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SAVE THE COAST!

REPORT

PROJECT 'PROTECTION OF THE COASTLINE AND ITS RESOURCES

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1. Introduction

Coastal zones, which serve as a transition between the marine and terrestrial environments, have long been a region with distinctive ecological and socioeconomic features that encourage the concentration of human activities. For a number of reasons, coastal management and protection are particularly important. First, to advance the blue economy¹ (Voyer, Quirk, McIlgorm, & Azmi., 2018), next to coordinate and advance both land and marine development (Barragán, J. M., Boy, Á., Carballo, A., Colina, A., Doménech, J. L., & Juanes, J. A., 1991), and finally to advance the creation of an ecological ecosystem. Blue growth that is effective and sustainable is essential for the economy's continued expansion, but it also needs to put equal emphasis on safeguarding the maritime environment, the coasts, and ensuring efficient and safe transportation.

Coastal wetlands connect the terrestrial and marine environments by acting as transitional habitats along the sea-land border. The idea that transitional waters are partially saline due to their proximity to coastal waters, but are strongly influenced by freshwater flows, is supported by the European Water Framework Directive (WFD, 2000/60/EC), which was developed in response to the need to unify water management actions in the European Union. The material and energy exchanges between land and the sea are regulated by these transitional ecosystems (Crespo Garay, 2021). Additionally, because they are home to a variety of habitats and offer a favourable setting for several endemic and/or protected species, they are important locations for biodiversity. Due to their paramount significance for wildlife, particularly migratory and breeding birds, and are very valuable due to their abundance in natural resources. They also offer a variety of ecological services, including the stabilisation of shorelines, control of nutrient levels, carbon sequestration, purification of contaminated waterways, and the provision of food and energy.

The main transitional ecosystem types along the Huelva coastline are coastal beaches and dunes, coastal marshes and estuaries, coastal lagoons, pine forests, and wetlands. At the national level, those already known were included in the first wetland inventory, while more knowledge was acquired as the identification and mapping of habitat types in Natura 2000 sites progressed, in accordance with the Habitats Directive. In the province of Huelva, the Natura 2000 Network offers protection to a great multitude of ecosystems, on the coast alone we can find: Doñana National Park, the lower Guadalquivir, the Dehesa de Torrecuadros and Arroyo de Pilas, the Dehesa del Estero and Montes de Moguer, the Estero de Domingo Rubio, the Palos and Las Madres lagoon, the Odiel Dunnes, the marshes and banks of the River Tinto and its estuary, the Odiel marshes of Carboneras, the Portil lagoon, the Enebrales de Punta Umbría, the marshes of the River Piedras, its estuary, and the arrow of Rompido, and the marshes of Isla Cristina.

While coordinated efforts to address them are long overdue, some of these coastal communities, which are in a highly vulnerable position, are already starting to feel the effects

¹ The blue economy promotes economic growth from a perspective in which the very engine of development is based on the preservation of marine ecosystems and environmental sustainability (Crespo Garay, 2021).

of climate change. Particularly in these coastal regions, where the tourism industry has grown significantly, the effects of climate change are having negative effects. Nevertheless, there are still little pertinent multi-level research on the effects of climate change, erosion, and sea level rise, despite the importance of coastal zones (Verdugo, E. M. C., Palomo, C. J. L., Martín, A. V., Vázquez, A. P., Álvarez, A. G., & Pérez, M. C., 2011).

2. Context of the coastal reality of Huelva

With this awareness campaign we aim to promote reflection and debate in our society about our coastal reality, with the capacity to evaluate, intervene and decide on the problems that affect our environment and specifically our coasts, which are becoming fragile spaces. The natural areas of Huelva, in which the fauna and flora live, are constantly undergoing changes and alterations due to various causes or sources. Humans, with their industrial and commercial activities, are the cause of most of these alterations. It is therefore necessary to employ methods to minimise or avoid these impacts if possible.

2.1 Current real problems

The coastline of Huelva is showing alarming symptoms of environmental degradation and saturation of the physical space, exceeding the carrying capacity of the territory, both in terms of the number of people and infrastructures. The causes are well known: overexploitation of fishing resources and illegal trawling; excessive water consumption for agriculture and tourism; pollution, both marine and terrestrial; the alteration of morphodynamic balances (construction of breakwaters) which is causing erosive damage in many parts of the coast; urban and tourist pressure, unsustainable in many coastal areas and the repeated failure to comply with coastal laws (Barragán, J. M., Boy, Á., Carballo, A., Colina, A., Doménech, J. L., & Juanes, J. A., 1991).

- Coastal areas have suffered the most intensely from the impact of increasing human pressure, urbanisation and tourism development.
- Massive urbanisation and the construction of different associated infrastructures have caused a radical transformation of the coastline and the disappearance of many sandy beaches.
- The construction of buildings, roads, promenades, etc. on the sandy surface of the beaches, the execution of inadequate land and maritime works, and the extraction of aggregates are some of the most frequent activities causing this transformation.
- Demographic pressure and the concentration of economic activities on the coast, with the cultivation of red fruits on the coast of Huelva being one of the activities that have the greatest impact, lead to an increase in the consumption of water resources to the point of overexploitation.
- The toxic phosphogypsum ponds and the heavy metals that mining contributes to the Tinto and Odiel rivers.

A specific pollution problem in coastal areas, as a consequence of overexploitation, is the salinisation of coastal aquifers due to seawater intrusion, one of the problems that most affect the Doñana National Park. The current model of human development in coastal areas is hardly sustainable in the terms in which it has taken place until now. If the current rate of growth of the main human activities were to continue, the resulting environmental problems would be of such magnitude that we can expect a decrease in the current quality of life and a strong weakening of the productive sectors.

2.2 Possible future problems

The most recurrent threat that endangers the coast of Huelva is the consequences of a tsunami which, as announced by various experts in the field, is certain to occur, although it is not known when with certainty. The impact of a tsunami on our coasts would be an environmental catastrophe of great magnitude, which is why the Andalusian Regional Government has announced the drawing up of a Contingency Plan for the risk of tsunamis in Andalusia. What the scientific community is asking for: an evaluation of the effects of a possible tsunami and an action plan to react to the emergency. Almost the same thing that the Huelva City Council, since December 2019, is carrying out in a pioneering way in Spain, circumscribed to the local area.

The Contingency Plan is insurance for the protection of the coasts. Until now it did not even exist, even though 23 million people live in the area. That is, 58% of the population is in an area of 7,660 square kilometres, and it is estimated that those affected by a tsunami on the coast of Huelva would affect a total of 112,700 victims Ronchel, J. (2021). After years of delay and the deployment of specialists, the State Plan places Spain at the forefront of Europe in this area. The plan aims to detect the phenomena as early as possible and to inform the population so that they can evacuate and protect themselves before the water reaches land. It seems simple, but according to Minister Grande-Marlaska, behind it, there is a "unique" coordination work between state and regional governments Ronchel, J. (2021). It is based on the National Tsunami Warning System and information from the National Seismic Network, tide gauges in ports and the detection systems of the Spanish Institute of Oceanography. Every effort has been made to determine where, when and how these giant waves could emerge. They travel thousands of kilometres at speeds of between 500 and 1,000 kilometres per hour, with potentially devastating impacts.

According to this plan, there are three risk areas in Spain. The most dangerous are the coasts of the province of Huelva, the west of Cadiz and the Canary Islands. The Mediterranean is a medium-risk area and the Cantabrian coast is the lowest-risk area. The results point to swells of up to eight metres, with arrival times ranging from 55 minutes for the west of Andalusia to one hour for the islands Ronchel, J. (2021). In the case of Andalusia, smaller tsunamis can also occur, with an arrival time of half an hour.

On the other hand, one of the biggest problems facing Huelva is the disappearance of freshwater in the Doñana National Park, which is home to one of the largest wetlands in Europe and is being threatened by intensive agriculture (particularly the cultivation of red fruits). Scientists claim that the park's water supply has declined dramatically due to climate

change and excessive water abstraction by neighbouring strawberry farms, often through illegal wells. This issue strongly divides those who want to preserve the park and the farmers.

Juan Romero, a representative of 'Salvemos Doñana' said: "The overexploitation of groundwater will destroy the wetlands of Doñana if there are no radical changes. And the radical changes would be: to stop overexploiting the aquifer, and close wells, that's what the administration has to do. They have to limit current extractions and reduce them by half. Despite repeated calls by activists, experts and even UNESCO to stop illegal groundwater extraction (WWF has catalogued more than 1,000 illegal boreholes), little has been done to address the problem. The effect of aquifer exploitation is most evident in the disappearance of the dune pools, which are directly dependent on the water table and are home to endemic species of plankton and rich communities of amphibians and dragonflies. However, when the aquifer is recharged, it also overflows into the marsh system that supports waterbirds, including greater flamingos, and this flow has been greatly reduced by drilling. To make matters worse, on 9 February 2022 the Andalusian regional parliament voted in favour of a plan to legalise 1,500 hectares of irrigated land and thus legitimise the operations of illegal farmers, despite open opposition from the Spanish central government, the EU, UNESCO and several non-governmental organisations.

2.3 Places where coastal dynamics make them particularly sensitive to any action.

As mentioned earlier in this report, in the province of Huelva, the environmental areas that enjoy protection under the Natura 2000 Network due to their vulnerability and sensitivity to any external action are: Doñana National Park, the lower Guadalquivir, the Dehesa de Torrecuadros and Arroyo de Pilas, the Dehesa del Estero and Montes de Moguer, the Estero de Domingo Rubio, the Palos and Las Madres lagoon, the Odiel Dunes, the marshes and banks of the River Tinto and its estuary, the Odiel marshes of Carboneras, the Portil lagoon, the Enebrales de Punta Umbría, the marshes of the River Piedras, its estuary, and the arrow of Rompido, and the marshes of Isla Cristina.

3. Analysis of this reality

3.1 Industry and phosphogypsum



The production of phosphoric acid at the Polo Químico de Huelva since 1967 has generated the accumulation of a waste known as phosphogypsum, directly on the marshes of the estuary of the Tinto river, less than 1 km from the city of Huelva. This waste (120 Mt) occupies an area of 1200 hectares and contains impurities of toxic metals and radionuclides (Bolívar et al., 1996; Pérez-López et al., 2007).

The fertiliser plant ceased dumping in 2010 by a decision of the National Court. However, the pond remains occupying the marshes of the Tinto river. This pond is located in the tidal prism of the estuary and is not watertight. The effluents from its leaching leave a characteristic footprint in the Huelva Estuary and can even spread to remote areas as a result of tidal action (Bolívar et al., 2002). Most studies on the Huelva phosphogypsum ponds have focused on the radiological impact on the estuarine environment (e.g. Bolívar et al., 2002). However, the contribution of metallic contaminants from the phosphogypsum to the estuary has recently been investigated (Pérez-López et al., 2011). Even so, the results of the classification and characterisation of phosphogypsum based on current legislation are not known.

Phosphogypsum is a waste consisting almost entirely of gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$), which can be recycled as an agricultural additive or as a building material. In addition, the phosphogypsum pond contains a small residual fraction of free acids from the industrial process, mainly phosphoric, sulphuric and hydrofluoric acids. Phosphoric acid is the main residual acid and corresponds to that fraction of the product that could not be separated at the plant for marketing. Most of the contaminants in the pond are mobile and are concentrated in

the residual acidic solutions that occupy the interstitial space of the waste. These acidic and potentially polluting solutions represent the real environmental risk of the phosphogypsum pond itself. The phosphogypsum pond is exposed to weathering conditions. The region is characterised by a Mediterranean climate with rainy winters and hot, dry summers. The pollutant dynamics in the pond are directly influenced by seasonal variations. During the rainy season, acidic pollutant solutions migrate along the phosphogypsum profile towards the deeper areas in contact with the marsh. In the marsh, the absence of oxygen and the high concentration of organic matter favour the presence of sulphate-reducing bacteria whose metabolic activity generates gaseous sulphur compounds. These gases react with the metals in the solution, and sulphide precipitation occurs, which limits the polluting capacity of these solutions. However, the marsh cannot retain all the acid solutions, and some of the leachates migrate laterally until they are discharged directly into the Huelva Estuary.

3.2 Plastic waste



Glasses, plastic bottles, straws, caps, farm waste, tons of greenhouse waste.... This is plastic waste that reaches the sea every day and enters the food chain and the stomachs of people and consumers. In Huelva alone, between 18,000 and 25,000 tonnes of plastic waste from agricultural use are produced every year. This is a local example of what Huelva 'contributes' to this issue that has the United Nations Organisation upside down. In addition to this, during 2018 alone, a total of 274,000 tonnes of waste were treated in the collection facilities under the Huelva Provincial Council. Of this, 36% (98,000 tonnes) are different types of plastics.

Every year the equivalent in plastic of 1,200 times the weight of the Parisian Eiffel Tower or the Riotinto Company's wharf in Huelva reaches the seas. And the Parisian

monument measures 300 metres and weighs 7,500 tonnes. Meanwhile, in Spain only 30% of plastic is recycled and a bottle of this material takes no less than 500 years to decompose. A walk along the beaches is enough to see that the sand is littered with bits and pieces of plastic. In fact, a field study is already being carried out on the Espigón beach in Huelva. At the same time, in Huelva, a recent report found that on the beach of Castilla (Almonte) no less than 700 plastic objects were accumulated in a short space of time: bottles, bottles, ropes, towels, jars...

It is a major problem. Because by 2020, global plastic production will reach 500 million tonnes, 900% more than in 1980. And the UN is already warning that in 2050, in 30 years' time alone, there will already be more plastics than fish. The question scientists and doctors are asking is how much of this material ends up in our bodies. There are already figures. And they can be extrapolated to provinces like Huelva. A new study finds that, on average, people could ingest approximately 5 grams of plastic every week, which is the equivalent weight of a credit card.

The analysis *No plastic in nature: Assessing plastic intake in people* prepared by Dalberg, based on a study commissioned by WWF and carried out by the University of Newcastle, Australia, suggests that people consume around 2,000 small pieces of plastic every week. That's about 21 grams a month, just over 250 grams a year. That's a quarter of a kilo. If we multiply this amount, 250 grams by the 500,000 inhabitants of the province of Huelva, it means that the people of Huelva 'eat' 125,000 kilos of plastic every year. The largest source of plastic ingestion is through water, both bottled and tap water, worldwide.

3.3 Doñana National Park (overexploitation of resources)



Doñana National Park is a mosaic of ecosystems that are home to unique biodiversity in Europe. The marshland stands out above all and is of extraordinary importance as a passage, breeding and wintering place for thousands of European and African birds. The Park is home to unique species in danger of extinction, such as the Iberian imperial eagle and the Iberian lynx. Doñana is the confluence of a series of ecosystems (beach, dunes, reserves, marshes...) that give the Park a unique personality (Barrera, F. B., 1992).

Water theft and overexploitation of the aquifer, poor water purification, illegal dumping, conversion of forest land for agricultural use, fires, noise and light pollution, poaching, and climate change are some of the environmental problems that threaten the Doñana National Park, as listed and described by WWF in its new report Doñana and the Guadalquivir River Estuary: WWF Spain's analysis of its environmental problems. Overexploitation of aquifers and water theft continues to be the main problem in Doñana. A critical situation has brought Spain before the European Court of Justice for non-compliance with several directives and has forced the Government, through the Guadalquivir Hydrographic Confederation (CHG) to initiate the process to declare the overexploitation of the aquifer on 21 February 2019. Despite recent efforts by the Confederación Hidrográfica del Guadalquivir to close numerous wells during 2019, water theft in the Cabecera de la Rocina, or the irrigable area of Los Hatos, among others, continues to be cancer for the Doñana aquifer (Montes-Vega, M.J., & Rodríguez-Rodríguez, M., 2021). And this is because, for the closure of illegal wells to be effective, it must be accompanied by strict application of the Forest Crown Plan, approved by the Andalusian Government in 2014, with actions on the estates that must be closed, a responsibility that the Junta de Andalucía systematically shirks.

The fact is that the area of unregulated soft fruit cultivation continues to grow unchecked and has increased by more than 13%. The total area under cultivation in areas that cannot be regularised is 1,653 hectares, which is 20% of the total cultivation under plastics. Meanwhile, sources estimate that there are more than 2,000 non-legal water-use infrastructures scattered throughout the territory. In addition, the occupation of riverbanks and watercourses for crops continues to grow; it is estimated that at least two-thirds of the rivers and streams studied are altered.

Other problems, broadly speaking, affecting Doñana:

A. Illegal landfills and rubbish dumps are another threat.

Illegal landfills and dumps threaten Doñana, because, like the burning of plastics, the abandonment of waste is an environmental problem that can also have an impact on the health of the population.

B. Fires:

The risk of fires has increased, as happened in June 2017. Increasingly hotter and drier summers will lead to a higher number of fires, fuelled by large unmanaged forest stands or stubble burning.

C. Invasive species:

The introduction of invasive alien species has increased markedly over the last 10 years.

D. Air, light and noise pollution:

Other problems also analysed are air, light and noise pollution. The heart of Doñana is not far from the chemical centre of Huelva, where gas emissions, phosphogypsum ponds or discharges into the marine environment, due to accidents in the unloading of oil, for example, are the consequences of the presence of companies dedicated to the production of fertilisers and oil derivatives.

E. Fishing activity is not exempt from problems either, the lack of control and surveillance, and the use of hydraulic dredges to catch clams destroy the seabed and affect species of great socio-economic importance such as prawns.

"Doñana is water and yet we are witnessing the theft of water in Doñana", explained the organisation, as the main problem affecting this Biosphere Reserve. WWF points out that the area of red fruit crops in an irregular situation has increased by more than 13% and that the total area of crops in areas that cannot be regularised is 1,653 hectares, a fact that dates back to the 1980s (Camacho, C., Negro, J.J., Elmberg, J. et al., 2022). Linked to cultivation, other environmental problems in Doñana are the dumping and burning of plastic waste. Given this situation, the organisation calls for the "strict" application of the Corona Forestal Plan in addition to the closure of illegal wells.

Other problems encountered by the organisation include the existence of "many wild cats and dogs", which "are a problem for the lynx". They also point out that fires, lynx being run over, management and human activity itself influence the National Park. Among the projects that could affect the National Park, according to WWF, are the expansion of roads or the "attempt to turn Doñana into a gas storage area". And even "cyclical projects that seem to be coming back, such as the Huelva-Cádiz road", which, according to the environmental organisation, "is not a viable project". Among the solutions and demands in the face of these environmental problems, WWF points to the approval of an annual plan for extractions from the aquifer, the reduction of the impact of maintenance dredging of the Guadalquivir River, and the proper management of agricultural plastics, waste and landfills, among other issues (Camacho, C., Negro, J.J., Elmberg, J. et al., 2022).

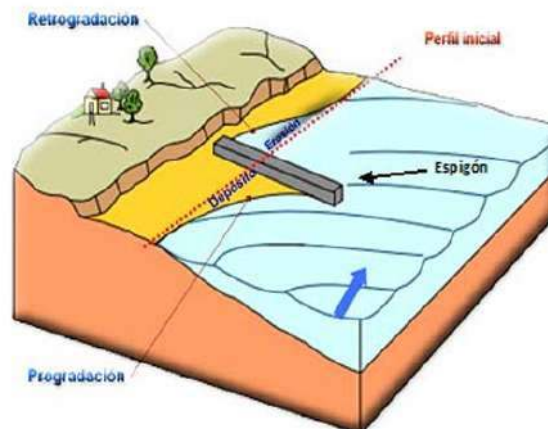
"Doñana is a symbol of conservation and resilience: it has been fighting for its survival for 50 years. It lives in a difficult ecological balance; if the administrations do not take measures for its protection seriously, its deterioration may become irreversible and the future of this World Heritage Site, for which the Andalusian and central governments are responsible, is even more uncertain", said Teresa Gil.

3.4 Coastal construction and creation of breakwaters

The disappearance of dune areas and their biodiversity, as well as the need for constant regeneration of the beach sand, show that the policy of transformation with

breakwaters, reservoirs and frontline developments has been a serious mistake (Isla Canela and Isla Cristina are examples of such constructions affecting the environment, the soil and the fauna).

In the course of the 20th century, the transformation of port activity on the coast of Huelva has led to the execution of a large number of works to stabilise the channels of the estuary, which is used as port access. With this premise, the breakwaters of Vila Real de Santo Antonio (Portugal), Punta de las Cañas (Ayamonte), Punta del Moral (Ayamonte), Punta del Caimán (Isla Cristina), Punta Umbría and Juan Carlos I (Huelva) were built in the 1970s (Morales, J.A., & Borrego Flores, J. 2008). As a consequence, the orientation of the wave trains on the coast of Huelva has undergone a modification as they refract on the rocky end of the same breakwater, reversing the direction of sand transport. This generates an area of divergence in the direction of coastal drift, which turns the beaches of Huelva into steeply sloping erosive areas, as occurs on the beaches of Islantilla, Isla Canela and Mazagón (Playa del Vigía area) (Morales, J.A., & Borrego Flores, J. 2008). On the other hand, the west side of the breakwaters generates an accumulation of sand, as is the case at Playa de las Cañas, Punta del Moral, Punta del Caimán, Punta Umbría, Playa del Espigón Juan Carlos I and Playa del Puerto Deportivo de Mazagón. The image shows the process of erosion and accumulation of sand due to the breakwaters.



Likewise, as a result of coastal development, botanical species such as the *Linaria lamarckii* have disappeared from their last habitat in the province as a result of the authorisations for urban developments in Punta del Moral and Rodadera del Castillo in Ayamonte. Their subsequent reproduction in greenhouses offers a similar case to that of the lynx; the ecosystem is not protected, only the emblematic species are saved in extremis, but without any plan for the future in their natural environment. Amphibians, bats and bats suffer a significant decline in their populations due to different environmental impacts. Freshwater fish and molluscs are threatened by the introduction of exotic species and fish stocks are declining due to overfishing and the degradation of the marine environment.

In general, we see that, while we are still unaware of the wealth that surrounds us, as new species continue to appear, the habitats that have allowed them to thrive continue to be destroyed and degraded without the social, economic and political mechanisms in place to learn to appreciate and defend them from excessive ambition. The diversity of life is diminishing and with it the richness of the human life of the population of Huelva.

4. The environmental values of our coastline and the problems it faces

The environmental and economic importance of the coastline has already been demonstrated and has been a determining factor in the irreversible modification it has undergone worldwide. The natural resources of the coastal strip have had to support a large number of activities. Considering their function in the production of goods, resources have often been overexploited because their rate of renewal has been exceeded, as in the case of fisheries or freshwater.

Coastal and marine areas are home to ecosystems, processes and natural resources that fulfil ecosystem functions that guarantee the quality of human life: climate regulation, food supply, support of activities, source of active ingredients for health management, flood and storm control, energy generation, emotional and aesthetic values. Hence, an important part of these spaces is considered to be in the public domain and therefore subject to specific regulations. On the coast, the convergence of uses and activities is common, sometimes driven by conflicting interests, which sometimes causes conflicts and environmental problems. In this scenario, the important role of environmental education in terms of information, training, awareness-raising and participatory democratic culture is understood.

5. Ideas, keys and tools for coastal and marine sustainability (best practices)

A multi-level campaign is badly needed to understand the perceptions of key social, political, economic and environmental actors in protected coastal wetlands and their surrounding areas. This would enable policymakers and society as a whole to better design and implement future climate change adaptation measures. It is essential to understand how the social, economic, ecological and institutional context mediates climate change impacts and influences adaptation and mitigation. Experts point out that local stakeholder perception cannot replace scientific research, but is an important complement to understanding local phenomena and specific local concerns. In addition, local perceptions of climate change can inform scientists by drawing attention to overlooked aspects and can help formulate new research questions.

Economies, populations and ecosystems are already affected by climate change and its impacts are likely to accelerate and increase in the coming decades. Through a campaign, therefore, local awareness of current and potential climate change impacts (and adaptation) would emerge that would be useful for future climate change policies in coastal zone

management planning. For example, with regard to coastal erosion, a vulnerability index could be developed. A vulnerability index that could correspond to a value denoting the capacity of the coastal system to cope with and recover from an erosion event. This index will allow an assessment of the potential impacts of coastal erosion in a socio-economic, ecological and cultural framework. Indicative examples may include:

- (i) Poor design and/or construction of buildings,
- (ii) Inadequate protection of property,
- (iii) Lack of public information and awareness,
- (iv) Limited recognition of hazards and preparedness measures,

It is also vitally important to develop a comprehensive guide to good practice in non-formal education that encourages citizen participation. The environmental challenges we face imply a change in education (formal and non-formal) that leads us from knowing how to be to know what to do for the benefit of all. In other words, moving from theoretical knowledge to knowledge accompanied by actions (practices) that seek changes in behaviour, in terms of improving the quality of education and life, the exercise of human and nature rights, the reduction of poverty and the consolidation of fairer and more sustainable societies. It is very important to achieve a collective commitment to the conservation of our coastline, through a good guide there will be a real capacity to make decisions on the conservation and protection of this space.

This guide will be focused on the young public and will include some simple measures that we can adopt in the activities that we carry out on the coast and whose aim is to reduce the environmental impacts of the activity that is carried out:

- A. When you go to the beach, reduce your waste generation and always plan what you are going to do with it.
- B. Don't leave your waste on the beach
- C. Before you leave, check the place you have occupied to make sure it is free of litter
- D. Don't waste water, use showers and footbaths sparingly.
- E. Comply with the warnings on signs and coastal regulations.
- F. Avoid actions that deteriorate the quality of the water.
- G. To access the beach use the authorised accesses, do not step on the dunes.
- H. Do not pull up plants or disturb animals, respect the environment.

6. Adapting ideas for dissemination in social networks

The protection of coastal and marine areas is neither easy nor straightforward. Multiple natural and human factors play the most important role and can have a positive or negative impact. The analysis and recording of all major and minor factors, which are responsible for the totality of problems in coastal and marine areas, is the first imperative action. Another important action is the design and creation of a multi-level information campaign at various

levels, both for local actors - community, the scientific community and relevant public bodies.

Interactive and lifelong learning is something that concerns the whole of society. In our subject, the education of local actors - society and subsequently the general population - is an absolute necessity. To disseminate good practice advice through social networks, it is necessary to synthesise and summarise the key ideas of this report. This dissemination will help more and more young people to apply the knowledge and advice in the most sustainable way possible and with the least impact. It is very important and necessary that the population becomes aware of the importance of the coastline and its natural resources, and how important it is to preserve and protect them. The coastline is the area where the marine and terrestrial environments converge and interact, home to a large number of endemic species, both flora and fauna, which are extraordinarily fragile to any type of aggression and which ensure the quality of human life: climate regulation, food provision, support for activities, source of active ingredients for health management, flood and storm control, energy generation, emotional and aesthetic values. Therefore, with the message and information that the campaign will provide, we will be contributing directly to environmental education.

7. Expert advice

To develop this report in a more complete and detailed manner, we enlisted the help of two experts in the field.

The expert Pedro Calvente Delgado, who holds a double degree in environmental sciences and geology from the University of Huelva, was awarded the prize for the best record in the geology degree in the 2020/21 academic year. He is currently an agronomic measuring station control technician for the company IG4, located in Gibraleón, Huelva.

As you show in your document, the coast of Huelva is a place with innumerable types of ecosystems and species that add great ecological value to our province, linked to different freshwater and saltwater environments.

This means that the activities that take place on our coast generate various environmental impacts on them, from industrial activity to the unsustainable use of water resources and tourism, as you have explained in the document.

It seems to me that the need for projects such as this one, which raises awareness of the conservation problems that exist in Huelva, is vital, above all to spread the idea that it is necessary to conserve what we have, as it is unique. From Doñana to the Guadiana River, numerous environments favour the rest of millions of birds on migration. We are at a strategic point for these birds, which year after year travel thousands of kilometres to feed or breed in our territory, both from northern Europe and southern Africa. As you rightly point out, the unsustainable consumption of water by agricultural activity in the Doñana area could mean the drying up of all the freshwater lagoons in the park, unique environments in terms of their

morphology and dynamics, but also because of the great biodiversity they contain, one of the largest, if not the largest concentration of different species in Europe.

For this and much more, I think the approach you have taken to the project is correct, well-documented and very rich in terms of the information provided.

The expert Maria Eugenia Beltran Becerril, Biology teacher at the "La Hispanidad" school and teacher of the participants in the LITORAL project.

As your report explains, our geographical location and the environmental problems associated with industrial and agricultural processes and our natural heritage make it essential and highly relevant to raise environmental awareness and care for the environment in which we live.

In addition to teaching and raising awareness of the importance of the environment, environmental education seeks to create values in citizens and attitudes that promote the rational use of natural resources and the solution to the numerous environmental problems that occur, mainly in cities.

More than an educational process, it is the basis for future generations to create a more environmentally aware lifestyle, in which it is of vital importance that students participate in the different educational stages. This implies generating tools that enable students and citizens of the future to acquire knowledge, values and skills that will allow them to take active action in the prevention and solution of current environmental problems, as well as responsible and quality management of the environment.

Participation in this project has been very positive at a pedagogical level. The students have been very involved and motivated in all the sessions carried out. They have participated actively and with great enthusiasm in the development of various activities (board games, stories, objects created with recycled material, videos, etc.) to contribute to the creation of a manual of good practices to help raise awareness among other schoolchildren who share the same environmental context.

At the same time, at a curricular level, the workshops have allowed the development of the specific competence 5 of the subject Biology and Geology for students of 1stESO: "To analyse the effects of certain actions on the environment and health, based on the fundamentals of biological and earth sciences, to promote and adopt habits that avoid or minimise negative environmental impacts, are compatible with sustainable development and allow the maintenance and improvement of individual and collective health, all within the framework of the Andalusian environment".

All these activities contribute to developing the educational line of our school, which currently participates in various training and environmental awareness programmes for pupils, such as Comando Verde and the School Garden, with the aim of educating in social values and fostering attitudes of respect towards the environment, which allow for the integral training of future citizens capable of living in a sustainable environment.

8. Bibliography

- Barbesgaard, M., (2018) Blue growth: savior or ocean grabbing?, *The Journal of Peasant Studies*, 45:1, 130-149, DOI: [10.1080/03066150.2017.1377186](https://doi.org/10.1080/03066150.2017.1377186)
- Barragán, J. M., Boy, Á., Carballo, A., Colina, A., Doménech, J. L., & Juanes, J. A. (1991). Gestión integrada de zonas costeras. *Bull., n. o, 23*, 265-270.
- Barrera, F. B. (1992). Geosistemas lagunares en el litoral de Huelva: los complejos húmedos de El Abalarío (Entorno de Doñana). *Huelva en su historia*, 4.
- Camacho, C., Negro, J.J., Elmberg, J. *et al.* (2022) Groundwater extraction poses extreme threat to Doñana World Heritage Site. *Nat Ecol Evol* 6, 654–655. <https://doi.org/10.1038/s41559-022-01763-6>
- Cumbrera, M. G., & Lara, E. L. (2010). Consecuencias del turismo de masas en el litoral de Andalucía (España). *Caderno Virtual de Turismo*, 10(1), 125-135.
- Dalberg Global Development Advisors (2019). Naturaleza sin plástico: Evaluación de la ingestión humana de plásticos presentes en la naturaleza. WWF España.
- Dunic, J. C., Brown, C. J., Connolly, R. M., Turschwell, M. P., & Côté, I. M. (2021). Long-term declines and recovery of meadow area across the world's seagrass bioregions. *Global Change Biology*, 27(17), 4096-4109.
- Carmona, J., Flores, P., (2019). Análisis de los problemas ambientales de Doñana y el Estuario del Guadalquivir. WWF España
- [Ministerio para la Transición Ecológica y el Reto Demográfico. Campañas informativas.](#)
- Montes-Vega, M.J., & Rodríguez-Rodríguez, M. (2021). Análisis del hidroperíodo de tres lagunas de la Reserva Biológica de Doñana (2018-2020). Universidad Pablo de Olavide.
- Morales, J.A., & Borrego Flores, J. (2008). “El litoral de Huelva: fisiografía y dinámica”. En: Olías Álvarez, M., et al.: "Geología de Huelva : lugares de interés geológico". 2ª ed. Huelva : Universidad de Huelva, 2008. págs. 28-34
- Ronchel, J. (2021). *Un estudio de 2005 calcula 112.700 víctimas por un tsunami en la costa occidental de Huelva.* HuelvaInformación. Recuperado de: https://www.huelvainformacion.es/huelva/estudio-calcula-victimas-tsunami-costa-occidental-Huelva_0_1609940037.html
- Unión Europea. Directiva (UE) 2000/60/CE del Parlamento Europeo y del Consejo, de 23 de octubre de 2000, por la que se establece un marco comunitario de actuación en el ámbito de la política de aguas.
- Verdugo, E. M. C., Palomo, C. J. L., Martín, A. V., Vázquez, A. P., Álvarez, A. G., & Pérez, M. C. (2011). Articulación territorial transfronteriza del litoral atlántico Algarve–Andalucía: la importancia de la Gestión Integrada de Zonas Costeras para una correcta Planificación Estratégica. In *Cooperación transfronteriza Andalucía-Algarve-Alentejo* (pp. 56-64). Universidad de Huelva.
- Voyer, M., Quirk, G., McIlgorm, A., & Azmi, K. (2018). Shades of blue: what do competing interpretations of the Blue Economy mean for oceans governance?. *Journal of environmental policy & planning*, 20(5), 595-616.