



e Man Mud Flats Birds Fresh Water Salt Water Coastline Wellington Boats Habitats Dunes Ducks Cutting Salt Marshes Wetland Land Sea Crosses Estuary...

Project Report

# *Life* Baie de l'Aiguillon 2016–2022



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# Acknowledgements

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# CONTENTS

|   |    |
|---|----|
| <i>Acknowledgements</i> .....   | 2  |
| <b>PART 1 • Development of a LIFE project</b> .....   | 4  |
| <b>PART 2 • The Aiguillon Bay and areas of intervention</b> .....   | 6  |
| The Aiguillon Bay.....  | 7  |
| Pointe de l'Aiguillon.....  | 8  |
| Prée Mizottière.....  | 9  |
| <b>PART 3 • Protecting biodiversity by managing environments and uses</b> .....                                 | 10 |
| <b>SHEET 1.</b> Protecting dunes, channelling beach users<br>and raising awareness about their environment..... | 11 |
| <b>SHEET 2.</b> Restoring anthropised inland dunes.....   | 14 |
| <b>SHEET 3.</b> Restoring mud flats by removing<br>former shellfish farms.....                                  | 16 |
| <b>SHEET 4.</b> Depoldering farmland.....   | 19 |
| <b>PART 4 • Learning through scientific monitoring</b> .....  | 22 |
| <b>SHEET 5.</b> Monitoring water quality<br>along the land-sea continuum.....                                   | 23 |
| <b>SHEET 6.</b> Monitoring use of the area by wintering Anatidae.....   | 26 |
| <b>SHEET 7.</b> Typifying available seed banks<br>in Anatidae habitats.....                                     | 28 |
| <b>PART 5 • Communication and raising awareness</b> .....   | 30 |
| <b>SHEET 8.</b> Creating various communication media.....   | 31 |
| <b>SHEET 9.</b> Sharing feedback during conferences.....  | 33 |
| <b>SHEET 10.</b> Raising public awareness through science shows.....  | 34 |
| <i>Contacts</i> .....   | 36 |
| <i>Sponsors</i> .....   | 36 |



# Development of a **LIFE** project

The salt marshes of Champagné-les-Marais.  
© RNN baie de l'Aiguillon



The Marais Poitevin is the largest wetland on the Atlantic coast. It is the result of the Golfe de Pictons being filled in, and today is home to various natural environments and considerable biodiversity. This is why it has been recognised as being of Community interest on a European level.

The Aiguillon Bay, a listed National Nature Reserve, is the maritime side of the Marais Poitevin. It is a huge natural area made up of remarkable environments and is home to exceptional biodiversity. This area between land and sea, influenced by tides and storms, is of great ecological interest. It is at risk of sedimentary filling, and is subject to significant human activity (coastal development, agriculture, shellfish farming and tourism). Furthermore, prospects of climate change have spurred this area

to adapt its protective measures against the sea. Coastal habitats now play a new role in public policy, because they can take part in developing protective measures.

The Marais Poitevin Natural Regional Park and managers of the Aiguillon Bay National Nature Reserve (the French Biodiversity Agency and the League for the Protection of Birds) developed and implemented the 'LIFE Baie de l'Aiguillon' project.

From January 2016 to June 2022, this project aimed to implement Natura 2000 initiatives, such as the protection, restoration and promotion of coastal areas of European interest, by putting into place five strands of ambitious action:





# The **Aiguillon Bay** and **Areas** of **Intervention**

The salt marshes and mud flats of Triaize.  
© RNN baie de l'Aiguillon

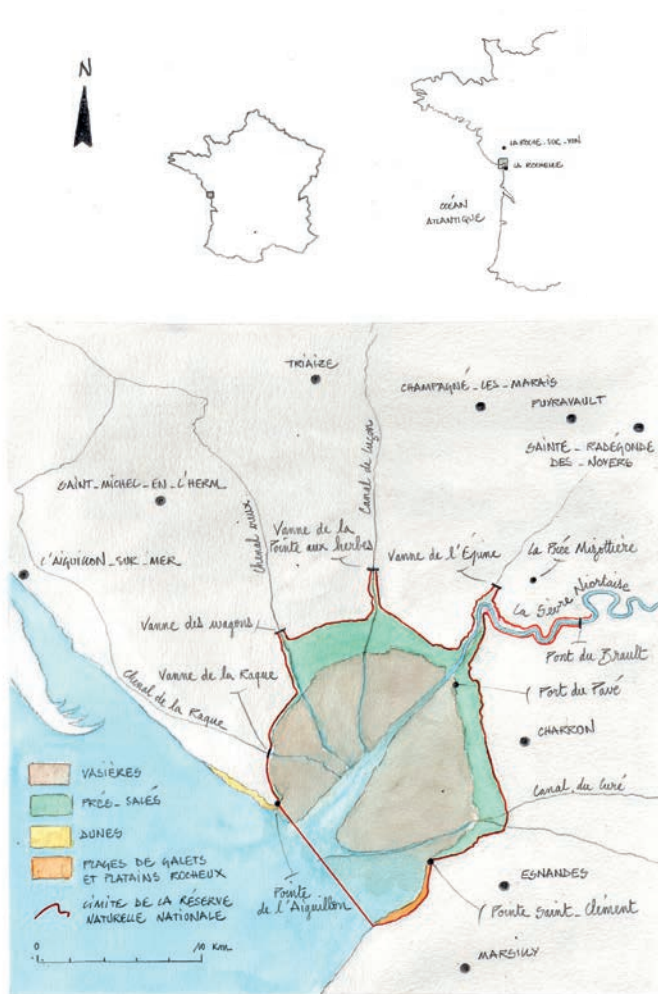


# THE DIFFERENT AREAS OF INTERVENTION OF THE LIFE BAIE DE L'AIGUILLON PROJECT

## The Aiguillon Bay

### ► Location and Presentation

The Aiguillon Bay National Nature Reserve is located on the Atlantic coast, straddling the Charente-Maritime and the Vendée departments. It is downstream of the Marais Poitevin and in the north of the Pertuis Charentais. The Aiguillon Bay has been listed as a Reserve since 1996 for the part in Vendée and 1999 for the part in Charente-Maritime. The National Nature Reserve is on a major migratory axis, and is an area for migrating and wintering birds to relax and feed.



Localisation and habitats in the Reserve in the Aiguillon Bay.  
© Benoît Perrotin

### ► Types of Environment and Biodiversity

- The mud flats (9,390 acres) are home to a large number of molluscs and worms, which are food for many types of birds
- The salt marshes (2,718 acres) are made up of typical flora that can resist coastal flooding. This type of plant encourages herbivore Anatidae to winter here. It is also a feeding area for fish
- There are smaller areas such as the dunes of the Pointe de l'Aiguillon, the pebble beaches in Egnandes and the rocky flats of Marsilly.



Dunlins (*Calidris alpina*) feeding on the mud flats.  
© Trevor Froud

### ► Identified Problems in the Area

- There are former shellfish farming structures that are changing the way the bay works
- The influence of fresh water from the Marais Poitevin on the coastal zone is of environmental and economic (shellfish farming area) importance.



Abandoned oyster racks, used for the development of Pacific wild oyster (*Calidris alpina*) beds.  
© Thomas Jouanneau/PHONIC LIPS





Pointe de l'Aiguillon  
© Thomas Jouanneau/PHONIC LIPS

## Pointe de l'Aiguillon

### ► Location and Presentation

The Pointe de l'Aiguillon is a 98-acre cusped barrier located at the mouth of the Lay river in the Vendée. The site is located on a maritime public domain and has been listed in decrees for the protection of biotopes (APPB) since 1998. The furthest end of the Pointe is included in the scope of the Aiguillon Bay National Nature Reserve.

Traces of intensive human activity in the area (former campsite, sand-extraction development, etc.) can be seen here. Storm Xynthia caused major changes to the site, with the destruction of dune areas, car parks, houses, etc. Since then, Natura 2000 and LIFE Baie de l'Aiguillon contracts have made it possible to carry out a renaturation programme at Pointe de l'Aiguillon.

### ► Types of Environment and Biodiversity

- 20 habitats of Community interest
- 7 protected species (including one on a national level)
- All types of dune: foredunes, beach ridges, marram grass and fescue white dunes and grey fixed to semi-fixed dunes
- Nesting passerines (crested lark, tawny pipit, bluethroat, etc.)
- Annual Kentish plover nidification on foredunes
- Plants on salt marshes that are suitable for passerine nidification and used as a feeding area for fish.

### ► Identified Problems in the Area

- Deterioration of dune habitats by pedestrians
- Remnants of hand fishing for seafood
- Nuisance to avifauna by unleashed dogs in the APPB
- Presence of old structures;
- Invading species, like Yuccas
- Difficult Kentish plover nidification due to heavily trafficked fore-dunes.

*Dianthus gallicus*, a nationally protected species.  
© Alain Texier



Bluethroat (*Luscinia svecica*).  
© Trevor Froud



Coastal medick (*Medicago marina*), a protected species in the Pays de la Loire region.  
© RNN baie de l'Aiguillon





Aerial view over Prée Mizottière.  
© RNN baie de l'Aiguillon

## Prée Mizottière

### ► Location and Presentation

The farm on the Prée Mizottière borders the Sèvre Niortaise and the Aiguillon Bay National Nature Reserve. It is a former grain farm stretching over 617 acres. It was acquired by the Conservatoire du Littoral in 2001.

Since 2004, the Conservatoire du Littoral has had a farmer use the land for extensive livestock farming, requiring development of pastured meadow areas to substitute cultivation zones. It is currently used for mixed farming, and bovine and ovine livestock rearing. Fodder production allows for self-sufficiency regarding livestock feeding.



Black-winged stilt (*Himantopus himantopus*) on Prée Mizottière.  
© Marianne Chassagnoux

### ► Type of Environment and Biodiversity

- Wet subsaline meadows: stopping areas for wintering and migratory birds who can find an abundant food supply and peace
- 24 acres of fresh water bodies of water, which are the result of repairs to seawalls post storm Xynthia. These bodies of water are visited by different species of nesting waterbirds (pied avocet, black-winged stilt, common redshank, mallard, etc.) and are home to certain amphibians
- Salt marshes, an integral part of the Aiguillon Bay National Nature Reserve. They have strong heritage value and are listed as habitats of Community interest in Annexe 1 of the Habitats Directive
- Reed beds
- Dykes, to protect the farm against coastal flooding. The first dyke is not listed and is managed by the Conservatoire du Littoral. The second dyke is listed and is managed by the Syndicat Mixte Vendée Sèvre Autise
- There are a few hundred acres of grain farming.

### ► Identified Problems in the Area

- Water management could be improved
- There is significant erosion at the foot of the first dyke along the Sèvre Niortaise.



A female mallard (*Anas platyrhynchos*) and her three ducklings.  
© Marianne Chassagnoux



# Protecting Biodiversity by Managing **Environments** and **Uses**

Aerial view of the depoldered area on the Prée Mizottière site.  
© RNN baie de l'Aiguillon





# PROTECTING DUNES, CHANNELLING BEACH USERS AND RAISING AWARENESS ABOUT THEIR ENVIRONMENT

## Challenges and Objectives

The beaches on the Pointe de l'Aiguillon are subject to intense human traffic, especially during the summer (tourism) but also during high tidal coefficients (hand fishing). Beaches and dune environments are fragile and at risk of erosion. The site is home to many protected species of European and national interest, such as: Kentish plovers, bluethroats, tawny pipits, *dianthus gallicus*, coastal medicks, *silene portensis*, etc. Salt marshes also play an important role in feeding and providing shelter for fish.

The LIFE Baie de l'Aiguillon project aimed to strengthen public access developments, in order to protect dune habitats from trampling and to keep the sand in place. Direction changes on the salt marsh help in protecting biodiversity in this environment.

## Implemented Developments

- ✓ Installation of 549 metres of sand fences and 1,038 metres of smooth wire
- ✓ 22 acres of protected dunes
- ✓ Closure of an access road to the beach to restore 10 acres of salt marshes
- ✓ Installation of awareness signs.

## Monitoring and Assessing

Public access development helped in protecting habitats on the Pointe and in the development of beach ridge, grey dune and salt marsh plant associations. They improve the way in which these areas can accommodate the species that depend on these environments. In doing so, annual monitoring of passerines and Kentish plovers allowed us to assess how well the site could receive these species.

Alongside this, habitat mapping was carried out in 2021, allowing us to monitor the return of plants. Of course, it should be taken into account that the environment restoration process can be long.



Installation of patented KastanéSAND sand fences by AB Forêt.  
© KASTANÉ.fr



Female Kentish plover  
(*Charadrius alexandrinus*) on her nest.  
© Jennifer Fabre



Kentish plover nest (*Charadrius alexandrinus*)  
© RNN baie de l'Aiguillon

The Kentish plover (*Charadrius alexandrinus*) is a small wader that is protected by French law. In general, females lay three eggs on the ground, in a small hole on foredunes, near marine debris. The eggs are mimetic and can go unnoticed. The Kentish plover is a species that is subject to several anthropic disturbances during reproduction, such as involuntary trampling, nest destruction, unleashed dogs, nuisance from adult birds during reproduction, etc. Steps to direct and inform the public are therefore important in ensuring successful reproduction of this particularly vulnerable species. Monitoring is carried out each spring to estimate the number of nesting couples and to raise awareness about protecting this species.



Sand fences and smooth wire along the beach access path.  
© KASTANÉ.fr

### What Works Well

- ✓ Installing sand fences and smooth wires is key to developing beach access paths that are needed to direct walkers on a protected site
- ✓ In heavily trafficked areas, metre-high sand fences create a barrier effect and dissuade walkers from going over it, all while maintaining an air of an open landscape.
- ✓ On foredunes and linear paths, smooth wire (one or two rows) can be used to channel the public, and is more affordable than sand fences.
- ✓ Several companies can install sand fences and smooth wire, and maintain them. Different initiatives can be organised between employees, with volunteers and in conjunction with city technical services.

### Recommendations

- ⚠ Select materials that are suitable for the site's environmental conditions (wind, tide, UV resistance, voluntary or natural abrasion from sand, etc.) and favour environmentally friendly materials
- ⚠ Think carefully about the location of the signs, both in terms of visibility for walkers and in terms of the direction of prevailing winds for better durability
- ⚠ Monitor developments in place, especially in the weeks following their installation. Vandalism, such as destruction of sand fences, can occur. Anti-graffiti signs can be used for easier cleaning.
- ⚠ The location of the smooth wire on foredunes should be well chosen to protect any plants on the beach ridge. In the event of high tides, stakes and smooth wires can be swept away. There needs to be a compromise between protecting the habitat and protecting the structures from degradation by users and the tides, in order to make the structures more durable (maintenance costs).
- ⚠ Installing sand fences is made easier by using mechanical equipment (transporting materials, installing stakes, etc.). Depending on how difficult it is to reach and how fragile the environment is, this is not always possible.

### Major Preliminary Stages

As the Pointe de l'Aiguillon dune site is state-owned (maritime public domain) and listed (APPB/Natura 2000), a request for an *Autorisation d'Occupation Temporaire* (AOT [Temporary Occupation Authorisation]) was required before any work could be undertaken, together with a Natura 2000 impact study.

The time to process an AOT is at least 2 months. This period is to be taken into account when planning worksites. An AOT can be requested for several years.

Works are planned on a yearly basis and agreed between the Regional Nature Park, managers of the Aiguillon Bay, the local authority and the State services.



### INSTALLING AWARENESS SIGNS

Various signs were designed and installed: an information and direction sign, an environmental information sign about Kentish plover nesting, and signage explaining the implementation of access closure works.

Information sign about the changes to the footpath and LIFE works.  
© RNN baie de l'Aiguillon



## Cost of the Act

| NAME OF THE EXPENDITURE   | UNIT COST<br>(€ TAX INCLUDED) |
|---|-------------------------------|
| Removing old developments (sand fences, etc.)                             | €1.80/lm                      |
| Supplying and installing sand fences                                      | From €27.60 to €34.80/lm      |
| Installing sand fences (without purchasing)                               | €9.25/lm                      |
| Installing smooth wires   | From €3.8 to €9.30/lm         |
| Removal of non-native species   | €280/m <sup>3</sup>           |
| Exporting waste   | Flat rate                     |
| Information sign about the works<br>(LPO graphic design)                  | €62/panel                     |
| Environmental Information Sign about Kentish plovers (LPO graphic design) | €50/panel                     |
| Environmental Information sign<br>(graphic and creation design)           | A sign and sign-post          |

## Possible Partners

| POSSIBLE TECHNICAL PARTNERS  | POSSIBLE FUNDING PARTNERS                                   | POSSIBLE SERVICE PROVIDERS                                 |
|------------------------------|---|--|
| Municipality, State services | State, territorial authorities<br>Conservatoire du Littoral | Environmental consulting services<br>Engineering companies |

## Contacts

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Pointe de l'Aiguillon  
© RNN baie de l'Aiguillon

## LEARN MORE

Infographic about the protection of dunes:  
• <https://vimeo.com/417591819>



# RESTORING ANTHROPISED INLAND DUNES

## Challenges and Objectives

Pointe de l'Aiguillon was a former developed area before it was listed in the APPB. A number of facilities bore witness to an urbanised area, with a former campsite and many concrete blocks (used to extract sand in the middle of the 20th century) in the area. Storm Xynthia in 2011 also caused considerable damage to the site and resulted in houses being deconstructed by the State.

Some poplars remained after the campsite closed. The site was reopened by felling these trees to allow the return of dune habitats and thus protect the fauna and flora that are specific to these environments. Yuccas and Sumac (ornamental plants) from plantations were also on-site. They are hardy perennial plants that are growing in size and that compete with local species.

The LIFE Baie de l'Aiguillon project aimed to restore dune habitats by removing man-made plants or developments.



Removing concrete blocks.  
© Alain Texier

## Implemented Developments

Work was carried out in three areas, restoring and/or protecting 33 acres of dunes and 10.3 acres of *obione* salt marshes.

### ✓ Plage des Sablons: 7.1 acres of dune habitats restored

916 m<sup>2</sup> of poplar seedlings and 458 m<sup>2</sup> of invasive plants were removed, and 5,005 m<sup>2</sup> of dune areas were cleaned

### ✓ Former campsite: 3.4 acres of dune habitats restored

150 m<sup>2</sup> of bitumen was removed, 46 poplars were felled and stumped over 4,000 m<sup>2</sup> of land, 100 m<sup>3</sup> of waste was removed (stumps, invasive plants, fences and bitumen), and 52 metres of old concrete fencing was removed

### ✓ Pointe de l'Aiguillon 6,000 m<sup>2</sup> of salt marshes were protected

92 tonnes of concrete blocks removed, several information and awareness signs were installed



Felling poplars.  
© Alain Texier

## Monitoring and Assessing

Restoring a site can be a long process, especially the phases of post-construction habitat stabilisation. The works took place between 2016 and 2021. The site was habitat mapped in 2011 and was updated in 2021. Comparing them allows us to see improvements in dune habitats.

## What Works Well

- ✓ After felling poplars, the wood was given to local authorities to be used as heating fuel (reducing landfill costs) or as mulch (crushed wood flakes)
- ✓ Recolonisation of salt marshes after closure of access paths was fast
- ✓ Explanation about partial demolition of concrete blocks, proof of a former local use, has led to better social acceptance of the work
- ✓ For invasive species, it is essential to intervene as early as possible, as soon as the first specimens are established, for maximum efficiency and minimum cost
- ✓ Manual removal of invasive plants works well when specimens are small (for *Baccharis* and *Yucca*)
- ✓ Even in fragile environments, it can be done with construction equipment without causing any disturbance to habitats and species. Nevertheless, equipment should be suitable, and work should be regularly monitored.



Yucca develop a complex and wide-spreading root system.  
© RNN baie de l'Aiguillon



## Recommendations

- ⚠ After felling trees, visit the area several times a year to remove waste before stumps are spent
- ⚠ The use of a mechanical shovel to remove the root system of poplars, sumacs and black locusts is effective on large trees. However, it can stimulate the following year's growth of new shoots from the pieces of roots that remain in the soil
- ⚠ To destroy concrete blocks and export waste, we needed to use trucks and mechanical shovels (20 T with hydraulic rock breaker). However, roads in dune areas are often not strong enough for several rounds of transporting equipment
- ⚠ Although this is stated in the specifications, it should be checked that the waste recycling (concrete, stumps, etc.) offered by companies does comply with legislation.



Clearing away poplar waste.  
© RNN baie de l'Aiguillon

## Major Preliminary Stages

As the Pointe de l'Aiguillon dune site is state-owned (maritime public domain) and listed (APPB/Natura 2000), a request for an *Autorisation d'Occupation Temporaire* (AOT [Temporary Occupation Authorisation]) is required before any work can be undertaken, together with a Natura 2000 impact study. The time to process an AOT is at least 2 months. This period is to be taken into account when planning worksites. An AOT can be requested for several years. It is essential to state that the worksite will require the use of mechanical equipment in order to obtain authorisation to travel on the maritime public domain.

## Cost of the Act

| NAME OF THE EXPENDITURE  | UNIT COST<br>(€ TAX INCLUDED) |
|--|-------------------------------|
| <b>PLAGE DES SABLONS</b>   |                               |
| Removal of old developments: closures, sand fences, grill fencing, etc.<br>Waste export and management | €4.90/lm<br>Fee               |
| Removal of non-native species and waste management   | €17/unit                      |
| <b>FORMER CAMPSITE</b>   |                               |
| Felling of trees and stump grinding<br>Waste export and management                                     | €55/unit<br>Fee               |
| Stump removal<br>Waste export and management   | €100/h<br>Per 25 tonnes       |
| Management of poplar waste and waste management  | Over 4,000 m <sup>2</sup>     |
| Removal of non-native species  | 4,000 m <sup>2</sup> flat fee |
| Cleaning and exportation of inert waste (bitumen, scrap metal, etc.)                                   | 100 m <sup>3</sup> flat fee   |
| <b>POINTE DE L'AIGUILLON</b>   |                               |
| Extraction of concrete debris<br>Waste export and management   | 92T                           |

## Possible Partners

| POSSIBLE TECHNICAL PARTNERS  | POSSIBLE FUNDING PARTNERS                                      | POSSIBLE SERVICE PROVIDERS   |
|------------------------------|--|--|
| Municipality, State services | State, region, local municipality<br>Conservatoire du Littoral | Environmental consulting services<br>Engineering and recycling companies |

## Contacts

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# RESTORING MUD FLATS BY REMOVING FORMER SHELLFISH FARMS

## Challenges and Objectives

Shellfish farming is a traditional activity in the Aiguillon Bay. In the 1960s, farms further upstream were abandoned. This was mainly due to the *Mytilicola intestinalis* crisis, but also due to the gradual and natural silting of the bay. These abandoned farms were not restored by their private users, and since then, have served as a development aid for wild Pacific oyster beds (*Magallana gigas*). The Aiguillon Bay is an important migratory stopover and wintering area for waterbirds. Protecting nutrient rich mud flats was necessary for them.

To this end, the LIFE Baie de l'Aiguillon project aimed to implement an experimental mud flat restoration initiative by removing wild oyster beds.

## Methodology

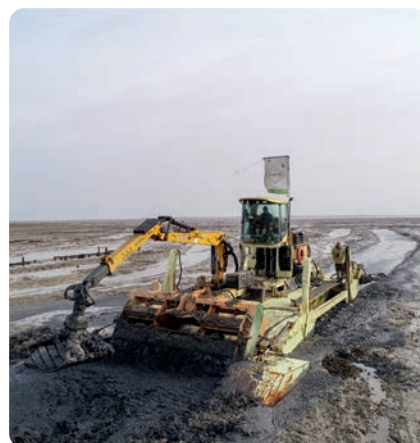
- ✓ Removing any structures (oyster racks mainly) and excavating the land of any metal, plastic and wood waste to recycle them.
- ✓ Destroying oyster shells by crushing them during low tide.

## Monitoring and Assessing

It was important to determine the initial state of the area before starting any work, in order to assess its impact and how well original objectives are reached. It was necessary to plan for multi-year monitoring after these works.

Several experiments were carried out:

- Inventory of the benthic macrofauna and particle-size analysis before and after works
- Topographic LIDAR surveys before and after works to assess the impact of this on the bay's sedimentary dynamics
- Annual monitoring of possible recolonisation on remaining oyster shells on the mud flats



Floating auger barge fitted with a 3-metre front-end shredder powered by a 500-horsepower engine.  
© RNN baie de l'Aiguillon



Aerial view of the wild oyster beds.  
© RNN baie de l'Aiguillon



Post-works recolonisation monitoring of oysters on remaining shells.  
© RNN baie de l'Aiguillon



Monitoring benthic macrofauna before work began.  
© RNN baie de l'Aiguillon





Pacific oyster beds on abandoned marine farming structures.  
© Max Waldborg/Shoot Vidéo

### What Works Well

- ✓ A barge equipped with a crusher and a worm screw to ensure propulsion on a soft substrate was designed for the project (SAS CTAT). The equipment was upgraded by the company during the project for increased efficiency.
- ✓ In areas that were difficult to reach, such as the Aiguillon Bay, the barge was left on site, tied to moorings. A barge was essential to reach the site on a daily basis. It was also needed to be able to drop off scrap metal and plastic to be brought ashore for recycling.
- ✓ Crushing oyster shells on site reduces the likelihood of species recolonisation. This is because oyster shells can act as an attachment aid for oyster larvae (spat), so care should be taken to leave as little residue as possible.
- ✓ Drones are a very useful tool to monitor this type of work carried out in difficult to reach areas. Drone reports are essential in estimating, using remote sensing, how large an area has been processed.



Row of racks with unused oyster bags.  
© Thomas Jouanneau/PHONIC LIPS

### Identified problems – Recommendations

- ⚠ Ahead of time, 'processed area' should be defined: does this mean the area corresponding to pure oyster beds or those with beds and outlying mud flats?
- ⚠ There may be oyster bags left on certain rack rows. This makes work more difficult as these bags are very heavy and difficult to move. Extra workers will be required to pick up as much plastic by hand, before and/or after crushing.
- ⚠ The experimental nature of this work led to some uncertainty beforehand regarding the speed of progress, and thus the time and budget needed to reach initial objectives.
- ⚠ This results in difficulties in travelling on foot in processed areas for post-operation monitoring, which requires significant physical effort!

### Major Preliminary Stages

- Water law and Nature 2000 impact assessment (6 months)
- Prefecture authorisation decree to carry out the work (1 month)
- Closing the last used shellfish farms
- AOT request to put in a temporary mooring and to travel on the maritime domain
- Monitoring benthic macrofauna before work begins
- Topographic LIDAR survey before work begins to monitor site sedimentation (one day), and data processing.



During the works, monitoring water quality on-site can be requested by the authorities, in addition to monitoring the REMI network. This means carrying out microbiological analyses of shells to detect a possible impact of the work on water quality and environmental sediments.



## Cost of the Act

| NAME OF THE EXPENDITURE   | UNIT COST<br>(€ TAX INCLUDED)          |
|---|--|
| Regulatory inquiry  | €40,000                                |
| Inventory of fauna, and particle-size and dosage analysis of organic matter | €24,000                                |
| Scrap metal recycling   | €620 per tonne                         |
| Bed removal   | €10.8-€12.4/m <sup>3</sup>             |
| Topographic study*  | €18,000 per 17,297 acres               |
| Recycling system test   | €1080/m <sup>3</sup>                   |
| REMI monitoring laboratory analysis**                                       | Between €25 and €30 per sampling point |

\*Includes preparatory work, acquiring samplings points, creating a digital land model and presentation of results.

\*\*For indicative purposes, may vary depending on the laboratory

## Possible Partners

| POSSIBLE TECHNICAL PARTNERS   | POSSIBLE FUNDING PARTNERS                          | POSSIBLE SERVICE PROVIDERS   |
|---|--|--|
| Support from Comités régionaux conchylicoles (shellfish regional committees) and State services that are responsible for managing the maritime public domain is essential for a successful project. | Agence de l'Eau<br>Marine park<br>CDC Biodiversité | In an area as unique as the Aiguillon Bay, which is difficult to reach due to its muddy nature, choosing a company that is attentive to the development of new techniques is essential.<br>Analytical laboratory that carries out analyses |

## Contacts

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Pacific oyster beds on abandoned sea farming structures.  
© Max Waldberg/Shoot Vidéo

## LEARN MORE

Videos and infographic about restoring mud flats:

- <https://vimeo.com/497269277>
- <https://www.youtube.com/watch?v=DYbp6aH-IcQ>
- <https://vimeo.com/417551580>

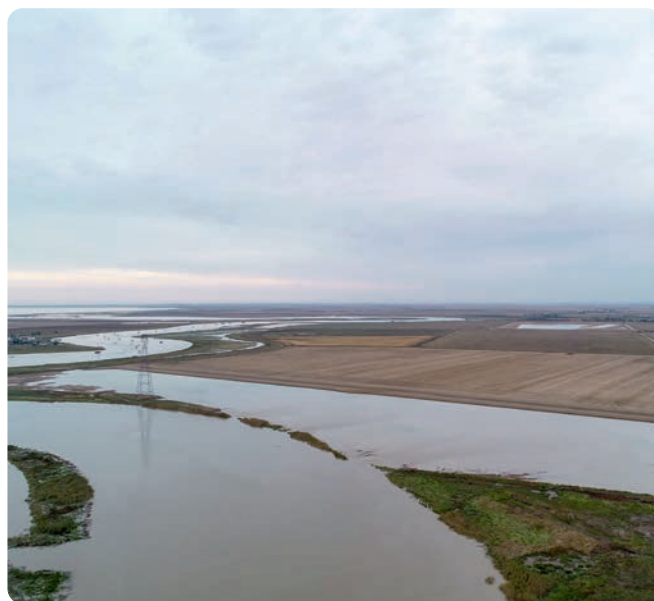




## DEPOLDERING FARMLAND



Former farmland.  
© RNN baie de l'Aiguillon



The area has been subject to tidal flooding since the high tides of September 2020.  
© RNN baie de l'Aiguillon

### Challenges and Objectives

Climate change is causing sea levels to rise, which directly impacts areas located below the highest sea level, such as the Marais Poitevin.

In this context of needing to adapt in the face of climate change, renaturation of poldered areas is a solution to limit the impact of extreme phenomena, such as coastal flooding. Intertidal zones and salt marshes play an important role in coastal protection by reducing wave power during coastal flooding.

Depoldering creates a marine water plain and reduces the impact of coastal flooding. Additionally, this allows nature areas to be reconnected to tidal rhythms.

On the Conservatoire du Littoral's Prée Mizottière site (Vendée), moving back a weakened sea defence dyke, located in a meander on the Sèvre Niortaise, allowed for restoration of 24 acres of intertidal natural environments, and improved protection of the farm on site.

Although it is still rare in France, by depoldering, we can characterise the evolution of restored natural habitats and evaluate the sociological perceptions of local players about this operation.



Levelling of the former dyke.  
0.8 km of dyke was deconstructed.  
© RNN baie de l'Aiguillon

### Methodology/Implemented Developments

1. Consultation with local players
2. Outlining the project
3. Preliminary regulatory inquiries (public consultation, water law application, Natura 2000 impact assessments, public surveys, etc.)
4. Earthworks: moving the weakened sea defence dyke 150m into a grain farming plot of land.



The foot of the dyke was subject to significant erosion by the flow of the Sèvre Niortaise.

Moving the dyke back onto farmland was the most durable technical solution.

## Monitoring and Assessing

- Annual monitoring of benthic macrofauna
- Creating an annual topographic report to monitor the evolution of sedimentary dynamics
- Ten-day monitoring of waterbirds
- Monitoring plants to characterise the evolution of plant association.



Area at the end of the work (September 2020).  
© Elise Chourré



Plants very quickly colonised the depoldered area (October 2021).  
© RNN baie de l'Aiguillon

## What Works Well

- ✓ This was the first time the Marais Poitevin has been depoldered. This experience will be used to acquire useful knowledge about this type of work, which is still rare on a national level
- ✓ The natural settling process of 20 cm to 40 cm of the newly created dyke was anticipated with the creation of an earth bank near the dyke. This will allow for dyke refilling in a few years.
- ✓ The site's biological response following works was immediate, with many different types species of waterbirds and passerines visiting the area
- ✓ It strengthened protection of the farm against flooding.

## Identified problems – Recommendations

- ⚠ The window to carry out this work was short and corresponded to the two months of the summer during which storms are weak and do not cause farmland to flood
- ⚠ It was regulatively impossible to pre-empt natural settlement of the dyke, by adding 40 cm to the newly built dyke (hence the creation of an earth bank nearby)
- ⚠ The health crisis due to the Covid-19 pandemic delayed the public survey, but work was nevertheless carried out within the allocated time.



Collaboration with the PEPPS2-DPM project. Led by the Université de Bretagne Occidentale (Brest), Université Bretagne Sud (Lorient) and Université de Rennes 1, this project focuses on formerly poldered areas which have been re-natured, be it purposefully or accidentally.

Prée Mizottière is also monitored on a biological level (monitoring plants, arthropods and pedology), and on a sociological level.



Black-headed gull (*Chroicocephalus ridibundus*) above the depoldered area during high tide.  
© RNN baie de l'Aiguillon



Construction of a new dyke and an earth bank (respectively to the left and right of the bulldozer).  
© RNN baie de l'Aiguillon



## The Main Phases of Preliminary Technical and Regulatory Inquiries

1. Signature of an occupation agreement for the site in order to develop and carry out work between the Conservatoire du Littoral and the Regional Nature Park
2. Recruitment of a specialist consultancy firm (2 months)
3. Case-by-case examination and exemption from impact assessment (2 months)
4. Water law application (environmental authorisation request) (1 year)
5. Approval of the draft project by stakeholders (3 months)
6. Public survey (6 months, due to the health crisis)

## Cost of the Act

| NAME OF THE EXPENDITURE  | UNIT COST<br>(€ TAX INCLUDED) |
|--|-------------------------------|
| <b>PROJECT MANAGEMENT, INCLUDING:</b>                            | €60,000                       |
| Topographic surveys  | €1,100                        |
| Density measurements   | €6,200                        |
| Environmental analysis and regulatory authorisation applications | €9,600                        |
| <b>WORKS</b>   |                               |
| Earthworks   | €210,000                      |
| Fencing  | €2,400                        |
| Grassing   | €3,900                        |
| H&S coordination mission   | €1,200                        |
| <b>RELATED ADMINISTRATIVE COSTS</b>                              |                               |
| Public survey, legal notices                                     | €4,800                        |
| Public survey, indemnities for the investigating commissioner    | €2,800                        |

## Possible Partners

| POSSIBLE TECHNICAL PARTNERS | POSSIBLE FUNDING PARTNERS                                   | POSSIBLE SERVICE PROVIDERS   |
|-----------------------------|---|--|
| Conservatoire du Littoral   | Conservatoire du Littoral<br>Agence de l'Eau Loire Bretagne | Engineering companies<br>Environmental consultation services<br>Surveyor companies |

## Contacts

Marais Poitevin Natural Regional Park

Loïc CHAIGNEAU: [l.chaigneau@parc-marais-poitevin.fr](mailto:l.chaigneau@parc-marais-poitevin.fr)

# Learning Through Scientific **Monitoring**

Aerial view of the Sèvre Niortaise and the salt marshes of Puyravault.  
© RNN baie de l'Aiguillon





# MONITORING WATER QUALITY ALONG THE LAND-SEA CONTINUUM

## Challenges and Objectives

At the crossroads between the continents and the oceans, the Aiguillon Bay and the Pertuis Breton are a coastal zone that is of great environmental and economic importance (shellfish farming areas). This area is influenced by freshwater inflows from the Marais Poitevin, notably via the Lay, the Sèvre Niortaise and numerous channels. These more or less regular quantitative and qualitative land-based inflows are one of the key factors in how the ecosystem works, partly influencing the bay's primary production.

The study of qualitative and quantitative aspects should therefore provide a better understanding of the link between the inflow from the Marais Poitevin, the functioning of the coastal zone and the impacts on biodiversity and humans.

The aim of this monitoring is to provide information on the dynamics of fresh water inflows to the Marais Poitevin – Aiguillon Bay – Pertuis Breton continuum.



View over the Sèvre Niortaise.  
© RNN baie de l'Aiguillon

This project, developed by IFREMER, aimed to meet certain requirements of the 2013–2022 management plan for the Aiguillon Bay National Nature Reserve. One of the objectives is to identify the role played by the land waters of the Marais Poitevin in shaping the first trophic level of the bay.

## Required Equipment

- ✓ Multiparameter high frequency probe
- ✓ Probe fixing measures (PVC tube, ropes, carabiners, buoys, etc.)

## Data Collection and Analysis

### a) Temperature and salinity monitoring

As part of the LIFE Baie de l'Aiguillon project, eight stations are monitored at a ten-minute acquisition frequency. Three stations are coastal and are monitored in the subsurface continuously throughout the day. The other stations are located on estuaries or channels with probes on fixed structures in relation to the seabed, which are subject to being uncovered at low tide.

Probes should be alternated monthly to retrieve data. After this, the probe should be cleaned and a new one should be put in place. Sorting raw data is essential, as to delete abnormal results, or results that correspond to periods of probe exposure at low tide.



Probe system in the Sèvre Niortaise.  
© RNN baie de l'Aiguillon



Sampling by LEAV carried out using a Nansen bottle.  
© RNN baie de l'Aiguillon

#### b) Monitoring space-time variations of different components

Sampling subsurface water on eight sites every two weeks from November to April, and every month from May to September, for laboratory analysis. Possible physicochemical parameters to follow are:

- Dissolved mineral nutrients: nitrates, phosphates, silica
- Parameters of the carbonate system
- Particulate matter: matter in suspension, chlorophyll and phaeopigments

#### What Works Well

- ✓ An acquisition frequency of 10 minutes can be used to monitor the evolution of salinity and temperature parameters in very fine detail. Salinity can show very significant intra- and inter-daily differences and is based on hydrological conditions (rain)
- ✓ Probe sensors can be damaged over time (spring and summer biofouling, for example). Annual verification in the autumn is essential to check data conformity, and if recalibration is required.
- ✓ Such monitoring can be used to shared salinity evolution data with interested marine professionals, in particular in the event of mussel mortality to create a possible link with desalting in the area.

#### Recommendations

Equipment malfunctions could cause temporary gaps in measurements:

- ⚠ Silting problems linked to sedimentary dynamics can be observed. Installing the probes vertically instead of horizontally avoids silting. During the summer, alternating the probes on the estuaries and channels should be done every three weeks.
- ⚠ At the end of the spring and during the summer, barnacles develop and attach to the support structures and probes. This can damage the sensors. Copper mesh can be put on salinity sensors for probes further out to sea that are subject to this phenomenon. On the other hand, copper mesh can cause silting and this type of system is not recommended in channels. Cleaning probes installed in the sea is recommended every two weeks between June and September.
- ⚠ Fixing systems should be sufficiently strong to avoid losing any probes (storm, etc.).



Copper mesh on the probe's salinity sensor.  
© RNN baie de l'Aiguillon



## Major Preliminary Stages

- Discussion about the subject and where the probes should go
- Probe installation systems

## Cost of the Act

| NAME OF THE EXPENDITURE  | UNIT COST<br>(€ TAX INCLUDED) |
|--|-------------------------------|
| Multiparameter probe*  | €2,844                        |
| Communication interface<br>(reading the probe to export data)*                 | €660                          |
| Copper mesh  | €4.18 for 15x15 cm of mesh    |
| Hydrological measurements over a year: samples,<br>measurements and analyses** | €44,956                       |
| Major physicochemical characteristics  | €8,935                        |
| Particulate matter   | €15,458                       |
| Dissolved mineral and organic nutrients  | €15,843                       |
| Parameters of the carbonate system   | €4,720                        |

\*Rate as of June 2015. Unit price can vary depending on the supplier and the number of probes purchases.  
 \*\*Rate as of 2016.

## Possible Partners

| POSSIBLE TECHNICAL PARTNERS  | POSSIBLE FUNDING PARTNERS   | POSSIBLE SERVICE PROVIDERS |
|--|---|----------------------------|
| Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER)<br>Universities | Etablissement Public du Marais Poitevin (EPMP)<br>Agence de l'eau | Analyses laboratory        |

## Contacts

The Aiguillon Bay National Nature Reserve  
Régis GALLAIS: [regis.gallais@ofb.gouv.fr](mailto:regis.gallais@ofb.gouv.fr)

Changing the probe on  
the Sèvre Niortaise, coastal station.  
© RNN baie de l'Aiguillon

### LEARN MORE

- Infographic and video about monitoring water quality:  
<https://vimeo.com/484337143>  
<https://vimeo.com/544527070>
- Report about the space-time variability of nutrients and carbon, and related flow along the temperate land water continuum (in French):  
<https://archimer.ifremer.fr/doc/00618/73003/>



# MONITORING HOW WINTERING ANATIDAE USE THE AREA



Northern shovellers (*Spatula clypeata*), Eurasian wigeons (*Mareca penelope*) and Eurasian teals (*Anas crecca*) flying.

© Jean-Robert Bariteau

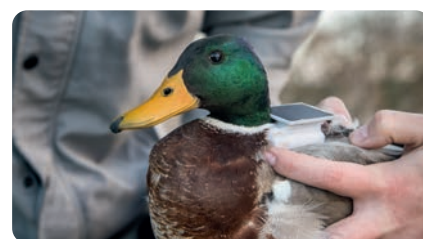
## Challenges and Objectives

The wetlands of the Marais Poitevin and the Aiguillon Bay are part of an eco-complex of international interest for waterbirds, in particular during wintering (Wetlands International 2020 summary)

The eco-complex is made up of several major areas: 115,791 acres of dry marshes (open landscape used for farming and as meadows), 79,908 acres of wet marshes and alluvial plains (floodplains for the most part on meadowland), 46,502 acres of intermediary marshes (the rest of former wet marshes now managed as dry marshes) and a 23,499-acre maritime side, made up of foreshores (salt marshes, mud flats, sandy and rocky areas) as well as dune environments.

These different environments are used separately by Anatidae, according to their biological clock. It has been shown that wet meadows are used for feeding (nocturnal foraging area) and that the mud flats of the Aiguillon Bay and other protected natural areas are used for resting (diurnal resting area).

One of the initiatives of the LIFE Baie de l'Aiguillon aims to improve knowledge of how the eco-complex works for Anatidae and the connections between feeding and resting areas. The aim is to identify feeding and recovery areas, to establish a link between these areas in order to determine where the Anatidae feed, what they eat and the evolution of seed resources in the Marais Poitevin. To this end, mallards, Eurasian teal and Northern pintails were fitted with GPS transmitters to track their movements during the winter. This study is part of the Observatory of the Natural Heritage of the Marais Poitevin



A mallard (*Anas platyrhynchos*) fitted with a GPS transmitter.

© Pierre-Lou Chapot

## Required Equipment and Methodology

- ✓ Capture equipment (cages/snares) and rings
- ✓ Authorisation to capture and fit via connection to a personal ringing programme
- ✓ GPS transmitters to follow Anatidae movements
- ✓ GIS software for mapping.



As part of this study, several types of transmitters were tested:

- Cattrack-like system: requires the bird to be recaptured to download data
- Transmitters with direct GSM transmission
- GPS-UHF transmitters needing movement of a station to retrieve data



## Data Collection and Analysis

The locations of Anatidae were followed from December to February and were mapped to characterise the environments used during wintering. This issue involves estimating home ranges and acquiring spatially fine environmental data.

Estimating home ranges involves collecting data at relatively homogeneous frequencies and taking sufficient sample points. The spatial evolution of vital domains during the winter requires individuals to be followed for a somewhat long time so that differences seen between GPSs are linked to phenology and not individual specificities.

Careful thought should be given to statistical analyses before birds are tagged in order to calibrate transmitter settings to the issue at hand.

## What Works Well

- ✓ GPS transmitters with direct GSM transmission do not need a directional antenna to be moved in order to download data stored in the device
- ✓ Technical improvements have made for less cumbersome equipment for the bird
- ✓ Cages are useful for capturing
- ✓ Preliminary work to select catch areas that depend on environmental factors is essential.

## Identified problems – Recommendations

- ⚠ Technical problems linked to malfunctioning GPS transmitters led to data loss
- ⚠ GPS transmitters often have a short battery life
- ⚠ Priority should be given to catching birds at the beginning of the wintering period or even in the autumn, especially for resident birds such as the mallard.



Ornithela GPS transmitter  
© Emmanuel Joyeux

## Cost of the Act

| NAME OF THE EXPENDITURE    | UNIT COST<br>(€ TAX INCLUDED) |
|----------------------------|-------------------------------|
| GPS transmitter            | €720-€1230*                   |
| GSM data subscription      | €636/year                     |
| Directional antenna        | €230                          |
| Ringing equipment          | €150                          |
| Snare design               | €860                          |
| Catching equipment (cages) | €17 per cage                  |

\*The price varies based on the tag.  
\*\*Fees are likely to have changed since the project started

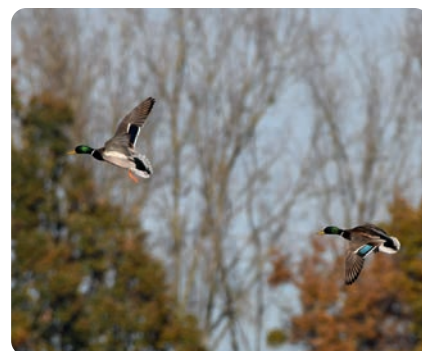
## Possible Partners

### POSSIBLE TECHNICAL PARTNERS

OFB: research programme  
about anatini

## Contacts

The Aiguillon Bay National Nature Reserve  
Paméla LAGRANGE: [pamela.lagrange@lpo.fr](mailto:pamela.lagrange@lpo.fr)



Mallards (*Anas platyrhynchos*).  
© Trevor Froud

# TYPIFYING AVAILABLE SEED BANKS IN ANATIDAE HABITATS



Salt marshes of Champagné-les-Marais.  
© RNN baie de l'Aiguillon

## Challenges and Objectives

This study aims to characterise and quantify the ground seed bank of different habitats that make up the feeding resource available for granivore Anatidae via core drilled sampling of seeds taken in the soil.

## Required Equipment and Methodology

- ✓ Core drills (diameter: 10 cm, length: 5 cm)
- ✓ 4 mm riddle to remove excess vegetation
- ✓ 300 micron riddle to remove soil residue
- ✓ Oven
- ✓ Binocular microscope.



As part of the LIFE Baie de l'Aiguillon project, core drilled soil samples are carried out over several periods of the year (spring, autumn and winter) over the course of several years. Samples are sieved then put in the oven for 4 days at 60 °C. The seeds were examined with a binocular microscope (at a minimum, the genus, and species if possible). Each identified taxon is then weighed and counted. In total, more than 11,000 samples were processed.



Earth plug sample.  
© RNN baie de l'Aiguillon

## Data Analysis

- The intra- and inter-yearly evolution of the diversity and the quantity of grains (number and biomass) and between different monitored sites.
- Study about the effect of the way the seed bank is managed.



## What Works Well

✓ A service provider specialised in identifying seeds.

## Recommendations

⚠ The number of samples should be adapted to the time and staff available and to the specific issue

⚠ Weigh seeds per sample as the environmental variability of the seed bank is considerable and using average masses from published research is not useful.



Identifying and counting seeds in a sample.  
© RNN baie de l'Aiguillon

## Cost of the Act

| NAME OF THE EXPENDITURE   | UNIT COST<br>(€ TAX INCLUDED) |
|---|-------------------------------|
| Smaller equipment (riddle/core driller)                                 | €36 for 3 riddles             |
| Pump for sifting  | €198                          |
| Oven  | €2,580                        |
| Petri dishes  | €350 for 2500 dishes          |
| Sample identification by a service provider                             | €3.05 per sample              |
| Binocular microscope (if you are carrying out identification yourself)* | €1300                         |
| *price according to the model   |                               |

## Possible Partners

| POSSIBLE TECHNICAL PARTNERS | POSSIBLE SERVICE PROVIDERS                                   |
|-----------------------------|--|
| Research institutes         | Technician with enough knowledge in botany to identify seeds |

## Contacts

The Aiguillon Bay National Nature Reserve  
Paméla LAGRANGE: [pamela.lagrange@lpo.fr](mailto:pamela.lagrange@lpo.fr)

# Communication and Raising Awareness

Field visit during a conference about coast restoration in 2020.  
© Romuald Goudeau





# CREATING VARIOUS COMMUNICATION MEDIA

## Website: <https://life.reserve-baie-aiguillon.fr/en/>

The website was created in 2016 to teach the public about the work done by the LIFE Baie de l'Aiguillon project. It presents the natural environments and species in the Aiguillon Bay, project goals and initiatives carried out. A 'resources' area allows the user to download publications and communication media related to the project. The website has been available in English since autumn 2021.



The LIFE Baie de l'Aiguillon website

## Brochure About the Project

- 2000 copies.

## Facebook: <https://www.facebook.com/lifebaieaiguillon>

- 1,119 subscribers in December 2021
- 1,033 people liked the page in December 2021

## A Travelling Exhibition about the Aiguillon Bay

More than 7,000 visitors! The 'Poses en Baie de l'Aiguillon' exhibition was an opportunity to learn more about the natural wealth of the reserve through professional and amateur photographs, and illustrator drawings.



The Aiguillon Bay illustrated book

## An Illustrated Book about the Aiguillon Bay

The drawings, watercolours, oil and pastel paintings in this book depict this extraordinary area. 1,500 copies were printed. They were given to schools and project partners.



Field notebook

## Discovery Booklet

This booklet is intended for the general public, but also for children aged 10 and over, and is made available to organisations that provide educational activities in the bay. The aim of this booklet is to learn more about the Aiguillon Bay by exploring its different habitats, fauna and flora, throughout the seasons.

This tool is used during activities on the ground (school trips and general public visits) as a learning tool.

## Infographic Videos

These three to four-minute videos explain certain aspects of the project in a fun way:

- The dune, wazzat?
- Crassats, wazzat?
- Water quality, wazzat?
- Ecology of the Poitevin duck, wazzat?

They have been translated into English and can be used by many different types of people. They can be shown at campsites, in tourist offices, leisure centres, etc.

<https://life.reserve-baie-aiguillon.fr/en/videotheque/>



Infographics

**SHEET 8**

32 Project Report *Life* The Aiguillon Bay 2016–2022



# SHARING EXPERIENCES DURING CONFERENCES

## « Adaptation des marais littoraux au changement climatique »

### *Adaptation of coastal marshes to climate change*

Date: November 2018

Place: La Rochelle

Duration 3 days

Type: International conference

Number of participants: More than 450, Number of speakers: 33

Act: Presentations and visits to 2 coastal sites (80 people)

1 dedicated website: <https://maraislittoraux.myportfolio.com>



Plenary presentation  
at l'Espace Encan (La Rochelle).  
© Romuald Goudeau

## « Restauration des fonctionnalités environnementales du littoral en contexte conchylicole »

### *Restoration of coastal environmental functions in a shellfish farming area*

Date: October 2020

Place: La Rochelle

Duration 2 days

Type: International conference

Number of participants: More than 200, 9 connected countries connected thanks to live streaming, Number of speakers: 15 contributors

Act: Presentations and a visit to a coastal site (50 people)

1 dedicated website: <https://www.colloque-lifebaieaiguillon-restauration-littoral.com/en/>



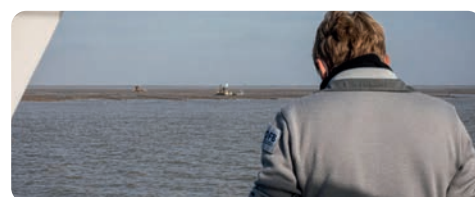
Day of presentations  
at the Forum des Pertuis (La Rochelle).  
© Romuald Goudeau

## Cost of the Act

| NAME OF THE EXPENDITURE  | UNIT COST<br>(€ TAX INCLUDED) |
|--|-------------------------------|
| Full day of photography  | €918                          |
| Recording, streaming in 2 languages,<br>recording of the presentations and export of the video files   | €3,465                        |
| Simultaneous interpretation French – English<br>Rental of 150 headsets, interpreter's desk, technical services<br>Two interpreters for 1 day | €2,782<br>€1,512              |
| Creation of French-English subtitles<br>for videos of the speeches<br>(Transcription and translation of approximately 300 minutes of video)  | €7,734                        |



Visit to the Pointe de  
l'Aiguillon (Vendée).  
© Romuald Goudeau



Visit to a site  
being restored.  
© Romuald Goudeau

# RAISING AWARENESS WITH THE GENERAL PUBLIC THROUGH SCIENCE SHOWS

## ‘Hé... la mer monte !’ science show

‘Hé...’ La mer monte !’ is a scientific show for the general public about climate change and its impact on the coastline, based on an insightful collaboration between a researcher and a committed ‘eco’ comedian, under the sharp pencil of a comic book artist.

It is neither a conference nor a science class. ‘La mer monte !’ is a clever mix of games of ‘evils’ and examples of climate change. The concept of popularising science and discussing it with the public appealed to the entire audience.

The show was hosted by actor and host Mathieu Duméry (aka Professor Feuillage), researcher Eric Chaumillon and cartoonist Guillaume Bouzard.

- A unique concept
- An original format
- General public
- 5 presentations
- Raising awareness to 2000 people

## ‘Hé... la mer monte !’

Following its success, the show was repeated several times in 2019 (Rochefort, Niort, Luçon and La Rochelle).

Following this success and outside the project, the book ‘Hé... la mer monte !’ was co-published by the Marais Poitevin Natural Regional Park and Plume de carotte in October 2019, written by Eric Chaumillon, Mathieu Duméry and illustrated by Guillaume Bouzard. Over 2,500 copies have been sold.

## ‘Hé... la mer monte !’ science show and book ‘La mer contre-attaque !’

Additionally, the Marais Poitevin Natural Regional Park organised a conference on coastal risks in November 2019, as a follow-up to the conference on the adaptation of coastal marshes to climate change. This conference led to the creation of a second scientific show: ‘La mer contre-attaque !’ and a new co-edition of ‘La mer contre-attaque !’ in October 2021, by the same people.



Eric Chaumillon and Mathieu Duméry on stage during the first performance of the show on 27 November 2018 in La Rochelle.  
© Romuald Goudeau



Full house during the science show in La Rochelle.  
© Romuald Goudeau



Book cover  
‘La mer contre-attaque !’.  
© 2019 Parc naturel régional du  
Marais poitevin & Plume de Carotte

Book cover  
‘Hey...the sea is rising!’  
© 2019 Parc naturel régional du  
Marais poitevin & Plume de Carotte





## CONTACTS

### Marais Poitevin Natural Regional Park

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79 510 COULON

Tel: +33 (0) 5 49 35 15 20

correspondance@parc-marais-poitevin.fr

### The Aiguillon Bay National Nature Reserve The French Biodiversity Agency (OFB) and the League for the Protection of Birds (LPO)

Ferme de la Prée Mizottière

85450 Sainte Radégonde des Noyers

Tel: +33 (0) 2 51 56 90 01

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## SPONSORS

LIFE Baie de l'Aiguillon was funded by:



AGIR pour la BIODIVERSITÉ

Total estimated amount of LIFE Baie de l'Aiguillon: €2,497,828

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## LEARN MORE

<https://life.reserve-baie-aiguillon.fr/en/>

<https://www.facebook.com/lifebaieaiguillon>



Avec Ecofolio  
tous les papiers  
se recyclent.