EUROPEAN OBSERVATION NETWORK
TERRITORIAL DEVELOPMENT AND COHESION

ESaTDOR
European Seas and Territorial Development, Opportunities and Risks

ANNEX 3 to the Scientific Report:

Atlantic Ocean Regional Profile

Applied Research 2013/1/5

Version 16/1/2013

Regional Sea Profile: the North Sea

1 Introduction

In the last few years there has been growing acknowledgement that the seas which surround Europe offer significant opportunities for - and potential risks to - territorial development. The sea provides resources on and in its waters and on and under the sea bed that can be harnessed as the basis for territorial development; it enables the flow of goods, services and people, connecting different parts of Europe to each other and the wider global community; and it provides an important environmental asset that needs careful management not least because the health of the sea is critical to efforts to combat climate change. However, different stakeholders have different priorities in terms of what uses and priorities should be privileged in different parts of the maritime environment and few have an overview of the range of issues that require consideration in making such judgements in an informed way.

Whilst there has been a growing recognition of the need for improved planning of maritime space, as exemplified by the growth of integrated coastal zone management and marine spatial planning, more broadly little has yet been done to explore the potentials and challenges of planning for these areas, particularly in relation to their transnational and cross border dimensions. As a step forward, this ESPON project aims to explore the territorial development opportunities and risks facing the seas of Europe by distilling key land/sea and transnational interconnections. Each European regional sea has its own specific characteristics in terms of territorial development opportunities and risks, and uses different governance structures to manage competing claims. This report focuses on one of the six regional seas which are covered by the project and provides a profile of the Atlantic Ocean.

Each Regional Sea Profile report is subdivided into two parts. The first part seeks to provide a detailed characterisation of the regional sea as it exists today. The second part starts to look to the future and describes the potential opportunities and risks pertaining to each sea, and sets out policy recommendations that can help guide territorial development within the region.

Part 1 begins with a brief section which provides contextual information including a description of how the boundaries of the regional sea have been defined for the purposes of this project. In some instances this has been relatively straightforward. In others we have had to make pragmatic decisions as varying boundary definitions are in use and in some areas are still very much contested. The second section then describes in more detail key thematic characteristics of each regional sea focusing on the maritime economy, transport, energy and undersea infrastructure and the environment. This characterisation reflects the existing situation and is based around a standardised series of maps which draw upon the limited number of data sets we have uncovered that relate to these themes where there is good European wide coverage. The maps have, in some cases, been supplemented by local information which is seen as being an exemplar of good practice and which might have relevance to other European regional seas in terms of improving data coverage and mapping to inform policy development.

One of the critical characteristics of all of the regional seas is that the effective management of both the opportunities and risks will require cross boundary and transnational cooperation between the

members states of the EU, members of the European Economic Area and potential accession countries and other countries who share a common interest in a particular sea. The configuration of interested nation states varies from regional sea to regional sea, although how transnational and cross boundary issues are being managed at the present time is reflected on in the governance section. Here a limited number of case studies are used to explore the effectiveness (or otherwise) of various maritime governance regimes designed to address specific cross border and transnational issues.

The final section of the first part provides an overall characterisation of the regional seas based on composite maps of flows, economic significance and environmental pressures. The purpose of these composite maps is to characterise the maritime regions covering both land and sea in terms of intensity of use and land sea interactions. Drawing upon these composite maps a baseline typology of maritime regions is presented which classifies these areas as European Core, Regional Hub, Transition, Rural and Wilderness based on their current attributes.

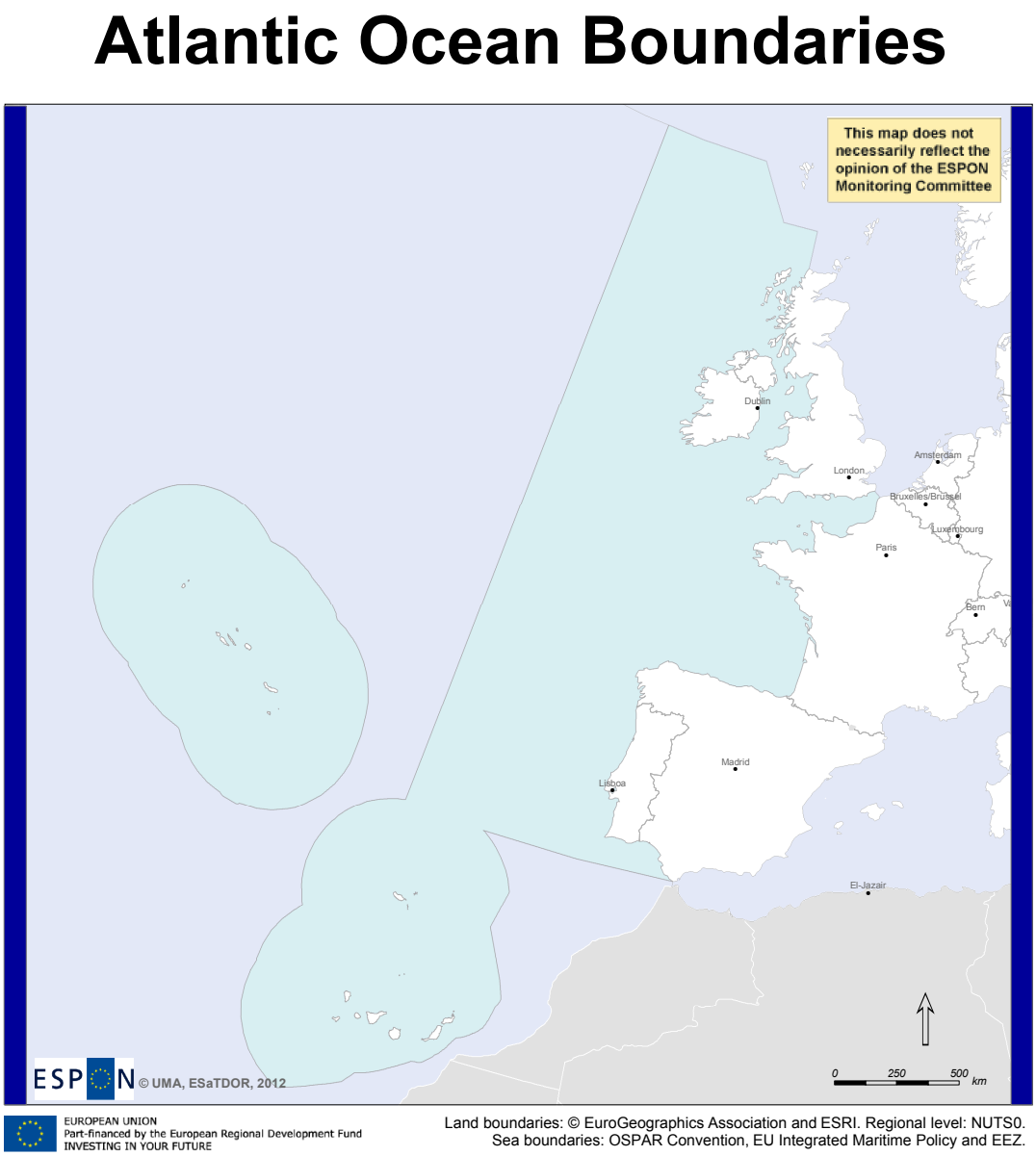
In the second part of the report the focus shifts to the future and it comprises two elements. First we summarise key opportunities and risks for future territorial development for the regional sea based on the understanding of current and potential land sea interactions. Second this assessment leads to a set of policy recommendations targeted at different stakeholder groups related to future planning and development in the region.

PART 1

2. Context

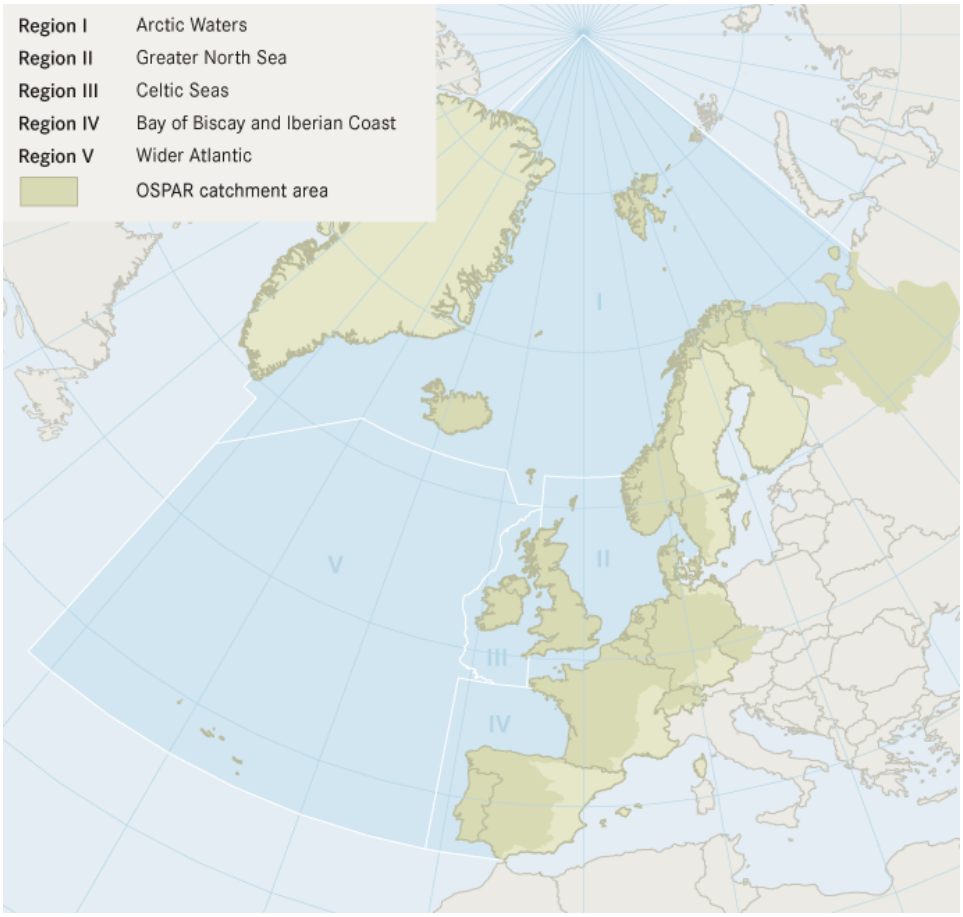
Boundaries

In the ESaTDOR Interim Report it was noted that several definitions for regional seas exist based on international law (more specifically UNCLOS, the UN Convention of the Laws of the Sea), ecological regions such as large marine ecosystems, or policy-related designations such as regional sea Commissions and the EU's Integrated Maritime Policy. Many of these definitions have overlapping boundaries, and in the case of ecosystem-based definitions, cut through politically defined areas such as Exclusive Economic Zones. Therefore, for the purposes of the ESaTDOR project the Atlantic Ocean region is defined by a synthesis of several existing boundaries and is shown in Map AT1 below:



Map AT1. Atlantic Ocean Boundaries (defined for ESaTDOR project)

The boundaries that have been chosen reflect three main sources – the OSPAR regional sea convention for the North East Atlantic, the EU's Integrated Maritime Policy and Exclusive Economic Zones. Under the OSPAR Convention, the larger area of the North East Atlantic is divided into five sub-regions including the Arctic, Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast, and the Wider Atlantic (see Map AT2). These divisions have provided the basis for defining the northern and north eastern boundaries of the Atlantic region in conjunction with the limits for the North Sea and Arctic Ocean regions which are classed as regional seas in their own right for the purposes of this project.



Map AT2. Regions of the OSPAR Convention *Source: www.ospar.org*

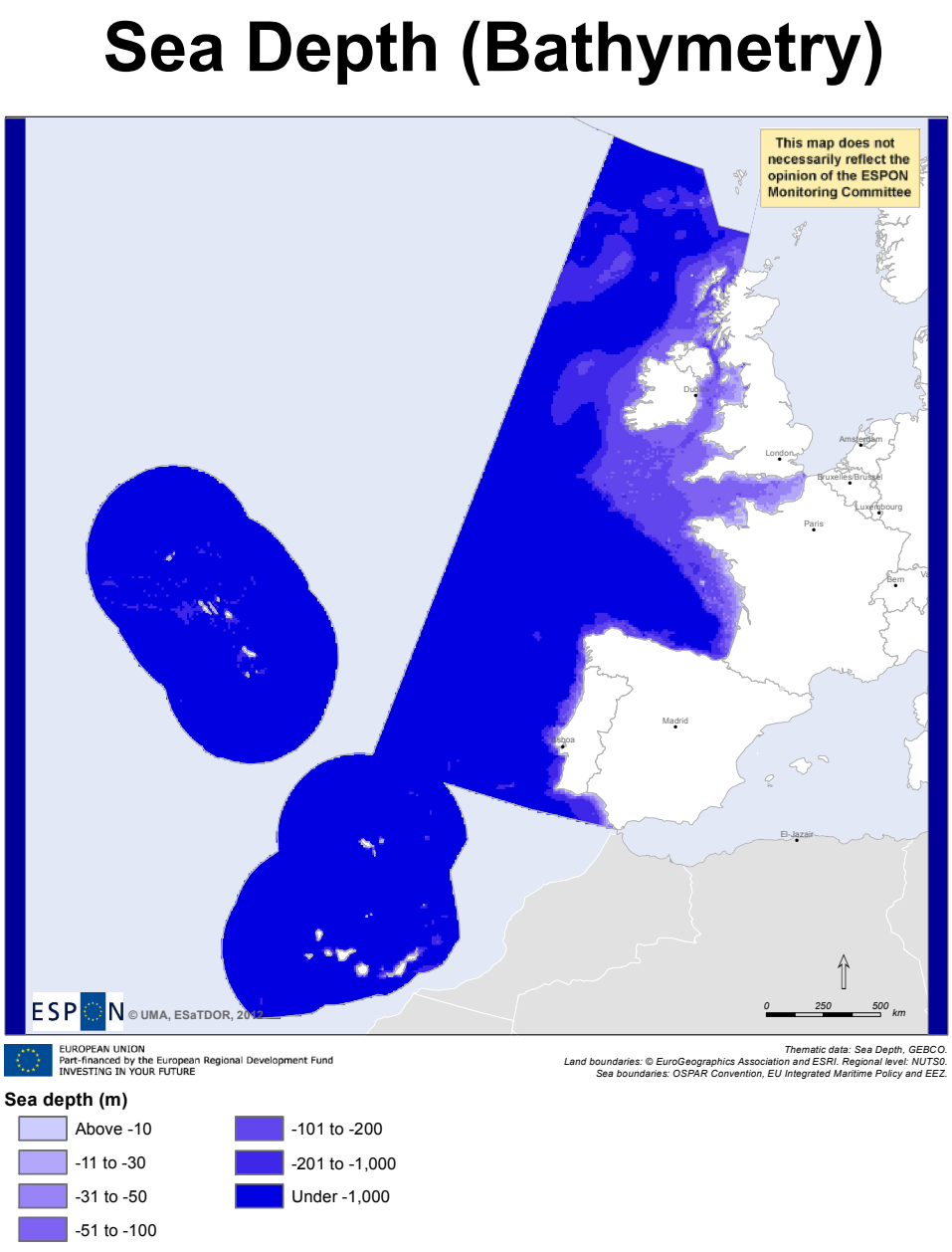
The western and southern boundaries of the Atlantic region are based on the Integrated Maritime Policy areas defined by the European Union for the Celtic Seas, Bay of Biscay and Atlantic Iberian Coast and the southern extent of the OSPAR regions. The EU's IMP boundary does not extend as far westwards as the OSPAR Wider Atlantic area which includes a large section of high seas beyond any national jurisdiction, but does encompass the Exclusive Economic Zones of the UK, Ireland, France, Spain and Portugal. In addition, although the Azores, Canary Islands and Madeira fall outside this zone, their EEZs (and IMP regions) have also been included as part of the Atlantic.

Between the UK and mainland Europe, the eastern limits of the Atlantic are defined using the line between the English Channel and the North Sea. This coincides with the IMP boundary of the Celtic

Seas and is appropriate given the Channel's importance as a Motorway of the Sea, providing a strategic transport route connecting North West Europe with the Atlantic Ocean.

Atlantic Ocean Region – General Conditions

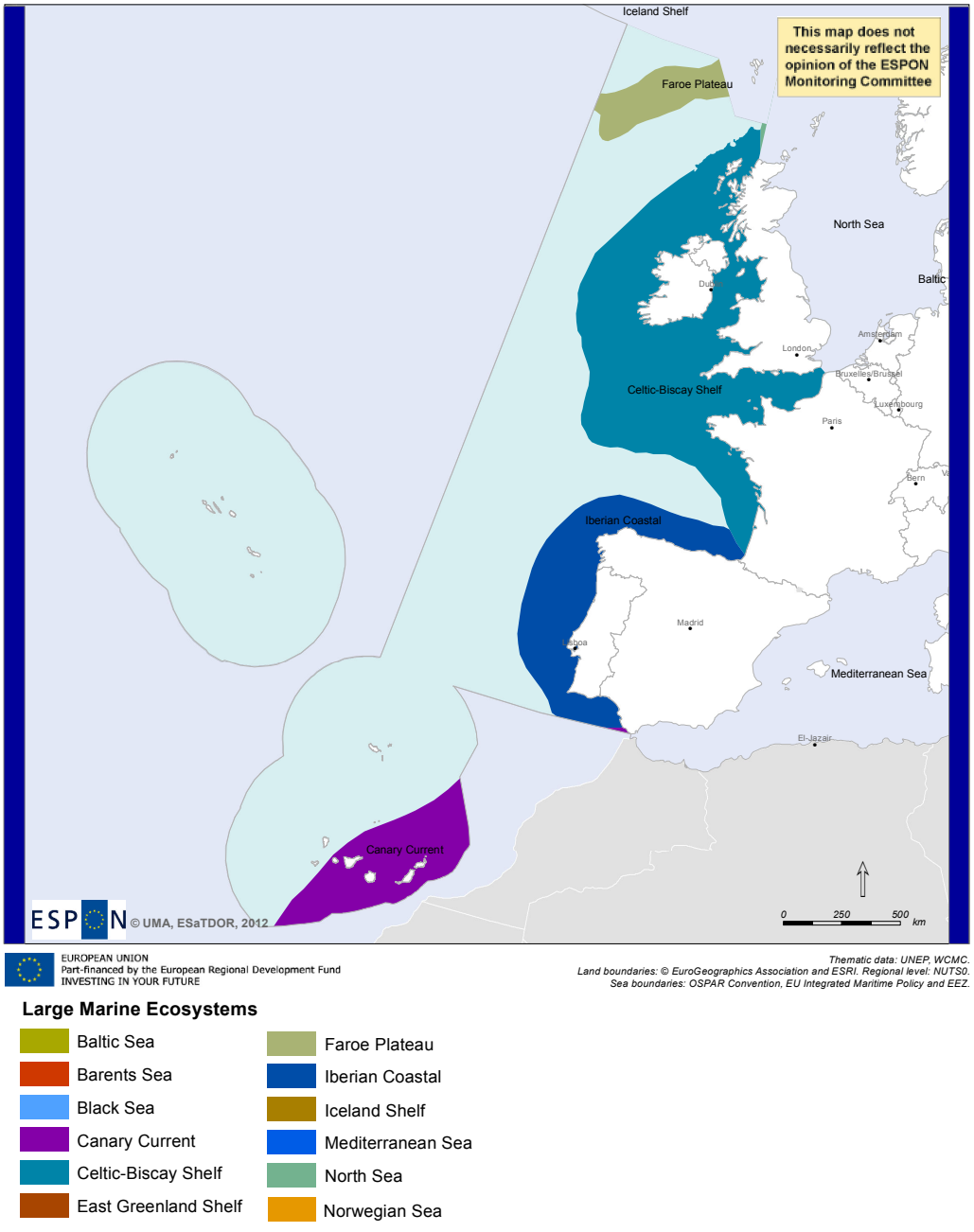
The Atlantic Ocean region of Europe stretches from the north of the UK down the western side of Europe to the Canary Islands west of Africa and extends out into the open waters of the wider Atlantic Ocean. Map AT3 (sea depth) shows an extreme contrast between the morphology of coasts from the north down to the south of the region, with the seas around the UK, Ireland and northern France being relatively shallow due to the westward extension of the European continental shelf, whilst around the southern parts of the Bay of Biscay and the Portuguese coast the Atlantic shelves steeply, reaching a depth of over 5000m in the Biscay Abyssal Plain.



Map AT3. Sea Depth (Bathymetry) in the Atlantic Area

Due to the size of this area there is great variability in the marine environment and a number of distinct marine ecosystems can be defined, as shown in Map AT4.

Atlantic Marine Ecosystems

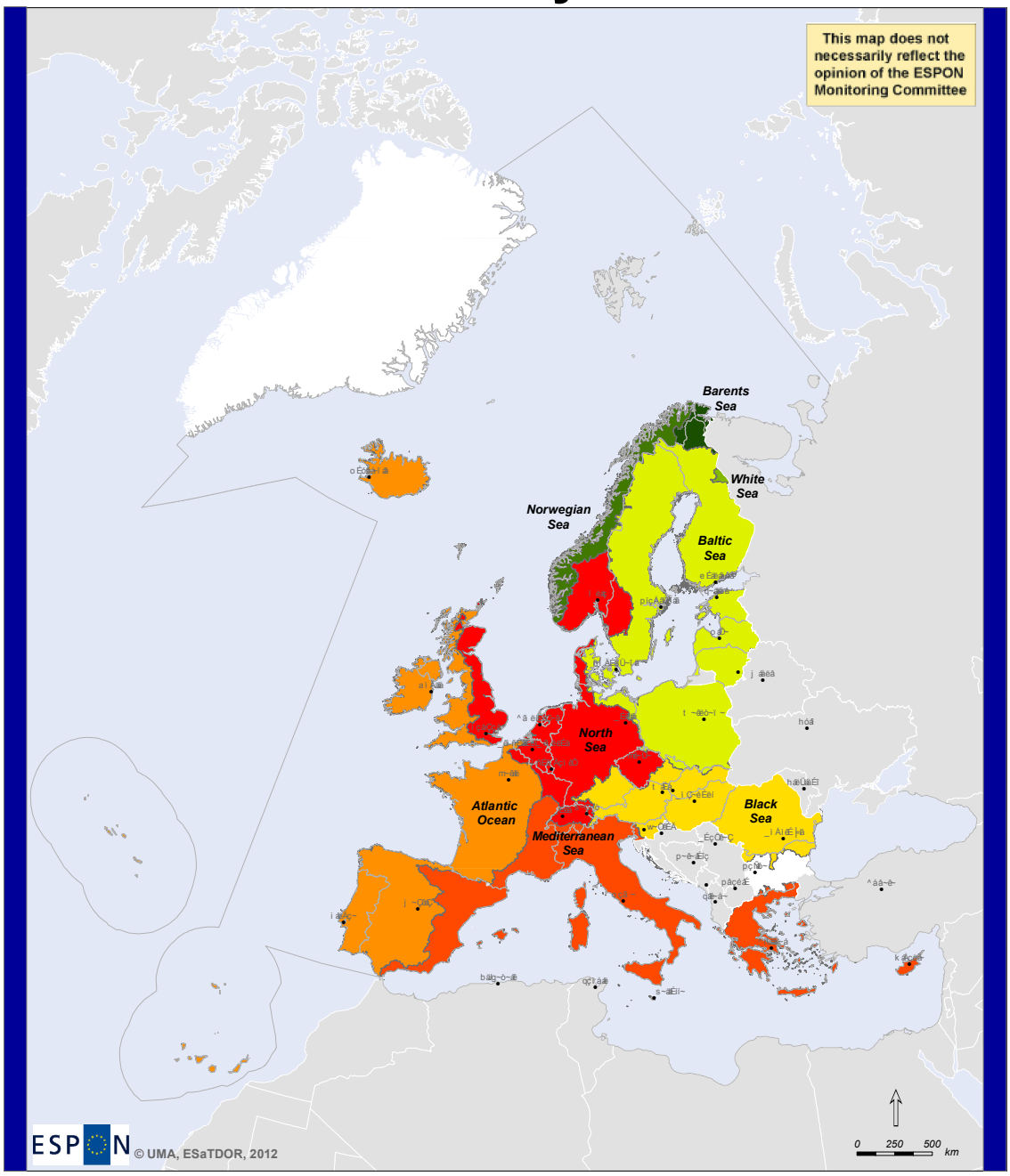


Map AT4. Large Marine Ecosystems (LMEs) within the Atlantic Area

In the far north, sub-Arctic conditions dominate in the Faroe Plateau LME, whilst the Celtic-Biscay Shelf and Iberian Coast LMEs have more temperate climates influenced by the Gulf Stream and are highly rich in flora and fauna. Further south, the Azores and northern parts of the Canary Islands experience a sub-tropical climate. To the east of the Canaries, the Canary Current LME experiences much more arid, desert-like conditions and significant upwelling in the waters off North West Africa make this a highly productive region for fisheries.

The Atlantic's inland catchment (shown in Map XE4a) encompasses the whole of Ireland and Portugal, the western side of the UK and extends deep into France and central Spain, taking in the waters of several important river catchments such as the Severn, the Loire, Douro, and Guadalquivir.

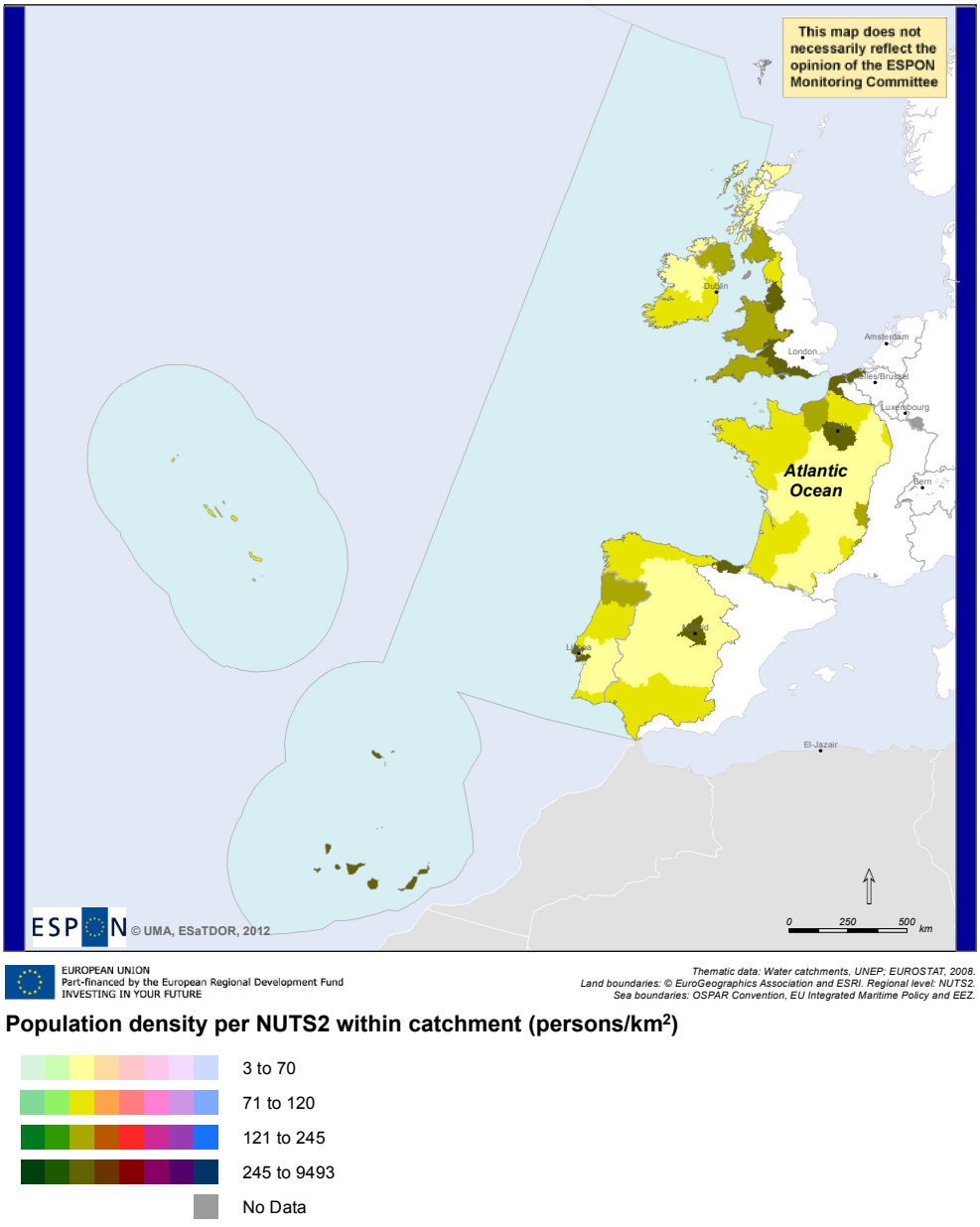
Inland Catchments and Population Density



Map XE. Inland catchment area and population density of the Atlantic Ocean area relative to other European catchments

Across this catchment area, the average population density is relatively low at approximately 123 persons per square km, however there are some more densely populated coastal regions containing large port cities such as Liverpool, Bristol, Bilbao, Porto and Lisbon, and inland urban areas within the Atlantic catchment (e.g. Paris and Madrid).

Population Density at NUTS2 Level

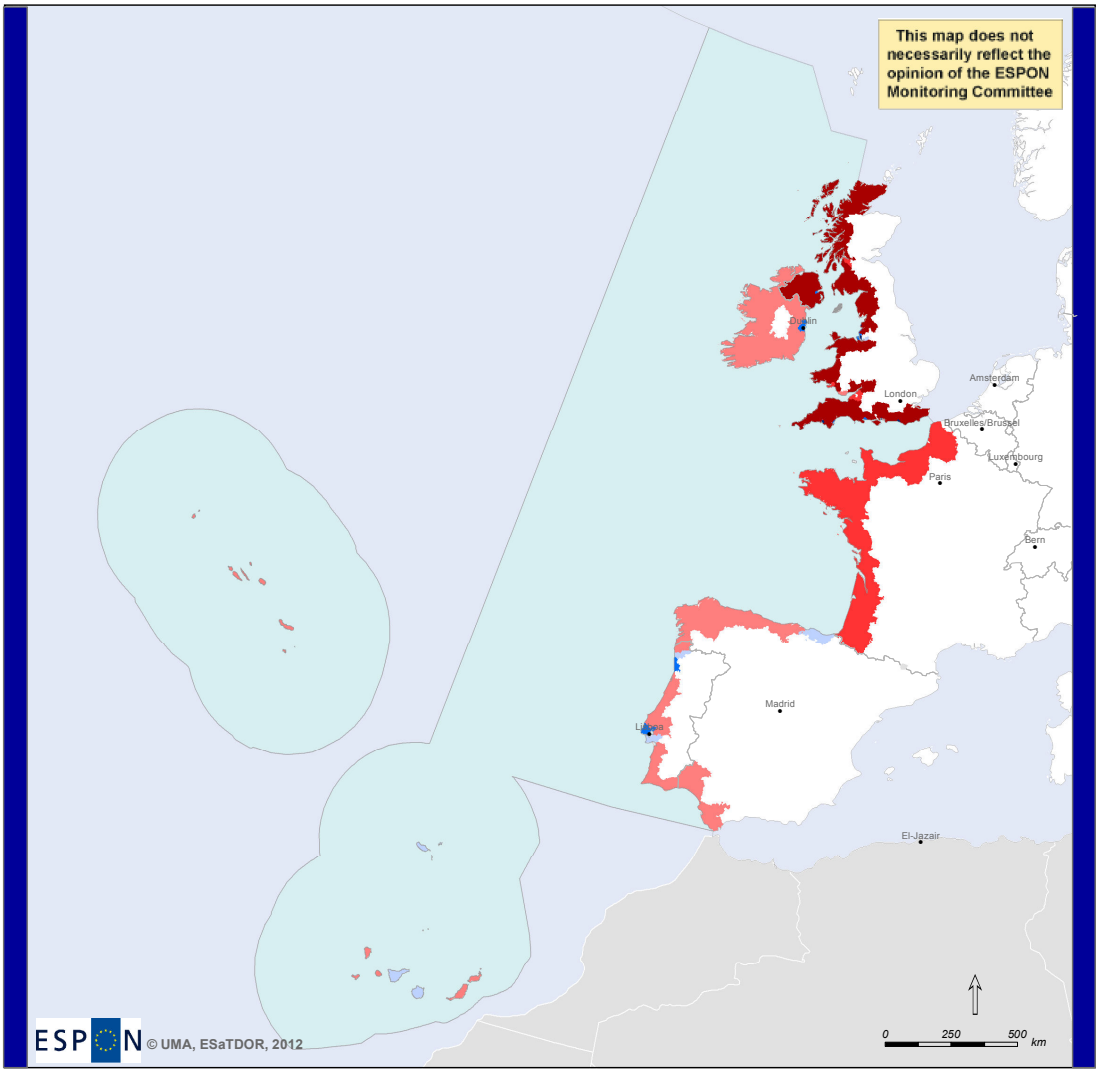


Map AT5a. Population density per NUTS2 region, Atlantic Ocean region

Whilst Map AT5a shows higher population densities in further north (in the UK), in contrast Map AT5b shows that relative to national population densities, the gradient between north and south follows an opposite trend, with coastal regions in the UK and Northern Ireland tending to be much lower than average, with some notable exceptions in port cities such as Belfast, Liverpool and cities along the south coast such as Southampton and Portsmouth. Further south, in northern Spain and Portugal, population densities in coastal regions are still below, but closer to national averages,

again with exceptions in the regions surrounding large port cities. (This opposite pattern may be due to the larger land area of NUTS2 regions in France, Spain and Portugal having a distorting effect).

Population Density in Coastal Regions

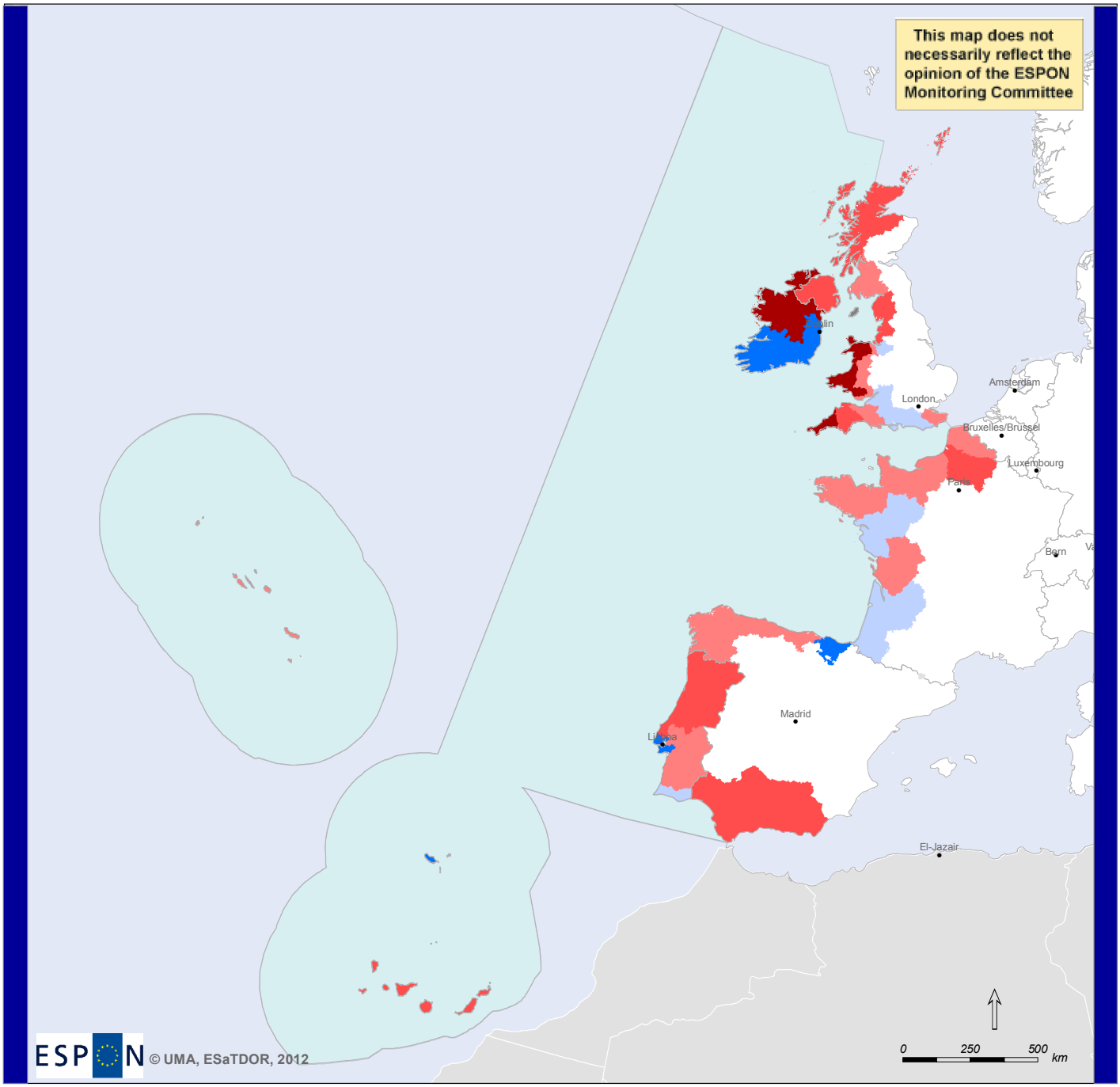


Map AT5b. Population density in coastal regions compared to national averages (2008), Atlantic Ocean.

Maps AT6a and AT6b show two important trends in economic performance across the Atlantic region. In Map AT6a (GDP in coastal regions relative to national averages), GDP is significantly below average for the predominantly rural and remote areas of western Ireland, Wales and southwest England and also below average in the north and west of the UK, northern France and across most of the coastal regions of the Iberian peninsula. There are only a few regions where GDP is above national average and these are concentrated in south east Ireland (where the capital city/Greater Dublin area is dominant), the south/southwest coast of England, western France, Bilbao, Lisbon and the Algarve.

In relation to the economic performance of coastal regions across ESPON space, Map AT6b shows a picture that is slightly different, but not necessarily better. Whilst parts of the UK, Ireland and northern regions of France show slightly higher levels of GDP relative to the entire ESPON space, many regions of the Atlantic coast are still underperforming – this is particularly the case for Portugal which has GDP levels significantly below the ESPON average, and the Andalucía region of Spain.

GDP Compared to National Average



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Thematic data: GDP, EUROSTAT, 2009; STATISTICS NORWAY, 2009.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

GDP in coastal regions (Euros/person compared to national averages)

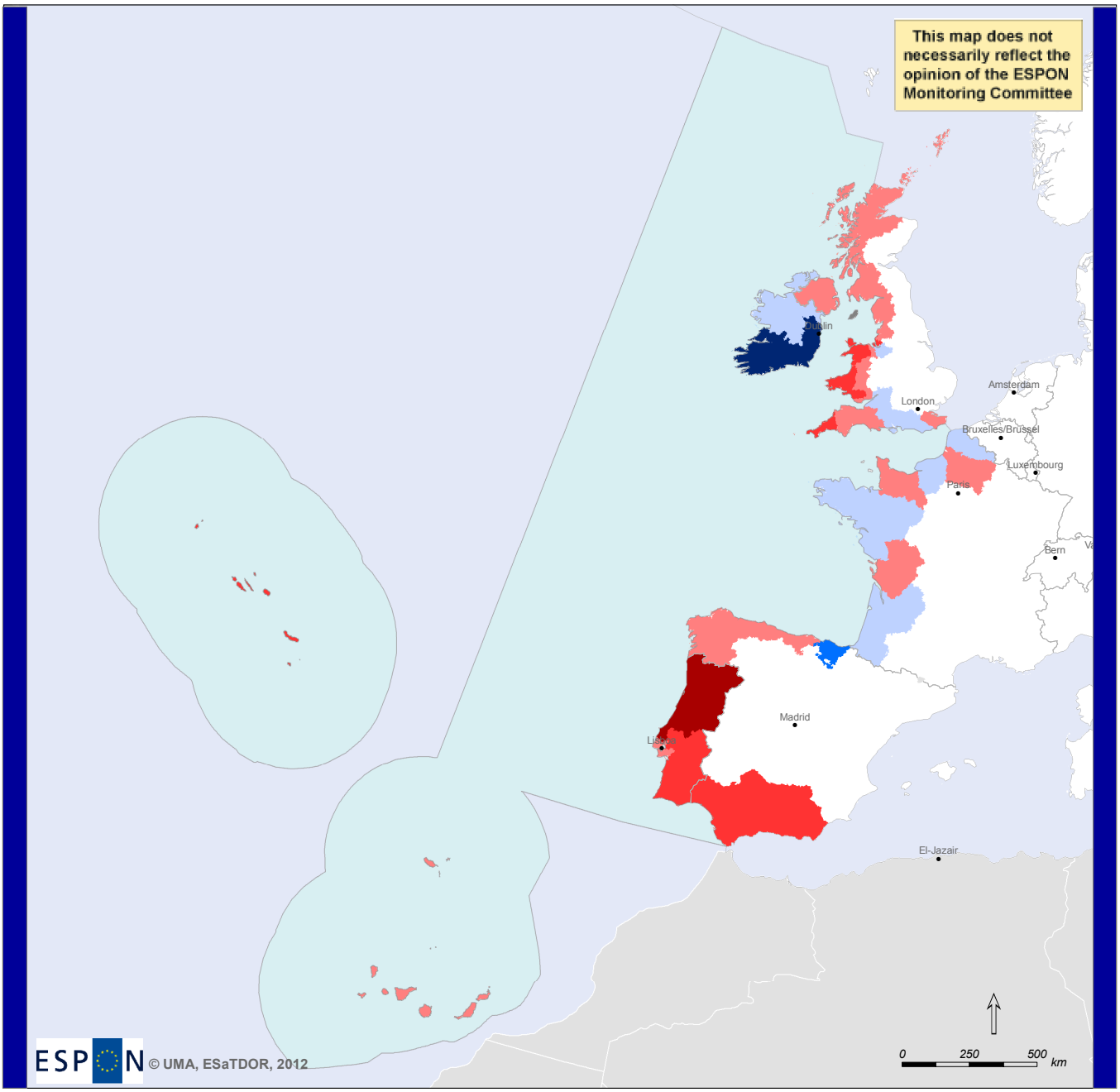
Above Mean
- 9,001 to 18,768
- 3,001 to 9,000
- 1 to 3,000
- 0

Under Mean
- -3,000 to -1
- -6,000 to -3,001
- -8,643 to -6,001

No data

Map AT6a. GDP in coastal regions relative to national averages (2009), Atlantic Ocean

GDP Compared to Coastal Average



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Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

GDP in coastal regions (Euros/person compared to ESPON Seas coastal regions average)

Above Mean
- 10,001 to 37,615
- 3,501 to 10,000
- 1 to 3,500
- 0

Under Mean
- -5,000 to -1
- -10,000 to -5,001
- -10,001 to -20,107

No data

Map AT6b. GDP in Atlantic Ocean coastal regions (2009) compared to average across ESPON coastal regions

3. Thematic Sections

The Maritime Economy

In terms of the maritime economy there a number of traditional sectors and some new and emerging sectors that are significant, although it is often difficult to disentangle the economic importance of these sectors at a NUTS2 level, the lowest scale at which information is available. Within each of the maritime sectors explored the numbers of individuals actually employed as a proportion of the total work force is very small so we have explored the data in terms of percentages and quartiles. The lighter shades on the following maps indicate percentages below the mean and the darker shades indicate a percentage above the mean. We consider each of the key maritime sectors in turn, starting with fisheries, shipbuilding, other maritime sectors, transport and finally tourism.

***Fisheries*.** Fishing and fishing related industries are a longstanding and traditional maritime activity and it is clear within the Atlantic that peripheral regions of Europe still sustain an important fishing industry where up to 8.5% of the regional workforce are directly engaged in fishing and related activities (supporting the fishing fleet and food processing related activities). Much of the western peripheries of the Atlantic region (southern Spain, Portugal, northern Spain, western France and northern Scotland) have a significant proportion of the workforce still employed in fishing. Based on the data in Table 1 it can be seen that for total fisheries production in the North East Atlantic area (both catch and aquaculture production), despite most countries experiencing a decline in overall production from 2004-2009 (with the exception of Ireland where fisheries production has remained stable), there are still regions where employment in the fisheries sector is relatively high, for example Galicia, which is home to a large proportion of the deep sea fishing fleet, the Highlands and Islands, Brittany and the Algarve, all significant aquaculture producers.

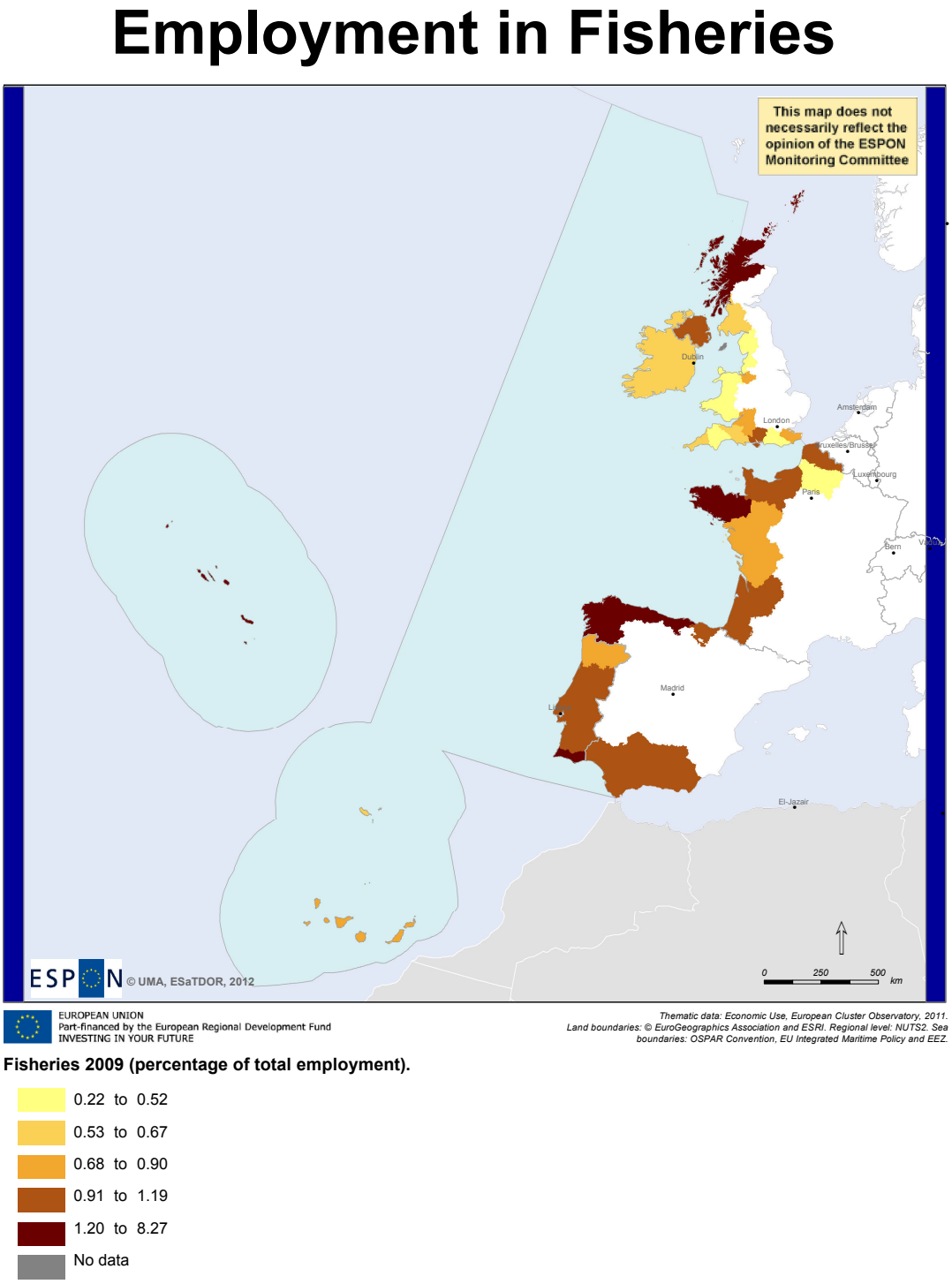
Table 1: Total Fisheries Production (in tonnes), North East Atlantic Area

	2004	2005	2006	2007	2008	2009	% Change in total production, 2004-09
EU27	5079413	4798939	4729477	4439649	4201773	4242065	-16.49
EEA (EU27 plus NO, IS, LI)	9976381	9511426	9029892	9026963	8717832	8847262	-11.32
UK	842354	820172	764604	754952	714111	747183	-11.30
Ireland	303047	293178	263555	266589	247165	303073	0.01
France	636074	582442	612632	585387	534809	488834	-23.15
Spain	561627	519345	638009	580827	572586	538406	-4.13
Portugal	196240	192819	197685	223307	194204	169077	-13.84

Source: Eurostat (2012)

Note: Data does not include all States fishing in the NE Atlantic

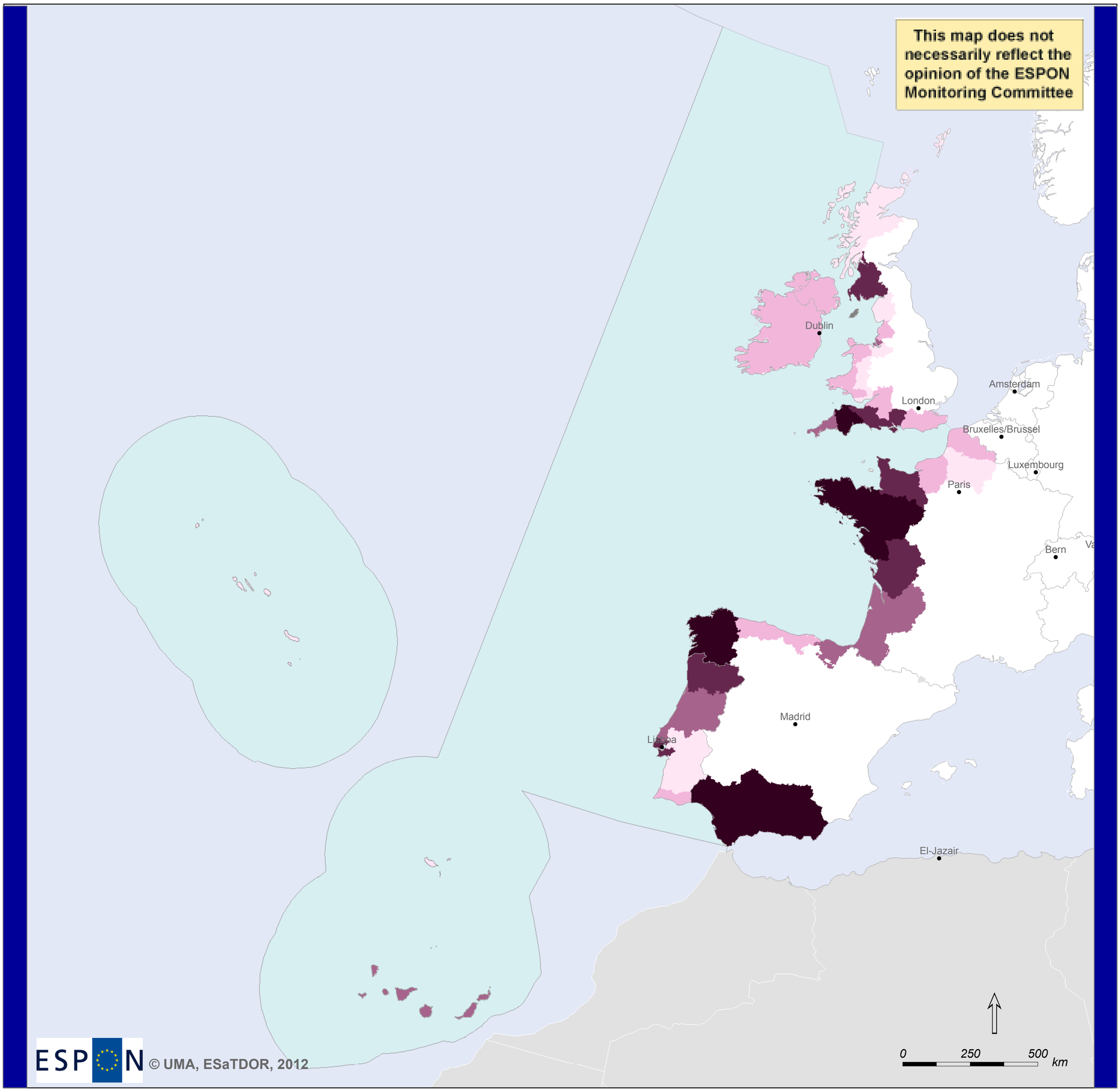
It should be noted that there are many caveats regarding the accuracy of fisheries production data as catch may be under-reported, and it is often difficult to establish a relationship between the exact location of catches and land based employment clusters. What is clear though is that the fishing industry continues to play a prominent role in the economic wellbeing of various maritime regions within the Atlantic, both in the north and southern peripheries and around the Bay of Biscay, as shown in Map AT7.



Map AT7. Employment in fisheries, 2009 (as a percentage of total employment per NUTS2 region)

Ship Building: Ship building (which includes the maintenance and repair of ships and boats) is a relative small employer throughout the region and is concentrated in certain traditional localities. Often the highest levels of shipbuilding and repair are associated with traditional naval establishments such as Galicia (northern Spain), Portsmouth and Plymouth (southern England) and Brest, Nantes, Saint-Nazaire (France), as shown in Map AT8. A recent European report has shown how naval defence projects and priorities are nationally driven, and questions in the future as to whether a more collaborative and transnational approach needs to be developed (PCG et al n.d.) in order to sustain and expand this important economic sector. Clearly the Atlantic region has many assets in this area and careful consideration needs to be given to how such knowledge and expertise which is critical to the wellbeing of certain regional economies can be protected and harnessed. Elsewhere there are small pockets of shipbuilding activity associated with traditional merchant navy activities and increasingly these places are becoming more focused on maintenance and repair rather than new build. Although locally significant they often account for less than 0.35% of all employment activities.

Employment in Shipbuilding



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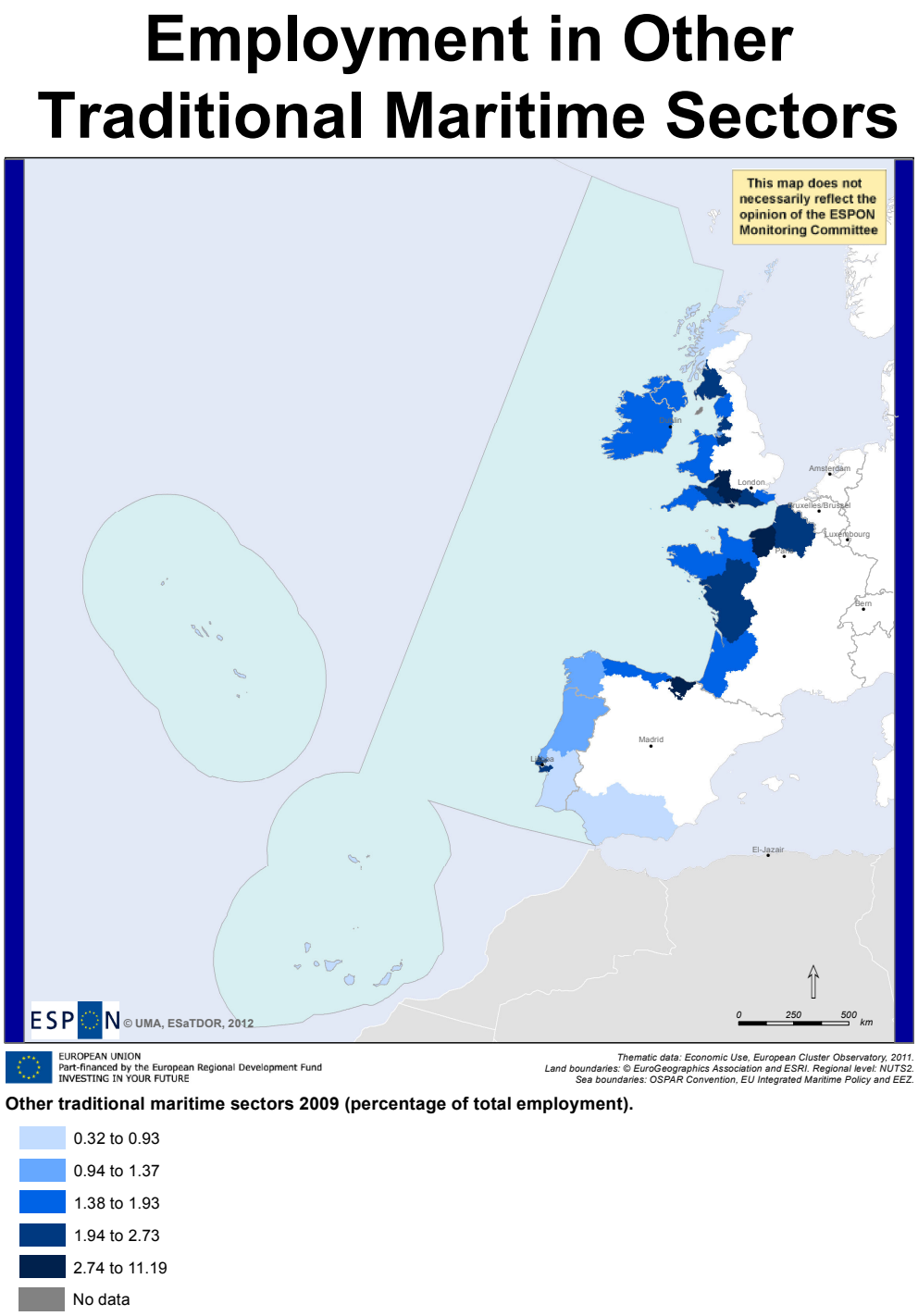
Thematic data: Economic Use, European Cluster Observatory, 2011.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Employment in Shipbuilding 2009, (number of employees).

- 0 to 166
- 167 to 573
- 574 to 1,632
- 1,633 to 4,106
- 4,107 to 25,113
- No data

Map AT8. Employment in Shipbuilding, 2009. Number of employees in Atlantic Ocean area.

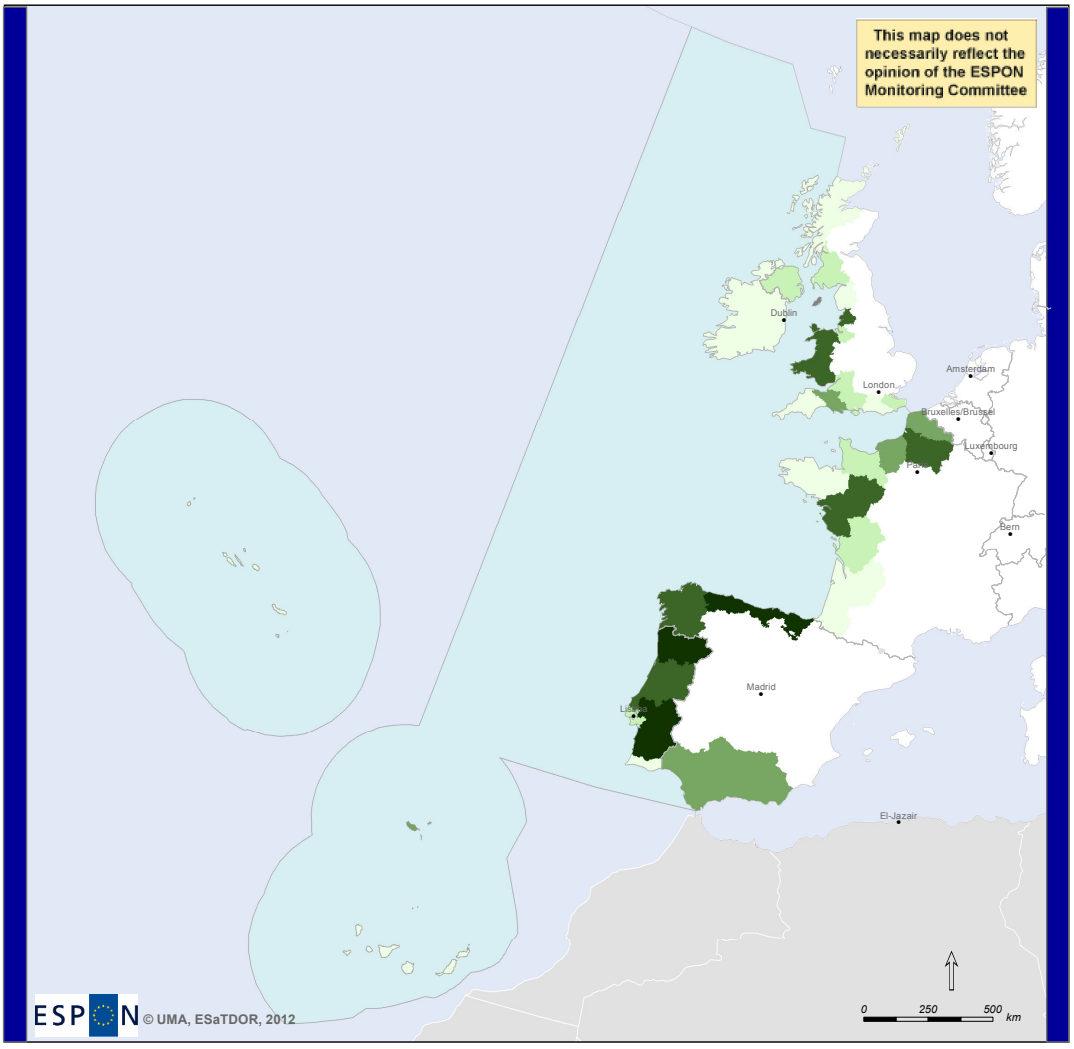
Other Traditional Maritime sectors: This is a broad categorisation of many different types of industrial sector that may be maritime related such providing equipment to shipping or shipping related activities. To this extent there is broadly an association between where such activities are clustered in the Atlantic region and shipping activities which are discussed later. Key areas for activities in this sector (see Map AT9) include clusters on both sides of the English Channel, in southern England and northern France suggesting a good supply chain relationship between shipping and subsidiary activities. In the Iberian Peninsula this interdependence appears, at least from the employment data to be less prominent.



Map AT9. Employment in other traditional maritime sectors (2009, percentage of total employment). Atlantic Ocean area.

Other sectors associated with the Maritime Cluster: Conversely with other sectors associated with the maritime cluster there does appear to be a greater concentration of individuals employed in this sector in Spain and Portugal (see Map AT10), suggesting this is where the supply chain activities are more associated with other shipping related activities compared with traditional maritime sectors, although concentrations around the English Channel also exist.

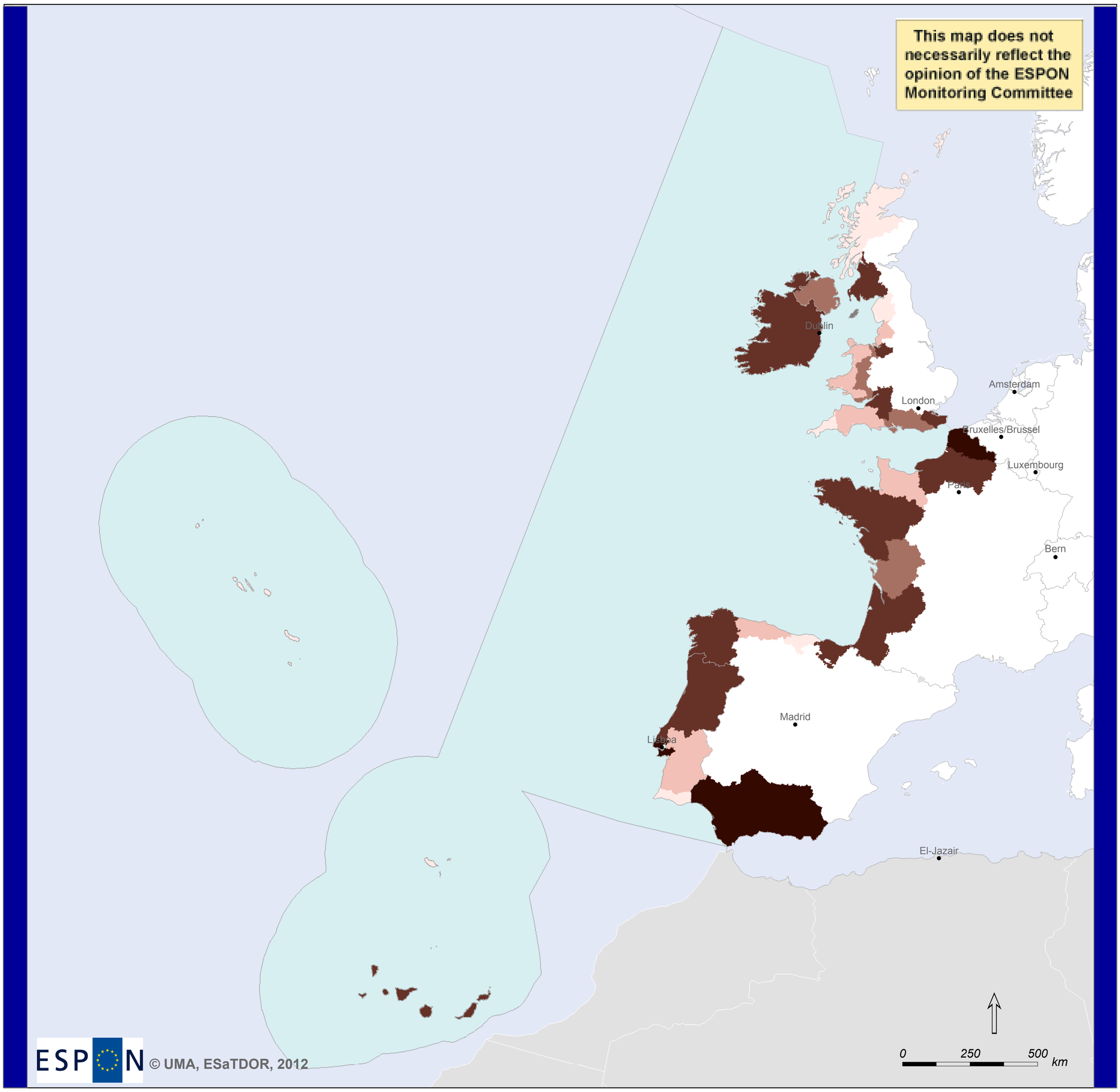
Employment in Other Sectors Associated with the Maritime Cluster



Map AT10. Employment in other sectors associated with the maritime cluster, 2009 (percentage of total employment). Atlantic Ocean area.

Transport: Transport is an important part of the maritime economy and traditionally the Atlantic has perceived itself as a gateway to and from Europe, reflecting historic links across the Atlantic, both in terms of the flow of goods and people. However the Atlantic does not in fact host any of Europe's megaports but rather a number of significant smaller ports and the transport sector in terms of employment tends to be concentrated within those areas where the larger of these ports are located and where there is an intensity of activity often associated with growth in port traffic (see Map AT11). The most apparent concentration of transport related activities in the region is around the English Channel, along the south coast of England and northern coast of France particularly associated with short sea cross channel shipping activities, but also as a gateway to the major ports of Europe, largely found in the North Sea. Hence in this focused part of the Atlantic, around the channel there is an extreme intensity of shipping movement. Elsewhere pockets of more intensive transport related activity are associated with key ports in northern Spain and Portugal (Lisbon). Algeciras in southern Spain is an important port of growing importance along the eastern western axis which flows through the Mediterranean.

Employment in Transport



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Thematic data: Economic Use, European Cluster Observatory, 2011.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Employment in Transport 2009 (number of employees)

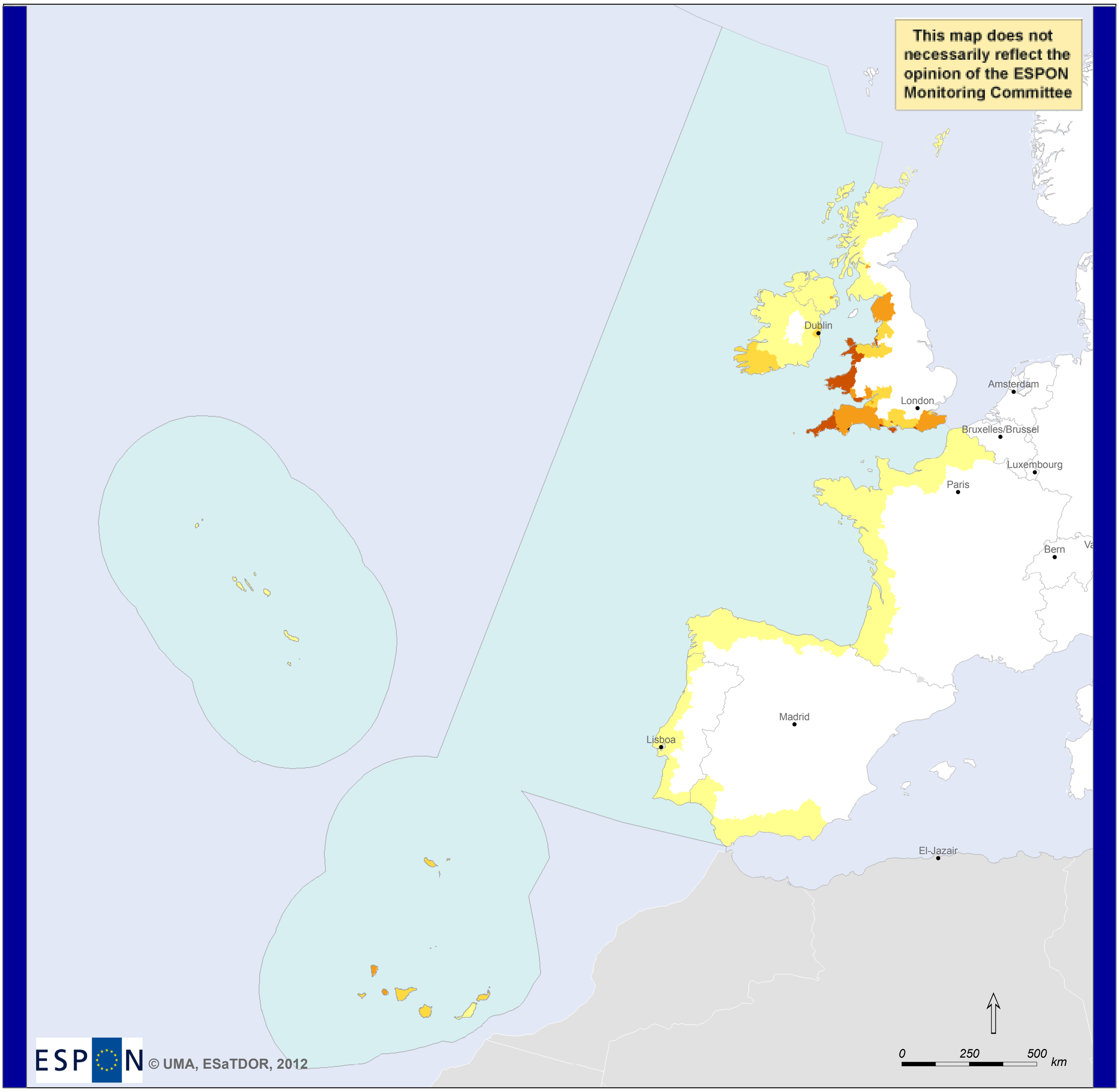
- 0 to 5,273
- 5,274 to 10,038
- 10,039 to 14,752
- 14,753 to 27,981
- 27,982 to 80,067
- No data

Map AT11. Employment in transport, 2009 (number of employees). Atlantic Ocean area.

Tourism: Tourism is perceived as being one of the core sectors that is often a feature of the maritime economy. In terms of exploring the implications of tourism activities in the regional seas we have explored two data sets, both of which are closely interrelated to each other. Tourism intensity examines the density of bedrooms, bed places and tourism establishments based on 1 by 1 kilometre grid squares and extending 20 kilometres inland from the coast, in other words focusing on the coastal strip. The other indicator at NUTS2 level explores the intensity of employment in the tourism sector as a percentage of total employment.

In terms of the intensity of tourism bed spaces Map AT12 appears to indicate that the most intensive tourism activity in the Atlantic is based along the south coast of England, the Welsh coast, the coast of North West England and may reflect at least in part the relatively high population density of the UK and relative ease of access of urban populations to coastal areas here. For much of the rest of the Atlantic coast the intensity of tourism related accommodation is surprisingly low, although this may in part be a function of larger regions and the way the data is actually measured. This interpretation is supported by the intensity of employment in tourism related activities, which picks up the importance of the tourism economy for the western part of the UK, but also other intensive clusters in the Algarve and Lisbon in Portugal, the southern and northern coast of Spain and the Canary Islands (see Map AT13). Whilst tourism as an activity is primarily concentrated along the coastal strip, its importance to the regional economy is very evident from the fact that up to 30% of the workforce is employed in tourism in these hotspot areas.

Tourism Intensity



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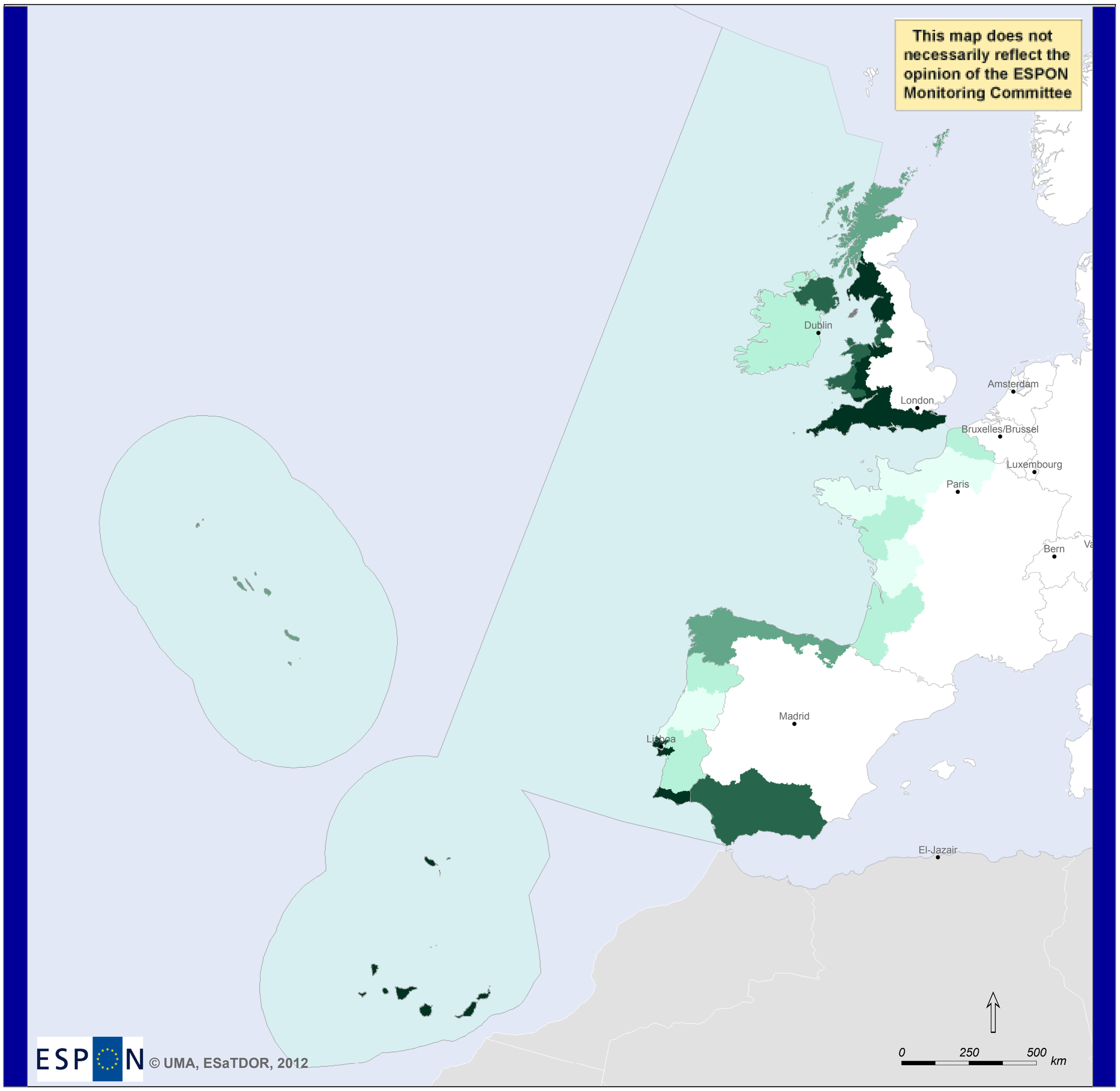
Thematic data: Tourism Intensity, EUROSTAT, 2009
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS3.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Tourism Intensity (establishments, bedrooms and bedplaces/km^2)

- 0.02 - 0.25
- 0.26 - 0.50
- 0.51 - 1.00
- 1.01 - 5.00
- 5.01 - 15.00
- 15.01 - 61.13

Map AT12. Tourim intensity measured as number of establishments, bedrooms and bedplaces/km^2. Atlantic Ocean area.

Employment in Tourism



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Thematic data: Economic Use, European Cluster Observatory, 2011.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Employment in Tourism 2009 (percentage of total employment)

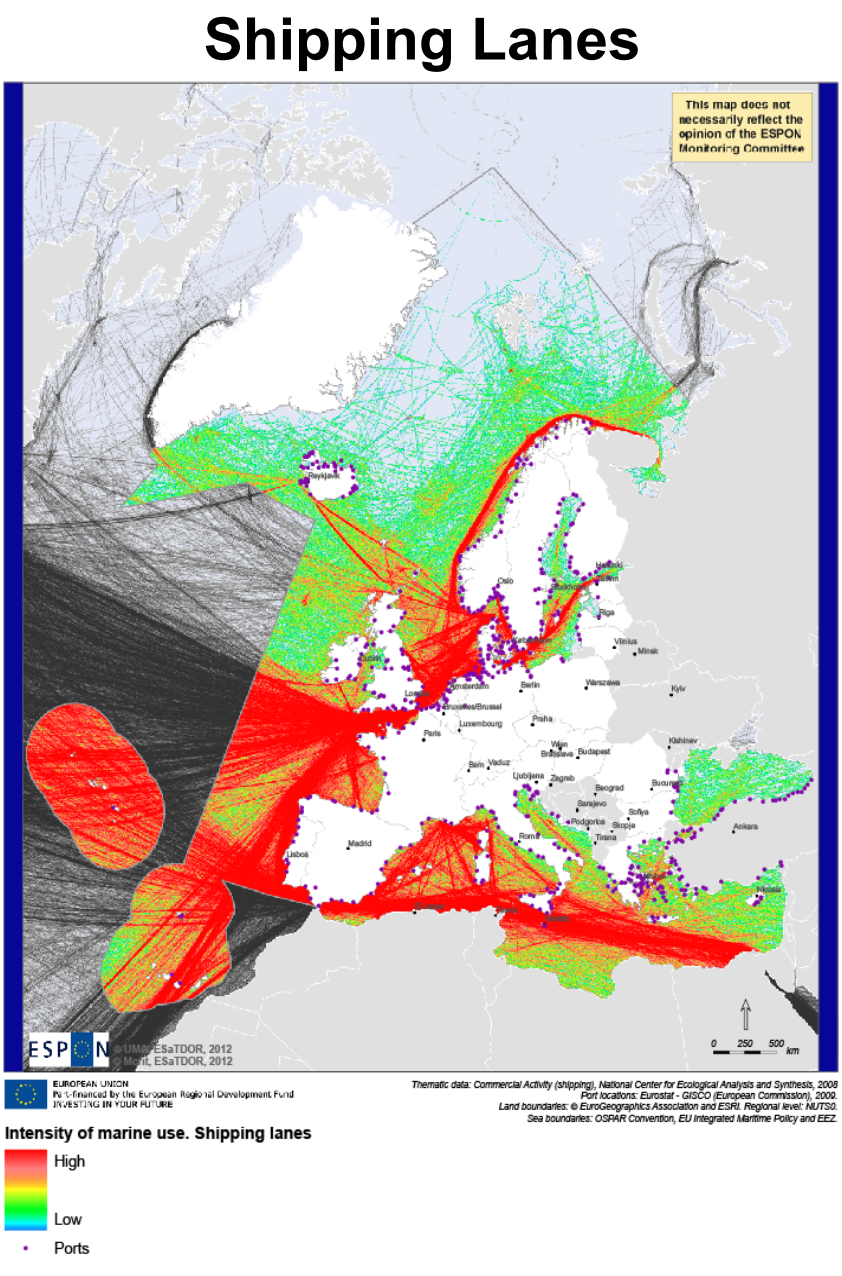
- 0 to 8.70
- 8.71 to 11.60
- 11.61 to 13.55
- 13.56 to 17.90
- 17.91 to 29.42
- No data

Map AT13. Employment in tourism (as a percentage of total employment), 2009. Atlantic Ocean area.

Transport

In terms of maritime transport activities we begin by focusing on the patterns of freight movement in general terms before considering particular types of cargo and then go onto consider the movement of people via shipping.

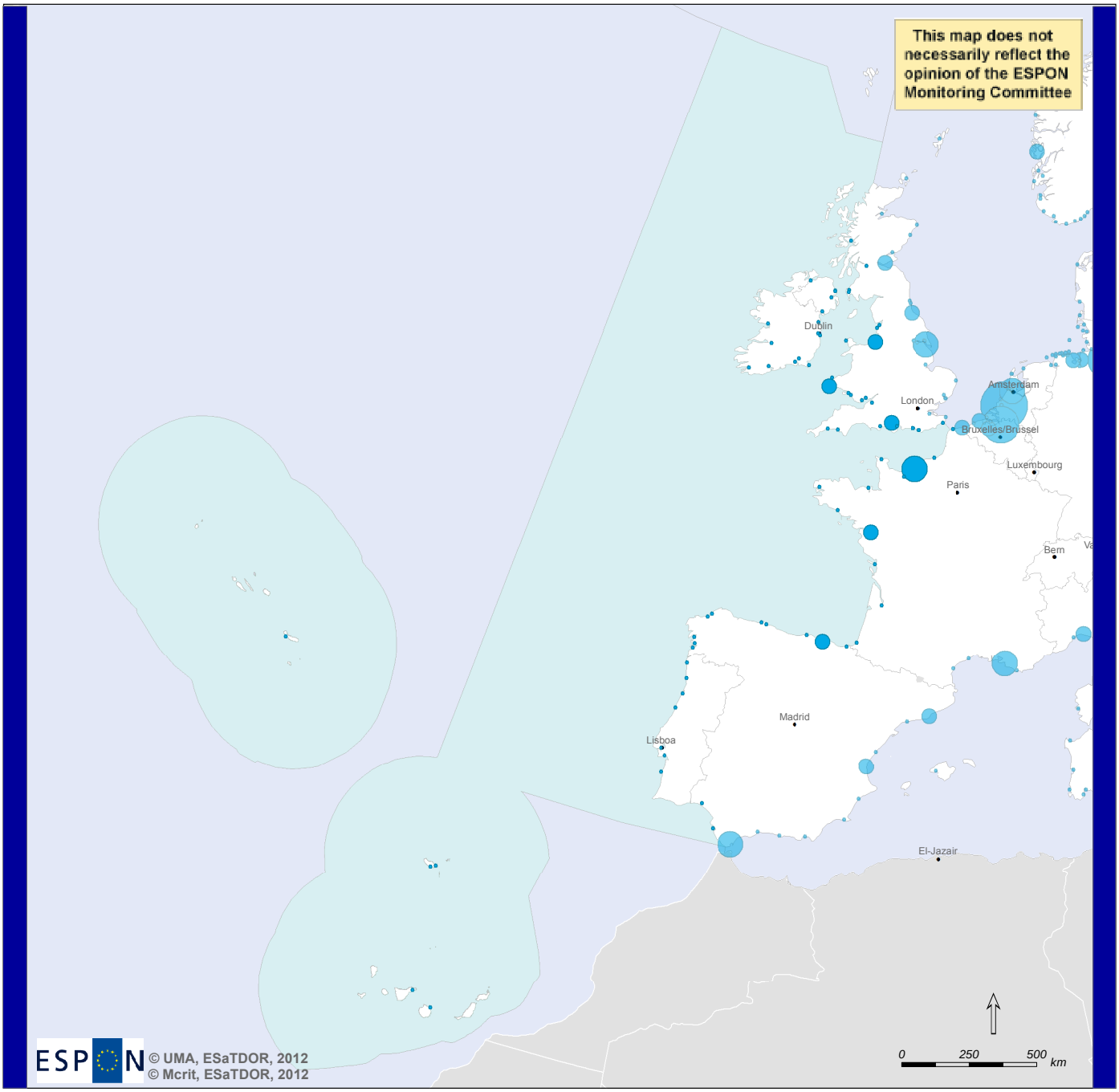
From a seas perspective it is clear that the Atlantic sea has major maritime connections (as illustrated by shipping lanes, Map AT14 below) both in terms of east west and north south traffic. Two east west corridors are particularly evident. First there is a channelling of shipping from the Mediterranean and across the Atlantic, and similarly in terms of focusing into the Channel. What is interesting about both corridors is that after the pinch points associated with the Channel and the Straits of Gibraltar the shipping lanes fan out significantly through the Atlantic. A second noticeable trend is the north south activity following the Iberian Peninsula before again converging in the Channel. This seems to relate to flows coming through the Mediterranean and from further south through the Canary Islands.



Map AT14. Shipping Lanes

Goods: In terms of goods and products flowing through ports in the Atlantic there is a substantial network of small ports with a few more strategic ports notably around the channel and the western coast of the UK. These include Liverpool, Milford Haven, Southampton, Calais and Le Havre. Further south Nantes, Bilbao and Algeciras are also significant within the context of the Atlantic. Most of these ports are gateways to Europe and show a tendency to import goods and products from other parts of the world rather than being used primarily as an export base (see Map AT15a and AT15b). This is a characteristic of all of the larger ports in the region defined here as ports handling more than 500 million tonnes of product per year. The ports in the Atlantic are experiencing mixed patterns of growth and decline, however the majority of ports are relatively stable, reporting modest growth (0-10%) by weight between 2004 and 2008, although it should be noted that this was at a time of relative economic prosperity. But it is also noteworthy that several ports, particularly in France and the southern coast of England are experiencing a decline in the total volume of cargo handled, as shown in Map AT15c.

Total Cargo Shipping



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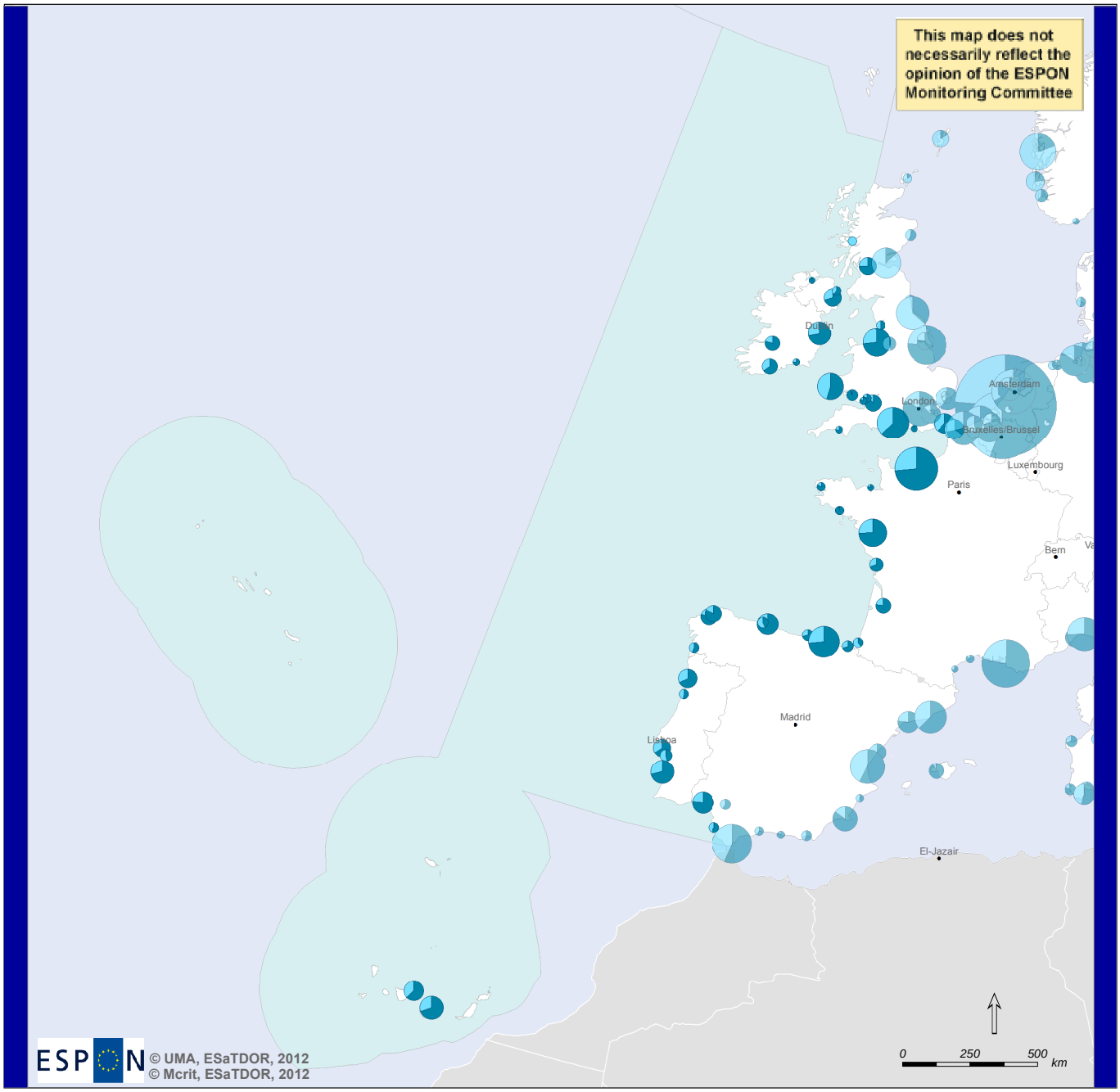
Thematic data:Gross weight of goods handled in all ports, EUROSTAT, 2008. Iceland data: EUROSTAT, 2006.
Port locations: Eurostat - GISCO (European Commission), 2009.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Total shipping at ports, 2008 (million tonnes). All ports.

- 1 - 250
- 250 - 500
- 500 - 1000
- 1000 - 2000
- > 2000

Map AT15a. Total shipping at Atlantic Ocean ports, 2008.

Cargo Shipping by Direction



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Thematic data: Gross weight of goods handled in all ports by direction, EUROSTAT, 2008.
Port locations: Eurostat - GISCO (European Commission), 2009.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

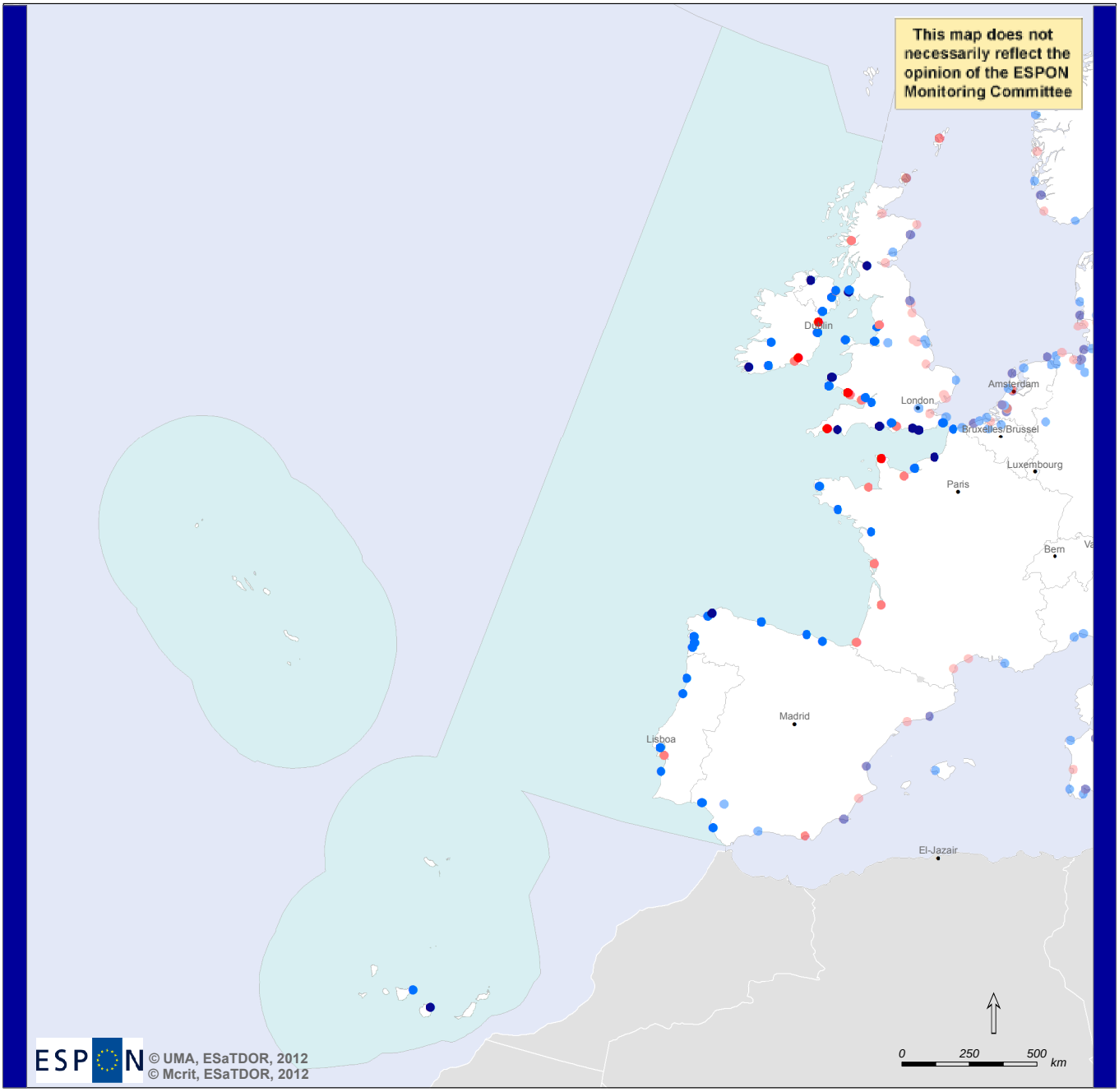
Total shipping at ports by direction, 2008.

Inward direction

Outward direction

Map AT15b. Total shipping (tonnes) at Atlantic Ocean ports by inward/outward direction, 2008.

Caargo Shipping Trends



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Thematic data: Gross weight of goods handled in all ports by direction, EUROSTAT, 2004 - 2008.
Port locations: Eurostat - GISCO (European Commission), 2009
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

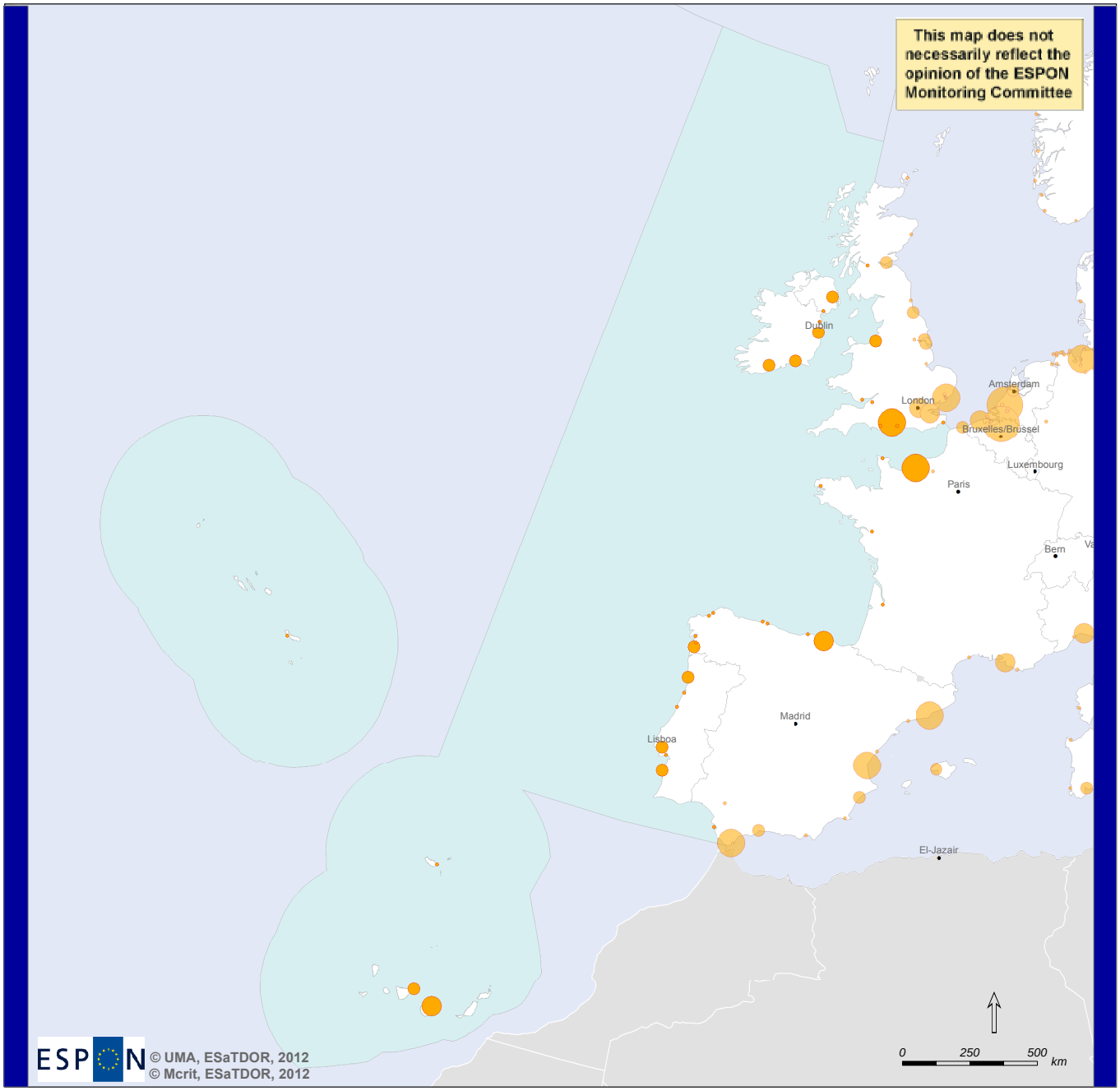
Total shipping at ports. Average annual traffic increase, 2004 - 2008 (%).

- < -20%
- -20% to -10%
- -10% to 0%
- 0% to 10%
- > 10%

Map AT15c. Average annual traffic increase (percentage of goods handled), 2004-2008. Atlantic Ocean ports.

The three previous maps cover shipping of all types of goods at ports, however it is understood that container shipping can be seen as a surrogate for higher value shipping related activity. The number of Atlantic ports that are capable of handling container traffic is more limited, with only three ports in the regional sea handling significant levels traffic at the present time, Southampton (England), Le Havre (France) and Algeciras (southern Spain), see Map AT16a. In comparison to all goods and services transported by shipping (shown in Map AT15b) which seems to indicate a net inflow of goods and services to Europe, most of the container ports in the Atlantic, whether large (at least within a regional seas context) or small exhibit an equal flow of goods in terms of importing and exporting containers, as shown in Map AT16b. Interestingly, virtually all of the container ports have been showing signs of increasing activity between 2004 and 2008, though in many cases their levels of growth were relatively modest, albeit from an initial low volume of activity (see Map AT16c).

Container Shipping, 2008



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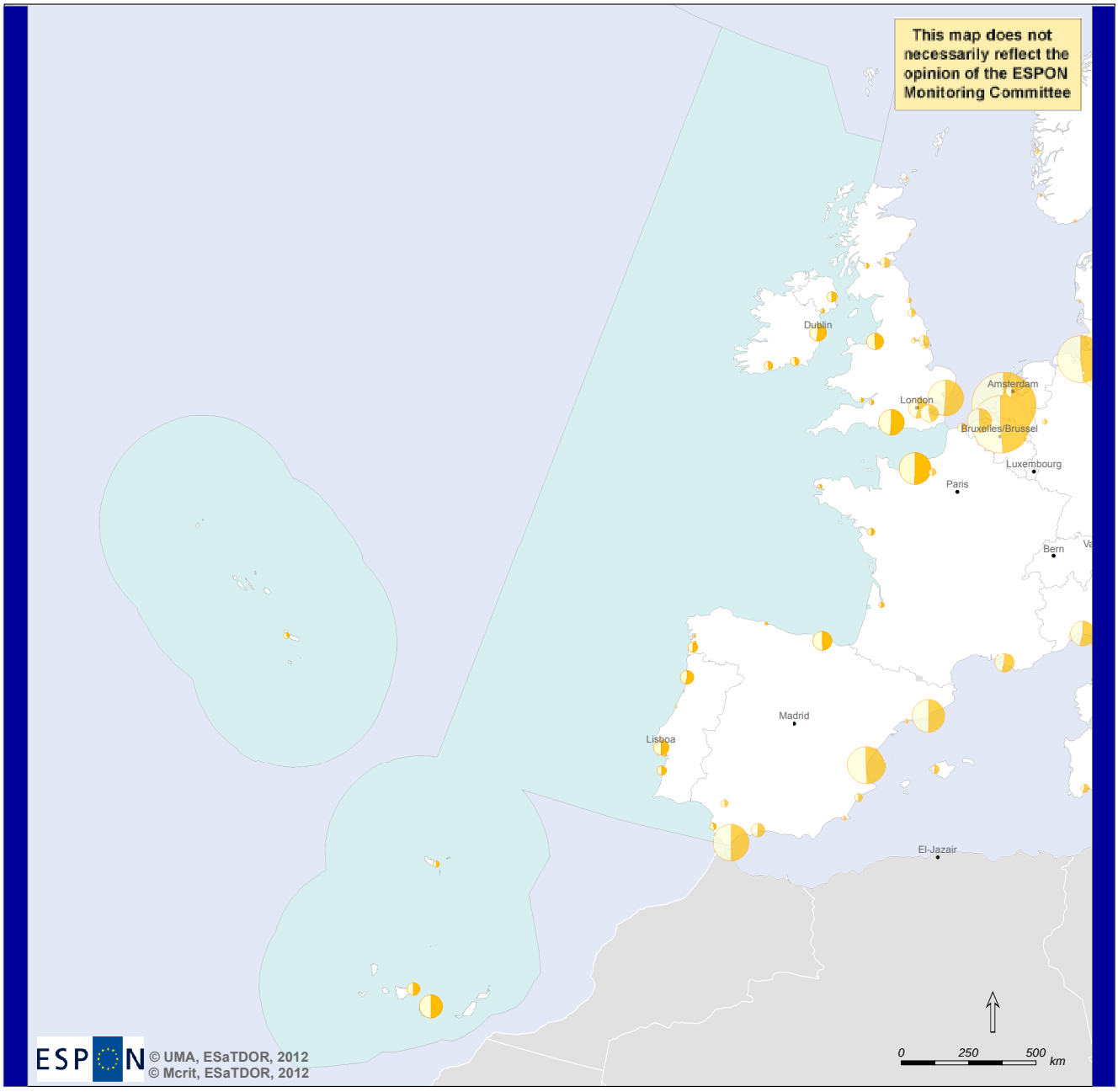
Thematic data: Containers handled in all ports by direction, EUROSTAT, 2008.
**Marsaxlokk data: Freeport Malta, 2008.*
Port locations: Eurostat - GISCO (European Commission), 2009
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Container shipping at ports, 2008 (million TEU). All ports.

- 0 - 0.15
- 0.15 - 0.70
- 0.70 - 1.6
- 1.6 - 5.5
- > 5.5

Map AT16a. Container shipping at Atlantic Ocean ports (million TEU), 2008.

Container Shipping by Direction, 2008



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Thematic data: Containers handled in all ports by direction, EUROSTAT, 2008.
**Marsaxlokk data: Freeport Malta, 2008*
Port locations: Eurostat - GISCO (European Commission), 2009
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

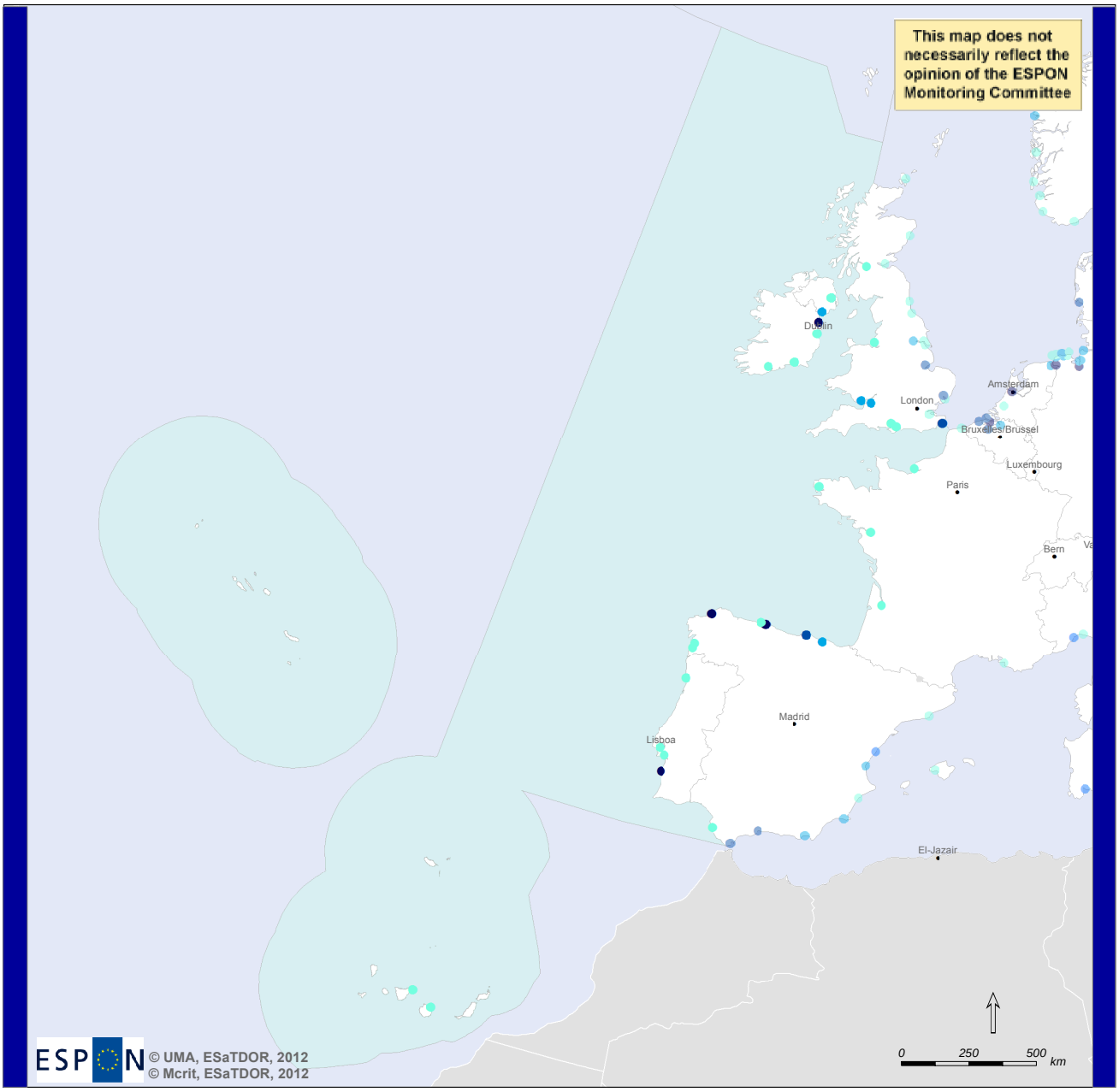
Container shipping at ports by direction, 2008.

Inward direction

Outward direction

Map AT16b. Container shipping at Atlantic Ocean ports by inward/outward direction, 2008.

Container Shipping Trends



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Thematic data: : Containers handled in all ports by direction, EUROSTAT, 2008.
**Marsaxlokk data: Freeport Malta, 2008.*
Port locations: Eurostat - GISCO (European Commission), 2009
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

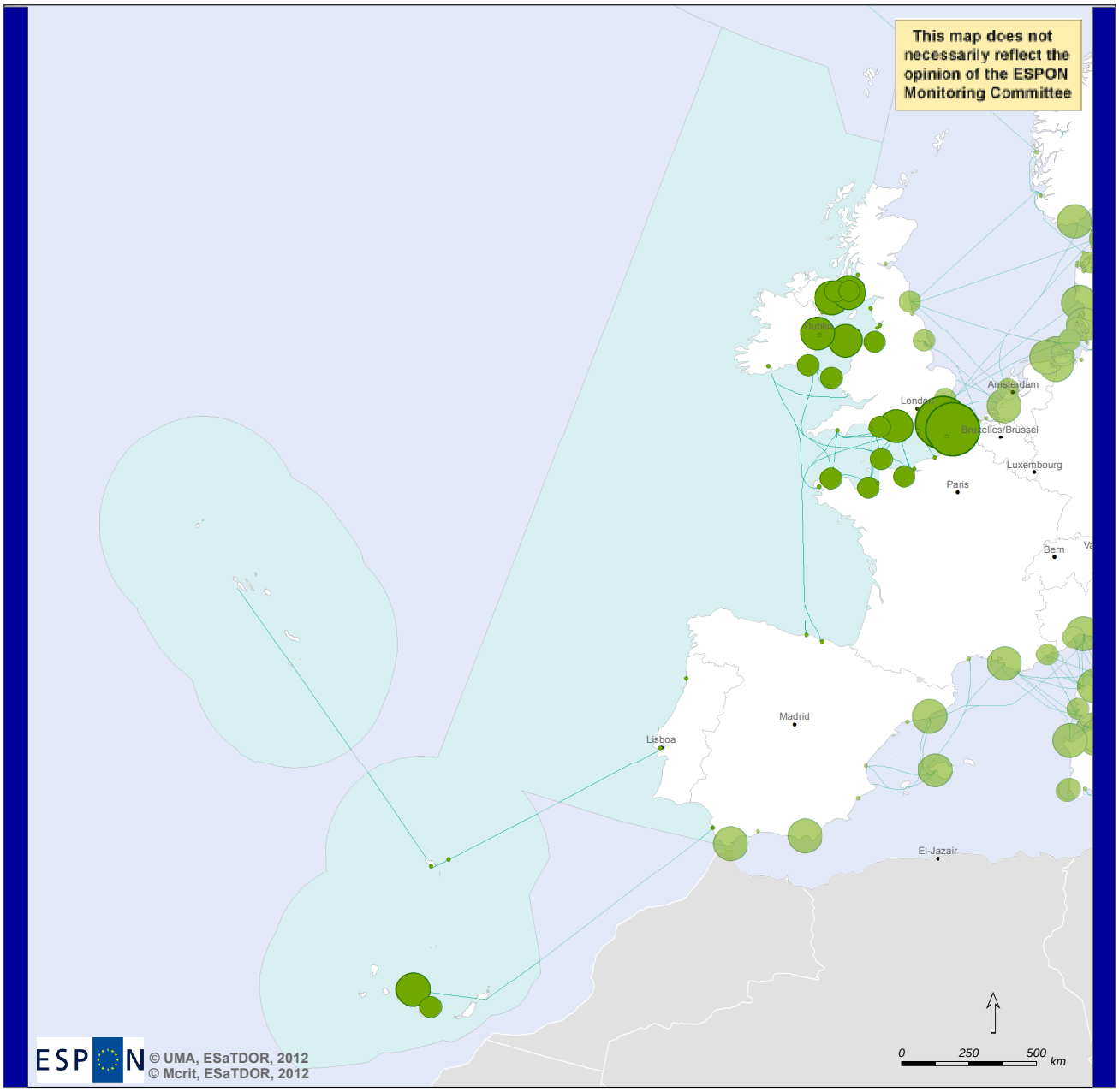
Container shipping at ports. Average annual traffic increase 2004-2008 (%).

- 0% - 10%
- 10% - 20%
- 20% - 30%
- 30% - 50%
- > 50%

Map AT16c. Average annual increase in container shipping (tonnes handled), 2004-2008

Passenger transport: In terms of the flows of people we have identified two types of activity. First there are passenger flows, and most of the key routes are characterised by short sea crossings with strong flows in the north of the Atlantic Sea region, between the UK and Ireland and the UK and France, particularly across the English Channel were the greatest intensity of activity is evident (Map AT17a). There are also some connections between the north Atlantic countries and southern Atlantic countries but these routes are not as large in terms of the number of passengers involved. In the Canaries there are significant flows between the islands, but in terms of the overall regional sea this is a bit of an outlier. One of the key characteristics of passenger flows is that there is evidence that almost all ports are witnessing declining numbers of passengers, as shown in Map AT17b. This may in part be associated with rise in cheap air travel.

Ferry Passengers, 2008



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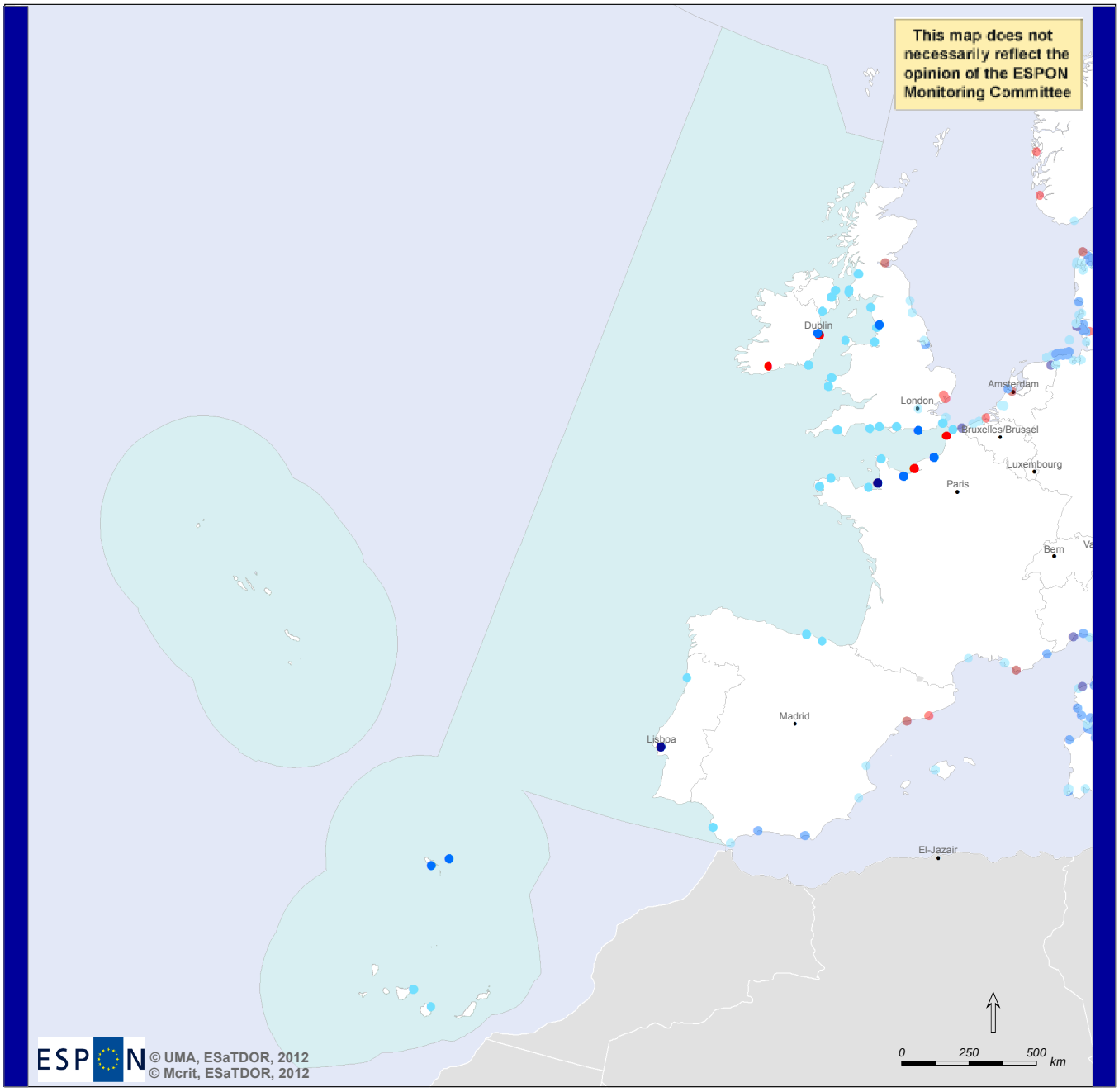
Thematic data:Passengers maritime transport by direction and type of traffic, EUROSTAT, 2008.
Ferry routes: TRANS-TOOLS (European Commission), 2005.
Port locations: Eurostat - GISCO (European Commission), 2009
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Ferry passengers at ports, 2008 (Mpax).

- < 500,000
- 500,000 - 1,000,000
- 1,000,000 - 5,000,000
- 5,000,000 - 10,000,000
- > 10,000,000
- Ferry routes

Map AT17a. Ferry passengers at Atlantic Ocean ports, 2008.

Ferry Passenger Trends



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Thematic data: Passengers maritime transport by direction and type of traffic, EUROSTAT, 2008.
Port locations: Eurostat - GISCO (European Commission), 2009
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

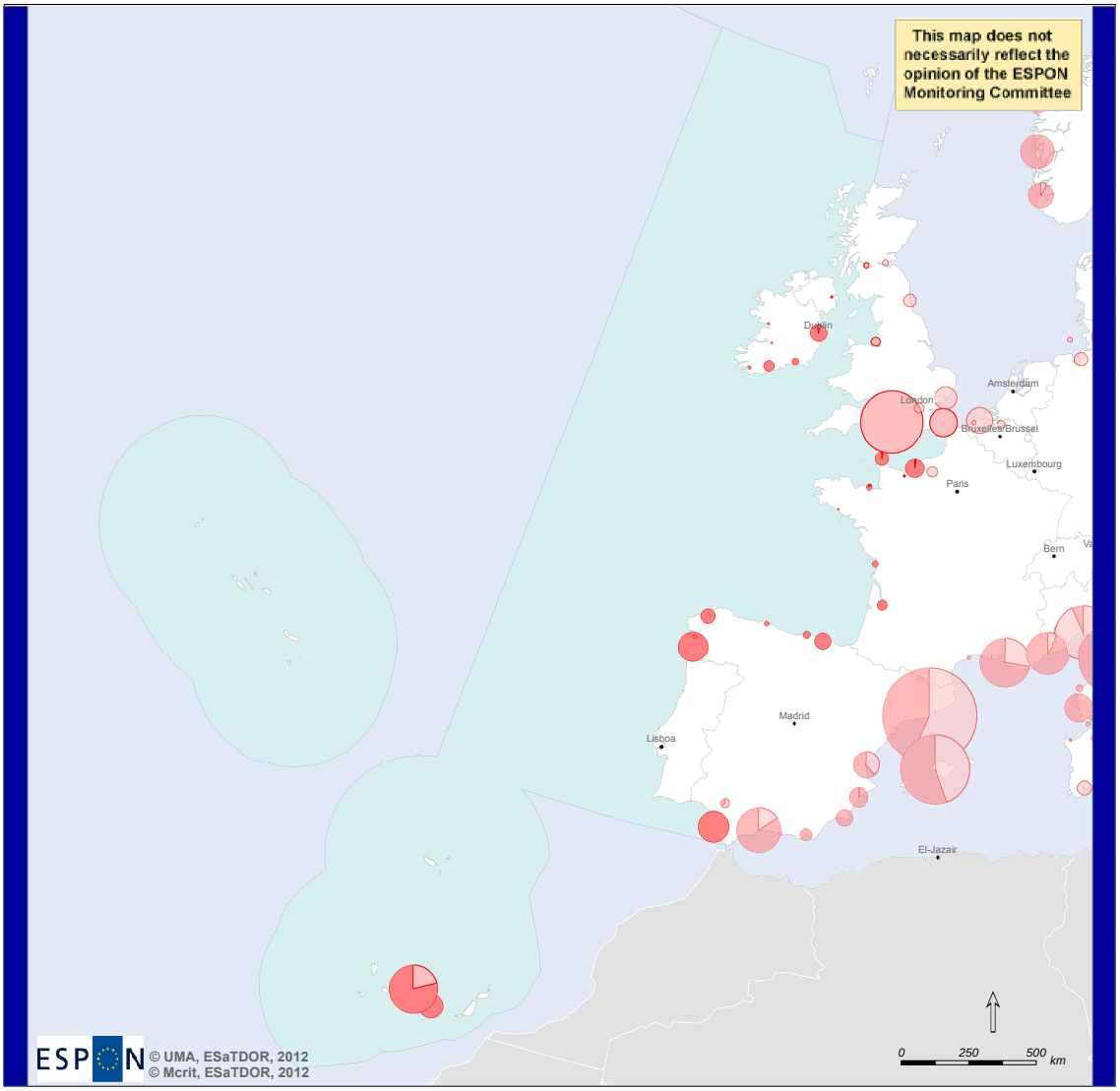
Ferry passengers at ports. Average annual traffic increase of ferry passengers 2004 - 2008 (%)

- > -35%
- -35% to -15%
- -15% to 0%
- 0% to 15%
- > 15%

Map AT17b. Average annual increase in ferry passengers, Atlantic Ocean ports (2004-2008).

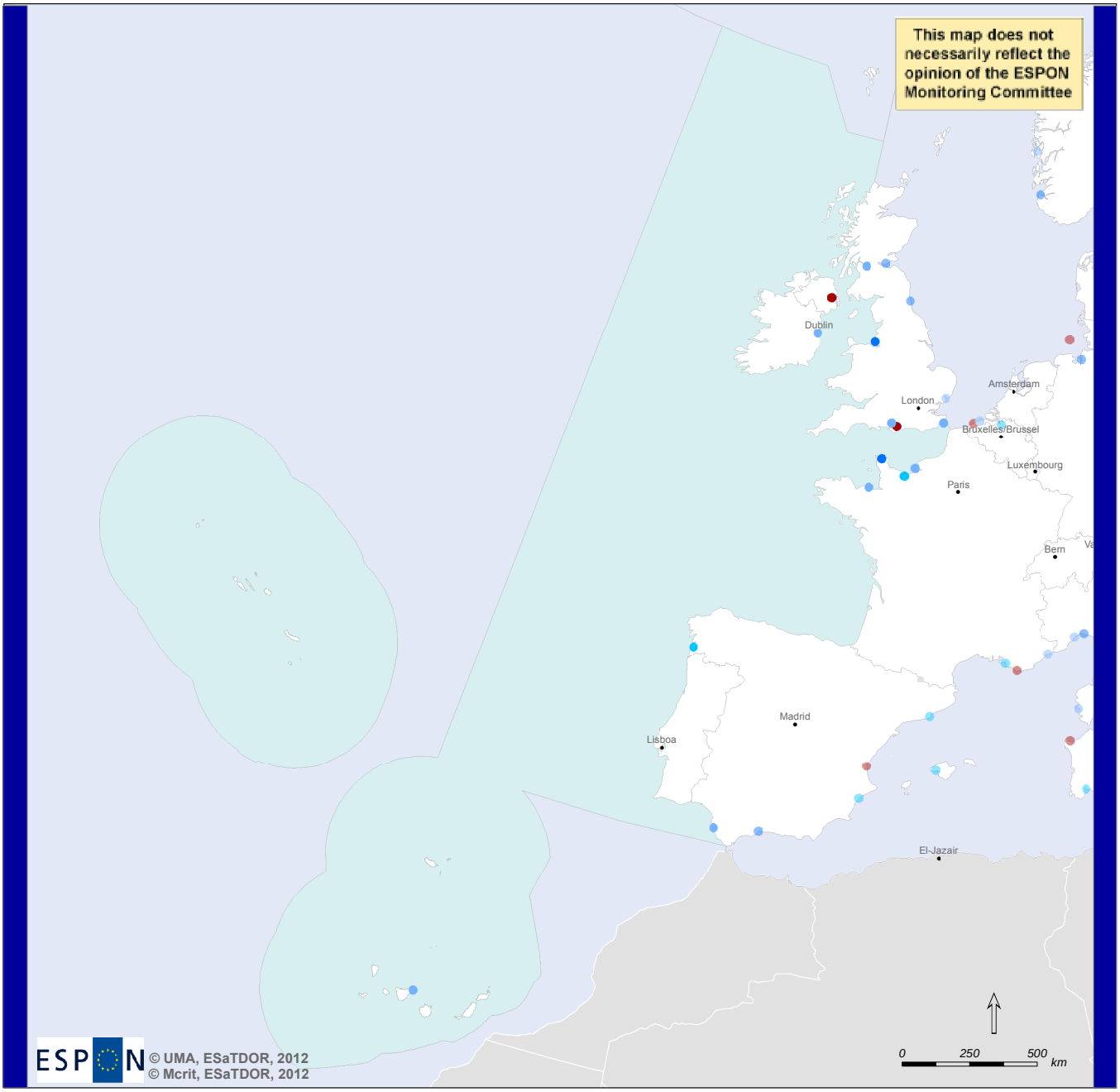
The second type of flow relates to cruise activity with Southampton being by far the largest Atlantic port involved in this trade, providing a key embarkation point for cruise passengers. A number of other ports in the region are excursion destinations with the most significant being located in northern and southern Spain (Map AT18a). The majority of Atlantic cruise ports saw a decline in passenger numbers between 2004 and 2008, but a few did see growth albeit from a very low base (Map AT18b).

Cruise Activity by Passenger Type, 2008



Map AT18a. Cruise activity at Atlantic Ocean ports by passenger type, 2008.

Cruise Passenger Trends



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Thematic data: Passengers maritime transport by direction and type of traffic, EUROSTAT, 2008.
Port locations: Eurostat - GISCO (European Commission), 2009
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Average annual passenger increase of cruise passengers, 2005 - 2008 (%).

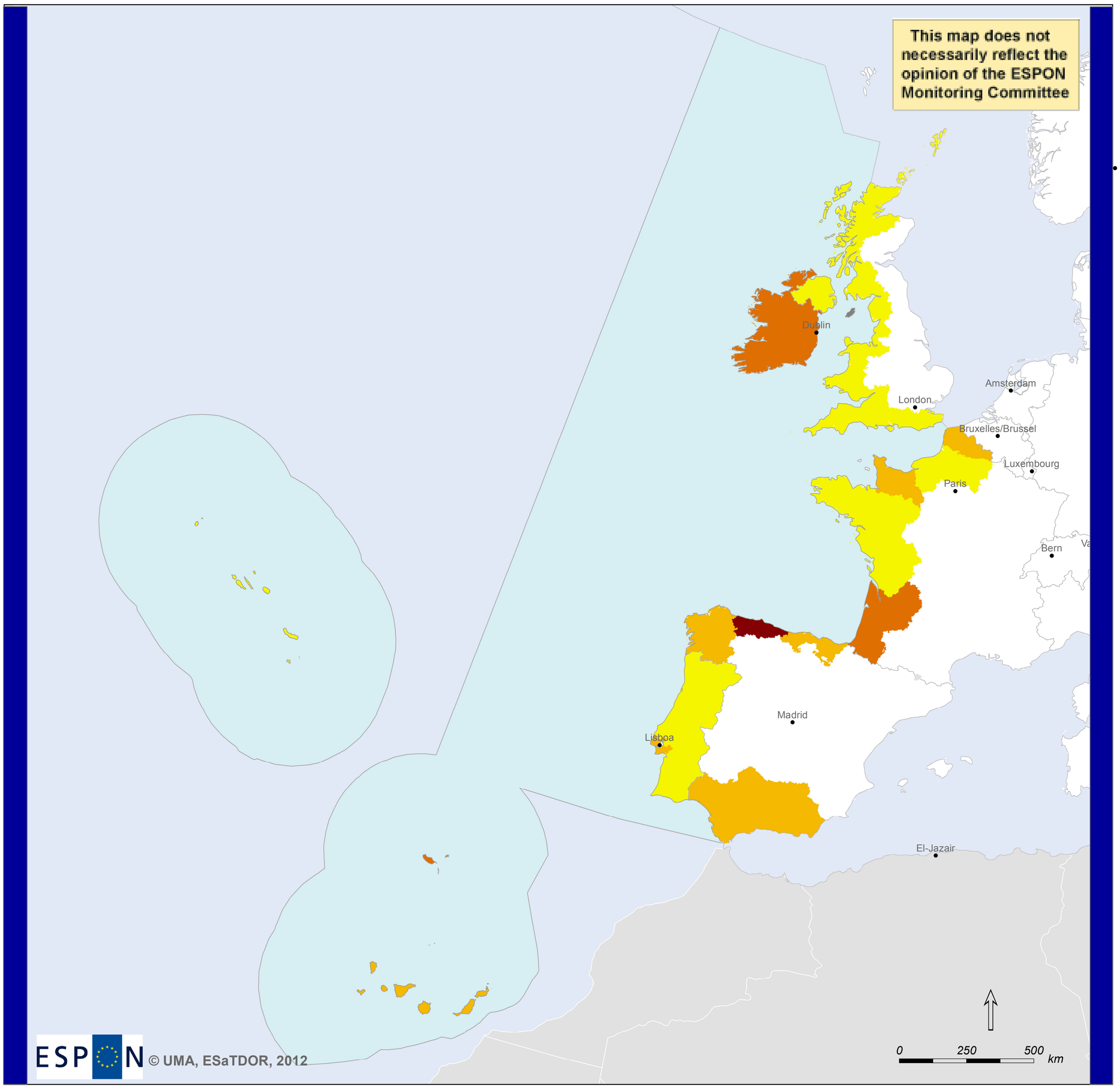
- < 0%
- 0% - 10%
- 10% - 20%
- 20% - 30%
- > 30%

Map AT18b. Average annual increase of cruise passengers 2005-2008, Atlantic Ocean ports.

Energy and Undersea Infrastructure

Energy: Within the Atlantic from the perspective of the exploitation of energy from the marine environment there is a clear north south divide, both in terms of what might be described as traditional marine energy sources (oil and gas exploration) and also in terms of renewable energy sources. This is then largely reflected in the concentration of oil and gas related employment opportunities that are found within the region. It is important to note that although the exploitation of oil and gas may be an important economic activity, nowhere in the region does it directly generate significant numbers of jobs. Even where the activities are most heavily concentrated (northern Scotland) here the jobs are on the east coast around Aberdeen and the North Sea, rather than the west coast and the Atlantic. A small concentration of oil and gas related employment appears to be evident in the southern part of the Bay of Biscay, which Saurez-de Vivero (2011) has identified, at least within Spanish waters as a place of hydrocarbons exploration and gas storage. In France, whilst resources might be available offshore, the exploitation is on land in or around the town of Lacq in the Aquitaine region. These employment figures are to some extent mirrored by the sparse distribution of oil and gas platforms in the Atlantic with very few beyond a small cluster in the Irish Sea (employment as a percentage of total employment in coastal NUTS2 regions is shown in Map AT19). This might tend to corroborate the perspective that gas storage in previously exploited wells in northern Spain is becoming more significant both as a sea use and an employer in the Atlantic.

Employment in the Oil and Gas Sector, 2009



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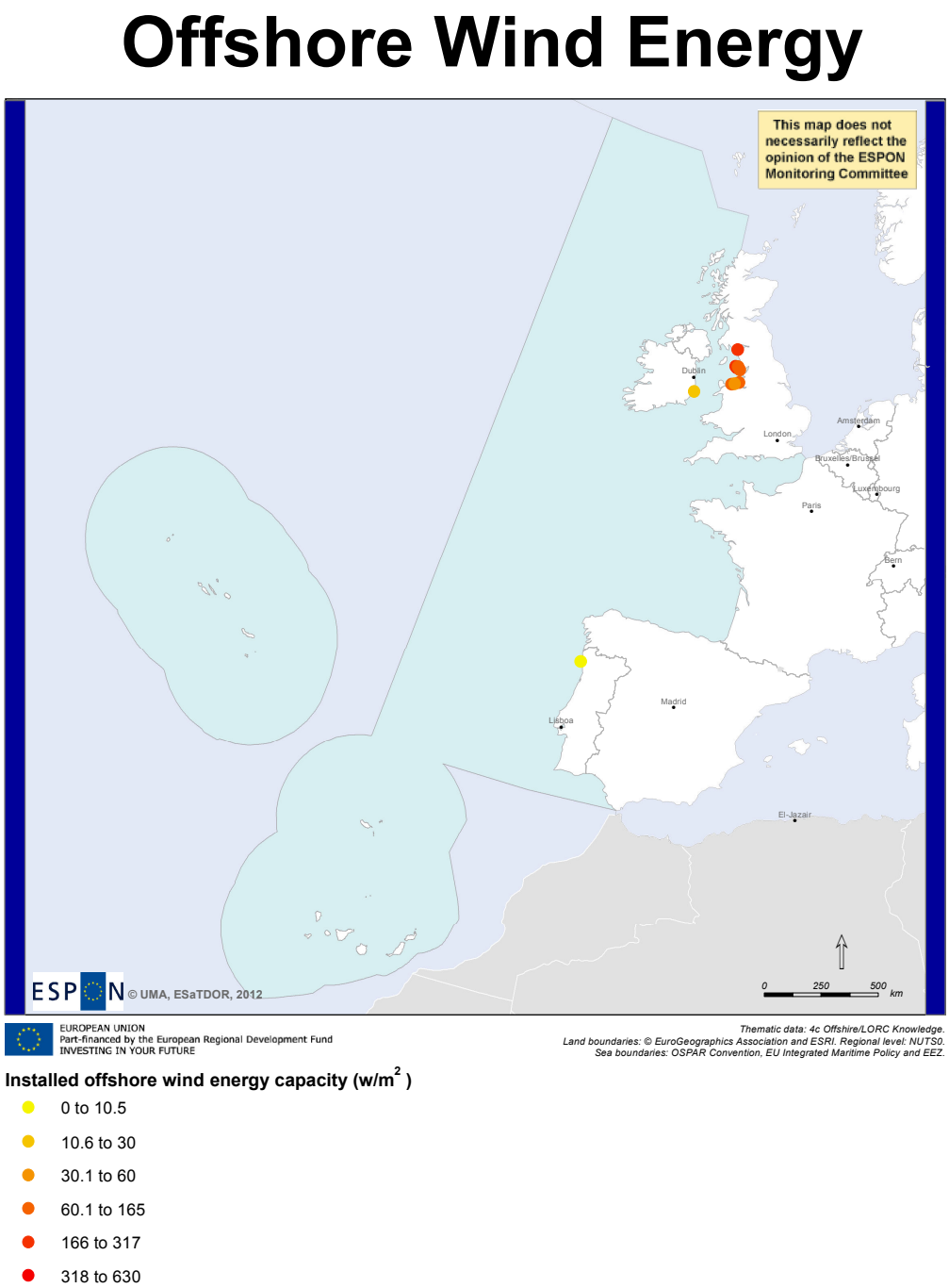
Thematic data: Economic Use, European Cluster Observatory, 2011.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Oil and gas 2009 (percentage of total employment).

- 0
- 0.001 to 0.003
- 0.004 to 0.03
- 0.04 to 0.11
- 0.12 to 8.88
- No data

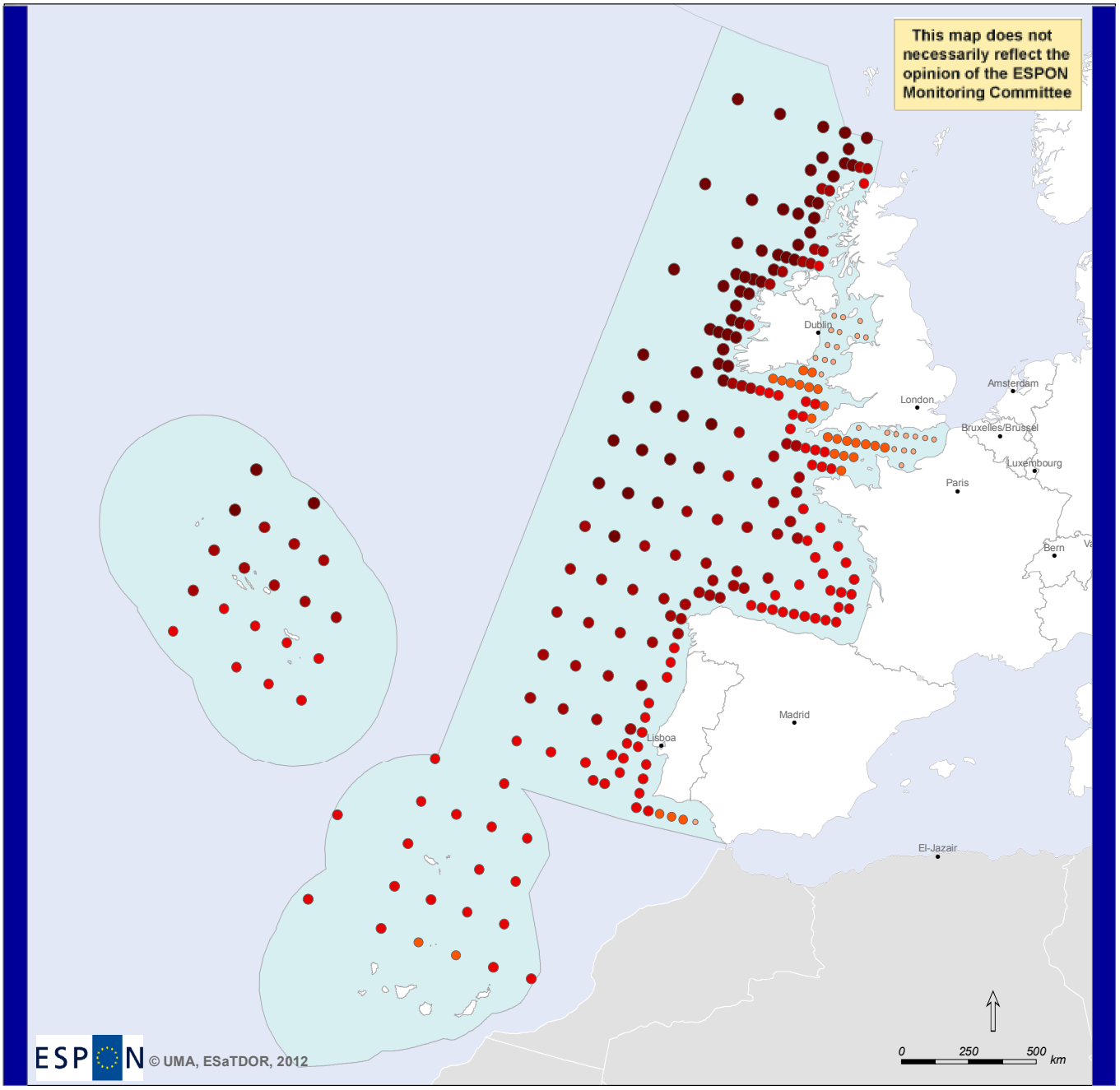
Map AT19. Employment in the oil and gas sector (as a percentage of total employment), 2009. Atlantic Ocean area.

With regards to renewable energy, the exploitation of marine renewable sources, currently mainly in the form of wind energy, is again very much concentrated in the north Atlantic, specifically in the Irish Sea (Map AT20). This is a function of the amenable geography, steady wind speeds and shallow seas combined with a permissive and enabling government framework. Elsewhere (with a small exception off the Portuguese coast) wind energy has not yet really taken off. From a futures perspective wave energy has great scope for development in the Atlantic again particularly in the northern part of the region (see Map AT21), but as yet technical difficulties in harnessing this potential and getting the energy to shore has limited its growth.



Map AT20. Existing wind farm generation capacity in the Atlantic Ocean

Wave Power Potential



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Thematic data: Fugro OCEANOR, Worldwaves, 2008.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

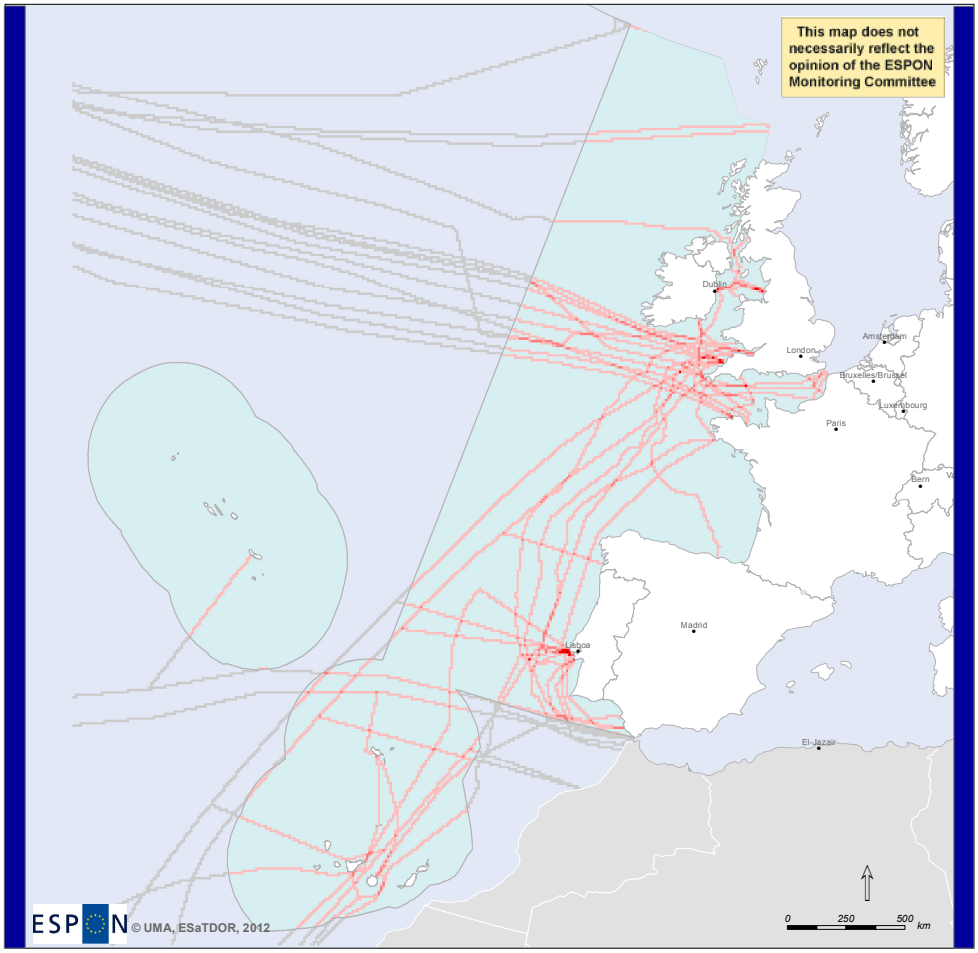
Wave power potential (KW/m)

- 0.5 to 11.0
- 11.1 to 24.3
- 24.4 to 39.0
- 39.1 to 55.9
- 56.0 to 81.6

Map AT21. Wave power potential in the Atlantic Ocean

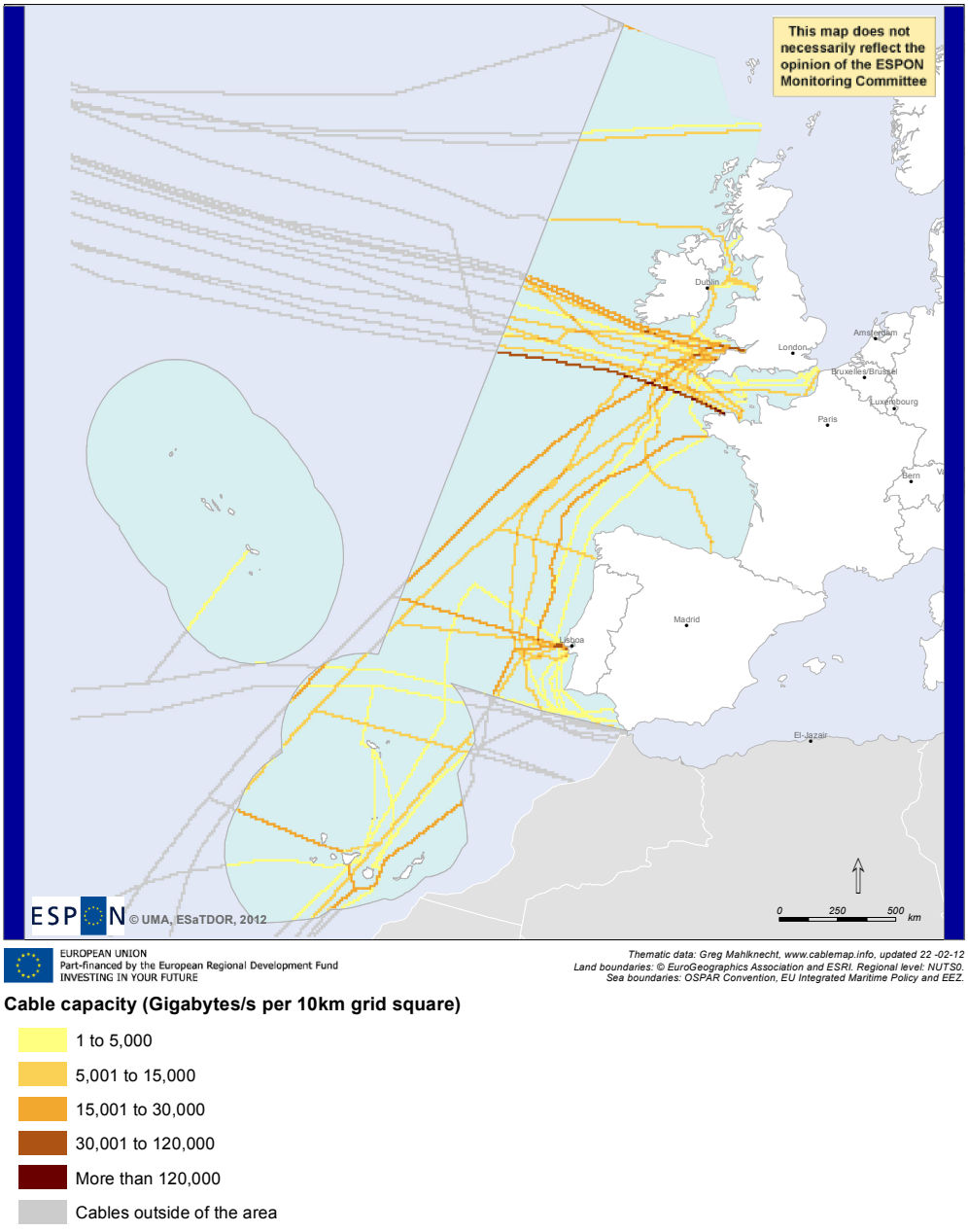
***Undersea Infrastructure*:** From the perspective of the network of telecommunications cables, both in terms of the numbers and length of cables and the intensity of flows along them, within the Atlantic three key patterns are evident (Maps AT22a, AT22b). First the Atlantic is an important gateway to and from Europe for information flows. There are very strong network links, particularly between northern Europe (northern France and south east England) and northern America. A second transcontinental set of flows is evident from the Atlantic regions in a southerly direction either to the west and southern parts of Africa, or South America. A third very evident pattern connects the Canaries to the mainland. With the growth of telecommunication technologies it is uncertain whether these undersea cable connections will continue to have so much importance in the future or whether satellite communications will become even more dominant making undersea cables largely surplus to requirements.

Undersea Cables (Length)



Map AT22a. Undersea telecommunications cables (length per 10km grid square), Atlantic Ocean.

Undersea Cables (Capacity)



Map AT22b. Undersea telecommunications cable capacity (Gb/s per 10km grid square)

In addition to undersea telecommunications cables, there are a number of power cables and pipelines along the Atlantic sea bed. In the Channel a power cable connects the UK and France, whilst in the Irish Sea there are already connections between the UK and Ireland, and plans for a High Voltage Direct Current (HVDC) submarine cable connecting Glasgow to Wirral in the UK, which would pass through the different marine jurisdictions of Scotland, Northern Ireland, the Isle of Man, England and Wales. HVDC will also support the expansion of wind farm developments in the Irish Sea.

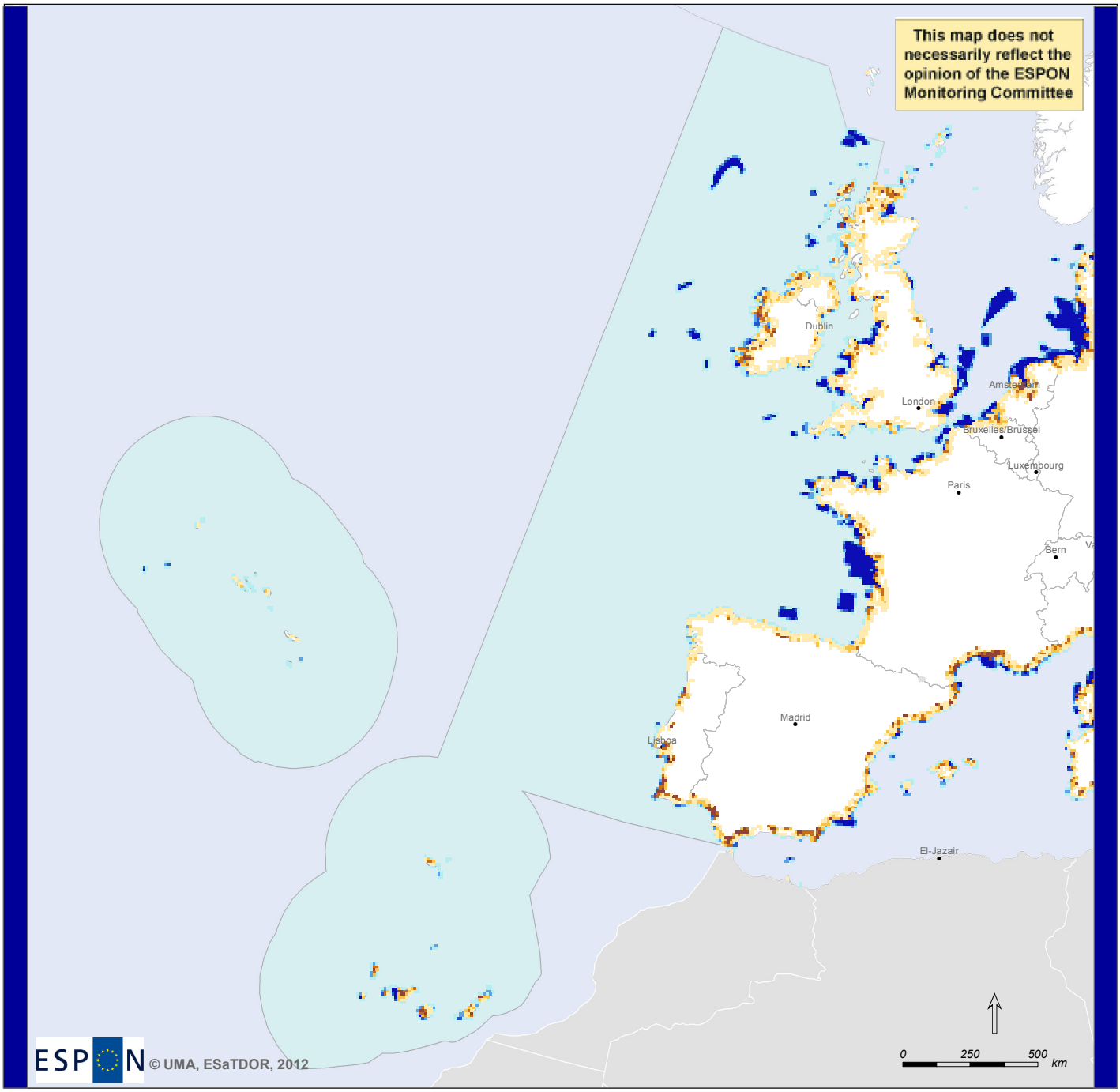
The main pipelines associated with the Atlantic Ocean are gas pipelines associated with developments in the Irish Sea, and a small spur in the Bay of Biscay associated with the Gaviota gas platform.

Environment

In terms of the natural environment, changes are often attributable to human activities, directly through close land sea interactions, (for example in the form of the discharge of water borne pollutants into the sea, or the impact of invasive species often transported into an area through shipping activities), or indirectly (for example in terms of anthropogenic influences on climate change).

These maps therefore explore the way that land to sea interactions are potentially exerting a negative impact on the marine environment as the natural ecosystems are disturbed by human derived inputs. Policy responses at a global and European scale have increasingly called for the designation of protected areas to help sustain valuable species, habitats and ecosystems. Map AT23 indicates the intensity of protected areas in both the land based coastal strip and the marine environment. This mechanism of protection is expanding rapidly and the map below indicates the position at a particular moment in time (in this case designated Natura 2000 sites up to 2010). It is noticeable that many of the marine protected areas are close to the coast and often associated with land based estuarine designations. It is also interesting to note that off the coast of the UK and Ireland there are a number of marine protected areas within the open sea, well away from land. The marine designations are at the moment more concentrated within the central and northern parts of the Atlantic Sea region, with only a very few small designations in the south. This in part might be a function of the sea depth off the coast as many of the marine protected areas are in shallower waters. There is a concentration of land based conservation areas along the southern coast of Portugal including the Natural Park of the South West Alentejo Coast (St Vicentina) and the lagoon system of the Ria Formosa, and in the Canary Islands, where the variety of sub-tropical and desert landscapes and coastal lagoons provide for great biodiversity. The most intensive concentration of marine protected areas is in the Bay of Biscay and it is interesting to note that this also coincides with the highest level of nutrient pollution and relatively high levels of invasive species, both of which might adversely affect the integrity of the ecosystem that the designation is intended to protect.

Protected Areas



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Thematic data: Natura 2000 Network, European Commission - European Environment Agency, 2010.
CAFF Arctic Protected Areas, CAFF and PAME Arctic Council, 2011.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Percentage of grid size (Land)

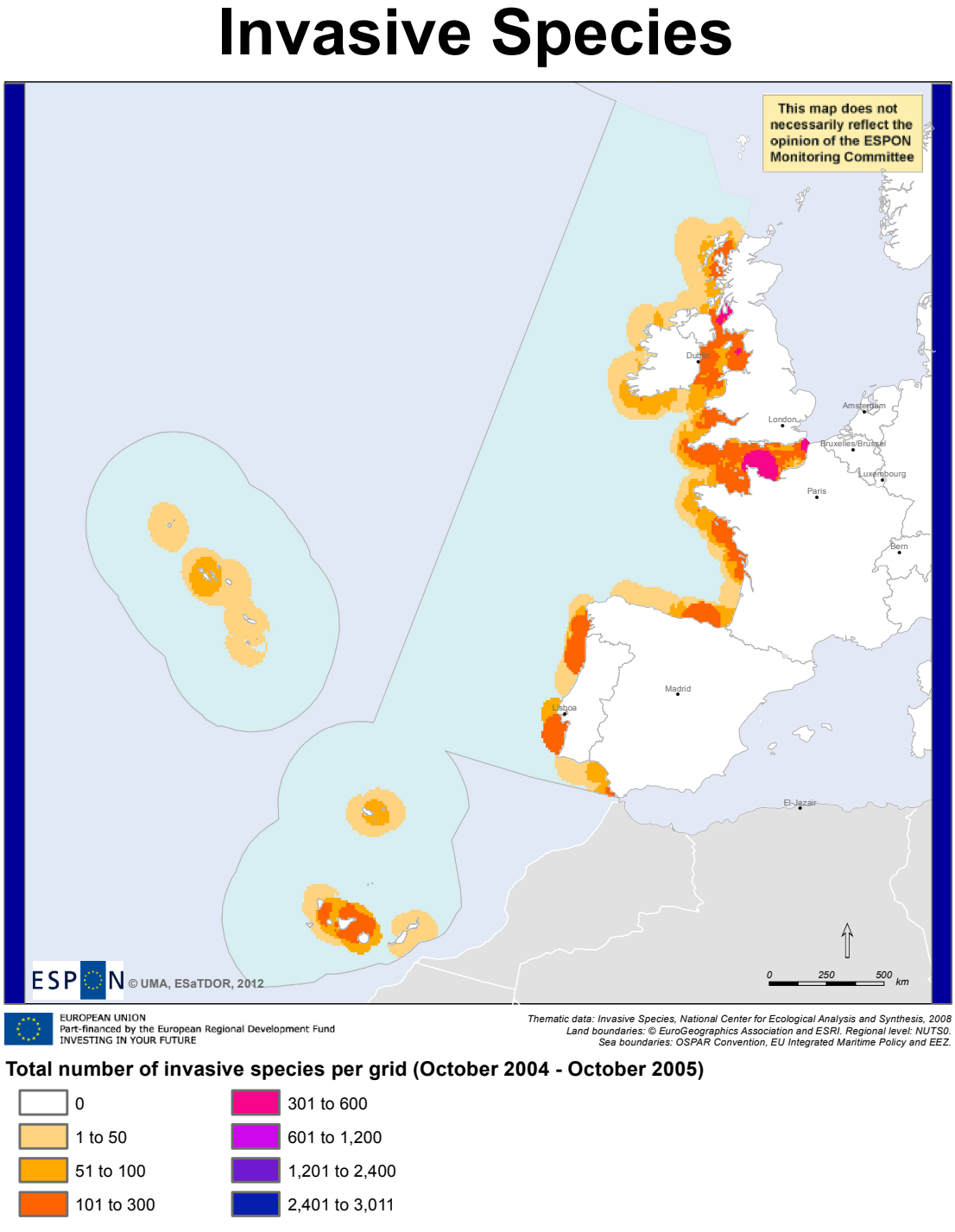
- > 25%
- 25 to 50%
- 50 to 75%
- > 75%

Percentage of grid size (Sea)

- > 25%
- 25 to 50%
- 50 to 75%
- > 75%

Map AT23. Protected areas (Natura 2000 and CAFF sites), percentage designated per 10km grid square. Atlantic Ocean.

Given the association between invasive species and shipping activities and the fact that the data is modelled to a sea depth of less than 60 metres, is not surprising that invasive species are concentrated in shallow seas, around the coast in areas with high levels of shipping activity, either as key connections through which shipping passes (e.g. the Channel) or associated with the key ports (as shown in Map AT24). We have already noted how many of the ports along the Atlantic coast are regional in character and therefore relatively small and this also helps to explain why the obvious concentrations within the regional sea as a whole are still relatively low.

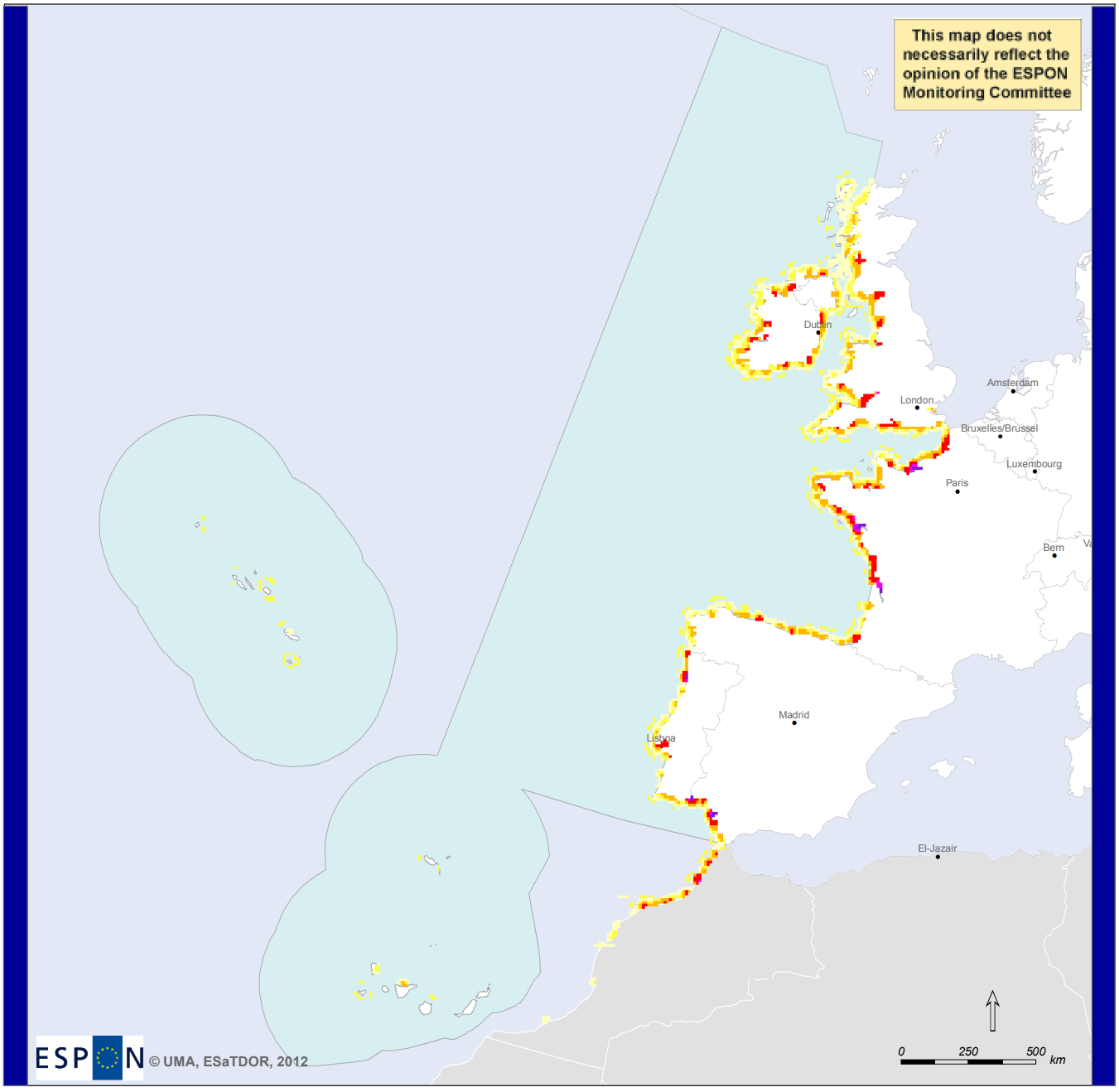


Map AT24. Incidence of invasive species per 10km grid square, October 2004 - October 2005, Atlantic Ocean.

The following maps explore in more detail the impact of land based pollution flowing into the sea, and the data is very focused around the coastal areas. The first map (AT25) shows concentrations of organic pollutants are largely derived from agricultural runoff and become concentrated in rivers before flowing out into the seas. Most of the areas of higher concentrations of organic pollutants therefore are closely associated with estuaries. The data available shows how such concentrations of pollution, where they exist are broadly within the territorial waters, although this is an observation based on limited data availability.

Map AT26 explores the quality of bathing water on beaches around the Atlantic coast. The majority of the coastline is largely compliant with EU bathing water regulations with a few isolated and scattered points throughout the region where compliance is below the required standard. What is readily apparent however is that along the north coast of Spain and along parts of the English coast (Irish Sea, Seven Estuary and some parts of the south coast of England) the standards achieved are less good than large parts of coastal France, Portugal, including the Azores and the Canaries. This is probably a function of relatively low population densities combined with open seas which provide for natural flushing of pollutants. The role of the UK's estuaries as internationally important locations for migratory birds and associated 'natural' sources of pollution also accounts at least in part for the lower standards achieved in this part of the Atlantic. This situation is likely to come into sharp focus beyond 2014 when more stringent EU Bathing water standards come into force.

Organic Pollution



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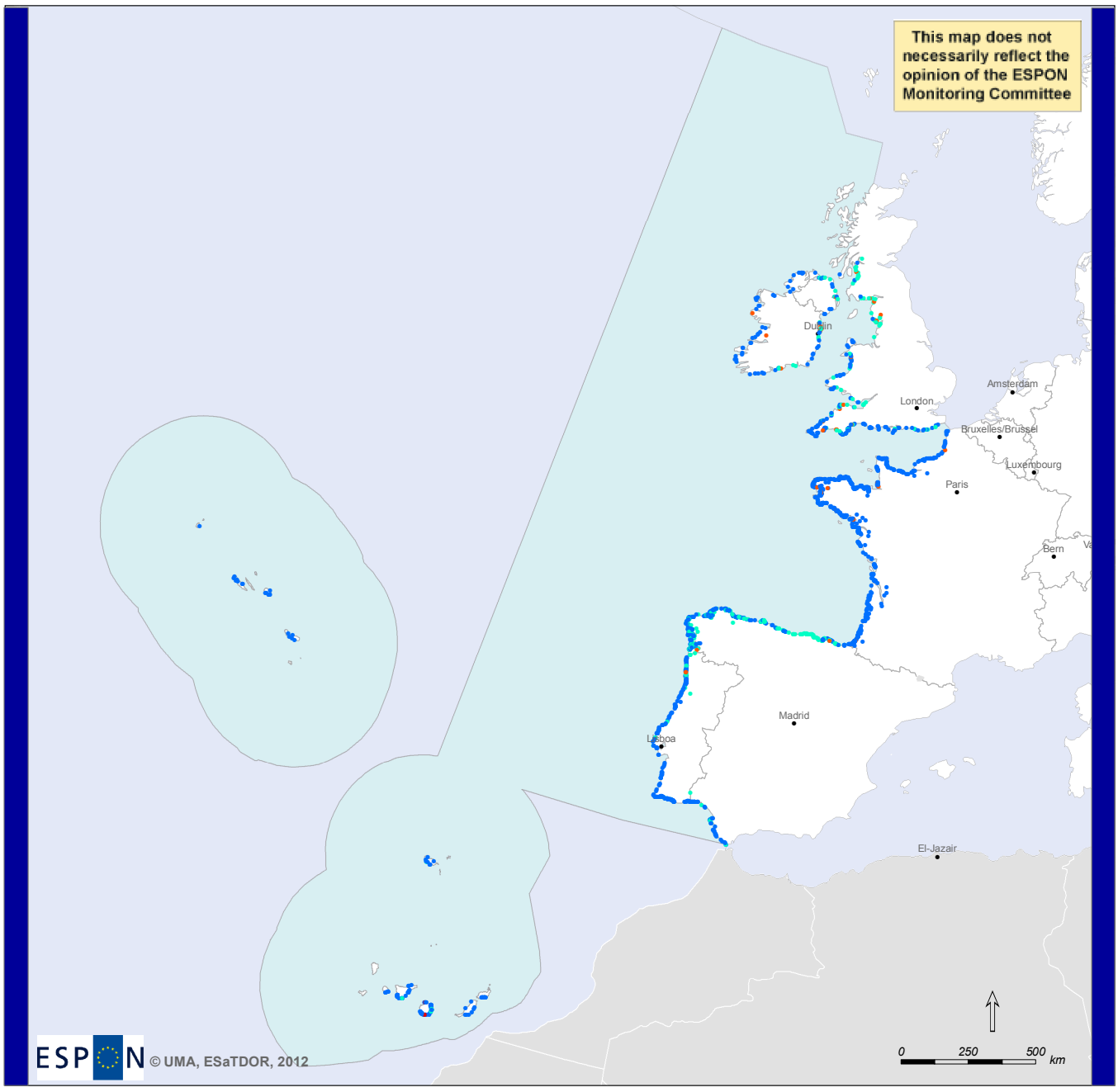
Thematic data: National Center for Ecological Analysis and Sysnthesis, Organic Pollution, 2008.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Organic pollution (total kg of pesticides per year)

- 1 to 3
- 3 to 10
- 10 to 50
- 50 to 500
- 500 to 2000
- 2000 to 10000

Map AT25. Organic pollution (total kg of pesticides), 2008. Atlantic Ocean.

Status of Bathing Waters, 2008



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Thematic data: European Commission, Bathing Water Directive 76/160/EEC Report, 2010
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Status of bathing water for year 2008

(Please note: symbols of upper categories are placed on top)

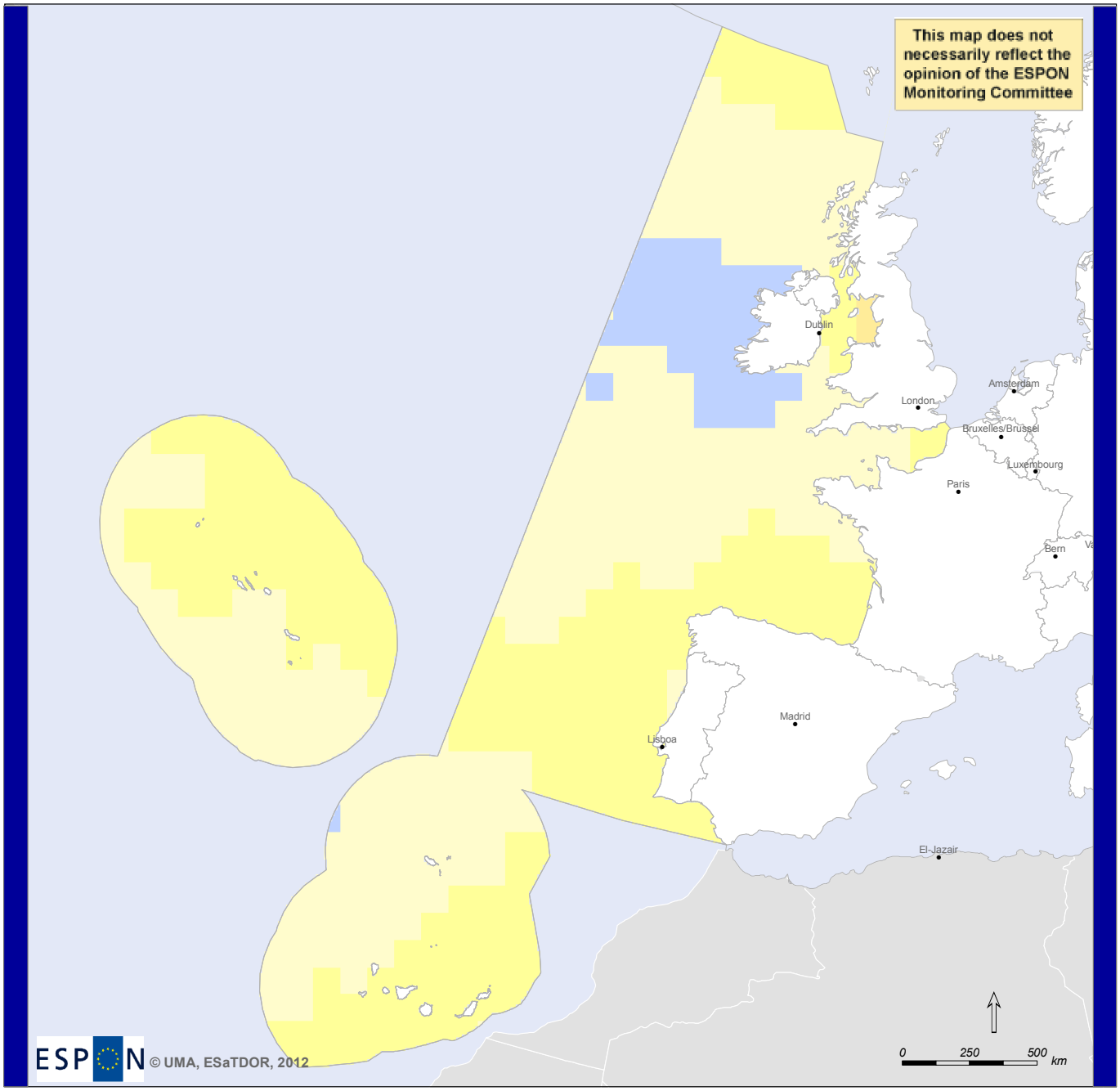
- Banned or closed (temporarily or throughout the season)
- Not compliant with the mandatory values of the Directive
- Compliant with the mandatory values of the Directive
- Compliant with the mandatory and the guide values of the Directive

Map AT26. Status of bathing waters relative to the Bathing Water Directive, 2008. Atlantic Ocean.

Given the association between invasive species and shipping activities and the fact that the data is modelled to a sea depth of less than 60 metres, is not surprising that invasive species are concentrated in shallow seas, around the coast in areas with high levels of shipping activity, either as key connections through which shipping passes (e.g. the Channel) or associated with the key ports. We have already noted how many of the ports along the Atlantic coast are regional in character and therefore relatively small and this also helps to explain why the obvious concentrations within the regional sea as a whole are still relatively low.

One data set which may be indicative of background changes in the maritime environment associated with global warming is sea surface temperature. Sea surface temperature (SST) is an aspect of climate change and climate variability that affects marine ecosystems. SST has environmental relevance because many marine ecological processes are profoundly influenced by temperature. Important differences are found between ecosystems at different latitudes with different temperature profiles. Map AT27 shows the average SST, based on monthly averages, for the period 1/12/1981-30/1/2012. The Irish Sea shows the greatest level of warming relative to other regions but warming seems to have occurred in all parts with the exception of the area immediately to the west of the Ireland. It should be noted though that increases in temperature over this period may not necessarily have been caused by climate change. For example this period overlaps with at least one climatic regime shift (in the late 1980s) associated with the North Atlantic Oscillation (NAO) and this was paired with increased oceanic influence and warmer water temperatures (among other variables). Even so, many argue that much oceanic warming over the recent decades is of anthropogenic origin.

Increase in Sea Surface Temperature



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Thematic data: National Oceanic & Atmospheric Administration (NOAA), Optimum Interpolation (OI) Sea Surface Temperature (SST) V2, 2012
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Increase in sea surface temperature between 1981-2011 (degrees Celsius)

-2.1 to -2	0.01 to 0.5	2.6 to 3
-1.9 to -1.5	0.51 to 1	3.1 to 3.5
-1.4 to -1	1.1 to 1.5	3.6 to 4
-0.9 to -0.5	1.6 to 2	
-0.49 to 0	2.1 to 2.5	

Map AT27. Increase in sea surface temperature 1981-2011 (degrees Celsius), Atlantic Ocean.

4. Governance Case Studies

Having provided a thematic overview of the existing character of the Atlantic, this section now explores three case study examples of transnational governance arrangements that attempt to achieve more coherent maritime planning and management in the region. The Atlantic Arc commission has been selected as a regional sea wide case study and this is discussed first followed by two cross border examples relating to the British Irish Council and the Solway Firth Partnership. The section concludes with a summary of the key messages and lessons from the case study for future maritime governance in the region. A full account of the Atlantic case studies and those for the other European sea is set out in a separate project report on governance which is available via the ESPON website.

Atlantic Arc Commission

The Atlantic Arc Commission is one of the geographical commissions of the Conference of Peripheral Maritime Regions (CRPM) and is made up of a number of local and regional authorities from the UK, Ireland, France, Spain and Portugal. The Atlantic Arc Commission exists to represent the Atlantic regions in Europe, and places particular emphasis on the challenges of the Atlantic region, for example problems of accessibility between regions and to the centre of Europe, disparities in income between metropolitan and rural areas, and also the potential opportunities for growth, for example through tourism and emerging markets in offshore energy.

Through its work with its member regions, the CRPM and European Commission, the Atlantic Arc Commission has achieved considerable success in highlighting the particular socio-economic conditions of the Atlantic area (for example through research supporting the Atlantic Spatial Development Perspective), and arguing for greater use of transnational spatial planning instruments such as INTERREG to help strengthen economic growth and development across the Atlantic area as a whole.

Whilst the Atlantic Arc Commission continues to be involved in a number of transnational cooperation projects, more recently it has focused greater attention on DG Mare's Communication establishing a strategy for the Atlantic. The Atlantic Arc Commission is actively involved in consultations on this new strategy to ensure that whilst maritime activities are coordinated through the Atlantic strategy, it also addresses territorial cohesion and sustainable economic growth through improved accessibility, developing and diversifying maritime industries, improvements in training, research and development, environmental protection and establishing multi-level governance arrangements to support implementation of the Strategy.

The British-Irish Council

The BIC was established in 1998 as part of the Multi-Party Negotiations (also known as the Belfast or Good Friday Agreement) between the British and Irish Governments and the political parties of Northern Ireland and exists to ensure cooperation on issues of mutual interest including spatial planning, the environment and energy. The BIC has a number of work streams operating on these

issues, and work is carried forward through regular meetings of officials from each administration and annual ministerial meetings.

The environment work stream has worked on issues such as ICZM, marine litter and marine spatial planning, whilst the energy group has two work streams, focusing on marine renewables and electricity grids. The proposal for a marine renewables grid has been included in a position paper, lobbying the EU for greater investment in offshore energy (wind, wave, tidal) as a strategic energy technology for meeting carbon reduction targets and creating employment in green technologies.

Although the BIC plays an important role in bringing together officials from different administrations and provides invaluable networking and information sharing opportunities, each administration retains the freedom to work to its own national legislation and policies. In this sense the BIC has no binding decision making powers, but through discussions each administration has the chance to learn from others and work more closely to adopt approaches (for example to environmental assessment or marine consenting) that are more compatible with those of neighbouring administrations. This will become increasingly important as each administration develops its own legislation and processes for marine spatial planning.

Solway Firth Partnership

The Solway Firth Partnership brings together local and regional actors with an interest in the management of the Solway estuary, which flows out into the Irish Sea and whose catchment includes predominantly rural parts of northwest England and south west Scotland. The Partnership aims to promote economically and environmentally sustainable development of the Solway Firth whilst respecting the natural character and heritage of this area, through a number of mechanisms including integrated coastal zone management (ICZM).

The Partnership has no statutory powers in relation to the planning and management of the Solway Firth but has established good working relationships with many of the key statutory agencies on both sides of the Firth, for example local councils and planning authorities, Natural England and Scottish Natural Heritage. Major issues of concern recently have been proposed wind farm developments in Scottish waters (which have subsequently been abandoned), enforcement of fisheries regulations and the proposed arrangements for marine spatial planning in Scotland and England, which could lead to two separate plans being produced for the Solway Firth. The Partnership has thus been active in trying to promote a coordinated approach to marine planning that crosses national jurisdictions, ensuring that future planning activities respect the ecosystem as a whole. Whilst the preparation of marine plans has yet to be undertaken for either side of the Solway Firth, the Partnership remains successful in bringing together a diverse range of stakeholders and representing their views on the management of the Solway to actors at the regional and national levels.

Table 2: Summary of Case Studies

	Atlantic Arc Commission	**British-Irish Council**	**Solway Firth Partnership**
Drivers	Economic development, accessibility, spatial planning	Offshore energy, ICZM, spatial planning, networking	Nature conservation, fisheries, cultural heritage
Challenges	Territorial cohesion, sustainable economic growth	Transnational cooperation	Cross-border cooperation
Legal Status	Not legally binding	Legally binding	Not legally binding
Effectiveness	High	Medium	Medium
Stakeholder Participation	Medium	Low	High

Key Lessons for Maritime Governance

The case studies outlined here (and described in more detail in Annex 9 of the ESaTDOR Scientific Report) provide some important messages for future maritime governance in the Atlantic and other European Seas. In the first instance, the example of the Solway Firth Partnership demonstrates the importance of planning that recognises ecosystem integrity and patterns of stakeholder use that often cross jurisdictional boundaries. For the Solway Firth, the potential for there to be two marine plans with different priorities affecting development in the same body of water prevents a holistic approach to management and could lead to greater conflict between uses of maritime space.

The work of the Atlantic Arc Commission provides a further example of the need for a holistic approach which encompasses planning for both the terrestrial and the marine environments. As maritime space becomes an increasingly important asset for economic growth (and marine plans are adopted to coordinate activities at sea), impacts on the land must also be considered. For the Atlantic Arc Commission and its response to the proposed Atlantic Strategy, this means ensuring that the territorial dimension of blue growth is given a high priority. In addition, for any future macro-regional maritime strategies, territorial development should consider both land and sea together.

Finally, the case studies demonstrate the need for high level governmental support for effective coastal management and maritime planning. In the example of the British-Irish Council, networking between ministers and officials of different administrations helps to raise awareness of activities and policy developments, which in turn may facilitate further transnational cooperation (for example in lobbying for investment in marine renewable energy technology). The Atlantic Arc, through its activities in conjunction with member regions, the CRPM and European Commission demonstrates that with political buy-in from the regions and European support it is possible to influence policy at the regional sea level (e.g. the Atlantic Strategy and regional policy/structural funding) to enable greater leverage of funding for projects and develop solutions that address the geographic specificities of the Atlantic area.

PART 2

5. Characterisation of the Sea

It can be seen from the above account that the European Atlantic, which is the most extensive European sea area defined by this project, is profoundly interwoven with the economic, social and environmental wellbeing of adjacent terrestrial regions and indeed of Europe as a whole. The previous maps which are based upon selected European wide data sets related to: economic use; transport; energy, cables and pipelines; and the environment highlight key land sea relationships and show that the marine environment supports a wide range of maritime activities and uses. What is clear from this account is that the nature of land sea interactions varies across the region, so before looking to the future it is helpful distil some of the main distinctions. In a recent report related to DG Mare's Blue Growth Strategy (DG Mare, 2012) three separate parts of the Atlantic are identified based on OSPAR divisions and an assessment given of the current focus of maritime industries and their environmental status. Drawing on this report and the findings discussed above the current position in different parts of the Atlantic is summarised in Table 3.

This analysis reveals a distinct north/south and east/west gradient with the highest levels of use and range of land sea interconnections generally being evident in the Celtic Seas and to a lesser extent in the Bay of Biscay and around the Iberian Peninsula. In contrast the wilder, more remote, western and southern fringes of the area are much intensely used and affected by human activity.

Table 3: Summary of Current Characteristics of Different Parts of the Atlantic

Area	Existing focus of maritime industries	Existing environmental status
Celtic Seas	Tourism, Fishing and aquaculture Sand and gravel extraction, Oil & gas exploration/production Wind power generation, Cables and pipelines Shipping, Coastal industry, Military activities, Dredging and dumping,	Reduction in the discharge of radionuclides, and good performance in TBT, but still some problems around ports and shipping lanes. Improvements in structure of fish communities that live on or near the sea bed, Hake stock now classified as sustainable. The seabed in some shallow areas of *the Celtic Seas*, have been significantly damaged by benthic trawling. Not all fisheries are sustainable. Hazardous substances unacceptable at some coastal locations. Heavy metal, concentrations in sediment, fish and shellfish are still above acceptable levels in some coastal areas mainly around the Irish Sea. On beaches around the Irish Sea there are unacceptable quantities of litter.
Bay of Biscay / Iberian Peninsular	Tourism, Fishing and aquaculture, Sand and gravel extraction, Development of wave, tide and wind power generation Cables and pipelines Shipping	Implementation of a number of improvements in fishing practices, establishment of El Cachucho MPA a major step forward. Concern about anchovy and hake fisheries demersal fish community. Eutrophication problems in small coastal bays and estuaries. Increased ship traffic poses increased risk of marine accidents and oil spillages. Mercury remains a particular problem and pollution from hazardous substances continues to be found in coastal locations close to urban and industrial areas.
Wider Atlantic	Tourism Fishing, Sand and gravel extraction (only around the Azores) Shipping, Cables and pipelines Military activities	Some deep-sea habitats now have some protection and are closed to bottom fishing at the least on a temporary basis. Deep-water fishing is exerting pressure on the ecosystems particularly around isolated seamounts and shallower parts of the Mid-Atlantic Ridge – where biodiversity is likely to be highest. Deep-water fish species have been shown to be particularly sensitive to exploitation. The potential for illegal, unregulated and unreported fishing is causing concern.

The spatial information about anthropogenic activities and their influences in the Atlantic region presented above, together with similar information for other European seas, provide the basis for deeper analysis of spatial patterns and interlinkages. The integration of the thematic information into composite maps gives a general overview on the economic, transport and environmental situation of Europe's seas and helps to refine and decipher the particular characteristics of different parts of the Atlantic.

Economic Use

A sum of percentages was calculated of every economic sector related to maritime activities in each NUTS 2 region[1] (percentage of the total employment representing the maritime cluster) to generate an economic use composite map. These sums have been classified by quintiles as follows:

Table 4: Composite classification of maritime economic use

Total Percentage	**Total Employees**	**Category name**
5.42 - 15.52	8,005 - 51,861	Very Low
15.52 - 17.60	51,861 - 109,775	Low
17.60 - 21.06	109,775 - 162,63	Medium
21.06 - 24.69	162,923 - 263,461	High
24.69 - 36.35	263,461 - 674,442	Very High

Flows and Environmental Pressures

A similar approach was undertaken for maritime transport patterns to produce a flows composite map consisting of data on cargo, volume of liquid bulk (energy products), economic influence of cruise passengers and information flows (Gb/s), and to produce a composite picture of environmental pressure. The environmental pressure composite map was obtained by calculating the average (equal weight basis) of layers with information about invasive species as well as organic and inorganic inputs. Their values were reclassified into five groups (based on quintiles) as follows:

Table 5: Composite classification of environmental impacts

Organic Inputs	**Invasive Species**	**Inorganic Inputs**	**Category name**
-	0*	-	-
1 – 60	1 – 60	0.1 – 320	Very Low
60 -120	60 -120	320 - 640	Low
120 – 180	120 – 180	640 - 960	Medium
180 - 240	180 - 240	960 – 1,280	High
240 – 7,662	240 – 3,030	1,280 – 10,186	Very High

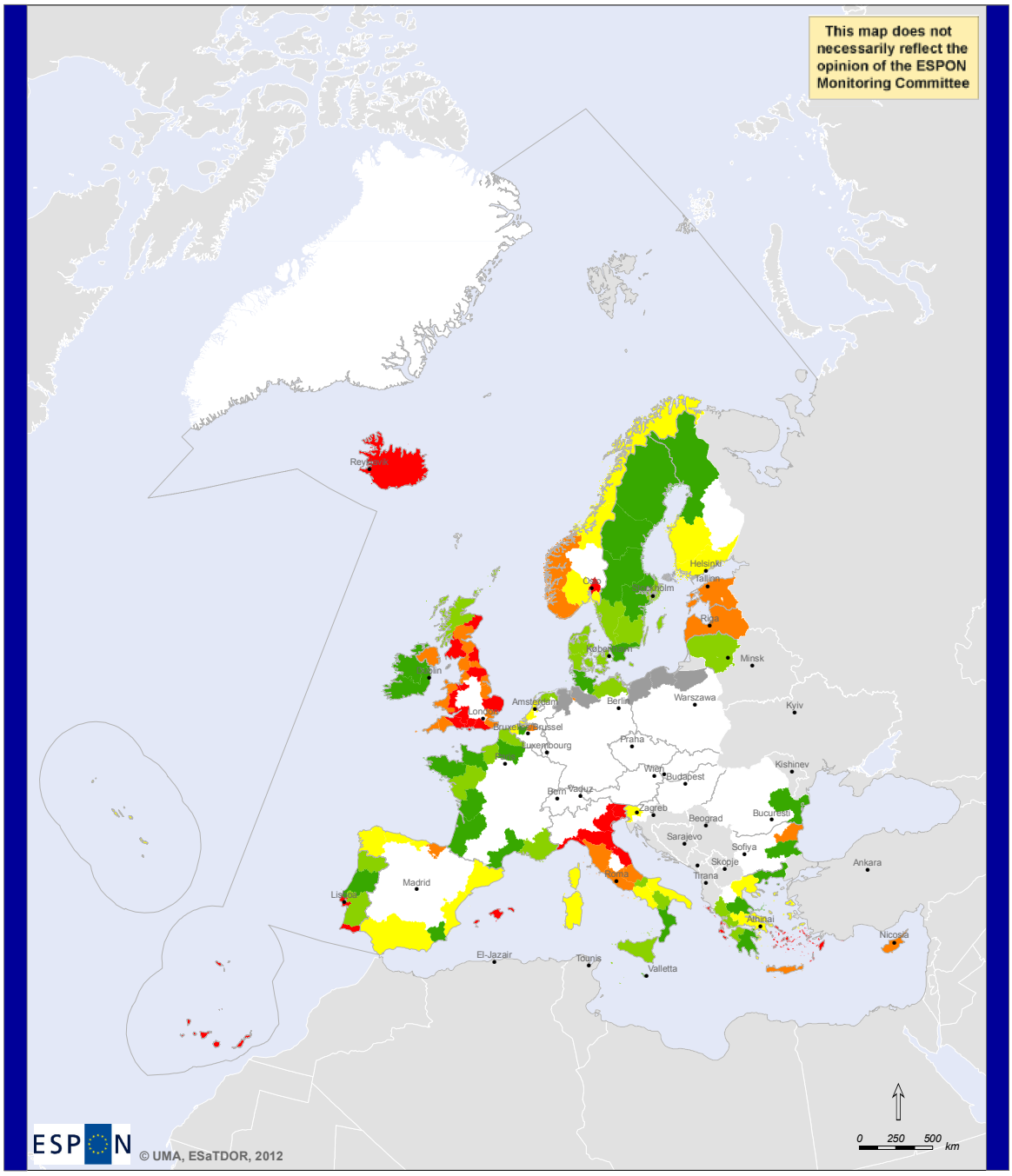
[1] Data for Denmark, Ireland and Slovenia are on national level because as no data was available on NUTS-2-level

In terms of economic use, the picture emerging for the Atlantic region (Map AT28) shows a high percentage of total employment in maritime related industries in the UK and the Canaries with medium to low percentages in these sectors across much of the remaining Atlantic seaboard, although small, regionally important concentrations are evident in Portugal and northern Spain. This pattern reflects the strong maritime and 'island' character of the UK and the Canaries with multiple types of maritime employment and in particular the relative significance of employment in coastal tourism that they share.

A broad variety of anthropogenic activities both on land and on sea cause environmental impacts in the Atlantic. Map AT29 combines pressures from invasive species, and organic and inorganic contaminants. This shows that medium to high levels of environmental pressure (coming from differing sources) are experienced in coastal waters across almost all of the Atlantic coastline but with notable concentrations in the Channel and the Irish Sea. The relatively enclosed circulation of the Irish Sea tends to compound environmental pressures in this part of the Atlantic.

The Atlantic also plays a critical role in the flow of goods and information across the globe, however it is evident that many of these flows simply pass through the region to major destination points elsewhere with significant pinch points or hotspots of activity being apparent around the Channel and the Straits of Gibraltar (Map AT30). Other smaller concentrations of activity are evident in the Canaries and around larger ports in Portugal and northern Spain. As we have seen from the maps presented earlier, beyond these locations shipping routes and cable corridors fan out and for the most part the Atlantic is characterised by very low transport and communication flows.

Employment in the Maritime Sector, 2009 (as a % of Total Employment)



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Thematic data: Economic Significance Composite Map.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

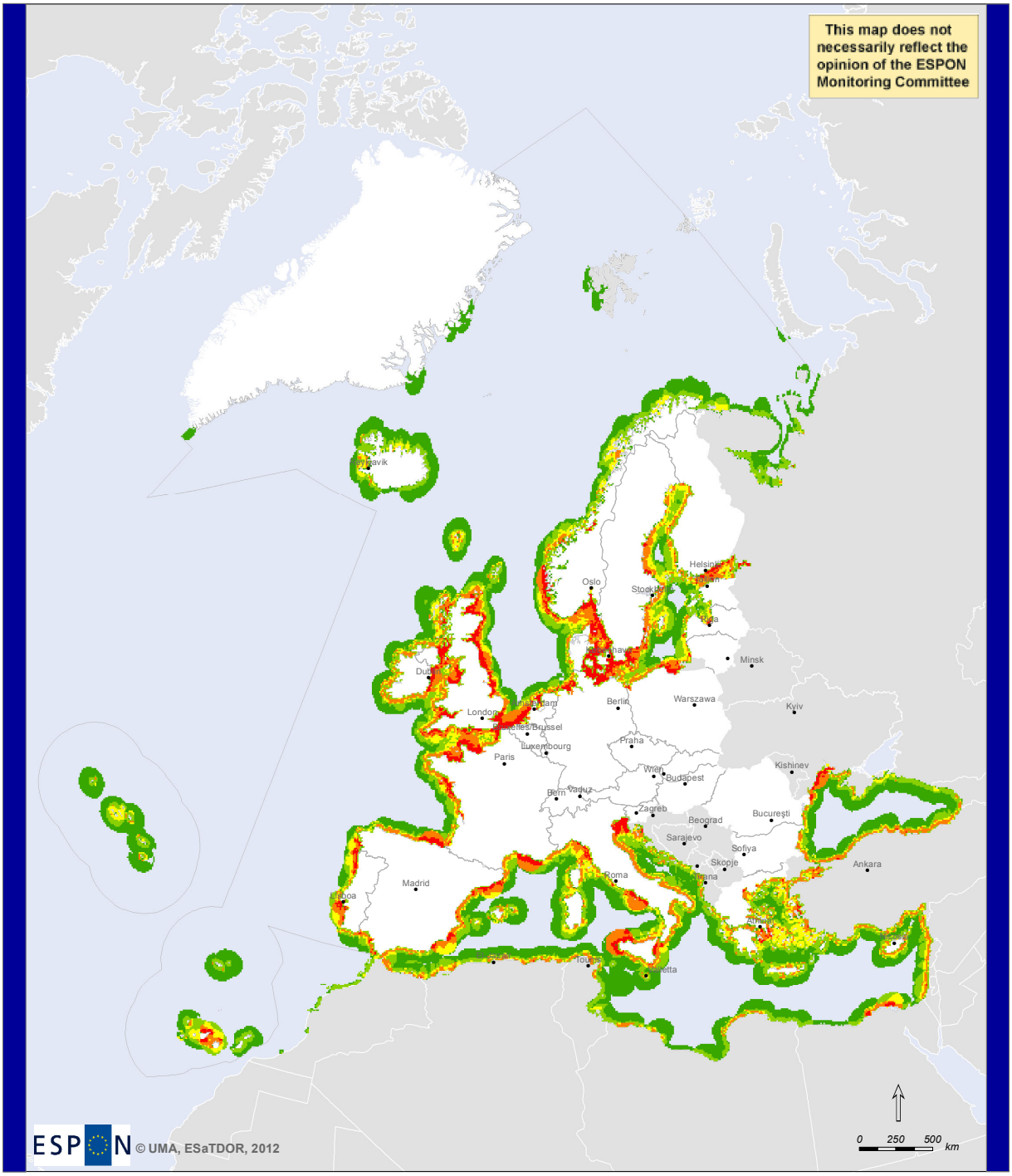
Total Maritime Employment Composite Map (percentage of total employment within each NUTS2 region)

- Very Low (5.42 - 15.52)
- Low (15.53 - 17.60)
- Medium (17.61 - 21.06)
- High (21.07 - 24.69)
- Very High (24.70 - 36.35)
- No data

NOTE: This composite map consists of data from the European Cluster Observatory on persons employed in fisheries, shipbuilding, other traditional maritime sectors, sectors associated with the maritime cluster, tourism and transport as a percentage of total employment within each NUTS2 region.

Map AT28 Total maritime cluster employees (as a percentage of total employment) per NUTS2 region, 2009

Environmental Pressures



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Thematic data: Environmental Pressures Composite Map.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

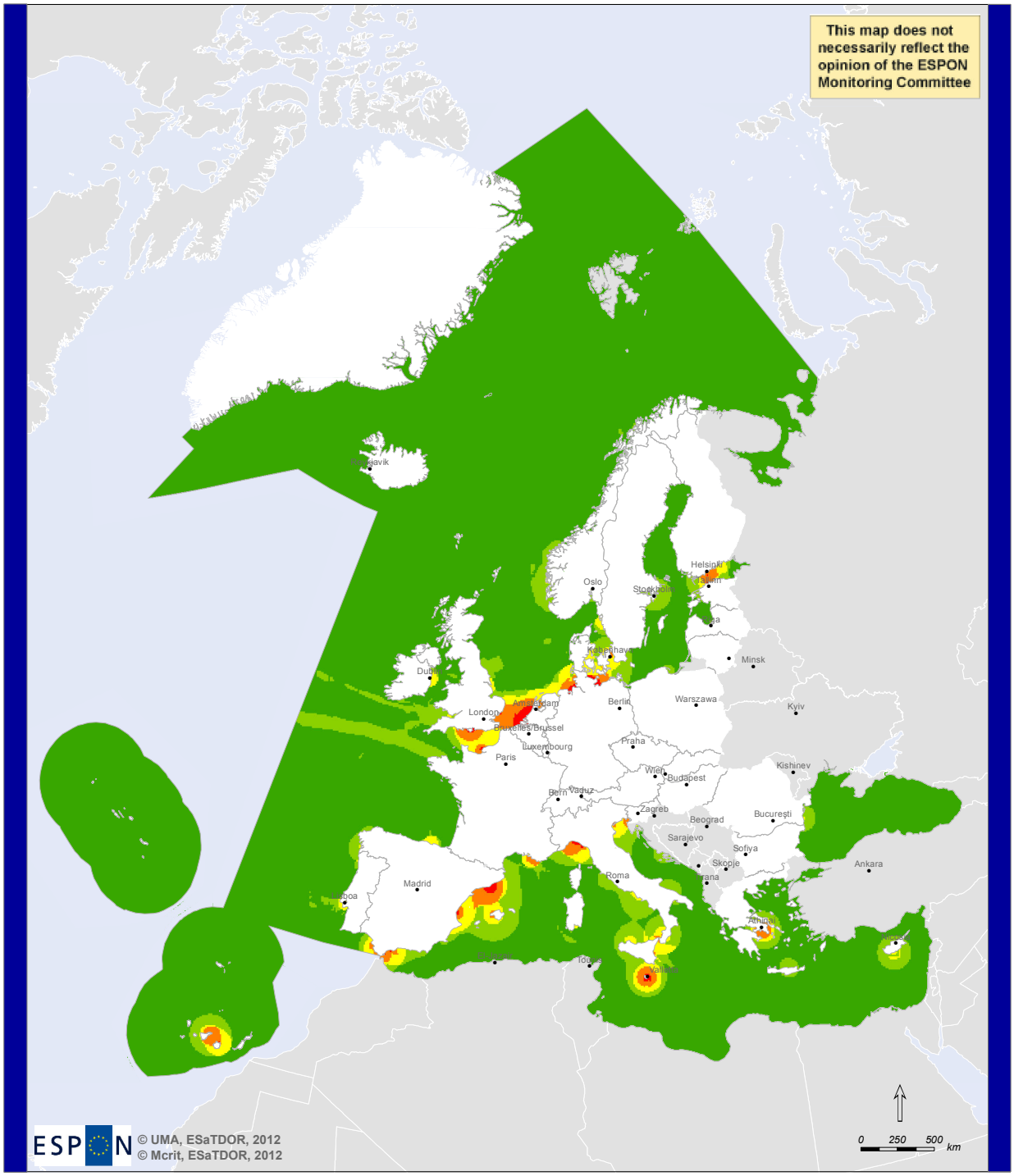
Environmental Pressures Composite Map

- Very Low
- Low
- Medium
- High
- Very High

This map is based on three data sets: incidence of invasive species, organic pollution (pesticides) and inorganic pollution (fertilisers).

Map AT29. Environmental pressures in Europe's coastal and marine regions (composite map)

Flows



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Thematic data: Flows Composite Map.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Flows Composite Map

- Very Low
- Low
- Medium
- High
- Very High

The Flows composite map is a proxy to land-sea interactions of goods, people, energy and information based on the analysis of flow magnitudes and interchange nodes. Influence of interchange nodes is higher with proximity to node and size of associated flow (container traffic, cruise traffic and LBK traffic plus Gb/s through cables).

Map AT30 Flows composite map

5.1 Towards a maritime region typology

Combining the composite pictures of economic use, transport flows and environmental pressures shown above has enabled maps showing coldspots (Map AT31a) and hotspots (Map AT31b) for maritime related activity within Europe's regional sea areas to be produced. This sets the background for the final step towards a maritime typology shown in Map AT32 which categorises maritime regions into a five-way typology: European Core, Regional Hub, Transition, Rural and Wilderness. The typology map is a simplified graphic presentation of the pattern of broad divisions evident from the data. The zones identified cover both land and sea and have deliberately 'fuzzy' boundaries reflecting data quality and availability issues which are discussed in more detail in the Data and Mapping report.

One of the premises for these maps was the selection of European data sets to ensure Europe wide comparability of maritime characteristics. For many sectors (such as fisheries) and issues (such as underwater noise, coastal erosion, dredging and eutrophication) adequate information was not available on a European level although very good data exists in relation to some regional seas. For example data collected for OSPAR purposes provides a very good basis for understanding many aspects of the Atlantic and North Sea marine environment, but compatible data is not available for other European seas. The picture presented is therefore less than ideal and the following maps should be understood as a first iteration of a European maritime typology, demonstrating how this concept could be developed over time as data improves.

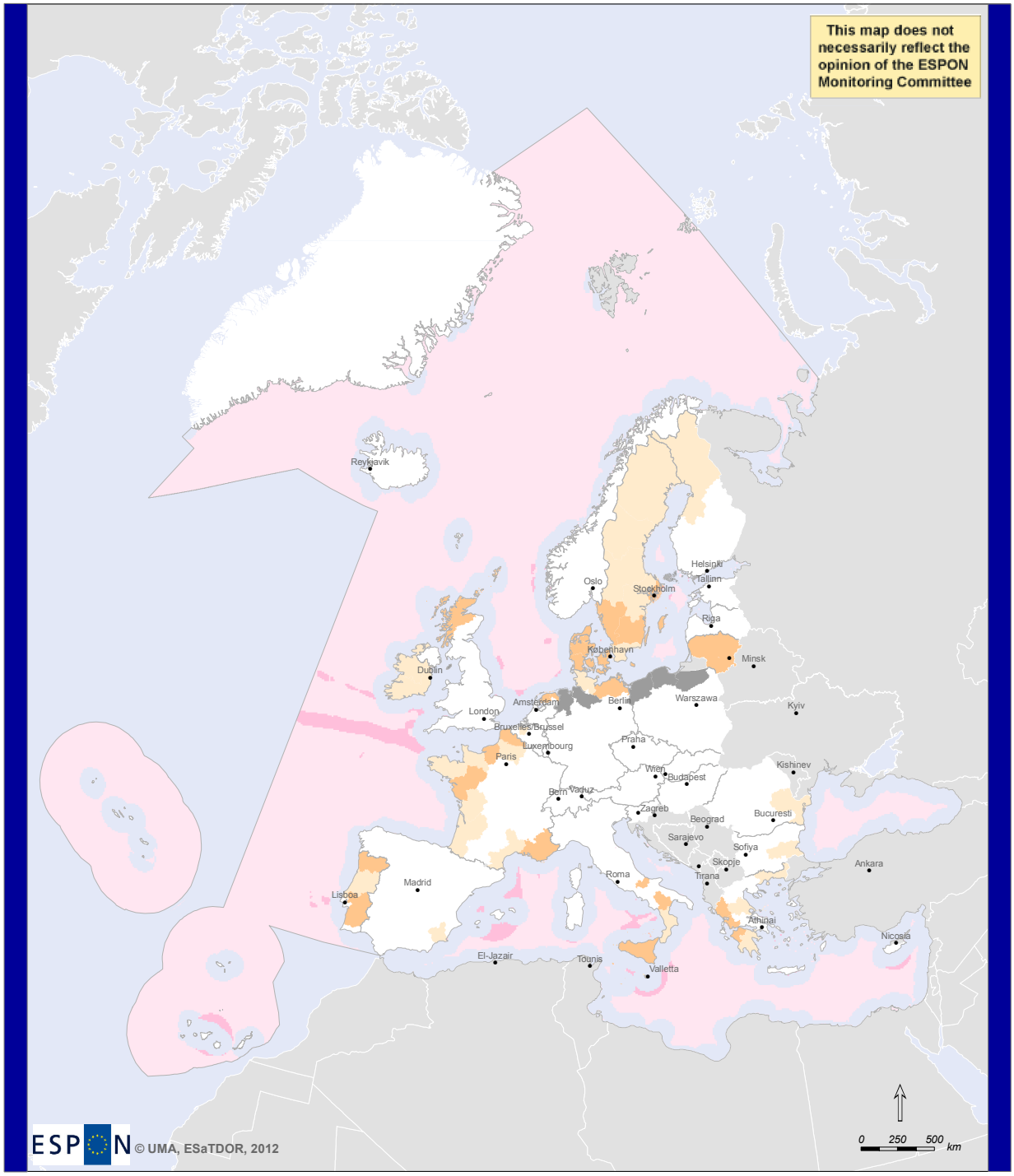
What emerges for the Atlantic is that the Channel and the adjoining areas in southern England and Northern France clearly lie within the European Core, exhibiting high intensity of maritime related economic use, flows and environmental pressures. The area forms the gateway to the main part of the traditional (terrestrial) European Core that lies around the southern North Sea, and its location reflects the strength and size of the economic heartland and urban conurbations focused within the London, Paris, Amsterdam axis, as well as strong inland transport connections to many parts of mainland Europe. The area's strategic location, combined with high levels of investment in maritime infrastructure seem to have resulted in a general strengthening/reinforcement of this premier position in recent times.

Beyond the core three/four regional hubs can be identified reflecting concentrations of maritime activity around groupings of larger ports, popular coastal tourism destinations and clusters of marine energy development. These hubs are to be found in the Irish Sea, on the north coast of Spain and along the Portuguese coastline centred on Lisbon. A further regional hub is present around the Straits of Gibraltar centred on the Mediterranean side on the port of Algeciras. Although regionally important, and with their fortunes significantly shaped by their maritime location and environment, these hubs exhibit a mixed pattern of performance with their peripherality on the edge of Europe and varying quality of connections to centres of population thought to be important factors here.

More low key maritime influences are present along the remaining Atlantic coastlines of mainland Europe in western France, the northwest of the Iberian Peninsula and in the Canaries and their adjoining coastal waters. These areas are classified as Intermediate and show a more dispersed pattern of maritime use and influence focused around smaller ports and coastal tourist resorts. The

remaining part of the regional sea area has been classified as rural reflecting the increasingly low levels of human use and the transition to the wilderness areas of the deep ocean that lie to the north and west beyond European waters. Parts of the west coast of Ireland and Northern Ireland as well as the Azores are included here. These lie at the extremities of European terrestrial space and exhibit their own very particular territorial characteristics, again significantly influenced by the issue of peripherality.

"Cold Spots" of Land-Sea Interactions



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Thematic data: Typology Map.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Typology Map (coldspots)

Sea *(Enviromental Pressures and Flows)*

- Very low intensity
- Low intensity

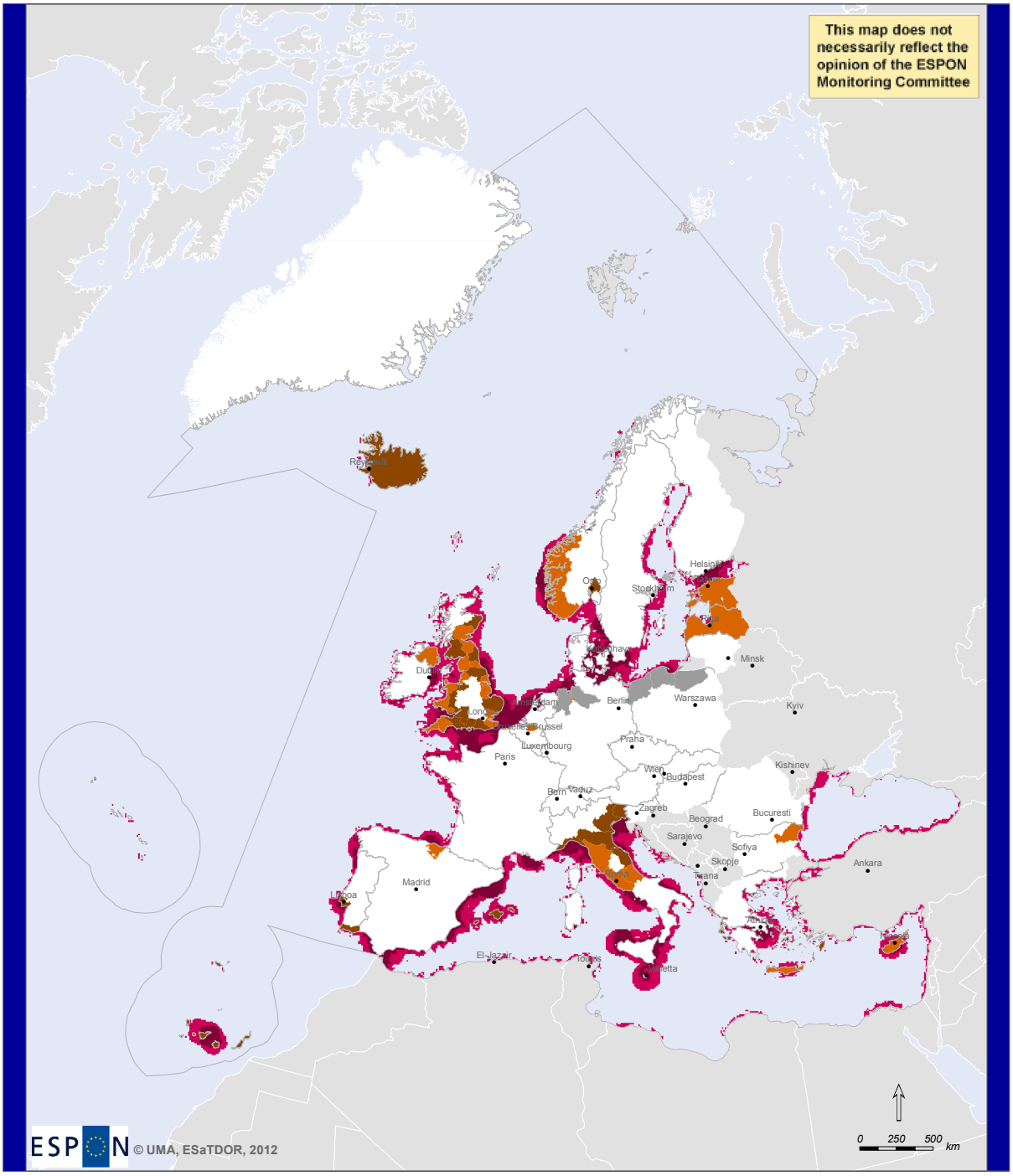
Land *(Economic Significance)*

- Very low intensity
- Low intensity
- No Data

This map shows where land-sea interactions are at their least intense in Europe's seas. The effect of the sea on the land is measured in terms of economic significance employment in maritime sectors) and the effects of anthropogenic activities on the sea are resented by environmental pressures (pollution from pesticides and fertilisers, incidence of invasive species introduced by shipping) and flows (of goods, including container traffic and liquid energetic products, people, from cruise ships and information, from telecommunications cables).

Map AT31a. "Cold spots" of land-sea interactions (low intensity)

"Hot Spots" of Land-Sea Interactions



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Thematic data: Typology Map.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Typology Map (hotspots)

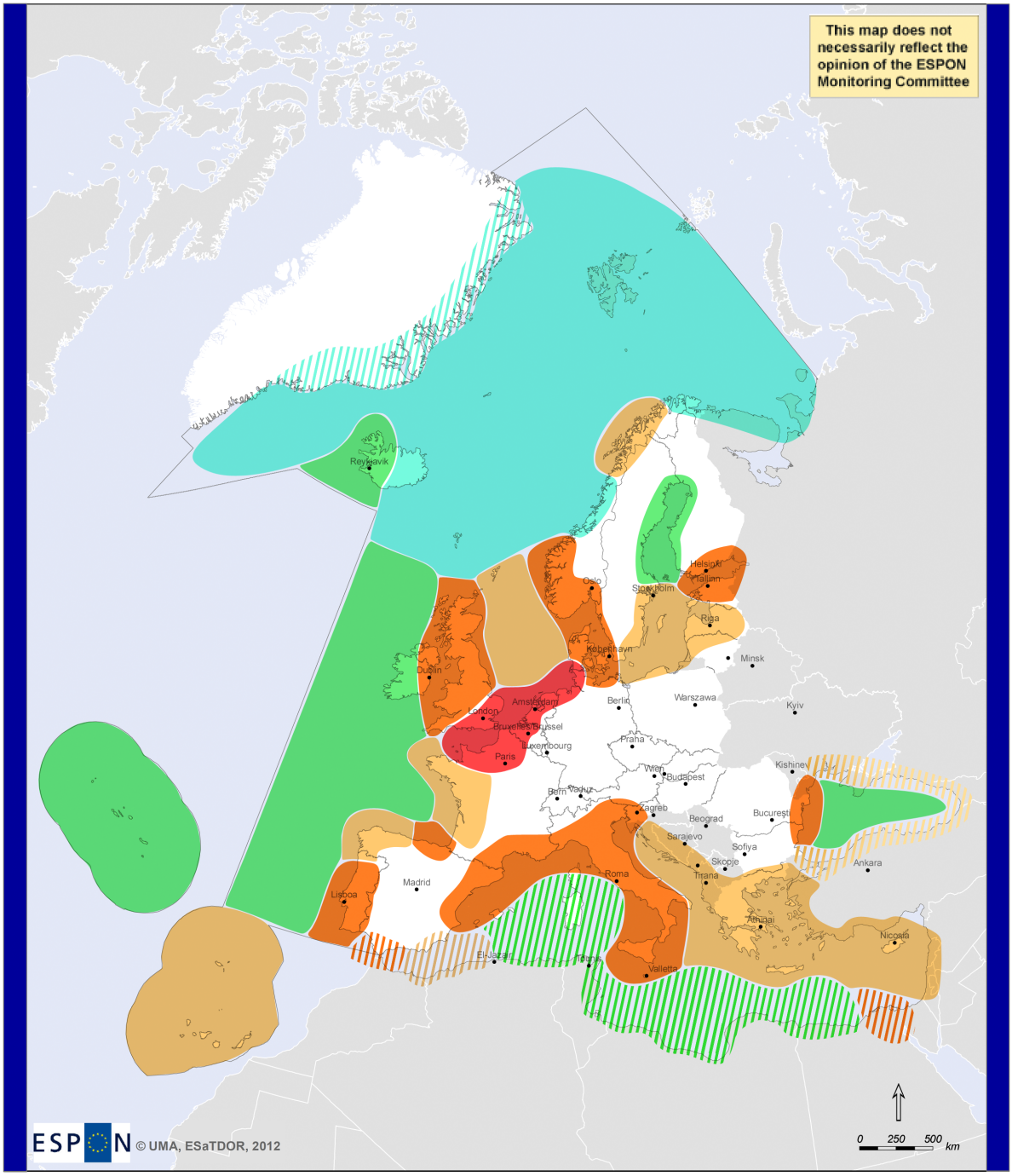
Sea *(Enviromental Pressures and Flows)*
- High intensity
- Very high intensity

Land *(Economic Significance)*
- High intensity
- Very high intensity
- No Data

This map shows where land-sea interactions are at their most intense in Europe's seas. The effect of the sea on the land is measured in terms of economic significance employment in maritime sectors) and the effects of anthropogenic activities on the sea are resented by environmental pressures (pollution from pesticides and fertilisers, incidence of invasive species introduced by shipping) and flows (of goods, including container traffic and liquid energetic products, people, from cruise ships and information, from telecommunications cables).

Map AT31b. "Hot spots" of land-sea interactions (high intensity)

Typology of European Maritime Regions



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Thematic data: Typology Map, Economic Significance and Environmental Pressures Composite Maps
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Regions derived from typology map

- European Core
- Regional Hub
- Transition
- Rural
- Wilderness
- Typology influenced by lack of data

This schematic typology map shows how Europe's coastal and maritime regions may be classified based on the intensity of land-sea interactions (economic activities, flows of goods, people and information and environmental pressures). These interactions are greatest in the European Core and at their lowest in the Wilderness.

Map AT32. Typology of European maritime regions (schematic map)

6. Key Territorial Development Opportunities and Risks

Three reports provide a very useful guide to future territorial development opportunities and risks for the Atlantic. These are the Third Interim Report on Blue Growth: Scenarios and Drivers for Sustainable Growth from the Oceans, Seas and Coasts (DG Mare, 2012a) and the associated summary report on the results of online consultation (DG Mare, 2012b), together with the EU report on developing a maritime strategy for the Atlantic Ocean Area (EC, 2011). Drawing upon these sources Table 6 provides a summary of the picture they present for each of the key themes of the ESaTDOR research project – Economic Use; Transport; Energy, Cables and Pipelines; and the Environment. Before providing a short explanation in each of these areas it is worth drawing out the central role that emerges for maritime research, education and training in terms of supporting efforts to respond to the opportunities and risks and providing better information to support decisions making in these areas. Developing maritime related research, education and training capacity and strengthening connections between universities, the public and private sectors is an important message in all the reports. Regional clustering of maritime industries with educational establishments as well as development of virtual clusters of industries and researchers in geographically separate locations is suggested as a key area for action.

Economic Use

Opportunities

Discerning tourism and *Nautical tourism and recreation* are both seen as areas offering moderate growth potential, building on the established strengths that exist throughout the Atlantic area. These are mature industries which have suffered in many locations in recent times as the range of European and wider international tourist destinations has grown. The Atlantic's rugged natural beauty, rich biodiversity, traditional seafood cuisine and Celtic culture are however assets that can be harnessed to attract new tourism activity but the emphasis needs to be on attracting all-year round trade in order to support quality jobs. Nautical activities are an important source of revenue and a creator of high-value jobs, however the Atlantic coast has a major deficit in berths especially for large recreational vessels and associated facilities at the present time.

Sustainable fisheries Fishing and associated industries have long been a central plank of local economies throughout the Atlantic region, but have been in decline in many areas due to unsustainable fishing practices and increasing levels of control. While significant growth in the traditional fishing sector is not envisaged, a key opportunity for the region is the development of a more sustainable fishing industry. Part of the response here could include expansion of *Aquaculture* as the Atlantic's clean coastal waters washed by strong tides provide an opportunity to meet demand for healthy, sustainably produced fish products including organic production.

Algae aquaculture is a related area that has also shown recent growth and its prospects for future growth are high, supplying products for the health and cosmetic sectors, food and animal feeds and energy. *Blue biotechnology:* Looking further ahead blue biotechnology is assessed to have a bright future. It involves the use of living organisms and bioprocesses from the sea, in engineering, technology and other fields requiring bioproducts. Blue biotechnology differs from algae aquaculture

as it uses these products for manufacturing. While still in the research and development phase, an early estimate of the global market for marine biotechnology products and processes is $2.4 bn with a wide range of applications predicted including new medical molecules, bio-plastics, enzymes and biocides. It is felt to offer particular potential for the outermost regions of the Atlantic notably Madeira and the Azores where the combination of unique maritime resources and research and business expertise offer the prospect of developing a new area of low weight and high value exports

Marine minerals mining The Atlantic seafloor near the Azores and Madeira contains various types of deposits (ferro-manganese, nickel, cobalt, copper, zinc). Economic mining of these deposits is still a major technical challenge, but with increasing global demand for raw materials there is great interest in research and innovation to promote sustainable access and exploitation of these potentially very valuable marine minerals.

Risks

All the opportunities described above are likely to result increasing competition for marine space with the prospect of advances in one area, reducing the scope of others. Equally they are likely to place increasing pressure on marine ecosystems and difficult balances will have to be struck between competing concerns. This is for example already evident in relation to fishing and wind farm development particularly when coupled with ambitions to establish a network of marine protected areas in the Irish Sea. Development of marine spatial planning, including transnational working where appropriate is seen as a key response to dealing with such conflicts. Equally multi-use approaches to MSP are encouraged. Potential synergies that have been suggested include: multi-purpose platforms for finfish aquaculture and offshore renewable energy; growing of macro-algae and links to coastal defence through its potential role in wave attenuation and erosion reduction; and the development of aquaculture together with marine biotechnology.

Table 6: Key Development Opportunities and Risks for the Atlantic

Theme	Opportunities		Risks
Economic Use	Mature Stage *Discerning tourism* *Nautical tourism and recreation* Sustainable fisheries Growth Stage Aquaculture Pre-development Stage *Blue biotechnology* Marine minerals mining	**Maritime research, education and training**	• Pressures on species expected to rise as offshore activities increase • Failure to develop long term, multi-species fisheries management plans. • Poor integration of fishing and other maritime development policies and action programmes. • Increasing competition for marine space and failure to adopt multi use approaches to MSP and to link MSP and ICZM and terrestrial planning activities.
Transport	Mature Stage *Short sea shipping* Low carbon shipping Growth Stage *Cruise tourism* Western Europe Motorway of the Sea as part of Europe's Trans European Network (TEN-T) **Maritime safety and security**		• Increasing pollution and risk of marine accidents and associated environmental damage. • Failure to improve landward transport connections to support marine transport growth and link MSP, ICZM and terrestrial planning activities
Energy cables and pipeline	Mature Stage Oil and gas Growth Stage **Offshore wind** Pre-development Stage **Ocean renewable energy- wave, tidal, currents and thermal gradient sources** Offshore energy grids		• Pressures on species expected to rise as offshore engineering activities increase. • Increasing competition for marine space and failure to adopt multi use approaches to MSP.
Environment	Mature Stage Coastal protection Emergency planning Pre-development Stage Ecosystem Approach to maritime management		• Pressures on species expected to rise as offshore and onshore engineering and activities increase. • Failure to adopt multi use and sustainable development approaches to MSP and to link MSP, ICZM and terrestrial planning activities.

Bold text indicates areas considered to offer particularly strong growth potential
Text in italics indicates areas considered to offer moderate growth potential

Transport

Opportunities

Short sea shipping: Short sea shipping is a mature industry which is part of the bedrock of the maritime economy of the Atlantic coast. In terms of gross weight of goods transported, approximately 14% of short sea shipping in European waters occurs in the Atlantic (Eurostat, 2010). Growth is anticipated in this sector supported by European efforts to promote lower carbon forms of transport. Developing the motorways of the sea in the Atlantic and supporting landward multimodal transport connections will be significant in realising potential in this area. Opportunities can also be envisaged in the short sea shipping value chain including shipbuilding, marine equipment, ship operators, handling services, port infrastructure provision and services, logistics and maritime infrastructure provisioning. Technological advances related to improving the energy efficiency of shipping are also key areas of potential for research and innovation.

Cruise Tourism: Globally cruise tourism is seen as a major growth sector and currently it is estimated that the Atlantic Ocean accounts for 13 % of European cruise passengers (Policy Research Corporation, 2009). In 2010 two of the top-10 European sea cruise ports (in terms of passengers embarking, disembarking or making a port call) were on the Atlantic coast (Southampton and Lisbon) (European Cruise Council, 2011). Opportunities for expansion relate to efforts by cruise operators to segment the market and offer an increasingly diverse range of destinations for all sorts of target groups. This presents opportunities for smaller ports on the Atlantic coast to increase their cruise trade or become cruise destinations for the first time. The quality of berthing facilities and the onshore offering for cruise passengers will be important factors in realising this potential.

Maritime safety and security is envisaged as a strong growth sector for the Atlantic as a significant proportion of all European seas trade passes through Atlantic waters. This sector includes maritime monitoring and surveillance which aims to improve the situational awareness of all activities at sea related to border control, the marine environment, fisheries control, trade and economic interests of the European Union as well as general law enforcement and defence. There is an important emergency planning and response dimension here with transnational cooperation related to this as well as other aspects of maritime safety and security increasingly seen as being critical. Research and innovation in associated technologies also offer development possibilities for the region.

Risks

In line with increasing shipping activity it can be envisaged that there may be an increase in chemical pollution due to oil spills, discharge of oil and ballast waters and pollution by anti-fouling agents. Other environmental impacts include potential increases in emissions of NOx, particulate matter and sulphide to the atmosphere and increased noise pollution. In addition there is increasing risk of marine accidents and associated environmental damage. From an economic perspective, failure to improve landward transport connections to support marine transport growth and link MSP, ICZM and terrestrial planning activities would constrain the ability of the Atlantic region to realise the development opportunities in this area. Both these issues highlight the importance of a holistic, transnational response to territorial development opportunities and risks.

Energy, Cables and Pipelines

Opportunities

Offshore oil and gas production and associated industries are a mature feature of the maritime economy in the northern part of the Atlantic, although much of the associated employment is located outside the region. Production is now in decline, but rising demand for fossil fuels globally is likely to maintain interest in finding new resources (including new types of fuel such as methane hydrates) and to change the economics of sources of supply in deeper, more remote ocean areas. Associated research and innovation and export of expertise to other parts of the world also offer new opportunities. As a result it is anticipated that some growth in this sector may occur.

Offshore wind: The Atlantic has stronger winds than the other seas and there are currently seven generating power wind farms in UK and Irish waters and many more are being investigated in all parts of the Atlantic region as part of efforts to move to low carbon energy resources and tackle issues of energy security. By 2020 it is estimated that 20% of Europe's offshore wind development will be located in the Atlantic offering growth possibilities in research and development, impact assessment, planning, design, manufacture, installation, operation, maintenance and decommission. To date employment associated with offshore wind has been most significant in Denmark and Germany, but there is scope for Atlantic areas to capture some of the growth potential this area offers.

Ocean renewable energy: Looking further ahead (i.e. more than 10 years) wave, tidal, currents and thermal gradient sources are also thought to offer strong growth potential in the Atlantic region. Tidal and current devices are seen as the next wave of renewable energy application with both large and small companies investing in associated technology. However all these areas are still in the early research and development phase, but it is important to note that European activity at present is very much focussed in the Atlantic with wave and tidal energy test sites in Scotland, Ireland, France, Spain and Portugal.

Offshore energy grids: Offshore wind and other forms of ocean renewable energy are increasingly being seen as resources that can usefully be combined and connected to macro regional energy grids. The development of a "Northern Seas offshore grid" linking the Atlantic and the North Sea and potentially parts of the Arctic as well is an example of the type of new energy infrastructure projects that could become more prominent in the future.

Risks

Although environmental standards in oil and gas production in the Atlantic are among the highest in the world, most operational installations are associated with air emissions and discharges to the sea as a result of oil and gas extraction as well as noise pollution. The risk of accidents also poses significant threats to the health of the marine environment. Offshore wind impacts include the noise effects on marine mammals and fish, disturbance and loss of habitats, bird collisions and visual intrusion. For other forms of ocean energy the main concerns at the moment relate to tidal energy where impacts can be expected on flora and fauna, as well as on changes in geomorphology and

processes, patterns and rates of sedimentation and erosion, transport and accretion. The construction phase of all offshore renewable energy developments are likley to be connected with short term peaks in impacts.

Offshore energy developments whether oil and gas or renewable are relatively fixed structures and their rapid development is presenting a very new pattern of human use of the sea which is potentially constraining and competing with both traditional activities such as fishing and new activities such as marine aquaculture. Mixed use development for example: OTEC combined with provision of air conditioning and condensing water; wave energy combined with coastal protection; and ocean renewable energy projects combined with the management of biological marine resources have been advocated as a response to this situation. Again this is something that emphasises the important role of MSP and ICZM.

Environment

Opportunities

Coastal protection: The Atlantic is the European sea with the third largest expenditure on coastal protection (after the North Sea and the Mediterranean) and although it is a mature activity it still offers the prospect of growth in coming years associated with a shift to more natural coastal defence technologies and also to climate change. In both areas European players are quite significant in leading global research and development. The coastal defence value chain includes monitoring, design, construction and maintenance as well as research and involves both central and local government agencies and research institutes as well as major engineering companies. As mentioned previously research and innovation potential includes interesting synergies and multi use approaches. There are already very good examples of links between coastal defence and tourism development, but new areas of opportunity include wave energy converters designed to attenuate wave attack as well as generate electricity and dredging linked with coastal aquaculture.

Emergency planning: The Atlantic along with the Arctic is one of Europe's wildest seas and its seaboard is particularly vulnerable to natural events such as storms, earthquakes, tsunamis and associated accidents such as oil spills. Climate change is anticipated to increase the risk of emergency events and further development of prevention and preparedness including technological advances in marine monitoring and forecasting is being called for. Potential therefore appears to exists for some employment growth in this area. This might be linked to technology and expertise with global as well as European application delivering interesting synergies, for example combining marine monitoring with a wide range of other marine activities.

Ecosystem Approach to maritime management: The document 'Developing a Maritime Strategy for the Atlantic Ocean Area' is interesting in highlighting that implementing the Ecosystem Approach in management of the Atlantic (through for example efforts to deliver the Marine Strategy Framework Directive) is likely to require additional efforts. This includes the development of local and national level MSP and ICZM activities and activities related to transnational cooperation in these areas and associated advances in data and monitoring as discussed above. These themes are reiterated in the report on consultation responses to the 2012 Blue Growth report. There is therefore a strong case

for job growth in this area in the Atlantic region and opportunities to develop expertise that may have wider application in other maritime contexts.

Risks

It is evident from the above discussion that there are many opportunities for territorial development in the Atlantic region that can draw upon its very distinct maritime context. However it is also evident that if these opportunities are taken up, human use of the European Atlantic Ocean and its seaboard will intensify. Already particular localities such as the Irish Sea and the Channel are experiencing a concentration of adverse environmental impacts, while certain aspects of the marine environment such as fisheries are significantly impacted by human pressure more widely. It therefore appears logical that if these territorial development opportunities are realised without due regard to environmental concerns, the health of the European Atlantic will suffer. Weak application of the Ecosystem Approach in MSP, weak links between MSP, ICZM and terrestrial planning and weak integration at transnational level on these matters present serious risks to the Atlantic maritime environment. Lack of popular understanding and political support, together with the current financial crises may favour short term economic gains over longer term environmental sustainability considerations. This could mean that limited funds are available to support growth in the environmental management sector which has traditionally been underpinned by the public sector. Funding problems may be particularly acute for initiatives that promote transnational cooperation and secure wide stakeholder involvement if there is a lack of leadership in promoting action of this nature.

7. Initial Policy Recommendations

The Atlantic maritime region marks the western boundary of Europe and is both extensive and an area of great contrasts. It includes: part of the European Core maritime area around the Channel; significant regional hubs in the Irish Sea, on the north coast of Spain, along the Portuguese coastline and around the Straits of Gibraltar; areas of more low key maritime activity focused around smaller ports and tourist resorts along the remaining Atlantic coastlines of mainland Europe in western France and the north west of the Iberian Peninsula and in the Canaries; and rural areas experiencing increasingly low levels of human use - these are mainly sea but also include parts of the west coast of Ireland and Northern Ireland as well as the Azores. Apart from the European core area which denotes the economic heartland and urban conurbations focused within the London, Paris, Amsterdam axis much of the rest of the area is characterised by its peripherality and here territorial development opportunities and risks seem particularly closely bound up with the maritime character of localities and the particular pattern of land sea interactions that has emerged over time.

In looking to the future it is recommended that:

1. Efforts should be made to strengthen the maritime focus of terrestrial planning and management activities in the Atlantic region and equally to strengthen consideration of landward interests and interactions in marine planning and management. The potential of MSP and ICZM as key mechanisms that can assist in this process should be nurtured and supported.
2. Creative, multi-use and multi-purpose perspectives should be encouraged in responding to the maritime opportunities and risks set out above to realise the potentially beneficial synergies that have been highlighted.
3. An Atlantic network of maritime clusters reflecting maritime opportunities and risks should be developed. This should strengthen connections between research and training institutions, public and private sector interests and other stakeholders both locally and across the Atlantic region.

4. The existing governance framework related to transnational approaches to maritime planning and management should be supported and developed to encourage an integrated approach to territorial development in the Atlantic. The EU's macro regional strategy for the Atlantic seems to have a key role to play here.

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