

# baies et rives

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# FOREVER, a project on flat oysters

## Heritage, biodiversity and the circular economy: a triple challenge

*FOREVER, for Flat Oyster REcoVERy, is a three-year project (2018-2020) to promote the reestablishment of flat oysters in Brittany. This multi-partner project is led by CRC Bretagne and involves CRC Bretagne Nord, IFREMER and ESITC Caen. It has just been selected as part of the 2017 FEAMP Aquaculture Innovation call for projects.*

The project consists of (1) inventorying and evaluating the status of the main wild flat oyster populations across Brittany, (2) making detailed environmental analyses of the two largest oyster beds in the bays of Brest (Roz bed) and Quiberon (Penthièvre bed) to enhance understanding of flat oyster ecology and recruitment variability and to suggest possible ways of improving recruitment, and (3) proposing practical measures for the management of wild beds, in partnership with industry professionals and marine managers through the establishment of an oyster restoration demonstration site using procedures linked to the circular economy.

### Context

In France, the flat oyster was once a dominant species in most coastal ecosystems but is now confined to only a few localized environments, notably in Brittany and Normandy. Moreover, these residual populations are subjected to growing threats that limit them still further, to the point that if no action is taken soon, the species and its habitats could disappear from our coasts. The species has already disappeared from a large part of the North Sea.

On an ecological level, oysters are an “engineer species”: they build habitats favourable for other organisms and thus increase the biodiversity of the surrounding environment. Because an oyster population has the capacity to construct real calcareous biogenic reefs, this group of species is the temperate

equivalent of tropical coral reefs. However, on a worldwide scale, oyster reefs are in the front line as some of the most severely threatened coastal habitats. A recent study showed that 85% of reefs in the world had been “seriously damaged or even destroyed”. This is particularly the case in Europe for the native flat oyster, *Ostrea edulis*, which is on the OSPAR (Oslo/Paris Convention for the Protection of the Marine environment of the North-East Atlantic) List of Threatened and/or Declining Species and Habitats and has been the subject of targeted conservation and restoration measures in the United Kingdom and Germany.

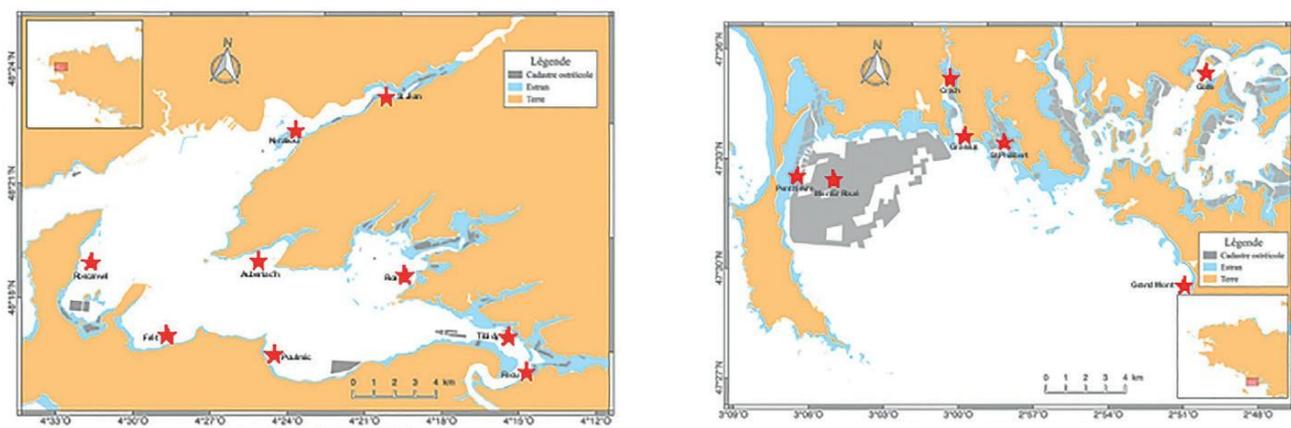
The restoration of flat oyster habitats and populations is an objective, the scope of which goes beyond Breton shellfish farming alone and corresponds perfectly with the challenge of blue growth foreseen in this century. Oyster reefs provide ecosystem services that include related benefits for coastal fisheries resources (nurseries, refuges, non-target species, etc.) for recreational activities and the health of the ecosystem as a whole.

### A short history

As the flagship species of Brittany shellfish farming, flat oyster production topped 20 000 tonnes p.a. in the 1960s. In the 1970s this fell dramatically to 2000 tonnes as a result of two parasitic diseases (Bonamiosis and Marteiliiosis) that are still present. This level of production has been maintained over the last 30 years. However, following poor recruitments in recent years, Quiberon bay production fell to 500 tonnes in 2015 causing financial difficulties for businesses specialising in this species. It should be noted that, although residual populations exist all along French coasts, flat oyster production in France relies on the collection of wild juveniles, which is only done in two sites in the bays of Brest and Quiberon. This collection was better in 2016 and 2017, but efforts made to sustain wild beds should be encouraged over the long term, accompanied by scientific research and strengthened by innovative approaches.

From 2010 to 2014, the PERLE and EVER projects made it possible to draw up an initial inventory of residual flat oyster populations in Brittany, notably in the two most important ecosystems for the industry (Brest and Quiberon bays, Figure 1.).

Figure 1: Sites of detailed study (Brest and Quiberon bays) and locations of important wild flat oyster beds.



## ➤➤ FOREVER (continued)

FOREVER aims to inventory the main remaining wild populations in Brittany, to gather as much detailed information as possible on the role of these populations in the recruitment of the species in the last two Breton ecosystems where wild collection is still done, and to propose innovative methods for restoring and sustaining the most remarkable beds. Together, these actions aim to perpetuate the wild collection and production activities of this endemic heritage species while ensuring its long-term role in the marine biodiversity of our coasts.

### Actions

⇒ **Action 1:** Inventory the main wild flat oyster populations in Brittany and describe their health status.

- **InVENTORY and characterization of beds in Brittany:** General health status will be evaluated through demographic parameters (density, size structure, and mortality) and associated benthic diversity. Certain beds will also be sampled for genetic diversity analyses.
- **In-depth characterization of genetic resources:** To place the Breton oyster populations in a national or European context, based on existing data, the different beds inventoried in Brittany will be analyzed for their diversity and genetic structure.



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⇒ **Action 2:** Perform a detailed environmental analysis and understand the dynamics of the two remarkable beds still remaining in the bays of Brest (Roz bed) and Quiberon (Penthièvre bed). These two beds are considered important contributors to recruitment (and therefore to wild collection) in these two ecosystems. This work includes (1) defining the precise geographic boundaries of these beds (2018 status), (2) characterizing the structure of the populations present (density, size structure and genetic structure), (3) characterizing the health status of the populations present (prevalence of Bonamiosis and Marteilirosis, physiological quality) and annual mortality rate, (4) describing the physical environment (Temperature, Salinity, pH) and the biodiversity associated with these beds (taxonomy of epibionts), (5) detailing the trophic environment of the oyster beds, (6) improving understanding of recruitment dynamics within a bed (distribution of larval abundance, regular deployment of experimental collectors, essential substratum, larval behaviour).



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⇒ **Action 3:** Propose a testing ground and safeguarding, restoration and management measures for these beds in partnership with local actors.

Recent studies have shown that the Roz bed in the bay of Brest and the beds in Quiberon bay are zones of interest and it is here that the first restoration operations were initiated by the oyster farming industry (seeding with juveniles in Quiberon bay) or by fishers (depositing shells on the seafloor to favour target species in the area). These operations, which the industry wishes to perpetuate, will also serve as pilot demonstration experiments.

These zones still harbour either threatened residual beds at similar densities of adult oysters (Roz and Penthièvre beds), or “artificial” beds, known as such because they are regularly seeded with inputs of endemic adult and juvenile oysters (central bed in Quiberon bay). Over all of these beds, some habitats are certainly degraded, notably by the lack of settlement structures (shells of adult oysters and other hard stable substrates) but this has not yet reached a critical stage. In fact, clumps of flat oysters (conglomerates of several oysters stuck to one another) can be observed, as well as isolated adults, serving as settlement substrates for newly recruited juveniles; this constitutes the first step in the formation of underwater reefs. It will, however, be necessary to add further settlement structures. Recent PhD work on artificial reefs underlines the benefits of using concrete that incorporates marine shells instead of the classic quarry aggregates. The objective will be to develop structures of a size and shape that are suited to flat oyster recruitment and growth, easy to use, and on which colonization can be easily evaluated.



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This work will provide a means of adding value to shellfish farming by-products (circular economy) for the production of settlement substrates, which will be developed to improve control of settlement, wild collection of flat oysters and bed restoration.

In general, throughout the project, the work will be done in partnership with industry professionals and fisheries and shellfish farming bodies, regional government authorities, environmental management organizations (e.g. Natura 2000) and ESITC Caen, who will be responsible for developing suitable settlement structures that have a high calcareous content by incorporating shellfisheries by-products in calcareous concrete.

### Expected results

By the end of the three-year project, the following results are expected:

- A regional inventory of the main flat oyster beds in Brittany, accompanied by an assessment of their health status and genetic diversity,
- In-depth characterization of the two main remaining wild beds in the bays of Brest and Quiberon,
- A better understanding of the factors determining recruitment of this endangered native species,

- Application of realistic larval connectivity tools, including larval behaviour, to better understand the living dynamics of an oyster bed,
- In-depth analysis of the distribution of parasites in the environment around the beds,
- Contribution to the implementation of bed management, conservation and restoration measures in partnership with industry professionals and managers,
- Development of special settlement structures made of calcareous concrete (e.g. shellfish by-products) that are more suitable for flat oyster bed restoration: design and manufacture of structures intended for immersion,
- Oyster bed pilot restoration site with or without the use of resistant lines (north Brittany, Porscave hatchery and south Brittany, respectively).

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Stephane Pouvreau (2017). Underwater images of the last native oysters beds in Brittany (France). IFREMER. <http://doi.org/10.24351/48842>



# Extra

## Perle II

*Perle II is a flat oyster selection programme. Its objective is to produce 200 families and test them at sea to find a pool of families of interest by selection based on oyster/parasite phenotypes.*

*Perle II has just been selected as part of the 2017 FEAMP Aquaculture Innovation call for projects.*

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