



MOLINO
EL Pintado
ECOMUSEO

EN

ECOMUSEUM INTERPRETIVE EXHIBITION OF


Molino Mareal El Pintado

 Junta
de Andalucía

Consejería de Sostenibilidad,
Medio Ambiente y
Economía Azul

The El Pintado Tidal Mill Ecomuseum, located in Ayamonte in the province of Huelva, within the Isla Cristina Marshlands Natural Site, is a resource available to the public as part of RENPA (Network of Protected Natural Spaces in Andalusia). The purpose of this initiative was to disseminate and raise awareness of the values of the natural and cultural heritage of the region and the area.

Tidal marshes

A white egret stands on a weathered wooden stump in the foreground. The background features a vast marshland under a dramatic sunset sky with orange and red hues. The water in the marsh reflects the sky and the bird. A large, faint watermark of a stylized arch is visible behind the bird and the text.

This nature reserve is principally made up of marshes, areas which are halfway between land and sea and which undergo continuous change.

A young and dynamic coastline

Tidal movement, wind and the Carreras and Guadiana Rivers are all powerful forces capable of transforming this coastal landscape.

Sediment brought by these natural forces differs in nature and intensity, depending on its origin. Some is heavy, such as that which is carried by sea storms, while other types of sediment, such as sand carried by the wind, builds up more gradually.



Inland marshes

Owing to their closeness to the sea and the fact that they are connected by means of the Carreras Canal, the Plata Canal and the port, these marshlands combine all the conditions necessary for the existence of vibrant biological activity, and for a wealth of flora and fauna that will be exhibited later on.



An aerial photograph of this nature reserve will help us see this protected area in context. In order to see its outer limits, press the key on the right. A series of small plans provides information about the towns, the water system and the infrastructure (ports, roads, paths and so on) and helps us learn more about its geography.

The high quality of the natural resources of the Isla Cristina Marshlands, such as its flora, its characteristic landscape, its estuary fish and, above all, the great number of migratory birds that it attracts, has been the reason for the protected status conferred upon it by the Junta of Andalusia in 1989. In addition, it is protected at a European level by the Natura 2000 network.

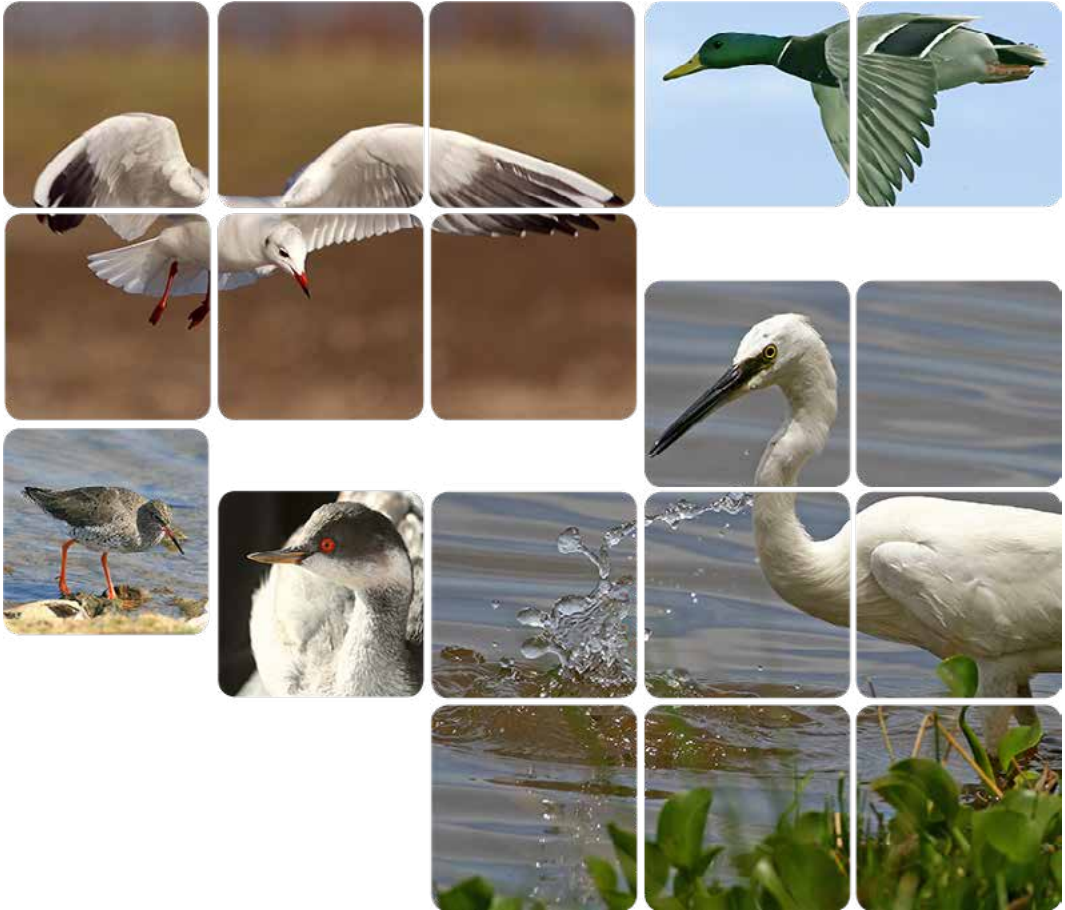


The most distinctive inhabitants of this nature reserve are common egrets, mallards, spoonbills and black-headed gulls, among many other species. These birds give life to the beaches and countryside, and offer the landscape a special appeal.

Year-round protagonists and seasonal visitors

Their adaptive mechanisms have responded to the different demands of the environment they frequent: feet that are adapted to swimming or climbing, that prevent sinking in mud and slime, and that can capture other animals; beaks especially designed to feed on small molluscs that live in the water and have to be filtered out, seeds that have to be ground, insects, or small animals. In all these cases, such solutions allow these birds to settle in or periodically visit these places.

In addition to the resident birds, the Isla Cristina marshlands habitually receive a great number of visitors in the form of migratory birds, for whom this area provides the ideal conditions in which to rest and reproduce. The abundant vegetation and the wide variety of fish and crustaceans provide them with the necessary refuge and food.

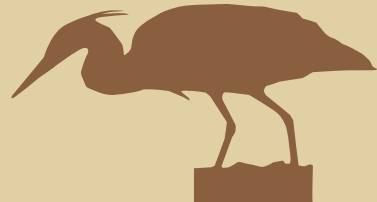
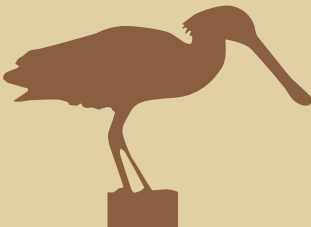


The Nature Site



A place for
breeding...
and rest

**On the screen, a computer programme helps us learn in greater detail about some of the characteristics of this reserve: the migratory birds that spend the winter months there, or that go there to reproduce; the marine fauna, the coastline flora and the landscapes.*



Below the staircase, you can see silhouettes of a heron, a black-headed gull, a spoonbill and a sanderling. Depicted flying towards the end of the room, the first three species are displaying their wingspans. In each case, the reproduction is life-size.



The marshland resources

The exploitation of the resources of these marshlands goes back thousands of years. Since time immemorial, the influence of the tides has been favourable to fishing and to the production of sea salt in the estuaries.

In more recent times, some forms of exploitation have come to an end, while others, such as fish-farming and industrial salt works, have intensified, due to ever-increasing demand.



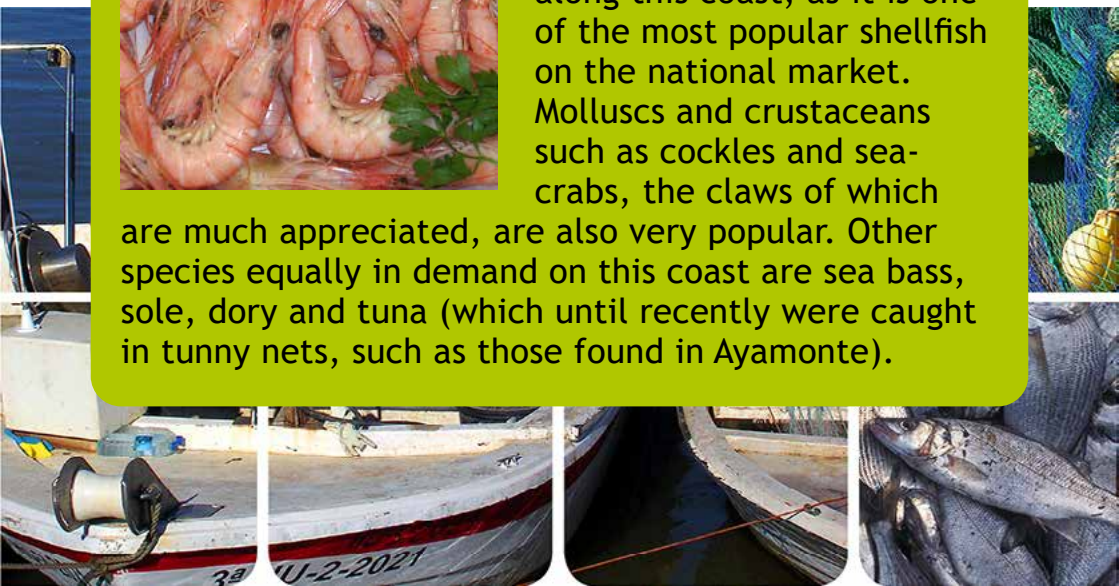
Marine delicacies for sale and consumption

Fishing continues to be one of the basic economic pillars of the area. Traditional techniques have given way to big canning companies and factories which now sustain this sector.



The white prawn is among the most valued species along this coast, as it is one of the most popular shellfish on the national market. Molluscs and crustaceans such as cockles and sea-crabs, the claws of which

are much appreciated, are also very popular. Other species equally in demand on this coast are sea bass, sole, dory and tuna (which until recently were caught in tunny nets, such as those found in Ayamonte).





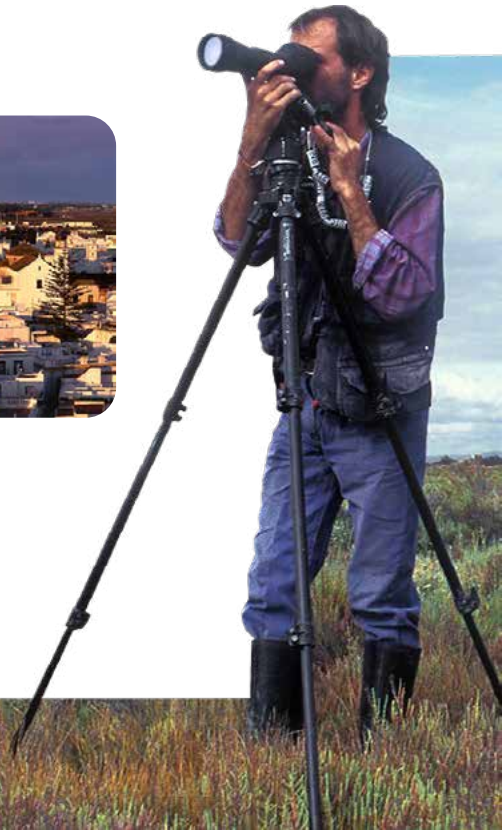
A place for leisure activities

In addition to its natural assets, the western coast of Huelva offers the tourist many leisure possibilities. Sports such as swimming, fishing, sailing and surfing, as well as simply enjoying the beaches, are some of the greatest attractions, and constitute some of the biggest sources of income for the Huelva coast.



Visits to Huelva's towns and villages, and to its festivals and cultural heritage sites are increasingly popular, and these give visitors the chance to come into contact with the hospitable local people.

Such progressive development means that these days, sustainable tourism must be encouraged.



EXHIBITION

El Pintado Tidal Mill

Enjoy your visit to El Pintado mill, discovering its influence on the in the region and the tide mills are of great importance throughout Europe.

As well as their main components and basic processes, such as the tides, the oyster stone and the trade of the miller.





1697-1780

Manuel Rivero, 'El Pintado'

An outstanding
Ayamonte man

First of all, let's get to know Manuel Rivero, 'El Pintado': An outstanding Ayamonte man. He is the protagonist of this mill, which he restored and renovated in the mid 18th century. Many letters and documents (some of which are on display in this room) can be found in Manuel Rivero's family archives. These letters and documents have allowed us to reconstruct a fairly accurate account of the details of the mill and its owner.

Coming as he did from a family with a history of trade with America, Rivero, at the age of 14, went on his first voyage to the New Continent as a cabin boy. Later, in charge of the family business in Ayamonte together with his wife, Juana Inocencio Díaz Cordero, he became one of the most important traders of the 18th century Andalusian bourgeoisie.

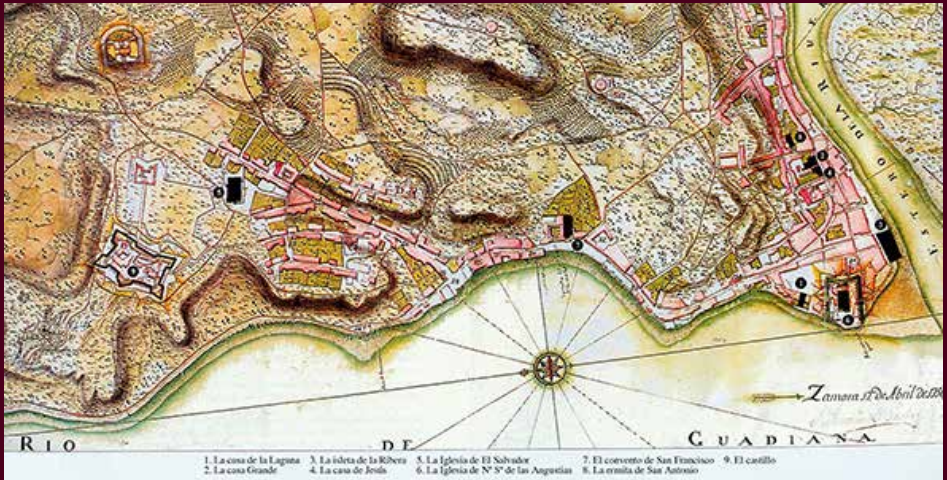
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In order to do business with the Indies, he created a shipping company in Cádiz, from which his six ships, laden with fruit and other products from his farm in Ayamonte, would set sail. He owned several properties and farms that produced brandy, wine, oil, hams, textiles and so on, in addition to La Huerta Noble, his country estate, on which he also spent time with his family. One of his main sources of income was the flour produced in this mill.

Another reason why 'El Pintado' is still such a well-known name in the city today is because of his work as a patron. He supported civil and religious works, such as the construction of Ayamonte's Casa Grande, in which he founded and established, in 1761, the headquarters of an entailed estate that would protect his rich heritage.

He also gave some of his money to charity and to commissioning and acquiring works of art, as befitted his economic position during that era. He bought sculptures, such as 'La Virgen de la Esperanza', and paintings by well-known artists, such as 'La Resurrección de Cristo' by Juan Valdés Leal.



In addition, as good businessmen often do, he entered politics with the aim of obtaining social and economic benefits. He became the Mayor of Castillo, the Deputy Chief Magistrate and Chief Justice of Ayamonte.





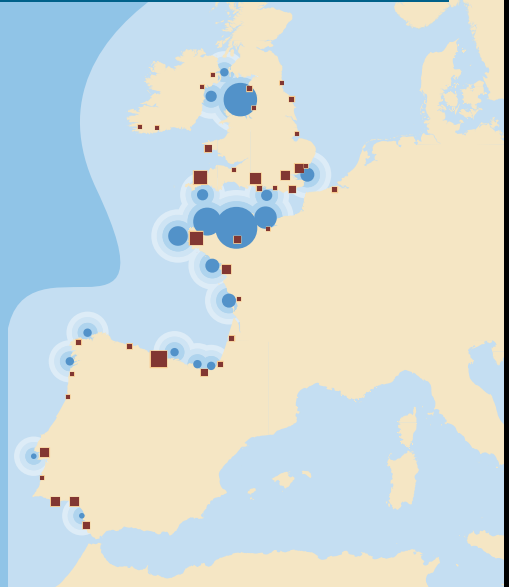
Coastal mill, renaissance mill

Tidal mills in the southeast of the peninsula

Tidal mills were built on the southeast coast of the Iberian Peninsula from the second half of the 13th century onwards. Many such mills existed, as much on the Huelva coast as on the coasts of Cádiz and the Algarve, especially in areas of estuaries and marshlands, where the medium tides made them the ideal location. Little by little, the Atlantic coast became full of them, and in the end there were more than a hundred between Faro and Cádiz. Some of them became very important, such as those of the *Río Arillo* in San Fernando and the *Quinta de Marim* in Olhao, or this one, *El Pintado*.

Tidal mills in Europe

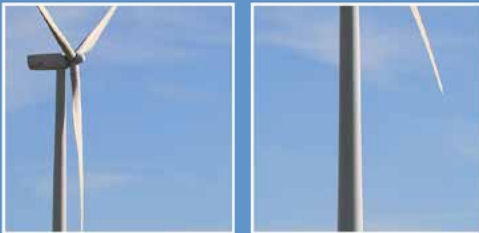
Mills constituted the first industrial revolution in history. Among all the different types, sea mills were an ingenious invention, taking advantage as they did of the movement of water by making use of tides.



Their optimum working state depended on the different levels of water that occur with tides, on the intensity of the sea currents and on the geography of the place itself. Therefore the distribution of tidal mills along European coastlines is variable; the English Channel had the highest concentration because of the favourable conditions in that area, which made it possible to produce a lot of energy.

From the 15th century onwards, due to renewed trading brought about by the discovery of America, tidal mills started to spread along all the Atlantic coastlines.

Renewable energies



Man's industriousness, inventiveness and scientific ability have always allowed him to make the most of available energies at any given moment in history. Before the Industrial Revolution, mills were powered by falls in the levels of a river, by the wind or, as in the case of El

Pintado, by tides. These are renewable energies which, in these times of scarcity and depletion of fossil fuels, are once again playing an important role in energy production.

Renewable energies are obtained from natural sources that can be considered inexhaustible, such as the sun, the water cycle, the wind or tides. They are clean energies that, in contrast to non-renewable ones such as petroleum or coal, don't contribute to global warming.

Tidal energy takes advantage of the force of tides and transforms it into electricity.

Wave energy is also related to the sea, as energy is generated from the force of the waves.

Geothermal energy takes advantage of the heat from the interior of the earth to produce electricity. The most favourable areas are the contact regions between tectonic plates.

We can obtain energy directly from the sun through various procedures. For example, through photovoltaic plates (as displayed here) or sophisticated thermal installations.

Wind power is generated by the force of the wind. This power can be generated mechanically or by means of wind turbines (as displayed in the model here).

Finally, **hydroelectric energy** is obtained by making use of different levels of water and turbine action to produce electricity.

Oyster stone

In this section we are going to look at one of the most unusual building materials used in this area.

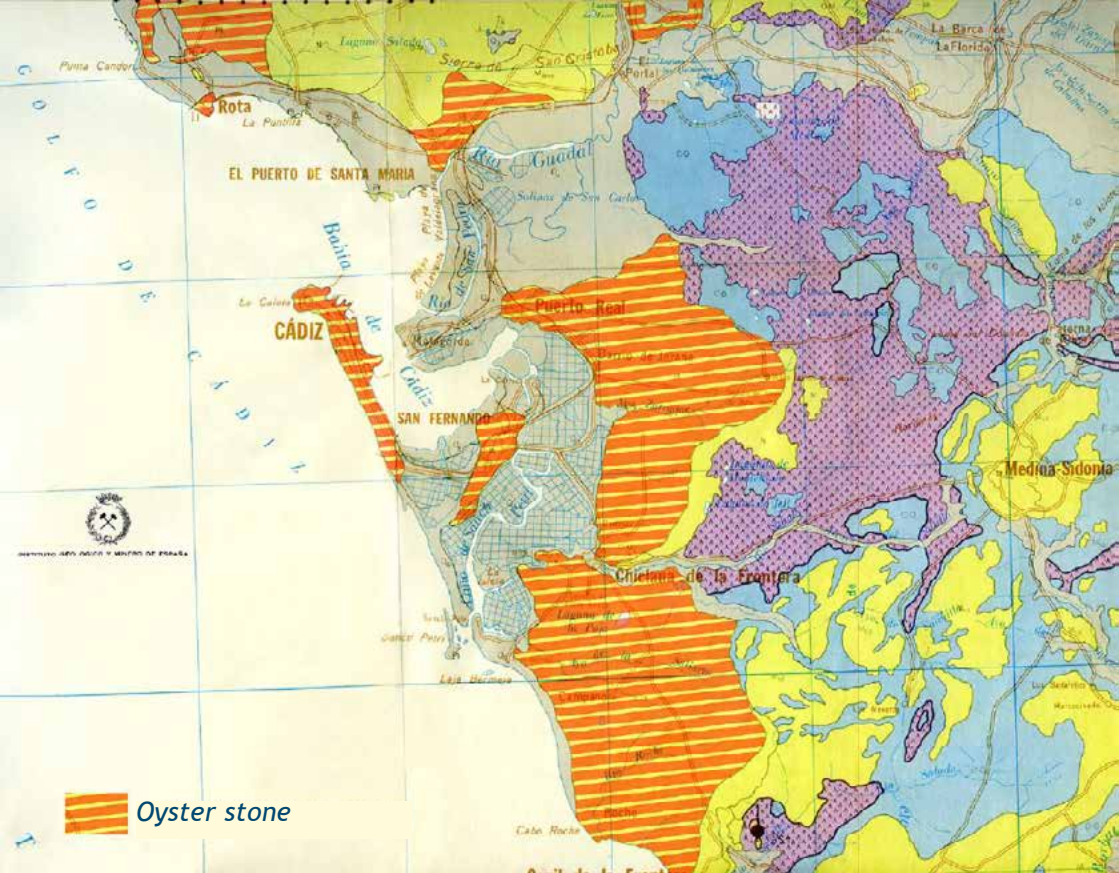
In rural buildings, simple materials and construction techniques were used, for example, brick, stone, sand and coated lime were the norm. However, in the *El Pintado* mill, an unusual material, '*piedra ostionera*' (oyster stone), was used. This stone is common along the Cádiz coastline and is therefore characteristic of many of the coastal buildings.

Manuel Rivero was able to obtain this unusual and expensive material thanks to his frequent trips between Ayamonte and Cádiz, which he made in order to transport his farm products to his shipping company.



Therefore it is not surprising that the *El Pintado* mill and Cádiz Cathedral share the characteristic of having been built on a base of oyster stone.





Oyster stone is rough and porous, having been formed by the hardening of seashells, sand and stones eroded by the sea. It is easy to work and very resistant to salinity, and it is known to have existed on the seabed of the Gulf of Cádiz since Late Pleistocene times, that is to say, since almost two million years ago.

This stone was also used in the construction of other features, such as lintels, benches or parapets (some of which have been restored in the renovation of this mill). Oyster stone was also used in the building of the new walls, as you will have seen in the previous room and in the reception area.

Other stones were also used, such as the flagstones which served as workbenches for polishing the mill's moving stones, and 'pedra canteada' (pebble stone), which are common in certain parts of the buildings.

Look at the structure of the stone, and discover the seashells that make it up!!.



Stone-cutting

This display, entitled Stone-cutters as well as Millers, looks at the different tasks millers had to carry out.

The miller was responsible not only for the functioning of the mill, but also for many other tasks, such as maintenance work and the repair or repositioning of pieces, tasks that required a certain amount of skill and specific abilities.

This is reflected in popular sayings such as ‘Molino que no muele, algo le duele’, which roughly translates as: ‘If it doesn’t mill, it’s ill’.



This refers to the obligation to keep the mill in ‘good health’. Or ‘Molino parado, no gana maquila’ (‘A stopped mill doesn’t earn its keep’), which makes reference to the continuous work that is necessary in the mill in order to make a good profit.



Self-sufficiency and skill in almost all the tasks involved were indispensable characteristics in this old profession. After the milling was over, there were periods between the tides given over to making sure everything was working properly, in readiness for when the tide rose again and the milling would recommence. For some repairs and special operations they had to wait for very low tides that allowed for better access to the rotors, which were situated beneath the stones.



Knowledge of how to handle a wide variety of tools, both for carpentry and stone-cutting, were essential for the work this entailed. Stonecutting was, in fact, one of a miller's main tasks.

Stones used for grinding

Millstones, protagonists of a technique that had survived until recently in this mill, are on display in this section: Stones used for grinding.

Certain popular expressions (such as, for example, ‘comulgar con ruedas de molino’ which can be roughly translated as ‘to take mill-wheels as a consecrated wafer’) run through milling as a metaphor. We can find examples in the writing of Miguel de Cervantes:

*Don Quixote to his squire:
“I tell you, Sancho, that a
mouth without back teeth is
like a mill without stones,
and that, moreover, one has
to value a tooth more highly
than a diamond.”*



The stones came from different sources. In some cases they came from the area itself, worked for centuries by specialised quarrymen from Ayamonte or from the mountains. These stones, known as white stone, were of a single piece, but they had the disadvantage of being soft. This meant that frequent recutting of the grooves was necessary, due to the wear on them caused by the constant scraping of against one another.



Thanks to rail transport, from the 19th century onwards a more hardwearing and compact stone was imported from France. This stone, known as French stone, was transported in fragments, which were later joined together with iron rings.

Two examples of early manual mills are exhibited here, in order to show the prehistoric origins of milling. These methods date back to the Neolithic Age, although even today they are still used in quite a few places around the globe.

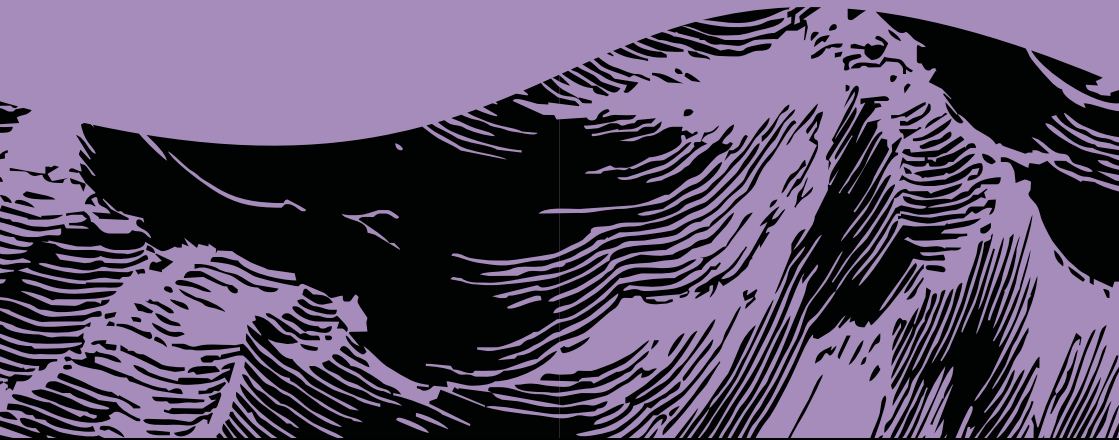
In the mortar, the grain was crushed by hitting it with a pestle. With the other system, it was ground by placing it between two stones which were turned manually; a basic technological technique that has remained in use for thousands of years, in larger or more sophisticated mills that use different energy sources (water mills, tidal mills, windmills, electric mills, and so on).

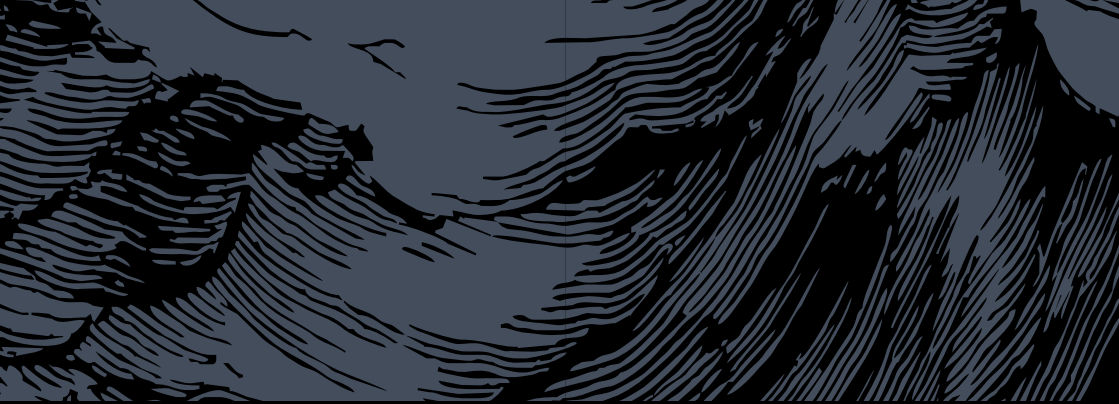


Tides, an inexhaustible energy source

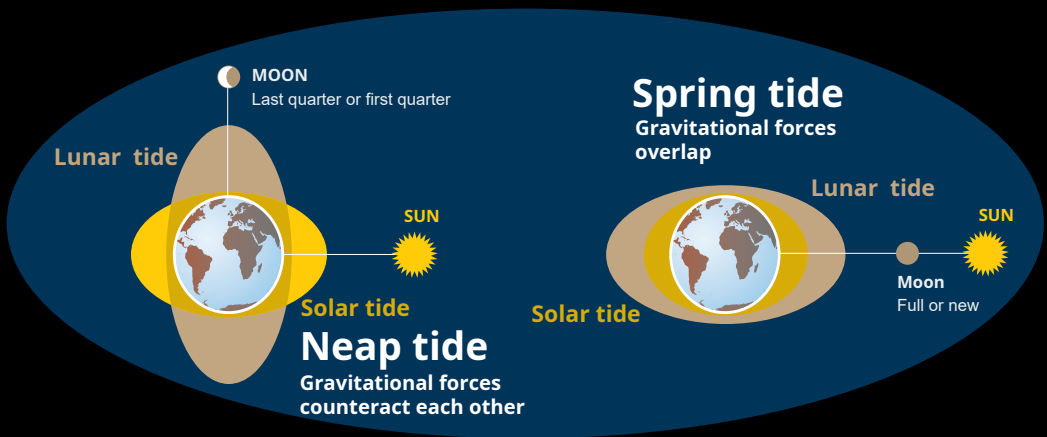
Tides are a widespread phenomenon, but their intensity and their cycle vary significantly along different coastlines around the globe. The choice of an appropriate location for a tidal mill, and its technical design, required expert knowledge about the dynamics of tides.

Gravitational forces, or the pull of the sun and the moon on the earth, are what create tidal cycles. This is explained in the illustration to your right.

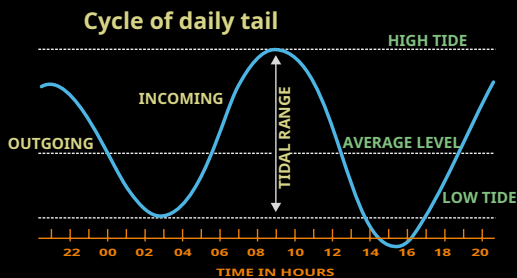




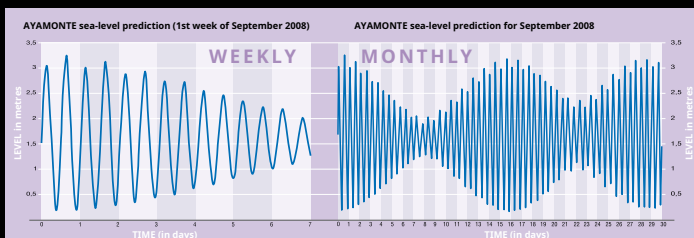
In the Isla Cristina marshlands, as all along the Andalusian coastline, there are two high tides and two low tides a day. Their intensity depends on the position of the stars, and as a consequence this intensity varies according to the time of year.



The forecasts for the rise and fall of tides are fundamental for the development of milling and other activities. The miller would base his forecasts on practical knowledge based on his own experience. Nowadays, major ports, such as that of Huelva, publish annual tidal timetables, which can be consulted in order to decide on the best time for shipping movement. These tables are based on complicated astronomical calculations that permit maritime traffic in each specific part of the port area at a specific time.



Weekly or monthly type tidal cycle



The *El Pintado* mill reservoir

Tidal mills functioned thanks to a dam built in the marshlands, which filled with water at high tide. This reservoir, which you can see through the window, was known as a '*caldera*', or cauldron. It would fill with the water that flowed through the estuaries at high tide, making it pass through a sluice to prevent it from flowing back out. This main sluice can be found under the bridge that you cross over on entering the building.



Tides, at the Pintado mill

The ‘caldera’, as we have said, is a living reservoir that fills and empties with the flow of tides. The water level in the dam changes depending on what point has been reached in the tidal cycle.

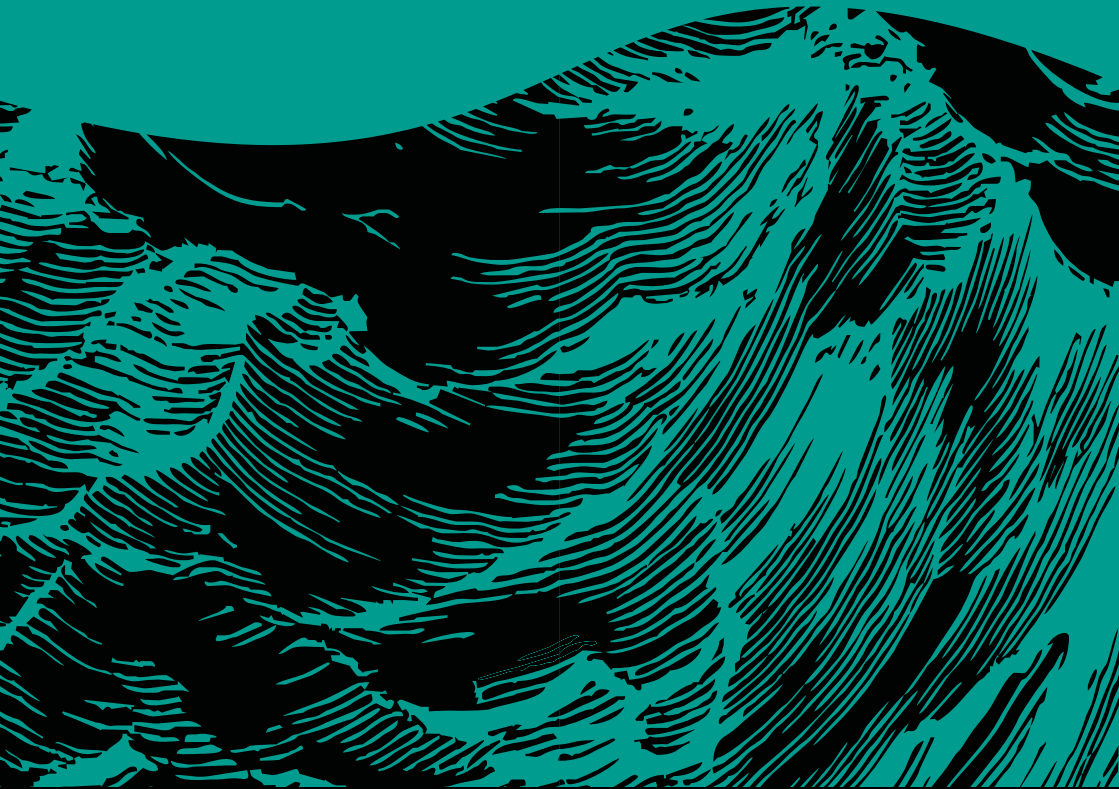


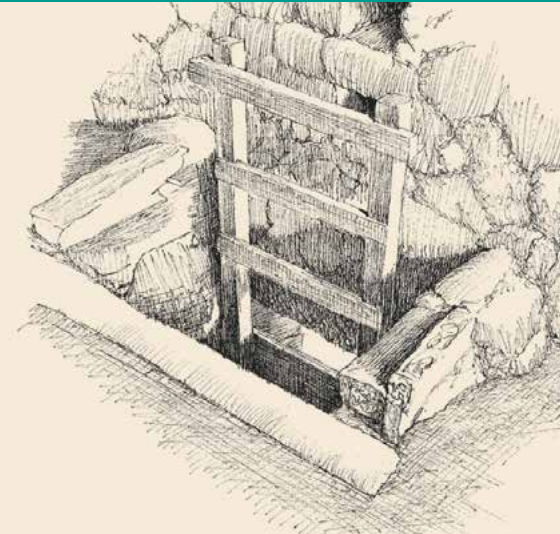
On the screen, a tidal cycle, which in real time takes twelve and a half hours, is reproduced in three minutes. The recording has been speeded up to help you understand the dynamics of a dam, from its filling up to its emptying out.



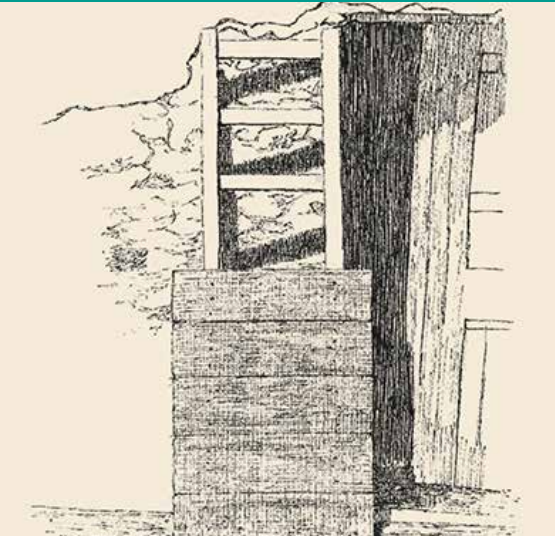
Emptying a dam is achieved by channeling the water towards the interior of the mill, as you can see through the glass window in the floor of this room.

As the functioning of the mill depended on the tides, the miller's working day was, by necessity, variable, and had to be adapted to the tidal cycle.



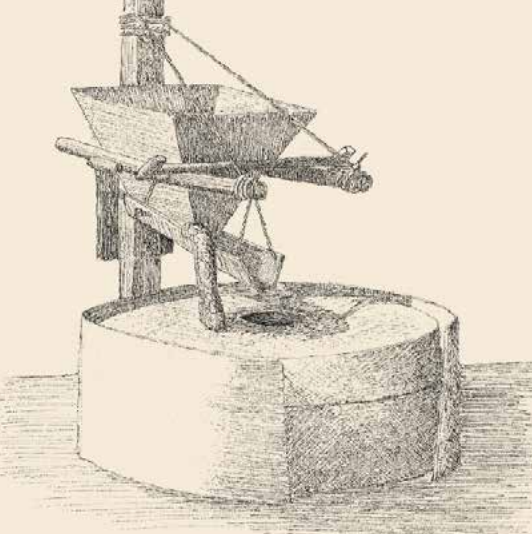


The siting of each mill along the coast affected the size of each of the dams. In this case there were six mills, so the dam had to be of a size large enough to accumulate the volume of water that was needed to move them. Depending on the quantity of water retained, the miller could set in motion as many mills as he wanted, by raising or by not raising the sluices. Other mechanisms allowed the water to be released without making the rotors turn.



At low tide, the channels empty, but the retained water is directed towards the interior of the mill, thereby operating a wheel (known as a rotor), and it is this action that makes the millstones turn. Later, the water returns to the estuary to restart the cycle with the new high tide.

El Pintado tidal mill



Dedicated to grinding, The Pintado mill used hydraulic mill technology to harness the power of the tides to move its grinding stones.

As the functioning of the mill depended on the tides, the miller's working day was, by necessity, variable, and had to be adapted to the tidal cycle.



A model of a cross-section of the mill explains how the water makes the grindstones work, thereby obtaining flour from the grain.

❶ «Alfanje» or the base of the mill which forms the structure on which the mill stones are set. These millstones are cylindrical and of the same diameter.

❷ The stationary lower stone or bed-stone is thick and solid to ensure that it lasts a long time. It has the same number of grooves as those in the wheel above, but cut in the opposite direction.

❸ The turning or runner-stone is normally lighter than the bed-stone. It is held in place by the shaft and balanced by the rotor.

❹ «Rodete» - a rotor or perforated circular metal plate that rotates with the force of the water.

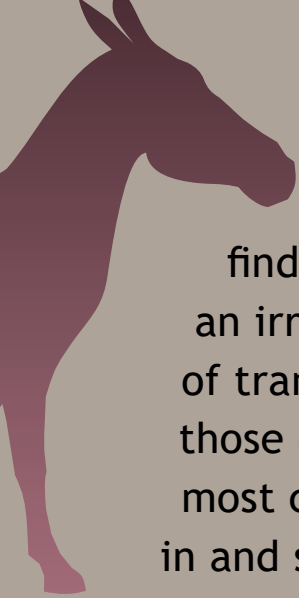
❺ The «Tolva» or hopper is a type of big wooden funnel or trough that spreads the grain over the grindstones at a constant rate.

Other parts: «Cabria» or shaft to hold up the chute, mat, wooden flour box, discharge gate screw shaft, sluice gate...



The miller is depicted carrying out one of his most delicate tasks: cutting the millstones. Given the size and the weight of the stones, *more skill than strength* was necessary in order to tip the upper stone (grindstone) over so as to leave the carved grooves on the underside accessible. These grooves needed to be checked every so often, because of the wear caused by the scraping of one against another.



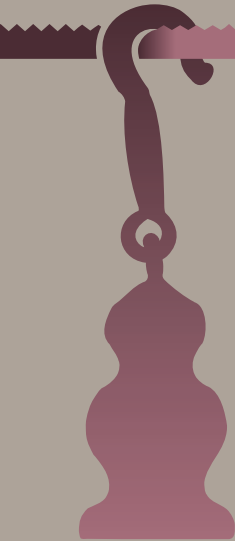


In the display opposite, you will find a model of a mule: an irreplaceable means of transport in the area in those days. This was the most common way of bringing the grain in and sending it out as flour, although when production was high, the flour could be transported using carts and wagons.



Finally, we have dedicated an area to flour, the end-product of the mill. The miller is depicted tipping a sack into a chute (a type of big wooden funnel that spreads the grain over the grindstones at a constant rate). At his side there are other tools and useful objects (sieves, brooms, ropes, sacks and so on), all of which help recreate the job in hand.





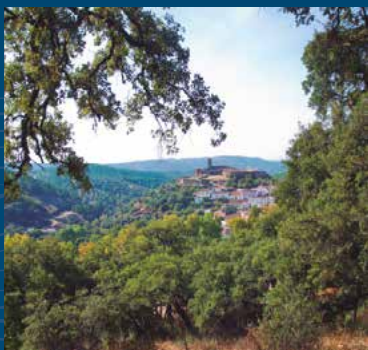
Opposite this, you can see the product already put into sacks, ready to be weighed on a steelyard, or scales, and transported. The miller's cut, that is, the proportion that was owed to him in relation to overall production of grain, flour or oil (in those mills dedicated to the production of olive oil) was normally decided at this final stage of the process.



Discover more about Huelva's protected natural areas

From the cliffs and forests of the Sierra de Aracena y Picos de Aroche to the marshes and islands at the mouth of the Odiel and Guadiana rivers, the province of Huelva boasts an environmental diversity which is unparalleled

Almost a quarter of Andalusia's Protected Natural Spaces are located in the province of Huelva, where there are three areas with their own distinct ecological characteristics:



Sierra de Aracena and Picos de Aroche

The diversity of the landscape of this mountain ridge, which combines spectacular geological formations, lush forests and traditionally man-made sites, has generated a great ecological richness.



Cuenca Minera and Andévalo

In the transition between the mountains and the coast, the ancient mining of the Tinto river basin has created an enclave of unique environmental and aesthetic characteristics.



Guadiana, Odiel and Doñana coasts and marshes

The coastline of Huelva, with its forests, beaches and marshes, is one of the most valuable and representative ecosystems of the entire continent, vital in the migratory routes of countless birds.

The Protected Natural Spaces of Huelva are included in the largest coordinated network of protected spaces in the world: The Natura 2000 Network, made up of the most ecologically valuable ecosystems in the European Union and created to ensure the conservation of biodiversity, in a way that is compatible with sustainable economic development.

More information:

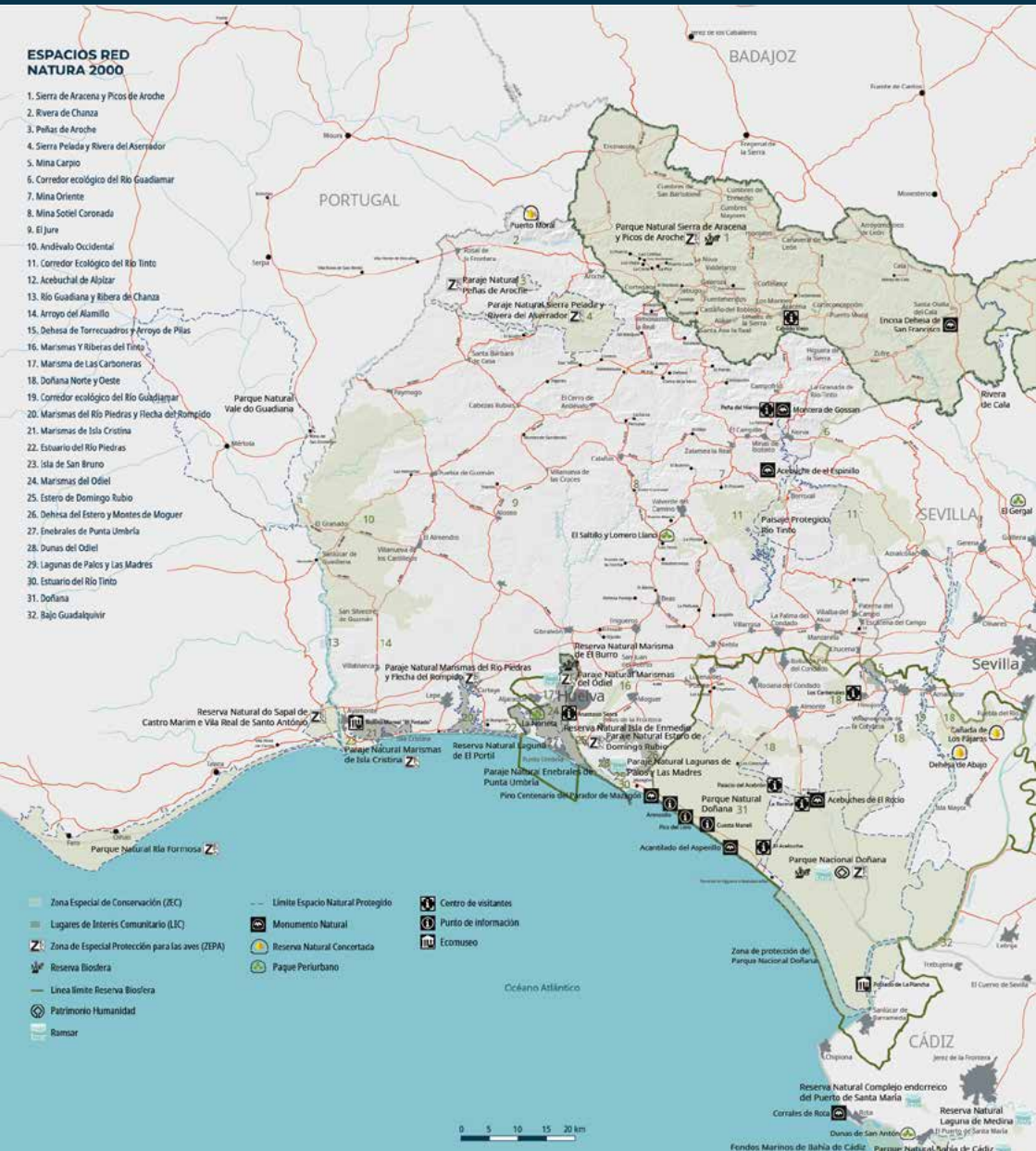
ventanadel**visitante**^{es}



CONSERVATION SCHEMES FOR THE NATURAL SPACES OF THE PROVINCE OF HUELVA

ESPACIOS RED NATURA 2000

1. Sierra de Aracena y Picos de Aroche
2. Rivera de Chanza
3. Peñas de Aroche
4. Sierra Peleada y Rivera del Aserador
5. Mina Carpio
6. Corredor ecológico del Río Guadamar
7. Mina Oriente
8. Mina Sotiel Coronada
9. El Jure
10. Andévalo Occidental
11. Corredor Ecológico del Río Tinto
12. Acebuchal de Aljizar
13. Río Guadiana y Ribera de Chanza
14. Arroyo del Alamillo
15. Dehesa de Torrecuadros y Arroyo de Pilas
16. Marismas Y Riberas del Tíbio
17. Marisma de Las Carboneras
18. Doñana Norte y Oeste
19. Corredor ecológico del Río Guadamar
20. Marismas del Río Piedras y Hacha del Rompido
21. Marismas de Isla Cristina
22. Estuario del Río Piedras
23. Isla de San Bruno
24. Marismas del Odiel
25. Estero de Domingo Rubio
26. Dehesa del Estero y Montes de Moguer
27. Enebrales de Punta Umbría
28. Dunas del Odiel
29. Lagunas de Palos y Las Madres
30. Estuario del Río Tinto
31. Doñana
32. Bajo Guadalquivir



Reserva Natural Complejo endorreico del Puerto de Santa María
 Corrales de Roca
 Reserva Natural Laguna de Medina
 Fendos Marinos de Bahía de Cádiz
 Parque Natural Salinas de Cádiz

National Parks

Natural areas of exceptional natural and cultural value, representative of the main Spanish ecosystems.

Natural Parks

Locations that are a prime example of the diversity of flora and fauna, and of the logical use of Andalusia's natural heritage.

Nature Reserves

Highly fragile ecosystems, harbouring a high degree of biodiversity in a small space.

Nature Sites

Sites with exceptional ecological values, whose conservation is compatible with traditional uses and activities.

Protected landscape

Spaces with an important cultural and natural heritage, which serve as a connection between various territories.

Peri-urban park

Locations set up for the recreational and leisure use of the population, associated with natural environments.

Jointly Managed Nature Reserve

Sites where there is an agreement between landowners and the administration in order to conserve their environmental values.

Natural Monument

Features of outstanding beauty, which enjoy special protection because of their biotic, geological, ecocultural or geographical values.

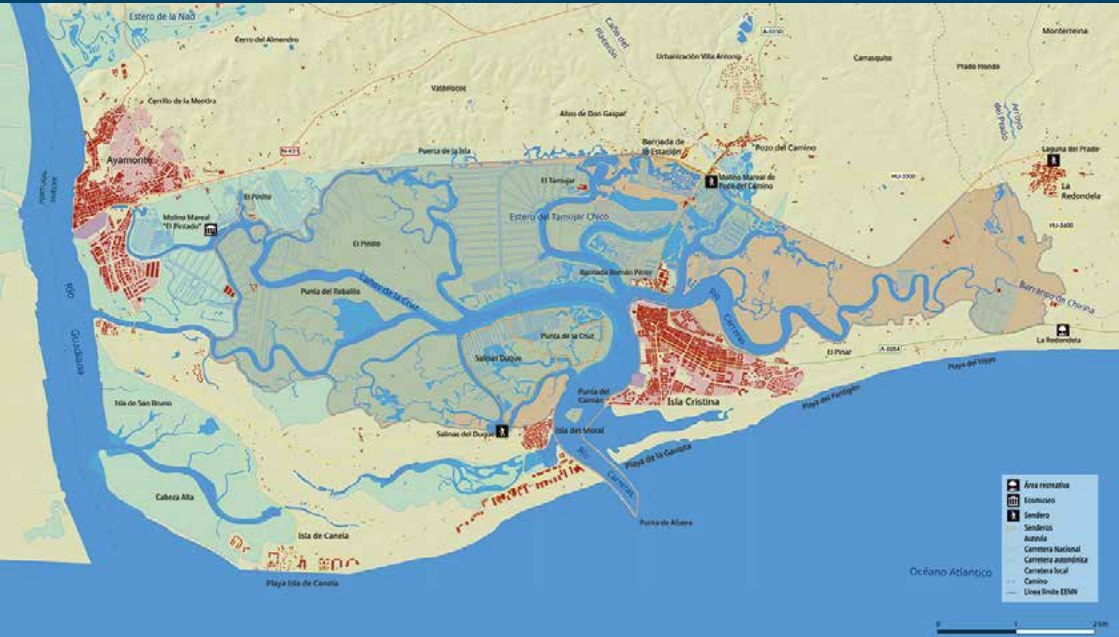


Marshes of Isla Cristina Nature Site

The mouth of the Guadiana, an intricate network of great ecological richness

The Marshes of Isla Cristina Natural Site is home to numerous plants, animals and, most importantly, bird species, which is why it has been declared a Special Protection Area for Birds (SPA). The environmental and scenic value of its 2,145 hectares, located in the municipalities of Ayamonte and Isla Cristina, have led to its inclusion in the Inventory of Wetlands of Andalusia (IHA) and its consideration as a Site of Community Interest (SCI) in the process of becoming a Special Area of Conservation (SAC).

The mouth of the Guadiana River forms a complex system of marshes, channels, canals and swamps which are profoundly affected by the winds and sea currents of the Atlantic, leading to dense pine forests and spectacular formations of barrier islands, arrows and coastal strands. The southwest of the peninsula is scattered with a succession of coastal wetlands of enormous beauty and ecological value, closely interrelated, including the Isla Cristina marshes. This network of interconnected wetlands is crucial for the survival of a large number of migratory birds.





ECOMUSEUM EL PINTADO TIDAL MILL

Making use of an old flour mill, which used the force of the ocean tides to move its milling wheels, the Molino del Pintado Ecomuseum was created. Its purpose is to raise awareness and disseminate the values of the natural and cultural heritage of the site, as well as to enrich the understanding and experience of visiting this extraordinary natural site.



LAGUNA DEL PRADO TRAIL

La Laguna del Prado is a freshwater wetland, which is part of the marsh complex of Isla Cristina. It is formed in a depression of the Prado stream, whose natural outlet was obstructed by the construction of the Huelva-Ayamonte railway line. This trail runs along the lagoon, allowing you to enjoy the birds and a landscape that changes according to the different land uses.



MOLINO MAREAL DE POZO DEL CAMINO TRAIL

The cyclical movement of the tides has been used since antiquity to extract marine salt, for estuary fishing and energy production. On this trail, you will be able to recognise these uses and observe one of the many tidal mills that used to line these coasts.



SALINAS DEL DUQUE TRAIL

Amidst the scents of tradition, fishermen and saltpetre, this path runs along the perimeter wall of the salt marshes, bringing you closer to a rich and biodiverse ecosystem, which is the natural habitat for a large number of birds, such as the spoonbill, which has come to breed in this wetland.

Find out more:

ventanadel**visitante**.es



MOLINO
EL Pintado
ECOMUSEO

