

## AQUABIO: PREVENT HEALTH RISKS TO BATHERS FROM DISCHARGES OF UNTREATED WASTEWATER

### CHALLENGE

From the 1950s to the 1980s, the city of **Barcelona lived with its back to the sea.**

In addition to the existence of factories and warehouses near the coast, there was an uncontrolled process of proliferation of shantytowns and shantytowns on several beaches, constructions that housed human settlements that lived poorly with very few economic resources.

The intensive human presence, the lack of government sanitation policies and the dumping of untreated water into the sea made the **Barcelona coastline unhealthy and usually acquired the sad appearance of an urban dump.**

The historical degradation of bathing water opened a new chapter in 1986 when **Barcelona was nominated to host the 1992 Olympic Games.**

Barcelona eradicated shantysm and **opened its life to the sea.**

Currently, the 4.5 km of coastline of the Catalan capital are distributed in 10 beaches that, according to the latest available data for the year 2021, have a very important socio-economic impact for the city.

They receive each year more than 3.8 million visitors who, on average, make an economic expenditure of 6 €/day accumulating a total expenditure of 695,007 €/day.

The great attraction of the coast is explained by several factors. Because of its proximity, environmental quality, leisure offer, relaxation and becoming an ideal place to socialize.

However, **Barcelona has a challenge.** To **monitor as accurately and efficiently as possible the quality of the bathing areas** and alert the population in case of non-compliance with established health standards.

The problem lies basically in two aspects.

**The first lies in the geography of Barcelona,** a city of 98 km<sup>2</sup> surrounded by two rivers (the Llobregat and the Besós) and with a very steep slope from the Collserola mountain to the sea.

The permeability of the soil has been greatly diminished by the exhaustive urbanization of a capital city with a population of 1.6 million citizens and a high density of inhabitants: 15,867 inhabitants/km<sup>2</sup>.

**The second problem is that the more than 1,800 km length of the sewer system forms a Combined Sewer System (CSS),** i.e., stormwater and domestic wastewater are collected in the same network of pipes.

Climate change models predict more heavy rainfall and current sewer systems have not been designed to cope with the new rainfall volumes.



aquaBio B-503

In case of heavy rainfall events the 500,000 m<sup>3</sup> capacity of the 15 storm tanks is overflowed and the rainfall events become uncontrolled discharges (pollution event) of untreated sewage **Combined Sewage Overflows (CSO)** into the sea.

Barcelona records an average of 7.5 USD events during the bathing season (June to September).

In addition, urban runoff discharged into the marine environment adds to the accumulation of waste of human, natural and animal origin: textile, metal, plastic and vegetable waste appears, as well as wet wipes, dead animals such as mice, bad odors and pathogens.

The **image of Barcelona is damaged** and the impacts on public health, economic, social, environmental, etc., increase exponentially.

## ADASA'S SOLUTION

To address this problem, Barcelona City Council is currently using the **aquaBio** device designed, manufactured, deployed and maintained by Adasa as part of the iBathWater project.

iBathWater is an initiative financed by the European Union's LIFE program (LIFE17 ENV/ES/000396) and involves partners such as **Adasa Sistemas**, Fundació Eurecat, Barcelona City Council, Barcelona Cicle de l'Aigua, SA and Kompetenzzentrum Wasser Berlin GmbH.

The main objectives are to **reduce the amount of land-based floating solids and garbage discharged into the sea** during rainy days, to **minimize the health risks for bathers associated with recreational water quality** by implementing an early warning system and to reduce the number of DSU during rainy days.

**aquaBio**, still in operation, has contributed to the project the **automatic, continuous and on-line monitoring**, identification and microbiological measurement of fecal contamination indicators such as *E. coli* (*Escherichia coli*) and *Enterococci* in two stations on the beaches of Bogatell and Port Olímpic in the catalan capital.

At the **Bogatell station**, the two **aquaBio** measurement equipment operated at first with two different intakes, managed by the BCASA control center. At present, the measurement is carried out at Nova Içària beach.

At the **Port Olímpic station**, the measurement point is at Somorrostro beach. A recirculation pump is used to take the water to the point where the two **aquaBio** units are taken.

One of the key features of **aquaBio** is the **episode mode**, which is activated during episodes of rainfall and makes it possible to know the exact moment at which the bathing water recovers the right quality.



Port Olímpic Station hosting the aquaBio device.

**aquaBio's** continuous, daily monitoring of the water quality status **provides up-to-date and reliable information**, thus exceeding the analysis requirements of the European Bathing Water Directive (DIR 2006/7/EC).

This regulation only requires specific measurements to be carried out at least 4 times during the bathing season, with an interval of no more than one month in between.

In the case of short-term pollution, an additional sample must be taken to confirm the end of the incident.

The disadvantages of this regulation lie in the frequency of measurements and the large investment of time needed to carry out the analyses, obtain the results and proceed to reopen the beaches.

## AQUABIO'S ADDED VALUE

With the incorporation of **aquaBio**, public entities multiply the benefits of the implementation of new strategies that seek to ensure the quality of beach water:

- Improved management of bathing areas:
  - Clearer and better managed public information.
  - Daily update of microbiological contamination to ensure the safety of bathers.
  - During the bathing season, management of the flags/information boards/web pages of the bathing areas.
- Minimises health risks to bathers.
- It reduces economic losses by avoiding long beach closures.
- It contributes to the calibration and verification of pollution dispersion models.
- It provides the possibility to consult statistical data throughout the year.
- Improve society's trust in local authorities.
- It adds value to tourism through a philosophy of sustainability and excellence.

**aquaBio's** services include:

- Thanks to **ETV verification (Environmental Technology Verification)** the data provided by **aquaBio** is reliable and its credibility is accredited by an independent body. In this way, decisions derived from monitoring with **aquaBio** can be made with confidence and ensure safe bathing for the users.
- Quantifies *E. coli* and *Enterococci* in MPN/100 ml in only 3 hours in heavily contaminated water and in 12 hours guarantees the absence of *E. coli*.



Nova Icària Beach at the Olympic Port of Barcelona.

## RESULT

**aquaBio** detected **31 discharges from the unitary system during the 45 days** of significant rainfall recorded in 2021 at Somorrostro beach (Port Olímpic station), 8 of which occurred in the four months of high season.

According to Barcelona Cicle de l'Aigua, SA (BCASA), the entity responsible for managing the water cycle in the city, having equipment such as **aquaBio provides detailed information on rainfall events that could not be detected with conventional weekly analysis methods.**

Thanks to **aquaBio**, it was possible to identify the 8 rainfall events recorded during the high season.

Furthermore, **aquaBio** has proven to be a technology that **provides reliable results in much less time than conventional sampling.**

In fact, the data obtained were compared with the analysis of samples in Adasa's laboratory.

Calculations showed that **there are no significant differences between the two methods, confirming aquaBio** as a totally reliable device for continuous, on-line microbiological measurement.

Therefore, **aquaBio** helps to **comply with RD 1341/2007, transposition of the European Bathing Water Directive D.2006/7/EC**, under which it is mandatory to have samples available during short-term pollution episodes until sufficient quality for bathing is reached.

On the other hand, the *E. coli* measurements obtained by **aquaBio** were contrasted with rainfall in Barcelona and the **correlation between rainfall and *E. coli* concentration was demonstrated.**

In general, the results provided show that **when it does not rain, *E. coli* remains at values <10 NMP/100 ml.**

At Bogatell beach, concentrations are generally much higher and the correlations between rainfall events and high *E. coli* levels were also confirmed.

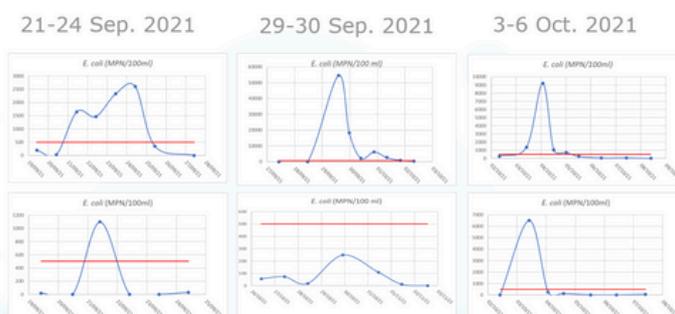
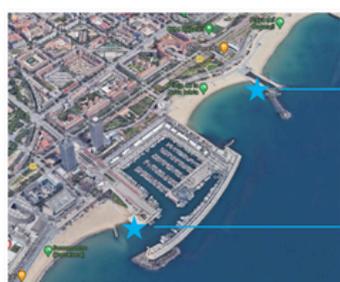
The implementation of the iBathWater project in Barcelona has been a **starting point for a real improvement in the management of marine bathing water** in urbanised cities.

The **aquaBio** equipment **continues to operate after the end** of the iBathWater project in 2022.

## CLIENT

The total budget of the project was 2,274,164 euros.

The EU LIFE programme finances part of this budget with 1,364,497 euros under grant agreement no. LIFE 17 ENV/ES/000396.



*The episode mode has been developed to be able to follow up after a DSU due to rain and is activated from the control center. The equipment switches from daily mode to continuous measurement until the value at which the water quality has recovered, allowing to know the moment when the quality is optimal again.*