

# Lagoons Technical Brief

*Integrated water resources and coastal zone management in European lagoons in the context of climate change*

**Issue No. TB2**



## *The Ria de Aveiro Lagoon, Portugal*

*It is important to enhance, maintain and promote in a sustainable way the ecosystem services, including biodiversity, provided by the Ria de Aveiro coastal lagoon.*

*The Lagoons Brief series translate the results from the FP7-funded Lagoons project into practical and useful information for policy makers and water managers*

## The Ria de Aveiro Lagoon, Portugal

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### Abstract

The Ria de Aveiro coastal lagoon is located on the Portuguese Atlantic coast. It is approximately 45 km long (NNE-SSW) and 10 km wide, with a complex history, both geologically and related to human activity. These activities created different habitats like saltpans, small navigation channels, and agricultural smallholdings named "*bocage*", and greatly enhanced biodiversity. The Ria is part of the Natura 2000 network, is designated a Special Protection Area, and includes several areas classified as Sites of Community Importance. However, human pressure has increased during the past decades, with clear effects on the system ecohydrology, endangering valuable habitats like seagrasses and salt marshes, and human activities like fisheries and agriculture. The Ria has an important natural capital that needs to be carefully managed, taking into account the temporal, spatial and managerial dimensions of Ria. Such an approach will promote a better understanding of the interactions between the activities, functions and uses of the lagoon, and also support the development of management guidelines.

### References

This Brief is based on the following research reports and scientific literature:

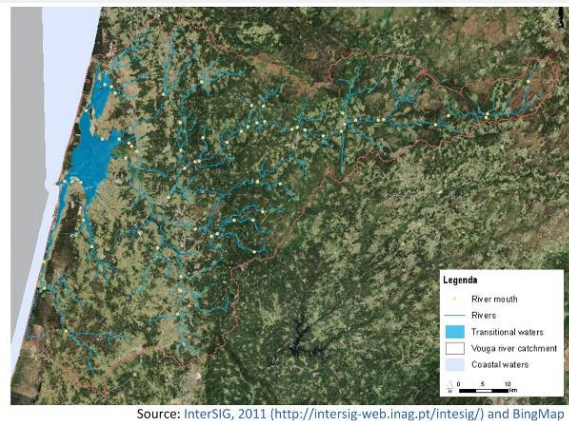
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### Fact box

According to 2011 census, Ria has a population of 353 688 inhabitants in the watershed area, with main activities in the industrial and service sector. For the local population, however, farming and fishing activities are still socioculturally and economically important. The lagoon's natural capital, including the variety of ecosystems services and biodiversity, is essential for the development of the region. Ria is managed within a complex policy and legislative context, with a wide variety of entities and actors engaged in the use and management of the lagoon.

## Environmental and socio-economic characteristics of the lagoon

The Ria de Aveiro (40°38'N, 08°45'W) is a shallow coastal lagoon located in the central coastal zone of Portugal. It covers an area of approximately 83 km<sup>2</sup> and 66 km<sup>2</sup> of wetland at high and low water respectively, integrating the Vouga River catchment area with approximately 3362 km<sup>2</sup> (Figure 1).



**Figure 1 | The Ria de Aveiro coastal lagoon and the Vouga River drainage basin.**

The Aveiro region is under the influence of a temperate maritime climate characterized by strong seasonal rainfall and temperature with warm period between July and September and a cold period between December and February. The Ria de Aveiro provides a wide variety of biotopes with high biological diversity (Figure 2) including open water, beaches, seagrass meadows, salt marshes, sand and mudflats, riparian forest, dunes and farmlands, namely the “Bocage” smallholdings with living hedges.



**Figure 2 | Left: Salt marsh; Right: “Bocage” cultivated with maize (© A.I. Lillebø).**

The Ria is part of the Natura 2000 network, it is a designated Special Protection Area (SPA), includes several areas classified as Sites of

Community Importance (SCI). Many species are protected by international conventions such as the EC Birds Directive and the EC Habitats Directive. The Ria was recently classified as in a reasonable good state of environmental preservation. However, changes in the system ecohydrology, namely in tidal prism, water velocity and turbidity are endangering valuable habitats and associated goods and services. Relevant examples are shown in Figure 3.



**Figure 3 | Left: erosion of salt marshes; Right: “Bocage” abandoned due to saltwater intrusion (© A.I. Lillebø).**

The lagoon supports a wide range of activities that are of significant economic importance, including offshore and inshore fishing, local professional fishing, shellfishing and recreational fishing (including baitdigging) as well as fish aquaculture, the preparation and processing industry, storage, transport and distribution, marketing, business support services, salt-production, port activities, tourism (including local festivals, devoted to local goods), ecotourism and catering (Figure 4).



**Figure 4 | Left: salt-production (© J.P. Coelho); Right: Oyster aquaculture (© A.I. Lillebø).**

According to the survey regarding fisheries carried out in Ria de Aveiro under the European Union in 2010, the existing fleet was composed by 18 offshore fishing vessels, 38 boats for coastal fisheries and 851 small scale fishing boats (Figure 5).



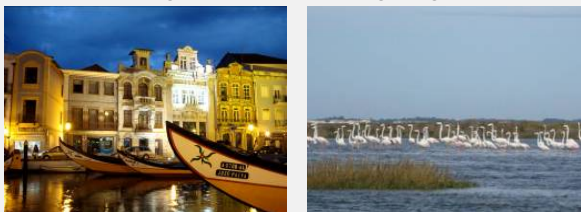
**Figure 5 | Left: Fishing vessel; Right: small fishing boat** (© A.I. Lillebø).

The Ria de Aveiro watershed area includes 11 counties, with a total population of 353 688 inhabitants (2011 census).

**In 2001 census the employed population by sector was:**

- › **Agriculture and fishery: 7 592 (5%)**
- › **Industry: 75 392 (47%)**
- › **Services: 78 098 (48%)**

Tourism is a sector with high strategic value to all counties in the lagoon watershed. Considering the Ria de Aveiro natural capital there is also a recognized potential for the development of recreational and ecotourism activities, such as the traditional "moliceiro" boat trips, sports activities (e.g. sailing, wind-surfing, kite-surfing and kayaking), walking and/or cycling in the diverse landscape (e.g. saltpans, S. Jacinto dunes, salt marshes, farmlands, quays and canals), fishing and birdwatching (Figure 6).



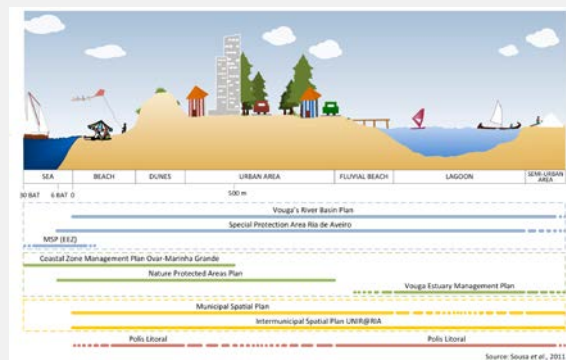
**Figure 6 | Left: "Moliceiro" boat for trips in the Aveiro city channels; Right: Flamingos in Ria** (© A.I. Lillebø).

### Laws and conflicts

The Ria de Aveiro is managed within a complex policy and legislative context, with a wide variety of institutions and actors engaged in the use and management of the lagoon.

#### SOME FACTS OR EXAMPLES:

- › The spatial planning in Portugal involve both multi-sector and multi-level tools for standardization and operations.
- › These tools and guidelines often overlap.
- › Not all types of territories are covered by the plans and programmes (Figure 7). There is a gap in terms of regulation of the marine space.



**Figure 7 | Territorial coverage of some of the plans and programmes on the Ria de Aveiro watershed area.**

### Knowledge gaps

The Ria de Aveiro has been the focus of considerable research during the last two decades, and more than 120 scientific publications have been written covering multidisciplinary issues. However, there are still research gaps regarding the system ecohydrology, specifically in identifying the impacts resulting from the changes in the system's tidal prism and water velocity in the Ria biotopes with recognized high biological diversity.

#### Examples of knowledge gaps in ecohydrology:

- › the effects of the changes in the system's tidal prism, water velocity and increase turbidity in the seagrasses communities;
- › the implications of the decrease of the salt marsh area in Baixo Vouga Lagunar due to the increase in saltwater inundation period;

- › the implications of the surface saltwater intrusion in the Baixo Vouga Lagunar farmlands; and
- › the implications of the collapse of the saltpans for the populations of waders (Figure 8).



**Figure 8 | Left: saltpans habitat for waders; Right: collapsed saltpans (© A.I. Lillebø).**

There are also gaps in the knowledge on Ria ecosystem services, particularly on the topic of ecology and socio-economic collaborative research in order to identify and value the provided services.

**Examples of knowledge gaps in ecosystem services:**

- › the Ria capacity to sustain shellfishing and recreational fishing (including bait digging) (Figure 9);
- › the ecologic and socio-economic impacts of the exotic species Manila clam (*Ruditapes philippinarum*);
- › the Ria capacity to increase its tourism and recreational activities potential;
- › assessment of trade-offs among ecosystem services under alternative management scenarios.



**Figure 9 | Left: Bait digging (© R. Calado); Right: Recreational fishing (© A.I. Lillebø).**

the introduction of a multidisciplinary and integrated approach enabled the development of new methodologies to promote an integrated development and management of coastal systems.

However, there is still a need to fill the existing gaps on the: i) protection of Ria de Aveiro's natural and cultural capital, which is considered insufficient given the ecosystem and biodiversity value and benefits not only for the local community, but also at regional and national level; ii) application of mechanisms for active participation (not only of stakeholders, but also ordinary citizens, as users of the Ria de Aveiro) in the decision-making process; iii) understanding on the evolution of the lagoon social-ecological system; and iv) understanding and integrating on management system of the lagoon's resilience and adaptability for human and natural change.

Since Portugal became an EU member in 1986, the national legal and administrative system has undergone profound changes. In this context,



universidade  
de aveiro



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**Title of project:**

*Integrated water resources and coastal zone management in European lagoons in the context of climate change*

**Contract number:** 283157

**Start date of project:** October 2011      **Duration:** 36 months

*Project funded by European Commission within the Seventh Framework Programme (2007-2013)*

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**Editors:** Katrin Knoth de Zarruk and Per Stålnacke (both Bioforsk)

**This brief should be cited as:**

LAGOONS. 2012. The Ria de Aveiro Lagoon, Portugal. LAGOONS Technical Brief TB2. 6pp.

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