ESPON

EUROPEAN OBSERVATION NETWORK
TERRITORIAL DEVELOPMENT AND COHESION

ESaTDOR
European Seas and Territorial Development, Opportunities and Risks

ANNEX 4 to the Scientific Report:
Baltic Sea Regional Profile

Applied Research 2013/1/5

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Regional Sea Profile: the Baltic 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 Baltic Sea.

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

The Baltic Sea is an epicontinental and enclosed sea bordered by Denmark, Sweden, Finland, Russia, Estonia, Latvia, Lithuania, Poland and Germany. The definition of an overall sea boundary is therefore limited to the transition region between Baltic Sea and North Sea. Different existing definitions can be found while most of them are closely link to specific views or purposes. The International Hydrographic Organization (IHO, 1953) has defined the limits of the Baltic Sea in this transition area as follows:

In the Little Belt: A line joining Falshöft (54°47'N 9°57.5'E / 54.783°N 9.9583°E / 54.783; 9.9583) and Vejsnæs Nakke (Ærø: 54°49'N 10°26'E / 54.817°N 10.433°E / 54.817; 10.433).

In the Great Belt: A line joining Gulstav (South extreme of Langeland Island) and Kappel Kirke (54°46'N 11°01'E / 54.767°N 11.017°E / 54.767; 11.017) on Island of Laaland.

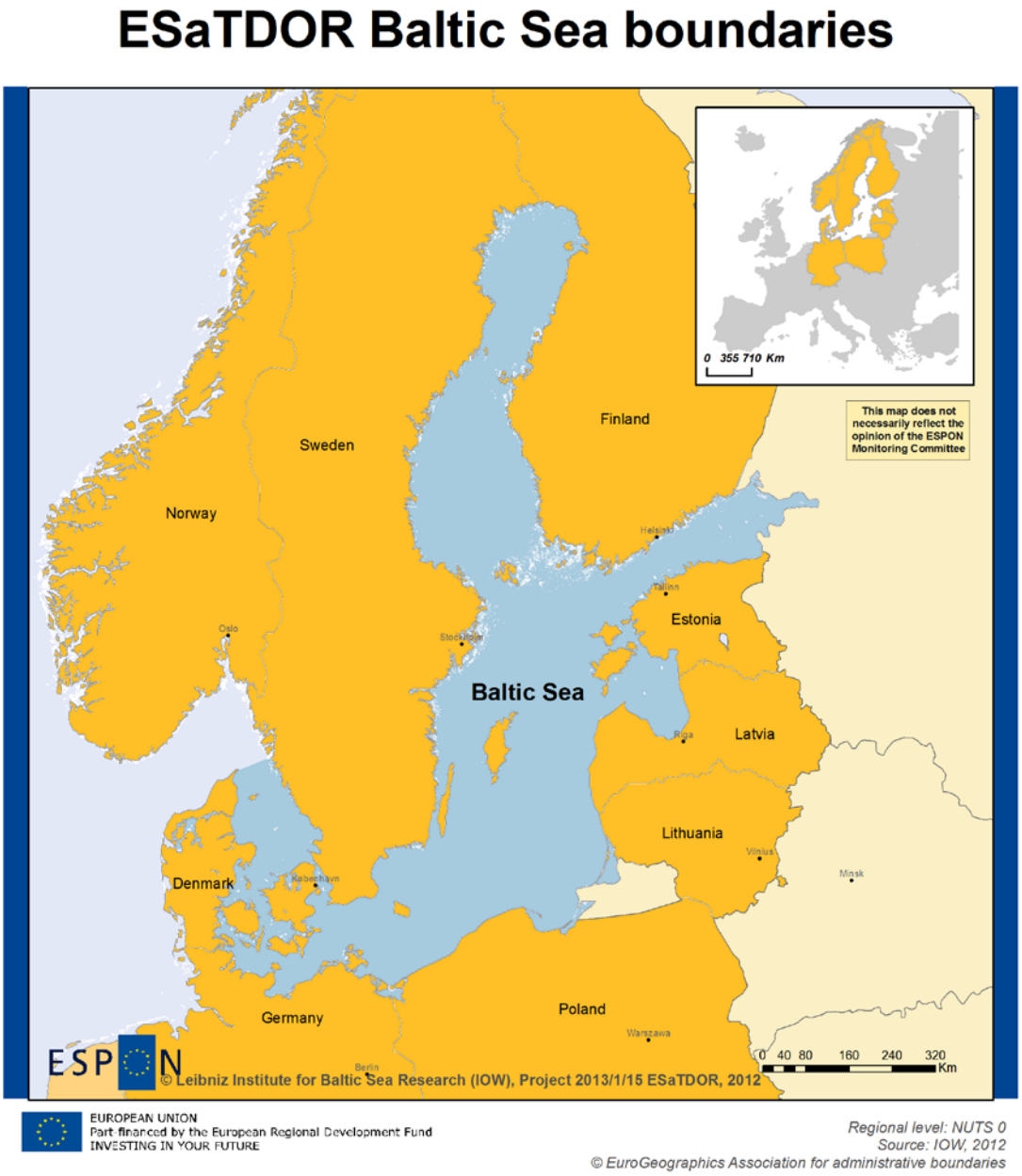
In Guldborg Sound: A line joining Flinthorne-Rev and Skjelby (54°38'N 11°53'E / 54.633°N 11.883°E / 54.633; 11.883).

In the Sound: A line joining Stevns Lighthouse (55°17'N 12°27'E / 55.283°N 12.45°E / 55.283; 12.45) and Falsterbo Point (55°23'N 12°49'E / 55.383°N 12.817°E / 55.383; 12.817).

This differs from the definition provided by the Integrated Maritime Policy (IMP) of the European Commission (EC), where the border of the Baltic Sea basin is usually drawn on the border to the Kattegat basin. This means a line between Ebeltoft and Sjællands Odde (both Denmark) plus a line between Stevns Peninsula (Denmark) and Falsterbo (Sweden).

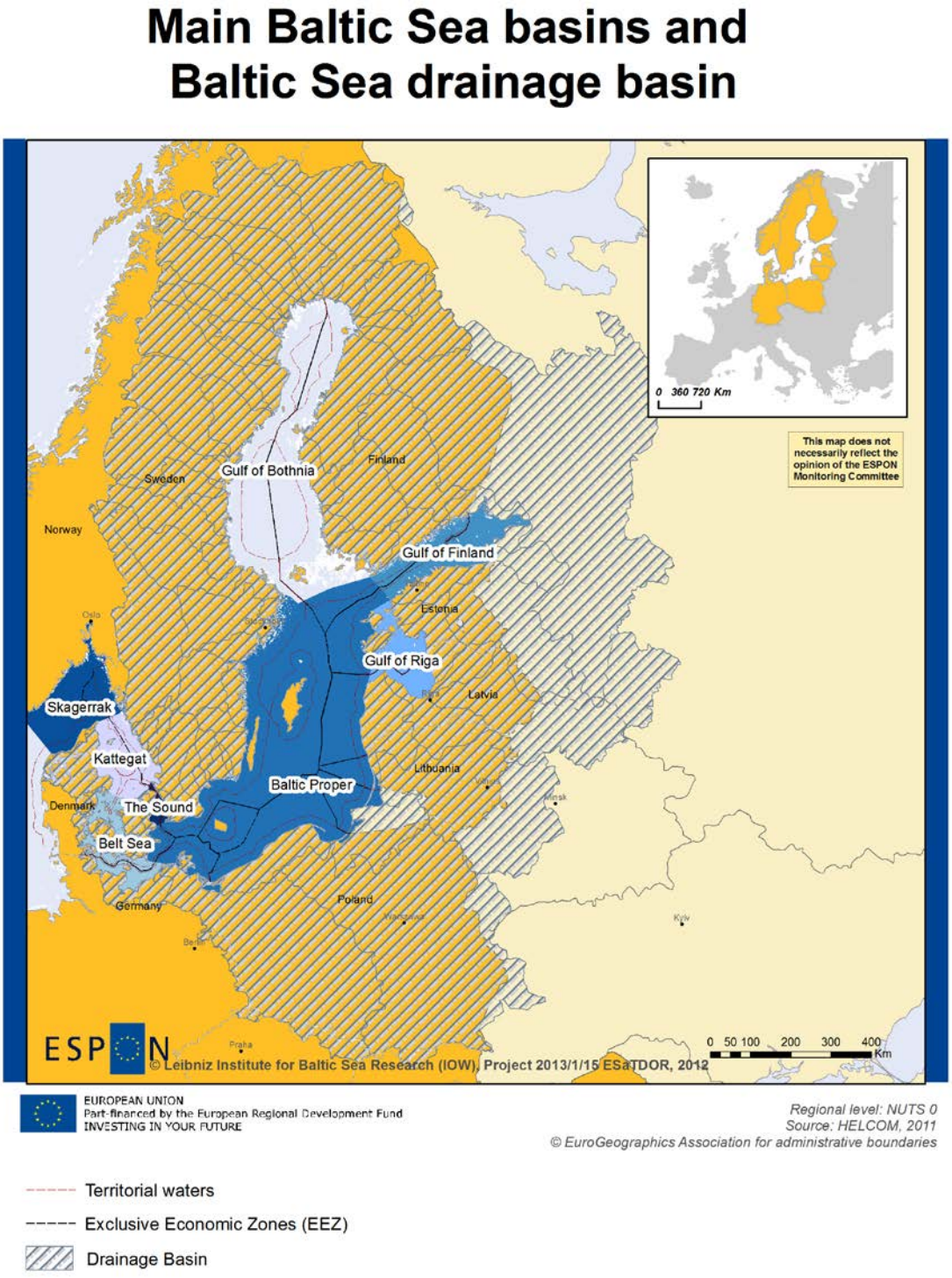
The Baltic Marine Environment Protection Commission (HELCOM) again uses another broader definition. In the Helsinki Convention the Baltic Sea area is defined as "the Baltic Sea and the entrance to the Baltic Sea bounded by the parallel of the Skaw in the Skagerrak at 57 44.43'N" (HELCOM, 2008). However, HELCOM handles this definition rather flexibly. On most HELCOM maps at least Kattegat is included in the Baltic Sea. On some maps also Skagerrak is part of the Baltic Sea. The later corresponds with the definition of the Baltic Sea Region as it used by the European Regional Development Fund (ERDF).

For the purposes of this ESPON project we included the Kattegat in the Baltic Sea because of its direct links to water catchments in Denmark and Sweden and due to its economic relevance for the Baltic Sea Region. The ESaTDOR boundary of the Baltic Sea (Map BA1) is therefore defined as a line joining The Skaw (Denmark) and Paternoster Skær (57°54'N 11°27'E) and thence northeastward through the shoals to Tjörn Island (Sweden). This is in accordance with the Baltic Sea drainage border as it was defined by the Baltic Drainage Basin Project (BDBP), a multi-disciplinary research project under the EU 1991-1994 Environment Research Programme. This definition is a pragmatic one considering numerous marine and maritime aspects and it is close to the definitions of HELCOM, ERDF and BDBP. More narrow approaches may lead to other definitions. The IHO definition, for example, corresponds to a stricter biochemical perspective where Kattegat might be considered as part of the North Sea (cf. OSPAR Convention Area) or as transitional waters.



Map BA1. Boundaries of the Baltic Sea defined for the ESaTDOR project.

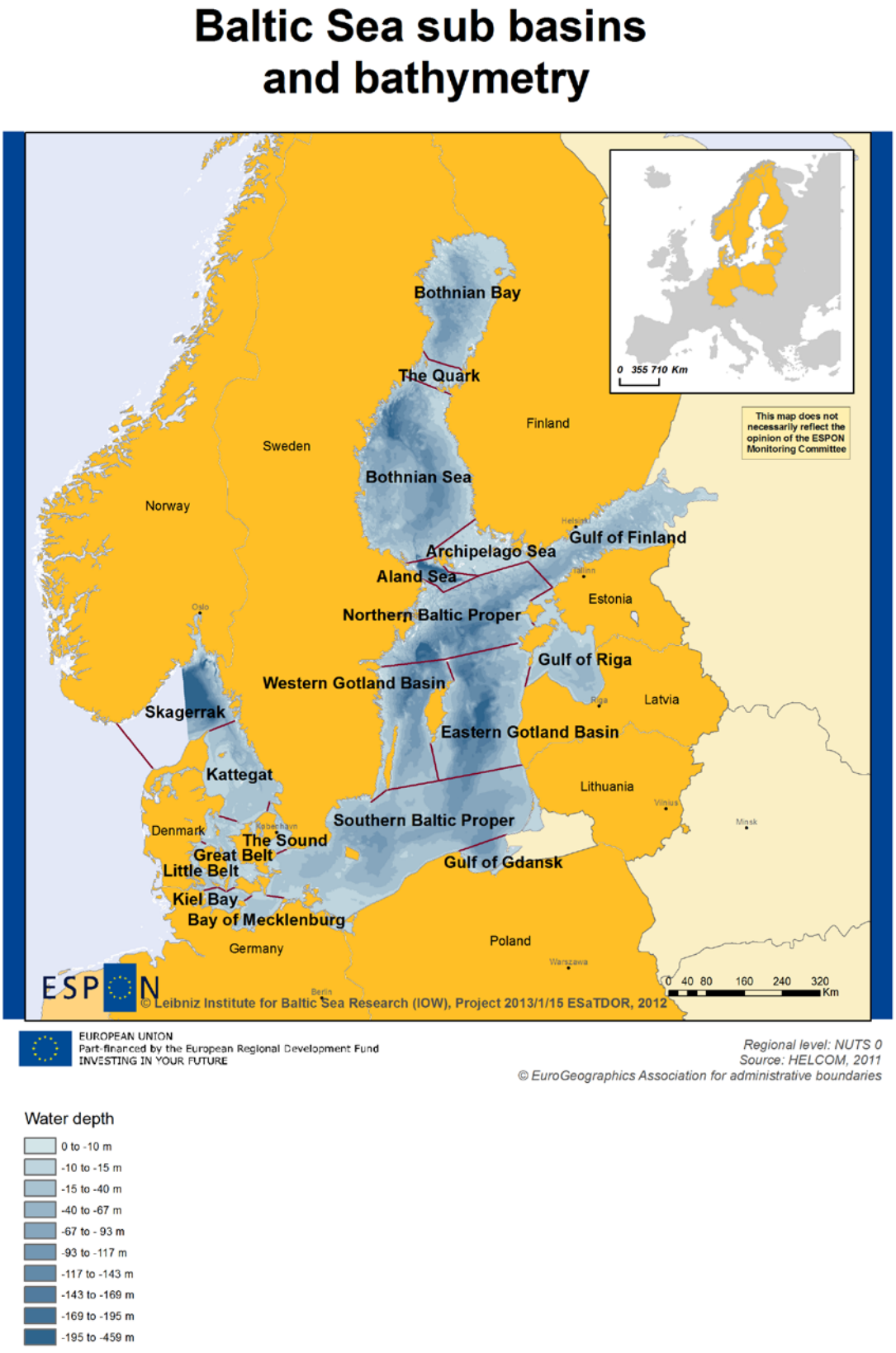
The Baltic Sea catchment area (Map BA2a) is home to more than 85 million people within 14 states. With a size of about 1.7 million km^2 the catchment area is about four times as large as the sea itself. The large catchment together with low water exchange rates of the sea (retention times of > 30 years) makes the Baltic Sea highly vulnerable to a variety of human activities. Being situated within a transitional climate region between the Atlantic marine and Eurasian continental systems, land use patterns in the catchment differ from north to south. Between 60-70% of the Baltic's catchment area is farmland, mainly in Denmark, Germany, and Poland. In Estonia, Finland, Russia, and Sweden the catchment is dominated by forests, wetlands and lakes.



Map BA2a. Main Baltic Sea basins and Baltic Sea catchment area

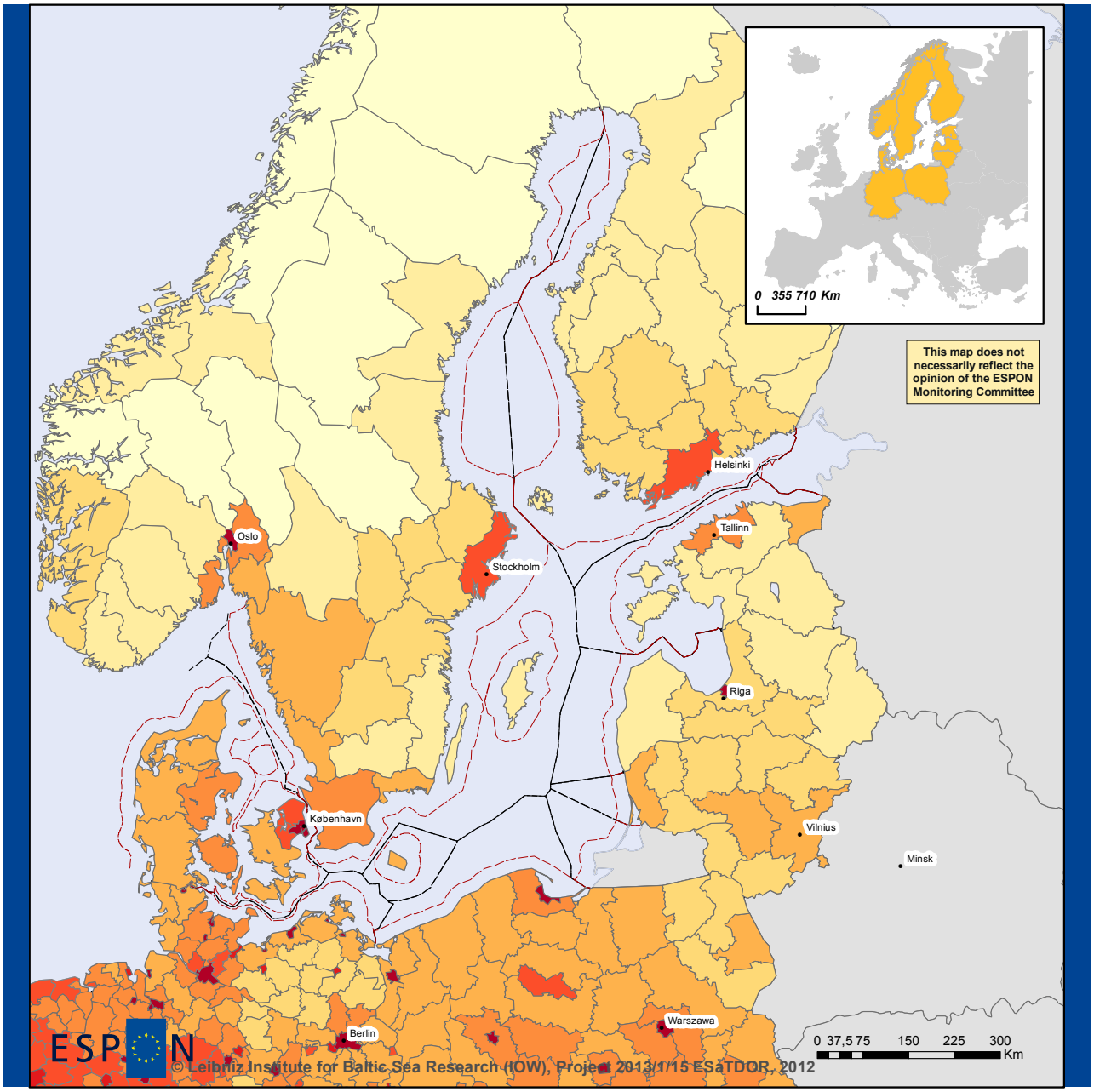
The Baltic Sea is a non-tidal, relatively shallow ecosystem (mean and maximum depth 50 and 459 m, respectively) that was formed after the last glaciation (~10,000-15,000 ybp). It is the only inland sea wholly in Europe and is one of the largest brackish-water basins in the world (Map BA2b). Temperature and salinity markedly decrease along a SW to NE gradient with the latter determined by both 1) the amounts and frequencies of saline, oxygen-rich inflows from the North Sea through the Danish Straits and 2) riverine freshwater inflows influenced by precipitation. This brackish

ecosystem is inhabited by relatively few species compared to other European seas; many of them live on the brink of their possibilities (ed. Rheinheimer, 1995).



Map BA2b. Baltic Sea bathymetry and sub-basins

Population density in Baltic Sea countries (2009)



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Regional level: NUTS 3
Source: Eurostat, 2011
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Population Density (inhabitants per km²)

- 1.0 - 10.0
- 10.1 - 25.0
- 25.1 - 50.0
- 50.1 - 100.0
- 100.1 - 200.0
- 200.1 - 500.0
- 500.1 - 1000.0
- 1000.1 - 4250.0

– – – – – Territorial waters

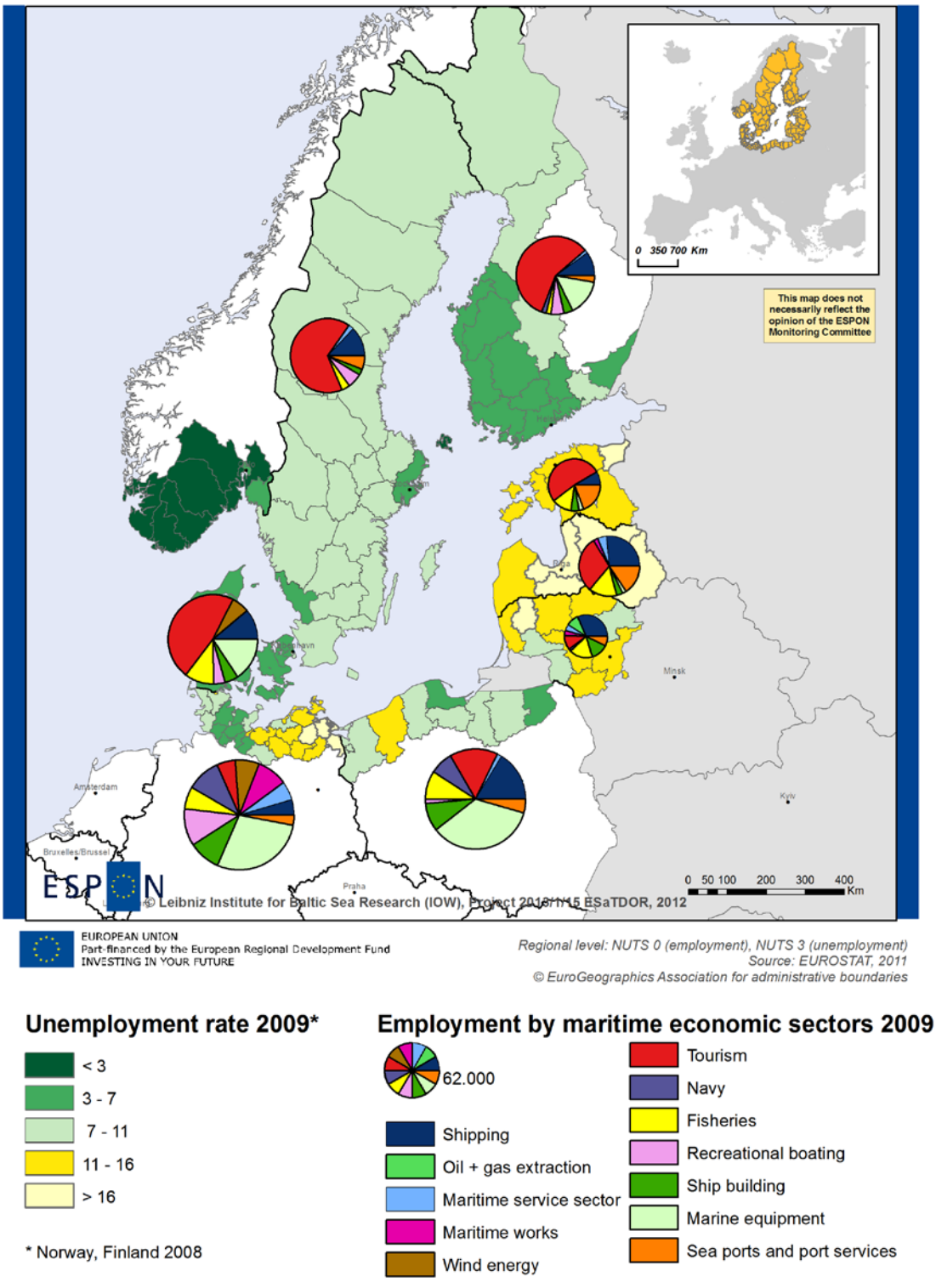
– – – – – Exclusive Economic Zones (EEZ)

Map BA3. Population density in Baltic Sea countries, 2009.

Population densities vary from more than 1000 inhabitants/km² in southern urban areas to less than 10 inhabitants/km² in northern parts of Finland and Sweden (Map BA3). About 26% of the 85 million people in the Baltic catchment area live in metropolitan areas, 45% in smaller urban areas, and 29% in rural areas. Only about eight million inhabitants live in the northern half of the Baltic Sea Region while population densities in the southern part are comparable to European average. Almost 15 million people live within 10 kilometres of the coast (HELCOM, 2012). In northern parts of the Baltic Sea Region, coastal regions show higher population densities than the hinterland while in southern parts the opposite is the case.

The Baltic Sea Region is characterised by a number of gradients. Land use varies from tundra and boreal forests in the northern part of the region, changing to agricultural land and urban and built-up areas in the south (VASAB, 2009; HELCOM, 2010a). The ice cover on the Baltic Sea during normal winters occupies up to 50% of the sea area in the northeastern part of the Baltic Sea with impacts on costs and risks for shipping. The southern part of the Baltic Sea is hampered by ice only in infrequent severe winters, and even then is usually not as thick as in the northern part. Another gradient is the composition of seabed sediments which changes from mostly sandy and muddy sediments in the south-western part over hard clay and mud in the central Baltic to increasing hard bottom complexes in the northern part. Together with other conditions (e.g. salinity, see above) this has impacts on the location of habitats, on species types and biodiversity as well as on productivity and services of the Baltic Sea.

While some of these gradients are caused by natural conditions (soil, climate) others relate to the fragmentation of the Baltic Sea Region into separate blocks during the cold war. However, after the fall of the Berlin Wall in 1989 new strong ties emerged causing a number of emerging markets. Nowadays the eight EU member states produce 29.3% of the EU gross domestic product (GDP), indicating their economic importance to Europe (Stiller & Wedemeier, 2011). In contrast the economy in eastern non-EU threshold countries is mainly dependent on natural resources. Economic integration between old and new member states of the EU as well as between EU and non-EU countries is ongoing. The internal economic relations of the Baltic Sea Region are currently developing more strongly than economic relations to external regions (VASAB, 2009). Unemployment rates in coastal regions of Nordic Countries are below 11% (2008/09) while they reach values above 16% in parts of the Baltic States and northeastern Germany (Map BA5i). Since 1999, the number of jobs in Baltic Sea Region countries has risen by 6.1%, with only Lithuania and Russia showing negative values (Stiller & Wedemeier, 2011). In general, traditional economic sectors like shipbuilding are in decline. But classic maritime technologies still play an important role, especially maritime services. Nevertheless, tourism is in many Baltic Sea countries one of the largest coastal employers.



Map BA4. Unemployment in Baltic coastal areas and employment by maritime sectors (national level)

3. Thematic Sections

The Maritime Economy

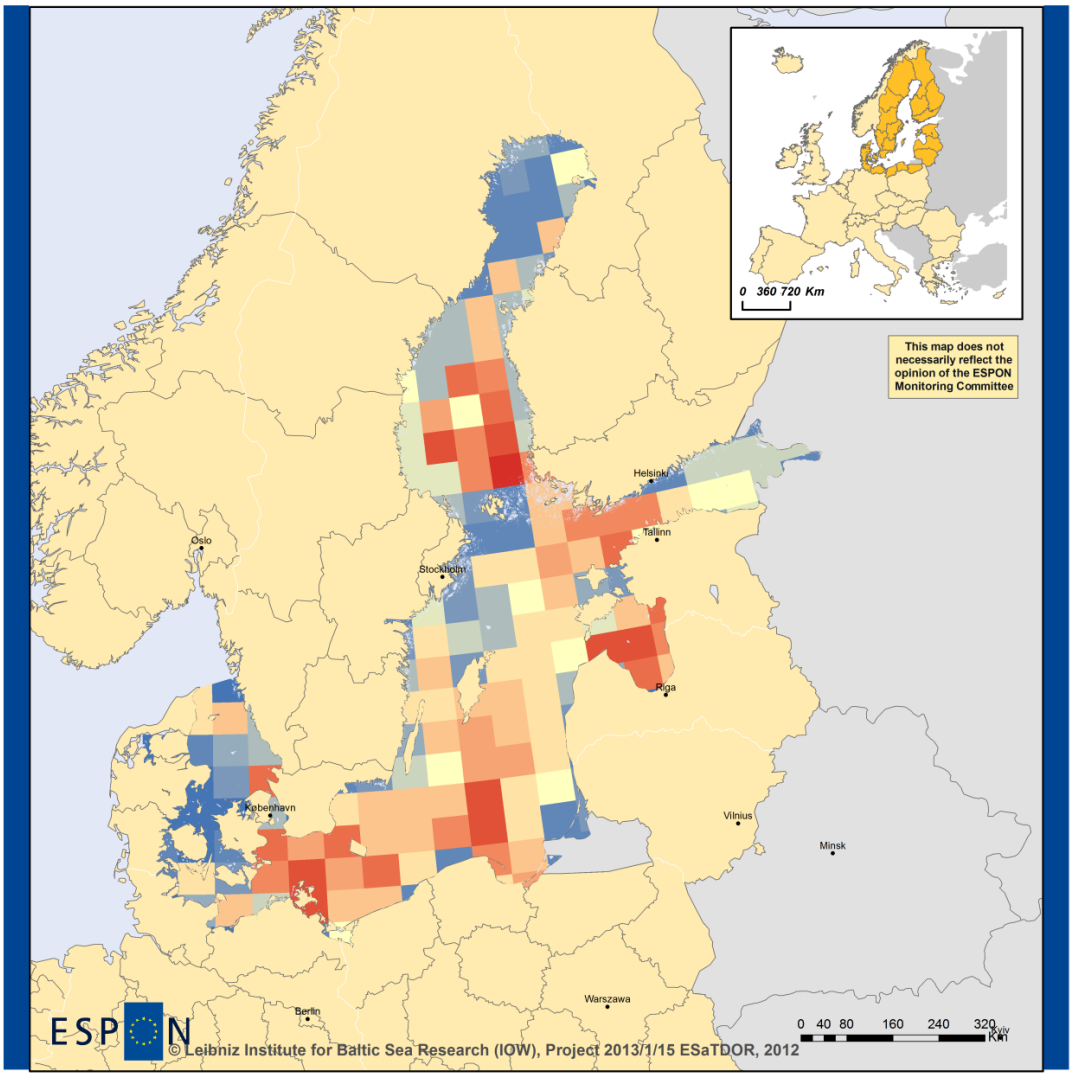
Entering or leaving the Baltic Sea 93,057 ships passed the two entrances Skaw and Kiel Canal in 2009 (HELCOM, 2010b; Kiel-Canal, 2012). The Baltic Sea is dominated by short sea shipping. More than 80 % of the about 500 million tons traded between Baltic Sea states is transported by ship. The total amount of cargo handled in ports around the Baltic Sea is about 820 million tons. However, the majority of ships on the Baltic Sea are not cargo ships. Estimations assume that more than 1.6 million leisure boats of all sizes are used (HELCOM, 2010b). Numerous wharfs and ship yards are specialised on different kinds of motorboats and sailings yachts. While boating as a strong tradition mainly in Nordic countries, coastal tourism is a major economic sector especially in south-western parts of the Baltic Sea Region. Especially Danish, German and Polish coastal areas benefit from tourism which became in some areas the most important economic sector. In contrast fishery is in decline in most countries. Commercial offshore fishery on cod, herring, sprat, and salmon is of importance mainly in the southern and central Baltic. Sprat and herring landings became dominant since the early 1990s. The largest fishing fleets are located in Denmark and Poland. However, data indicates that both the location of fishing fleets as well as the distribution of fish processing industries might not always relate with fishing grounds as modern logistics causes spatial decoupling.

As in other European seas the production and transportation of energy comes more and more into focus. Oil tankers heading mainly from Russia towards the North Sea have a share of about 20% of those ships registered by AIS (Automatic Identification System), carrying about 166 million tons of oil. Two oil platforms in Russian and Polish waters produce oil. Gas pipelines from Russia to Germany as well as various cables deliver the infrastructure to transport energy. In the light of the European “20-20-20” climate and energy targets and of partly even more ambitious national renewable energy strategies the construction of offshore wind farms is currently intensively discussed. Here the spatial focus is on southern and western parts of the Baltic Sea due to water depth, windiness, space availability and other limitations more.

The Baltic Sea shows strong gradients in the distribution of anthropogenic activities which are caused by various factors such as climate (e.g. temporally ice coverage), salinity, population density or land based infrastructure (e.g. BPS oil pipeline Nowokujbyschewsk (Samara region) - Ust-Luga (St. Petersburg)).

Fishery in the Baltic is of economic importance mainly for the Baltic States and Poland (EC 2006a, cf. Maps BA5, BA6a, BA6b). It plays also a significant role in Denmark and Germany. However, statistical data allows no clear breakdown between fisheries in the North Sea and the Baltic Sea for both countries. In the Baltic region around 30 % of the people who work in the fisheries sector are fishing vessel crew, while 62 % work in the processing industry and around 6 % in aquaculture. Some 70 % of all people working in the fisheries sector can be found in the coastal regions of Latvia (EC 2006b).

Total commercial fishery in the Baltic Sea in 2008



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Regional level: NUTS 0
Source: HELCOM, 2011
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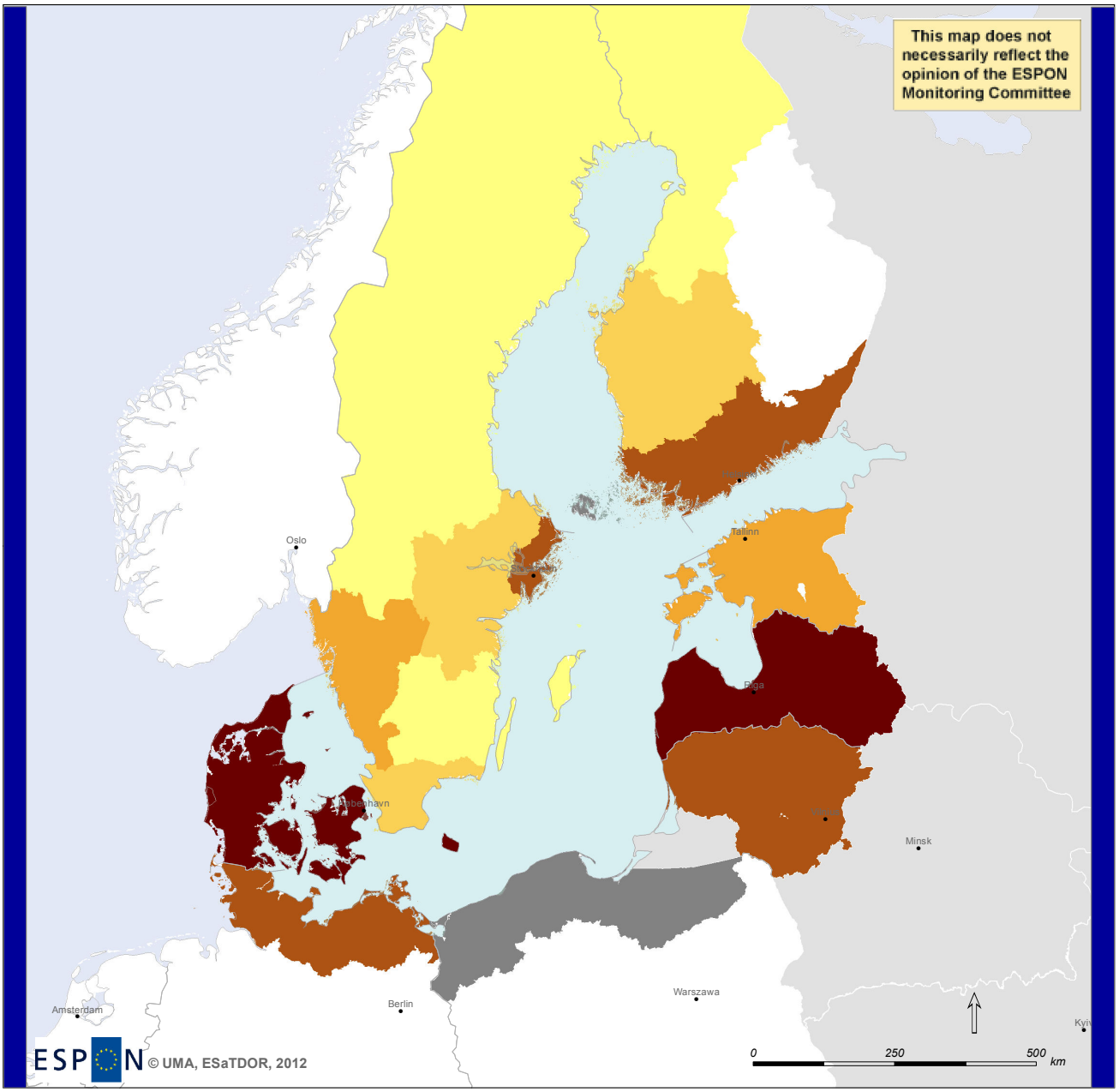
Catches per ICES rectangle (to)

0 — 250 — 2000 — 18000

Map BA5. Total commercial fish catch in the Baltic Sea, 2008.

Employment in Fisheries (total number), 2009



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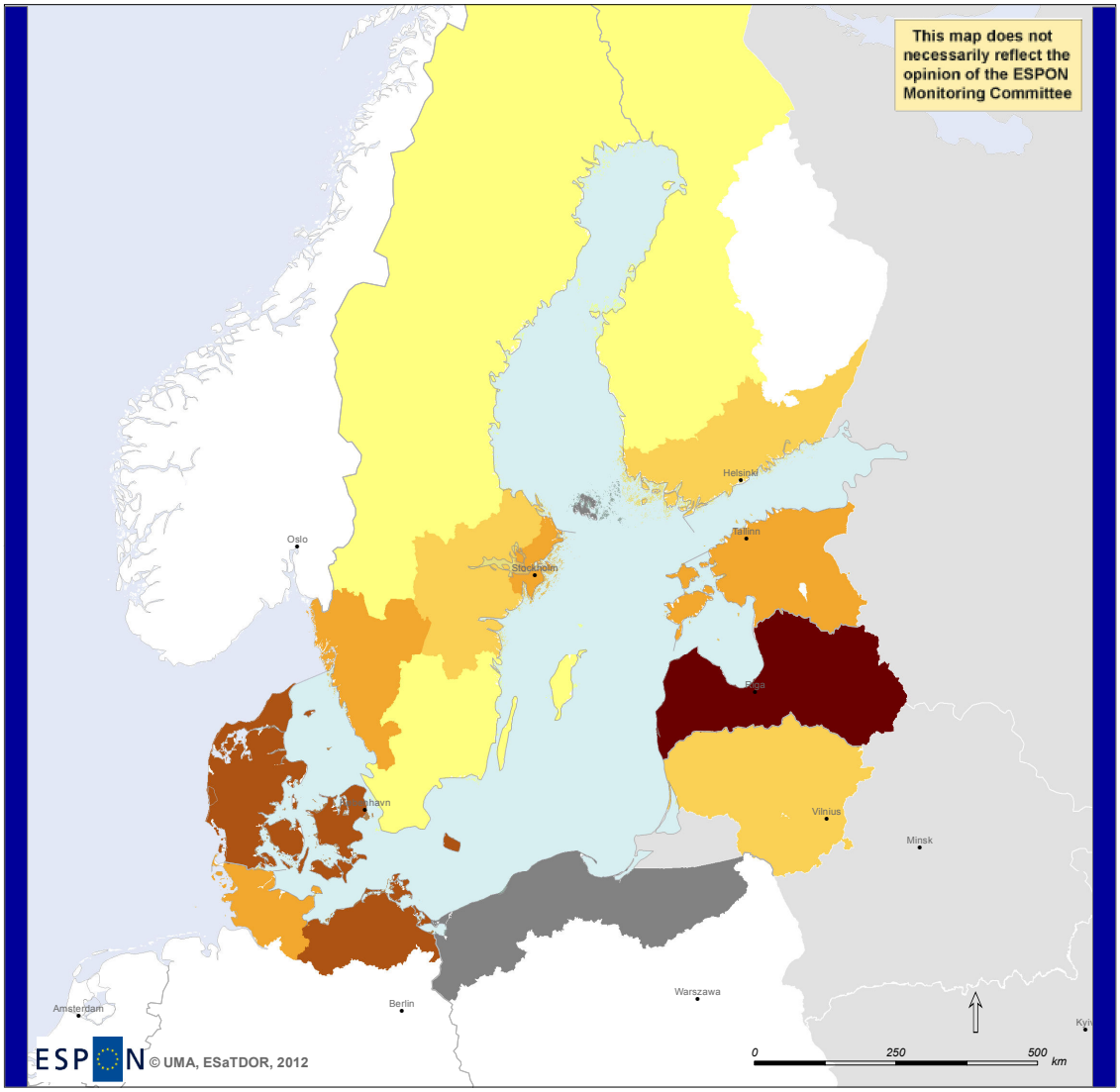
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Fisheries 2009 (number of employees).

- 332 to 2,420
- 2,421 to 4,093
- 4,094 to 7,046
- 7,047 to 11,524
- 11,524 to 45,302
- No data

Map BA6a. Employment in the fisheries sector in 2009 (number of employees), Baltic Sea.

Employment in Fisheries (% of total employment), 2009



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Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

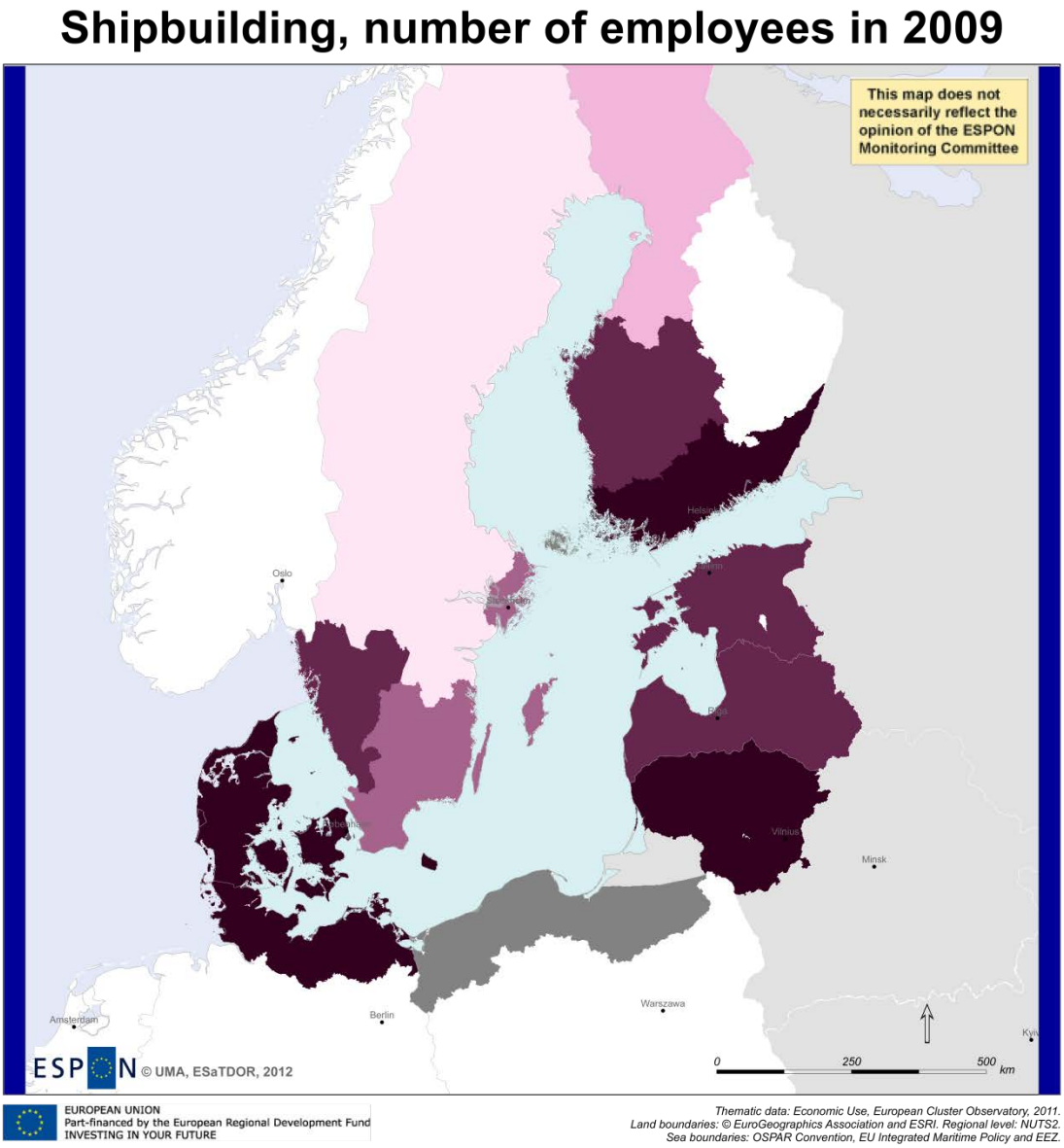
Fisheries 2009 (percentage of total employment).

- 0.22 to 0.52
- 0.53 to 0.67
- 0.68 to 0.90
- 0.91 to 1.19
- 1.20 to 8.27
- No data

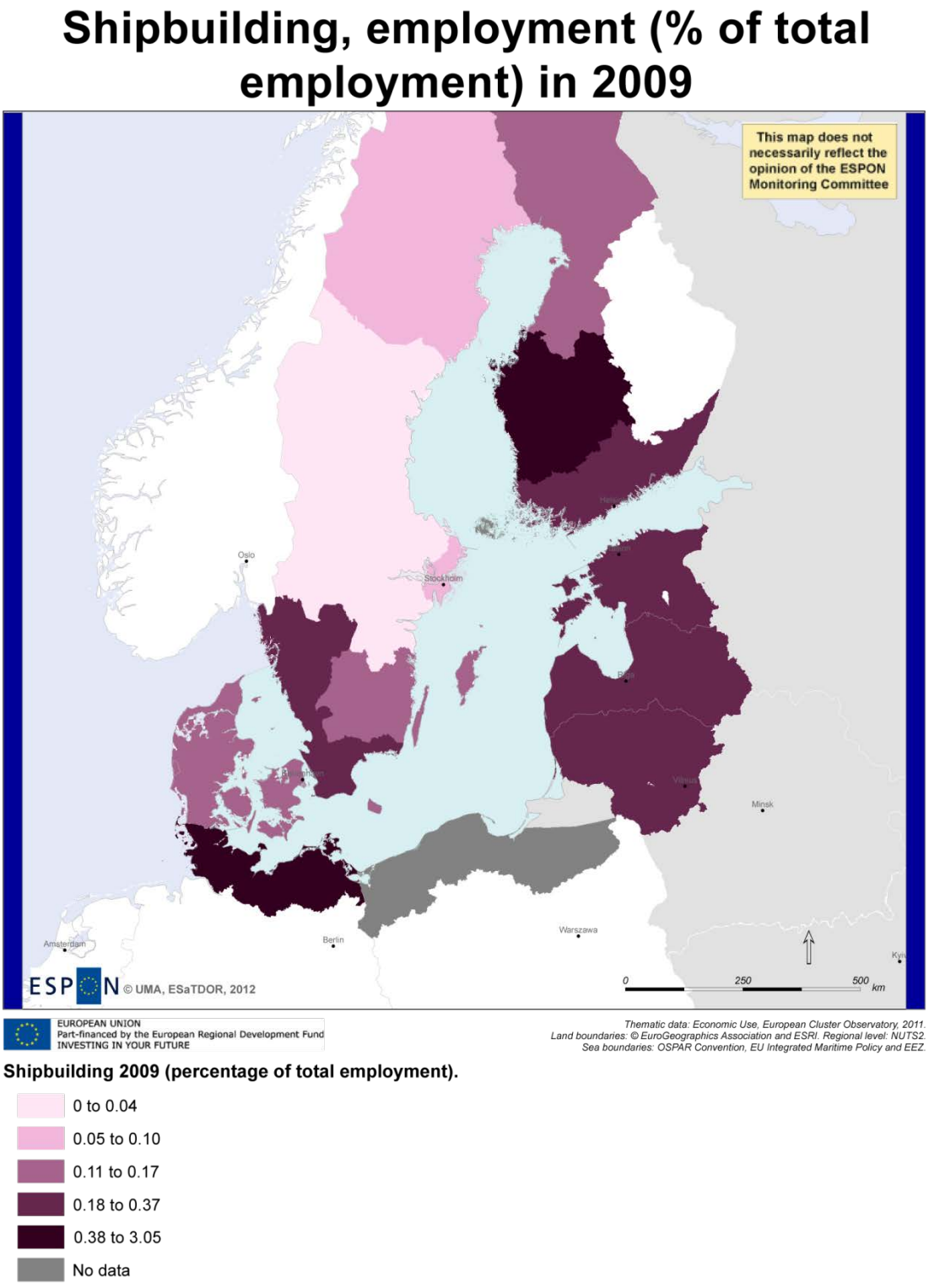
Map BA6b: Employment in fisheries (% of total employment) in 2009.

Despite strong transformation processes over the last 25 years the Baltic Sea Region is still home to numerous shipyards. Finish regions are specialised in steamships, car ferries and icebreakers. Polish shipyards build roll-on roll-off carriers and ship hulls. Some German regions build container vessels, submarines, and ferries (EC 2012). Some yards try to specialise in new business areas such as elements for offshore wind farms or construction and maintenance ships for wind farms.

Several wharfs for sailing and luxury yachts are spread around the Baltic Sea. With about 8,000 jobs shipbuilding is especially important for Poland. In Finland in comparison shipbuilding employs 3,800 people (CESA 2010, cf. Maps BA7a, BA7b). In all cases the economic transformation pressure on the shipbuilding sector stays high and the employment might further decrease in the next decade.



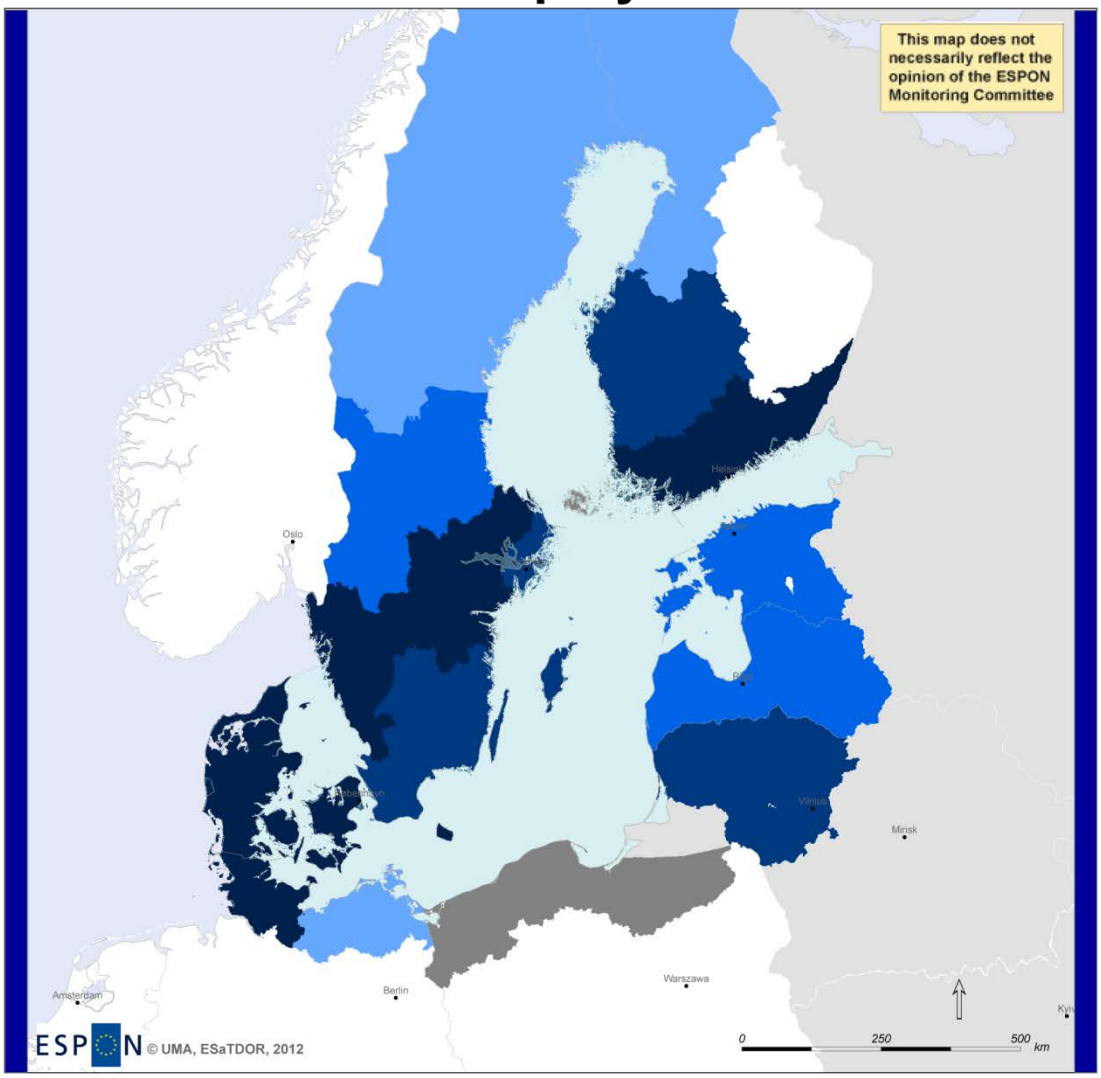
Map 7a. Number of employees in the shipbuilding sector in 2009 (please note: the maximum number of 25,113 employees as listed in the legend does not occur in the Baltic Sea Region but in South-East Romania)



Map 7b. Employment in the shipbuilding sector (% of total employment) in 2009

Statistics for other traditional maritime sectors (e.g. marine equipment, maritime services, maritime works) are patchy and fragmented. This is mainly caused by national differences in definitions. Regarding employment (Maps BA8a, BA8b) these sectors play a strong role, especially in Denmark. Again, it is unclear from the statistics whether the related activities origin from the Baltic Sea or from the North Sea. The patchy nature of the employment data makes it is difficult to determine exact trends or background information for these sectors.

Other traditional maritime sectors, number of employees in 2009



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Thematic data: Economic Use, European Cluster Observatory, 2011.
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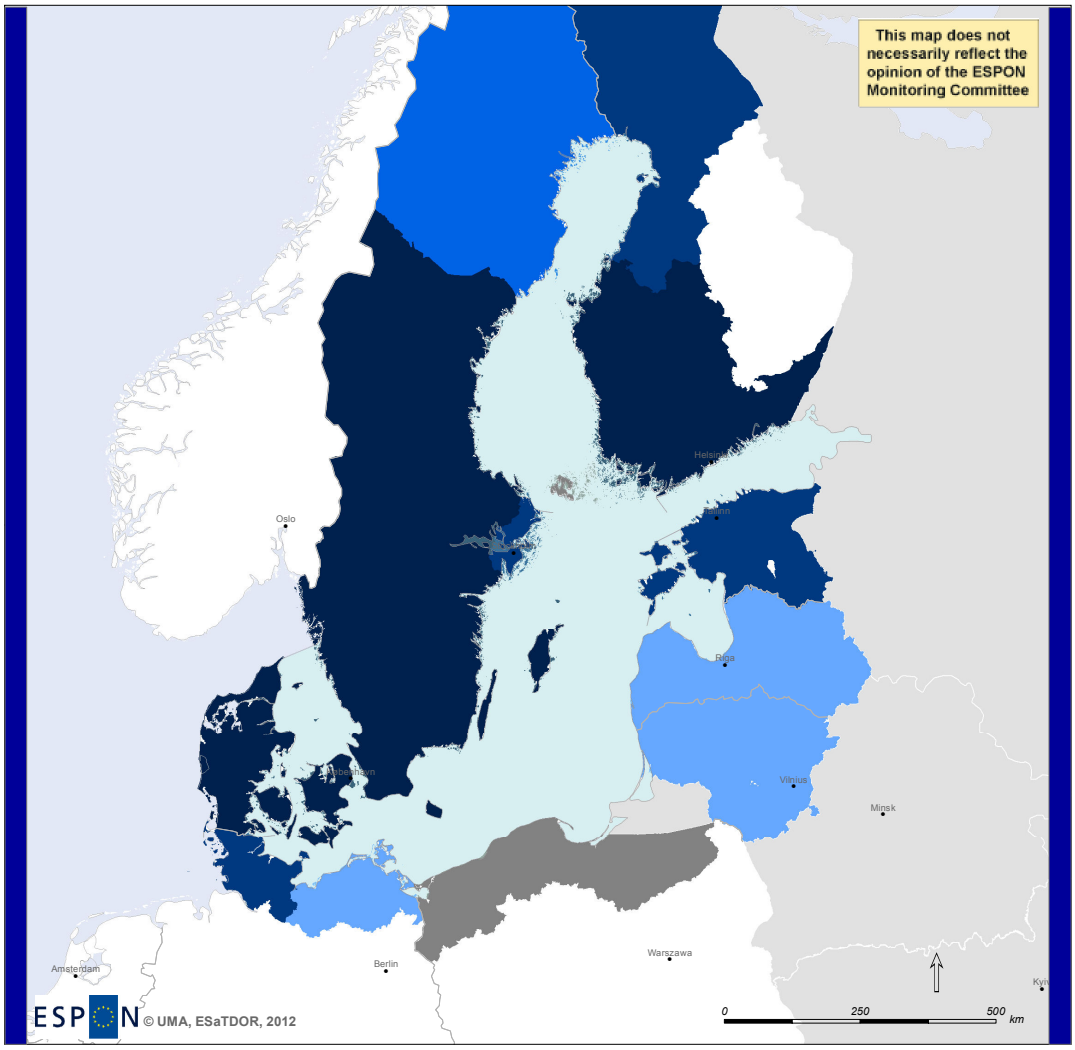
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Other traditional maritime sectors 2009

- 223 to 3,348
- 3,349 to 9,618
- 9,619 to 15,490
- 15,491 to 27,258
- 27,259 to 109,756
- No data

Map BA8a. Number of employees in other traditional maritime sectors (e.g. marine equipment, seaports, maritime services) in 2009 (please note: the maximum number of 109,756 employees as listed in the legend does not occur in the Baltic Sea Region but in the Region of Emilia-Romagna, Italy).

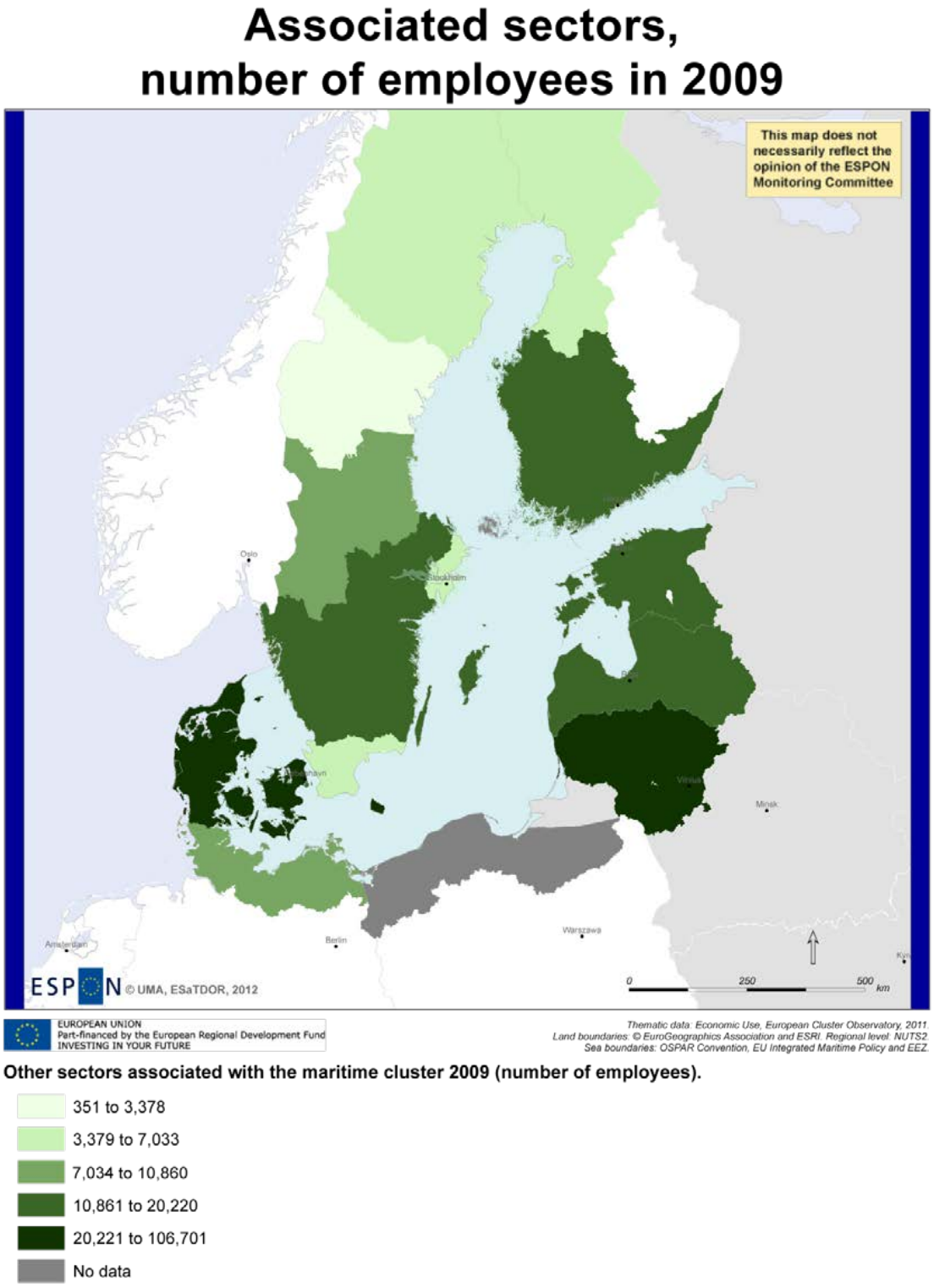
Other Traditional Maritime Sectors (% of total employment)



Map BA8b. Employment in other traditional maritime sectors (e.g. marine equipment, seaports, maritime services; % of total employment) in 2009

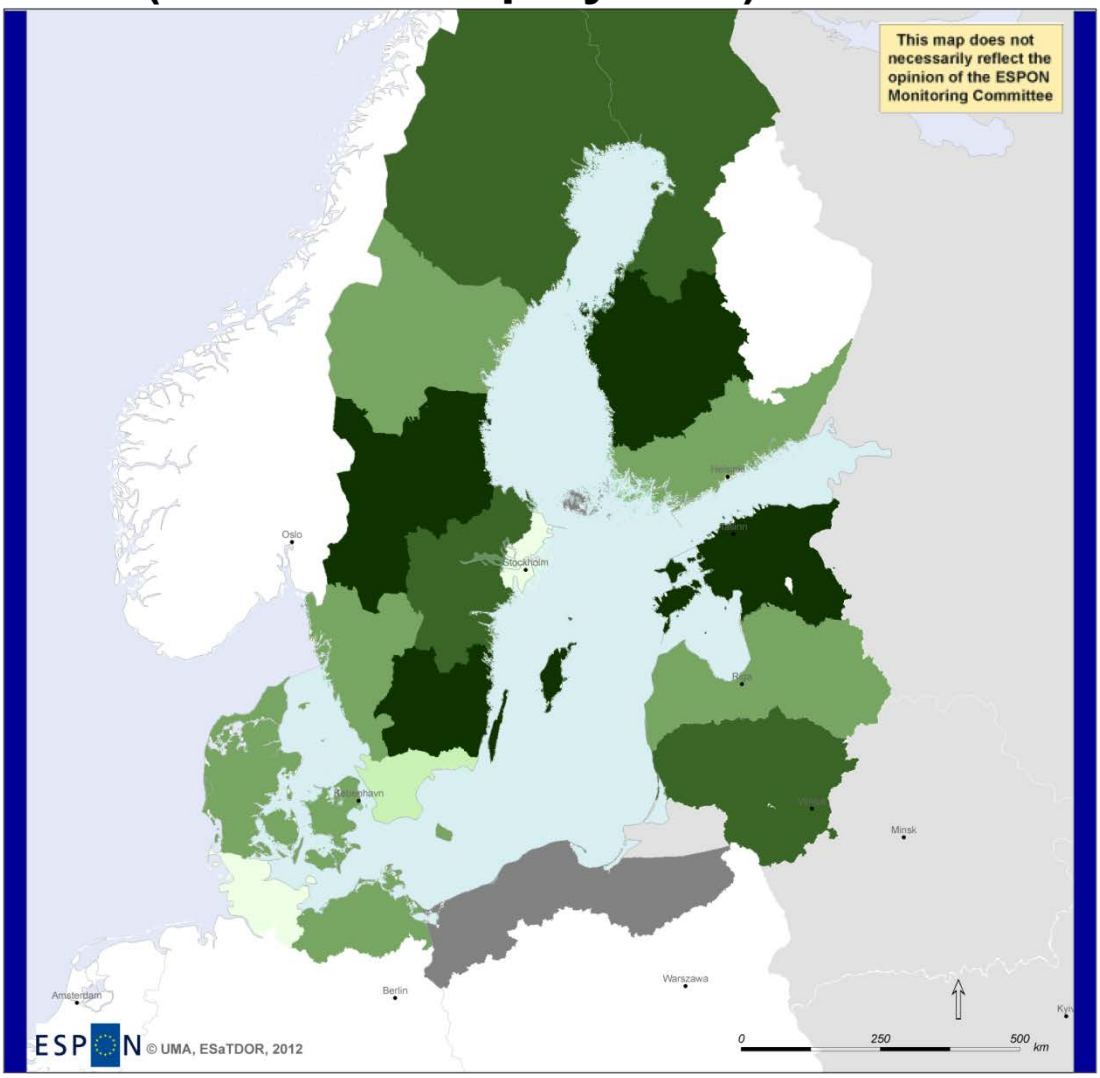
Especially northern and Baltic states benefit from employment in sectors related to maritime activities such as the manufacture of tubes, pipes, hollow profiles and related fittings, of steel; treatment and coating of metals or repair of fabricated metal products. The leading position, however, has Poland with 38,351 employees in these sectors. These sectors have a strategic

importance for the Swedish region of Småland where 3.7% of all employees work in a sector associated with the maritime cluster.



Map BA9a. Number of employees in other sectors associated with the maritime cluster (e.g. manufacturing and repair of maritime tools and precast parts) in 2009 (please note: the maximum number of 106,701 employees as listed in the legend does not occur in the Baltic Sea Region but in the Region of Venice , Italy)

Employment in associated sectors (% of total employment) in 2009



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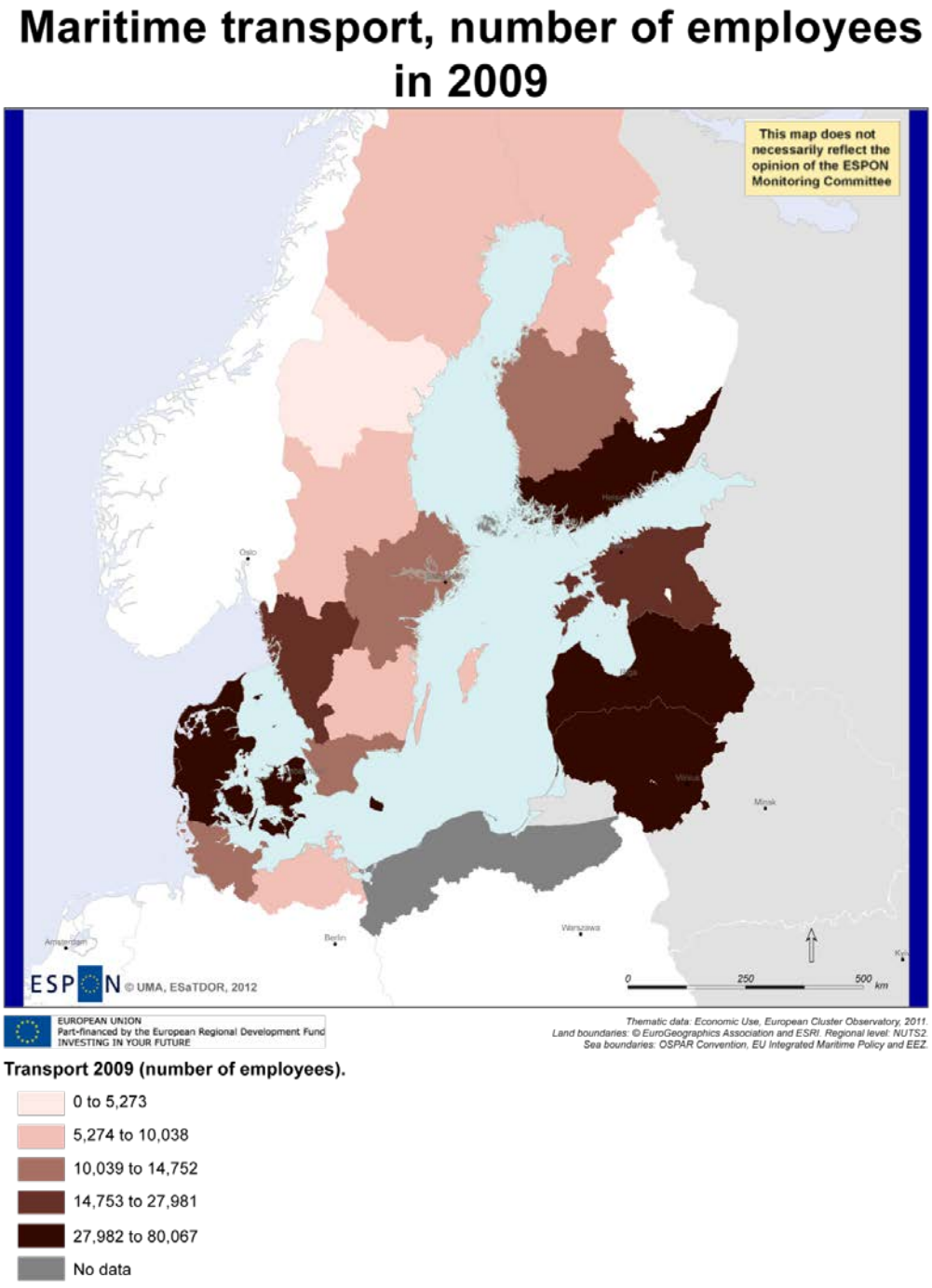
Thematic data: Economic Use, European Cluster Observatory, 2011.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Other sectors associated with the maritime cluster 2009 (percentage of total employment).

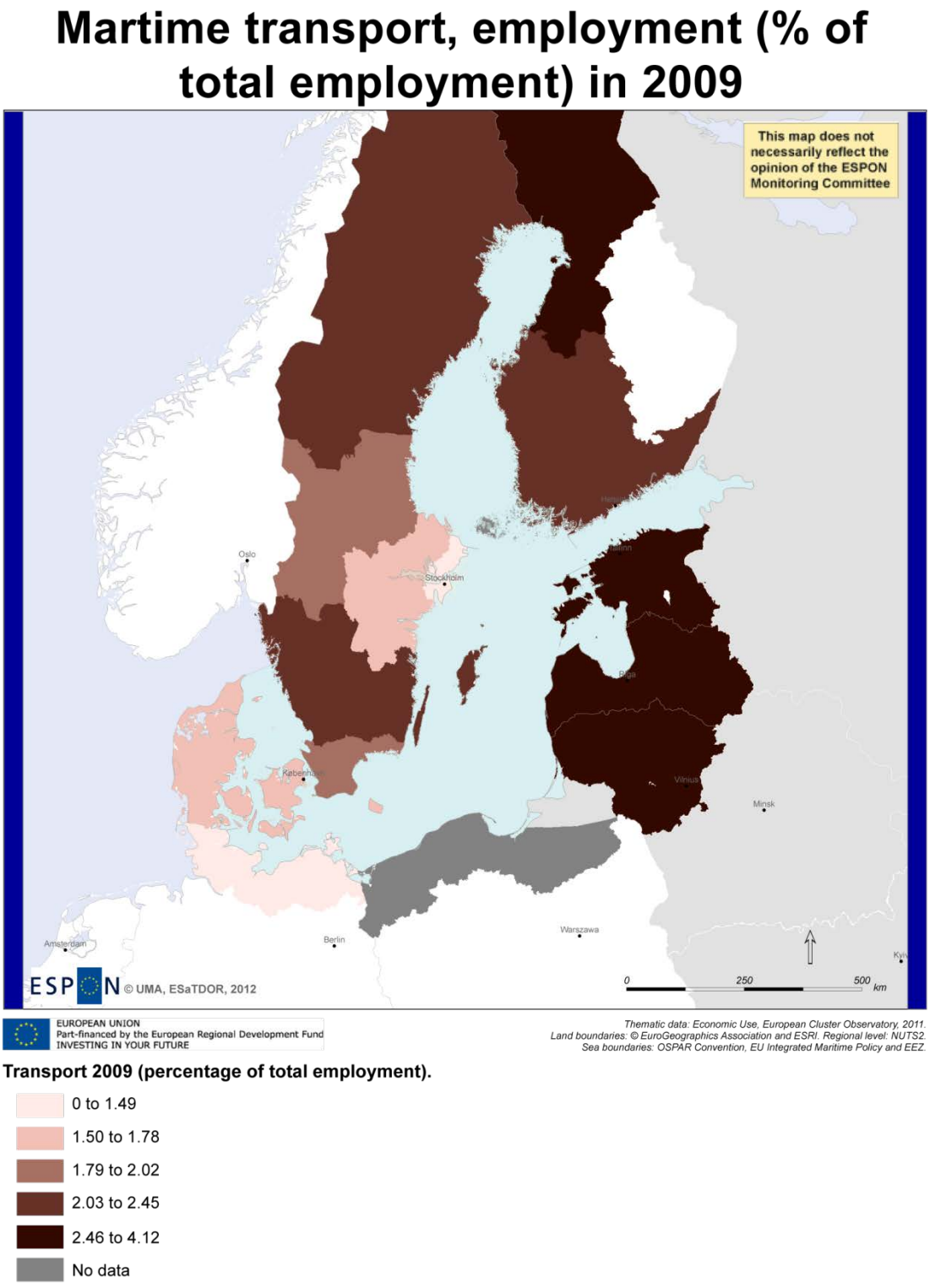
- 0.28 to 0.85
- 0.86 to 1.21
- 1.22 to 1.47
- 1.48 to 2.06
- 2.07 to 6.10
- No data

Map BA9b. Employment in other sectors associated with the maritime cluster (e.g. manufacturing and repair of maritime tools and precast parts) in 2009

According to workforce statistics, the shipping industry is in relative terms a larger industry in the new Member States than in the old Member States (EC 2006a). Poland has the largest seagoing workforce, followed by the three Baltic States. Considering the size of the countries shipping has a strategic importance especially in the Baltic States where more than 3% of all employees are employed in the maritime transport sector. However, only a small minority of seafarers is employed on vessels registered under Baltic flags. Former seafaring traditions of the Soviet Union still play a certain role. Approximately 70% of Latvian seafarers have their origins either in Russia, Belarus or the Ukraine (Southampton Solent University, 2005).



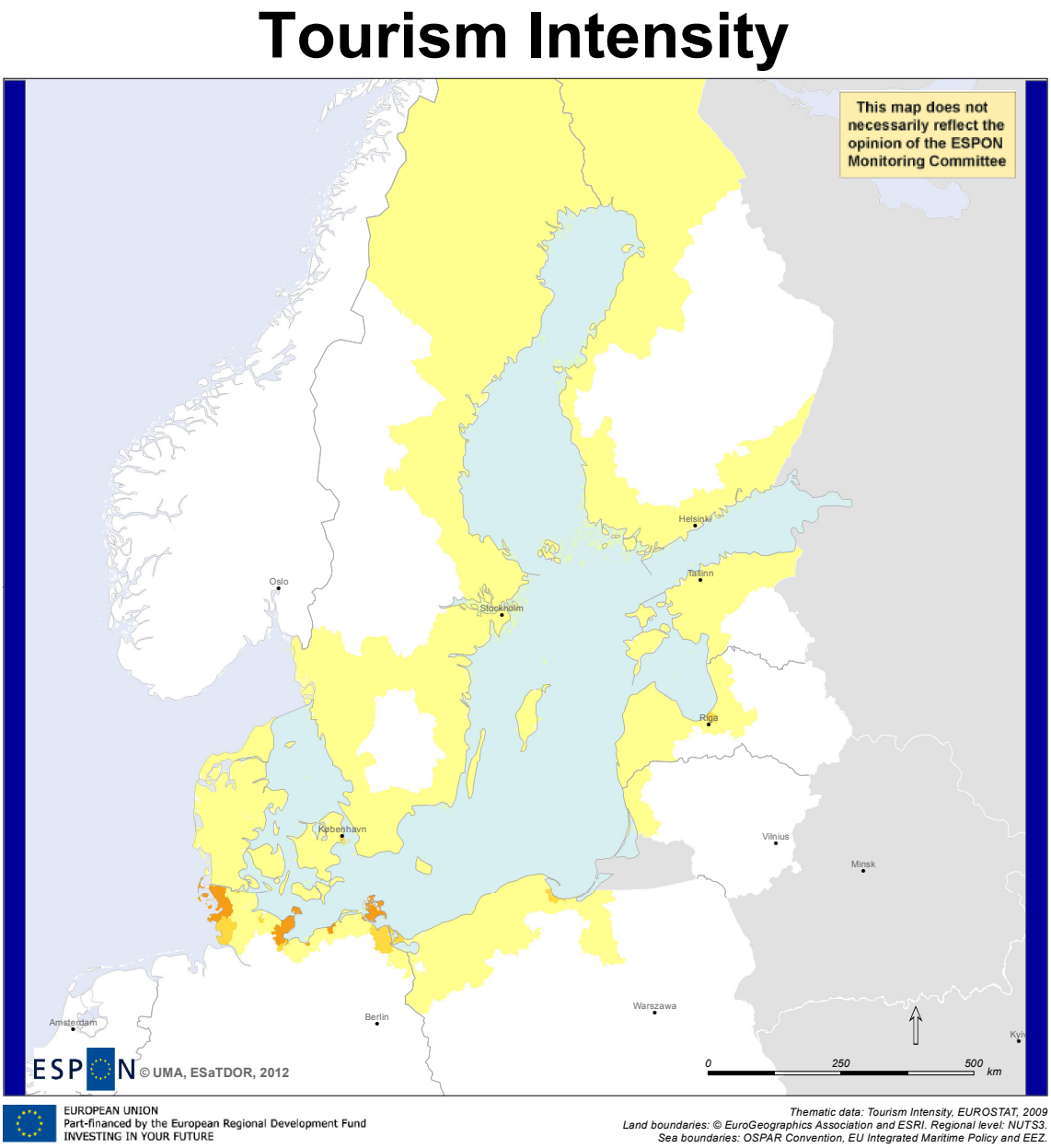
Map BA10a. Number of employees in the maritime transport sector in 2009 (please note: the maximum number of 109,756 employees as listed in the legend does not occur in the Baltic Sea Region but in the Region of Catalan, Spain)



Map BA10b. Employment in the maritime transport sector (% of total employment) in 2009

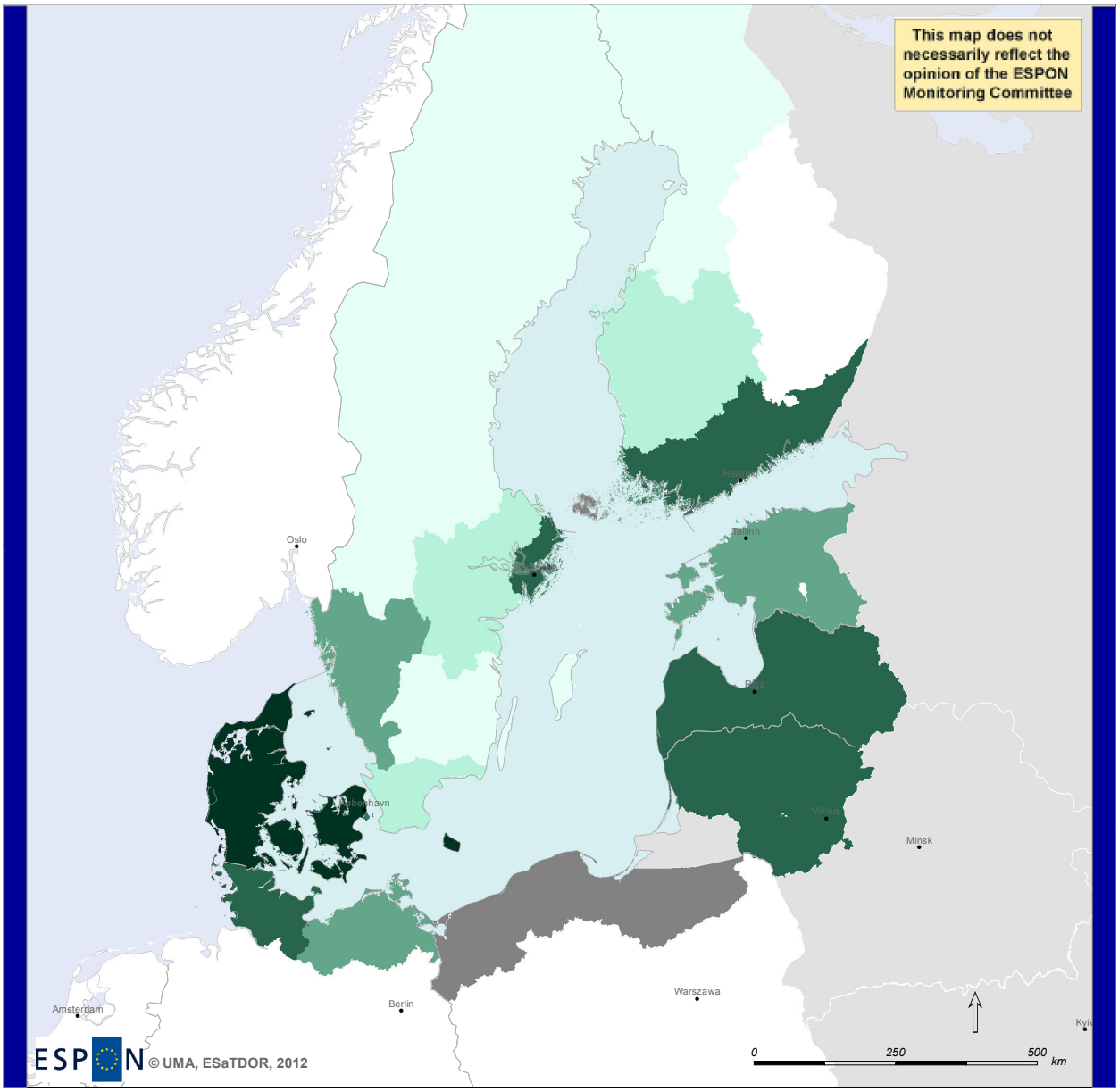
Southern and south-western areas of the Baltic Sea Region (BSR) are leading in the tourism sector due to climate conditions and sandy beaches (Maps BA11, BA12a, BA12b). This may also be explained by higher population density in southern parts of the BSR (cf. Map BA4i) which are the

main catchment area for coastal tourism on Baltic shores. For some of coastal regions (e.g. Mecklenburg-Vorpommern) tourism became the most important economic sector.



Map BA11. Intensity of coastal and marine tourism (measured as number of establishments, bedrooms and bedplaces/km²) in 2009

Tourism, Number of Employees



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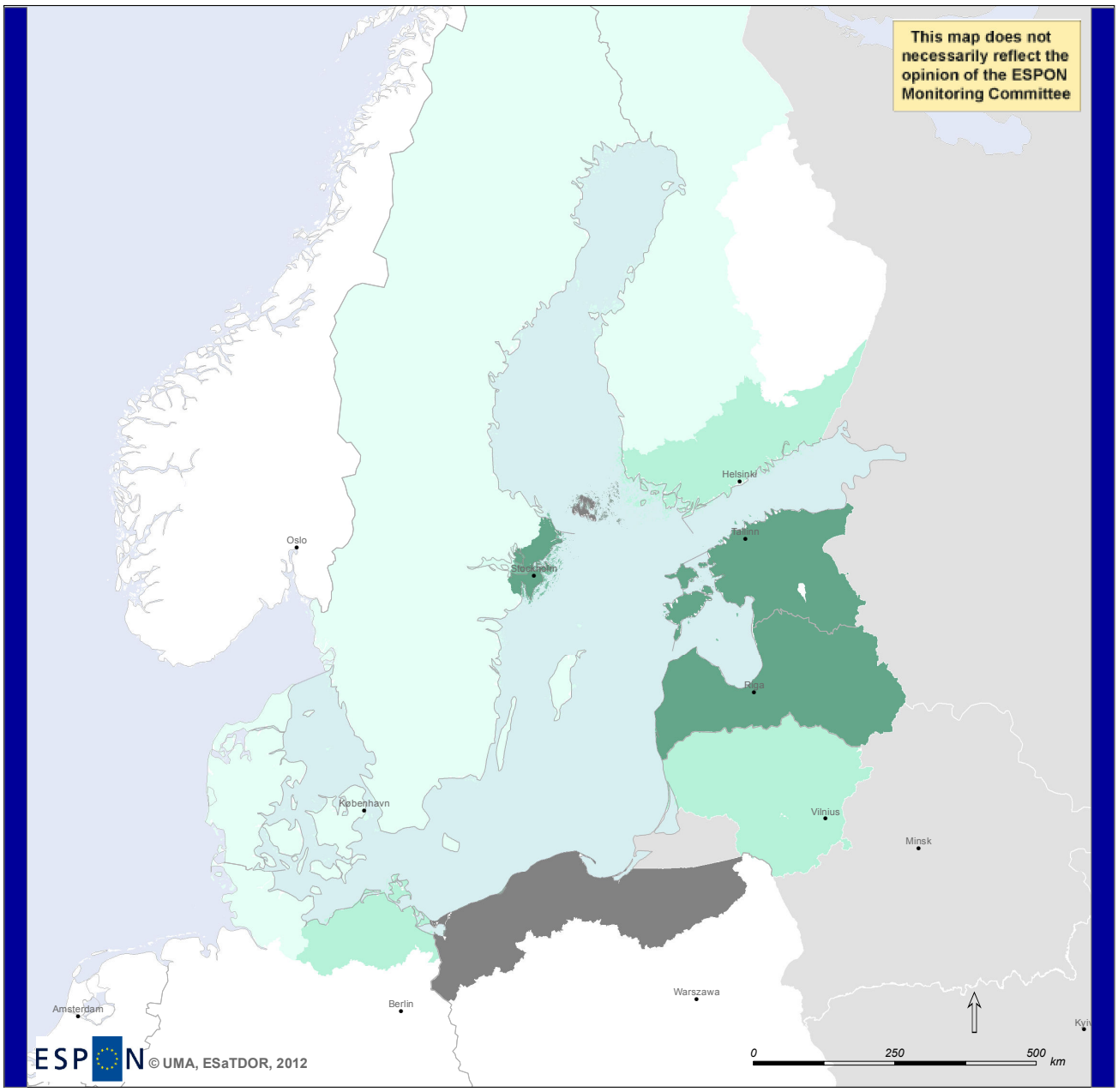
Thematic data: Economic Use, European Cluster Observatory, 2011.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Tourism 2009 (number of employees).

- 0 to 32,447
- 32,448 to 61,022
- 61,023 to 108,951
- 108,952 to 199,374
- 199,375 to 444,732
- No data

Map BA12a. Number of employees in the tourism sector in 2009 (please note: the maximum number of 444,732 employees as listed in the legend does not occur in the Baltic Sea Region but in the Region of Andalusia, Spain)

Tourism (% of total employment), 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.

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 38.33
- No data

Map BA12b. Employment in the coastal and marine tourism sector (% of total employment) in 2009.

Transport

Maritime transport in the BSR is focused on following transport modes (VTT 2002):
- Bulk or general cargo, semi-finished products. Oil products, chemicals, minerals, metals, coal and fertilizers belong to this category,
- High-value products, transported typically in containers or in packed form and
- Ferry transport including passenger transport, cars, trucks and rail wagons.

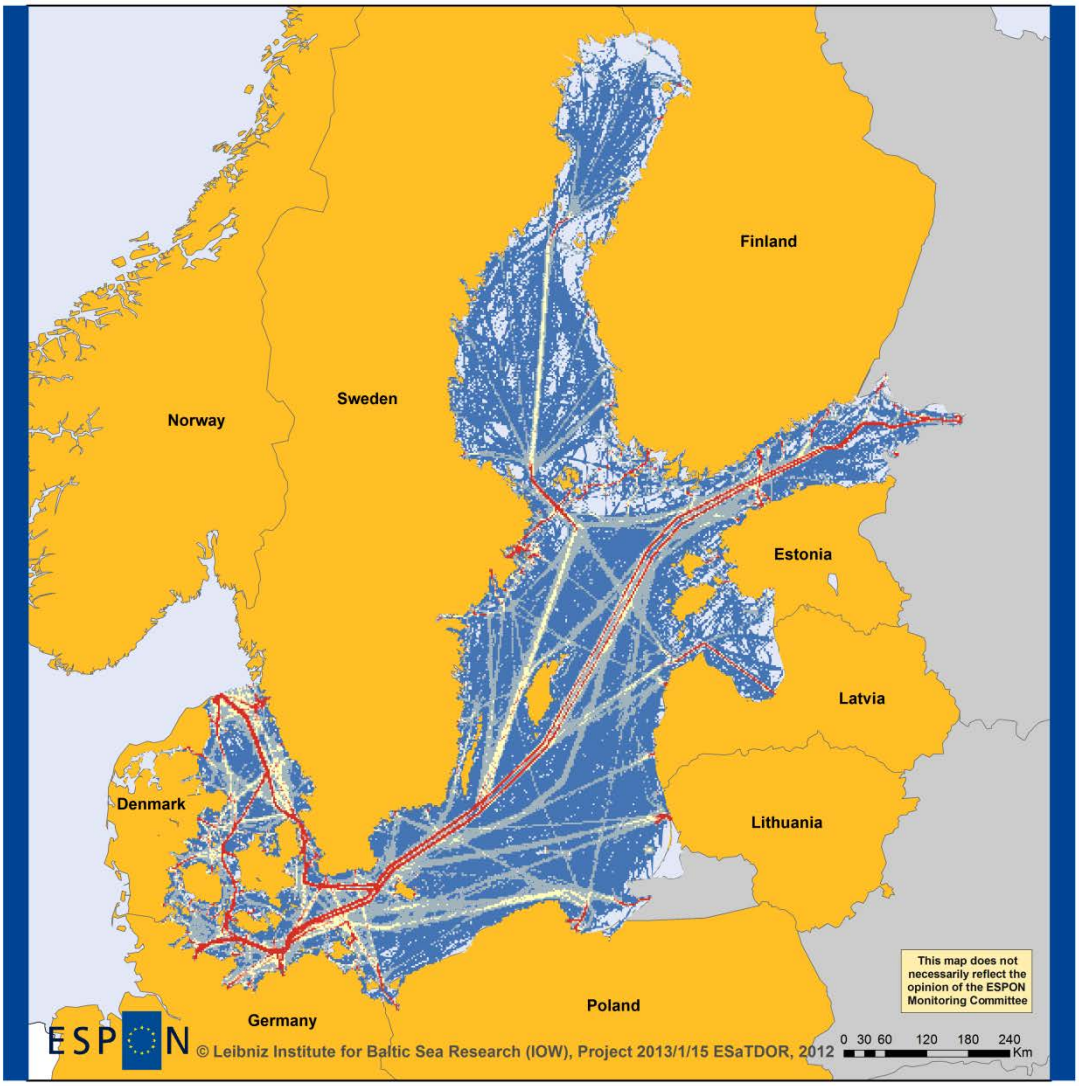
Bulk cargo is still of great importance for maritime transport in the BSR. A major driver for this is oil export from Russia. Among the major ports in the BSR are Gothenburg (due to its easy accessibility via the North Sea), Riga and Tallinn (Map BA14a). The latter two show good connections towards Russia, Ukraine and Belorussia. Russia lost its main ports during the independence process of the Baltic States. Hence a lot of Russian, Ukrainian and Belorussian bulk products are still transported via the Baltic States. Russia, however, has in recent years been extending its own port capacities against a background of decreasing traffic in some ports in the Baltic States (Map BA14b). Maritime transport in the Baltic Sea as a whole has shown a strong increase from the mid-1990s to 2007. Between 1997 and 2007 the aggregated volume of cargo handled in the BSR ports grew from approximately 580 million tons to 825 million tonnes, resulting in an increase of 42%, or an average of 3.6% per annum (Map BA14c). Key drivers for this development were increasing intensity of Russian oil exports, advancing globalisation with the related increase in trade and intensifying trade integration between the BSR countries, and favourable economic development especially in the eastern reaches of the BSR itself (Saurama & Särkijärvi, 2010). The economic crisis of 2008 caused a decrease in cargo handling in many Baltic ports during 2008 and 2009. Nevertheless, a further increase is assumed for the midterm, among other reasons due to a possible increase of GDP in Russia.

The Baltic Sea is characterised by a large share of short-sea shipping (Map BA13). In 2010 the share of short-sea shipping (SSS) of goods in total sea transport was above 90% for Denmark, Finland and Sweden. Poland and Latvia achieved SSS values above 80% (Eurostat, 2012a). The large share of SSS may be explained by intensive trade between neighbouring states but also by a large volume of feeder services towards/from larger international ports along the Northern Range (e.g. Hamburg, Rotterdam).

Container transport still plays a relatively small role in the Baltic Sea. Only a few ports in the BSR have the technical infrastructure to handle larger container volumes. The main container port in the BSR is Gothenburg which again is due to its easy accessibility via the North Sea (Maps BA15a, b). Nonetheless, all ports which handle containers showed an increase in traffic from 2004 to 2008 (Map BA15c).

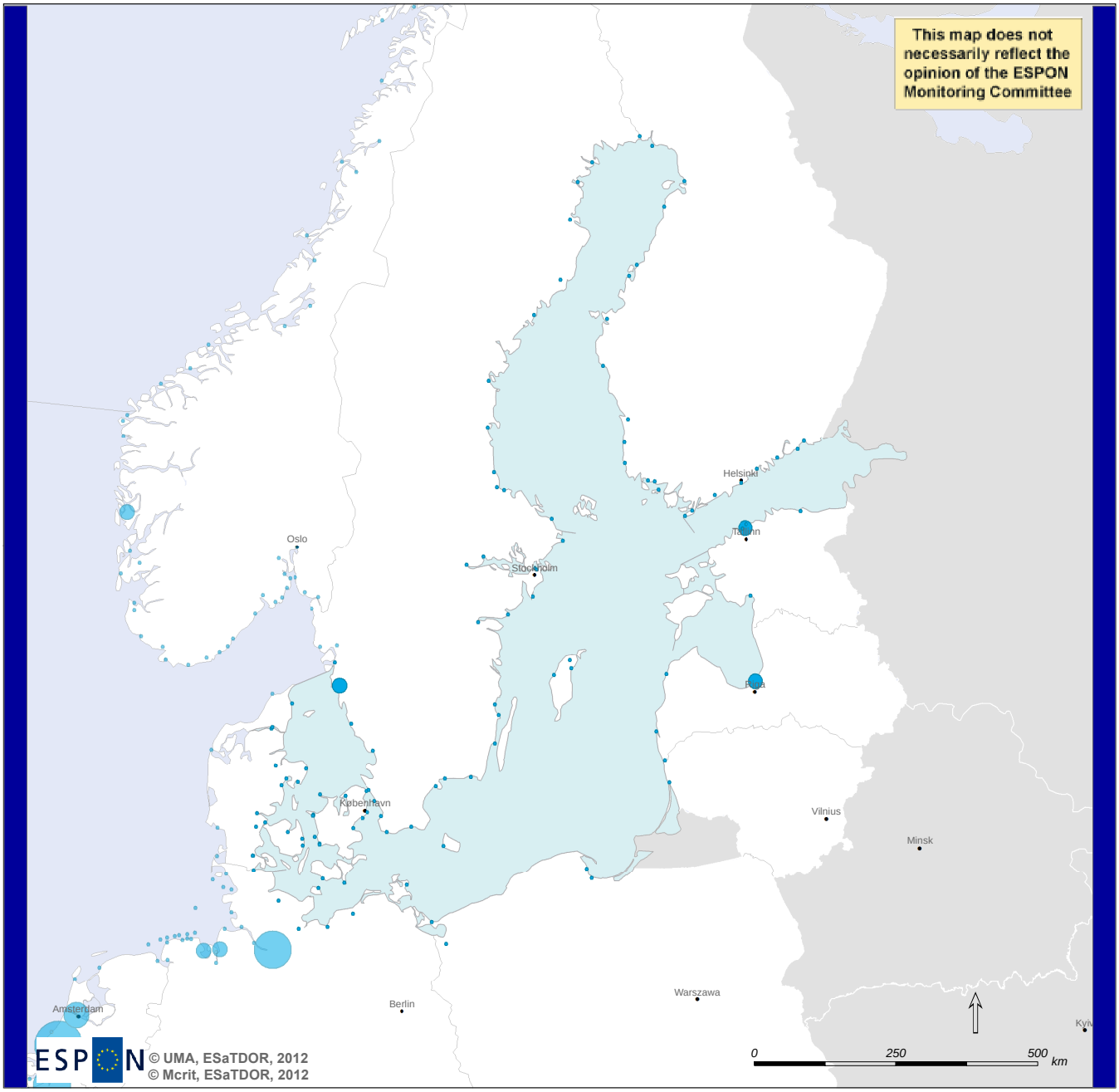
About 20% of those ships registered by the Automatic Identification System (AIS) are oil tankers heading mainly from Russia towards the North Sea. About 290 million tonnes of oil are transported yearly mainly from or towards Russia and Sweden. These numbers have been relatively stable in the years 2008-2010 (Turku University, 2012). In the midterm an increase of oil transport via the Baltic Sea may be assumed as Russia seeks to increase its oil production and as a new oil pipeline (Baltic Pipeline System 2) will increase the capacity of the Russian Ust-Luga port. This in turn increases the risks of collisions and groundings of oil tankers, especially for the narrow Gulf of Finland but also the narrow and shallow shipping routes along the Kadet fairway and through the Danish straits.

Average monthly density of ships in the Baltic Sea (2008)



Map BA13. Average monthly density of ships and main shipping routes in the Baltic in 2008 (AIS data only)

Total Goods Shipping, 2008



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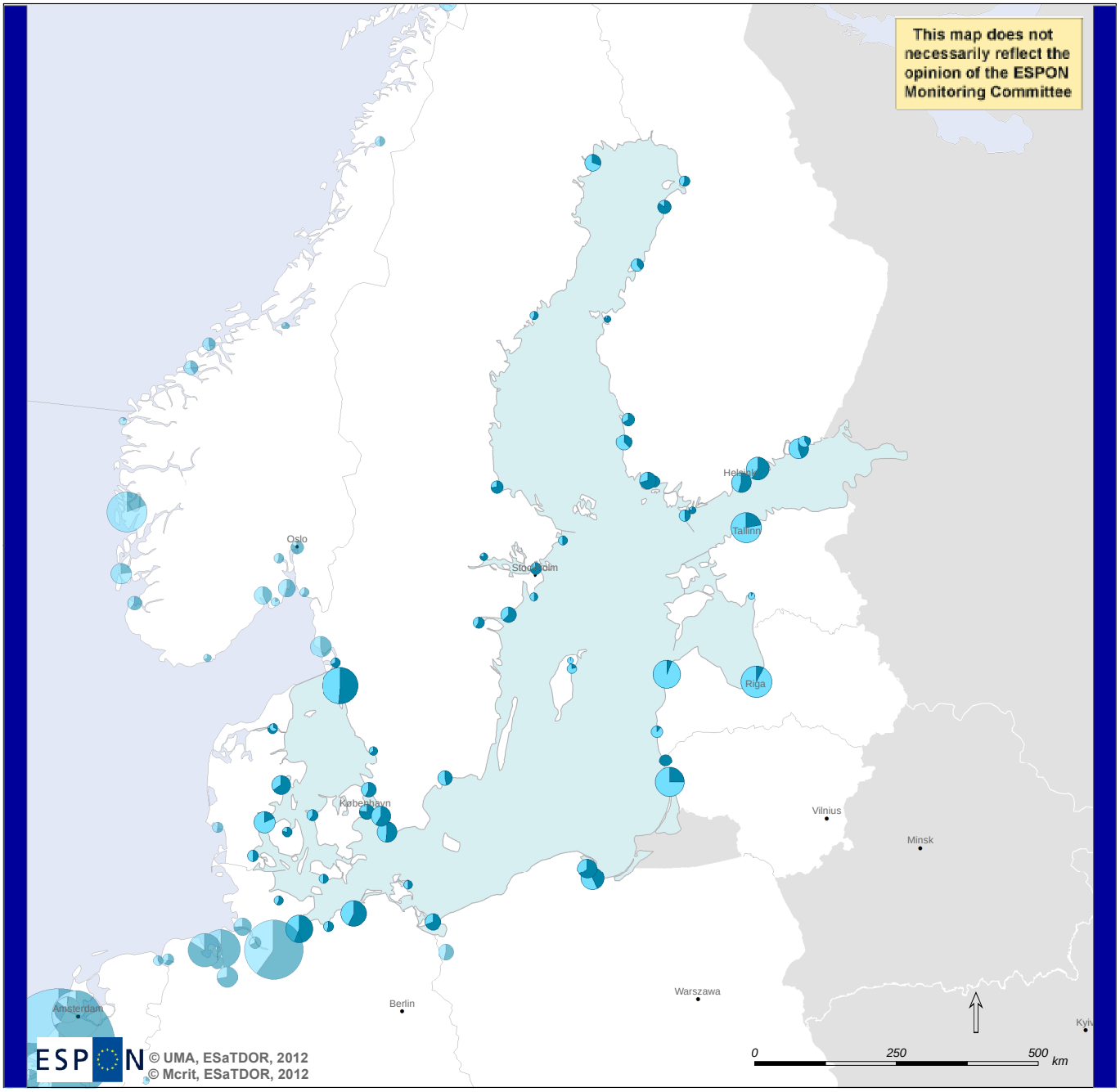
Thematic data: Gross weight of goods handled in all ports, EUROSTAT, 2008.
Port locations: Eurostat - GISCO (European Commission), 2009
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

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

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

Map BA14a. Total shipping at Baltic Sea ports in 2008 (million tonnes).

Shipping by Direction, 2008



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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.

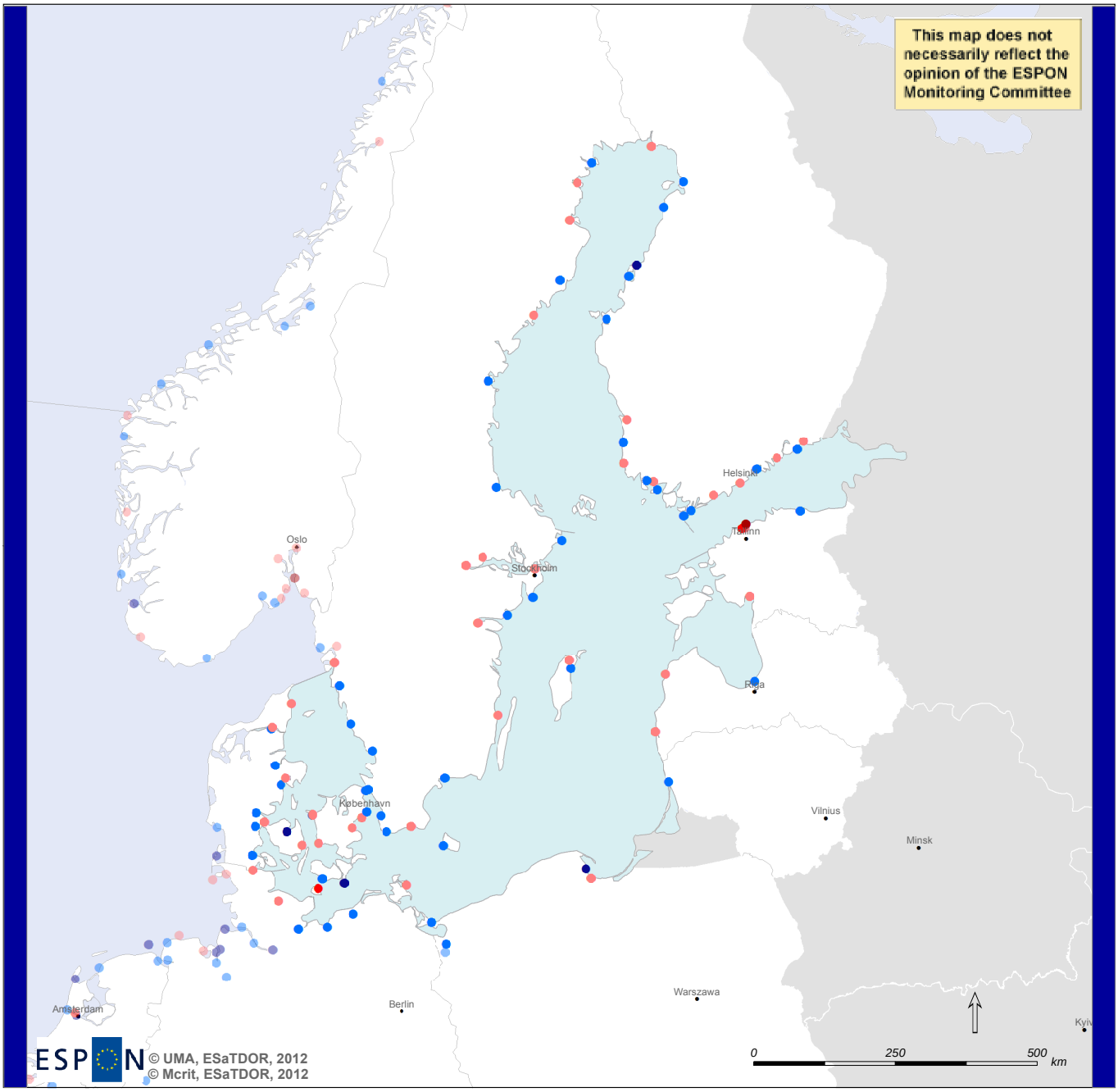
Total shipping at ports by direction, 2008.

Inward direction

Outward direction

Map BA14b: Total shipping at Baltic Sea ports by inward/outward direction in 2008

Shipping Trends



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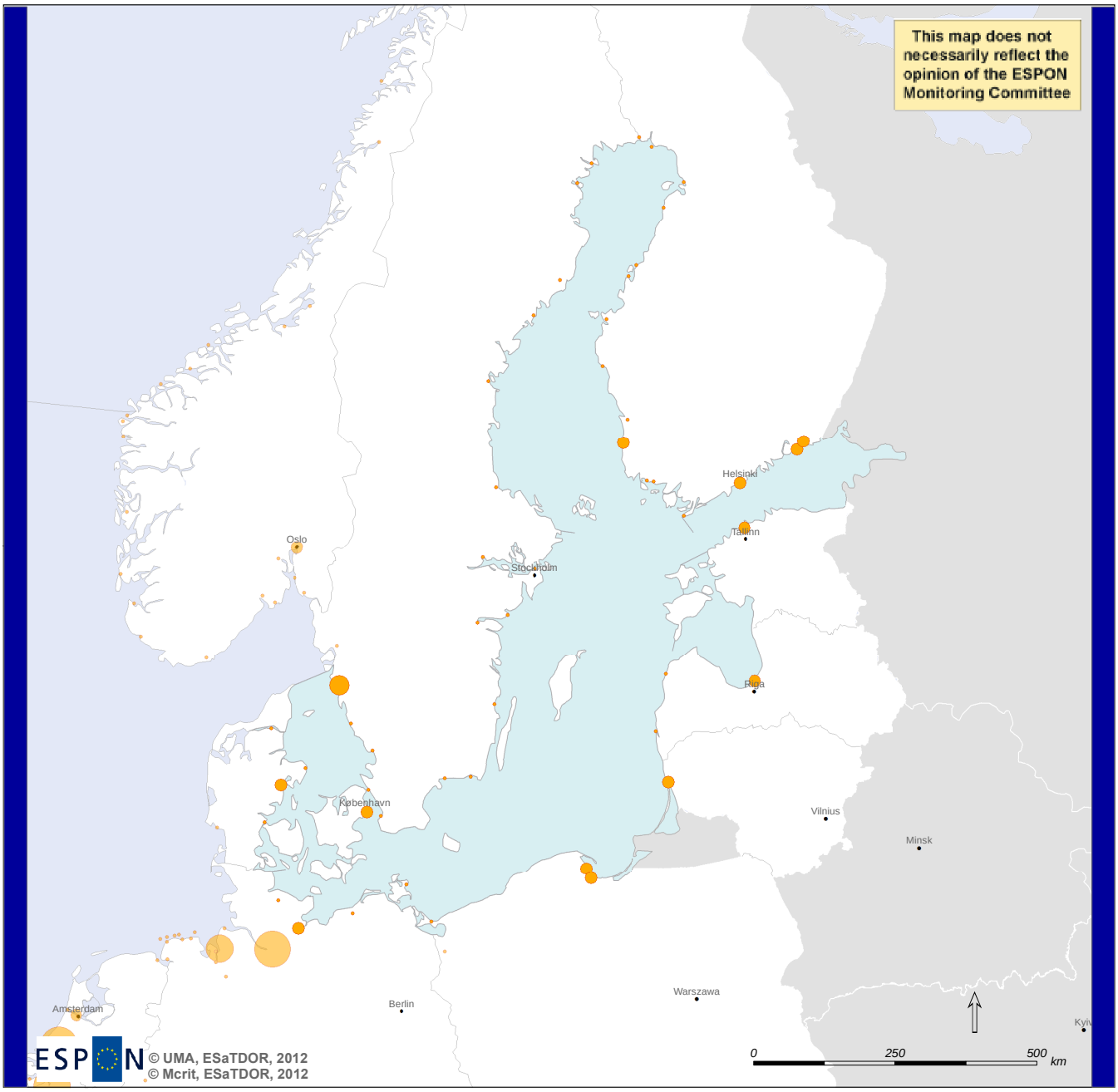
Thematic data: Gross weight of goods handled in all ports by direction, EUROSTAT, 2004 - 2008.
Port locations: Eurostat - GISCO (European Commission), 2009
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and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

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

- < -20%
- -20% to -10%
- -10% to 0%
- 0% to10%
- > 10%

Map BA14c. Average annual traffic increase (total goods handled) at Baltic Sea ports, 2004-2008.

Container Shipping, 2008



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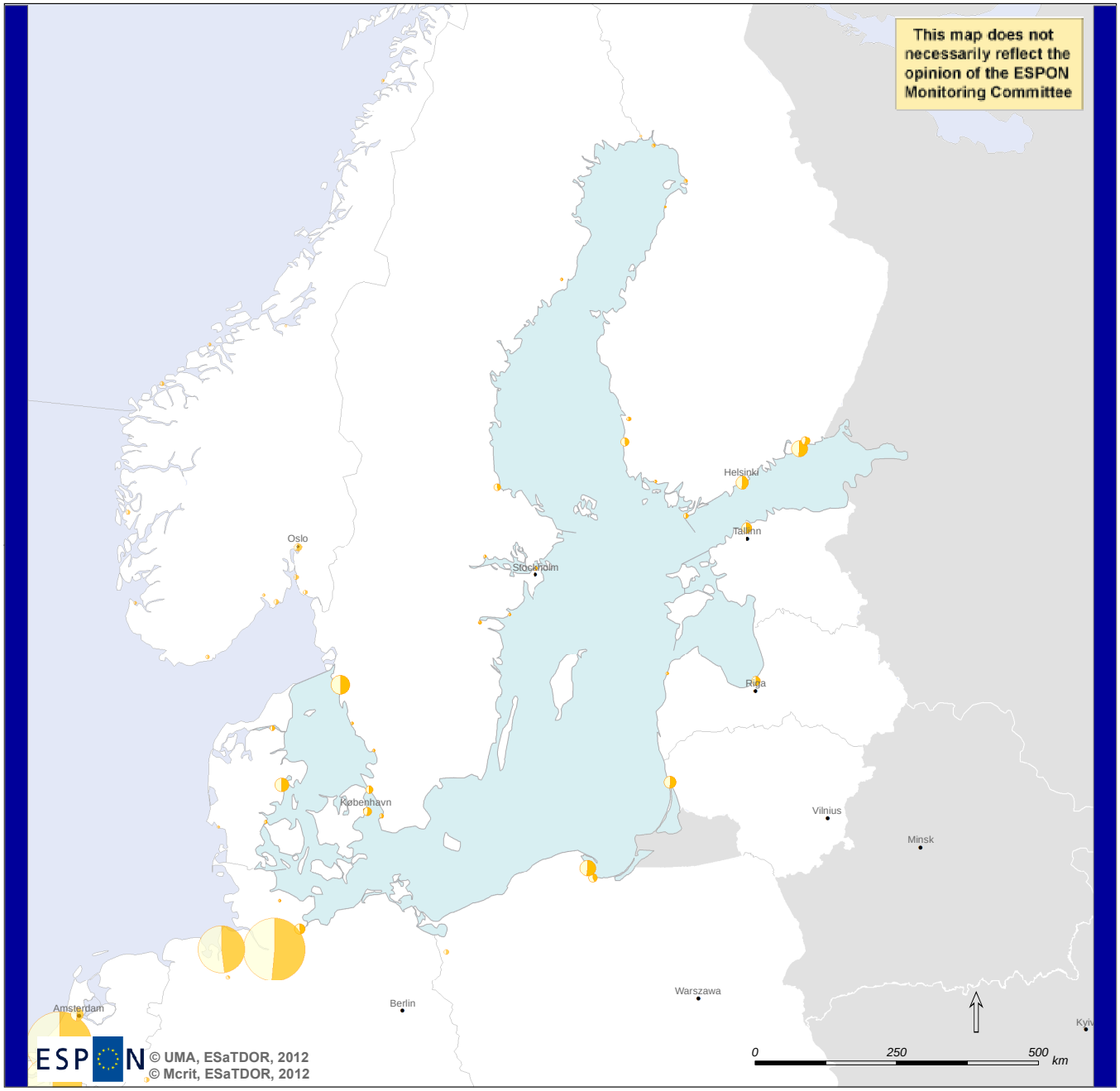
Thematic data: Containers handled in all ports by direction, EUROSTAT, 2008.
Port locations: Eurostat - GISCO (European Commission), 2009
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

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 BA15a. Container shipping at Baltic Sea ports (Million TEUs), 2008.

Container Shipping by Direction, 2008



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Thematic data: Containers 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.

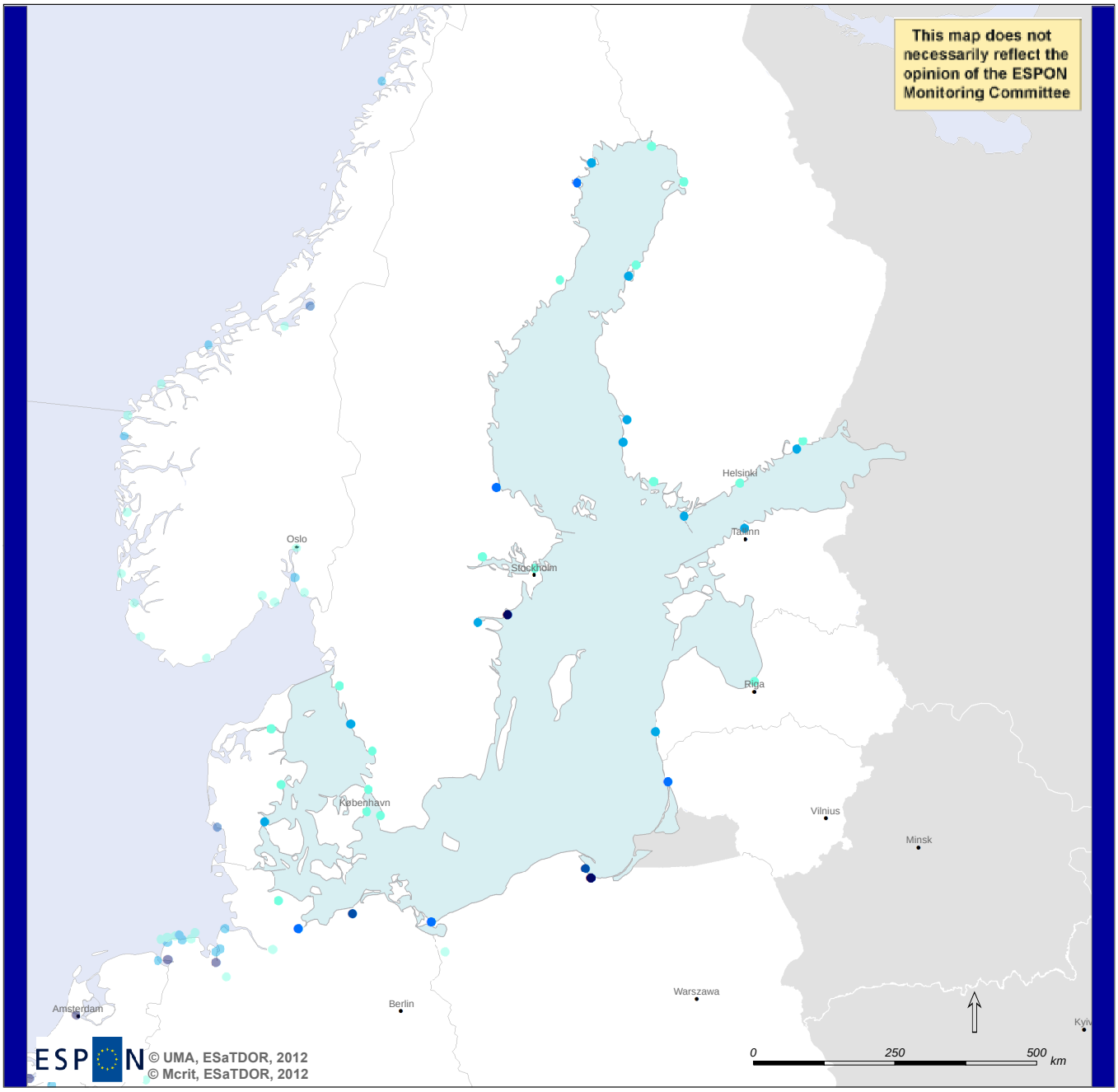
Container shipping at ports by direction, 2008.

Inward direction

Outward direction

Map BA15b. Container shipping at Baltic Sea ports by inward/outward direction, 2008.

Container Shipping Trends



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Thematic data: Containers 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.

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

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

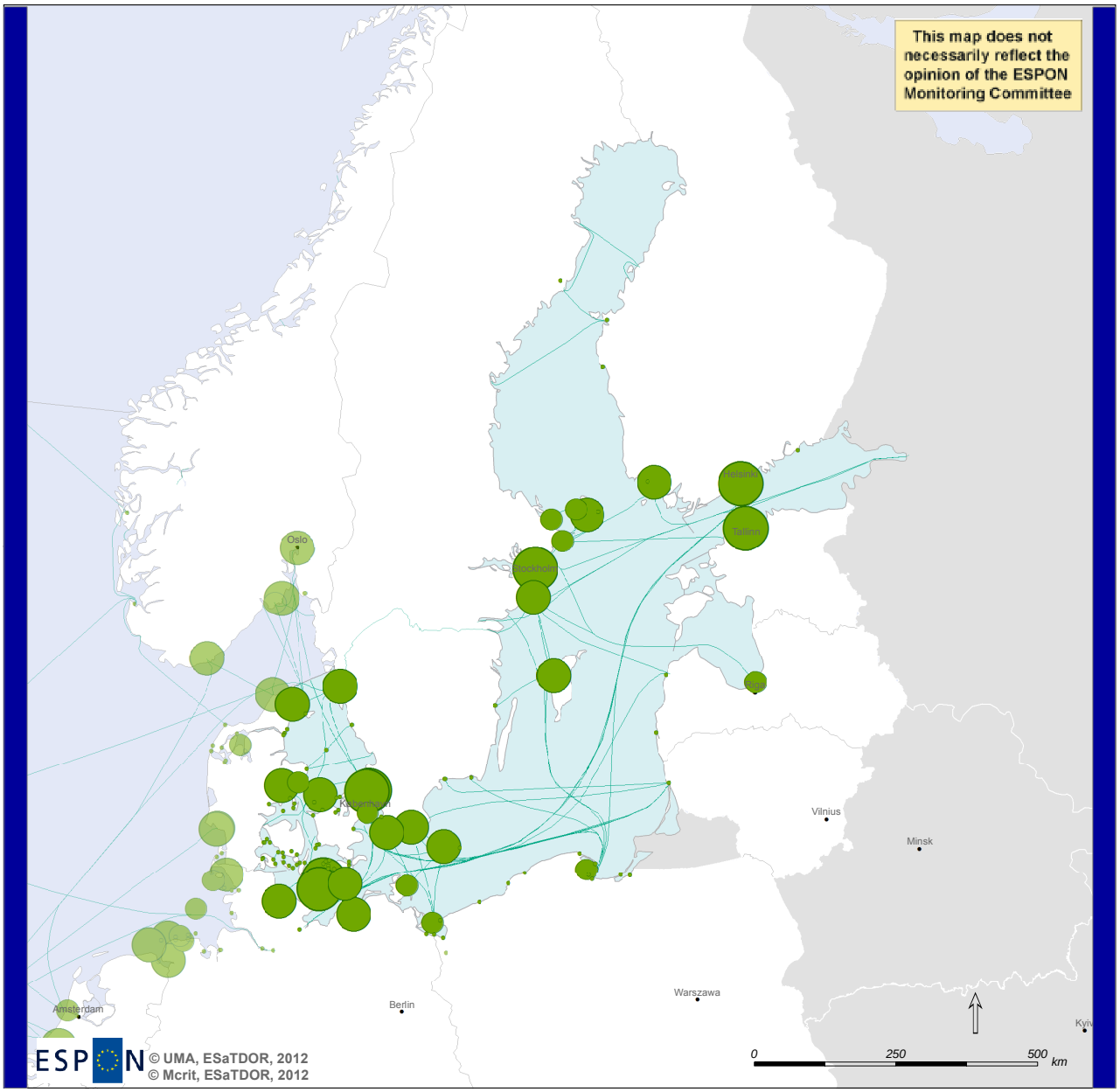
Map BA15c. Average annual traffic increase in container shipping at Baltic Sea ports, 2004-2008.

Main routes for passenger traffic across the Baltic Sea are traditionally following links (Map BA16a):

- Denmark – Germany
- Denmark – Sweden
- Finland – Åland
- Finland– Sweden
- Finland – Estonia

These major ferry routes are used by about 40 million passengers annually (VTT, 2002). All in all about 134,000 passengers traveled by ship in the European member states around the Baltic Sea in 2009 (DE & DK: including North Sea; Eurostat 2012b). The development of passenger transport by ferries has been manly stable to positive during the recent years (Map BA16b). However, ferries in the BSR carry not only passengers but are in many cases carriers mainly for trucks, trailers and partly railway wagons. As such they also play an important role in cargo transport across the Baltic Sea (see above).

Ferry Passengers, 2008



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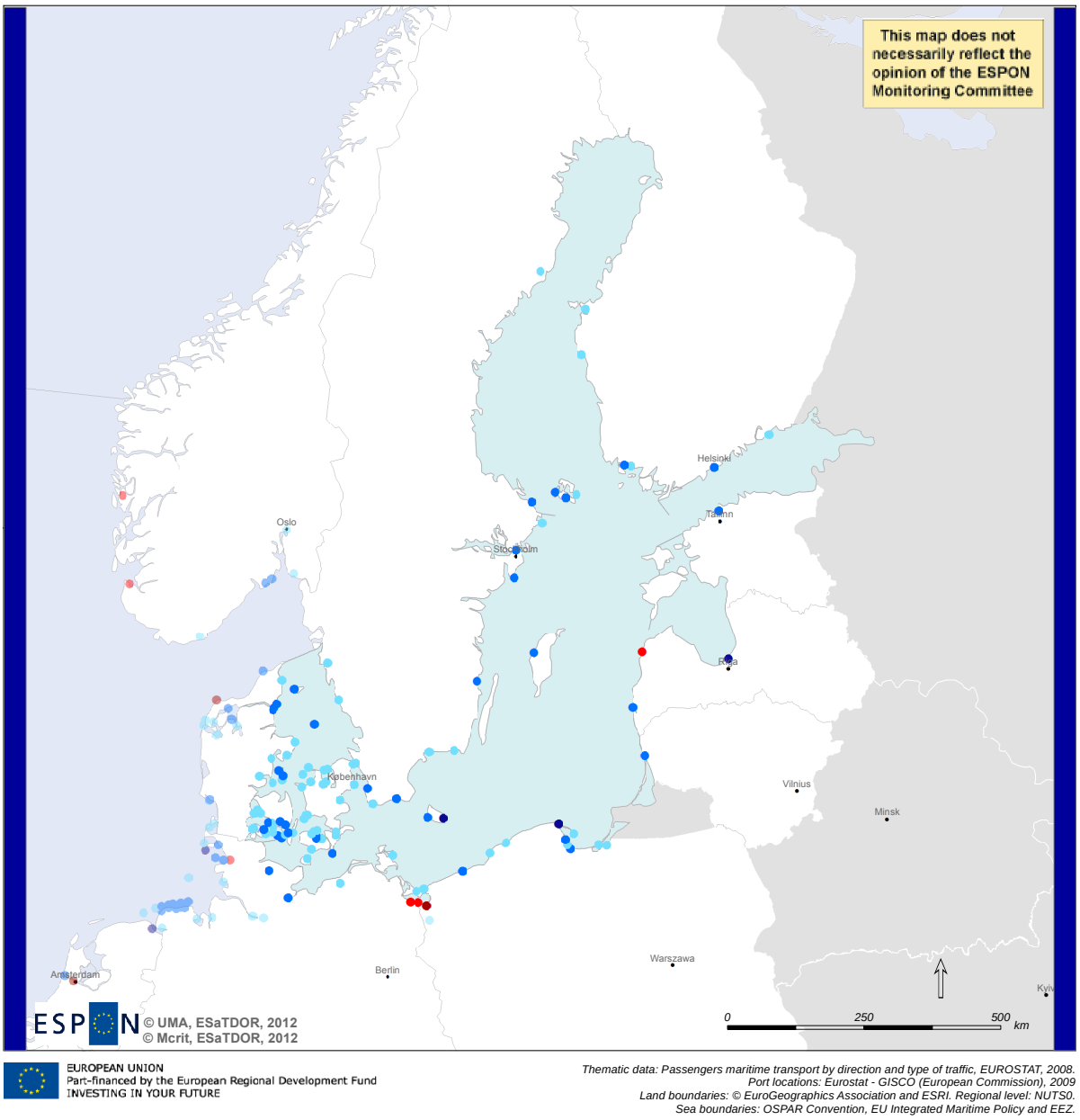
Thematic data: Passengers maritime transport by direction and type of traffic, EUROSTAT, 2008.
Ferry routes: TRANS-TOOLS (European Commission), 2005.
Port locations: Eurostat - GISCO (European Commission), 2009
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: 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 BA16a. Number of ferry passengers at Baltic Sea ports, 2008.

Ferry Passenger Trends



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

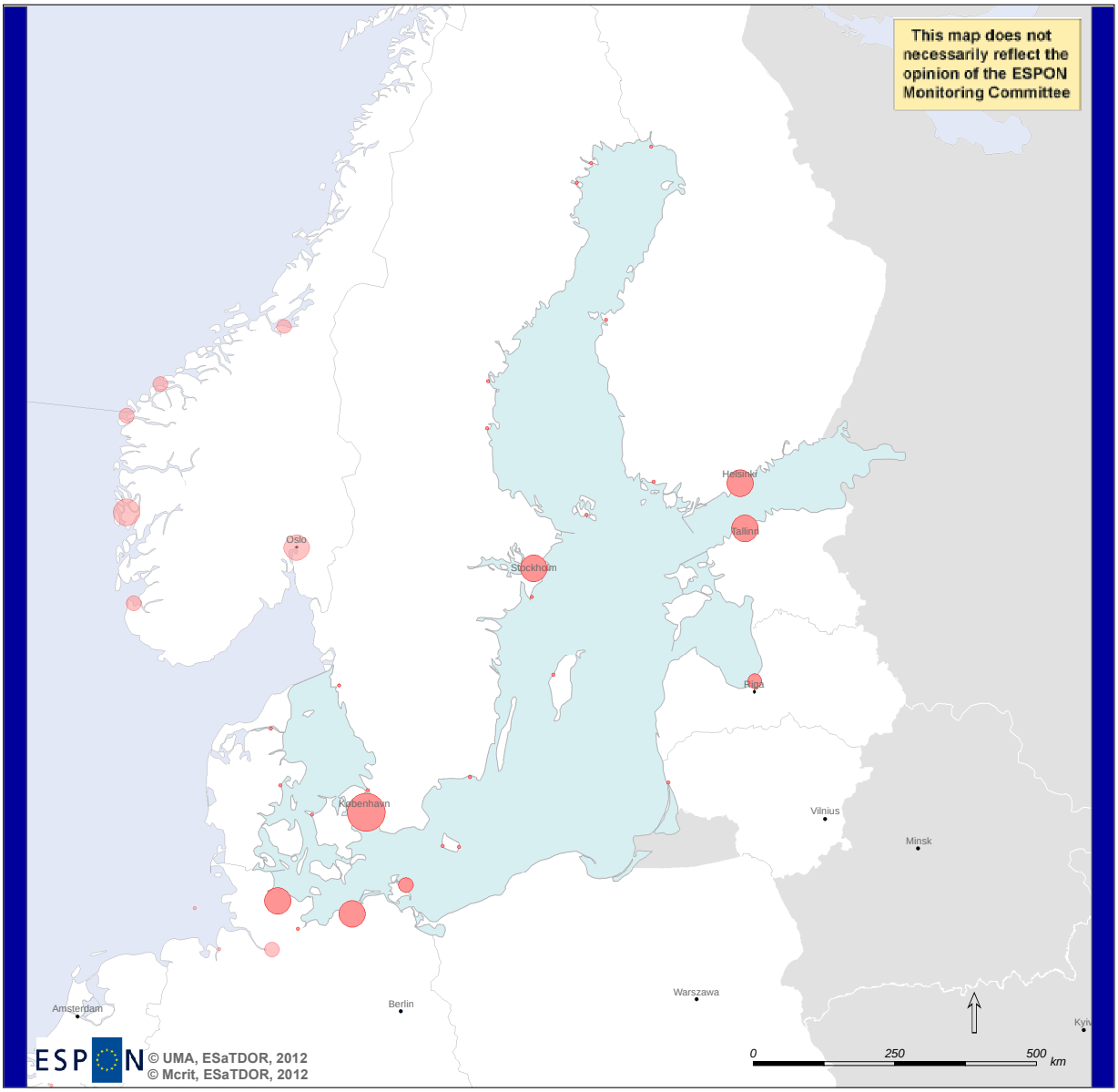
- > -35%
- -35% to -15%
- -15% to 0%
- 0% to 15%
- > 15%

Map BA16b. Average annual traffic increase of ferry passengers at Baltic Sea ports, 2004-2008.

Cruises have become an important economic development in the BSR over the last decades. The Baltic Sea countries are visited by about 10 per cent of the world's cruise tourists (Nilsson et al, 2005). Cruise ships sail in the Baltic mainly between Easter and October and call mainly at larger cities, e.g. Copenhagen, Helsinki, Stockholm, and Riga (Map BA17a). Additionally the German ports of Kiel and Warnemünde attract a significant number of cruise ships, partly because of their connectivity with larger urban complexes (Hamburg, Berlin). Furthermore, German ports act

together with Copenhagen as starting points for cruises (Map BA17b). This may again be explained by the higher population density in southern parts of the BSR (cf. Map BA3) and the existence of relevant target groups for cruises in Western Europe. The number of passengers increased from 2005 to 2008 in all Baltic ports called by cruise ships (Map BA17c).

Cruise Passengers, 2008



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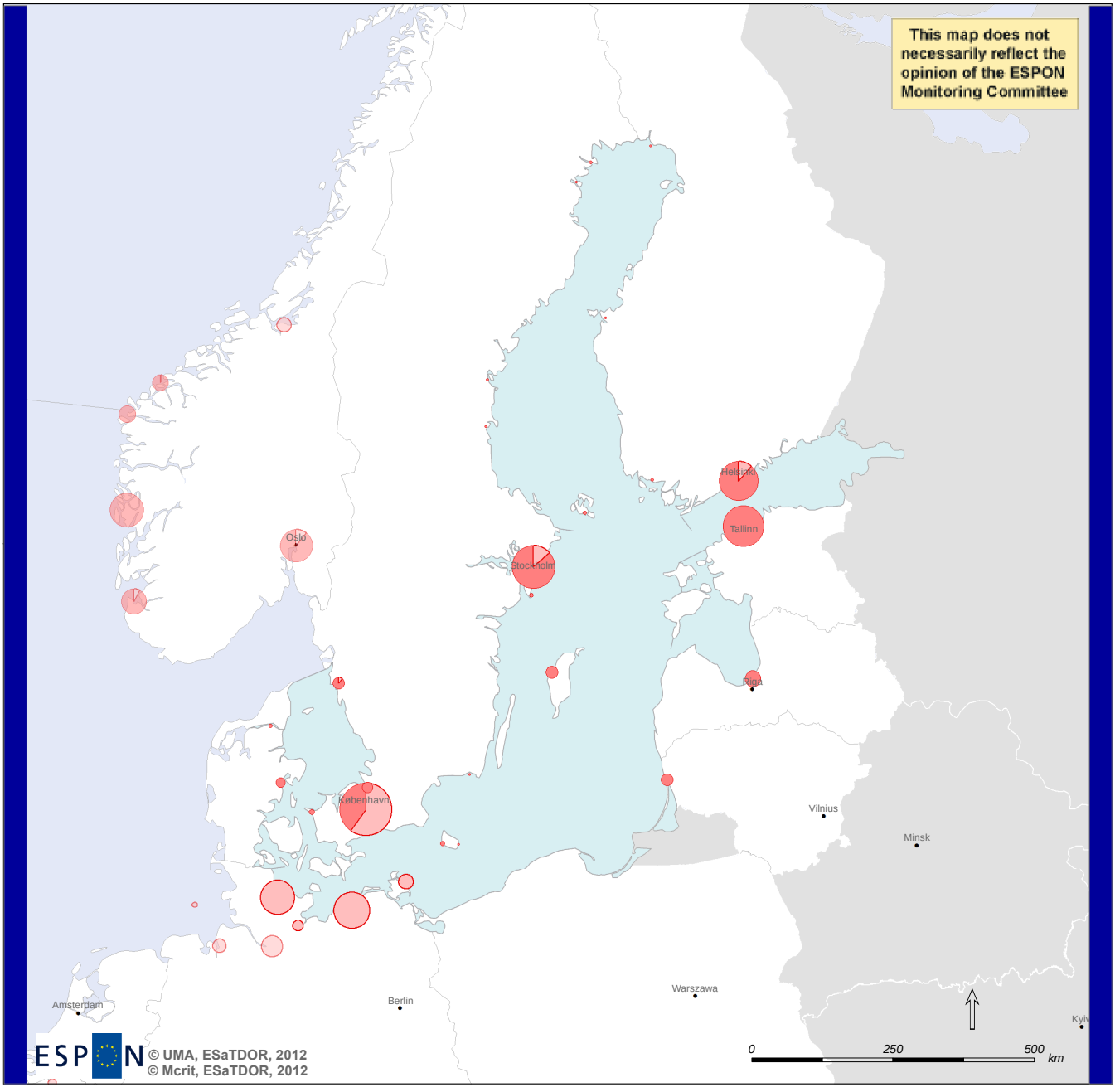
Thematic data: Passengers maritime transport by direction and type of traffic, EUROSTAT, 2008.
Port locations: Eurostat - GISCO (European Commission), 2009.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy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

Cruise activity at ports, 2008. (Thousand passengers). All ports.

- 1 - 50
- 50 - 250
- 250 - 500
- 500 - 1000
- > 1000

Map BA17a. Cruise activity (number of passengers) at Baltic Sea ports, 2008.

Cruise Activity by Passenger Type, 2008



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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.

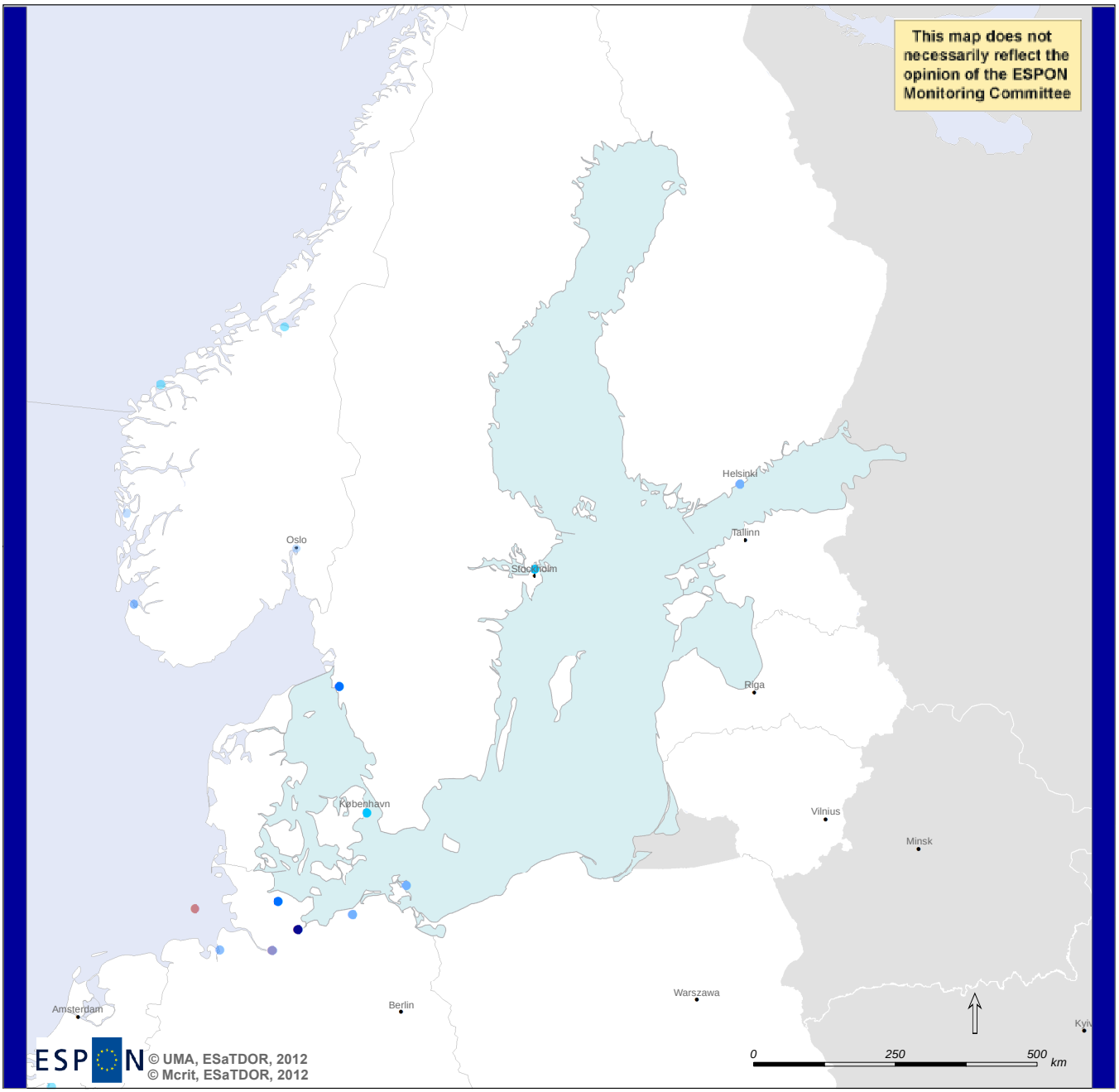
Cruise activity at ports by passenger type, 2008.

Starting or ending a cruise

On excursion

Map BA17b. Cruise activity at Baltic Sea 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 BA17c: Average annual increase of cruise passenger numbers at Baltic Sea ports, 2005-2008.

Energy and Undersea Infrastructure

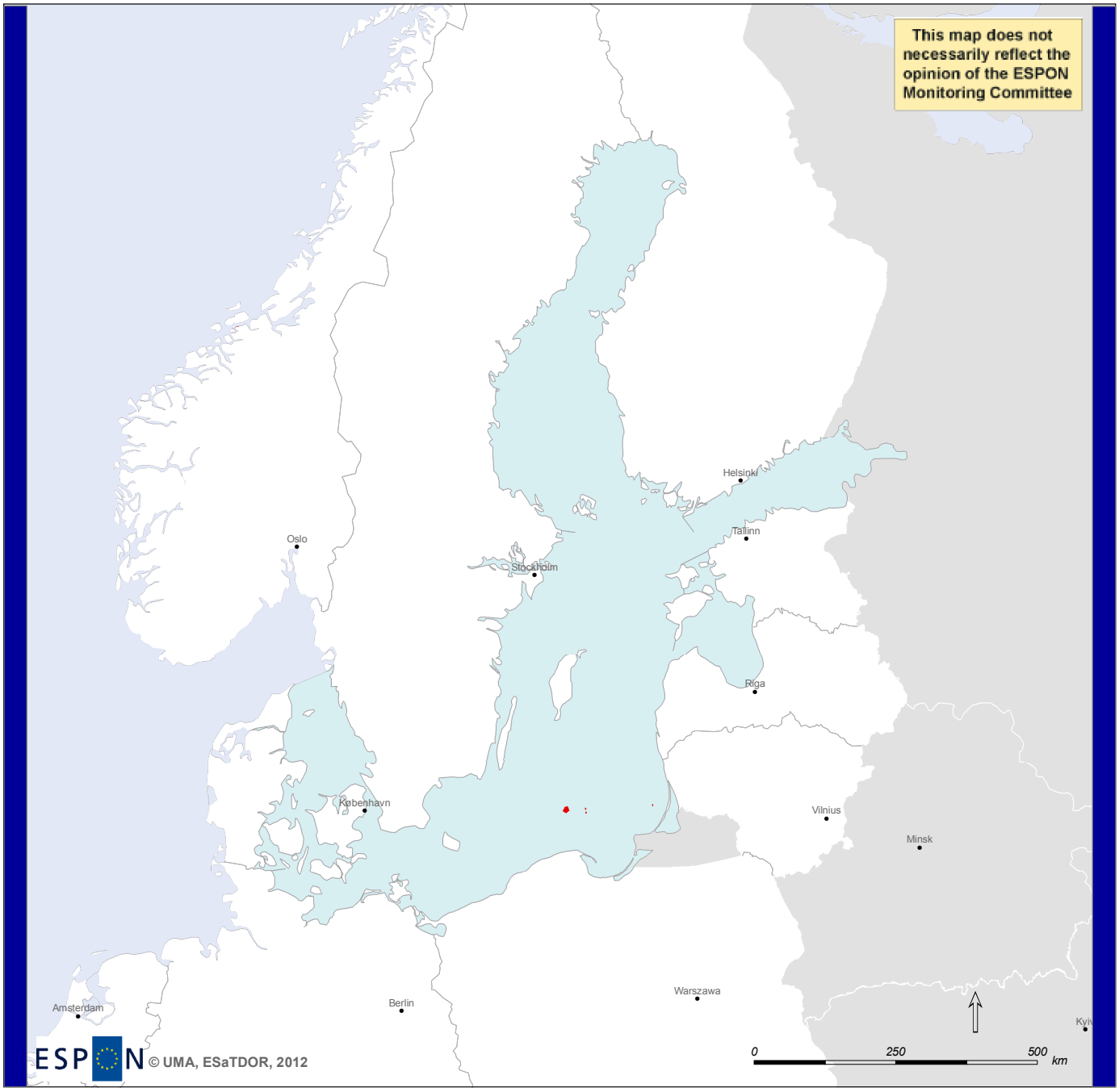
Energy production and transportation in, on or across the Baltic Sea has fossil and renewable dimensions. Oil is extracted from four oil platforms (Map BA18a), all of them being located in the south-eastern part of the Baltic Sea. Three of the platforms, Baltic Beta, Petro Baltic and PG-1, are in Polish waters, and one, MLSP D-6, is in Russian waters. The reserves in these oil fields (Kravtsovskoye, B-3) are estimated to last until 2030 or longer (WWF, 2010). Interest in oil exploration in the Baltic Sea is growing and further oil has been found southeast of Gotland as well as along the German-Polish coastline but this is not yet extracted.

Transportation of fossil energy across the Baltic Sea plays an increasing role. In particular Russia possesses large amounts of oil and gas and has a strong strategic and economic interest in the export of its fossil energy carriers. In 2011 the North Stream gas pipeline from Russia to Germany was inaugurated (see Map BA21). Further natural gas pipelines are under preparation, e.g. the "Baltic pipe" project between Denmark and Poland. Furthermore Russia is currently enlarging its infrastructure for oil export via the Baltic Sea. The Baltic Pipeline System (BPS) transports oil from West Siberia and Urals-Volga regions to Primorsk, an oil terminal at the eastern part of the Gulf of Finland. This pipeline system was expanded by BPS-2 in March 2012, connecting the Druzhba pipeline near the Russia-Belarus border with the new oil terminal Ust-Luga. The new oil port of Ust-Luga, south-west of St. Petersburg, was opened in April 2012. Russia, the world's top oil producer, exported about 28 per cent of its crude oil via the Baltic in 2011 (Bloomberg, 2012). All in all about 70,000 tanker movements are registered by AIS in the Baltic per year (HELCOM, 2010b).

Jobs in the extraction of oil and gas play a minor role in the BSR due to the currently limited number of oil rigs (Maps BA18b, BA18c). The major exception is Estonia which benefits from the activities of its Russian neighbour. Also Denmark shows a high number of jobs in the oil and gas industry, this, however, is most probably related to North Sea activities mainly in British and Norwegian waters.

Especially in the western Baltic Sea Region, the share of renewable energies is increasing. In some of the Baltic Sea States national renewable energy policies are partly more ambitious than Europe's 20-20-20 targets (greenhouse gas reduction of at least 20%, 20% of energy consumption from renewable resources, 20% reduction in primary energy use). The generation of renewable energy by offshore wind farms is likely to increase significantly, primarily in the Western Baltic Sea where wind conditions are slightly better than in the eastern Baltic Sea (Map BA19). In March 2012 Denmark passed a new Energy Agreement with the target of 100% renewable energy in 2050 (ENS, 2012). Already in 2020 half of its energy consumption will come from wind farms. The energy concept of the German Government aims at a share of 50% for offshore wind farms in the national energy production by 2050 (BMU, 2011). A capacity of 25 GW shall be installed offshore until 2030. Sweden's energy policy foresees a 50% share of renewable energies with 10 TWh offshore wind energy production in 2020 (Regeringskansliet, 2009). This will lead to a considerable expansion of today's offshore wind farms mainly in the Western Baltic Sea, where single wind farms have already been built in Danish and German waters during recent years. Offshore wind farm projects are on the way also in the Bothnian Bay (Sweden/Finland) and a few other areas. Energy generation potential from wave power in the Baltic Sea is low (see Map BA20), and at present there has been little testing of wave energy technologies in the region (SUBMARINER Project, 2012).

Location of Oil and Gas Rigs



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Thematic data: National Center for Ecological Analysis and Synthesis based on data from NOAA's National Geophysical Data Center, 2008; HELCOM and LOTOS Petrobaltic S.A., 2011. Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0. Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

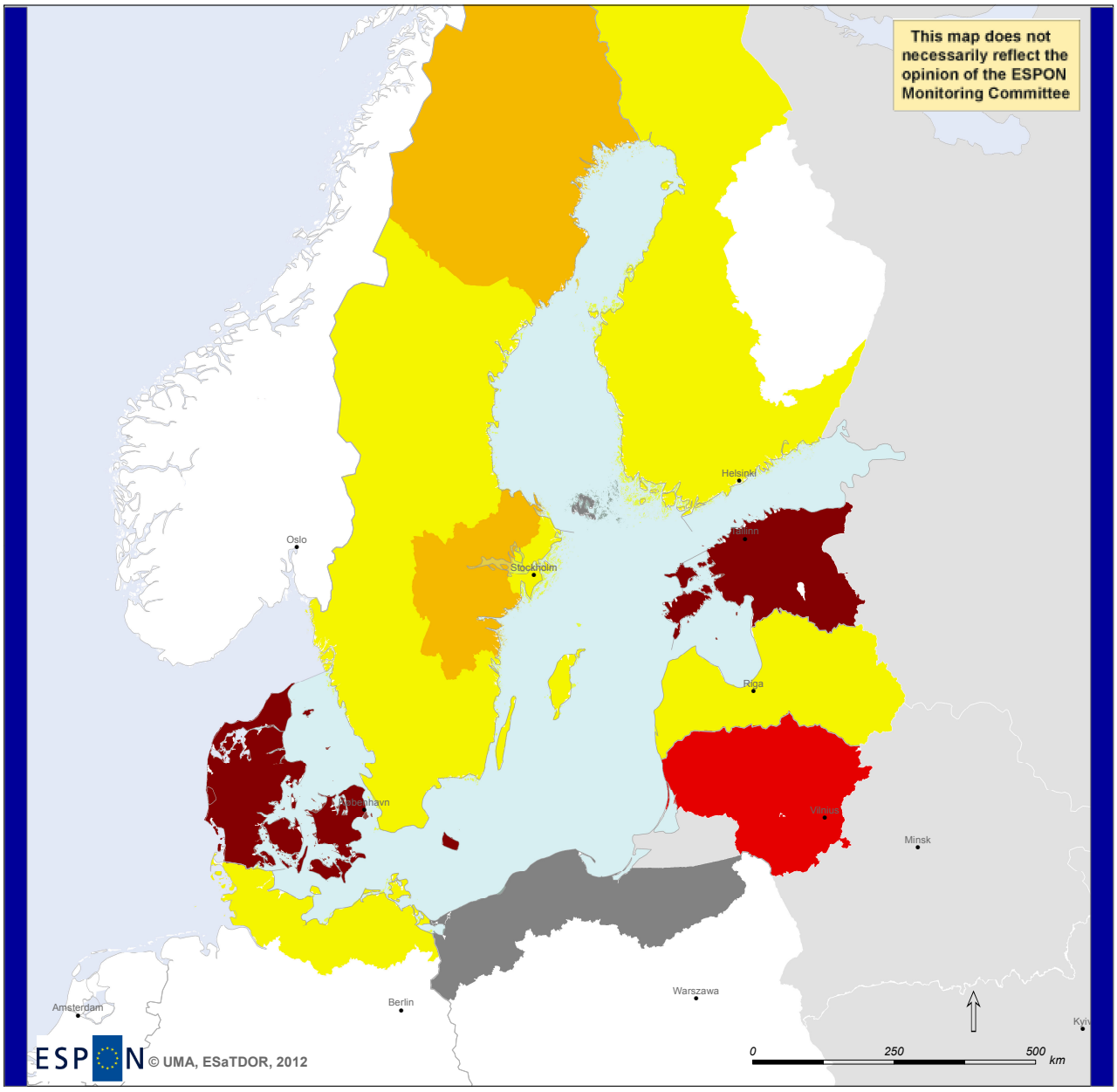
Location of oil and gas rigs

Oil and gas rigs

This map is produced using data on the location of stable lights at night (the Stable Lights of the World dataset) of a NOAA program with ephemeral sources of lights (e.g. fires, mobile structures) removed. Data represents presence/absence of light in a resolution of 30 arc-second for 2003. This has been integrated into a 10x10km grid based on the presence or absence of light in every cell, which does not mean that the whole cell is occupied by oil or gas rigs.

Map BA18a. Oil and gas platforms in the Baltic Sea, 2008

Employment in Oil and Gas (total number), 2009



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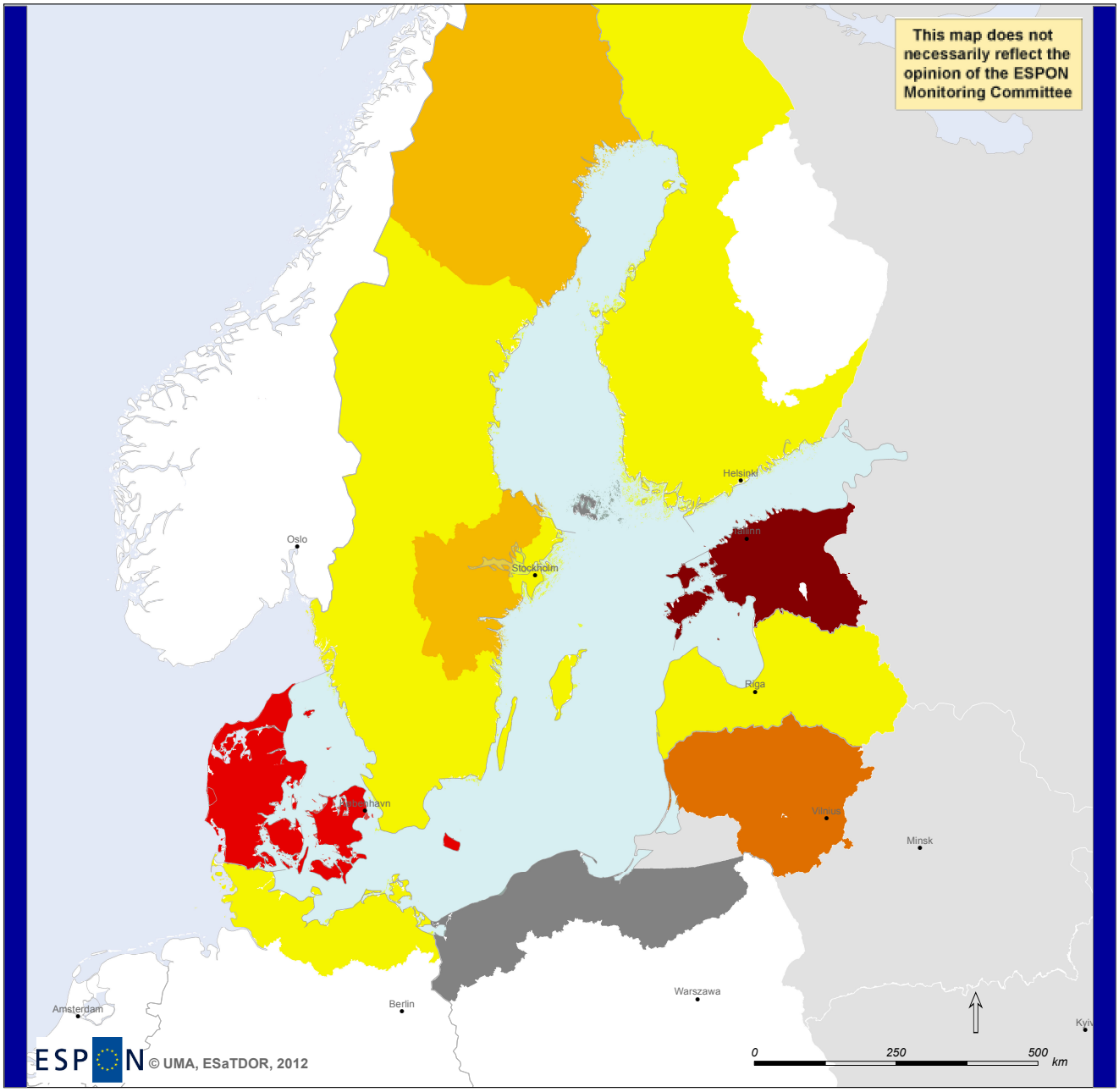
Thematic data: Economic Use, European Cluster Observatory, 2011.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Oil and gas 2009 (number of employees).

- 0
- 1 to 22
- 23 to 300
- 301 to 1,040
- 1,041 to 20,344
- No data

Map BA18b. Number of employees in the oil and gas sector in 2009 (please note: the maximum number of 20,344 employees does not occur in the Baltic Sea Region but in the UK).

Employment in Oil and Gas (% of total employment), 2009



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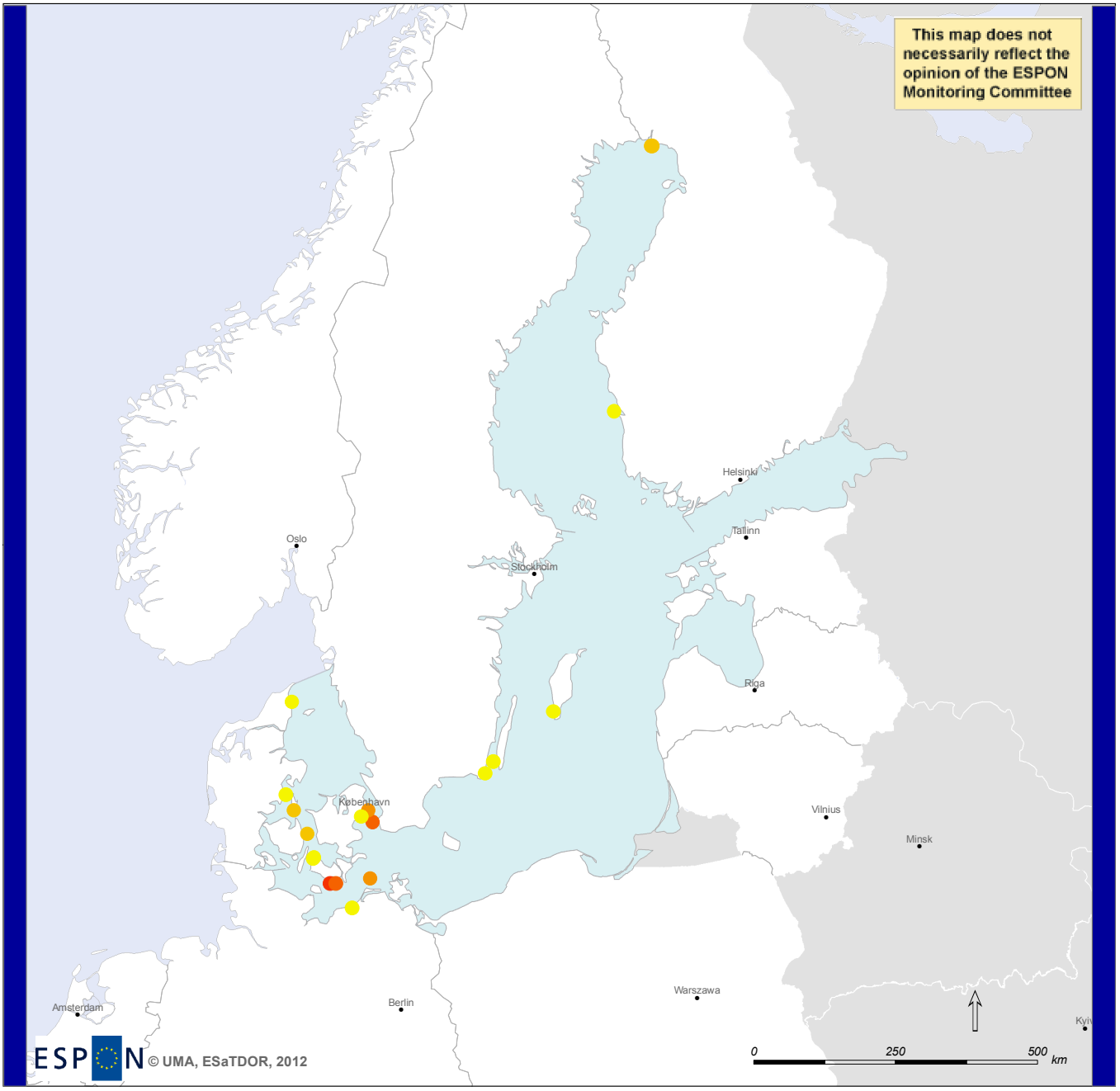
Thematic data: Economic Use, European Cluster Observatory, 2011.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

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 BA18c. Employment in the oil and gas sector (as a % of total employment) in 2009, Baltic Sea.

Offshore Wind Energy



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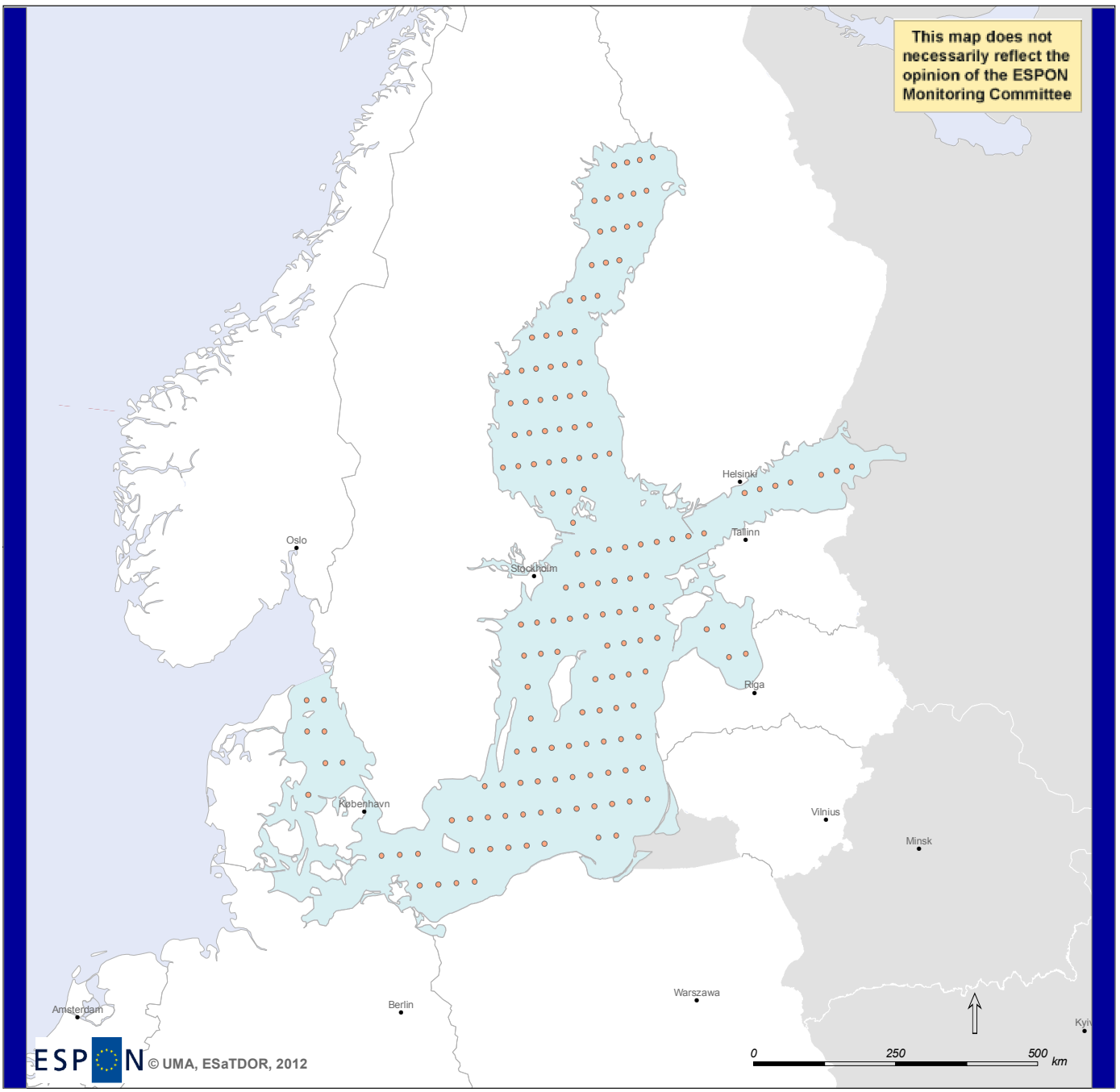
Thematic data: 4c Offshore/LORC Knowledge.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

Installed offshore wind energy capacity, (W/m^2)

- 0 to 10.5
- 10.6 to 30
- 30.1 to 60
- 60.1 to 165
- 166 to 317
- 318 to 630

Map BA19. Existing wind farm generation capacity in the Baltic Sea.

Wave Power Potential



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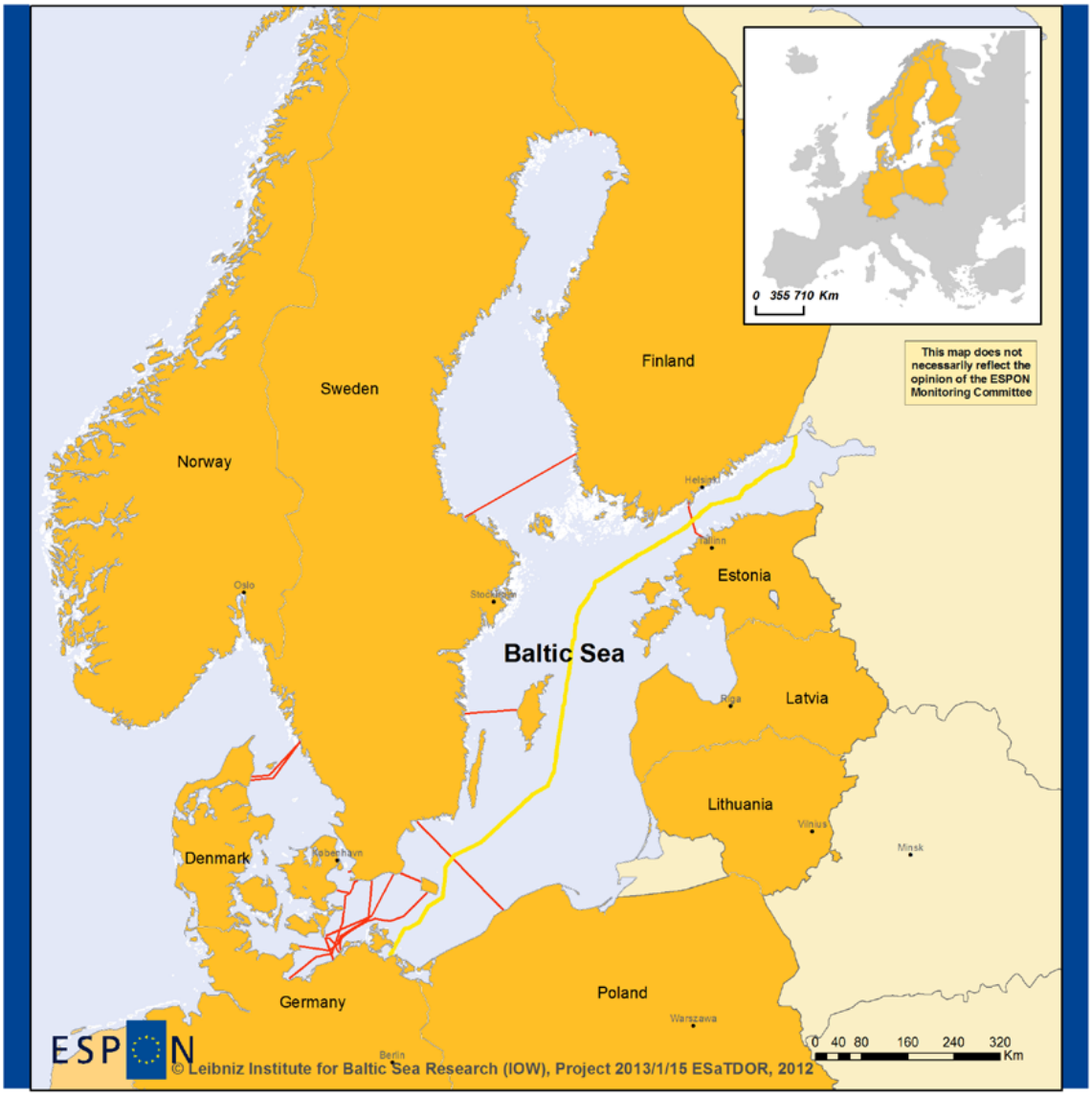
Thematic data: Fugro OCEANOR, Worldwaves, 2008.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

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 BA20. Wave power potential in the Baltic Sea.

Undersea cables and pipelines (HELCOM)



Map BA21. Cables and pipelines under the Baltic Sea in 2011 (HELCOM data)

Environment

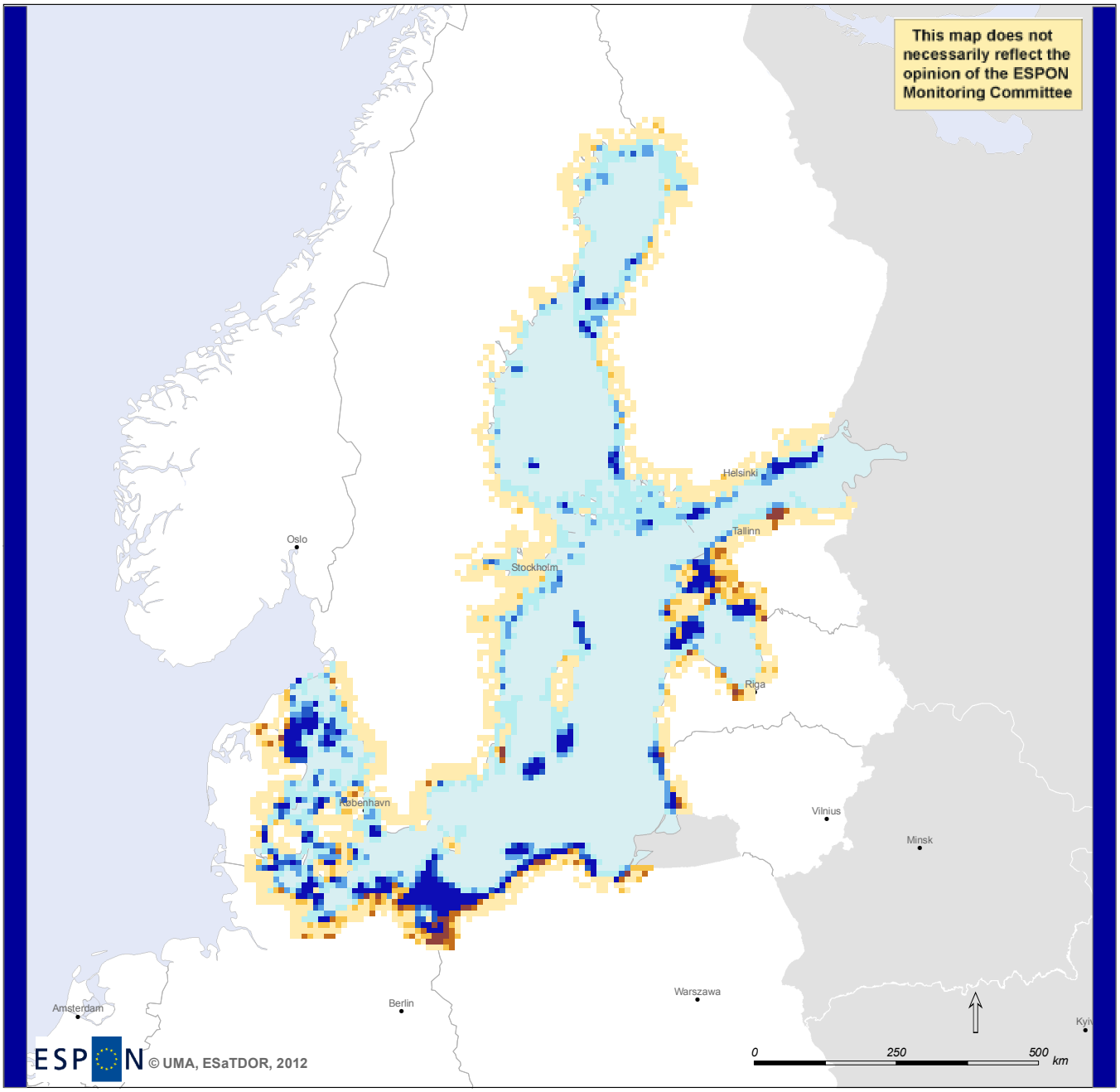
According to the HELCOM HOLAS-Assessment (HELCOM, 2010c) the environmental status of the Baltic Sea is generally impaired: “None of the open basins of the Baltic Sea has an acceptable environmental status at present.” This may partly be explained by the geographical, climatological and oceanographic characteristics of the Baltic Sea. It is a small sea and it is almost entirely enclosed by nine nations. Water exchange with open oceans is limited to the bottleneck of the narrow and shallow Danish straits. Contaminants brought into the Baltic Sea will stay there for comparatively long times due to limited water exchange with open oceans and water retention periods above 30 years. The input of riverine freshwater is larger than the inflow of saline water from the North Sea. This causes stratification of the water column with temporal hypoxia or anoxia at bottom water layers. Any increase in nutrients which augments biological productivity amplifies this problem. This is actually what happens in the Baltic leading to the largest dead zone in the world (Diaz & Rosenberg, 2008).

Eutrophication is a major problem in the Baltic Sea. Nearly all open waters are affected by eutrophication with the Bothnian Bay and Swedish parts of the north-eastern Kattegat being the only exceptions, the latter being renewed by oxygen rich North-Sea waters (HELCOM, 2009a). The same is true for all coastal waters where only the Gulf of Bothnia has some single areas left being unaffected by eutrophication. All others show impaired conditions including increased levels of nutrients and chlorophyll-a, loss of submerged aquatic vegetation, as well as periods of oxygen depletion particularly affecting benthic invertebrates (HELCOM, 2010c). Although the inputs of nitrogen and phosphorus have been significantly reduced since the late 1980s, large parts of the Baltic Sea still suffer from severe algae blooms which may partly be toxic.

The pollution of the Baltic Sea is especially serious as the Baltic is an ecologically unique sea. Being small on a global scale it is one of the world’s largest brackish water bodies. Sixty different benthic landscapes give home for a richness of about 100 species of fish, 450 macroalgae species, about 1000 zoobenthos species and many thousands of plankton species and partly unknown bacteria and viruses (HELCOM, 2009b). Furthermore the Baltic Sea is characterised by a number of gradients, e.g. salinity gradients with decreasing salinity from west to east and south to north. The sub-basins therefore show varying physical-chemical and biological conditions. Due to this variety of conditions many species live already on the brink of their possibilities while others are relatively robust due to large variability of hydrographical conditions. All in all this leads to a unique mix of marine, brackish and fresh-water species. This ecosystem is not only valuable as such, it provides also a variety of goods and ecosystem services such as nutrient recycling, climate regulation, food production and others (HELCOM, 2009b). Considering the impaired environmental status this leads to a need for the protection of certain habitats and functions. Approximately 7 per cent of the Baltic Sea is currently protected under Natura 2000 with a focus mainly on territorial waters (Map BA22; BALANCE, 2008).

Most flora and fauna in the Baltic Sea are postglacial immigrants as the Baltic Sea is a comparatively young sea. Some of these invaders are considered as alien species occurring outside of their natural range. Since the early 1800s, about 120 alien species have been recorded in the Baltic Sea (Map BA23; HELCOM, 2009b). Alien species may alter the taxonomic structure of established communities.

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

Protected areas (Natura 2000 and CAFF sites)

Percentage of grid size (Land)

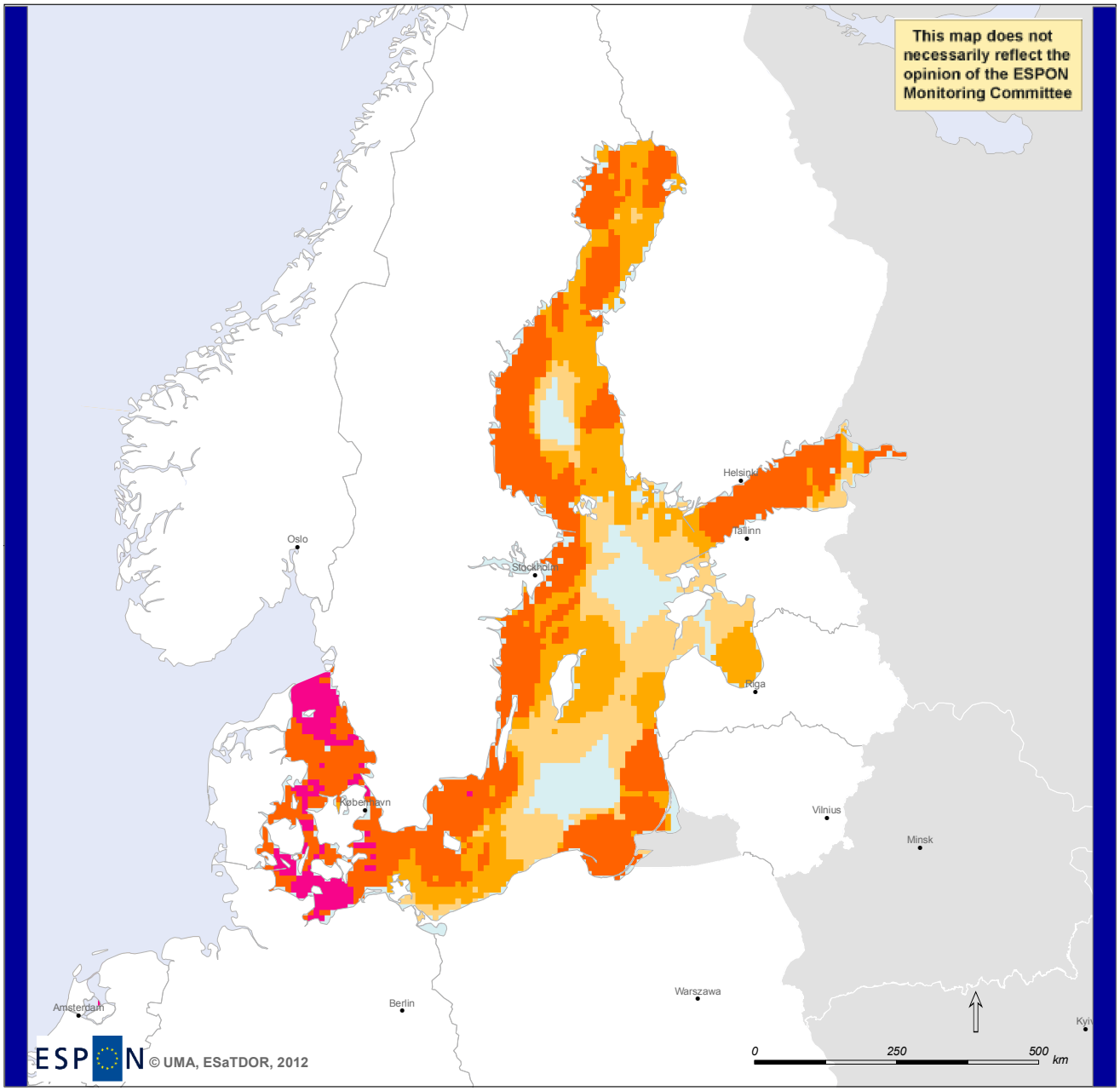
- > 25%
- 25 to 50%
- 50 to 75%
- > 75%

Percentage of grid size (Sea)

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

Map BA22. Protected areas (Natura 2000 and CAFF sites), percentage designated per 10km grid square. Baltic Sea.

Invasive Species



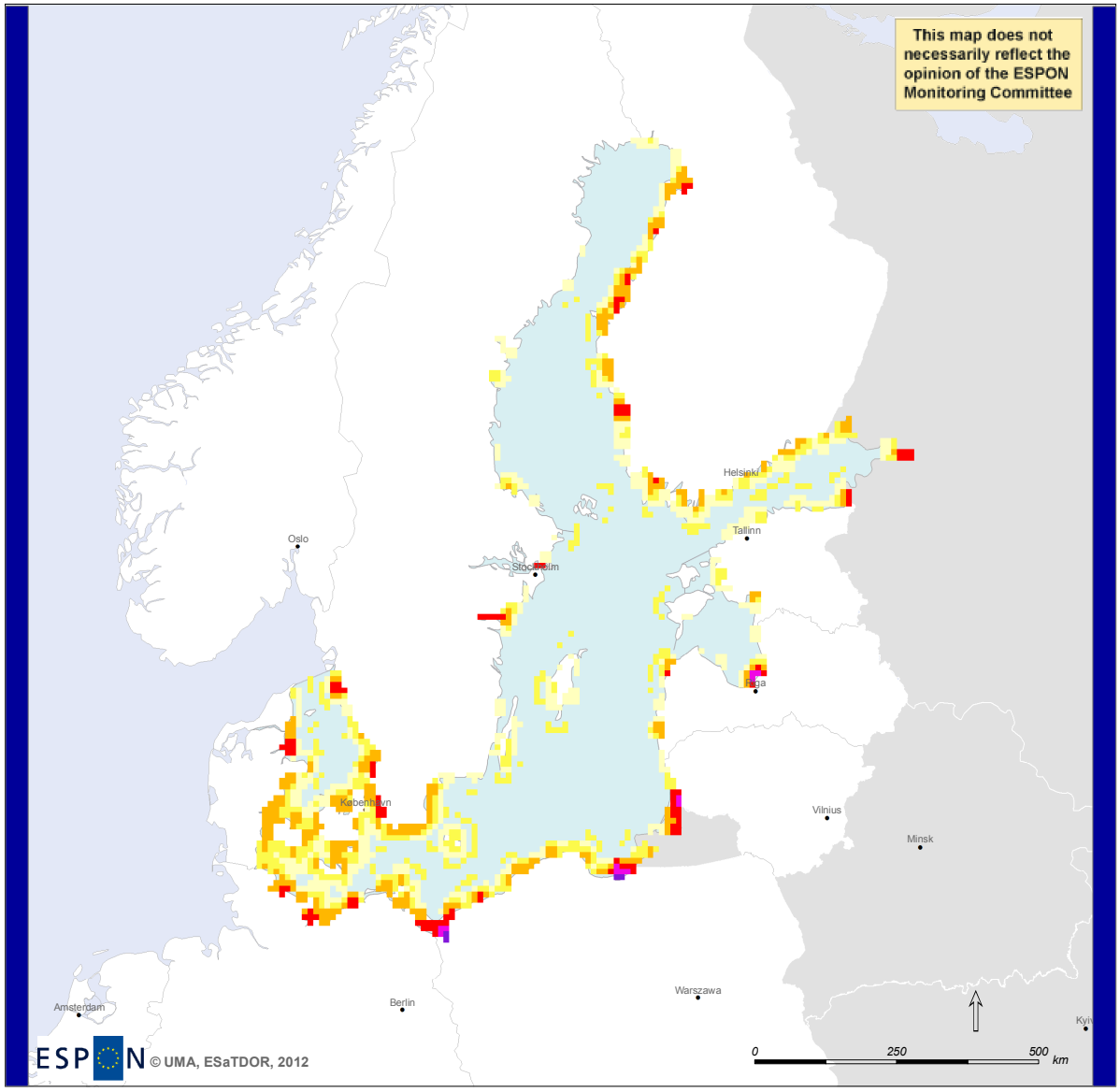
Total number of invasive species per grid square (October 2004 - October 2005)

0	301 to 600
1 to 50	601 to 1,200
51 to 100	1,201 to 2,400
101 to 300	2,401 to 3,011

Map BA23. Incidence of invasive species per 10km grid square (October 2004 - October 2005), Baltic Sea.

During the late 1990s and early 2000s the Baltic Sea was an area with high contamination by hazardous substances (HELCOM, 2010c), especially the central parts (Northern Baltic Proper, Gotland Basin) together with parts of Kiel and Mecklenburg Bights were most disturbed by hazardous substances such as persistent organic pollutants (POPs) (Map BA24) or heavy metals. For some substances there are positive signals of decreasing trends. These are mainly related to bans or restrictions on the production and use of those substances.

Organic Pollution



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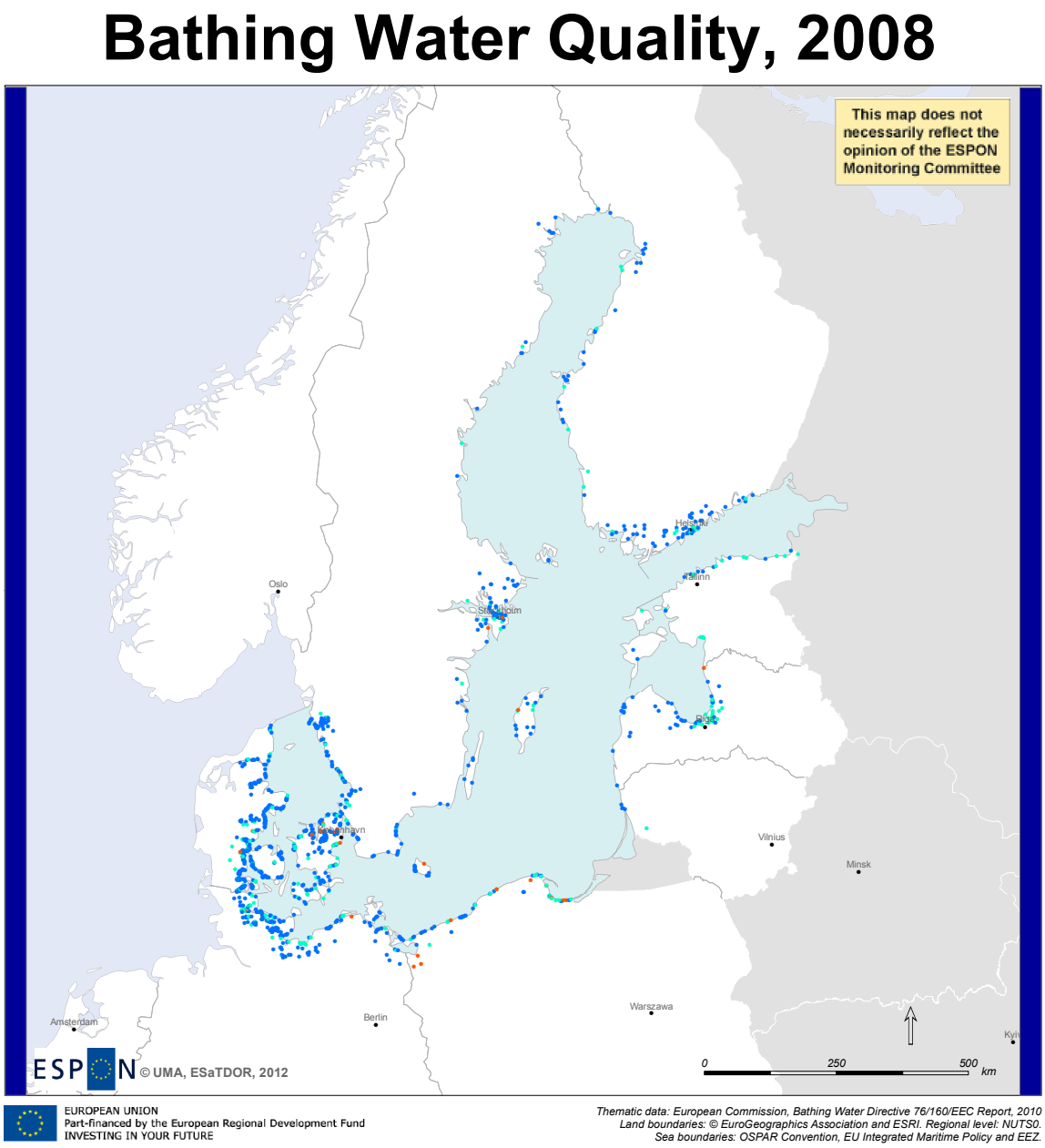
Thematic data: National Center for Ecological Analysis and Sysnthesis, Organic Pollution, 2008.
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS0.
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

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 BA24. Sources for organic pollution (pesticides), Baltic Sea.

In the Baltic Sea Region there are about 660 coastal bathing water sites with 93.5 % of them being in compliance with the mandatory values of the Bathing water Directive 2006/7/EC (Eurostat, 2012c). Problems exist mainly around larger urban complexes and at the estuaries of larger rivers (Map BA25).

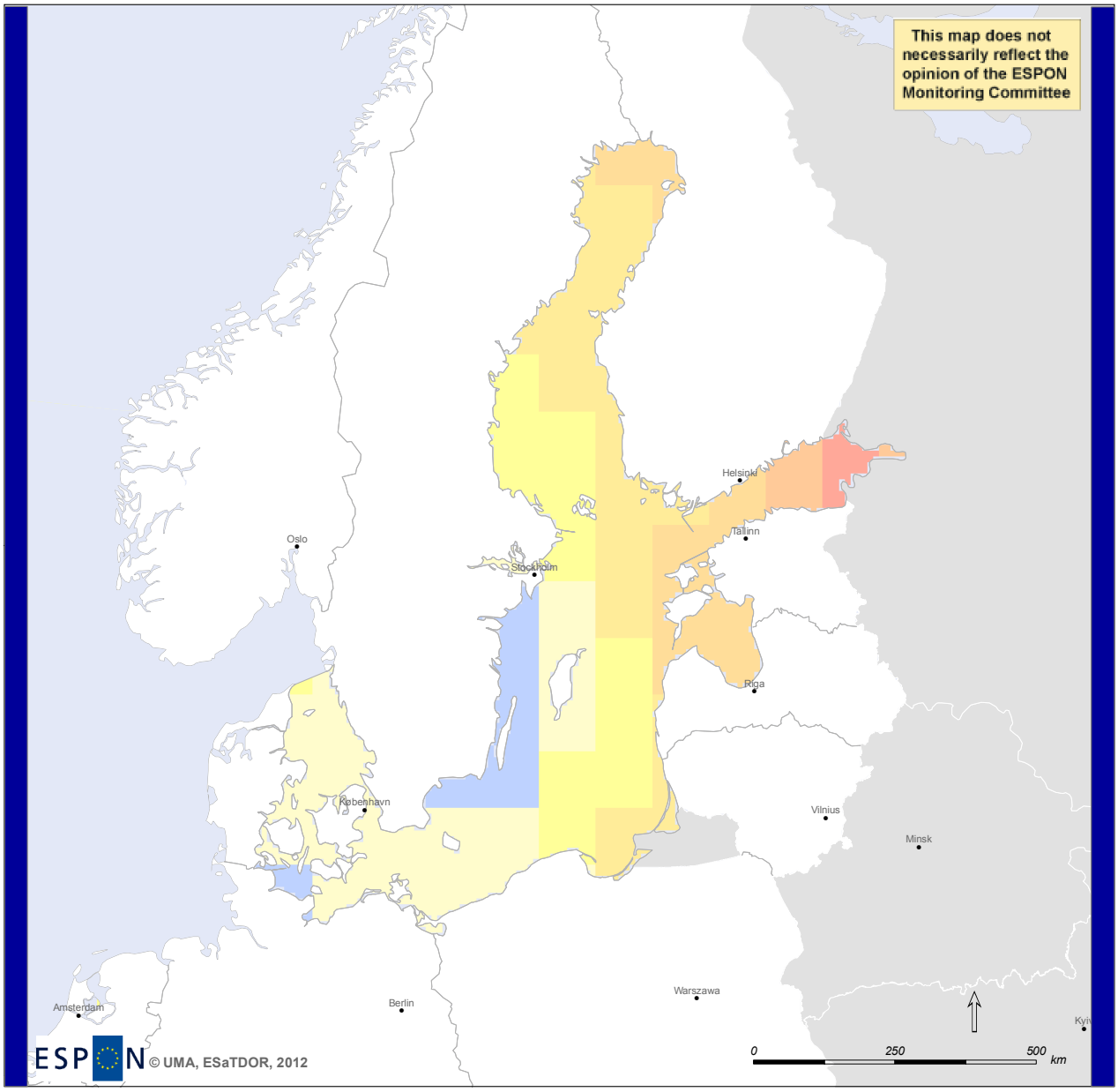


Map BA25. Status of bathing waters relative to the Bathing Water Directive in 2008, Baltic Sea.

From 1981 to 2011 the sea surface temperature (SST) of the Baltic Sea has shown an increase especially in eastern parts (Map BA26). Modelled studies (Neumann, 2010) suggest a further warming in SST, which is expected to be in the range of 1–4 K depending on IPCC-scenario, season and region. Warming could be greatest in the Gotland Sea in spring. In the Bothnian Bay, the strongest SST change signal occurs is in summer if ice has covered the Bay previously.

During the ice season SST remains close to the freezing temperature; as long as sea ice covers the sea water, temperature changes are small.

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 BA26. Increase in sea surface temperature (degrees Celsius) between 1981 and 2011, Baltic Sea.

4. Governance Case Studies

Governance for marine and maritime issues in the Baltic Sea Region has evolved over a number of decades. Against this background the governance structures and processes had and have to adapt to changing situations. When the decision was made to found HELCOM, The Baltic Marine Environment Protection Commission, in 1974 the Baltic Sea Region was characterised by the so called Cold War. The Baltic Sea Region was divided into two opposing alliances (NATO and Warsaw Pact) with Sweden and Finland being neutral. In contrast the decisions to re-establish HELCOM and to found VASAB, The Baltic Sea Region co-operation of Ministers for spatial planning and spatial development, were made in a situation where the Baltic Sea Region was in an upheaval process with numerous new and independent states. EU enlargement and increasing European competences in both marine conservation and regional development policies again changed the situation for the regional governance arrangements. This partly led to an increasing pressure on some of the pan-Baltic institutions and may have helped them to be innovative in developing regional tools and policies. On the other hand the legitimation for the existence of these pan-Baltic bodies is also based on the fact that the Baltic Sea Region countries felt a strong need for their own regional attempts and solutions in addition to national and European policies.

The four Baltic Sea governance case studies highlighted here are:

- The Baltic Marine Environment Protection Commission (HELCOM)
- The Baltic Sea Region co-operation of Ministers for spatial planning and spatial development (VASAB)
- The joint HELCOM-VASAB Maritime Spatial Planning Working Group (HELCOM-VASAB MSP WG)
- The case study “Pomeranian Bight” of the BaltSeaPlan project

All of them are examples for transnational governance. HELCOM is the pan-Baltic body to safeguard the marine environment of the Baltic Sea. Being a soft-law institution HELCOM needs the cooperation of its contracting parties. To achieve its aims HELCOM acts as policy maker on different levels and is a forum for numerous stakeholders.

VASAB has larger spatial and thematic scale. Covering the Baltic Sea Region it deals with the broad concept of spatial planning and regional development. Nevertheless, VASAB focused relatively early on the sea as a fundamental pillar for accessibility, integration and sustainable development of the macro-region. In comparison to HELCOM, VASAB does not seek publicity in the same manner. However, VASAB has been quite successful in influencing other bodies and is one of the forerunners in developing and establishing Maritime Spatial Planning.

In the HELCOM-VASAB MSP WG both parties, HELCOM and VASAB, cooperate to lay the foundation for transnational Maritime Spatial Planning in the Baltic Sea Region. This has not always been without tension as both parties had a different understanding of spatial planning. It is, however, a good example of knowledge transfer and cooperation beyond thematic borders to achieve sound transnational marine governance. Their degree of success will be measurable from 2013 on.

The BaltSeaPlan case study “Pomeranian Bight” again is an interesting example for non-binding cooperation between spatial planning agencies and stakeholders on a smaller regional level to solve conflicts and to achieve a common vision for the spatial development of marine space.

Something all case studies have in common is their work on a soft-law or voluntary basis and their openness and transparency.

Table 1: Summarised assessment of Baltic Sea governance arrangements

	HELCOM	**VASAB**	**HELCOM-VASAB MSP WG**	**BaltSeaPlan case study Pomeranian Bight**
Drivers	Nature conservation, pollution	Upheaval of the Baltic Sea Region after 1989.	Need for integrated marine management	Need for trans-boundary maritime spatial planning
Governance challenges	Novel approach that will maintain its relevance given EU marine and maritime initiatives and the integration of non-EU countries	Novel approach that will maintain its relevance given EU macro-regional policies and the integration of non-EU countries	A common vision for the Baltic Sea including aspects of conservation and regional development, a variety of planning traditions, legal and administrative situations	A common vision for the Baltic Sea including aspects of conservation and regional development, a variety of planning traditions, legal and administrative situations
Substantive challenges	Eutrophication, pollution, maritime transport, fisheries and others more	Transnational regional development, integration, accessibility	Realisation of transnational MSP in the Baltic	Maritime transport, offshore wind-farms, fisheries, nature protection, tourism, mineral extraction
Legal status	Non-binding recommendations	Political agreement, not legally binding	Political agreement, not legally binding	Voluntary, temporary, not legally binding
Effectiveness	Medium	High/medium	(pending)	Medium/low
Inclusiveness	High	High/medium	Medium	Medium

5. Characterisation of the Sea (current position)

The Baltic Sea underlies manifold uses. To illustrate this by a single sector of major concern: Around 2,000 ships are at sea at any time. The number of ships entering or leaving the Baltic Sea via Skaw in 2009 has increased by 20% since 2006. Each year 120-140 shipping accidents occur in the Baltic Sea (HELCOM, 2010a). Reading these numbers it has to be considered that the Baltic Sea is a comparatively small sea. Despite its limited space some parts of the Baltic Sea show a high density of uses. These uses can be classified into 12 sectors:

- Cables and pipelines
- Defence
- Fishery
- Heritage
- Mariculture
- Marine research
- Maritime transport
- Offshore wind farms
- Oil and gas extraction
- Other infrastructure
- Sand and gravel extraction
- Tourism and leisure uses

The intensity and spatial distribution of uses differs from sub-basin to sub-basin. In particular south-western areas of the Baltic Sea underlie a high density of uses while northern parts (Bothnian Bay) show low levels of anthropogenic use. Reasons for this are, among others, low population density in adjacent land areas as well as the fact that parts of the sea are covered by ice for several months per year.

The above presented variety of spatial information about anthropogenic activities on European Seas, the economic effects related to these and the environmental impacts caused by these allow deeper analysis of spatial patterns and interlinkages. The integration of this thematic information into composite maps gives a general overview on the economic, transport and environmental situation of Europe's seas.

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). These sums have been classified by quintiles as follows:

Table 2: 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

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

A similar approach generated composite maps for maritime transport patterns (flows) and environmental impacts. The environmental impact 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 3: Composite classification of environmental impacts

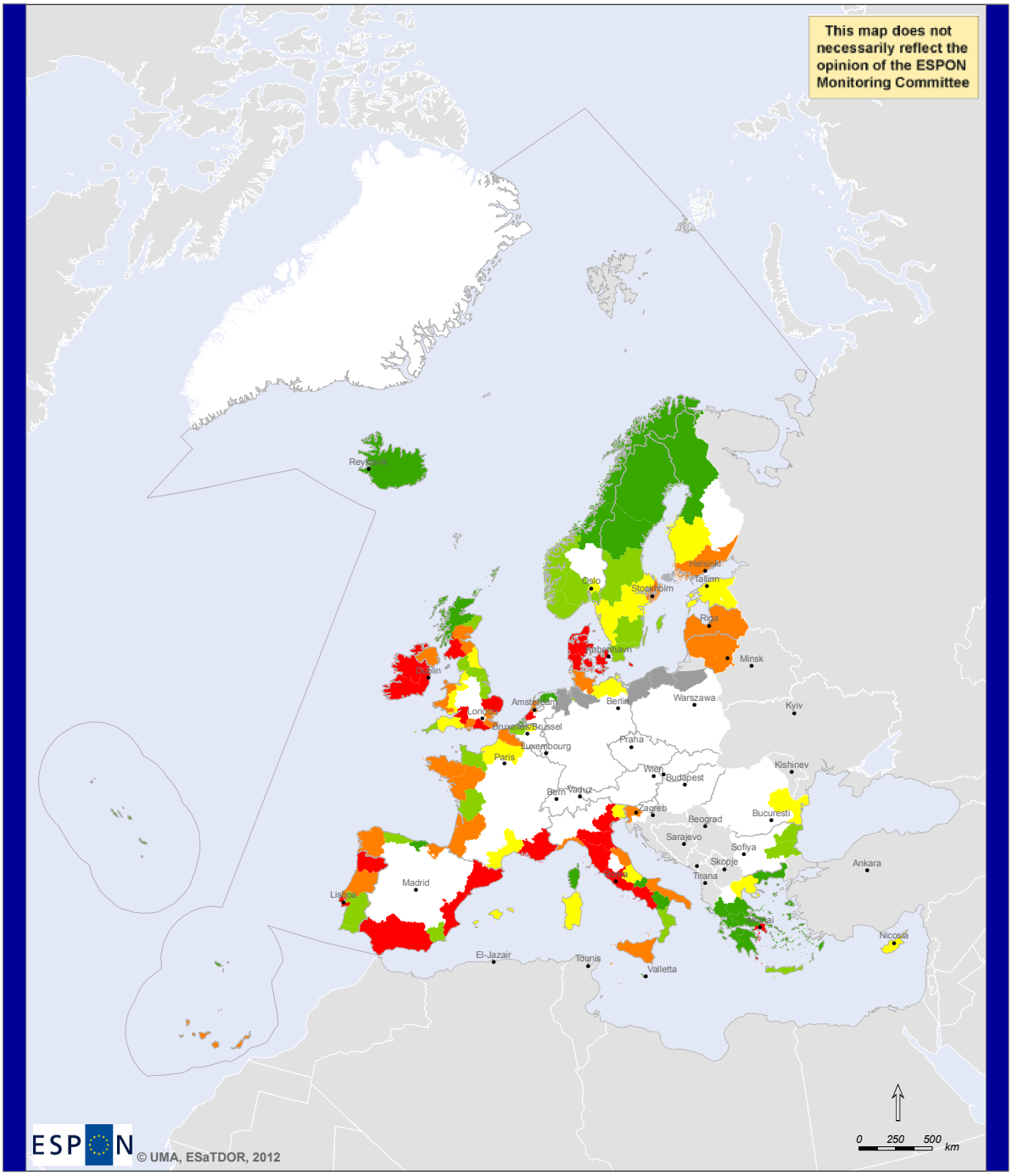
Organic Inputs	Invasive Species	Inorganic Inputs	Category name
-	0*	-	-
1 – 60	1 – 60	0.1 – 320	Very Low
60 -120	60 -120	320 - 640	Low
120 – 180	120 – 180	640 - 960	Medium
180 - 240	180 - 240	960 – 1,280	High
240 – 7,662	240 – 3,030	1,280 – 10,186	Very High

The picture emerging for the Baltic Sea Region shows a low to medium share of maritime jobs for Denmark, Finland Germany, Sweden and Lithuania (Map BA27, BA28). Estonia, Latvia and also Poland (being not presented in the map due to data constraints) show a higher employment share especially in traditional maritime sectors. The higher share of maritime activities in new European member states is partly caused by their economic structure and by their geopolitical situation as European border regions. On-going transformation processes, however, are leading to a decrease of traditional maritime jobs for some of them. Nonetheless, maritime economy may be a locally important employer both in new and old EU member states.

A broad variety of anthropogenic activities both on land and on sea cause environmental impacts in the Baltic Sea. Map BA29 combines pressures from invasive species, and organic and inorganic contaminants. In comparison to broader and more holistic approaches like the HELCOM Baltic Sea Pressure Index or the HELCOM Baltic Sea Impact Index, Map BA29 is rather selective but allows a Europe wide comparison. Especially the south-western Baltic Sea but also the Gulf of Finland and the Bay of Gdansk are under considerable pressure. While mainly ports and shipping activity contribute to higher invasive species values, organic and inorganic pollutants originate primarily from riverine discharges.

The Baltic Sea accounts for about 15% of the world's cargo transportation. Of great importance are connections between the Nordic countries (Denmark, Norway, Sweden, and Finland) and Central and Western Europe. Transport hotspots are therefore Baltic Sea regions between Germany and Denmark as well as between Estonia and Finland (Map BA30). The Baltic Sea is characterised by a large share of short-sea shipping showing intensive trades between neighbouring states but also a large volume of feeder services towards/from larger international ports in the North Sea. About 20% of AIS registered ships are oil tankers heading mainly from Russia towards the west.

Total Number of Employees in the Maritime Sector, 2009



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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.

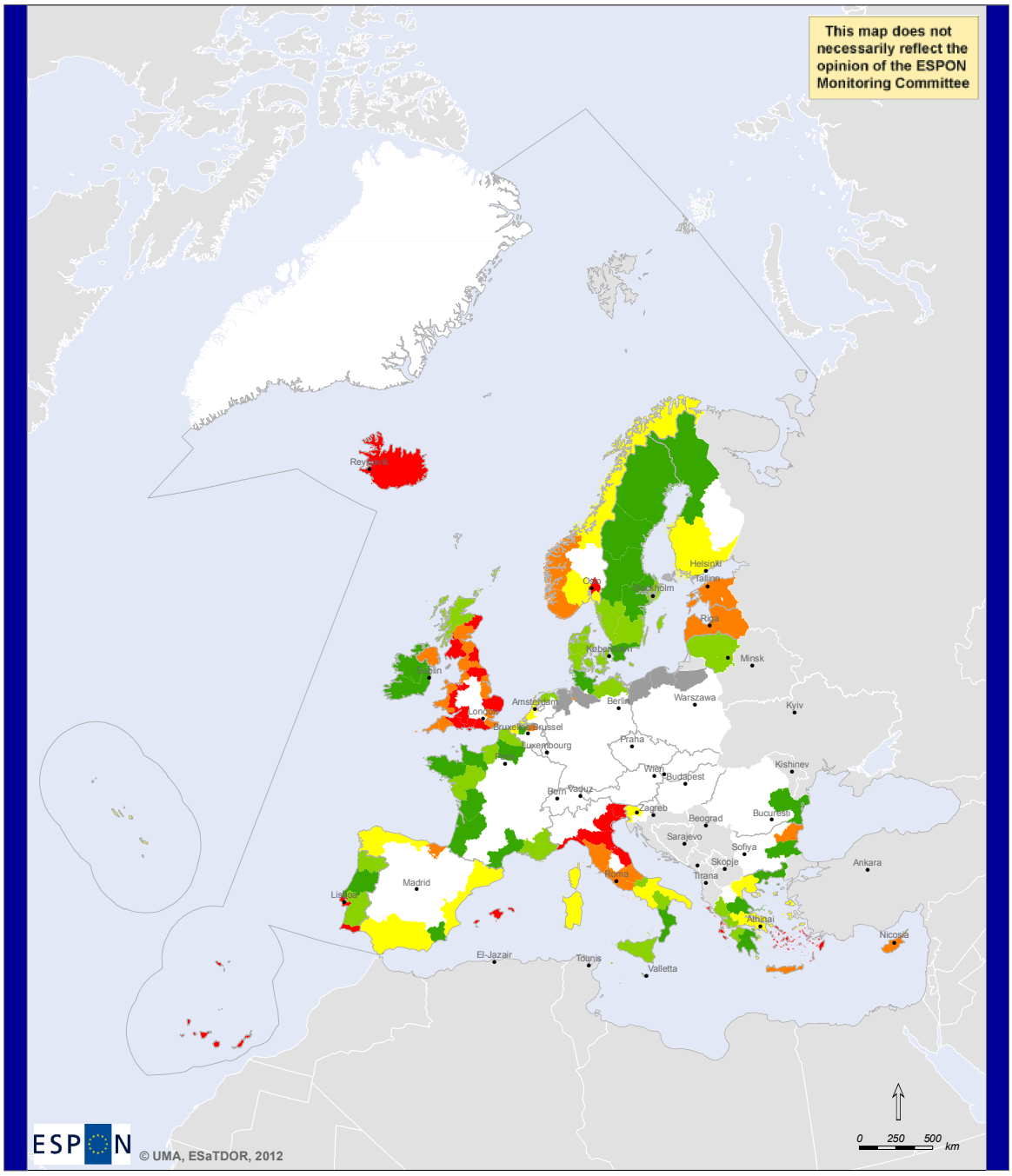
Economic Use Composite Map (total maritime cluster employees within each NUTS2 region).

- Very Low (8,005 - 51,861)
- Low (51,862 - 109,775)
- Medium (109,776 - 162,923)
- High (162,924 - 263,461)
- Very High (263,462 - 674,442)
- No data

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

Map BA27 Total maritime cluster employees per NUTS2 region, 2009

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.

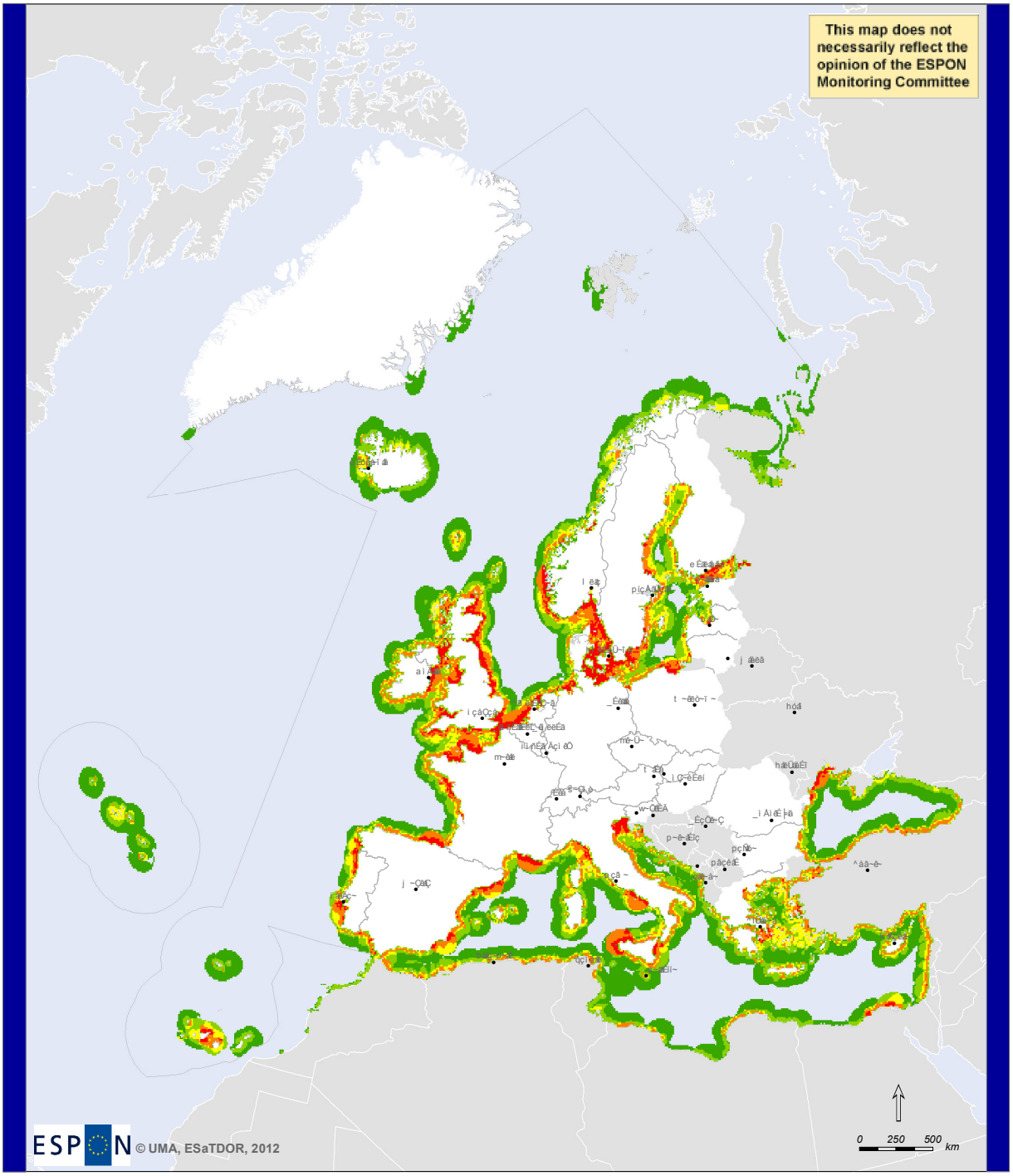
Total Maritime Employment Composite Map (percentage of total employment within each NUTS2 region)

- 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 BA28 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.

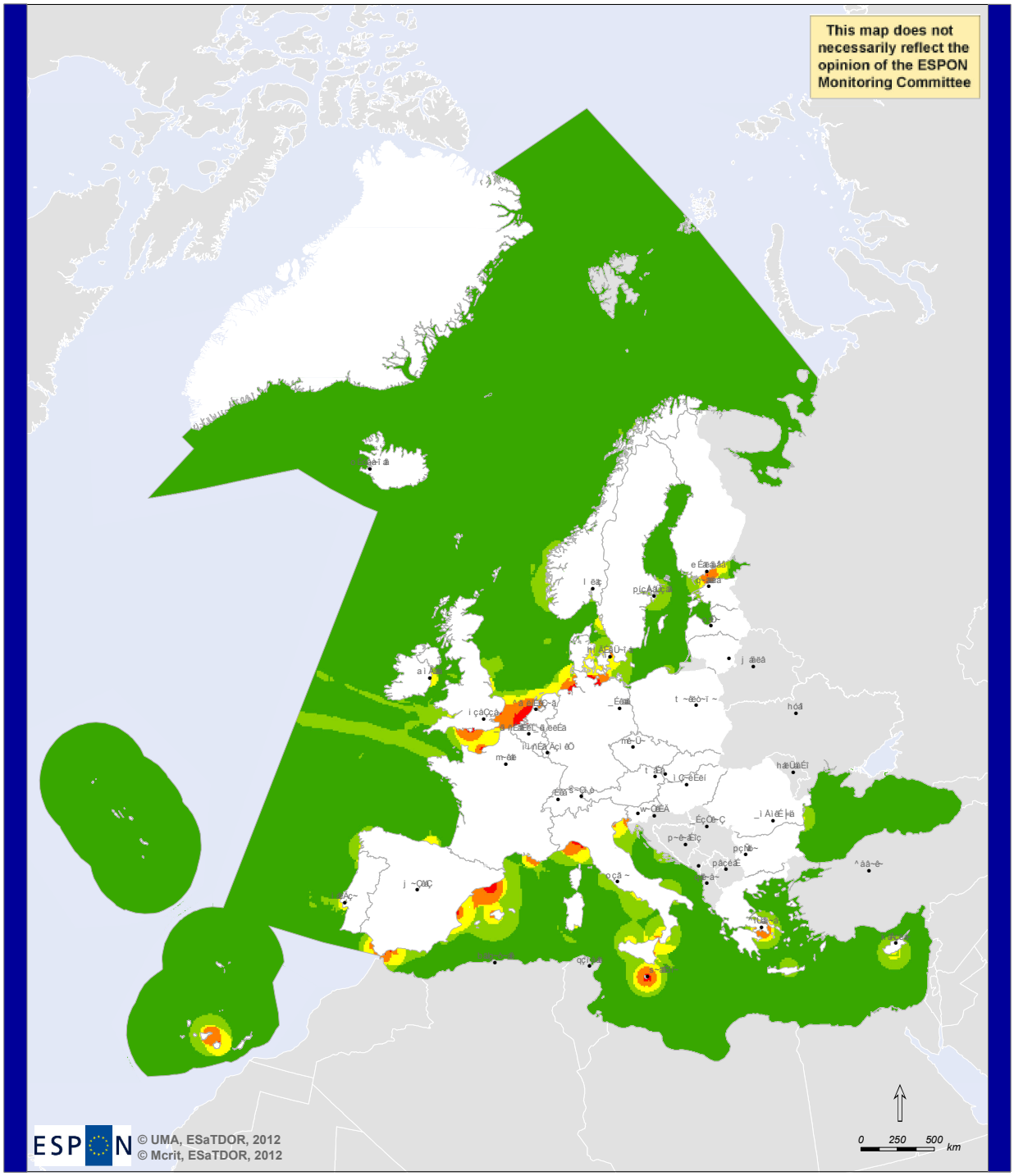
Environmental Pressures Composite Map

- sÉêó=ç ï
- i çï
- j ÉÇå ã
- e åÖÜ
- sÉêó=e åÖÜ

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

Map BA29 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

- sÉêó÷ çï
- i çï
- j ÉÇà ã
- e áÖÜ
- sÉêó÷e áÖÜ

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 BA30 Flows composite map

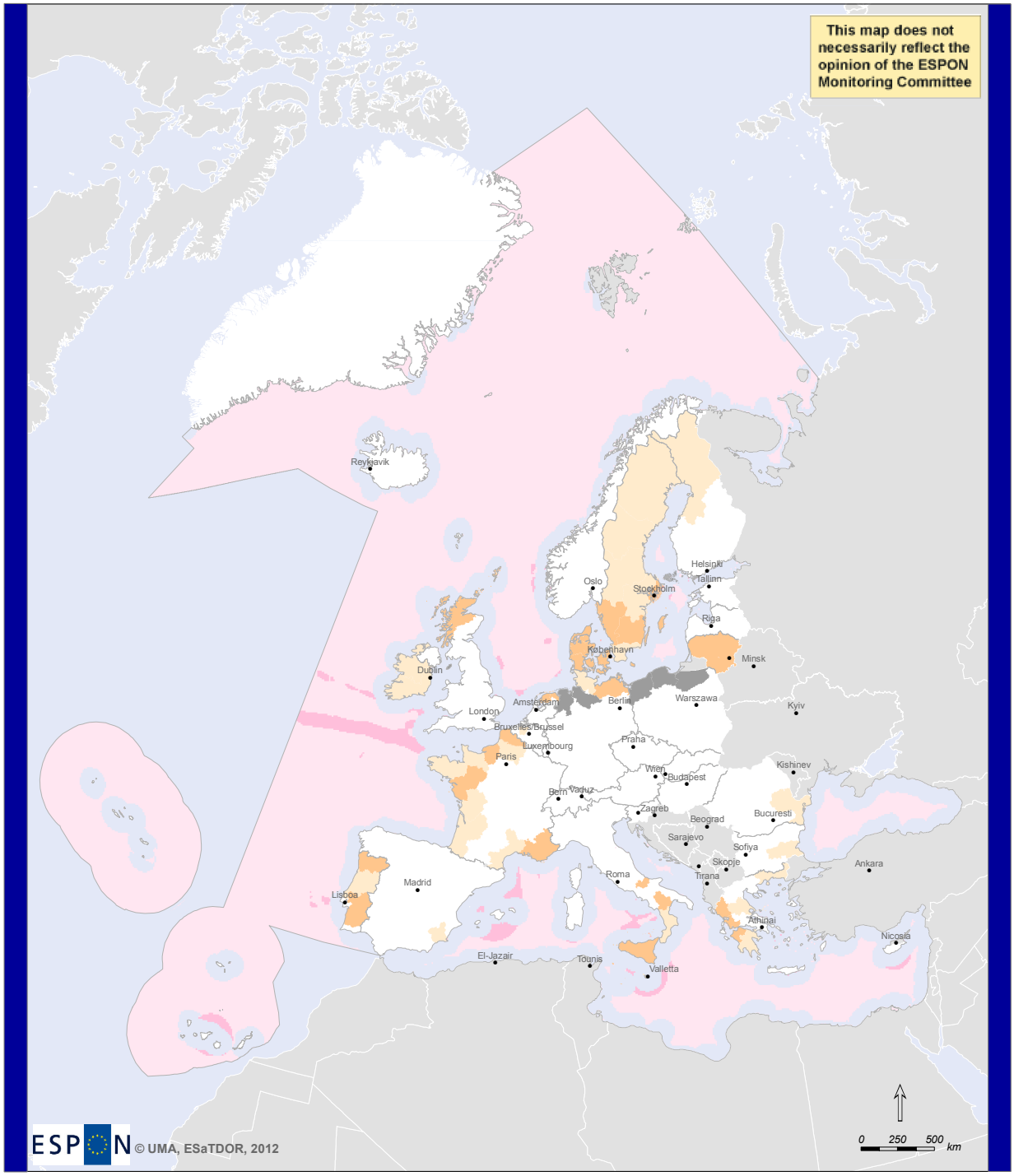
5.1 Towards a marine typology

Combining available European data sets on maritime economy, the spatial distribution of anthropogenic activities on the sea, transport patterns and environmental impacts as shown above, following maps show coldspots (Map BA31a) and hotspots (BA31b) for territorial development driven by European Seas. This sets the background for the final step towards a marine typology as shown in Map BA32.

One of the premises for these maps was that European data sets were used to ensure the Europe wide comparability of regional categories. For several sectors adequate information was not available on a European level. This is true for example for the most traditional anthropogenic use of the sea: fishery. Data with a reasonable spatial resolution was available for the Baltic Sea but not for all other European seas. Furthermore versatile data or simulations on environmental conditions and environmental impacts are available for the Baltic Sea including issues like underwater noise, dredging or eutrophication. Again, this data was not available as European-wide data sets. Also statistical data on employment effects of the maritime economy was insufficient. Within the Baltic Sea Region (BSR) this might lead to an under-representation, especially of Poland. Furthermore the following maps consider the share of maritime employment as percentage of the total employment (economic significance). This partly emphasises the role of the maritime economy especially in those national economies which are under transformation and where traditional maritime employment still plays a stronger but often decreasing role. A consideration of the total employment in the maritime sector (instead of percentage share) would lead to a slightly different picture with higher values for Denmark, Northern Germany, Southern Finland and Latvia.

Considering these weaknesses which are mainly related to insufficient data availability, the following maps (BA31a, 31b, BA32) should be understood as a demonstration of how a marine typology could be developed. For the Baltic the overall picture of *Regional Hubs* in the west/south-west BSR and in the Gulf of Finland are in compliance with further data sets and expert opinions. Also the consideration of the Bothnian Sea as a *Rural area* which is dominated by fisheries, a few leisure activities, some shipping and in the near future possibly by single wind farms is covered by additional Baltic data sets.

"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

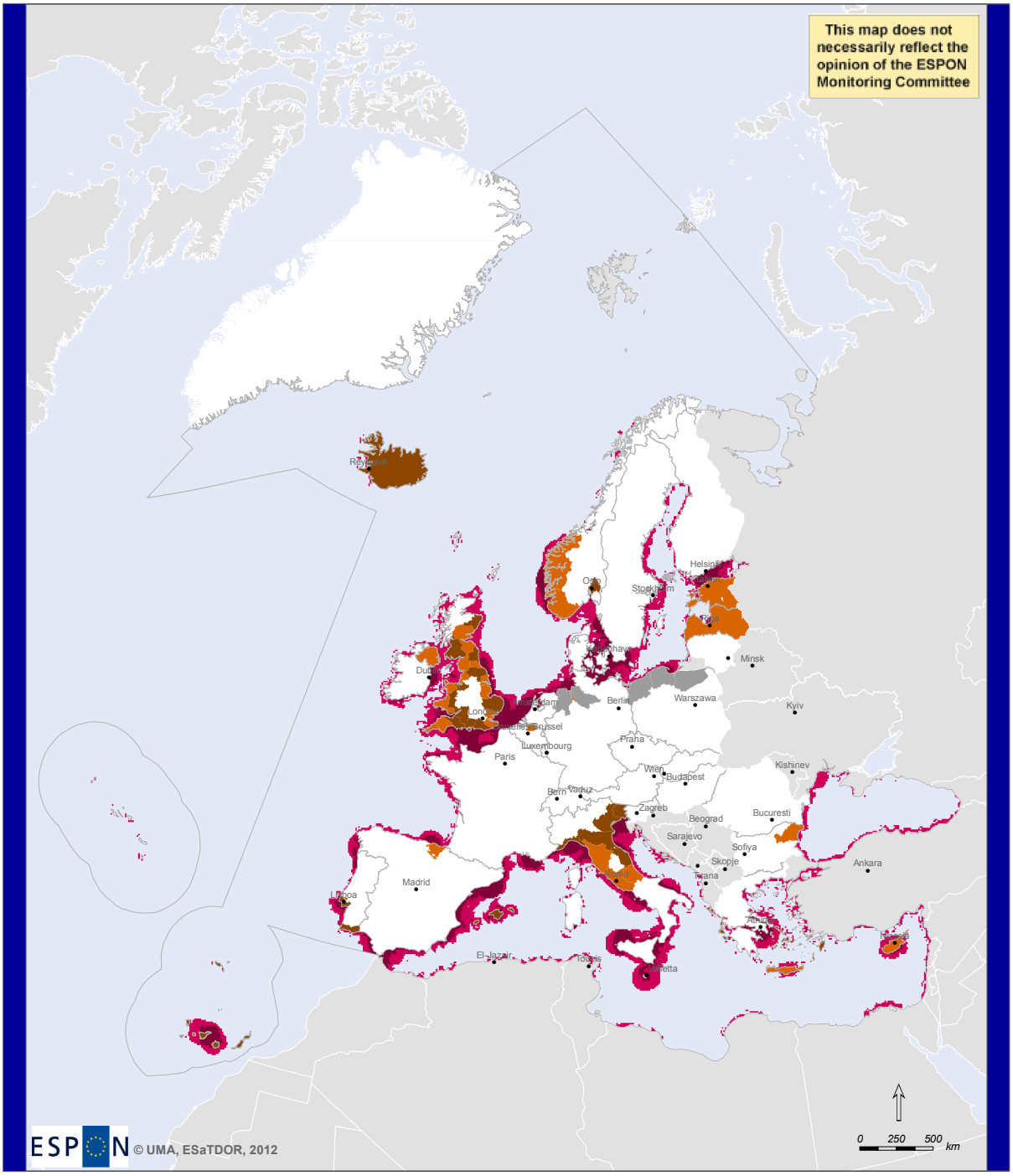
Land *(Economic Significance)*

- 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 BA31a "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)

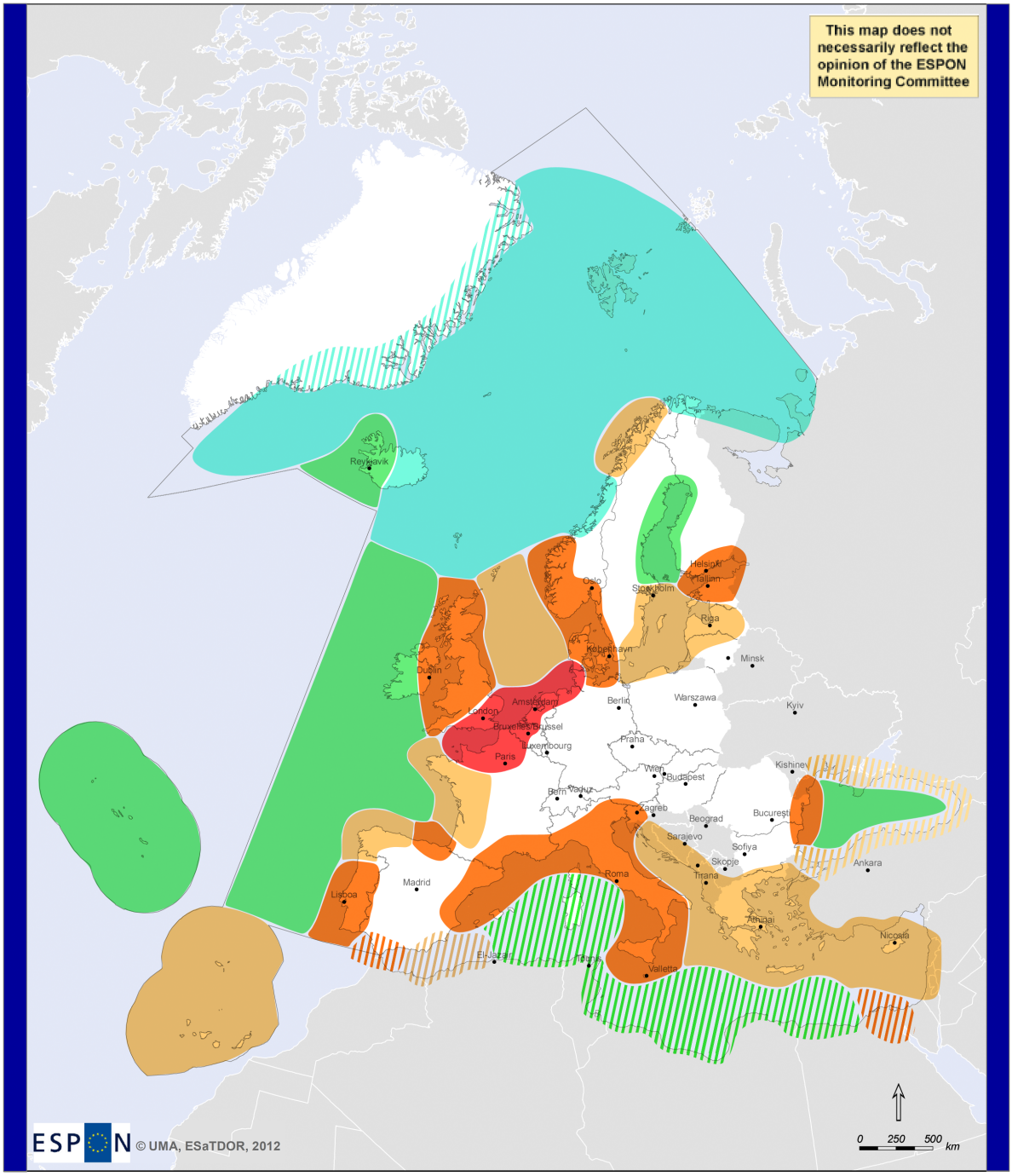
Sea *(Enviromental Pressures and Flows)*
- High intensity
- Very high intensity

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 BA31b "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 BA32 Typology of European maritime regions (schematic map)

6. Key Territorial Development Opportunities and Risks

The Baltic Sea Region has shown a successful convergence process over the last two decades. Revitalised historic ties around the Baltic Sea, increased pan-Baltic co-operation and the EU Cohesion Policy have led to new opportunities for growth and employment as well as increased environmental and social development. The Baltic Sea itself is both an obstacle and a driver for the development of the Baltic Sea Region. The VASAB Long-Term Perspective for the Territorial Development of the Baltic Sea Region (VASAB, 2010), which is aiming for a well-integrated and coherent Baltic Sea macroregion in 2030, states: "The Baltic Sea presents a natural obstacle for the expansion of the terrestrial means of transport, such as road and rail. At the same time, however, it is an outstanding asset for the development of an integrated maritime transport network between the BSR countries and regions to further enhance mobility and integrate labour markets.

The intense development of a range of economic activities, including, inter alia, offshore energy production, maritime tourism and sea-borne traffic, results in conflicting interests in using the Baltic Sea resources. Complemented with onshore based pollution of the Baltic Sea waters by nitrogen and phosphorus, as well as by hazardous substances from the catchment area, these sea use conflicts contribute to a gradual depletion of the resources and deterioration of marine landscapes. In the long run, they may negatively influence the development and quality of life of the BSR community." The ESaTDOR thematic briefing papers have identified a number of risks and opportunities for the territorial development of European Seas similar to the above VASAB statement. In the following section these opportunities and threats will be highlighted briefly for the Baltic Sea Region.

Energy and Pipelines

<u>Opportunities</u>

- *Fossil fuel Development*
  Extracting fossil energies plays no major role in the Baltic Sea. Only four oil platforms exist. Extended exploitation is possible in single onshore regions but this will be a minor development due to geological reasons. However, transport of fossil energy carriers, mainly Russian oil and gas, might lead to increased shipping capacities and further extensions of pipeline networks.
- *Marine Renewables*
  Being a semi-enclosed sea with relatively low salinity values, very limited tides and changing wave heights it is not likely that renewable ocean energies such as tidal power, wave power or osmotic power will play a substantial role in the near future. But the Baltic Sea has a potential for offshore wind energy which is not fully tapped yet. While so far Denmark and Germany are leading in the development of offshore wind farms, new wind farms are projected in Finland (for 2014), Estonia (2015), Poland (2015, 2018-2020) with an assumed capacity of 2800 MW (Anonymous, 2011).
- *International energy and telecommunication grids*
  Currently three new interconnector cables are under development (Finland-Estonia, Sweden-Latvia, Finland-Sweden). It is likely that additional grids will be established within the next 10-15

years against the background of the EU's 2020 renewable energy 20% target and to further improve the energy supply (De Decker & Woyte, 2011).

- *Carbon storage*
  CO2 storage capacities have been found mainly in south-eastern areas of the Baltic Sea (waters of Poland, Russia, Lithuania and Latvia). Carbon Capture and Storage (CCS) research and development projects are currently under development in Denmark and Germany (onshore) while mainland projects are planned in Poland. Maritime carbon storage is not developed yet but likely to be developed in the future (Haszeldine et al, 2011). Initial proposals already exist in Poland.

Risks

- *Increased carbon emissions associated with oil and gas development*
  Like other areas the Baltic Sea suffers from climate change in a large variety of ways. Impacts differ along diverse gradients from north to south and east to west, for details please see the BACC report (BACC Author Team, 2008).
- *Environmental damage associated with new energy sources*
  New energy sources (offshore wind farms) and new energy transport grids (cables, pipelines) can lead to various environmental impacts with the Baltic including changes in food web and habitat structures. Intensive development of new energy sources could be an additional pressure on the Baltic Sea. This is however depending on local conditions wherefore a general assessment is not possible here.
- *Restrictions to other sea uses associated with energy development*
  The Baltic Sea is already today heavily used with multiple spatial claims for most of the area. Additional anthropogenic uses will lead to an increasing number of spatial conflicts.

Transport

Opportunities

- *Growth of shipping*
  The Baltic Sea is among the busiest seas (each month around 3,500-5,000 ships ply the waters of the Baltic Sea and about 2,000 ships are on Baltic waters at any given moment). Both the number of ships and the size of ships (and so the quantities of cargo) on the Baltic have been growing rapidly until 2008 with a decrease in 2009 due to the economic crisis (Eurostat, 2011). Further growth of maritime transport is assumed (cf. transport chapter) in the near future.
- *New maritime routes*
  Being a semi-enclosed sea it is unlikely that shipping routes within the Baltic will change within the near future. In the long run decreasing ice coverage might lead to more frequent shipping into the Bothnian Bay (e.g. heading for mines in northern Finland) and an Artic passage could lead to increased shipping via northern ports.
- *Short Sea Shipping*
  Short Sea Shipping is - due to the geographical situation of the Baltic Sea - the major type of maritime transport and is likely to increase further.

- *Cruise activity*
  Cruise shipping is of major importance for various ports around the Baltic Sea. The number of cruise ship passengers has increased from 1.1 million in 2000 to 3.1 million in 2010. For 2011 almost 3.5million passengers are expected. It cannot be expected that these annual growth rates of around 11-12% will continue in future but further increase of passengers seems possible for single ports (Cruise Baltic, 2011).
- Cleaner shipping
  The Baltic Sea is designated by the International Maritime Organization as Particularly Sensitive Sea Area (PSSA). This allows only limited NOx emissions from ships. Against this background shipping might need to use cleaner power fuel in the future. Dual-fuel and/or gas motors (LNG) might become more common in future.
- *New infrastructure*
  In general there is a sufficient maritime infrastructure in place within the Baltic Sea Region. Increased shipping, technological revolutions and changes in demand will however lead to constant reconstruction and infrastructural adaption of Baltic ports. This is true also for a fuel-filling infrastructure with LNG (see above) and the allowance for LNG driven ships to enter Baltic ports. Both are currently insufficient.
- *Gas and oil shipping*
  Oil transportation is important in the Baltic Sea due to the export of Russian oil. The export of Russian oil alone is expected to reach 180 million tonnes by 2020 (HELCOM, 2010a). The overall export of oil from Russia is unlikely to increase and might decrease from 2036 on or earlier (Mäkivierikko, 2011). A significant increase of oil tankers over a longer period therefore seems also unlikely. Russian gas will be transported via the North Stream pipeline from late 2011 on. Transport of liquefied natural gas is likely to increase after a first terminal has been opened near Nynäshamn, Sweden.
- *Fishing*
  Fishery has been in decline in the Baltic Sea since the 1980s. Interest in aquaculture is increasing but limited water exchange in the Baltic is a large obstacle for conventional aquaculture.
- *Leisure development*
  Using yachts and sporting boats has a long tradition especially in Scandinavia. Increasing living standards mainly in the Baltic States, Poland and Russia and on-going increases in tourism development might lead to an increased number of leisure boats and marinas especially in southern parts of the Baltic.

<u>Risks</u>

- *Shipping accidents and pollution*
  Between 2004 and 2009 the number of yearly shipping accidents has varied between 105 and 146 accidents per year without a clear trend (HELCOM, 2011a). Most of these accidents occurred near shore or within ports. Only a small amount of accidents lead to pollution (e.g. ten accidents resulted in 2009). Increasing maritime transport is also likely to cause an increasing number of accidents in the future. Other ship based sources of pollution are illegal oil discharges (149 in 2010; HELCOM, 2011b), ballast water and exhaust emissions. Assuming that the Ballast Water Convention might be ratified in the near future and that the status of being a Particularly

Sensitive Sea Area (PSSA) declared by the International Maritime Organization in 2005 has further effects, the overall amount of pollution could possibly be limited to a minimum in the near future. But increased shipping might cause contrary results.

- *Administrative barriers to shipping*
  Like in other European seas EU customs legislation is an obstacle for maritime transport. It is a hurdle which can be cleared but raises transport costs. A solution to this problem would be to eliminate the border formalities in maritime transport in intra-EU trade. Elimination of customs formalities in maritime transport has been proposed by the European Commission initiative of the Common European Maritime Transport Space without Barriers. This initiative may enhance trade development and intermodal maritime transport in the Baltic Sea region (Kowalczyk et al., 2011).

Environment

Opportunities

- *Ecosystem preservation/improvement*
  Baltic Sea habitats and species are threatened mainly by eutrophication and hazardous substances. The inputs of some hazardous substances into the Baltic Sea have reduced considerably over the past 20 to 30 years, in particular discharges of heavy metals (1990-2007: -46% for cadmium, -23% for mercury, and -69% for lead). A range of anthropogenic activities contribute to the significant inputs of nutrients to the sea. Although nutrient inputs from point sources such as industries and municipalities have been cut significantly, the total input of nitrogen to the Baltic Sea is still almost 837,500 tonnes per year. The main source of nutrient loads to the Baltic Sea is agriculture. Mainly because of changes in meteorological conditions, annual nitrogen deposition to the Baltic Sea and its sub-basins varies significantly from one year to another in the period 1995 - 2007. Nevertheless, the annual deposition of oxidized, reduced and total nitrogen in 2007 was respectively 14%, 2% and 8% lower than in 1995 (HELCOM, 2011c). The Marine Strategy Framework Directive and the Water Framework Directive may lead to further improvement of marine water quality but setbacks are likely due to climate change and changes in agriculture.
- *Ecotourism*
  Sustainable tourism plays a strong role in the Baltic Sea Strategy and is currently supported by a number of projects (Baltic21, 2010). It seems likely that ecotourism will play an increasing role in the near future.
- *Maintaining fish stocks*
  Currently 33% of commercial fish stocks in the Baltic Sea are overfished and fishery fleets still have overcapacity in the Baltic. While the Common Fisheries Policy seeks to achieve a balanced commercial fishing system it is hard to tell how fish stocks will develop in future (HELCOM, 2011d).
- *Increased resilience*
  Resilience of the Baltic Sea is dependent on several variables, e.g. the catchment generating nutrient loads, the marine basins with their temporal and spatial nutrient and oxygen regimes in the water and in the sediments, and the food web as a responsive system to bottom up (salinity, temperature, nutrients, oxygen) and top down (fishery, seabird and seal predation) effects (BNI,

2011). While the resilience has increased during recent years future development is currently unsure as it is dependent on manifold parameters.

- *Carbon buffering*
  According to Kulinski & Pempkowiak (2011) the Baltic Sea is a net CO_2 source (1.05 Mt C/year) caused by high carbon discharge from land (riverine discharge: 10.9 Mt C/year) and remineralisation of organic matter in sediments (1.14 Mt C/year). However, Baltic Sea sediments serve as a carbon sink for 3.87 Mt C/year. Changes in climate and riverine discharges will change these numbers in both directions.

Risks

- *Fisheries and aquaculture depletion*
  Fishery is in decline in the Baltic Sea and larger fishery fleets are left only in Denmark and Poland. There is a risk of further decrease in fishery while the possibility to establish aquaculture (based on today's technology) is limited due to limited water exchange in the Baltic Sea.
- *Species loss*
  About 59 species in the Baltic Sea are threatened or in decline (HELCOM, 2011e). There are many reasons for this situation which might further worsen due to climate change. Salinity changes for instance are of great importance for the Baltic Sea which is a sensitive ecosystem on the edge between marine and fresh water conditions.
- *Loss of natural sea defences*
  Erosion is a serious problem especially in the southern Baltic Sea. There are controversial discussions over whether this situation might become worse e.g. by climate change or not. However, costs for coastal protection measures are increasing and it seems to be illusory to believe in total coastal protection for all parts of the coastlines in the long-run.
- *Decline in water-based tourism*
  Bathing tourism is of great importance in the south-western Baltic Sea and good water quality is one of the main demands of summer tourism in this region (Schernewski et al., 2009). Decreasing water quality would hamper one of the most import economic sectors in the southern Baltic Sea Region. But also increasing water quality is sometimes not attractive for tourists if it goes together with larger amounts of biomass on the beach (e.g. algae, seaweed).
- *Human health impacts*
  Hygienic water quality of coastal waters is of great importance for human health especially in areas with bathing and leisure activities. Coli and vibrio bacteria cause problems in the Baltic Sea in single events but it does not seem likely that this will increase. Heavy metal values are still too high in some areas of the Baltic Sea but inputs of heavy metals into the Baltic are in decline (see above).

Economic use

Opportunities

- *Climate Change > new fishery species*
  Climate change might affect the distribution and abundance of fish in the Baltic Sea. Currently 28 alien fish species have been observed within the Baltic (Baltic Sea Alien Species Database, 2011). But so far there are no references that they might reach the status of a commercial fish species in the near future.
- *Infrastructure associated with new maritime routes*
  (see topic *New infrastructure* under "Transport")
- *Aquaculture development*
  Due to decreasing fish stocks it seems likely that aquaculture will further develop within the Baltic Sea in the long-run. However, limited water exchange leads to insufficient water qualities required by aquaculture. Therefore new aquaculture technologies are needed for many Baltic Sea regions to reach a substantial level.
- *Increased cruise tourism*
  (see topic *Cruise activity* under "Transport")
- *Ecotourism*
  (see topic *Ecotourism* under "Environment")
- *New technologies in shipbuilding and marine renewable energy production*
  Maritime industry is of importance for many regions around the Baltic Sea. While shipbuilding on a larger scale is in decline there has been notable innovation capacity in the last years, especially by SMEs. Core topics are green shipping, off-shore installations (energy and mariculture) and maintenance as well as issues of security, safety and surveillance. Currently these markets cannot be quantified exactly as most of the existing technology has a pre-commercial status (Baltic Supply, 2011).

Risks

- *Environmental pressures caused by intensive (coastal) land use*
  Eutrophication is a major problem in the Baltic Sea. It is caused by large amounts of nutrient loads mainly due to a high population density and a well-developed agricultural sector. Eutrophication causes impacts like changes in the structure and functioning of the entire marine ecosystem and a reduction in ecosystem resilience (HELCOM, 2009a). The Baltic Sea Action Plan, the Marine Strategy Framework Directive and the Water Framework Directive may lead to further improvement of marine water quality but setbacks are likely due to climate change and changes in agriculture.
- *Pollution threat to marine living an non-living resources*
  The entire Baltic Sea was an area highly contaminated with hazardous substances during the period 1999-2007 according to the CHASE assessment (HELCOM, 2010d). Many of these substances are quite persistent. Discharges of PCBs, DDT, TBT and heavy metals that took place decades ago are still detectable in the Baltic Sea. Dredging contaminated sediments therefore causes resuspension of hazardous substances. Although there are decreasing trends of certain

substances there is still a long way to reach the goals of the Baltic Sea Action Plan. Furthermore prolonged growth seasons and increased precipitation both due to climate change are likely to increase the discharge of hazardous substances again.

- *Relatively high labour costs in production call for high capital intensity and on-going innovation*
  According to the Swedbank unit labour costs are expected to decrease in the Baltic Sea Region – albeit to a varying extent – "in nominal and real terms in most Baltic Sea region countries. In relative terms, compared with other industrial nations, Latvia will gain most in competitiveness (but starting from low levels), followed by Estonia and Lithuania. In the Nordic countries and Germany, developments will stabilise (Swedbank, 2010)".

7. Initial Policy Recommendations

The Baltic Sea Region has shown impressive developments over the past decades. The upheaval processes during the late 1980s and early 1990s led to comprehensive changes. New and independent states were constituted, the geostrategic situation of the Baltic Sea changed, and both economy and administration were and partly still are subject to intensive transformation processes. Already existing regional co-operation between the Baltic Sea states has further intensified leading to manifold transnational fora and institutions. But all that glitters is not gold.

The Baltic Sea has for 50 years suffered from eutrophication. This problem became so visible that during the Cold War an international commission was constituted across the Iron Curtain to protect the Baltic Sea against pollution. Despite more than 30 years of active work of HELCOM (The Baltic Marine Environment Protection Commission) and of other stakeholders the eutrophication problem is still unsolved. While HELCOM has attained great success in some fields this example shows the general problem of soft-law institutions. They rely on the co-operation of their contracting parties and on their willingness to implement agreed policies. Most of the transnational institutions in the Baltic are soft-law institutions and many of them have to fight with this problem.

The regional seas policy of the European Commission (EC) is supportive to the regional co-operation across and around the Baltic Sea. It gives a framework and partly also the resources for exchange and co-operation. In single cases the EC acts as driving force for processes. It is, however, important to keep a balance between the different policy levels. On the one hand regional seas initiatives need time, freedom and resources to develop their policies. This gives the chance to come up with innovative and regionally adjusted solutions. However, it also obliges contracting parties to be and to stay active and to actively contribute to the implementation of these policies. On the other hand regional soft-law institutions may be slow and not very effective in certain cases. In these cases legal enforcement of minimum requirements needs to be ensured by upper policy levels. Further close co-operation between different policy levels will safeguard the further development of the Baltic Sea Region. Related to this is a need for further and intensified higher education in various fields of international management with a focus on Europe's seas.

With the Baltic Sea Action Plan the Baltic Sea states have set themselves ambitious goals. In spite of the demanding challenges related to this action plan they will be well advised to actually implement it. Every riparian state has its own relation to the Baltic Sea but they all benefit from this sea in various ways. Not only a more holistic management but also marine spatial planning requires legal certainty e.g. about the exact lines of borders in EEZ waters, a problem which occurs not only in the Baltic and therefore possibly needs to be considered by the UN. To speed up the process voluntary agreements but also informal co-operation may be helpful for various kinds of marine management.

The Baltic Sea Region faces several opportunities for regional development driven by the sea. Various parts of the maritime cluster offer growth potentials. And ambitious environmental policies may be able to safeguard a sustainable development of the Baltic Sea. This, however, requires continuous active engagement of all stakeholders.

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