

Pond of San Giovanni
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SMART GATE AND MONITORING NETWORK



Site: Marceddì
Lagoon and San
Giovanni Pond
Municipality: Terralba
RAMSAR Site: No. 179
SAC: ITB030032
SPA: ITB034004



the Rio Mogoro, Rio Mannu, and Rio Sitzerri.

The two basins are separated by an inter-lagoon embankment. A small overflow basin was created at the river mouths to channel freshwater towards the sea and isolate it from the rest of the lagoon system.

The area has been internationally recognized under the Ramsar Convention since 1979 for its importance to nesting and wintering waterbirds, and is part of the Natura 2000 network (SAC and SPA) due to priority habitats and species of EU interest.

The lagoon is regionally important for fisheries managed by the Consorzio Coop. Riunite della Pesca di Marceddì, involving about 140 operators under concession from the Sardinia Region.

The numerous hydraulic modifications carried out in recent decades, including the construction of the bridge connecting the opposite banks of Marceddì and the embankment bordering the San Giovanni lagoon, have disrupted the natural balance between freshwater and brackish water, impacting oxygenation, water quality, and productive activities.

PROJECT DATA

➤ **Type:**
Technological and digital solution

➤ **Authorization phase duration:**
10 months

➤ **Implementation phase:**
16 months (Jan 2024 – Apr 2025)

➤ **Testing start:**
May 2025

➤ **Funding sources:**
H2020 TransformAr project (EU) and Waterlands project (private funds)

➤ **Total cost:**
290.000 €

The Marceddì and San Giovanni lagoon system, located in the southern part of the Gulf of Oristano (Sardinia), consists of the brackish Marceddì Lagoon and the San Giovanni Pond, whose salinity is influenced by freshwater inflows from

Main Environmental Issues

- Poor water circulation
- Gradual silting of the San Giovanni inner basin
- Decreased fish stocks
- Low oxygenation of water, especially in summer
- Deterioration of chemical-physical parameters
- Weak ecological connectivity
- Sediment pollution

Technology and Innovation

This wetland system is now at the heart of a broader environmental restoration project that integrates Nature-Based Solutions with innovative technology.

A key element is a pilot project to regulate water flow between the freshwater inputs (from rivers) and the brackish waters of the San Giovanni Pond.

The project is based on the integration of several elements.

➤ INFRASTRUCTURE

A stainless steel Smart Gate, with movable components for partial or full opening depending on hydrological conditions, operated by a hydraulic motor. Powered by solar panels installed on the roof of a birdwatching hut built near the Smart Gate to enhance nature tourism.

➤ MONITORING NETWORK

The Smart Gate is controlled by a network of multiparametric sensors and level gauges distributed in three different stations: 2 stations inside the San Giovanni Pond and 1 at the river mouth. They measure in real-time the following parameters: Temperature, pH, dissolved oxygen, conductivity, turbidity, redox potential, water level.

Wooden poles anchored to concrete bases ensure stability even in unstable muddy terrain and strong winds. Each station includes a data logger with SIM for data transmission and a solar panel for autonomous power.

A weather station and two additional hydrometers on the Marceddì Bridge complete the environmental monitoring network.

➤ DATA PLATFORM

Data collected every 30 minutes is transmitted to an online platform, where a centralized management software integrates everything and allows remote control of the Smart Gate.

A geoportal enables users to view and download raw or processed data depending on their profile.

Objective
To define an integrated model of technology and environmental protection that can be replicated in other lagoon contexts



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System Functioning

The operation of the Smart Gate is mainly based on the following conditions:

- Water level at the river mouth exceeds safety thresholds
- Water quality parameters are critical for fish fauna
- Adverse weather with flood risk is forecast
- Seasonal water renewal is needed for ecological or management purposes

The thresholds were defined through a multidisciplinary calibration involving ecologists, engineers, managers, and fishermen.

Normally, the Smart Gate remains closed to prevent freshwater from entering the pond and to maintain optimal levels. It opens when model-defined thresholds are reached — primarily following the Italian Environmental Law D.Lgs. 152/2006, especially relevant to shellfish farming.

A full weekly open/close cycle is planned to ensure regular operation.

In case of extreme weather events, the Smart Gate can also be manually or remotely controlled.

MAIN COSTS

- **Smart Gate and hydraulic motor** (~ 96,000 €)
- Providing and installing **3 water monitoring stations** and **1 weather station** (~ 65,000 €)
- **Birdwatching hut** with integrated **solar panels** (~91,000 €)
- **IT control platform** for data management (~ 18,000 €)
- **Technical support** and designing the solution (~19,000 €)



Smart Gate installation

Smart Gate control cabinet

Station with multiparametric probe

Weather station on Marceddì bridge

Birdwatching hut

LESSONS LEARNED

Among the aspects that emerged during the implementation and management phases of the project, and which are useful for improving future installations and replications of the model, are:

- **Careful selection of sensors:** it is important to choose devices designed for brackish and marshy environments, preferably models equipped with integrated self-cleaning systems. This helps to extend the operational life of the devices, reduce routine maintenance costs, and ensure the quality of the collected data. In any case, it is advisable to include at least monthly cleaning in the maintenance plan.
- **Early involvement of future system operators,** ensuring that technological choices (e.g., radio transmission, remote access, solar power supply) are compatible with potential technical requirements and available resources.
- **Use of AISI 304 stainless steel** for structural components to ensure durability and resistance in marine and lagoon environments.
- **Potential sediment buildup in the Smart Gate closure area,** which could hinder proper closing: it is recommended to equip the system with position or motion sensors to monitor the actual status and position of the Smart Gate.
- **Direct connection between sensors and automation system** improves efficiency and autonomy of hydraulic regulation.



PROJECT COORDINATION AND DEVELOPMENT

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COLLABORATIONS

Emanuele Tiddia (Project Director)

Criteria srl (Designers)

NemeA Sistemi spa (IT platform developers)

Geoves (Suppliers of environmental monitoring probes)

CGP srl (Construction company)

IREM (Smart Gate design and implementation)

The Wetland Observatory supports the conservation and sustainable management of wetlands in Sardinia. It collects and analyzes environmental data to monitor ecosystems, threats, and conservation strategies. Through webGIS and technical reports, it disseminates information on ecological status, biodiversity, and ecosystem services, raising awareness of the importance of wetlands in tackling climate change.

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