4 key accumulation hotspots mapped

Operational results

- Deployed **201** smart GPS/AIS tracking buoys across the Aegean Sea and Northern Greek river mouths (Axios, Aliakmonas, Strymonas, Evros).
- Tracked over **15,000 km** of cumulative sea-current drift pathways, mapping major Mediterranean plastic transport corridors and seasonal accumulation hotspots (Kavo Doro Strait, Oinousses, Amorgos, Chania Gulf).
- Engaged over **100** citizens, fishers, and local volunteers in buoy recovery actions using internal identification tags and the REMEDIES App.

Performance

- Engineered with UV-reinforced LHDPE plastic casing (~258 g, matching a 500 mL water bottle profile) offering high impact resistance and **4x faster drift velocity** compared to early wooden prototypes.
- Powered by long-life batteries providing up to **5-year tracking autonomy** and transmitting location coordinates via M2M connection every 12 hours.
- Full digital portal synchronization featuring automated “trapped device” alerts triggered when buoys remain stationary for **over 48 hours.**

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Pillar 1 | Monitoring & Detection

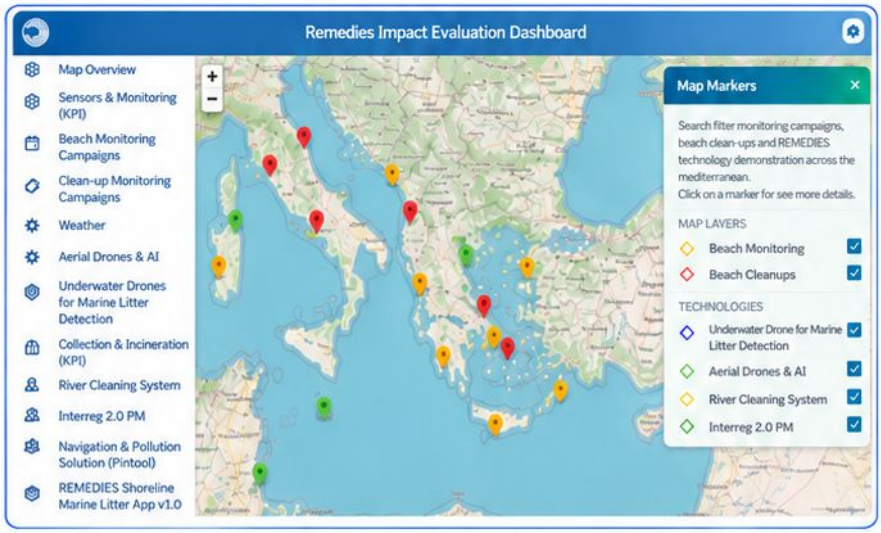
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Impact Evaluation Dashboard

Owner: CIBOS

A centralized Software-as-a-Service visualization platform that unifies clean-up, drone, and sensor data via automated APIs. Evaluates real-time KPIs, carbon footprint impacts, and policy progress across demonstration sites.





354
field campaigns
56 monitoring surveys and 298 clean-ups since 2023

40,790
litter items
recorded and sorted by material (92.6% plastic)

26.8
tonnes
of litter removed in clean-ups

Operational results

- Brings together **354** field campaigns in one platform, open to the public without login: **56** beach monitoring surveys on **6** beaches and **298** beach clean-ups since 2023.
- Covers **40,790** beach litter items recorded and sorted by material (92.6% plastic), and **26.8 tonnes** of litter removed in clean-ups.
- Presents the results of **11** REMEDIES solutions across the three pillars, linking them directly to their page in the REMEDIES Innovation Marketplace.

Performance

- **700+** active users, above the project target of 500. A visit counts only when the visitor actually uses the dashboard, not a single click.
- Updates automatically via API from the REMEDIES data repository, so the figures grow as partners add new campaigns.

Top 5 Countries by Litter Collected

Countries ranked by combined plastic and other litter weight collected across all recorded beach cleanup campaigns.



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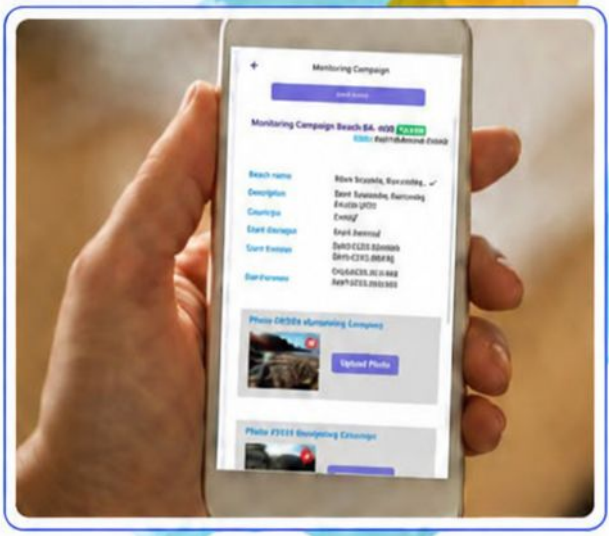
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Pillar 1 | Monitoring & Detection

REMEDIES Shoreline Marine Litter App v.1.0

Innovation owner: INFOR & VLPF

A guided mobile application standardizing beach surveys along 100-metre transects using J-coding. Converts volunteer clean-up data into EMODnet-compatible datasets, bridging citizen science with formal policy reporting



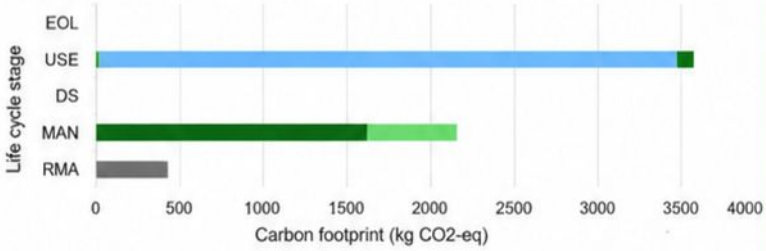
100-metre transects

J-coding standardisation

EMODnet-compatible datasets

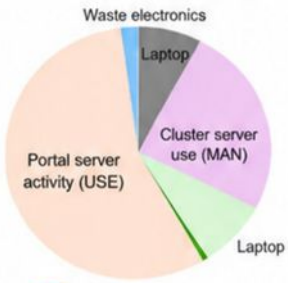
Citizen science + policy reporting

Hotspot Assessment (T4.1)



Laptop | Diesel | Cluster server use (MAN)
Laptop use (MAN) | Downloads (DS) | Foreground app use (USE)
Background app use (USE) | Portal server activity (USE) | Portal storage (USE)
Portal network (USE) | Waste electronics

Distribution of processes contributing towards carbon footprint



Laptop | Diesel | Cluster server use (MAN)
Laptop use (MAN) | Downloads (DS) | Foreground app use (USE)
Background app use (USE) | Portal server activity (USE) | Portal storage (USE)
Portal network (USE) | Waste electronics

What the graph shows

- Environmental impacts (carbon footprint) across the app's life cycle.
- Contribution of hardware, software development, server activity and network energy use.
- Identification of the main environmental hotspots.

Key Findings

- Digital solutions also have an environmental footprint, mainly due to servers and hardware.
- The use phase generates the largest share of impacts because of continuous server operation.
- Manufacturing impacts are linked to software development and computing equipment.
- Raw material impacts originate primarily from computer hardware.
- Optimising server efficiency and consideration of electricity sources offers the greatest improvement potential.

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