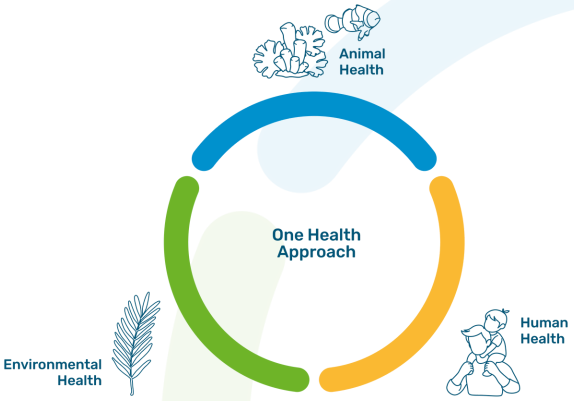
Case Study: Barcelona beaches and Ebro delta

Applying a One Health approach to protect people, nature and the coastal economy.

ENHANCE

What's at Stake: One Health Approach applied to Barcelona Urban Beaches and Ebro Delta

One Health is a **holistic framework** that sees human health, animal health, environmental quality and biodiversity as deeply interconnected. This approach is particularly relevant along the **Barcelona urban coastline** and the **Ebro Delta**—areas under intense touristic, urban, and climate change pressures. Declining water quality, beach erosion, and habitat loss don't just threaten local marine life—they compromise public health, reduce recreational value, and undermine vital economic sectors like tourism and fisheries.

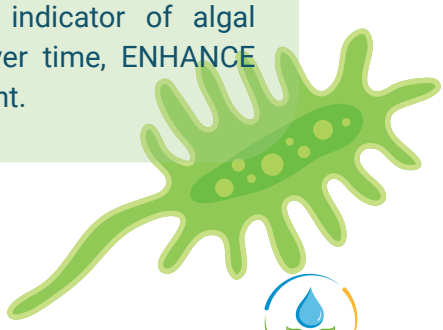


By applying the One Health lens, ENHANCE works to capture these **interdependencies**, empowering decision-makers to manage coastal zones more sustainably. In areas facing challenges like **eutrophication**, erosion, and habitat degradation, the project uses **citizen science**, advanced AI, and Earth observation data to track environmental pressures. This supports local stakeholders in protecting ecosystems and building climate-resilient, healthier coastal communities.

What is eutrophication, and why does it pose a major threat to the Catalan coastline?

Eutrophication occurs when **excess nutrients**—mainly from farming, runoff, or aquaculture—accumulate in coastal waters. This fuels rapid growth of **phytoplankton**, microscopic algae naturally present in marine ecosystems. In excess, they cloud the water, deplete oxygen, and disrupt marine life and ecosystem balance.

And that is a growing concern along the Catalan coastline. Nutrient runoff from rice fields, mussel farming, and heavy tourism fuel algal blooms, risking biodiversity and health. **Chlorophyll-a,** a pigment in phytoplankton, is a key indicator of algal concentration and **eutrophication** risk. By tracking its levels over time, ENHANCE helps detect **nutrient pollution** early and guide coastal management.



ENHANCE

Two hotspots, one coastline

BARCELONA METROPOLITAN BEACHES

Tourism pressure and eutrophication risk

- **Barcelona** has 10 million visits/year and the highest population density in Spain (16,637.5/km²).
- Beaches are the city's **main spaces** for **mental** and **physical health** and recreational outdoor activities.
- Beach bars, surf schools, dive and snorkel tour operators, among others, all rely on **clear, safe** and **well-kept beaches**.
- Since 2014, severe **storms** and isolated depressions at high levels (DANA Spanish acronym (e.g. Glòria, Filomena) accelerating systems changes.

EBRO DELTA BAYS

Agricultural drainage, aquaculture and phytoplankton-bloom risk

- The **Ebro River** drains Spain's largest basin (84,230 km²) and builds a 320 km² delta, a recognised nature-protected area.
- The delta also hosts **Spain's largest rice fields**, and about 3,000 tonnes of mussels are farmed yearly on 166 rafts.
- **Seasonal swings** in salinity and nutrients fuel phytoplankton blooms that can cloud the water and stress farmed and wild species.
- The delta is literally shrinking as sediment supply falls, exposing fields, wetlands and villages to **erosion** and **storm surge**.

The Goals

People

Protect public health by maintaining healthy coasts and ecosystems, ensuring safe bathing waters, nutritious seafood, and accessible beaches for recreation and well-being.

Nature

Reduce eutrophication and track coastal erosion, using satellite and in-situ monitoring, to safeguard habitats, foster biodiversity, and build coastal resilience against storms and climate change.

Economy

Deliver actionable data that supports sustainable tourism, aquaculture, and farming—aligning local economic activity with long-term ecosystem health.

ENHANCE

The Challenge

To manage the health of coastal ecosystems like the Barcelona beaches and the Ebro Delta, ENHANCE integrates **diverse data streams**—high-resolution satellite imagery, **Copernicus** water-quality layers, low-cost sensors, and citizen science records. The challenge is not just gathering data, but making sense of it in places facing overlapping pressures: tourism and wastewater in Barcelona, and agricultural runoff and aquaculture in the Delta. Turning this complexity into **timely, usable information** is essential for local stakeholders—**from coastal managers** and **public authorities** to **businesses** whose livelihoods depend on clean, resilient shorelines.

ENHANCE Tools & Innovations

SCIENTIFIC & ADVANCED MONITORING

- **Copernicus Sentinel-2** satellite images (10-20 m) track shoreline change, turbidity and chlorophyll-a every few days.
- **Copernicus Mediterranean Bio-Geo-Chemical** layers (L3 daily, L4 monthly) supply chlorophyll-a, nutrients and oxygen maps.

PARTICIPATORY SCIENCE

- **MINKA platform** hosts 34,000+ volunteer observations of 600 marine species from divers, snorkellers and beachgoers.
- **"Do It Yourself" low-cost optical sensors** stream real-time colour, turbidity and temperature from buoys and piers.

By fusing these input layers, ENHANCE will produce **pressure maps** (D-LUSI, chlorophyll-a) and **impact maps** (water quality, biodiversity loss) for early warning on environmental health risk in both areas.

ENHANCE

Who's involved: the One Health Community for the Catalan coastline

Leading community (Academia): The **Institut de Ciències del Mar (ICM-CSIC)** leads on satellite and sensor science, ensures data quality, hosts the **MINKA** Citizen Science Observatory and organises stakeholder workshops.

Participatory community (Civil Society): volunteer divers, snorkellers, **beachgoers**, and Blue Schools pupils involved in on-site measurements;

Mobilising community (Business and NGOs): **Coastal SMEs** (surf schools, dive & snorkel operators, mussel farmers, rice growers), the **Catalan Federation of Underwater Activities** (FECDAS) and NGOs that recruit, train and equip volunteers.

Facilitating community (Public Authorities): **Barcelona City Council**, Catalan regional agencies, and the **Ebro Delta Natural Park** provide long-term monitoring data, ensure open data access, and help embed project results into coastal management.

ENHANCE

Lead Partners in Barcelona Case Study

embimos

Institut de Ciències del Mar

EXCELENCIA SEVERO OCHOA

CSIC

How to get involved ?

Explore ENHANCE project and follow our progress and milestones!

Join our community!
enhance-onehealth.eu

@enhance_eu **@enhanceeu**

Upload your beach observations to MINKA. Help keep our coasts healthy!

Contribute to MINKA
Citizen Science Observatory
https://minka-sdg.org

MINKA

A project coordinated by

Singular Logic

Funded by the European Union

EUSPA European Union Agency for the Space Programme

"This project has received funding from the European Union's Horizon Europe under grant agreement No 101180146 —ENHANCE. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the granting authority. Neither the European Union nor the granting authority can be held responsible for them."

Singular Logic CSIC University of Thessaly Amaranthus ENRICH Global G.A.C. Group nazka