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Port City Atlas: Mapping European Port City Territories

From Understanding to Design

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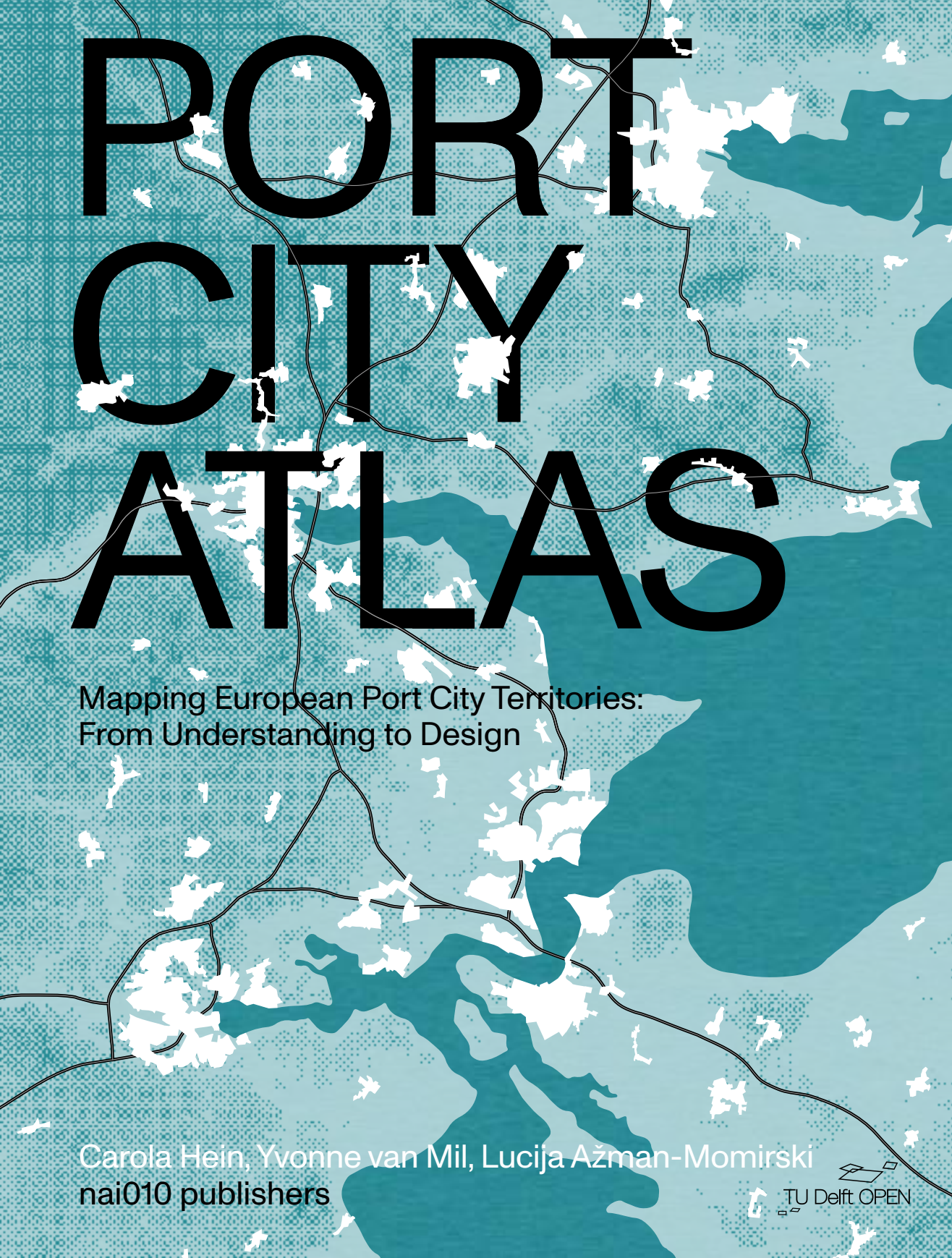
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Mapping European Port City Territories:
From Understanding to Design

Carola Hein, Yvonne van Mil, Lucija Ažman-Momirski

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100 European Port City Territories

BALTIC SEA

ID	Port Name
HEL	Helsingborg, SE
HLS	Helsingør, DK
CPH	Københavns, DK
TRG	Trelleborg, SE
MMA	Malmø, SE
RNN	Rønne, SE
STO	Stockholm, SE
LLA	Luleå, SE
TKU	Turku, FI
NLI	Naantali, FI
HEL	Helsinki, FI
SKV	Sköldvik, FI
TLL	Tallinn, EE
RIX	Riga, LV
VNT	Ventspils, LV
LPX	Liepaja, LV
KLJ	Klaipeda, LT
BOT	Butinge, LT
GDN	Gdansk, PL
GDY	Gdynia, PL
SZZ	Szczecin, PL
SWI	Swinoujscie, PL
RSK	Rostock, DE
ROF	Rødby, DK
PUT	Puttgarden, DE
SLM	Sillamäe, EE
LBC	Lübeck, DE
KEL	Kiel, DE
FRC	Fredericia, DK
AAR	Århus, DK
SST	Statoil-Havnen, DK
SJO	Sjaellands Odde, DK

NORTH SEA

AAL	Aalborg, DK
FDH	Frederikshavn, DK
HIR	Hirtshals, DK
EJB	Esbjerg, DK
BRB	Brunsbüttel, DE
HAM	Hamburg , DE
BRE	Bremen , DE
WVN	Wilhelmshaven, DE
BRV	Bremerhaven, DE
DZL	Delfzijl, NL
EME	Emden, DE
AMS	Amsterdam, NL
RTM	Rotterdam, NL
ANR	Antwerp, BE
GNE	Ghent, BE
ZEE	Zeebrugge, BE
DKK	Dunkirk, FR
DVR	Dover, UK
CQF	Calais, FR
MED	Medway, UK
LON	London, UK
FXT	Felixstowe, UK
HRW	Harwich, UK
IPS	Ipswich, UK
IMM	Immingham, UK
HUL	Hull, UK
MME	Tees & Hartlepool, UK
TYN	Tyne, UK
FOR	Forth (Edinburgh), UK
BGO	Bergen, NO
TON	Tønsberg, NO
OSL	Oslo, NO
GOT	Göteborg, SE

ATLANTIC

CYP	Clydeport (Glasgow), UK
CYN	Cairnryan, UK
BEL	Belfast, UK
LAR	Larne, UK
DUB	Dublin, IE
LMK	Limerick, IE
ORK	Cork, IE
HYM	Heysham, UK
LIV	Liverpool, UK
HLY	Holyhead, UK
MLF	Milford Haven, UK
BRS	Bristol, UK
SOU	Southampton, UK
PME	Portsmouth, UK
LEH	Le Havre, FR
NTE	Nantes Saint-Nazaire, FR
LRH	La Rochelle, FR
BOD	Bordeaux, FR
BIO	Bilbao, ES
GIJ	Gijón, ES
LCG	La Coruña, ES
FRO	Ferrol, ES
LEI	Leixões (Porto), PT
LIS	Lisboa, PT
SET	Setúbal, PT
HUV	Huelva, ES
LPA	Las Palmas, ES
SCT	Santa Cruz de Tenerife, ES
CAD	Cádiz, ES

MEDITERRANEAN SEA

ALG	Algeciras, ES
CEU	Ceuta, MA
CAR	Cartagena, ES
VLC	Valencia, ES
CAS	Castellón, ES
TAR	Tarragona, ES
BCN	Barcelona, ES
MRS	Marseille, FR
TLN	Toulon, FR
GOA	Genova, IT
SVN	Savona, IT
SPE	La Spezia, IT
LIV	Livorno , IT
CVV	Civitavecchia (Roma), IT
NAP	Napoli, IT
PFX	Porto Foxi, IT
CAG	Cagliari, IT
PMO	Palermo, IT
SIR	Siracusa, IT
MSN	Messina, IT
MLZ	Milazzo, IT
GIT	Gioia Tauro, IT
REG	Reggio di Calabria, IT
TAR	Taranto, IT
RAN	Ravenna, IT
VCE	Venezia, IT
TRS	Trieste, IT
KOP	Koper, SI
MNF	Monfalcone, IT
RJK	Rijeka, HR
SPU	Split, HR
PIR	Peiraias (Athene), GR
PER	Perama, GR
EEU	Elefsina, GR
SKG	Thessaloniki, GR


North Sea
Baltic Sea
Atlantic
Mediterranean Sea
LLA
BGO
OSL
TON
STD
NLC/TKU
HEL
SKV
TLL
SLM
HIR/FDH
GOT
VNT
RIX
LPX
AAL
AAR
HLS/HEL
EDI
FRC
SOO/STT
CPH
TRG/MMA
BGT/KLJ
RNN
GDY/GDN
CYP
FOR
BEL
CYN
HYM
MME/TYN
DUB
KLY
LIV
HUL/IMM
LMK
ORK
MLF
BRS
IPS/HRW/FXT
LON MED
DVR/CQF
SOU/PME
LEH
DKK
ZEE
GNE
ANR
AMS
RTM
DZL/EME
WVN/BRV
BRB
BRE
KEL
LBC
HAM
RSK
SWI
SZZ
NTE
LBN
BOD
LCG/FRO
GIJ
BIO
LEI
LIS/SET
HUV
CAD
ALG/CEU
CAR
VLC/CAS
BCN
TAR
MRS
TLN
SVN/GOA
SPE
LIV
PFX/CAG
MNF/TRS/KOP
VCE
RAN
RUK
SPU
CVV
NAP
TAR
MLZ/MSN
PMO
REG/GIT
SIR
SKG
EEU/PIR/PER
↙ LPA & SCT

1.1 ID

1.2 Port Name, AA

1.3 a b

1.4 a b c d

PORT

1.5 a b c d e f g

ID (%) XX.X XX.X XX.X XX.X XX.X XX.X XX.X

1.6

	ID
Liquid	XXXX
Dry bulk	XXXX
Container	XXXX
Specialized	XXXX
General	XXXX
Cruise ship	XXXX
Passenger	XXXX
Other	XXXX
Vessels	XXXX

1.7

	ID
Liquid bulk	XXXX
Dry bulk	XXXX
Containers	XXXX
RoRo	XXXX
Other	XXXX
Cargo (t)	XXXX

1.8

Passengers	XXXX

CITY

2.1 a b c

City

2.2	→ Capital national (km)	→ City XXX
	→ Capital regional (km)	→ City XXX
2.3	Area (km²)	XXX
	Built-up area (km²)	XXXX
	Density (per km²)	XXXX
	Population	XXXX
2.4	Population structure (%)	15 65 / XX.X XX.X XX.X
2.5	Distribution built area (%)	B A I P / XX XX XX XX

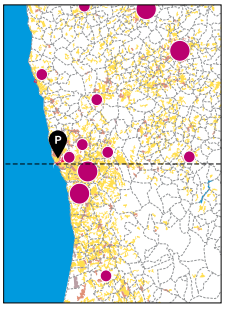
TERRITORY

3.1 a b c 3.2 a b c

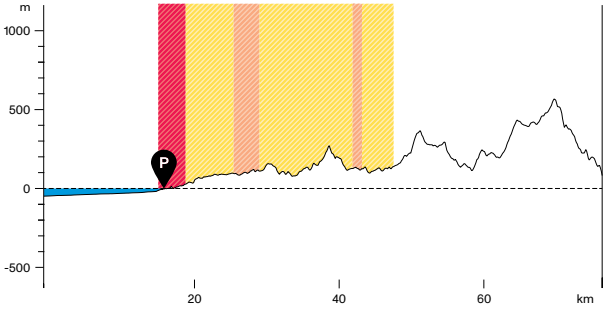
Territory

3.3	Area (km²)	XXXX
	Density (per km²)	XXXX
	Population	XXXXXXXX
3.4	Natura2000 (km²)	M T / XXXX XXXX

3.5



3.6



PORT

1.1 Port's UNLOCODE
UNLOCODE is the United Nations Code for Trade and Transport Locations.

1.2 Official name and nationality of the port according to Eurostat
Eurostat Maritime transport data/
GISCO Transport networks-port 2013.

1.3 Main type of transit
a Cargo b Passenger
Eurostat Maritime transport data 2019.

1.4 Water-land category based on ESPON and the name of the water
a Embayment, Protected Coast or Marine Inlet
b Engineered Coastline c River d Estuary
ESPO Port Performance Dashboard 2013.

1.5 Port functions in % of the total extent of port sites within the administrative entity of the adjacent city
a Cargo b Passenger c Fishing d Naval
e Marina f Shipyard g Local multi-functional
Typologies calculated on the basis of the Copernicus Coastal Zone 2018 dataset. Note: This is not the total surface of the port area in the territory; part of the port may be outside administrative boundaries.

1.6 Number of vessel types in thousands and percentage of total number of vessels calling at the port. Below the line the total number of vessels in thousands and in relation to the other selected ports.
Eurostat Maritime transport data 2019—Vessels in main ports by type and size of vessels.

1.7 Tonnage of cargo types in thousands and % of total cargo handled in the port. Below the line, the total tonnage of cargo in thousands and in relation to the other selected ports.
Eurostat Maritime transport data 2019—Gross weight of goods handled in main ports by direction and type of cargo.

1.8 Total number of passengers in thousands embarking and disembarking in the port and in relation to other selected ports.
Eurostat Maritime transport data 2019—Passengers embarked and disembarked in all ports by direction, excluding cruise ship passengers and private vessels.
Note to 1.6 & 1.7: The total tonnage of cargo or numbers of vessels does not always correspond to the sum of the typologies. In case of missing data for 2019, available numbers from previous years have been used.

CITY

2.1 Official name and local typology of the city according to Eurostat
a Greater City b City c LAU
Eurostat Urban Audit data 2020 (City and Greater City) or Local Administrative Units (LAU).

2.2 Distance of the port to the nearest national or regional capital
Calculated in GIS based on port location in Eurostat in relation to National & Provincial Capitals of Europe.

2.3 Total area of the local administrative entity according to Eurostat and the extent of built-up area
Eurostat Urban Audit data 2020 and Local Administrative Units (LAU) data 2019.

2.4 Population structure of the administrative entity
Eurostat Urban Audit data 2020 and Local Administrative Units (LAU) 2019, or the nearest year for which data is available.

2.5 Built-up area of the administrative entity in typologies and % of the total built-up area
B: Built-up area, A: Airport, I: Industrial, P: Port
Calculated in GIS based on Copernicus Corine Landcover 2018 data and rounded to whole numbers.

TERRITORY

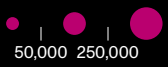
3.1 Official name and urban typology of the territory (NUTS 3) according to Eurostat
a Urban b Intermediate c Rural
Eurostat Territorial typologies data-urban-rural typology of NUTS 3 2018: predominantly urban regions, intermediate regions, or predominantly rural regions.

3.2 Presence of UNESCO World Heritage properties
a Cultural b Natural c Maritime related
UNESCO World Heritage Convention, World Heritage list 2022.

3.3 Total surface area and population number of the NUTS 3
Eurostat NUTS 3 regions in 2019, or the nearest year for which data is available.

3.4 Total area of Natura2000 areas in the NUTS 3 in km², both marine (M) and terrestrial (T)
Calculated in GIS based on EMODnet Natura2000 data in combination with NUTS 3. The marine Natura2000 sites are calculated within a 25-kilometre offset of the coastline of the NUTS 3 region.

3.5 Map indicating position cross-section of the height profile and the configuration of the LAU in combination with urban settlements with at least 5,000 inhabitants
OSM places 2021, combined with population numbers



3.6 Height and depth profile of the water- and landside of the port city territory with a projection of the land cover
Calculated in GIS based on EMODnet Bathymetry data in combination with Copernicus Corine Landcover data 2018.

Further note:
No data means that data is not registered with Eurostat, not that there is no throughput.

GENERAL FEATURES

Administrative division of the European maritime waters (EMODnet, Regional Advisory Councils, 2014)

- Atlantic (North Western Waters)
- Baltic Sea
- Mediterranean Sea
- North Sea

Bathymetric contour lines with 50, 100, 200, 500, 1000, 2000, 5000-metre intervals (EMODnet, Bathymetry WMS)



Depth contours

Land mass and elevation pattern (Copernicus, Land Elevation dataset EU-DEM V1.1, 2017)



Elevation from 0–5000 metres

Protected areas within the Natura2000 network (EMODnet—Human Activities, 2021)



Natura2000 Marine



Natura2000 Terrestrial

European network of rivers and canals (Eurogeographics, EuroGlobalMap (EGM), 2021)



River or canal

LANDCOVER

Morphology of land cover pattern (Copernicus, Corine Land Cover dataset (CLC), 2018; port area is also based on Coastal Zone dataset, 2018)



Airport



Built-up area



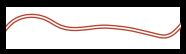
Industrial area



Port area

TRANSPORTATION

European transport network of motorways (Eurogeographics, EuroGlobalMap (EGM), 2021)



Primary road



Secondary road



Ferry lines

European transport network over rail (Eurogeographics, EuroGlobalMap (EGM), 2021)



Primary railway, station



Secondary railway, station

BOUNDARIES

National, urban and municipal administrative boundaries (Eurostat, Local Administrative Units (LAU), 2019; Urban Audit, 2020)



Country border



Municipal border



Administrative border of selected port city

LOCATIONS

Infrastructural functions within the transport network of goods and people (Eurogeographics, EuroGlobalMap (EGM), 2021)



Airport (public)



Port selected for the atlas



Port selected for the atlas, cross-section



Ferry terminal

Cultural, health, education, and local government (OpenStreetMap (OSM) points of interest, 2021)



University



Town hall of selected port city

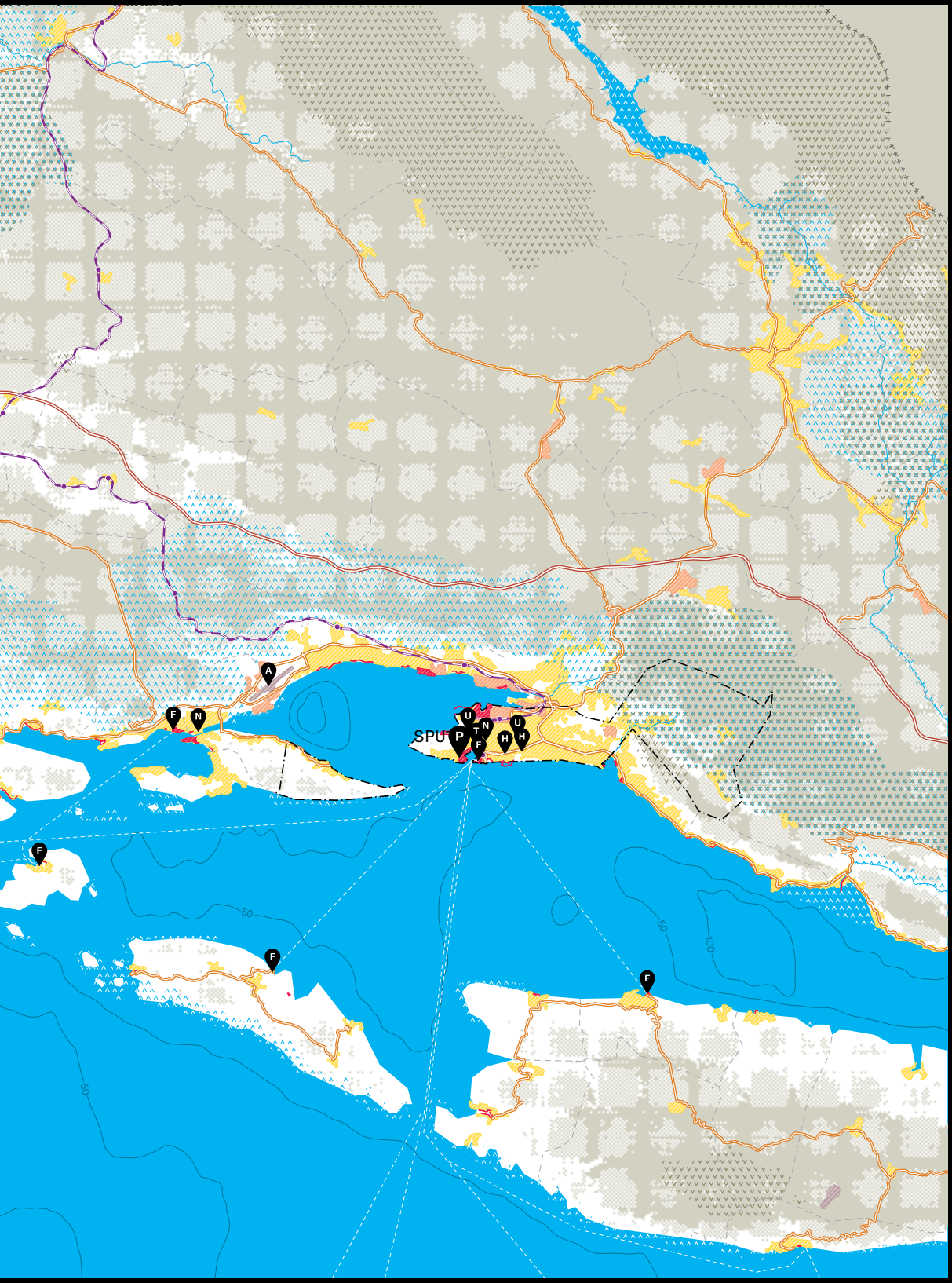


UNESCO World Heritage property



Hospital (public)

Scale 1: 450,000
1 cm on the map corresponds to 4.5 km on the ground, Pseudo-Mercator projection


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Port City Atlas
Mapping European Port City Territories: From Understanding to Design

Carola Hein
Yvonne van Mil
Lucija Ažman-Momirski

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Foreword

This atlas is a valuable tool for visualizing and designing the geography of our port cities, which are on the front line of major contemporary issues such as migration, the energy transition, and digitization. The Covid-19 pandemic and the war in Ukraine are a reminder, more than ever, of just how strategically important they are to the trade of essential goods and to human mobility.

The Association Internationale Villes et Ports (AIVP) brings together public and private stakeholders, all motivated by the same commitment to creating safer, more resilient, more innovative port cities. AIVP's 2030 Agenda provides the organization's members, who come from around fifty different countries, with an initial policy framework for achieving the United Nations' sustainable development goals. By regularly sharing our experiences and best practices, we aim to fine-tune a strategy that promotes global cooperation while taking account of local specificities.

The result of rigorous work, initiated by the University of Delft under the direction of Professor Carola Hein, using data freely available from the European Commission, this atlas reveals the complexity and fragility of land-sea ecosystems. It advocates the pioneering 'port city territory' concept, encompassing all of the various spaces affected by maritime traffic, along coastlines or river-sea corridors. It lays the foundations for analysing these territories from a maritime perspective. It identifies water and port cities as central to a systemic understanding of the European space and its integration.

These maps are intended to foster dialogue by highlighting shared opportunities and challenges from one territory to another, from governance to infrastructure planning, and from health to heritage. Cooperation and solidarity have been AIVP's core values ever since its creation, and I have no doubt that this atlas will be the new gold standard for informing citizens, scientists, and decision-makers in port cities. Happy reading!

Édouard Philippe, President of AIVP, Mayor of Le Havre

Foreword

I very much welcome this new *Port City Atlas*, which visualizes a hundred port city territories in a comprehensive way and brings to the forefront the important role of port cities as essential and unique interfaces between sea and land.

Many historical cities and their surrounding fore- and hinterlands in Europe are what they are today because of their proximity to the sea and the port as a gateway to the world. The economic and cultural wealth of these port city territories reflects the importance of their port. Even today there are some examples of young cities that are developing because of the port. A perfect example is the city of Esbjerg, Denmark's energy metropolis, often called Denmark's youngest city.

The relation between port and city is however not an easy one. Historically, both fought for space and land on and near the waterfront. Then the increasing size of vessels, the expansion of port facilities as well as the broader role of ports meant that ports had to move out of the city into the territory. Real estate, tourism and recreational purposes are now competing for space both on the newly attractive old port waterfronts and in the hinterland. Meanwhile, as the saying goes: 'out of sight, out of mind'—port citizens have more difficulty seeing the added value of having a port or understanding what it means.

The energy transition and ongoing energy crisis could bring ports back to the centre of attention. Ports play a strategic role and are proving to be indispensable links and players as Europe aims at becoming independent from Russian energy. In the pandemic and the energy crisis we are going through, it has become clearer than ever what the port can do for the city and its territory. Ports are essential in keeping supply chains going and ensuring that citizens all have the goods and materials they need. At a time when everyone is looking for alternative energy suppliers and aiming to accelerate the energy transition, ports are again showing resilience in helping to ensure the supply of today's energy, and they will be instrumental in supplying the economies of port city territories with renewables.

The expanding and new roles of ports as hubs of energy, blue economies and blue industries will create new partnerships and attract new job profiles to the port. In this respect, these changes will also bring port, city and territory closer together again.

Taking all these developments into account, I believe that the territorial approach taken in this *Port City Atlas* is of paramount importance. The *Port City Atlas* clearly shows that Europe's borders do not stop on land. The maritime dimension is an integral part of Europe's continent, strength and future. It also demonstrates that the positive impact of the port exceeds the mere boundaries of a city; it also covers the port city territories. I invite all readers to dive into this unique view of Europe from the sea, that is this *Port City Atlas*.

Isabelle Ryckbost,
Secretary General of the European Seaports Organisation

Acknowledgements

This book is the outcome of our long effort to raise awareness of maritime flows across sea and land, through ports, cities, and territories. All three editors are members of the Leiden-Delft-Erasmus (LDE) PortCityFutures Centre, directed by Carola Hein, who also leads the recently established UNESCO Chair Water, Ports and Historic Cities hosted by the Leiden-Delft-Erasmus University consortium.

We are grateful to the student assistants and doctoral students, who, under the supervision of Yvonne van Mil, contributed to the making of the maps and infographics: Stephan Hauser, Batuhan Özaltun, Mees van Rhijn, Myrthe Peet, Lukas Höller, Hülya Lasch and Douwe de Jager. We particularly appreciate the technical support of Lukas Höller, who worked closely with Yvonne on the Mapping Handbook, a technical guide to map port city territories.

The book would not have been possible without the financial support of the Chair History of Architecture and Urban Planning at Delft University of Technology, the Department of Architecture TU Delft, the TU Delft Central Library, LDE PortCityFutures Centre, the University of Ljubljana Faculty of Architecture, the Van Eesteren-Fluck & Van Lohuizen Foundation and the Dutch research organisation NWO who supported the publication through a NWO KIEM grant and NWO Open Access.

We are grateful to Association Internationale Villes et Ports (AIVP) for their support, notably Bruno Del Salle, Jose Sanchez and Martial Dubuisson, who introduced us to their members and the association's president, Edouard Philippe, who kindly wrote a preface for this book. We would like to extend our gratitude notably to those port authorities and city officials who took a preliminary look at the maps and provided us with feedback. We are very grateful and would like to thank the Ports of Bordeaux, London, Marseille, Algeciras, Valencia, Helsinki, Bilbao, Dunkirk, Venice, La Rochelle, Taranto, Rotterdam and Antwerp. Whenever possible, we included their responses. We are equally thankful to the European Seaport Organisation (ESPO) for their support, especially Isabelle Ryckbost. We look forward to continuing to refine the methodology that

provides shared and comparable insights on port city territories based on the same type of data, the same territorial scale and the same indicators, even though more concise or up-to-date data may be or become available in select locations.

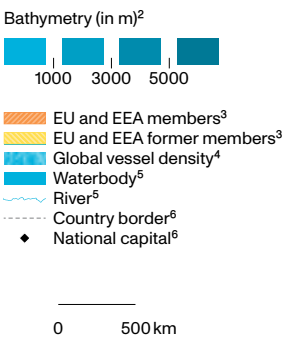
We are also indebted to our colleagues Reinout Rutte, Dirk Schubert, and Stephen Ramos for valuable insights into the scientific argumentation of the book and the mapping approach, and to Laura Helper for her excellent editorial insights.

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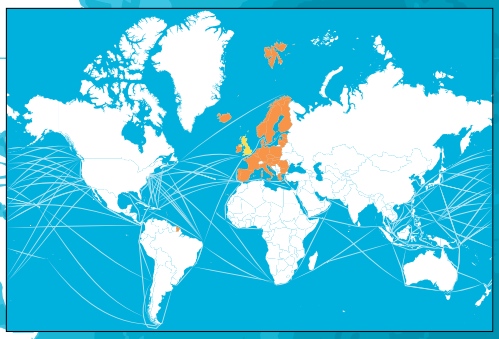
Carola Hein, Yvonne van Mil, Lucija Ažman-Momirski

Global Vessel Density and Port City Territories on Europe's Coasts

Shipping and ports are essential for international trade and commerce: the EU transports 90 per cent of its external trade and more than 40 per cent of its internal trade by sea, and more than 3.5 billion tonnes of cargo and 350 million passengers pass through Europe's seaports every year.[1] The EU controls 40 per cent of the world's fleet and its leadership in this global industry is indisputable. The map shows the density of shipping around Europe per year and (on the inset map) the global maritime routes. The high density of vessels between the Strait of Gibraltar and the Suez Canal in the Mediterranean and around the Strait of Dover between the Atlantic and the North Sea stand out. It also reflects the many connections between Central America and Europe, and the connection between Europe and Russia along the Norwegian coast. Even though the map does not actually identify the leading European port city territories, it is easy to tell that those ports are located where the density pattern is thickest. These global transport networks on the seas and oceans, in combination with other claims on the maritime waters (as shown on page 31), cumulatively exact a high spatial and temporal toll on the world ocean.



1 Directorate-General for Internal Policies: policy department b: Structural and cohesion policies Transport and Tourism, The evolving role of EU seaports in global maritime logistics (2009).
2 Natural Earth.
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5 HydroSHEDS, B. Lehner and G. Grill, Global River hydrography and network routing: baseline data and new approaches to study the world's large river systems. Hydrological Processes (2013), 27(15), pp 2171–2186. Data is available at www.hydrosheds.org.
6 Eurostat/ Natural Earth.



Barents Sea
Norwegian Sea
Reykjavik
Oslo
Stockholm
Helsinki
Tallinn
North-Western Atlantic Waters
North Sea
København
Baltic Sea
Riga
Moscow
Vilnius
Minsk
Dublin
London
Amsterdam
Berlin
Warsaw
Brussels
Kyiv
Luxembourg
Prague
Paris
Vienna
Bratislava
Bern
Vaduz
Chișinău
Budapest
Zagreb
Ljubljana
Belgrade
Monaco
San Marino
Sarajevo
Bucharest
Andorra
Podgorica
Pristina
Black Sea
Vatican City
Sofia
Tbilisi
Madrid
Rome
Sarajevo
Tirana
Ankara
Lisbon
Yerevan
Athens
Algiers
Tunis
Valletta
Nicosia
South-Western Atlantic Waters
Beirut
Damascus
Rabat
Tripoli
Mediterranean Sea
Jerusalem
Baghdad
Amman
Cairo
Kuwait City
Riyadh

Introduction: Mapping European Port City Territories: from Understanding to Design

Abstract

Europe is a continent surrounded by water on three sides; major seaports and metropolises are located along the coast lines. Public and private responses to contemporary crises—climate change, sea-level rise, migration—all depend on coordinated approaches along Europe's coasts. Yet, the sea borders of Europe are rarely recognized as part of European policymaking and identity creation. The focus internally on nation states, national borders and European unification has distracted policymakers and stakeholders from a maritime perspective on the continent. But looking from sea to land, using an ecosystem approach, we can recognize seaports and their unique role in shaping Europe's future. Moreover, we can see the port and its adjacent port city, marine foreland and terrestrial hinterland as a distinctive type of space: the port city territory. The *Port City Atlas* shines a light on the port city territory as a key player, a key location and a potential steward of water futures. This perspective opens up a critical new opportunity to meet contemporary challenges of climate crises, energy transition, migration and multiple water-related urgencies and to address contemporary challenges at the boundary between sea and land in a coordinated way. Yet this perspective also shows us that stakeholders in these territories are diverse and multiple, governance at the scale of the territory is missing, methodologies to comprehensively understand these territories are lacking and the important impact of ports on territorial development is not fully understood. We need a new type of governance to organize port city territories and to connect the various stakeholders and interests. Naming and conceptualizing the port city territory—its form, governance and culture—as unique, and developing methods to visualize the multiple flows, institutions and practices that occur in these territories is the first step in our new conceptual and methodological approach for understanding and designing coastal areas. This book argues that visualization of quantitative and qualitative data in maps and infographics can provide a foundation for comparative analysis beyond case study

Carola Hein, Yvonne van Mil, Lucija Ažman-Momirski

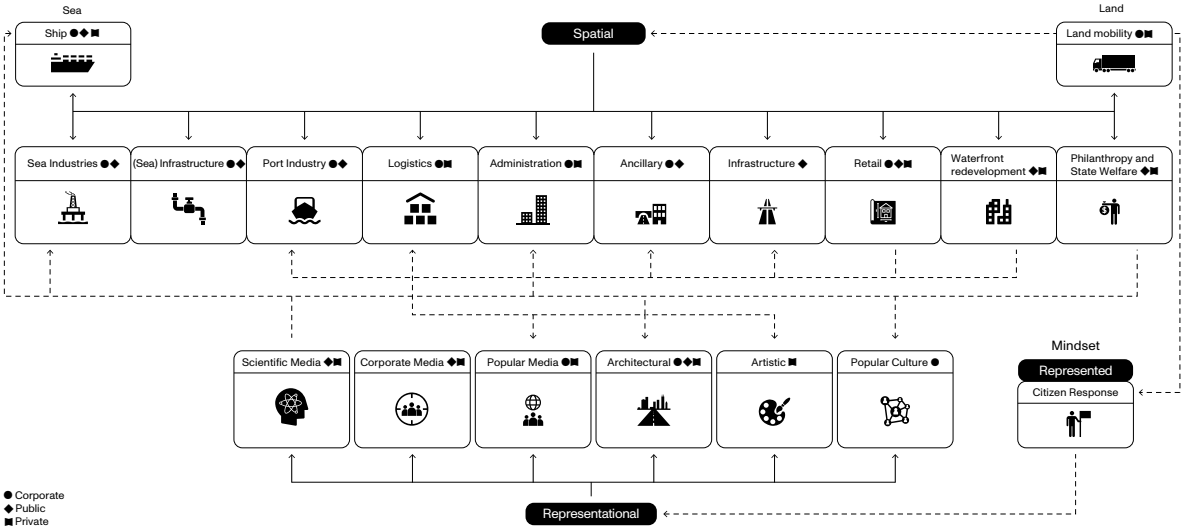


Fig. 1 The PortCityScape (Author: Carola Hein).

approaches that are often locked into national contexts, select languages or disciplinary approaches. It proposes that a comprehensive, mapping-based approach allows for the exploration of a single port city territory as part of a larger system of maritime and transport connections, and for standardized comparison among multiple territories. In doing so, the *Port City Atlas* opens up a new field of study that explores territories from the lens of water bodies, including rivers, and that sets the stage for additional thematic atlases. The chapter posits that such an approach affords local decision-makers novel insights into the complex territories at the boundary between sea and land, and proposes that the *Port City Atlas* provides the foundation for follow-up studies that take a sea-based approach to the understanding and design of Europe.

Introduction

At a time of multiple crises that involve the sea—climate change, environmental pollution, water-related urgencies, migration—the *Port City Atlas* (re)conceptualizes Europe as a continent surrounded by water, with a shared coast, with shared needs and interests beyond national borders, and it visualizes global and local patterns from sea to hinterland. Europe is a maritime continent. None of the other five continental masses has more points of contact with the seas (pages 19 and 31). From the water, we can see that oceans and seas create the highly recognizable form of the European continent: the Arctic Ocean and the Barents Sea are part of its northern border; the Atlantic Ocean, with the North and Baltic Sea, forms its northern and western edges; and the Mediterranean Sea

is the southern border. Only in the east the European continent is separated from another land mass by a mountain range rather than water, making the boundary with Asia much less obvious. We rethink the spaces where sea and land intersect as ecosystems where maritime practices engage with urban and rural ones, and as zones of porosity[1] where different types of water meet and mix with land. Coastal areas are among Europe's most vulnerable ecological spaces; they are also shipping-based and industrial economic hubs and population centres. Ports play a unique role in these territories, their infrastructure for transhipment and logistics carrying flows of people and goods. Urban and territorial actors have their own visions for these spaces, imagining them in terms of mobility, housing, and other functions. Each territory mirrors the others while depending on its own local geography, topography, history, politics, economy, and culture. We argue that these marine and terrestrial spaces are unique and require conceptualization, understanding and design, so that they can serve as stewards of a sustainable future. We propose the notion of *port city territory* as a distinctive type of space that includes a maritime foreland and a terrestrial hinterland, a space where ports have major impact on and co-exist with urban settlements and rural areas. We visualize qualitative and quantitative data in maps and infographics, a fresh methodological foundation for comparative analysis of these complex spaces at the boundary between sea and land.

Shipping follows the coastlines; its maritime flows and transhipment historically created port city territories along flat and sandy coasts, against steep mountains or in swamps. Nonetheless, European unification has long connected different nations through land-based infrastructure; no single institution governs the complex economic and ecological dynamics of these areas; and no methodology acknowledges the multiple flows, practices, and interests that act upon spatial development. A 2014 EU directive did establish a framework for maritime spatial planning, taking an ecosystem approach and acknowledging the importance of sea-land interaction, of sustainable development and use of marine and coastal resources, but it does not specifically address the development of port city territories.[2]

The *Port City Atlas*'s concept of port city territories is *first of all a new conceptual and methodological approach* that can help diverse local and global stakeholders gain a comprehensive understanding of the spatial impact of shipping, logistics, commodity flows and other port related activities on nearby maritime, urban and rural areas. The concept of the port city territory builds upon and aims to enrich the large body of research on ports, port cities and waterfronts in multiple fields, including economics, geography and planning (too large to summarize here).[3] It provides a foundation for collaborative approaches that will allow us to plan,

1 C. Hein (ed.), 'Planning for Porosity: Exploring Port City Development through the Lens of Boundaries and Flows', *Urban Planning*, Vol. 6 (2021). Also online. Available HTTPS: https://doi.org/10.17645/up.v6i3.4663.

2 'DIRECTIVE 2014/89/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 July 2014 establishing a framework for maritime spatial planning', *Official Journal of the European Union*. Online. Available HTTPS: https:/eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX%3A32014L0089.

3 For an overview see also: C. Hein, 'Port cities and urban waterfronts: how localized planning ignores water as a connector', *WIREs Water* 3 (2016), 419–438.

govern and design better ecosystems on sea and land. Such new approaches to port city territories that cross land and sea allow for a rethinking of governance structures and the establishment of more comprehensive approaches that connect diverse stakeholders and interests.

The *Port City Atlas* builds from a single important premise to address this diversity in port city territories: a sea-based approach that looks at water as a key connector of ports, cities and nearby territories, for human living as well as for shipping—thus overcoming traditional land-based approaches that depend on national boundaries. The Atlas builds on this premise to pursue three key goals. It first aims to place our understanding of current challenges into their long-term development from the past to the future, building on the discussion of path dependency. It then argues that multi-scalar understanding is needed to explore how maritime flows intersect with urban practices and transport. Finally, it posits that we need new approaches for multi-stakeholder collaboration and frameworks for shared governance among stakeholders of diverse power and territorial control. To address the premise and these goals, the *Port City Atlas* proposes that a combination of quantitative and qualitative approaches—primarily mapping and infographics—allows for a more comprehensive understanding of economic, social and other developments in these specific geographical spaces. The *Port City Atlas* thus newly links a maritime approach to the planning of port city territories.

While multiple disciplinary approaches have contributed to the understanding of economic flows, urban development, planning, heritage and culture, as discussed by Carola Hein and Yvonne van Mil,[4] the *Port City Atlas* integrates quantitative and abstract data-based approaches with qualitative spatial analysis for the first time, and connects global flows to local territories. Making these global flows and local conditions visible in maps and infographics can facilitate communication and collaboration among local stakeholders in one port city territory; it can also provide a foundation for collaboration and shared strategies among diverse stakeholders along the European coast and in its four maritime waters (Baltic Sea, North Sea, North Atlantic Ocean, Mediterranean Sea).

The port city territory as proposed here builds upon long-standing recognition of the importance of maritime flows for development on sea and on land.[5] We acknowledge that the terms *hinterland* and *foreland* have specific historic and conceptual, notably economic connotations, including in the colonial context, and are largely disconnected from specific spatial conditions.[6] But the English terms have recently been more closely aligned with the original German word. In line with Merriam-Webster, we have chosen to use the most straightforward definition of *hinterland*: the area lying inland from a coast, remote from urban areas.[7]

4 C. Hein and Y. van Mil, 'Towards a Comparative Spatial Analysis for Port City Regions Based on Historical Geo-spatial Mapping', *PORTUSplus* 8 (2019), 1–18. Online. Available HTTPS: https://portusplus.org/index.php/pp/article/view/189.

5 G.G. Chisholm, *Handbook of Commercial Geography* (London: Longmans, Green and Co, 1889).

6 Hinterland (Geography), *Encyclopedia Britannica*. Online. Available HTTPS: https://www.britannica.com/science/hinterland.

7 hinterland, *Merriam-Webster*. Online. Available HTTPS: https://www.merriam-webster.com/dictionary/hinterland.

Second, the Port City Atlas *proposes (geospatial) mapping as a methodological approach to the study of port city flows.* All port city territories are the result of investment in port and transport infrastructure, governance systems, policies and regulations aimed at connecting global flows to local territories with their specific topographical, morphological, political, economic, social or cultural requirements. Yet, the port city territory as a whole is not an institutional or statistical entity. On the contrary, it crosses institutional and administrative borders, and is often difficult to recognize due to absence of clear spatial borders and relevant datasets. (To distinguish this concept from administrative language, we opted to not use the term *region*, as in port city region.) Nonetheless, mapping requires delineation. We therefore chose a standardized frame corresponding to 75 by 100 kilometres, centring each frame over a port and its city, or constellations of ports and port cities, as a basis for comparing them. Standardized comparison—across multiple port city territories as part of a larger system of maritime and land-based transport—can help guide European development, helping stakeholders forge shared policies on maritime trade and port development, on health, heritage and ecology, and even forge a shared European identity.

Moreover, mapping can serve as what we call a "gap-finder"—that is, as a tool to identify transitional territories that often cross institutional boundaries without strong, mutually supportive governance frameworks, legal systems, and planning guidelines.[8] Here we build on an important insight from the members of the PortCityFutures research group, who recognized networked spaces in ports affected by commodity flows—infrastructure, warehouses, headquarters, housing, and even leisure or other functions—and termed them a PortCityScape[9] (figure 1). This enabled the research group to investigate the urbanization of the sea,[10] and to reflect on water and its role in connecting diverse spaces—think of industrial ports or rebuilt waterfronts that serve as places of leisure and urbanity.[11] To their concept we have added, among other things, a visualization of each port city territory through the spatial extent of the port itself, the built-up area within and around the port, infrastructure and the hinterland, with detailed information on institutions of health, education and governance. For the mapping of 100 port city territories, with 25 per sea, we have used open-access data and chosen a scale independent of institutional borders that can capture a larger territory. We have opted to map these territories on the same scale and to use both morphological and functional aspects to highlight their shared typology, while examining the unique needs and opportunities of each. The choice of 25 port city territories per sea has allowed us to pay attention to the diversity in terms of location, while also offering a much richer approach to ranking ports or cities.

8 C. Hein and Y. van Mil, 'Mapping as Gap Finder: Geddes, Tyrwhitt and the Comparative Spatial Analysis of Port City Regions', *Urban Planning* 5, 2 (2020), 152–166. Also online. Available HTTPS: https://www.cogitatiopress.com/urbanplanning/article/view/2803/2803.

9 C. Hein, 'The Port Cityscape: Spatial and institutional approaches to port city relationships', *PortusPlus* 8 (2019), 1–8. Online. Available HTTPS: https://portusplus.org/index.php/pp/article/view/190.

10 N. Couling and C. Hein (eds.), *The Urbanisation of the Sea: From Concepts and Analysis to Design* (Rotterdam: nai010/BK Books, 2020). Also online. Available HTTPS: https://doi.org/10.7480/isbn.9789462085930.

11 C. Hein, 'Port cities and urban waterfronts: how localized planning ignores water as a connector', *Wiley Interdisciplinary Reviews: Water* 3, 3 (2016), 419–438. Online. Available HTTPS: https://doi.org/10.1002/wat2.1141.

Third, and finally, the Port City Atlas *establishes a foundation for advanced analysis, informed decision-making and collaboration in these complex areas at a territorial scale for a diverse group of people.* The maps and infographics provide a space-based framework for close reading by all stakeholders. Port authorities can use the maps to gain a better understanding of their impact on nearby cities and territories. Port authorities are often powerful institutions, as ports are economic engines of national relevance with extensive technological and communication capacities. Though they control a limited and very specific area, they also seek to develop spaces beyond that area, and therefore need insight into them. For example, they need to know where road, rail or waterway infrastructure in the territory might be restrained by urban development; where commodities flow; where they can site warehousing (dryports), even located tens or even hundreds of kilometres away from the port itself. They collaborate with stakeholders such as international shipping companies like Maersk, CMA CGM or Sinotrans, and terminal operators—COSCO, DP World or APM Terminals—that have very limited spatial control, but can strongly affect the nearby territory through the growth and decline of their international activities.

City and regional authorities can similarly use these maps and infographics as they search for space to build housing, develop green energy or strive for sustainable development, at times conflicting with port developments. Local citizens, seafarers, port workers and fishermen, who may or may not have a say in port development—even as the port may affect their environment and quality of life—can use the maps to form coalitions. The interests of these locals often compete with the interests of port and city decision-makers, those of a logistic company, a port authority, a local government, a tourist bureau or even an NGO. They also have different degrees of power, longevity and control. This means that compromises have to be made. All struggle with understanding of and planning for the spatial, economic, and social impact of ports, shipping and logistics; all share concerns for environment, health, sustainable development and questions of citizen participation in the limited space they share. Currently, each actor is engaged in their own space, without taking into account the needs and opportunities of the nearby port, city or agricultural space, but such an approach to a limited functional zone is no longer in line with contemporary comprehensive planning.

Overview

The *Port City Atlas* brings together academic reflection and spatial analysis to outline the legitimacy and urgency of the port city territory as a scalar unit for European data collection, mapping, analysis and planning. At the pluri-national, trans-European scale, port city

territories are key sites of economic, spatial, cultural, ecological collaboration and integration, which, when identified, can inform planning policy and integration. The book is set up in three parts, each focusing on a specific aspect of the port city territory.

Part I, composed of three chapters, sets out the foundations of the project from three perspectives: conceptualizing port city territories; establishing infographics and geospatial mapping as a method for understanding port city territories; and the role of port development in shaping port city territories. Chapter 1 examines the development of the new concept, the European port city territory. It explores current European port city territories as a result of historical path dependencies and looks at the present and future of their integrated governance. Chapter 2 explores geospatial mapping more deeply, as a novel methodological approach to explore port city territories comprehensively, both across local borders and comparatively across Europe. Chapter 3 shines a light on the role of port development and planning in port city territories. Together these chapters set the stage for conceptual, methodological innovation and for new approaches to policymaking, planning and governance in these territories. European-scale maps (pages 19, 31, 41 and 51) accompany the texts and visualize their sea-based approach to Europe. They show Europe's position in the global trade network, Europe's seaports, related urbanized territories and major sea- and land-based mobilities. They show the importance of these coastal ports, and adjacent urban settlements and territories, and demonstrate their unique geographical, topographical, historical, national and other patterns. The map on page 51 features the 100 largest port city territories in terms of throughput and provides a first glimpse of the unity in diversity of port city territories and the benefits of a shared approach.

Part II is the core of the project, featuring 108 maps in three sections and three short chapters. Each of the sections applies our concept and methodology to the European Union. Each section is composed of a short introductory text and relevant maps that again focuses on each scale of analysis: the European scale, the scale of the four maritime waters and that of the 100 port city territories. The chapters briefly present the geographical and topographical particularities at the scale of Europe, the four maritime waters and the port territory respectively. They address questions of geography, history, and the role of ports in their territories, and they discuss the scale chosen for mapping as a foundation for interpretation and design. Chapter 4 introduces two European maps (pages 67–69) that show how both cargo and passenger ports have an impact on the form and function of the port city territory, respectively. Chapter 5 introduces the level of the four maritime waters, attending to their characteristics, such as depth, size, ecology and location on shipping routes (pages 75, 81, 133, 185 and 236–237).

Chapter 6 introduces the 100 port city territories that form the core of the *Port City Atlas* (pages 81 to 287). Ranking cargo and passenger ports, and taking into account the number of inhabitants of port city territories, we have identified the 25 key ports in each of the four European maritime waters.

Part III provides deeper interpretative analysis, bringing together lessons from the making of the *Port City Atlas* through the lens of port development, and of mapping and conceptualizing European port city territories. Chapter 7 explores the many ways in which port development and port planning have shaped and continue to shape the port city territory. Chapter 8 examines the lessons that can be drawn from the mapping and analysis of individual port city territories. Chapter 9 explores the multiple opportunities and challenges of the location of UNESCO World Heritage properties in port city territories for the protection of Outstanding Universal Values (OUV) for maritime flows and economic growth at a time of climate change and changing water levels.

Together with the dedicated spreads of maps, the articles show both the level of threat that Europe faces in its coastlines and port city territories, and provide a proof of concept for a better understanding of shared challenges and opportunities for these territories.

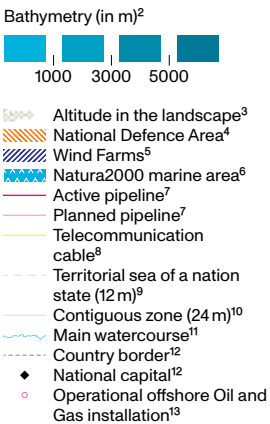
We sincerely hope that this *Port City Atlas* will serve as a methodological model for international investigation; as a bridge between different disciplines and fields, such as history and design, planning and governance, logistics and urban design, ecology and economy; as a catalyst for new scholarly and professional explorations of the impact of ports on cities and territories—a theme that many ports recognize as being of key importance; and as a foundation for discussion, updates, and innovation within and among port city territories themselves.

Even though not all European countries have access to the sea; they are all dependent on seaport territories through river networks. Landlocked countries such as Switzerland and Austria have major river ports, for example in Basel and Vienna. For the purpose of this *Port City Atlas*, we have focused on seaports; a second volume will study river and channel port territories that are major inland connectors. In a next step this methodology can be used as a foundation to explore how historical development has shaped development patterns today in diverse port city territories; or for citizen engagement, with the goal of developing shared approaches in support of ports that serve nearby territories as well as far-flung fore- and hinterlands.

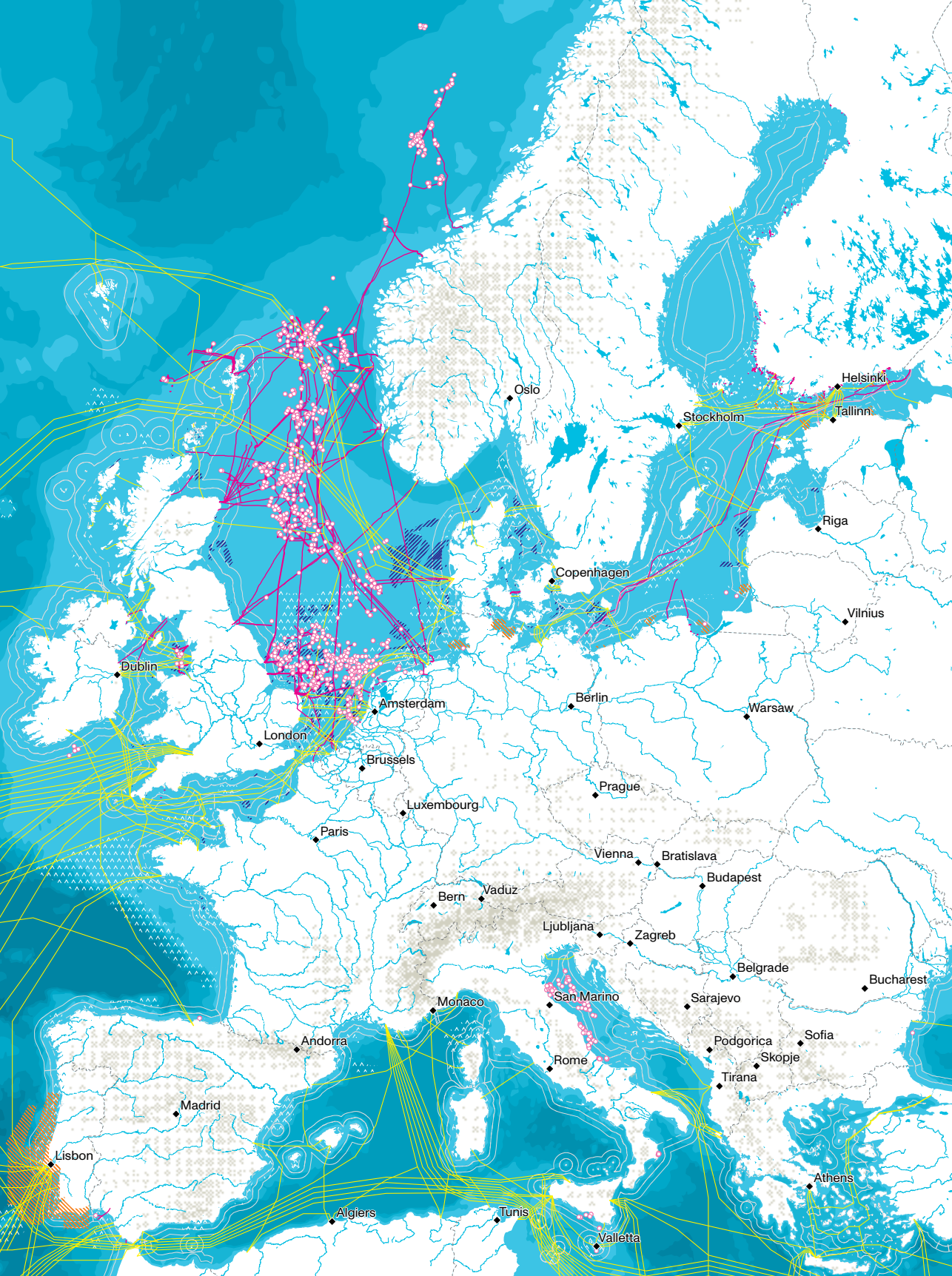
I Exploring

Europe from its Maritime Waters and Coasts

The sea is not an empty space, but a territory where multiple political, economic, commercial and military interests coexist and sometimes collide. It is a territory of maritime flows that shape the coasts of Europe independently from national borders and land-bound dynamics. It is also a territory where many challenges play out, including climate change, energy changes, migration, and sea-level rise. The map shows both tangible and intangible features at sea: energy extraction (oil terminals and wind farms) and transport (pipelines and telecom cables), military control (national defense areas), economic and political interests (maritime boundaries and shipping lanes) and nature protection (Natura2000). To manage all these factors, port city territories must forge both far-reaching cooperation and regulation. One example of this work is Maritime Spatial Planning (MSP), by which the relevant Member State's authorities analyse and organize human activities in marine areas to achieve ecological, economic and social objectives.[1]



1 Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning, Article 20. Also online. Available HTPPS: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0089.
2 Natural Earth.
3 EA EuroGeographics EuroDEM, 2022.
4 EMODnet Human Activities, MilitaryAreas 2021.
5 ———, Windfams, 2022.
6 ———, Environment, Natura2000, 2015.
7 ———, pipelines, 2022.
8 ———, Telecommunication and power cables, schematic routes, 2021.
9 ———, Maritime boundaries, 2022.
10 An extension of the territorial sea to a maximum of 24 nautical miles (44.4 km) from the baseline, within which a state can exercise limited control (EMODnet Human Activities, Maritime boundaries, 2022.
11 Based on Eurogeographics, (2020). EuroGlobalMap. Version 2020 Eurogeographics. Retrieved from https://eurogeographics.org/maps-for-europe/open-data.
12 Eurostat/ Natural Earth.
13 EMODnet Human Activities, Oil and Gas, Offshore Installations, 2015.


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San Marino
Sarajevo
Andorra
Podgorica
Sofia
Skopje
Rome
Tirana
Madrid
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Athens
Algiers
Tunis
Valletta

1 European Port City Territories in the Past, Present and Future

Abstract

European port city territories have been at the heart of European development at the edges of the continent for centuries. They are closely interlinked, face similar challenges, and have evolved in relation to each other in continuous global and local exchange. Their shared characteristics start with their relation to the sea and to shipping, and continue in spatial, economic, political, social and cultural patterns. The stakeholders of each port city territory include a port authority—often very powerful and with ties to national authorities—and diverse local actors and groups of citizens, often less powerful. At the same time, each port city territory has developed its own distinctive spatial strategies and constellation of stakeholders over time. Collaboration among these stakeholders depends largely on their willingness to engage with each other, and on the availability of shared spaces and tools. Only a few institutions promote collaboration among these interest groups or across and among these territories. With a stronger awareness of the historic conditions shaping port city territories and their relationships with each other, stakeholders can better work together to overcome spatial, social and cultural challenges today, such as sea-level rise and other climate-related changes in water patterns. This chapter first shows, through the cases of London, Rotterdam and Hamburg, how historic investments and actor constellations influence decision-making today and going forward. It then examines current stakeholders, their collaborations, and tools, and posits that this atlas can facilitate the emergence of shared practices, policies and governance systems for these delicate territories at the boundary between sea and land.

Introduction

Our Atlas starts with a focus on seaports: engines of technological innovation, economic development and prosperity, and agents of urban and European territorial development. Seaports have long served as hubs of transit for global flows of goods; accordingly,

Carola Hein

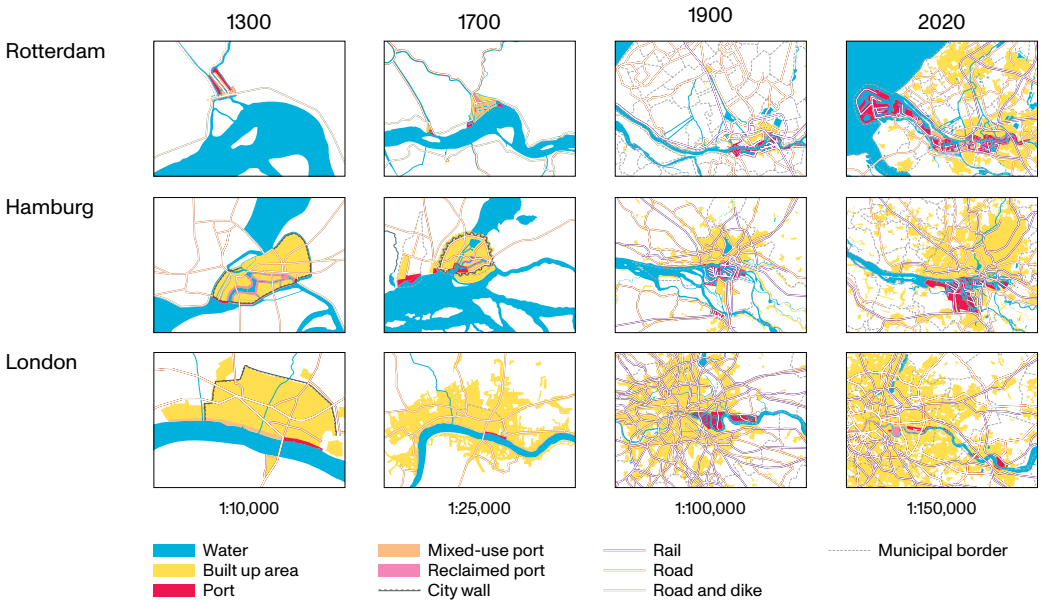


Fig. 2 Comparison of the historical spatial and institutional urban development in three port city territories from 1300 to 2020, with a selected abstraction of land and water, built-up area, infrastructure and administrative boundaries (Authors: Carola Hein, Yvonne van Mil, Blanka Borbely and Batuhan Özaltun).

large numbers of people have settled near them, creating industrial hubs and metropolitan areas where the land meets the sea over millennia. Many developed into global metropolises, leaders in urban transformation and creativity. To serve shipping, and to facilitate local and regional growth, public and private leaders have built harbours, urban spaces and infrastructure in and near the port. They created port city territories that have been key to European development on the borders of the continent. These port city territories have long facilitated the development of new spatial and institutional solutions. They can also be critical in addressing the challenges we face today, such as the energy transition and implementing the UN Sustainable Development Goals (SDG). Given the urgency of the current climate crisis and its impact on water systems, Europe needs comprehensive multi-scalar collaboration with new approaches to governance and spatial development. Recognizing where we stand—in spatial development, in institutional collaboration and in their respective narratives—is a key step in overcoming blockages from long-term petroleum-fuelled unsustainable development.[1]

Port city territories around the world today are the outcome of long-standing stakeholder collaborations (and sometimes their absence) and other historical practices established often over a long period of time. As current stakeholders prepare plans and policies with each other, whether in one or across multiple port

1 A. Sorensen, 'Taking Path Dependence Seriously: An Historic Institutionalist Research Agenda in Planning History', *Planning Perspectives* 30, 1 (2015), 17–38. Also Online. Available HTTPS: https://doi.org/10.1080/02665433.2013.874299.

city territories, they can collaborate better when they understand these roots at the territorial scale and develop a comprehensive understanding of how flows of goods and people through ports shape port city territories. In Europe, they can contribute to shared values and cohesion policies. This chapter first explores the role of historical processes and stakeholder engagement through a few case studies, identifying historic trajectories, so-called path dependencies and key moments of change, or so-called critical junctures—concepts derived from the political sciences in the context of the theory of Historical Institutionalism.[2] It then addresses stakeholder interaction in a single port city territory and collaboration among stakeholders in multiple port city territories. Understanding these complex situations, in part by mapping and visualizing port- and shipping-related flows, can provide stakeholders with a much-needed foundation for engaging with each other, overcoming disciplinary approaches, and building new coalitions for sustainable planning and policymaking.

2 Sorensen, 'Taking Path Dependence Seriously'.

The Past Shapes the Present: Historical Processes as the Roots of Contemporary and Future Port City Territories

Historical analysis is important to gain a better understanding of local development and of the goals and often long-standing power interrelations among local actors. While we do not explore the historical development of port city territories, our maps show the outcome of long-term investment and long-standing institutional constellations. As public and private leaders and diverse citizens in Europe built harbours, cities, and infrastructure over the centuries, they developed distinctive social and cultural practices that continue to shape development today and in the future, or path dependencies. These are self-reinforcing practices, in part because their 'embeddedness' in institutional dynamics and physical structures implies that there will be significant costs to changing strategy. Once a development path is established in a port's space—particularly in the capital-intensive port infrastructure[3] of wharves and docks—it can determine port and city functioning and institutional interactions for decades, if not centuries to come. Moreover, in making complicated decisions, stakeholders often rely on familiar, proven strategies. Path dependence theory emphasizes not only this institutionally established continuity, but also the role of critical junctures, decisive interruptions that privilege some pathways over others, in turn reshaping institutions. For port city territories, the arrival of steam ships and containerization have served as such critical junctures. Ongoing decisions almost necessarily follow these privileged paths; in many cases, decisions and built structures cement ('lock in', to use path-dependence terminology) development paths and once again change becomes difficult. The actions of individual actors within and among port city territories

3 C. Hein and D. Schubert, 'Resilience and Path Dependence—A comparative study of the port cities of London, Hamburg and Philadelphia', *Journal of Urban History* (2020), 1–31. Also online. Available HTTPS: https://doi.org/10.1177/0096144220925098.

are thus the outcome of historic processes, and in the absence of new critical junctures future decisions will still follow established development paths.

The relationship between ports and city authorities has its own historical path dependencies and critical junctures. Historically, diverse stakeholders collaborated to facilitate the transfer of goods and people across each territory, and they often found ways to balance positive and negative effects of the presence of the port on the territory to make the areas attractive enough for workers and cities. Increased wealth, jobs and education are advantages; environmental pollution, safety risks, and decay of natural ecosystems are detrimental to the health of communities living nearby. Following containerization in the 1960s, the historical balance shifted: people lost their jobs and ports moved from their nearby cities and territories to new deep-water sites for container storage and logistics. In the places they left, waterfront redevelopment for urban activities emerged as a key planning challenge—even as the residual environmental impact of the ports lingered. Air and water pollution, both past and present, clearly illustrate the need for collaborative understanding and governance of port city territories. The exhaust gas of ships, of industries and of logistics travels across the borders of land ownership and the fences of port areas. Citizens in the nearby territories are subject to this pollution and other forms of what are often called negative externalities. Port authorities need these citizens' support for their activities, the 'licence to operate'; they also need new workers to do the work of the ports of the future. Finding novel ways to collaborate with their neighbours will enable port city territories to keep playing their traditional role as places of innovation and will also make them key agents for a collective European future.

Conceptual, Methodological and Planning Innovation

Despite their similarities and shared functions, port city territories differ from each other, often profoundly, as each territory's current form and function is the outcome of centuries of a distinctive history. They can consist of a major port and a large metropolis (e.g., Barcelona); of a large port and a decentralized urban agglomeration (e.g., Rotterdam); of an important port and a tiny settlement (e.g., Bremerhaven); or of multiple ports in a sparsely populated territory (e.g., Las Palmas). These multiple spatial constellations are also shaped by different maritime functions. Transport of containers or bulk cargo (including petroleum) has a different spatial impact than cruise shipping or yachting; another key activity, fishing, is not even included in this analysis. Furthermore, each port city territory also has a multitude of governance structures, institutions and collaborations, each of which has its own data, policies and tools for planning and development.

Carola Hein and Yvonne van Mil pursued a historical mapping of European port city territories in the first incarnation of this project. However, we found that the analysis of historic maps and archival documents this requires was extremely time consuming and required deep local knowledge. We therefore switched our attention to the contemporary situation, for which open-access data is available. But these barriers would be far lower for local stakeholders, and we encourage readers to consider developing similar historical map sequences for their own port city territories. These will reveal which actors have been the driving force behind change in the past and can potentially be activated to engage with challenges and transitions going forward. To provide an incentive for readers to pursue their own historical geospatial mapping, here are the results of our pilot mapping and comparative analysis of three European port city territories—Rotterdam, London, Hamburg.[4] Reading these analytical maps in conjunction with historical documents reveals continuities beyond moments of extreme change. In all three examples, port, city and territorial activities have close spatial and institutional connections; there are specific relationships that drive future development; and each faced the same challenges of shipping and maritime development. Yet the relationship between different actors, their control of space, and their respect of each other's needs has worked out in very different ways in these port city territories.

In the case of the port city territory around Rotterdam, including its neighbouring cities The Hague and Dordrecht, the historical mapping suggests, and historical investigation confirms, that the port authority has spearheaded local spatial, economic, and social development by introducing novel technologies or developing new spaces; these moments of innovation included the advent of steamships, the growth of petroleum storage, and containerization. Even today, the Port of Rotterdam takes the lead, addressing challenges of energy transition and digitization. Meanwhile, in the case of London, stakeholders privileged the urban function over port activities. London's historic dependence on private shipping and the strength of its financial system ultimately separated port and city functions: port stakeholders and urban decision-makers developed new sites for shipping, moving port functions first beyond the borders of the city and then outside the larger London region. Critical junctures, including strikes, did not reverse these roles, and maritime heritage serves as a backdrop for urban activities today. In the case of Hamburg, port and city activities started off intertwined and have been governed together as a tandem; as the city grew, so did the port, and they have developed very much in relation to each other. Local actors responded to critical junctures from both city and port perspectives. It can be expected that strategies for sustainable development will follow similar patterns,

4 C. Hein and Y. van Mil, 'Towards a Comparative Spatial Analysis for Port City Regions Based on Historical Geo-spatial Mapping', *PORTUSplus* 8 (2019), 1–18. Also online. Available HTTPS: https://portusplus.org/index.php/pp/article/view/189.

the Port leading in Rotterdam, the City in London, and Hamburg working as a tandem.

Historical geospatial mapping helped us visualize these path dependencies and critical junctures in these select territories at specific moments in time. It showed that the historic responses from each territory were different, even as each location dealt with the same challenges.[5] We haven't yet analysed the interaction between port city territories, but this could be an important next research step. This historic overview suggests that today's futureoriented solutions need to acknowledge historical path dependencies as a foundation for current conditions; in other words, current conditions are an outcome of the physical spaces, institutional structures, and cultures established over centuries, and thus those dynamics and structures will continue to shape the future. This diversity of responses also signals that we need a mixture of global interventions and locality-specific approaches and that different territorial stakeholders must collaborate for sustainable development both within and among port city territories. In finding this balance, port city territories and their governance authorities can effectively contribute to European cohesion and sustainable development.

5 AIVP Agenda 2030. Online. Available HTTPS: https://www.aivp.org/en/acting-sustainably/agenda-2030/.

The Present Shapes the Future: European Port City Territories as Stewards of Sustainable Development at the Boundary between Sea and Land

Path dependencies are embedded in the spaces, institutions, and cultures of port city territories. They are at the heart of hidden designs of spatial strategies, policies and laws with a single port city territory. They also mark shared development among port city territories, as these host the same ships and face the same water-based challenges.[6] With the climate crisis, we are again at a critical juncture. A number of new institutions, collaborations and tools are starting to work to involve different communities of actors in port city territories in the conversation about sustainable development: to offer advice, to collect best practices, and to align the work of port city territories. These include the worldwide network of port cities, AIVP (Association Internationale Villes et Ports), and RETE, the Association for the Collaboration of Ports and Cities. AIVP promotes its own agenda 2030 for sustainable development.[7] RETE aims to bring together diverse actors for port city territory governance.[8] Meanwhile, the UFM (Union for the Mediterranean) is developing tools for collaboration between port city territories on sustainable development, including its Strategic Urban Development Action Plan 2040.[9] The development of infrastructure and sustainable mobility on the sea-land continuum is part of ongoing discussions about the European Commission's European Green Deal.

6 'Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning'. Online. Available HTTPS: http://data.europa.eu/eli/dir/2014/89/oj.

7 AIVP Agenda 2030.

8 RETE. Online. Available HTTPS: https://retedigital.org/?lang=en.

9 UFM, 2021, Strategic Urban Action Plan 2040. Online. Available PDF: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://ufmsecretariat.org/wp-content/uploads/2021/09/UfM_Strategic_Urban_Development_Action_Plan_2040.pdf.

Through the EU directive on Maritime Spatial Planning, the EU promotes planning for a comprehensive ecosystem to connect water and land.[10] The Commission has also recognized the importance of ports with regards to sustainable European development.[11] The proposed revision of the TEN-T Core Network,[12] which contains all modes of transport (roads, railway lines, inland waterways, maritime shipping routes) that are of European importance, addresses questions of sustainability, resilience and future-oriented mobility; sea and river ports are core nodes in this infrastructure.[13] The European Commission's concept of Motorways of the Sea (MoS), a network of short-sea routes, ports and other relevant maritime infrastructure and facilities, aims to achieve a European Maritime Transport Space without barriers.[14] Ports themselves have established institutions to facilitate exchange and best practices for sustainable development, including the European Sea Port Organization (ESPO), the International Association of Ports and Harbors (IAPH), MedPorts, and the World Port Sustainability Program (WPSP). Meanwhile, cities have gathered in organizations such as the C40 Cities Climate Leadership Group, the Resilient City Network, and MedCities to address challenges of the climate crisis. Numerous cities and regions celebrate the annual European Week of Regions and Cities to showcase their capacity of creating jobs and growth, providing good governance and implementing European cohesion policy, as well as addressing the climate crisis.[15]

Other projects aim to promote sustainability at a larger territorial scale. Boussole 21, for example, is a digital tool that helps stakeholders to set priorities and to identify challenges and opportunities to achieve UN 2030 SDGs. Amira Ghennai and colleagues have already applied the tool with stakeholders from Algiers and explored its potential for the port city territory of Skikda.[16] Similarly, the industrial canvas (Toile industrielle®) graphically represents important relationships and exchanges between different industries in the port city of Dunkirk and provides stakeholders with a systemic approach for designing economic strategies based on common goals.[17] It can support projects that aim to help former port areas whose redesign is particularly constrained by costs of decontamination and complex landownership,[18] such as the project European Sustainable Urbanisation through port city Regeneration (ENSURE), a project by ESPON. It can also support innovative ways of accelerating the transition to cleaner energy sources, as proposed by MAGPIE, the European project for smart green ports.[19] Others are introducing alternative modes of transport in port cities across Europe, as in the project CIVITAS PORTIS.[20] Finally, some ports, cities and other entities are already collaborating directly on sustainable development; the cases of Limassol[21] and Barcelona are worth mentioning here.

A focus on port city territories as key agents at the boundary between sea and land, and as a collective agent in European

10 'Directive 2014/89/EU'.

11 EU Commission, 'COMMUNICATION FROM THE COMMISSION Ports: an engine for growth'. Online. Available PDF: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52013DC0295.

12 Trans-European Transport Network (Ten-T). Online. Available HTTPS: https://transport.ec.europa.eu/transport-themes/infrastructure-and-investment/trans-european-transport-network-ten-t_en.

13 S. van der Werf, J. Arts, G. Smit, M. de Bruijn, K. van der Linden, R. Poppeliers and P. Staelens, 'Validated policy recommendation for better integration of urban nodes in the ten-t network.' (2020) Online. Available PDF: https://vitalnodes.eu/wp-content/uploads/2020/01/Vital-Nodes-recommendations_final.pdf.

14 Motorways of the Sea (Mobility and Transport). Online. Available HTTPS: https://transport.ec.europa.eu/transport-modes/maritime/motorways-sea_en.

15 Van der Werf et al., 'Validated policy recommendation'.

16 A. Ghennaï, S. Madani, and C. Hein, 'Evaluating the sustainability of scenarios for port city development with Boussole21 method', *Environment Systems and Decisions* (2022). Also online. Available HTTPS: https://doi.org/https://doi.org/10.1007/s10669-022-09869-9.

17 J.-F. Vereecke and C. Hein, 'Port city ecosystems and the "canvas" as a tool for analysis, interpretation and planning', *PortusPlus* 2022-1 https://portusplus.org/index.php/pp/article/view/262/235.

18 ENSURE. Online. Available HTTPS: https://www.espon.eu/ENSURE.

19 Magpie. Online. Available HTTPS: https://www.magpie-ports.eu.

unification and climate change mitigation and adaptation, however, is still largely missing from these sustainable development initiatives. Our atlas provides these projects and actors with a shared framework for potential policy transfers, or more general comparison, providing a visual foundation. It conceptualizes and visualizes port city territories, fostering a governance approach that allows stakeholders on the sea-land continuum to coordinate with each other. It lets people look closely at individual port city territories and across multiple port city territories, providing insights into both shared maritime threats and opportunities, as well as local particularities that require individual solutions. Its comparative detail lets academic and professional stakeholders think about, for instance, how transport infrastructure concretely affects territories, people's lives and heritage sites. Stakeholders can gain a better understanding of the evolving spaces and scales in which they are active.

Conclusion

Port city territories are uniquely suited to guide European development and to serve as stewards of the sea. But the diversity today of European port city territories, of institutions, and of policies and laws, requires a careful analysis both of individual port city territories and of their intersections, while acknowledging the local histories of development and engagement among stakeholders. Understanding both the shared needs and the spatial, social and other differences among port city territories, stakeholders can develop locally adapted strategies and provide a framework for the development of European cohesion policies.

This atlas captures a snapshot of the current situation as a result of past investments and practices. It clarifies the need for the European Union to develop shared perspectives for port city territories and for collaboration among multiple entities. Such a comprehensive approach to port city territories can facilitate discussions on new strategies and tools to (re)shape built-up and agrarian areas, including expropriation and land readjustment or zoning[22] and facilitate solutions for contested projects. European professional organizations such as AIVP, RETE and academic groups such as LDE PortCityFutures and the UNESCO Chair Water, Ports and Historic Cities promote such collaboration through their engagement with professional and academic members, and through new tools and concepts. Their work complements and links to ongoing collaboration among like-minded actors who have formed thematic networks, including port, city and territorial authorities. These and other cross-border collaborations are an important step forward to overcome the limitations of the laws and policies of local, regional, national and international (including European) governance systems, and to address the economic and ecological needs and challenges of spatial systems that flow beyond administrative borders.

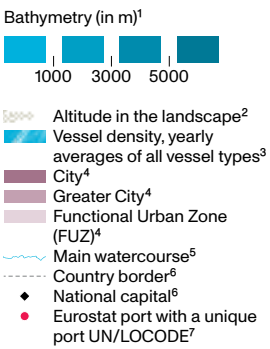
20 Civitas Portis. Online. Available HTTPS: https://civitas.eu/projects/portis.

21 Institute, Cyprus Marine and Maritime, 'Sustainable Blue Economy 2030 Emerging challenges and prospects' (2022). Online. Available HTTPS: https://www.cmmi.blue/sustainable-blue-economy-2030-emerging-challenges-and-prospects.

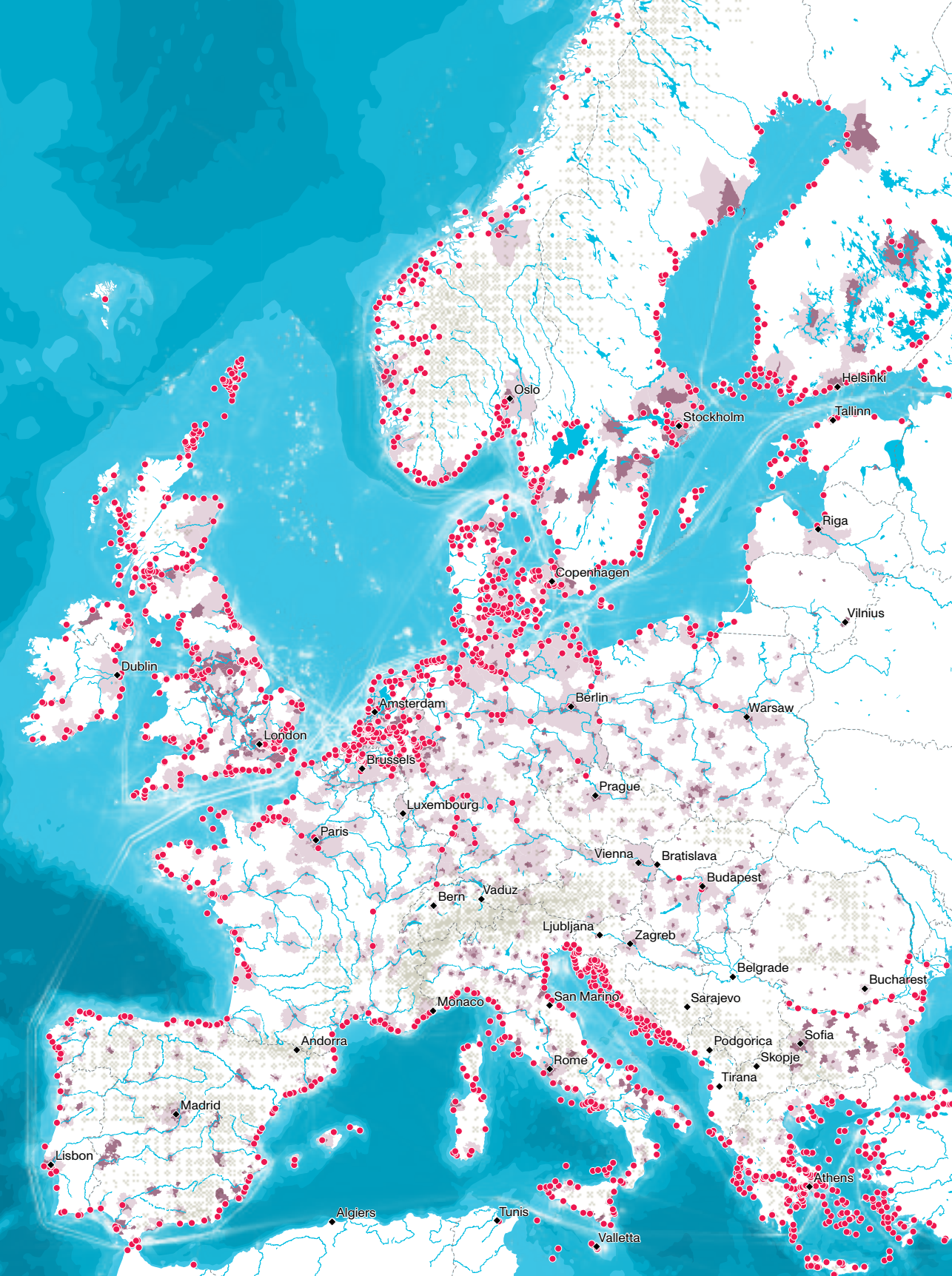
22 R. Alterman and C. Pellach, *Regulating Coastal Zones. International Perspectives on Land Management Instruments* (Routledge, 2021).

Europe through its Ports and Metropolitan Areas

The European territory is dotted with ports, most of them sea ports along the coast; they have been engines of economic development for many centuries. As agents of climate change, they can also be key players in the shift to sustainable development at the border between sea and land. The map shows all the ports—big and small—that report to Eurostat, in relation to high-density metropolitan areas, specifically Cities, Greater Cites and Functional Urban Zones (FUZ, or a city and its commuting zone whose labour market is highly integrated with the city). Inland metropolitan areas are connected to seaports by the main waterways, which cross multiple nations, regions with a variety of governance systems, and a range of geographies. Only a few inland metropolitan areas are not directly or indirectly connected to the sea.



1 Natural Earth.
2 EEA EuroGeographics EuroDEM, 2022.
3 EMODnet Human Activities, Vessel Density Map 2019.
4 Eurostat Urban Audit, 2020.
5 Based on Eurogeographics, (2020). EuroGlobalMap. Version 2020 Eurogeographics. Retrieved from https://eurogeographics.org/maps-for-europe/open-data.
6 Eurostat/Natural Earth.
7 Eurostat, GISCO ports, 2013.


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2 How Can Mapping Help to Better Understand Port City Territories?

Abstract

Understanding the unique spaces of port city territories where global flows meet local geographies, topographies, histories and practices, requires a uniform approach of visualization, specifically mapping a large number of territories in a unified way. Such an approach can also help us understand the relationships between sea and land, and among port, city and territory. It furthermore helps us explore the relationship among multiple port city territories as part of international networks of trade, and it can facilitate the identification of 'gaps' where spatial, institutional or cultural opportunities and challenges exist and where planning can be beneficial. But how do we achieve this mapping method? The challenge is to capture the great diversity of port city territories and to make it possible for readers to explore and compare their spatial particularities. This chapter explores maps and mapping as tools for the analysis of port city territories generally and discusses the availability and interpretation of European datasets for that mapping of European port city territories in particular. It explains the relevance of choices made in the map-making process and points out the challenges of developing a research method that contributes to future spatial development of port city territories.

Introduction

At first glance, port city territories may look similar around the world in terms of location, global connection and infrastructure. However, their scale, form and spatial characteristics, as well as their political, social and cultural structures all vary greatly. We use geo-spatial mapping as a powerful tool to enable a systematic and analytical study of this great complexity within similarity, and to explore how port city territories operate internally, on the seas they border and within Europe. Mapping means discovering all kinds of things and identifying key indicators of port city territory transitions. It can result in a map, of course, but also in other forms, including graphics and narrative analysis. It distils complexity and helps us explore

Yvonne van Mil

the relationship between the spatial characteristics of port cities and their surroundings. Most broadly speaking, we propose a systematic geo-spatial mapping with a uniform approach. This method requires multiple steps of decision-making, including defining the right scales and spatial level for the maps; finding and interpreting sources; and identifying and mapping the most relevant data. These steps are essential and must be carefully assessed and documented; they form the 'black box'[1] of the mapping process.

This chapter describes our mapping method. By separating the various structures that make up port city territories into (thematic) layers in a Geographic Information System (GIS), studying them in a selected and reduced form, and then overlaying them on a map, we make it possible to discern relationships between them. These layers are explained in more detail in this chapter: their relevance for the study of port city territories; how they are identified and represented on the map; and what sources, definitions and decisions they are based on.

Mapping as a Way to Study Port City Territories

How do we devise a mapping method that captures the great diversity among contemporary European port city territories in a uniform way? Maps enable us to form a spatial understanding of things, concepts, conditions, processes and events in the world;[2] they are a means of communication, and they act as an interface between reality and humans. A map is defined by the International Cartographic Association as 'a symbolized representation of a geographical reality, representing selected features and characteristics, resulting from the creative effort of its author's execution of choices'.[3] Mapping is the acquisition and processing of spatial data, which can result in the construction and communication of spatial knowledge though maps.[4] Mapping is a way of doing research; in this case it is a powerful way to see and analyse the spatial structure of port city territories and to see connections or interrelationship between different spatial, social and cultural features and systems that otherwise might remain unnoticed. GIS enables researchers to process, analyse and display complex spatial data. It allows them to combine and compare different spatial and statistical data at multiple scales, and to visualize and analyse these data at a comparable level of abstraction, without losing context or too much detail. Geo-spatial maps and mapping can act as a 'gap-finder', by identifying spatial, institutional or cultural opportunities and challenges, and where planning may be beneficial.[5] The increasing number of spatial datasets available on the internet made it easier for us to collect data. However, these data sources are of limited use if we cannot find meaning in them; perhaps the greatest challenge of mapping is to find a way to use data to create maps that provide new insight into our research questions.

1 B. Harley, 'Deconstructing the map', *Cartographica: The International Journal for Geographic Information and Geovisualization* 26/2 (1989), 1–20.

2 B. Harley and D. Woodward (eds), *The history of cartography*, volume 1 (University of Chicago Press, 1987).

3 International Cartographic Association, 'Strategic Plan for 2003–2011' (2011). Online. Available PDF: https://icaci.org/files/documents/reference_docs/ICA_Strategic_Plan_2003–2011.pdf.

4 D. Dorling and D. Fairbairn, *Mapping: ways of representing the world* (London: Routledge, 1997).

5 C. Hein and Y. van Mil, 'Mapping as Gap-Finder: Geddes, Tyrwhitt, and the Comparative Spatial Analysis of Port City Regions', *Urban Planning* 5/2 (2020), 152–166. Also online. Available HTTPS: doi:https://doi.org/10.17645/up.v5i2.2803.

The mapping methodology used in this atlas involved abstraction of spatial features, selection and layering of spatial (related) data, and standardization of the projection, scale, and symbology. We built on the method that geographer James Bird used to arrive at his well-known *Anyport* model (1963).[6] Bird used a series of uniform abstract maps on multiple scales and diagrams of port statistics, to define, compare and examine the collected scientific data; he used mapping to spatially analyse source material to see connections. In his maps as well as his model, Bird aimed to provide an analytical depiction of similarity by abstracting the ports into standard objects and combining them with a particular version of reality. While we also used abstraction, our methodology differs from Bird's, as we include topographical aspects that are key to development. Our temporal, spatial, and disciplinary approach are new. We explicitly focus on the physical reality of port cities, analysing them in relation to their spatial, political, social and cultural context.

6 J. Bird, *The Major Seaports of the United Kingdom* (London: Hutchinson of London, 1963).

For the mapping of 100 port city territories on multiple scale levels, we depended on existing spatial datasets. It is important to note that these datasets record earlier map-makers' definitions and decisions, and they reflect local particularities or political choices that may already shape answers. Without understanding these definitions and adjusting our approach accordingly, we might well make incorrect assumptions or create misunderstandings. Nevertheless, the choices that cartographers make, consciously or unconsciously, mean that a map is far from objective. As geographer Mark Monmonier puts it, 'There's no escape from the cartographic paradox: to present a useful and truthful picture, an accurate map must tell white lies'.[7] In fact, for a comparative analysis of port city territories and to highlight relevant aspects, maps need to give a selective, incomplete view of reality. But we can make this selective view as clear and honest as possible. To this end, we are not only publishing the outcome of the research—the written as well as the mapped results—but also this 'black box'[8] of the study: the underlying reasoning, decisions, definitions and sources.

7 M. Monmomier, *How to lie with maps* (Chicago: University of Chicago Press, 1991), 1.

8 Harley, 'Deconstructing the map'.

Selecting Levels of Scale and Focus Areas

To study European port city territories in light of their global, national and local contexts, we defined three scale levels of spatial interest: Europe, the four maritime waters of the European continent, and the port city territory. As a continent with a long maritime border and historically strong oversea connections, Europe has promoted sea-based transportation for centuries. Shipping, industrialization and urbanization, the growth of ports, cities and neighbouring areas have led to the emergence of port city territories with their shared goal of facilitating the transhipment and throughput of goods and people, which have led to unique spatial patterns. Each of the four maritime waters has distinctive geographical features, with its own

long maritime history and position in global transport networks; and each sea creates a unique framework for groups of port city territories and helps explain the configuration of each territory. This sea-based approach allows us to both present the larger spatial context and to zoom in on the level of a single territory. It helps us to explore the ways in which the European coast and the four maritime waters have served as foundation for political, economic and social development; and to link this foundation to the analysis of the port city territories.

The *European* scale means that all port cities are part of the same overarching political entity, with corresponding legislation, regulation, and a common European history. This scale helps us to show how the port city territories are connected through water and over land, and how they are related to each other; to their geographical, topographical and political context; and to the European network of trade. At the same time, the nations are very different from each other, and their borders have changed over time; if we looked only at this European scale, we would end up with a strong emphasis on the North Sea, since the major cargo ports and most of the densely populated regions are located here.

Adding a second scale, and exploring port city territories within and among *the four maritime waters that surround Europe*—the Baltic Sea, the North Sea, the North Atlantic Ocean and the Mediterranean Sea—we can identify special constellations and conditions, such as natural geographical conditions, cultural and political settings and their position in maritime networks, which differ for each sea. This scale allows us to study the interaction between port city territories within the context of a common body of water and a shared hinterland.

The *port city territory* is the third scale, capturing the spatial relationship between the port, the adjacent city and the surrounding landscape, and their geographical location and urban patterns, as well as transport networks and institutional borders. To map each port city territory in a uniform manner, we selected a scale independent of institutional borders and pragmatically chose a format that can be printed in a standardized book format. That is, whereas Europe and the seas can be clearly defined based on statistical and spatial data from the European Commission, the port city territory is not a defined administrative or governance unit. Administrative units are institutional and do not necessarily coincide with the area that the port presence negatively or positively affects. Rather, a port city territory is a functionally connected area, bordering a foreland (sea or ocean) and connected to a hinterland. It cannot be strictly defined on the basis of data, as such areas are changeable over time, can be intertwined with other port city territories and merge into one another in barely perceptible ways. The uniform scale reveals how relatively big or small ports and their

urban settlements are—Rotterdam port barely fits into this format, and London actually needs two maps. The maps do not necessarily show the whole territory of a port, as it is difficult to define, and at times ports that have the same throughput cover a larger territory and can have a bigger impact on their environment. Rather, they show (part of) the area under the influence of the port city.

We followed the Eurostat definition of a *port* as 'a place having facilities for merchant ships to moor and to load or unload cargo or to disembark or embark passengers to or from vessels' and classified their data by cargo, and passenger transportation.[9] To test our methodology, we decided to select 25 ports per sea. This number was somewhat random, but multiplied by the four maritime waters it gave us a sample of 100 territories. To enable comparison between the four different waters—to understand how different nations engage with the sea, for example, and how they have historically evolved—we used the same selection criteria or indicators for all four maritime waters. We selected ports based on their throughput of total tonnage of cargo and total number of passengers, with cargo being weighted more heavily. Then, since we focus on *port city territories*, not ports alone, we combined these figures with the population numbers of Eurostat NUTS 3 regions, or regions with at least 150,000 inhabitants and with major settlements.[10] For the following cities, we have also selected some ports that didn't meet these criteria, such as Bordeaux and Oslo. We included them because they are important historical and cultural port cities that have adapted to the transit of freight and passengers for decades or sometimes centuries. Although they have recently lost some of their port function and can no longer compete with modern industrial ports, their urban structure, infrastructure and architecture is still based on that (former) port function, and they face similar future challenges as other port cities, such as the redevelopment of former industrial port areas. Finally, given that all the infrastructure is still there, they have the potential to become important again.

9 Eurostat, 'Reference Manual on Maritime Transport Statistics version 4.1' (2019), 8. Online. Available PDF: https://ec.europa.eu/eurostat/documents/29567/3217334/Maritime_reference_manual_2019.pdf.

10 Eurostat, 'Regions in the European Union. Nomenclature of territorial units for statistics NUTS 2013/EU-28' (Luxembourg: Publications Office of the European Union, 2015). Online. Available PDF: https://ec.europa.eu/eurostat/documents/3859598/6948381/KS-GQ-14-006-EN-N.pdf/b9ba3339-b121-4775-9991-d88e807628e3?t=1444229719000.

Finding and Interpreting Datasets

To study and compare these European port city territories at three different scales consistently and systematically, we used harmonized datasets that cover all European nation-states with sufficient spatial resolution. National and regional data may be more detailed and accurate, but is often not freely accessible, and each dataset has its own definitions and criteria, which makes combining and comparing difficult. To avoid incompatibility issues across incomparable definitions, we selected spatial and statistical data from open access European datasets: the statistical data for the maps and infographics come from *Eurostat* and are combined with spatial data from *Copernicus*, maritime data from *EMODnet* and data on transport networks from *EuroGeographics*. These agencies are

coordinated by the *European Commission* and produce environmental and statistical datasets of the *European Economic Area* (EEA). Understanding by whom, how and for what purpose the data was obtained is important: these dynamics and choices affect how data can be interpreted and used. For example, the spatial datasets are based on satellite imagery and automated photo interpretation, therefore they are not always accurate and detailed. This in turn limits the scale to which the datasets can be applied and the precision of figures shown in the infographics that accompany each map. Matching the detail level of a dataset to the scale of the map is important: more detailed data holds more knowledge, but this knowledge is lost in translation when it is not readable on the map. Less detailed data, on the other hand, can overgeneralize knowledge, which can in turn lead to wrong conclusions.

Port city territories are embedded in their natural and man-made geography. To study the natural geography of port cities, we selected basic geospatial layers: the morphology of land and water, the elevation of the landscape and the depth contours of the sea. To study the relationships between port city territories at the European and sea level, these layers are complemented by maritime statistics, data on the urbanization of administrative units, and global infrastructure networks. At the scale level of the port city territory, we added spatial patterns on the basis of an abstract morphology of the land cover, which is an abstraction of the built and natural details on the surface, mapped and recorded through land cover survey initiatives (EEA CORINE land cover programme by the European Environment Agency;[11] Urban Atlas;[12] Coastal Zones.[13] In order to study shared or conflicting interests between natural location and man-made features, we completed this land cover data with information from Natura2000 areas, a network of protected areas for Europe's most valuable and threatened species and habitats. We overlaid these spatial layers with a layer of European, national and regional transport networks to illuminate the connections between the port and its territory, particularly its hinterland and foreland. Local administrative boundaries are added to show urban and maritime areas in relation to local regulations and interests. The maps are supplemented with infrastructural, political, cultural and social objects of interest to signal the degree of urbanization and centralization in each territory.

11 Copernicus, 'Corine Land Cover version 18.5' (2018). Online. Available HTTPS: https://land.copernicus.eu/pan-european/corine-land-cover.

12 Copernicus, 'Urban Atlas version 013' (2018). Online. Available HTTPS: https://land.copernicus.eu/local/urban-atlas.

13 Copernicus, 'Coastal Zones version 010' (2018). Online. Available HTTPS: https://land.copernicus.eu/local/coastal-zones.

Selecting and Mapping Relevant Data

Using European datasets, it is important for the mapmaker to select and identify relevant features per scale level. Selection is a form of generalization, a process of meaningfully removing and abstracting details to support the purpose of the map. Maps are useful not because they represent all of reality in all its complexity, but because they intentionally omit details to make the subject as clear as possible.

Land Cover

Mapping the abstract morphology of land cover—distinguishing between built-up areas, industry, port typology and airports—allows us to analyse urban settlements, the spatial relationships between a port and its adjacent city, patterns of urbanization and the degree of industrialization in the territory. This helps us to identify and better understand the complex urban patterns and densities that characterize port city territories.

Transport Networks

Transport networks over water, land and rail create conditions for urban settlements, economic activities, and mobility of people and things. Mapping this infrastructure gives us another view of how port cities are connected to the hinterland and to the foreland, as well as of their impact on the territory. Each nation-state has its own definitions and classification of infrastructure. To bridge national differences, these networks are distinguished by function and importance rather than by physical characteristic and legal classification. On the maps we show a hierarchy of two classes: the first class represent the main transport routes and corresponds to the comprehensive Trans-European Transport Network (TEN-T) of the *European Commission*; the second class comprises infrastructure of national importance that links larger cities and towns in the territory with national and regional facilities.

Administrative Entities

Mapping administrative boundaries helps us to explore the complex governmental structure of port city territories. Most ports are spread over several local administrative units and have to relate to local as well as regional and state governments. In addition, administrative units are used for analysing data. Harmonized definitions of administrative areas are essential for defining almost all statistics of social, economic, or cultural characteristics. Each nation-state, however, has its own definition and levels of administrative units, which complicates the analysis of port cities within and across multiple nations. In order to avoid incompatibility among administrative definitions, we selected three hierarchical classes corresponding to Eurostat NUTS classification: class one represents a recognized independent state (country), corresponding to NUTS 1; class two is the intermediate or regional level (province, region, county), corresponding to NUTS 3; class three represents local government, including municipalities, communes, and districts, which correspond to the Local Administrative Units (LAU).

Urban Patterns and Objects of Interest

To explore the degree of centralization in the territory, urban functions and the accessibility of nearby towns and villages, we supplemented territorial maps with objects of interest or points of

recognition: buildings for the transport of goods and people (railway stations, airports and ferry stations), health care (public hospitals), higher education (universities), culture and heritage (UNESCO World Heritage properties) and politics (city hall of the port city). These objects are no quantitative overview. They should be considered indicators of presence and location in the territory, and the maps show these objects in relation to their surroundings. A port city that for example accommodates all hospitals and universities in the territory has a centre function, but is also a university city; a railway station shows that an area can be reached by train; a city hall indicates the city centre.

Statistical Data

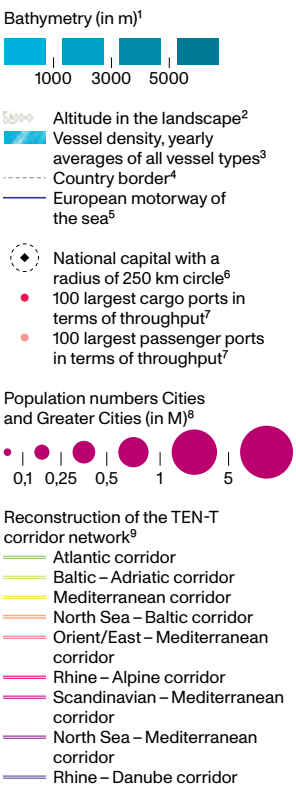
To show more detailed similarities and differences among European port city territories, the territorial maps are displayed in relation to a series of infographics. Each geo-visualization represents the typology and function of the waterbody, port, city and territory, based on statistical data from Eurostat and calculations made in GIS of the land cover, height profile, and distances between the port and nearby capitals. Due to their abstraction and lack of spatial context, these visualizations and graphics make it possible to visualize more and more detailed data not easily represented in maps. Statistics on vessels, for example, show the presence of cruise ships and other vessel types, and statistics on cargo indicate the specialization of ports for oil, containers, or other commodities.

Conclusion

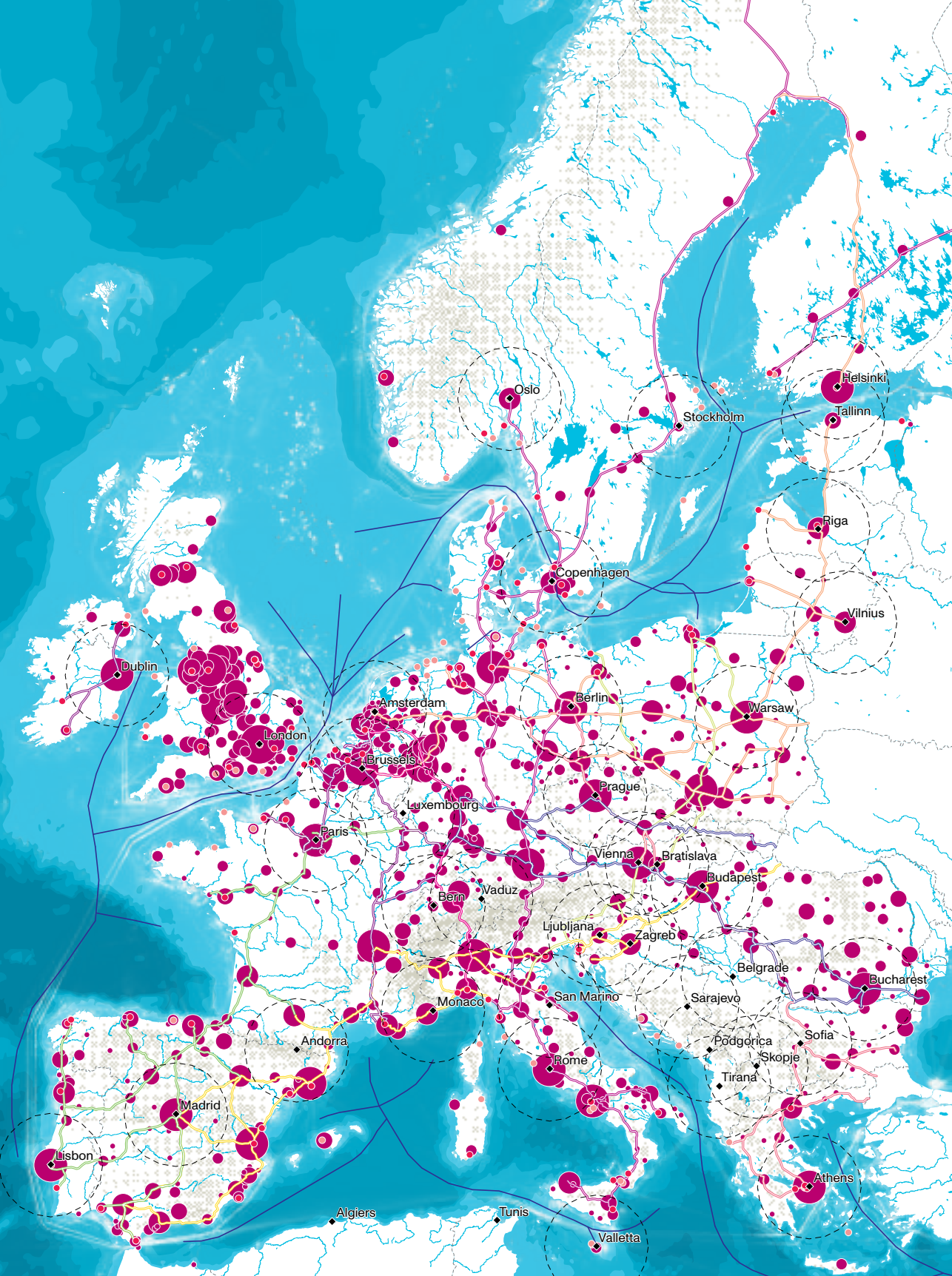
Mapping port city territories and then analysing the resulting maps and infographics helps us to better understand and compare interrelationships among different components of territories, including their spatial characteristics. The key to our mapping method is the uniform legend and its common definitions. By using standardized datasets from the European Commission and carefully interpreting the data and making informed decisions on how to define and present them on the map, we achieved a mapping method that allows us and others interested in port city territories to better understand their complex spatial patterns. The method also allows readers to further refine the maps, choosing themes, time periods or geographical areas; and combining those choices with the infographics. Thus, it can serve as a guide for scholars and professionals working in urban port territories. Choices made during the mapping process have been accurately documented. Only with their documentation can maps and mapping contribute to answering future questions about the spatial development of port city territories.

Europe as a Space of Mobility

The European territory is connected through maritime flows—the exchange of goods and people and their distribution throughout the continent—along its coasts and water, road, and rail corridors. Supranational or European planning has focused on communication and TEN-T networks and on shipping lanes, so-called motorways of the sea, and has been an important part of European unification strategies since 2000. Ports are key nodes in these flows. The map shows that the nine corridors of the TEN-T network connect important urban centres (ranked by population) to the major European ports, carrying goods and passengers from land to sea networks. The map also shows that ports and port cities have important, albeit diverse, connections to European capital cities. While many European national capitals are themselves port cities (Amsterdam, Tallinn and Lisbon), other leading ports serve non-coastal cities—such as Paris by Le Havre, Brussels by Antwerp, Dunkirk and Zeebrugge (even Rotterdam) and Ljubljana by Koper. A circle around each European capital indicates a distance of 250 kilometres, showing the proximity of ports to capitals.



1 Natural Earth.
2 EEA EuroGeographics EuroDEM, 2022.
3 EMODnet Human Activities, Vessel Density Map 2019.
4 Eurostat NUTS 1 data.
5 TEN-T network—European Commission.
6 Natural Earth.
7 Eurostat Maritime transport data, 2019.
8 Eurostat, GISCO Urban Audit, 2020.
9 https://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/map/maps.html?corridor=1&layer=8,9.


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Tirana
Madrid
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Athens
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3 How has Port Planning Shaped European Port City Territories?

Abstract

European ports developed in relation to nearby port cities, and port city territories, shaping each other in planned and unplanned ways. Port authorities and other actors have invested in port terminals, docks, warehouses and port infrastructure over time. This construction and planning of ports has a long history as an engineering discipline. Today port planning is part of urban and spatial planning, and engineering plans are part of executive phases. Unlike urban planning, though, port planning is not bound to administrative boundaries; port city territories elude planning boundaries and established planning procedures. Port planners and port authorities have to find planning compromises at local, regional and national levels as they create and plan ports handling a wide range of cargo or ports handling special cargo, terminals with dedicated functions and, more recently, inland port terminals. Thus, port authorities contribute to the shaping of the port city territory.

Introduction

Port authorities' decisions about port structure, development, and requirements can shape an entire port city territory. Since the mid-twentieth century, port authorities have commissioned port planners to design port layout and infrastructure, including port terminals (their functions, dimensions, capacity, components), port basin dimensions, berths, road systems and railway systems. Port planners take into account local geographic conditions on sea and land, the evolution of vessel types and the room they need to manoeuvre—including sufficient sea depth—and the logistics of transit or transhipment to transfer cargo or containers from one ship to another on their way to final destinations. They develop master plans that provide a blueprint for future development and establish the framework within which each port authority must operate, defining and detailing port-related functions by current and planned land use per location and activity. The data underlying this information is available at the EU level through the Lucas survey

Lucija Ažman-Momirski

carried out by Eurostat.[1] This data shows that ports can be poly-functional, handling a wide range of special and general cargoes, or mono-functional, primarily handling one special cargo; it also shows that terminals within port areas are mono-functional.

Yet, the planning powers of port authorities are generally limited to the immediate water and land port areas and do not capture the impact of flows throughout the port city territory on its space. Our maps exhibit the result of *all* past port, port city and port city territory European development and planning. Throughout much of European history, planning for ports was part of the developing, determining, designing and drawing up of plans for urban areas. Ports were embedded in urban plans, like the development of the seaport of Piraeus, the port city of ancient Athens. Port construction evolved as an engineering discipline starting in antiquity, and during the nineteenth century developed into a large and specialized profession. The hydro-engineer and builder of the port of Marseille, Hilarion Pascal (1815–1896), for example, drew up construction plans for Trieste, Rijeka, Varna, Istanbul, Izmir and other ports.[2] Port engineers also included railroad specialists, who planned railways into the port itself and across the port city territory.

In the late nineteenth century, urban planning was established as a discipline and later port planning evolved as part of it. But although there are procedural similarities, port planning in practice differed and continues to differ from urban planning. The port plan is usually defined by property borders, while municipal urban plans are generally defined by administrative boundaries of the municipality or settlement. Port planning at the local level also focuses on the relationship between the port and the city—their separation or merging, and the relationship between the port and the landscape; at the regional level it focuses on wider strategies for parts of the port city territory.

During the twentieth century in today's EU member states, port planning became part of spatial planning, which even more broadly 'sets the frame for the development of a specific area'.[3] The approaches to the making of these plans and the role of key stakeholders vary. In Slovenia, for example, port planning is an integral part of national spatial planning and port master plans are national spatial plans—such as Slovene roads, railways, gas pipelines, transmission lines and power plants.[4] The official initiator of port planning, which is the Ministry of Infrastructure of the Republic of Slovenia, and the investor, the port authorities of the port of Koper, follow the spatial planning procedures in cooperation and coordination with the national and local spatial planning authorities and the public. The government approves the port master plan; then Slovenian local authorities must respect such a plan and adopt its provisions when preparing municipal urban plans. The complexity of the process makes it difficult to amend. Another

1 Eurostat, 'LUCAS—Land use and land cover survey' (2021). Online. Available HTTPS: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=LUCAS_-_Land_use_and_land_cover_survey.

2 V. Hastaoglou-Martinidis, 'Réseaux d'innovations: travaux portuaires dans les villes levantines, 1850–1920,' 7th Urban History Association Conference—Athens 2004. Online. Available PDF: http://pandemos.panteion.gr:8080/fedora/objects/iid:434/datastreams/PDF1/content.

3 J. Knieling and F. Othengrafen, 'Planning Culture—A Concept to Explain the Evolution of Planning Policies and Processes in Europe?', *European Planning Studies* 23/11 (2015), 2133–2147. Also online. Available HTTPS: http://dx.doi.org/10.1080/09654313.2015.1018404.

4 Republic of Slovenia, 'Državni prostorski načrti' (2022). Online. Available HTTPS: https://www.gov.si/teme/drzavni-prostorski-nacrti/.

example is the case of Dublin, where the master plan for the port is not required by law, but has been prepared by the Dublin Port Company as part of EU policy, national, regional and local development plans. The Dublin Port Company Board adopted the master plan 2012–2040 in 2012 and revised it in 2018. During the planning process, stakeholders, customers, employees, interest groups, the local community, the general public and others significantly and extensively participated: the Dublin Port Company received over 300 submissions in response to the Issues Paper published as part of the master planning process and following the publication of the draft master plan.[5]

5 Dublin Port Company, 'Dublin Port Masterplan 2040, Reviewed 2018' (2018). Online. Available PDF: https://www.dublinport.ie/wp-content/uploads/2018/07/DPC_Masterplan_2040_Reviewed_2018.pdf.

The port city territories we mapped provide insight into the outcomes of historical port planning and port development, and help us better understand the impact of port planning at the port, port city, and port city territory level. The following sections outline four themes that illustrate the interrelationship between ports, cities and territories: (1) The influence of the territorial conditions of the four maritime waters surrounding the European continent on the development and planning of its ports and port city territories; (2) the impact of port functions on the planning of ports and their role in European port city territories; (3) the governance of European port authorities that organize, structure, manage and decide on the development of the European ports; and (4) planning culture as a necessary step toward the social integration of European ports into the broader community. While the first is clearly visible on the maps and the second is explained in the infographics, the third and fourth are given as additional explanations to aid reading and understanding our maps.

Ports Located on Water, Land and Territory

Ports are fixed landing places for loading and unloading sea cargo and sit at the heart of their port city territories. Multiple factors influence the selection of a location for a port: territorial conditions come first, before economic growth, social welfare, environmental sustainability or political acceptability. The starting point of any port planning is the choice of a suitable site, where ports take advantage of the local geographical features and port planning strengthens and compensates for unfavourable site characteristics. Cartographic exploration of European port city territories shows that they are mostly located where topographic features sheltered the water. Ports are located on rivers (e.g., Riga, Bremen, Hamburg, London), in estuaries (e.g., Liverpool, Immingham, Hull, Humber), in bays (e.g., Thessaloniki, Koper, Trieste, Monfalcone), and next to maritime waters as engineered coastlines (e.g., Santa Cruz de Tenerife, Rønne, Barcelona, Dover, Calais). In each case, port planners created appropriate conditions for the transfer of goods and people from sea to land and vice versa.

More than half of the ports on the Baltic Sea have developed from their original location towards the shore, which in most cases is not exposed to the open sea but is part of a sheltered bay. The availability of non-freezing ports was particularly important in this region, providing port services to port city territories in Russia, Kazakhstan, Belarus and other countries in all seasons. Port developers found other conditions on the west side of the European continent where it meets the North Atlantic Ocean. There, port founders mainly sought locations on estuaries or rivers, or on sheltered bays and natural harbours. On the south coast of Ireland, the Port of Cork is located in the second largest natural harbour in the world and is at the same time a hugely important catalyst for trade and employment in the port city territory. The Mediterranean topography allowed planners to locate ports right on the coast, but in most cases, they are partially protected by the larger space of the bay in which they were built. Because of steep slopes right next to the waterfront, further port expansions are difficult to engineer, although they are generally quite large. Passes through steep hillsides are crucial for the development of port city territories on parts of the Mediterranean. Sometimes port developers sited ports in less favourable areas and protected more exposed sites with new construction. Holyhead Port, on the Atlantic, for example, is built on an exposed waterfront. Similarly, the ports in Dover, Calais, Zeebrugge, Dunkirk, Hartlepool, Frederikshaven and Hirtshals are the most exposed port locations along the North Sea; and here too protective constructions secure port operations from wind, sea and swell. The port city territories vary widely, ranging from densely populated industrial cities near Zeebrugge to the non-metropolitan region of Hartlepool.

Port Functions

Port authorities across Europe decide which functions will be performed in the port based on strategic considerations, including national preferences. The choice of such a function has multiple effects on the nearby port city and port city territory, offering different types of jobs and producing diverse environmental impacts. Sometimes shipping companies, which are global actors, also make decisions about the functions of ports or terminals within them, which are previously agreed upon with national authorities. The organization of these terminals determines the role and function of the port.[6] Containers are sent across rail and road infrastructure to numerous destinations scattered throughout the vast port city territory, while oil refineries, chemical companies, and other oil businesses are usually co-located with a terminal facility or near the port, as seen in Algeciras. In other cases, as in Trieste with the Transalpine Pipeline, the oil is destined for liquid hinterland flows. In the majority of the cases, European ports, such as Rotterdam,

6 T. Notteboom, A. Pallis and J.-P. Rodrigue, *Port Economics, Management and Policy* (New York: Routledge, 2022).

prepare master plans for such port planning and expansion, which include development visions for port functions, infrastructure, and other facilities and capacities, usually with a planning horizon of 10 to 30 years. The type of goods handled by ports has an impact on urban and territorial development. In ports where multiple types of cargos are handled, the environmental impact of transport and transhipment accumulates, often with a negative effect on sustainable development.

Ports sometimes have only one terminal or handle only one type of cargo, such as the Butinge oil terminal in the Baltic Sea, in operation since 1999. It was planned, designed and implemented by the US multinational engineering and construction firm Fluor Corporation as part of the only Mažeikiai oil refinery in the Baltic States. These monofunctional ports most often handle bulk or liquid cargoes, via specialized quays. The passenger port is one kind of monofunctional port (or sometimes a terminal within a port) where passengers can board and disembark from watercraft. In contrast, other major ports have numerous terminals to handle, store, and process cargo, such as Algeciras, Livorno and Genoa in the Mediterranean, Belfast, Southampton and Las Palmas in the North Atlantic Ocean waters; Dover, Rotterdam and Zeebrugge in the North Sea; and Rostock, Tallinn and Swinoujscie in the Baltic Sea. These polyfunctional ports handle a variety of specialized and general cargoes, such as containers, bulk, cars and liquids. Some do not only handle cargo, but also host other activities such as fishing, ferries, cruises and marinas; others cater to leisure vessels and yet others handle a significant amount of commercial traffic.

In European port city territories, some ports are military—the port of Toulon, for example, is the principal base of the French navy—which has its own challenges for the surrounding areas in terms of safety and security. And some commercial ports have terminals dedicated to military functions. In case of armed conflict, these ports have a plan for the whole port to support deployment of material and troops. Such ports have a double strategic role: their day-to-day commercial functions continue to be important in wartime, as their routine enables them to minimize disruption to trade, and when the war is over, these ports can quickly transform infrastructure and facilities from a wartime footing back to commercial work. Diversification of ports and terminals is an important prerequisite for the successful import/export of combat-ready equipment.[7] Such port cities and port city territories are of a strategic importance and can be targets of military operations, just like the port itself.

Port Governance

There is no such thing as a standard governance of port city territories; in fact, no two ports operate in exactly the same way. This variety of governance models and ownership structures is an

7 Lt. Col. J.D. Tillman and Maj. A.M. Karlewicz, 'Port Diversification and Strengthening: Sustainment Relies on U.S. Military's Ship-to-Shore Capacity in Europe' (2021). Also online. Available HTTPS: https://www.army.mil/article/252652/port_diversification_and_strengthening_sustainment_relies_on_u_s_militarys_ship_to_shore_capacity_in_europe.

important feature of the European port system and has major impact on the port city territory. The World Bank's 2007 Port Reform Toolkit defines four port governance models (the Service Port, the Tool Port, the Landlord Port and the Fully Privatized Port) that summarize how ports are organized, structured and managed. These models differ in the services provided by the public sector, the private sector or mixed-ownership providers. Their orientation (local, regional or global) is also taken into account, as well as who owns the superstructure and capital assets, and who provides port workers and management. The vast majority of European port authorities are publicly owned and, for that reason, tend to engage closely with the nearby city and territory.

The following examples show the diverse ways in which port governance influences port city territory relationships. In Portugal, the public sector (the government or port authority) is usually responsible for constructing and dredging the port, as well as for ensuring land access to the port.[8] In Lisbon, dredging affects the sensitive environmental systems in the Tagus estuary, but the interests of the port, the city and the port city territory collide. This impasse can only be resolved through a joint approach, so in order to balance the quality of the estuary and the quality of life of the people living there, cooperation has been sought with other organizations and communities in the port city territory. In Spain, the State Port Authority, under the Spanish Ministry of Economic Promotion, is responsible for managing the Spanish port system. The planning, design and construction of ports are subject to the provisions of the 1998 'Strategic Framework of the State Ports System' and are the responsibility of the Ministry of Public Affairs in cooperation with the port authorities.[9] Each Spanish port operates as an 'Advanced Landlord Port', a market-oriented model that brings in capital from the private sector and thereby reduces the public fiscal burden. Each port manages its entire port cluster, meaning the port land and the surrounding port water. It also plans and leases port space and infrastructure to private operating companies. In Italy, reform in 2016 restructured, streamlined and simplified port authorities,[10] merging 24 existing port authorities and other smaller ports into 15 Port System Authorities (PSAs). The central government decides on finances, while the PSAs coordinate and plan ports logistics and expansion. Changing the governance system also changed the port city territory, because the reform addressed inefficiencies related to hinterland connections. The 15 PSAs assumed the duties and powers of traditional port authorities, but with a broader geographic scope, as within the region of Apulia: Bari and Brindisi formed a single PSA with a couple of minor ports. Finally, the major French port authorities consist of advisory and decision-making bodies in accordance with the provisions of the French Port Reform Act of 2008. Consequently, the Port of

8 J.L. Moreira da Silva, 'Portugal', *Ports and Terminal* (London: Law Business Research, 2021).

9 J. Bautista Mendo, A. Camarero Orive, Nicoletta González-Cancelas, and B. Molina Serrano, 'Update of the Strategic Framework for the Spanish Port System Using a SWOT Analysis', *Cuadernos De Administración* 36/68 (2021), 96–111. Also online. Available HTTPS: https://doi.org/10.25100/cdea.v36i68.9459.

10 'Italian Port reform. Reorganization, rationalization and simplification of port authorities and additional projects for the renewal of ports and logistics in Italy'. Online. Available PDF: https://www.gop.it/doc_pubblicazioni/530_3rzbn8azeb_cn.pdf.

Le Havre, the 'Grand Port Maritime', is a public body that manages both the port functions and the development of the port area. Port authorities are full owners of their domains, but their objective is still to develop and expand the port area in accordance with the interests of local stakeholders and authorities, and in coordination with other ports on the same coast or waterway in the port city territory.[11]

11 A. Serry and L. Loubet, 'Comparative analysis of port governance and cooperation between actors in European port- cities', World of Shipping Portugal, An International Research Conference on Maritime Affairs, 21–22 November 2019, Carcavelos, Portugal.

Ports and Planning Culture

Port development is in line with local and national planning cultures, which define, for example, the participation of stakeholders in planning processes, the identification of planning challenges, the interpretation of planning tasks, or the application of planning procedures and rules. The degree of consensus and compromise between the wide range of stakeholders in the port city territory—the level of collaboration among city planning departments, residents, local administration, private companies, non-governmental local associations, educational institutions and regional governments—is also a result of such a planning culture. Yet stakeholders have come into conflict over issues like urban development and environmental protection. The absence of governance at the port city territory level is a key challenge here. Port authorities can help bridge different styles of planning (or planning cultures) in the port city and port city territory to contribute not only to the success of the port, but also to urban and spatial planning. Our work points to areas where experienced planners think port authorities are more likely to seek port development alternatives, particularly because of the sensitivity of Natura2000 protected areas along the ports and in the hinterland, as can be found in Huelva and Le Havre, for instance.

Planning culture also plays an important role in the social and cultural engagement of port city territories with their neighbouring areas. The European Sea Ports Organization (ESPO) holds that social integration, or bringing social groups together by preventing segregation between them, is one of the main tasks of port authorities in the twenty-first century. Social integration includes creating supportive and transparent planning and spatial planning processes that foster and maintain public participation in decision-making, better communication in all planning areas, the participation of all sectors, and, ultimately, consensus between public and private interests. In line with that premise, the organization has awarded its ESPO Award since 2009 'to promote innovative projects by port authorities that improve the social integration of ports, particularly with the city or wider community in which they are located'.[12] It is not surprising that all the winners of ESPO Awards are among the leading ports on the *Port City Atlas* list.

12 'ESPO Award'. Online. Available HTTPS: https://www.espo.be/news/seven-ports-in-the-running-for-the-espo-award-2022.

Conclusions

Our maps identify key elements in the complex relationship between the functioning and planning of the selected ports and their role in the European port city territories. The mapping also shows the relationship between the port area, the urban area and the landscape as they negotiate many current challenges, including the climate crisis and trouble in the contact areas between ports and their surroundings. Port planning policy responses to these challenges can vary widely—by port, port city, port city territory and EU member state—even when all countries agree on common objectives. These situations offer the opportunity to find and develop innovative urban planning solutions,[13] including balanced and sustainable development, or to implement already established advanced urban planning solutions. Port city territory development therefore makes an important contribution to the development of the discipline of urban planning in general.

13 L. Ažman Momirski, 'Port of Koper: New models of port-city relationship', *Portus* 10/20 (2010), 12–17. Online. Available PDF: https://portusonline.org/wp-content/uploads/2021/12/Puerto_de_Koper.pdf.

II Mapping

4 Exploring Europe through the Mapping of Coastal Areas and Seaports: a Comprehensive Approach

Abstract

Scholars and professionals have recently started to pay more attention to maritime perspectives on Europe. This renewed engagement with the continent's coastal areas harks back to centuries of sea-based European development and global engagement. This is an important turn both in terms of Europe's global economic competition and for the continent's sustainable development. Comprehensive European policies are urgently needed to address these dual challenges, facilitating the decision-making and development of European ports as important economic players that can work together when faced with new competitors, for example in the context of the Chinese Belt and Road development. Policies are also needed to address the economic, social and ecological impact of ports on their neighbouring cities and territories.

The port city territories we mapped are all part of the same political entities, the European Union (EU) and European Free Trade Association (EFTA), with shared European legislation, regulation and history. We define Europe on the basis of the spatial coverage of European Commission data, including all 27 EU member states, plus Norway as member of EFTA and the United Kingdom as a former member of the EU. The Spanish islands of Las Palmas and Tenerife are included analytically, as they are located in the North Atlantic Ocean, but we do not show them on the maps due to scale and page size. As we are looking inland from the perspective of the European seas, we did not include overseas territories. The European scale allows us to see major differences in the length of sea borders per country (notably, island nations have longer sea borders), the number of seas accessed (consider how many seas France and Spain touch), and in the number of major port city territories (particularly high in Italy).

Our sea-based approach links this atlas to a growing number of maritime and marine studies that go beyond a long-standing

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focus on land-based reflections that considers the sea a barrier. New fields of international historical investigation include investigations of seascapes focused on maritime histories cultures and exchanges,[1] and studies that pay new attention to ships and other types of sea machines, exploring these marine technologies in relation to architecture over time.[2] Other historical studies explore Europe's role in the maritime world, the role of traders and shippers in exchanging goods,[3] Europe and the sea,[4] and European trading networks that connected diverse geographical and cultural spaces.[5] Our own work has engaged with the sea-based approaches notably through the study of the urbanization of the sea[6] in line with Neil Brenner and Christian Schmid's concept of planetary or extended urbanization,[7] and explorations of the sea as a blank place to be reclaimed for comprehensive spatial development.[8] Using geospatial mapping and visualization, we aim to overcome approaches that stay within the borders of a nation-state or language region.

European coastal areas are not only highly recognizable, they are also key to European history. European port city territories are heritage landscapes: over centuries, they have attracted travellers from sea and land, hosted ports and settlements, and brought trade and prosperity to rural areas. The Greek and Roman Empires depended on maritime transport, as did the Venetians and the Dutch. Shipping was central to European colonialism, and the architecture and urban design of European seaports have shaped the European imagination. In the nineteenth century, European seaport cities started to thrive as hubs of petroleum storage and refining, eventually fuelling the growth of industrial ports, metropolises and territories, and of new mobilities between them. In turn, the growth of nation states and later European unification fostered the mobility of goods, people and ideas, with seaport city territories as key nodes of arrival and departure between sea and land. The scale of port city territories increased as petroleum-fuelled engines shortened workers' travel times, allowed people to live further away from their workplaces, and made it possible for individuals and companies to transport goods faster and over longer distances. Seaport cities became hubs for infrastructural innovation once railways and canals (such as the New Waterway in Rotterdam) connected ports to their fore- and hinterlands. Cross-oceanic connections were at the heart of global flows; the British Empire and the transfer of planning ideas via maritime colonialism to other parts of the world are key examples. Cities around the world looked at London as a model of a capital city and an exemplary seaport. New metropolises emerged as private and public investments rapidly expanded ports; these were often so-called second cities,[9] like Rotterdam, Hamburg, Antwerp and Dunkirk, that tried to keep up with their rapidly growing territories.

1 J.H. Bentley, R. Bridenthal, and K. Wigen (eds.), *Seascapes: Maritime Histories, Littoral Cultures, and Transoceanic Exchanges* (Honolulu: University of Hawai'I Press, 2007).

2 Seamachines Symposium. Online. Available HTTPS: https://www.seamachines.org/.

3 M.B. Miller, *Europe and the Maritime World: A Twentieth Century History* (Cambridge: Cambridge University Press, 2012).

4 D. Blume, C. Brennecke, U. Breymayer and T. Eisentraut (eds.), *Europe and The Sea* (Munich: Hirmer Publishers, 2018).

5 W. Blockmans, M. Krom and J. Wubs-Mrozewicz (eds.), *The Routledge Handbook of Maritime Trade Around Europe 1300–1600. Commercial Networks and Urban Autonomy* (London, New York, Routledge, 2019).

6 N. Couling and C. Hein (eds.), *Urbanisation of the Sea: From Concepts and Analysis to Design* (Rotterdam, Delft: nai010; BKBooks, 2020). Also online. Available HTTPS: https://doi.org/10.7480/isbn.9789462085930.

7 N. Brenner and C. Schmid, 'Planetary Urbanization', in: M. Gandy (ed.), *Urban Constellations* (Berlin: Jovis, 2011).

8 N. Couling and C. Hein, 'Blankness: The Architectural Void of North Sea Energy Logistics', *Footprint* 23 (2018), 87–104. Also online. Available HTTPS: https://doi.org/https://doi.org/10.7480/footprint.12.2.2038.

9 J.I. Hodos. *Second Cities: Globalization and Local Politics in Manchester and Philadelphia* (Philadelphia: Temple University Press, 2011).

European coastal ports, cities and port city territories rapidly expanded in the 1960s, a result of decolonization and Europe's loss of access to colonial port infrastructure, the rapid growth of car use and urbanization, and shipping containerization. In particular, containerization and the accompanying automation rendered traditional workforces and warehouses obsolete. Only a few workers were needed to handle containers, and the containers themselves could be stored on large open areas accessible by rail and road. Globalization, increased transportation speed, new high-speed road and rail infrastructure, and more consumption all fuelled private and public investment and planning of larger port areas and of deep-sea ports, with automated terminals for transhipment where possible. In fact, ports no longer had to be in cities, and urban and port planning spatially disconnected as well. Inland intermodal terminals, so called dry ports, emerged as storage and distribution centres for cargo. Private companies and public institutions sited such hubs on cheaper land outside of major metropolises; this extended the port city territory along major highways and railway infrastructure into the landscape and to smaller settlements. At sea, new infrastructure—windmills, drilling platforms, and waiting spots for ships—has also expanded the range of ports and the port city territory on sea and land.

With the creation of the European communities and later the European Union, policymakers focused on European cohesion by forging internal connections, such as border-crossing road and rail infrastructure throughout Europe. Yet EU ports and cities have often competed with one another in line with EU policy and often lack the power to withstand the consolidated interventions of actors from outside Europe. The impact of the Chinese Belt and Road Initiative exemplifies the urgency of this issue: when the state-owned China COSCO shipping company purchased rights to operate in European ports such as Piraeus, local protests and conflicts ensued.[10] Citizens fought the construction of six new cruise ship piers which threatened to bring pollution and environmental damage to heavily populated areas and heritage sites, destroy a popular local beach, and create heavily polluted mud, harmful to public health. Advanced attention to European waters, coasts and port city territories can facilitate European cohesion and help model new governance at the territorial scale—in turn, a coherent port policy would help ports, cities and territories make coherent decisions in line with European values.

At the scale of 1:27,000,000, as used in this section, one centimetre on the map corresponds to 27 kilometres on the ground, making the morphology of Europe clearly visible: coastlines, mountainous areas, major rivers and bodies of water. This scale helps us see how port city territories are related to their geographical, topographical and political context, including European networks

10 Contested Ports. Online. Available HTTPS: https://www.contestedports.com/piraeus-greece/.

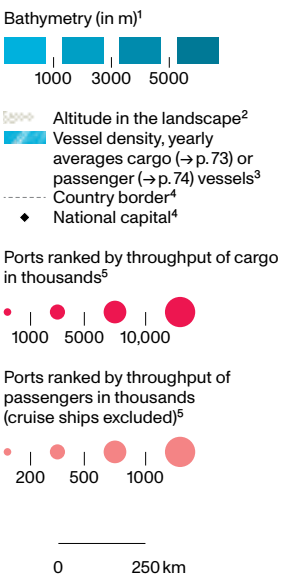
of trade, the location of military ports or of capital cities. The presence of political functions, for example, can go hand in hand with the existence of a military port or certain political interests, which can hinder free trade that is so important for port cities. The maps make spatial and functional patterns visible, including for example relationships between neighbouring ports, dynamics between military ports and capital cities, and political relationships between ports and national capital functions that result of geographical, locational and historic factors. For example, the maps show that only 12 per cent of the largest port cities in terms of throughput are also capital cities, and most of them are in the Baltic Sea. Some countries on the Mediterranean have coastal capital cities in port city territories, either because they are small, such as Latvia with the port city and capital Riga, or because they have long maritime borders, such as Italy. Many port city territories on the Baltic Sea are also capitals, including Helsinki, Tallinn, Stockholm, Riga, Oslo and Copenhagen. For the large countries of Scandinavia, the reason for maritime capitals may be historical proximity to the heart of Europe and population density.

Exploring Europe from a sea-based perspective with an eye towards port city territories, the maps also reveal useful information about industrial development, including environmental and health issues, and potential challenges. For example, we can see on the maps that numerous protected Natura2000 areas—a large coordinated network of protected breeding and resting sites for endangered species that covers 18 per cent of the EU's land and 8 per cent of its marine territories[11]—lie in the vicinity of port city territories. Clearly ports, which are densely built-up areas with intense traffic, need to develop sustainable environmental practices to further protect and preserve these unique natural sites. Mapping on the European scale also helps us see the probable impact of maritime traffic and maritime spatial development on the health of people on European coasts and in port city territories. They show, for example, that the great number of ships in the English Channel and around Gibraltar overlaps with air pollution corridors; that is, we can see where and why air pollution affects some port city territories more than others. Finally, the maps show that numerous European historic landscapes and heritage sites are located in coastal areas and are therefore under threat of sea-level rise, unstable weather, and other climate change related water threats. Our atlas can help planners develop shared responses to these and other threats.

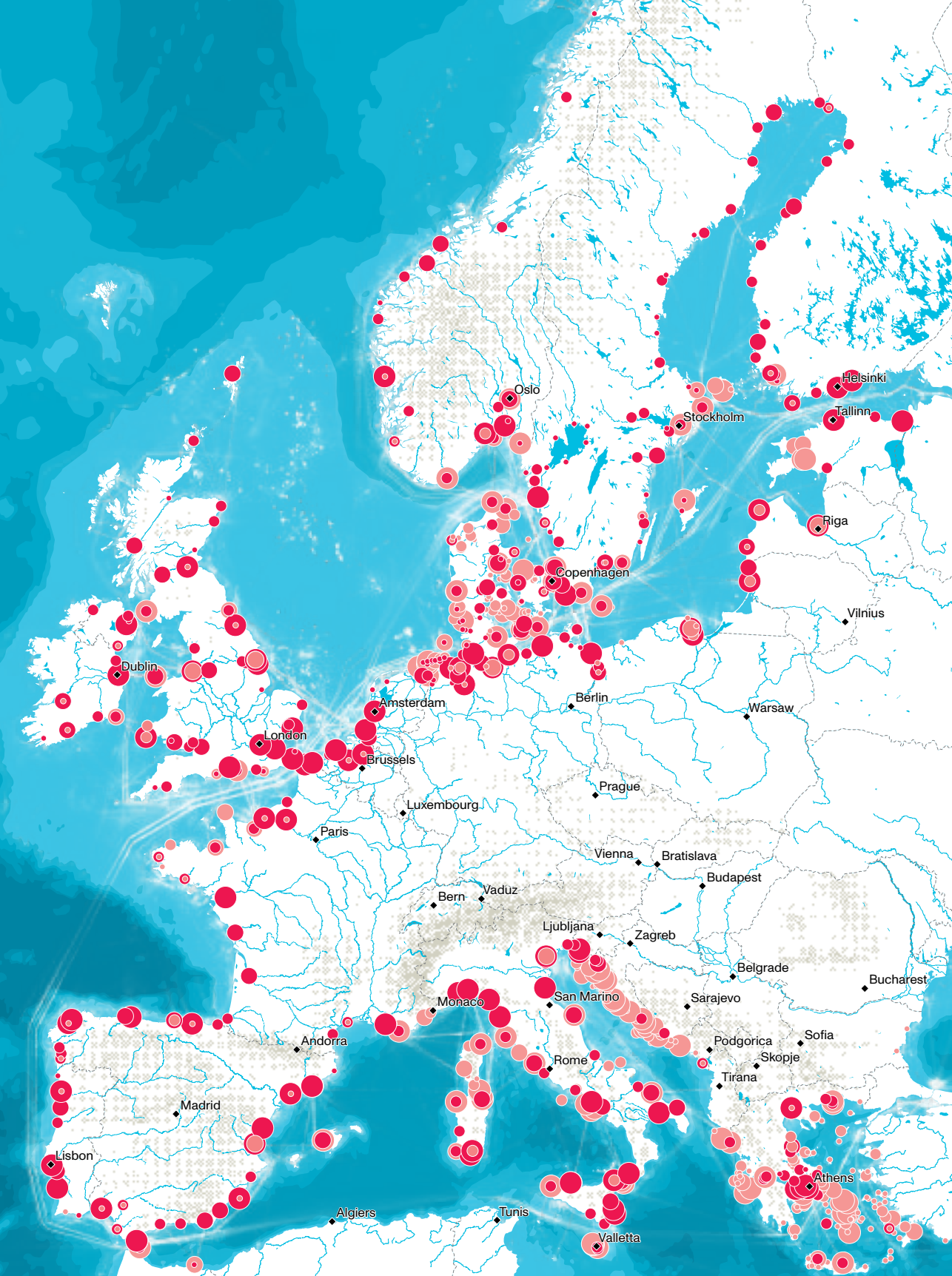
11 European Commission, Natura2000. Online. Available HTTPS: https://ec.europa.eu/environment/nature/natura2000/index_en.htm.

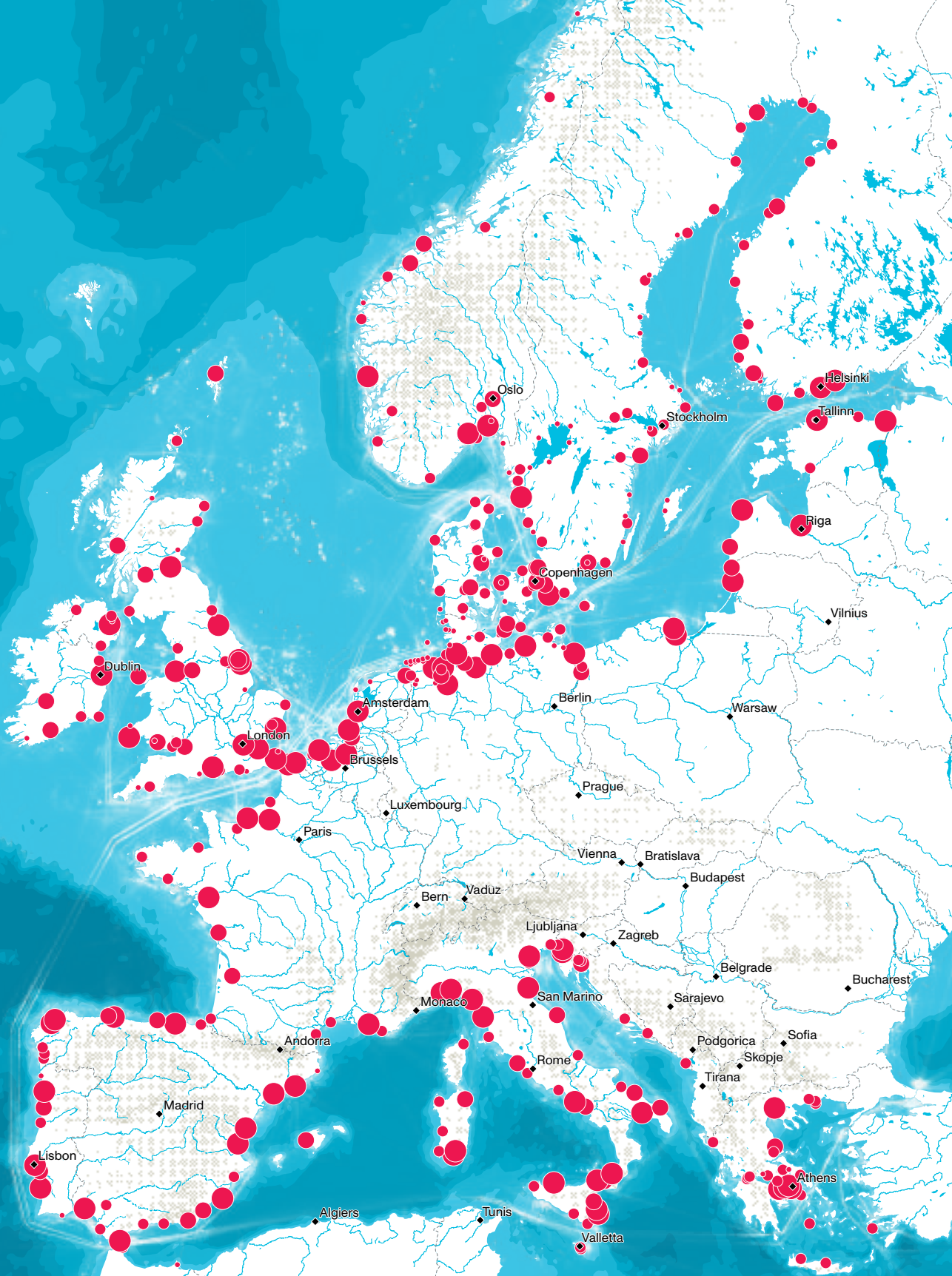
Ranking European Ports by Type of Throughput

Mapping ports based on their throughput of goods or passengers in relation to their vessel density produces two different patterns on the map (pages 68–69). Ports have multiple types of throughput and can appear in both cargo and passenger-based rankings. Cargo ports are scattered all over the European coastline, while passenger ports are concentrated on island regions. Cargo ports are gateways for global flows of containers and bulk goods, and vessels docking at these ports often travel long distances. Passenger ports serve as a base for ferries (travel) and cruise ships (holidays); these vessels travel short distances, often as scheduled services. The function of the ports also determines their relation to the city and territory. Cargo ports are largely automated nowadays and can be located outside the city, often in the less densely built territory and closer to the hinterland dryports and logistics centres. Passenger ports remain more connected to urban areas.



1 Natural Earth.
2 EEA EuroGeographics EuroDEM, 2022.
3 EMODnet Human Activities, Vessel Density Map 2019.
4 Eurostat/Natural Earth.
5 Eurostat Maritime transport data, 2019.


Oslo
Stockholm
Helsinki
Tallinn
Riga
Copenhagen
Vilnius
Dublin
Amsterdam
Berlin
Warsaw
London
Brussels
Prague
Luxembourg
Paris
Vienna
Bratislava
Budapest
Bern
Vaduz
Ljubljana
Zagreb
Belgrade
Bucharest
Monaco
San Marino
Sarajevo
Andorra
Podgorica
Sofia
Skopje
Rome
Tirana
Madrid
Lisbon
Athens
Algiers
Tunis
Valletta


Oslo
Stockholm
Helsinki
Tallinn
Riga
Copenhagen
Vilnius
Dublin
Amsterdam
Berlin
Warsaw
London
Brussels
Prague
Luxembourg
Paris
Vienna
Bratislava
Budapest
Bern
Vaduz
Ljubljana
Zagreb
Belgrade
Bucharest
Monaco
San Marino
Sarajevo
Andorra
Podgorica
Sofia
Skopje
Rome
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Madrid
Lisbon
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Paris
Vienna
Bratislava
Budapest
Bern
Vaduz
Ljubljana
Zagreb
Belgrade
Bucharest
Monaco
San Marino
Sarajevo
Andorra
Podgorica
Sofia
Skopje
Rome
Tirana
Madrid
Lisbon
Athens
Algiers
Tunis
Valletta

5 Looking at Europe through the Lens of its Four Maritime Waters: (Re)connecting Nations

Carola Hein, Yvonne van Mil, Lucija Ažman-Momirski

Abstract

Looking at Europe from the seas allows us to study how people have adapted the spatial configuration of their port city territories to the characteristics of their neighbouring sea or seas. Starting with the four maritime waters—the Mediterranean, North and Baltic Sea and the Atlantic—that surround Europe on three sides, the maps show distinctive characteristics of sea and land, including the morphology and bathymetry of each sea. They identify maritime patterns, including shipping routes, oil platforms, wind farms on the seas and Natura2000 areas; they also identify land-based conditions, including topography along the coastlines, national borders, and regional and urban data entities (NUTS). The sea-based approach allows us to discern similarities and dissimilarities in port city territory development on a single sea and among seas.

European development is heavily influenced by its four waters, each with its own character: the Mediterranean in the south, the North and Baltic Sea in the northwest, and in the west the North-Western and South-Western Waters, here called the Atlantic. We focus here on the four major seas that surround the European continent, the outlines of which are defined on the basis of the European Regional Advisory Councils of Emodnet.[1] The Norwegian and Barents Seas are not included in the maps as they do not border EU countries. Each of the four maritime waters includes several smaller seas, such as the Adriatic Sea as part of the Mediterranean and the Gulf of Bothnia of the Baltic Sea; each has its own character and challenges while connecting the different nations of Europe.

These seas are hubs of regional exchange and shared development. Yet, few publications speak to the potential of exploration through the lens of a specific sea. The French historian Fernand Braudel's masterly book *The Mediterranean*[2] has modelled a sea-based approach to studying larger territories. In *The Edge of the World: How the North Sea Made Us Who We Are*, British novelist

1 Emodnet, 'European Atlas of the Seas' (2014). Online. Available HTTPS: https://ec.europa.eu/maritimeaffairs/atlas/maritime_atlas/#lang=EN;p=w;bkgd=5;theme=2:0.75;c=1224514.3987259883,6446275.841017013;z=4.

2 F. Braudel, *The Mediterranean and the Mediterranean World in the Age of Philip* Second edition (Fontana, Collins: University of California, 1975).

and journalist Michael Pye[3] points out that the world looks different when the sea is perceived as facilitating movement: land becomes a barrier and the sea the bearer of trade and prosperity. We have started to challenge this approach: exchange across the North Sea is the focus of a recent article by Yvonne van Mil and Reinout Rutte.[4] In the *Urbanisation of the Sea*, Nancy Couling and Carola Hein[5] demonstrate how spatial development in and on water shapes port city territories. For centuries, people and goods have flowed through and around these seas, linking port city territories. In each of the seas, seaports have been key gates from and to Europe in war and peace, as numerous heritage sites attest. Having a location by the sea can also mean access to the resources and raw materials available in the sea, including oil, gas, and fish. Indeed, for port city territories, the maritime foreland is as important as the hinterland. Maritime zones, established through international conventions, allow coastal states to use such resources and maintain political harmony in international waters.

The unique features of the four seas warrant shared analysis as they shape development of the European Union and the European continent. The Baltic Sea is a semi-enclosed, relatively shallow sea basin that can only be entered through the Kattegat and Skagerrak straits, along which lie major port cities such as Copenhagen, Malmo and Helsingborg. In addition to nine EU Member States, the Baltic Sea borders Russian territory and provides shipping access to the two major Russian port cities of Kaliningrad and St. Petersburg. The Baltic Sea serves a range of functions, including shipping, fishing, wind farms and mineral extraction. The coastline is characterized by large gorges and smaller bays in the south, and archipelagos and islands in the north. Historically, port cities such as the Hanseatic cities collaborated across the North and Baltic seas and even set up shared fleets and protection. Today, collaboration continues, but its various functions also increasingly compete for limited space.

The North Sea—bordered by the five EU countries of North-West Europe, Norway and Great Britain—connects to the Atlantic Ocean via the English Channel and the Norwegian Sea and gives ships access to two of the world's largest ports: Rotterdam and Hamburg. The North Sea is relatively shallow and has a wide variety of marine landscapes, including fjords, estuaries, sandbanks, bays and intertidal mudflats. It has been the point of origin for colonial empires, notably the British and the Dutch. Throughout history, it has been one of the busiest European seas, with extensive shipping, fishing, energy production, aggregate extraction, defence and recreation; it also has the world's largest agglomeration of drilling rigs. It is precisely all these spatial claims on the sea that threaten its rich and complex biological systems, with important areas for marine birds, fish and mammals.

3 M. Pye, *The edge of the world: How the North Sea made us who we are* (London: Penguin Books, 2014), 78.

4 Y. van Mil and R. Rutte, 'Urbanization Patterns around the North Sea: Long-Term Population Dynamics, 1300–2015', *Urban Planning* 6/3 (2021), 10–26. Also online. Available HTTPS: doi:https://doi.org/10.17645/up.v6i3.4099.

5 N. Couling and C. Hein, 'The North Sea: New perspectives on the sea-land continuum', in: N. Couling and C. Hein (eds.) *The Urbanisation of the Sea: From concepts and analysis to design* (Rotterdam: Nai010 Publishers, 2020), 6–15. Also online. Available HTTPS: https://doi.org/10.7480/isbn.9789462085930.

The European (North-East) Atlantic is generally characterized in the north by relatively shallow water and a gently sloping flat landscape. Along the coastline there are several estuaries and estuarine systems. The southern part, on the other hand, is characterized by a steep and deep coastline and a mountainous landscape. Fishing has long been a key industry here, while coastal tourism and shipping are of great importance to all EU member states bordering this area. The Gibraltar Strait and the English Channel are major shipping gateways connecting Europe with the wider world. Port city territories such as Dublin and Lisbon have been shaped by global (including colonial) connections across this sea; after the discovery of the Americas, New World gold coming through Sevilla and Cadiz propelled the growth of Spanish cities.

The Mediterranean Sea is an almost-enclosed sea basin that can be reached from the west via the Strait of Gibraltar, passing the ports of Algeciras and Ceuta; from the south-east via the Suez Canal; and via the Bosporus by Istanbul from the Black Sea. It is part of one of the most important maritime corridors in the world, the gateway to Africa for EU countries and non-EU countries alike. The coastline of the Mediterranean Sea is characterized by its depth, together with a mountainous landscape above the water and a multitude of small islands off the coast, especially along Croatia. The Mediterranean Sea was at the heart of several empires: heritage sites still speak to the presence of the Greeks, who created new colonies whenever Athens became too crowded; Venice (and Genova) ruled the trade with Asia for many centuries. Today, this millennial heritage attracts cruise tourists, while refugees from Africa and the Middle East brave the sea to reach the safety of the European Union.

The morphology of each sea and its surrounding lands—water depths, mountains, plateaus and plains, bays and islands along the coastline—greatly influences its respective port city territories and nations: it determines what port infrastructure suits shipping; whether the location best suits military uses, fishing or transhipment; what infrastructure can connect the port to the hinterland. A bay or estuary protects the port from physical risks like wind and tides, offering ships a calm environment for loading and unloading. It also creates a permanent problem of siltation, requiring continuous dredging. A mountainous coastline can mean a less populated hinterland or poorer connection to the hinterland. Islands influence the foreland by protecting the coast from wind and tides, but they also limit the accessibility of the port for large ships, and ports located on an island may be at a disadvantage from a smaller hinterland or poor connection with the mainland.

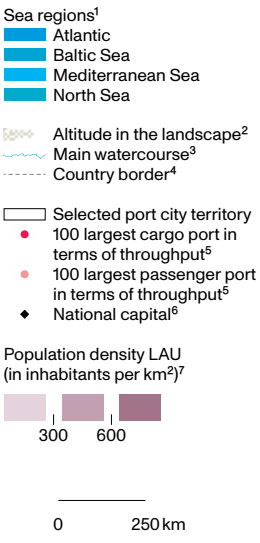
In this section, we show seaport territories at the scale of 15,000,000 (which means that one centimetre on the map corresponds to 15 kilometres on the ground), distinguishing the different

seas with different shades of blue. Their spatial characteristics, such as the shape of the coastline and islands and peninsulas, are represented on the maps on the basis of the morphology of water and land, the depth and profile of the seabed (bathymetry) and unique maritime landscapes (Natura2000 areas). The importance of shipping routes is shown by vessel density (at European and sea level) and ferry lines (at territorial level). Maritime borders and borders of administrative entities (defined at European level in NUTS) show the political situation and therewith indicate the multiplicity of international, national, regional and local regulations, interests and policies in which the port city territories are placed.

This atlas allows readers to compare port city territories and thus to address questions about the role of coastal topographies in the development of major port city territories. For example, one can posit that flat sandy territories in the North Sea have facilitated the growth of Hamburg, Rotterdam and Antwerp, while mountainous areas confine Genova, Rijeka and Toulon. Other questions can be asked about opportunities for stakeholder collaborations or, on the contrary, competing economic interests of ports sharing their position on the international transport network and hinterland.

Europe through its Four Waters

The west coast of Europe is surrounded by water: the Baltic Sea, the North Sea, the Mediterranean Sea and the Atlantic. Each maritime water has its own unique character, shaped by its geographical landscape and maritime history. They provide a common, sheltered base for port cities to emerge and develop in. The map shows that we selected our 100 port city territories based on the ranking of the largest European ports in terms of passenger and cargo throughput and the population density of local administrative areas (LAU). Although the selected ports are all leading ports in Europe, the individual differences in volume of transit are significant, both within a maritime water and between maritime waters. This becomes clear when studying the list of selected ports attached to the maps of the four maritime waters (p. 81, 133, 185, 236–237). Although almost all port cities are located in densely populated areas, the combination of maps and data also makes it clear that high population density is not necessarily a prerequisite for high throughput.



1 EMODnet Human Activities: Regional Advisory Councils, 2014.
2 EEA EuroGeographics EuroDEM, 2022.
3 Based on Eurogeographics, (2020). EuroGlobalMap. Version 2020 Eurogeographics. Retrieved from https://eurogeographics.org/maps-for-europe/open-data.
4 Eurostat NUTS 1 data.
5 Eurostat Maritime transport data, 2019.
6 Natural Earth.
7 Eurostat, GISCO LAU, 2019.


North Sea
Baltic Sea
Atlantic
Mediterranean Sea
Oslo
Stockholm
Helsinki
Tallinn
Riga
Copenhagen
Vilnius
Dublin
Amsterdam
Berlin
Warsaw
London
Brussels
Prague
Luxembourg
Paris
Vienna
Bratislava
Budapest
Bern
Vaduz
Ljubljana
Zagreb
Belgrade
Bucharest
Monaco
San Marino
Sarajevo
Andorra
Podgorica
Sofia
Skopje
Rome
Tirana
Madrid
Lisbon
Athens
Algiers
Tunis
Valletta

6 Examining 100 European Port City Territories through Maps and Infographics: (Re)conceptualizing Water-Land Intersections

Carola Hein, Yvonne van Mil, Lucija Ažman-Momirski

Abstract

We have mapped and depicted all 100 European port city territories in a comparative and uniform manner, which allow us to identify, compare and examine their water-land intersections. The chapter describes in detail the methodology used to select the top 100 European port city territories. Our maps show selected ports with adjacent cities and the port city territories, integrating their maritime and land part. Infographic information additionally further illustrates key geographic, port, port city and port city territory data. This work lays the foundation for reconceptualizing the water and land of European port city territories, both in academic research and in future development and planning.

Port city territories sit at the intersection of sea and land, and the distinctive characters of each intersection of land and water in a given port city territory determines their ecosystem. Uniform mapping and infographics information allow us to identify and compare these water-land intersections.

When selecting the top 100 seaport city territories, we considered ports as key signifiers in the transmission of people and goods from sea to land and land to sea. Starting from maritime flows, we identified leading ports first, then looked at each port's adjacent city or cities and port city territory. To identify ports, we used existing statistics. Eurostat categorizes the main ports according to the Directive 2009/42/EC as ports handling more than 1 million tonnes of goods or 200,000 passengers annually.[1] If we were to limit ourselves only to these figures, the Mediterranean ports would dominate the top 100 of European ports, with 38 cargo ports and 52 passenger ports. But these criteria do not provide the comprehensive overview of sea and land, of port, city and territory that we sought. The focus on ports alone does not provide insights into relation with the urban and rural development near the port or the people inhabiting port city territories. The inclusion

1 Eurostat, 'Glossary:Main ports' (2022). Online. Available HTTPS: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Main_ports.

of a population density factor in the list of the top 100 ports in Europe not only increased the number of cargo ports in the North Sea from 25 to 32 and in the Baltic Sea from 18 to 22, but also increased the number of passenger ports in the Mediterranean from 52 to 59.

To identify the leading port city territories, we used port functions (cargo and passenger ports) to rank the top 25 ports for each of the four maritime waters (Mediterranean, Baltic, North Sea and Western Waters). Taking into account the total gross weight of cargo and the total number of passengers in combination with the number of people living in the urban area resulted in our selection of leading 100 European ports.[2] More specifically, the main ports were ranked by combining four indicators from Eurostat (2019). Indicator 1 presents the absolute values of cargo, which is the gross weight of goods handled (unloaded and loaded) in the port. Indicator 2 provides the number of passengers who embarked and disembarked in the port. Indicator 3 and 4 are the total tonnage of the throughput in the port and the total numbers of passengers, divided by the number of people living in NUTS 3 where the port is located. NUTS 3 is a subdivision of the European territory into metropolitan areas and other areas with a population between 150,000 and 800,000 people.

We used the indicators at both the level of the EU and of the four maritime waters. All eight data points for each port were given weights: We gave Indicator 1 and 2 for EU and for each water a heavier weight underlining our focus on ports and their functions, than Indicator 3 and 4 for EU and for each water. The sum of all eight values gave a final score or final ranking of leading 25 ports in each of the four maritime waters. Only a handful of ports received the highest final score: two in Western waters—Belfast and Southampton; one port in the North Sea—Dover; and two in the Baltic Sea—Rostock and Tallinn. No ports in the Mediterranean ranked this high. In the selection process, we saw that ports fell into three groups within the 25 selected ports for each water: ports important for both cargo and passenger traffic; ports where cargo traffic is the main focus; and ports we included to correct for selection error or because we thought they were too important to leave out even though the methodology did not select them. We included the port of Rijeka, for example, because in the past, it was one of the ten busiest European ports: on the eve of the First World War the port recorded 2,1 million tons of traffic,[3] and it still is the largest and most important seaport in Croatia because of a cargo throughput of 13.6 million tonnes (2020). To examine and select port city territories from the sea meant that we needed a methodology to help understand sea-land transfers. To do this, and to depict each port city territory comparatively uniformly, we chose a scale of 1:450,000, which means that 1 centimetre on the map corresponds to 450 metres on the ground. This view, the most detailed in this

2 Eurostat, 'Reference Manual on Maritime Transport Statistics. Version 4.1.' (2019). Online. Available PDF: https://ec.europa.eu/eurostat/documents/29567/3217334/Maritime_reference_manual_2019.pdf.

3 L. Rijeka, 'History' (2022). Online. Available HTTPS: https://lukarijeka.hr/en/history.

atlas, shows the port, the city, their maritime foreland and their terrestrial hinterland of the 25 port city territories of the Mediterranean, Baltic, North Sea and Western Waters. Some maps (and thus port city territories) contain two or more important ports or port cities, as for example Gdansk and Gdynia in the Baltic Sea; while some ports and cities need two maps to fully represent all of the port city territory, as for example London in the North Sea. This scale also allows us to show sea and land elements, including sea depth, administrative borders, transport networks, and the relief of the terrain. The maps furthermore depict concentrations of primary (agriculture and forestry), secondary (industry), tertiary (services and transport) and quaternary (health, education, administration) socio-economic activity in port city territories. Maps display some of these activities as infrastructural and socio-cultural functions: information on the locations of, for example, hospitals, universities and city government headquarters shows their proximity to the port.

An infographic page accompanies each map, with the name of the selected port and its nationality code in the header. In the footer, there is a schematic cross-section of the port on the seaward and landward sides. Four uneven areas on the page display: the name of the water and associated coast category defined by ESPO;[4] detailed information about the port (such as data on ships, terminals, number of passengers, cargo types); information on the port city (such as percentage of built-up area, industrial area, port area, the number of people living in the area); and information on the port city territory (such as data on geography, demography).

This state-of-the-art identification allows scholars and professionals to reconceptualize water-land intersections both in interpretation and in future development and planning. They can see, for example, whether there is room for ports to move into adjacent vacant land and areas of the city, or whether expansion will encroach on ecologically valuable areas. They can also use the maps to see whether port areas are located near or co-located with other industrial areas where stakeholders might develop spontaneous or planned forms of circular economy (a production and consumption model that extends the life cycle of products). These are all urban and spatial planning issues, the resolution of which can bring positive attention and recognition to the water-land intersections of the European port city territories in the context of port planning.

We can see from the maps that the character of the water side of European port city territories varies greatly: from large snake-shaped rivers in Hamburg, Bremen and London, where the predominant port city territory is land, to seas around islands like Las Palmas, Santa Cruz de Tenerife or Rønne, where other land is barely in sight. In the former case, the water element is highly subordinate to a terrestrial landscape within the port city territory; in the latter

4 ESPO, 'ESPO Port Performance Dashboard' (2013). Online. Available PDF: https://www.espo.be/media/espopublications/espo_dashboard_2013%20final.pdf.

case, the sea is the overwhelming and central feature of the port city territory. Such different geomorphological baselines lead to completely different development and planning of port city territories, and they shape the quality of life throughout the port city territory. In turn, these territories are key to European development, though port, urban and spatial planners do not yet approach them as one spatial unit.

Baltic Sea Map and Statistics

ID	Port name	[1]	[2]
HEL	Helsingborg, SE	8,839	7,153
HLS	Helsingør, DK	5,052	7,105
CPH	Københavns, DK	6,659	1,213
TRG	Trelleborg, SE	11,798	1,814
MMA	Malmø, SE	7,813	329
RNN	Rønne, SE	1,393	1,860
STO	Stockholm, SE	4,726	8,349
LLA	Luleå, SE	7,355	0
TKU	Turku, FI	2,134	3,137
NLI	Naantali, FI	7,589	194
HEL	Helsinki, FI	14,370	11,619
SKV	Sköldvik, FI	25,198	
SLM	Sillamäe, EE	10,492	
TLL	Tallinn, EE	19,636	9,961
RIX	Riga, LV	30,628	799
VNT	Ventspils, LV	19,600	232
LPX	Liepaja, LV	7,025	40
KLJ	Klaipeda, LT	42,705	343
BOT	Butinge, LT	9,542	0
GDN	Gdansk, PL	45,520	289
GDY	Gdynia, PL	20,551	791
SZZ	Szczecin, PL	9,583	6
SWI	Swinoujscie, PL	15,937	1,170
RSK	Rostock, DE	19,993	3,394
ROF	Rødby, DK	8,394	0
PUT	Puttgarden, DE	5,375	6,007
LBX	Lübeck, DE	16,022	458
KEL	Kiel, DE	4,819	2,331
FRC	Fredericia, DK	6,869	0
AAR	Århus, DK	8,617	3,385
SST	Statoil-Havnen, DK	7,900	0
SJO	Sjaellands Odde, DK		3,493

1 Total tonnage of cargo in thousands and in relation to the other selected European ports. Eurostat, 2019.
2 Total number of passengers in thousands and in relation to other selected European ports. Eurostat, 2019.
3 EMODnet Human Activities: Regional Advisory Councils, 2014.
4 EEA EuroGeographics EuroDEM, 2022.
5 EMODnet Human Activities, Vessel Density Map 2019.
6 ———, Environment, Natura2000, 2015.
7 Based on Eurogeographics, (2020). EuroGlobalMap. Version 2020 Eurogeographics. Retrieved from https://eurogeographics.org/maps-for-europe/open-data.
8 Eurostat NUTS 1 data.
9 Eurostat Maritime transport data, 2019.
10 Natural Earth.
11 Eurostat, GISCO LAU, 2019.

Sea regions[3]
Baltic Sea
North Sea

Altitude in the landscape[4]
Vessel density, yearly averages of all vessel types[5]
Natura2000 marine area[6]
Natura2000 terrestrial area[6]
Main watercourse[7]
Main land roads[7]
Main railroads[7]
Country border[8]

Selected port city territory
Selected port based on tonnage of cargo handled[9]
Selected port based on number of passengers handled[9]
Main port outside the EU
National capital[10]

Population density LAU (in inhabitants per km²)[11]
300 600

0 100 km


LLA
Gulf of Bothnia
NLI/TKU
Helsinki
HEL
SKV
Finnish Gulf
Oslo
Stockholm
STO
Tallinn
TLL
SLM
VNT
Riga
RIX
LPX
BOT/KLJ
Kattegat
AAR
HLS/HEL
Copenhagen
SJO/STT
FRC
CPH
TRG/MMA
Baltic Sea
RNN
PUT/ROF
KEL
LBC
RSK
SWE
SZZ
GDY/GDN
Vilnius
Berlin
Warsaw

HEL
HLS

Helsingborg, SE
Helsingør, DK

Øresund
Øresund

PORT

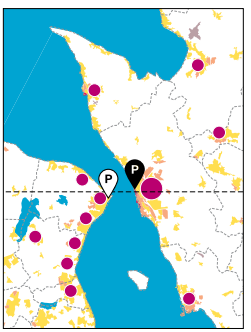
HEL / HLS (%) 18.6 40.5 1.1 55.7 59.5 24.6

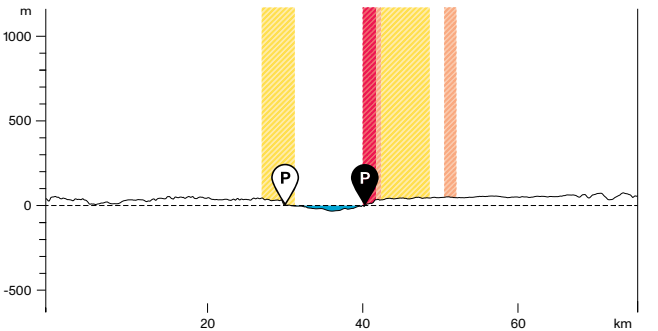
	HEL	HLS
Liquid	194	
Dry bulk	150	
Container	580	
Specialized		
General	24,793	28,055
Cruise ship		
Passenger	4,220	
Other	5	
Vessels	29,942	28,055

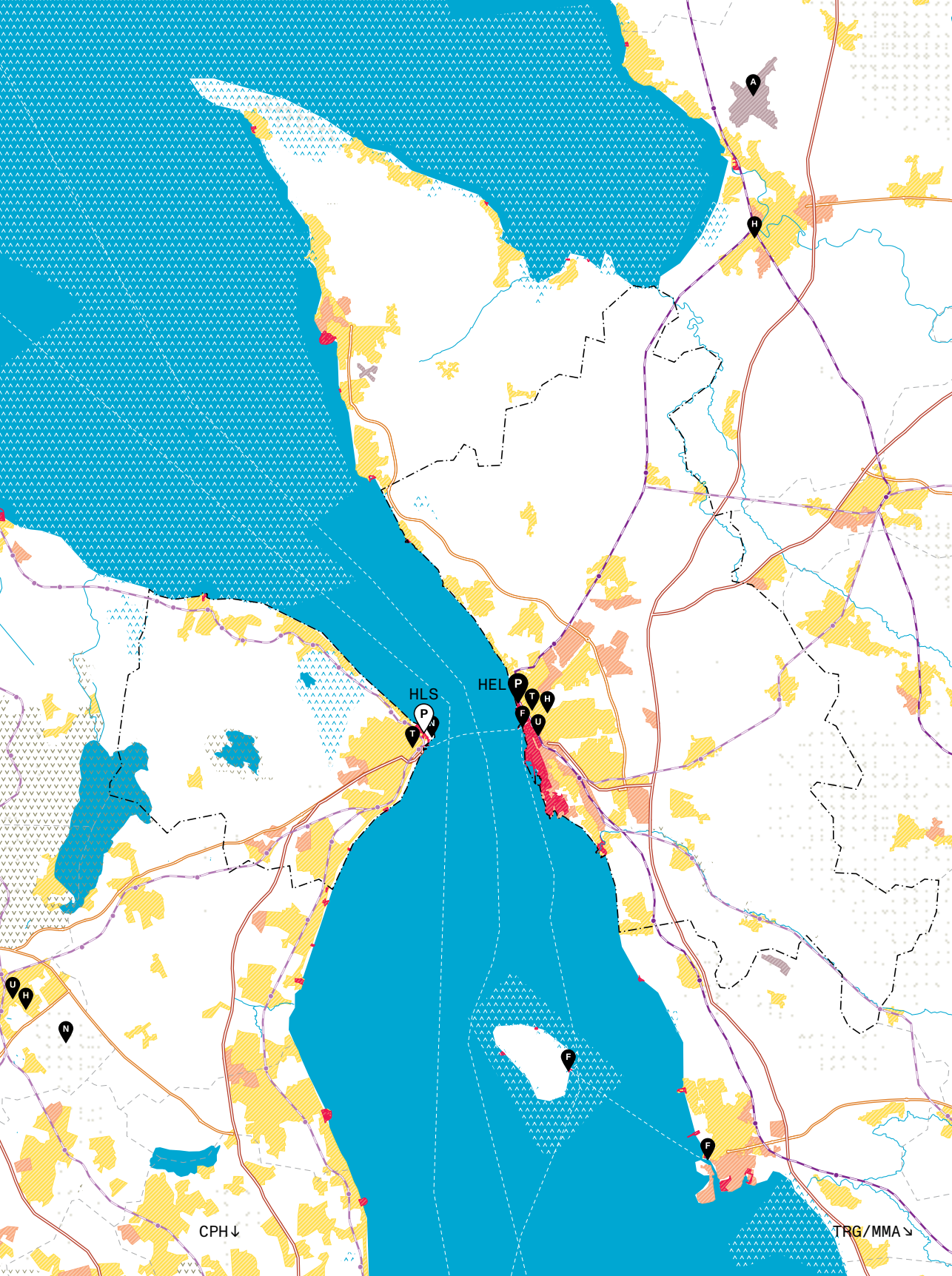
	HEL	HLS
Liquid bulk	757	
Dry bulk	707	
Containers	2,170	
RoRo	5,052	5,052
Other	153	
Cargo (t)	8,839	5,052
Passengers	7,153	7,105

CITY	HEL	HLS
	Helsingborg	Helsingør
→ Capital national (km)	→ Stockholm 487	→ Copenhagen 38
→ Capital regional (km)		
Area (km²)	347	124
Built-up area (km²)	44	23
Density (per km²)	413	506
Population	143,304	62,567
Population structure (%)	15 65 / 17.8 63.4 18.7	17 65 / 19.3 55.5 25.2
Distribution built area (%)	B I P / 72 22 6	B I P / 87 9 4

TERRITORY	HEL	HLS
	Skåne län	Nordsjælland
Area (km²)	11,363	1,460
Density (per km²)	120	318
Population	1,362,164	463,748
Natura2000 (km²)	M T / 2,920 351	M T / 1,767 225






HLS
HEL
CPH↓
TRG/MMA↘

Københavns, DK

Øresund

PORT

	CPH (%)	24.1	46.1	23.9	5.9

	CPH
Liquid	572
Dry bulk	330
Container	275
Specialized	15
General	617
Cruise ship	346
Passenger	
Other	345
Vessels	2,500

	CPH
Liquid bulk	2,846
Dry bulk	1,844
Containers	1,345
RoRo	223
Other	401
Cargo (t)	6,659
Passengers	1,213

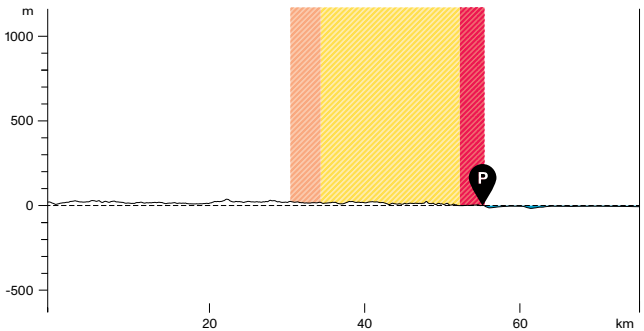
CITY

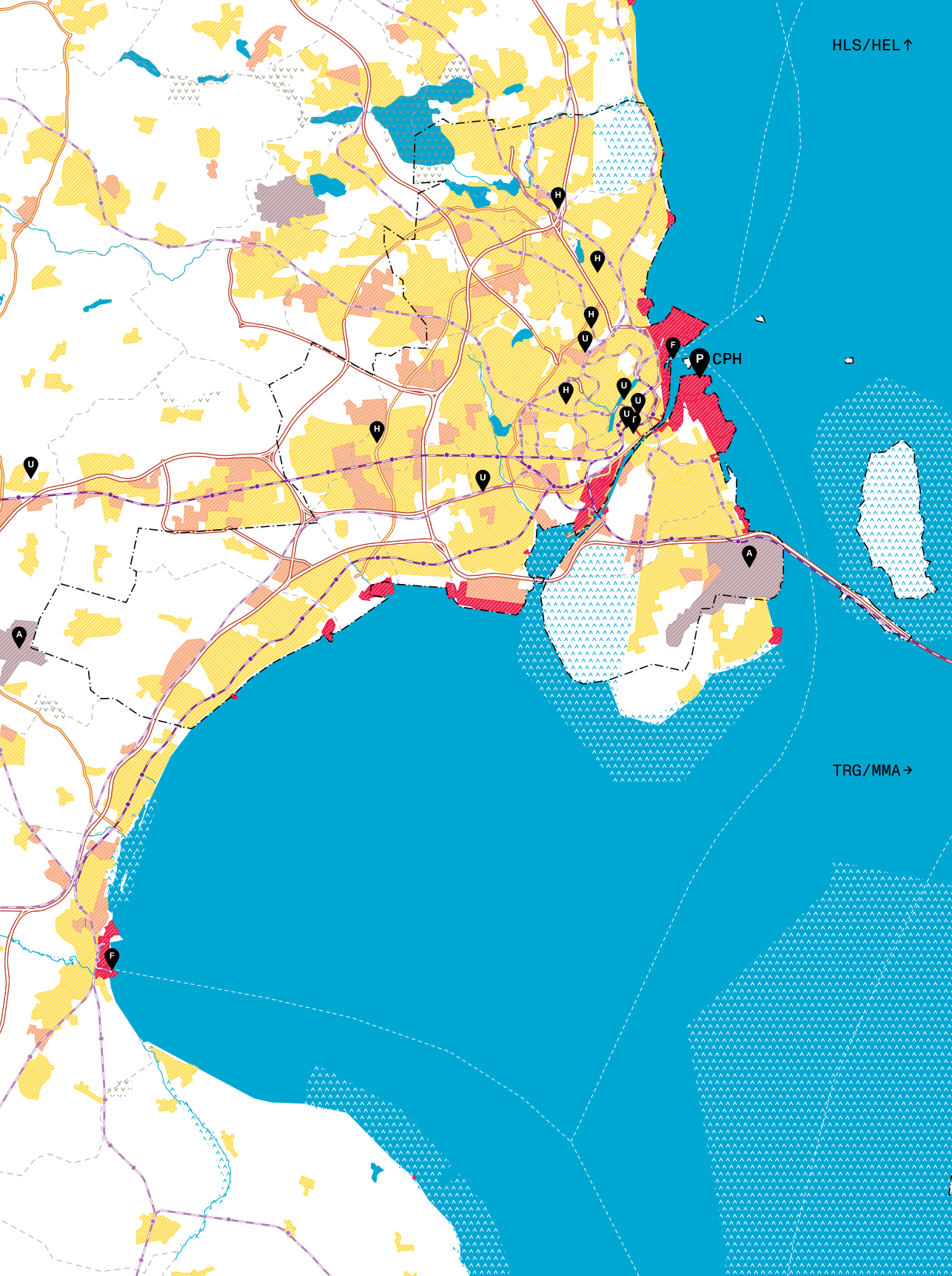
	CPH
	København
→ Capital national (km)	→ Copenhagen 0
→ Capital regional (km)	
Area (km²)	460
Built-up area (km²)	259
Density (per km²)	6,141
Population	559,440
Population structure (%)	15 65 15.4 74.2 10.4
Distribution built area (%)	B A I P 79 4 12 5

TERRITORY

	CPH
	Byen København
Area (km²)	185
Density (per km²)	4,241
Population	784,618
Natura2000 (km²)	M 1,065






HLS/HEL↑
CPH
TRG/MMA→

TRG

MMA

Trelleborg, SE
Malmø, SE

Baltic Sea

Øresund

PORT

TRG / MMA (%) 100 100

	TRG	MMA
Liquid	13	451
Dry bulk	5	54
Container		49
Specialized		241
General	5,412	2,062
Cruise ship		
Passenger		
Other	2	17
Vessels	5,432	2,874

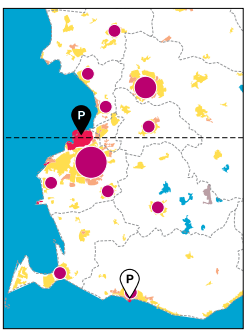
	TRG	MMA
Liquid bulk	44	2,253
Dry bulk	39	578
Containers		183
RoRo	11,715	4,298
Other		501
Cargo (t)	11,798	7,813
Passengers	1,814	329

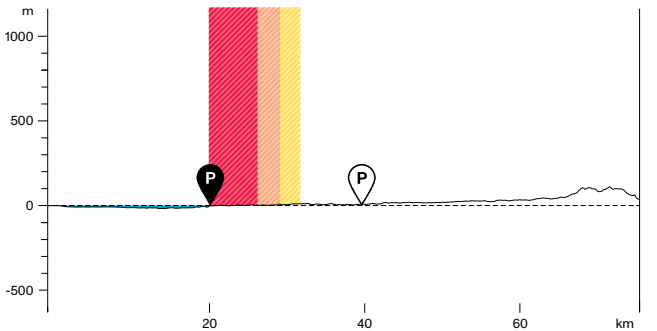
CITY

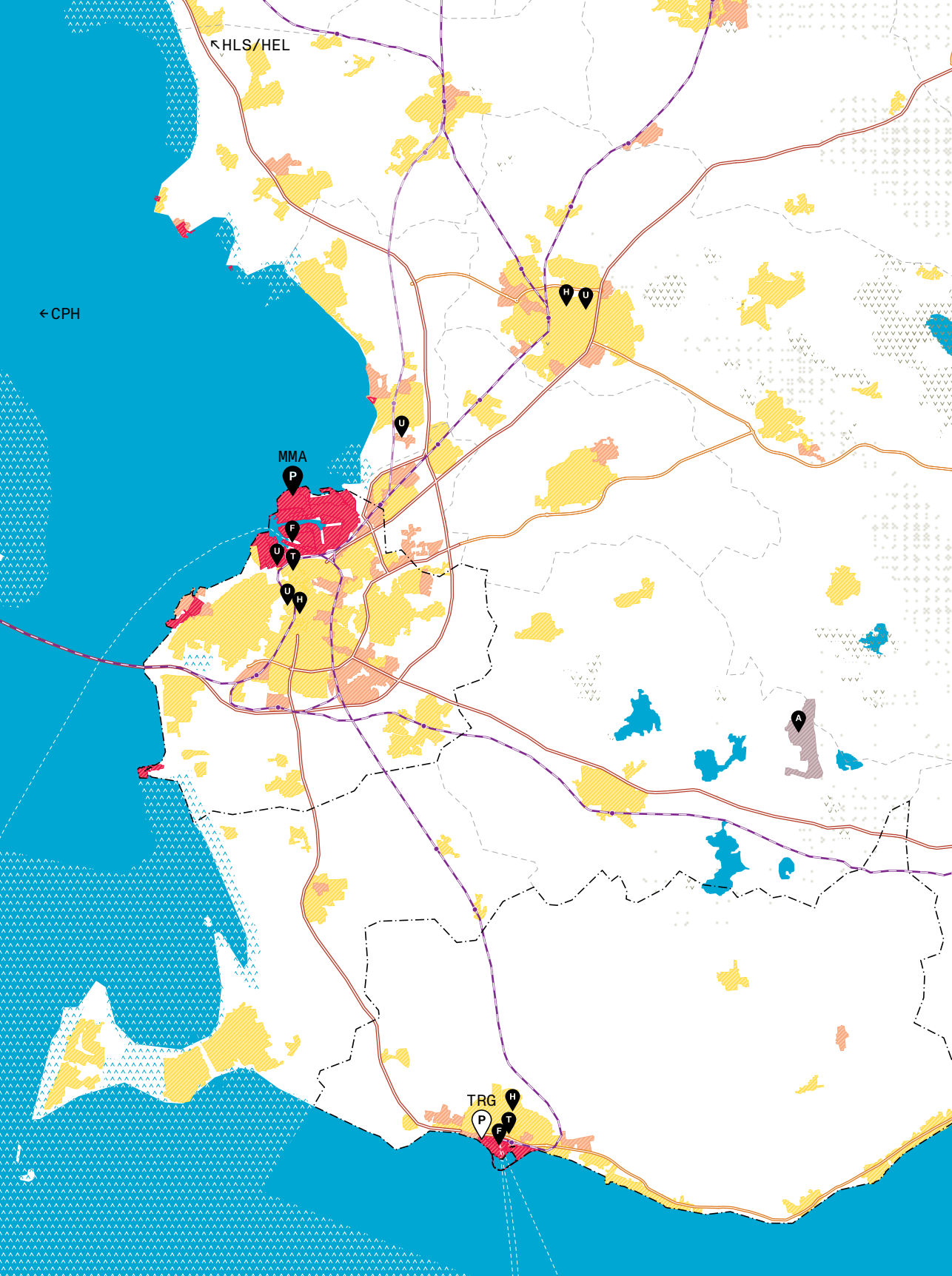
	Trelleborg TRG	Malmö MMA
→ Capital national (km)	→ Stockholm 512	→ Stockholm 529
→ Capital regional (km)		
Area (km²)	344	159
Built-up area (km²)	19	67
Density (per km²)	131	2,105
Population	44,902	333,633
Population structure (%)	17 65 / 21.4 57.1 21.5	15 65 / 18.4 66.3 15.2
Distribution built area (%)	B I P / 84 15 1	B I P / 70 16 13

TERRITORY

	Skåne län TRG	Skåne län MMA
Area (km²)	11,363	11,363
Density (per km²)	120	120
Population	1,362,164	1,362,164
Natura2000 (km²)	M T / 2,920 351	M T / 2,920 351






↖HLS/HEL
←CPH
MMA
TRG

Rønne, DK

PORT

RNN (%) 33.0 | 8.5 | 40.3 | 18.2

	RNN
Liquid	20
Dry bulk	158
Container	
Specialized	583
General	2,399
Cruise ship	
Passenger	
Other	46
Vessels	3,206

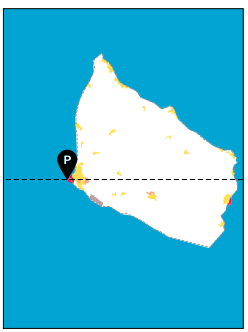
	RNN
Liquid bulk	68
Dry bulk	688
Containers	
RoRo	607
Other	30
Cargo (t)	1,393
Passengers	1,860

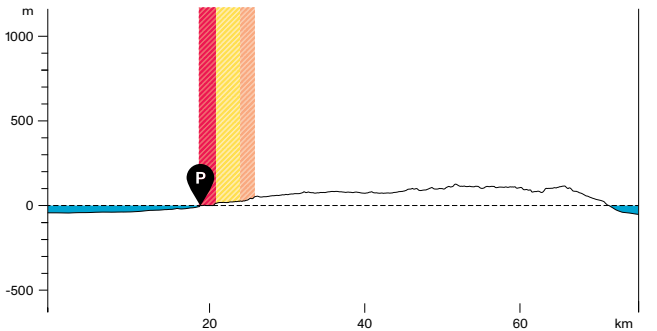
CITY

	Bornholm RNN
→ Capital national (km)	
→ Capital regional (km)	→ Copenhagen 150
Area (km²)	590
Built-up area (km²)	25
Density (per km²)	67
Population	39,572
Population structure (%)	17 65 16.9 53.3 29.8
Distribution built area (%)	B A I P 79 9 7 5

TERRITORY

	Bornholm RNN
Area (km²)	592
Density (per km²)	67
Population	39,662
Natura2000 (km²)	M T 45 61






RNN
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F
F
50
60

Stockholm, SE

Riddarfjärden

PORT






ST0 (%)	6.2	32.7	52.8	8.3

	ST0
Liquid	93
Dry bulk	540
Container	160
Specialized	
General	3,211
Cruise ship	
Passenger	322
Other	305
Vessels	4,631

	ST0
Liquid bulk	349
Dry bulk	921
Containers	420
RoRo	2,451
Other	585
Cargo (t)	4,726
Passengers	8,349

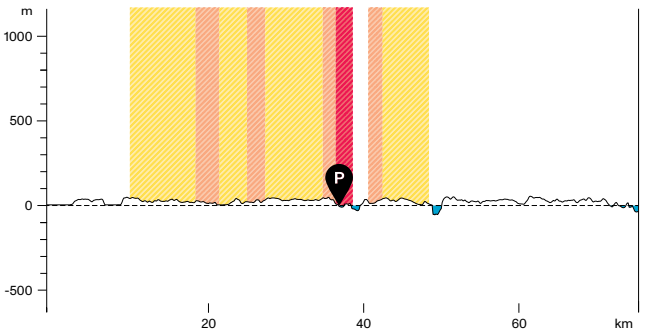
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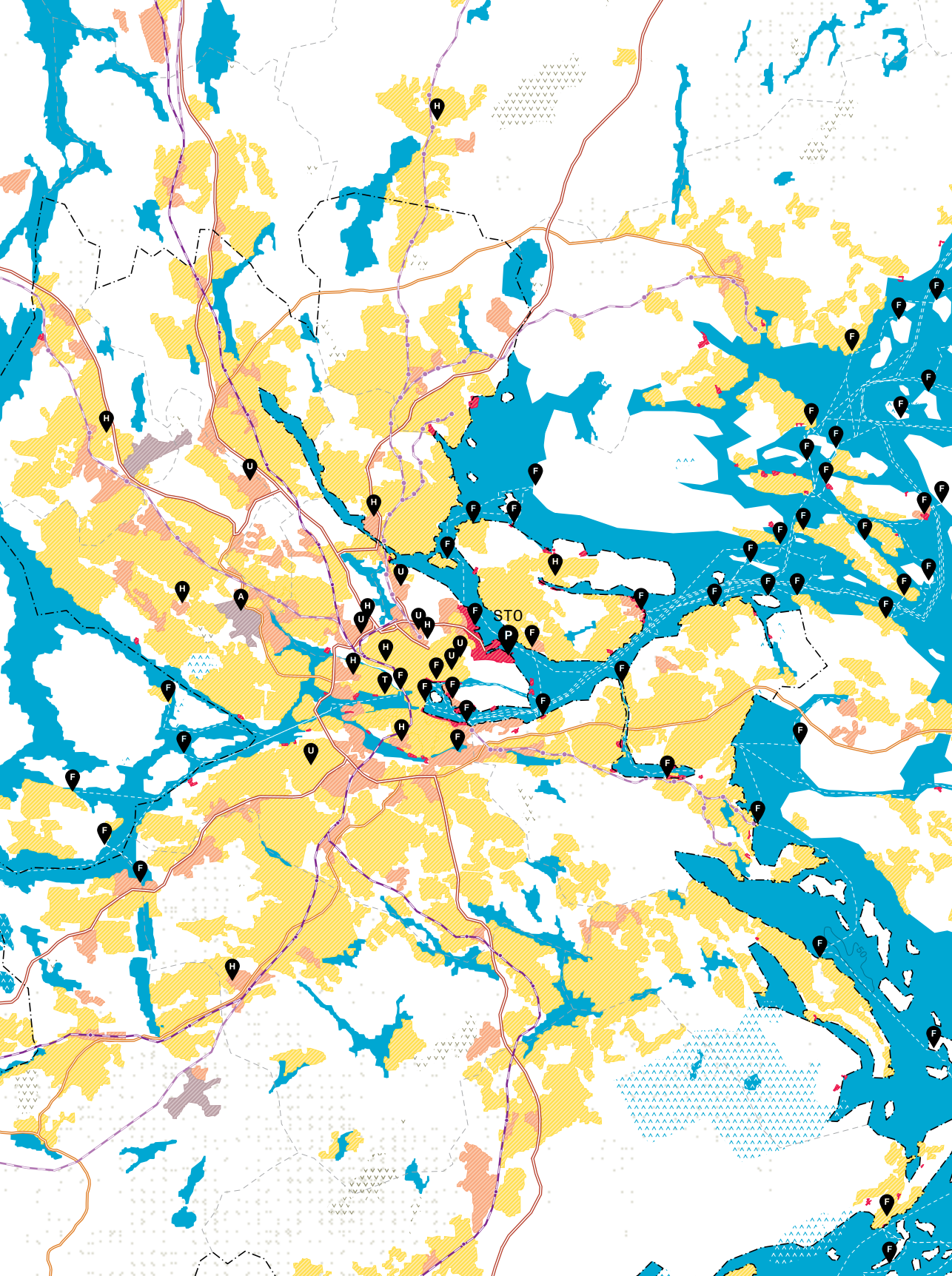
	Stockholm ST0
→ Capital national (km)	
→ Capital regional (km)	→ Stockholm 0
Area (km²)	1,458
Built-up area (km²)	407
Density (per km²)	651
Population	949,761
Population structure (%)	15 65 18.5 66.3 15.0
Distribution built area (%)	B A I P 86 1 12 1

TERRITORY

	Stockholms län ST0
Area (km²)	7,073
Density (per km²)	331
Population	2,344,124
Natura2000 (km²)	M T 612 46






STO

LLA

Luleå, SE

Lule River

PORT

LLA (%) 31.4

	LLA
Liquid	34
Dry bulk	61
Container	
Specialized	158
General	294
Cruise ship	
Passenger	
Other	2
Vessels	549

40.6 28.0

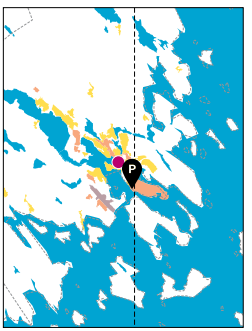
	LLA
Liquid bulk	247
Dry bulk	6,855
Containers	
RoRo	
Other	253
Cargo (t)	7,355
Passengers	0

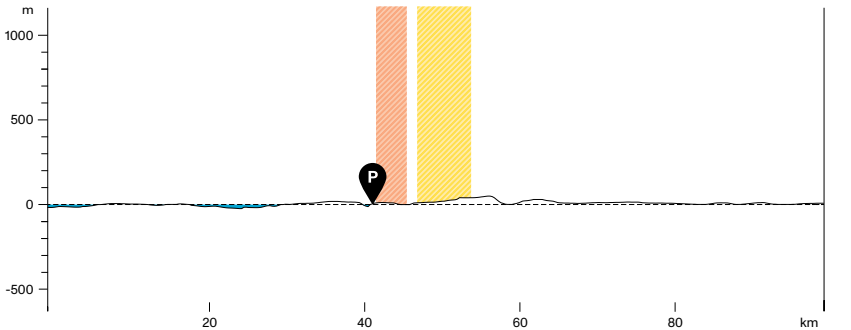
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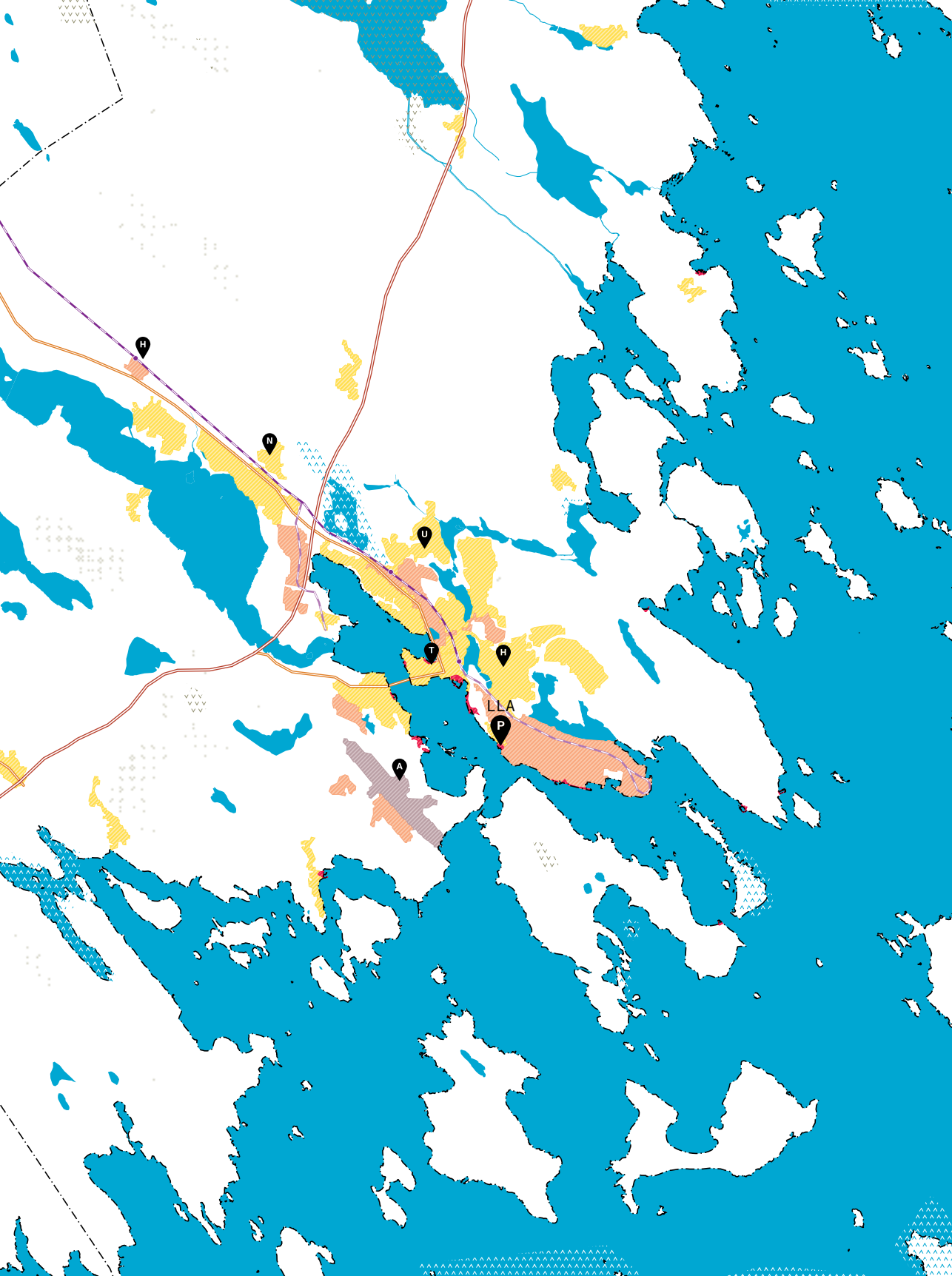
	Luleå
→ Capital national (km)	
→ Capital regional (km)	→ Stockholm 729
Area (km²)	2,255
Built-up area (km²)	50
Density (per km²)	35
Population	77,832
Population structure (%)	17 65 18.8 60.2 21.0
Distribution built area (%)	B A I P 64 6 29 1

TERRITORY

	Norrbottens län
Area (km²)	105,908
Density (per km²)	2
Population	250,497
Natura2000 (km²)	M T 1,270 27,458






H
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TKU
NLI

Turku, FI
Naantali, FI

River Aura
Archipelago Sea

PORT

TKU / NLI (%) 85.0 10.0 5.0 10.0 10.0 80.0

	TKU	NLI
Liquid	69	352
Dry bulk	6	17
Container		
Specialized		
General	1,701	1,100
Cruise ship		
Passenger		
Other	10	
Vessels	1,786	1,468

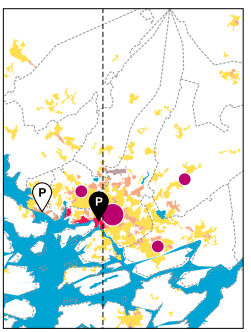
	TKU	NLI
Liquid bulk	111	4,807
Dry bulk	40	763
Containers	15	
RoRo	1,621	1,931
Other	347	88
Cargo (t)	2,134	7,589
Passengers	3,137	194

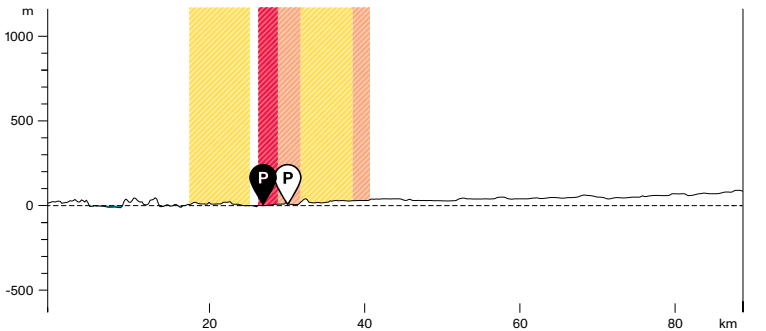
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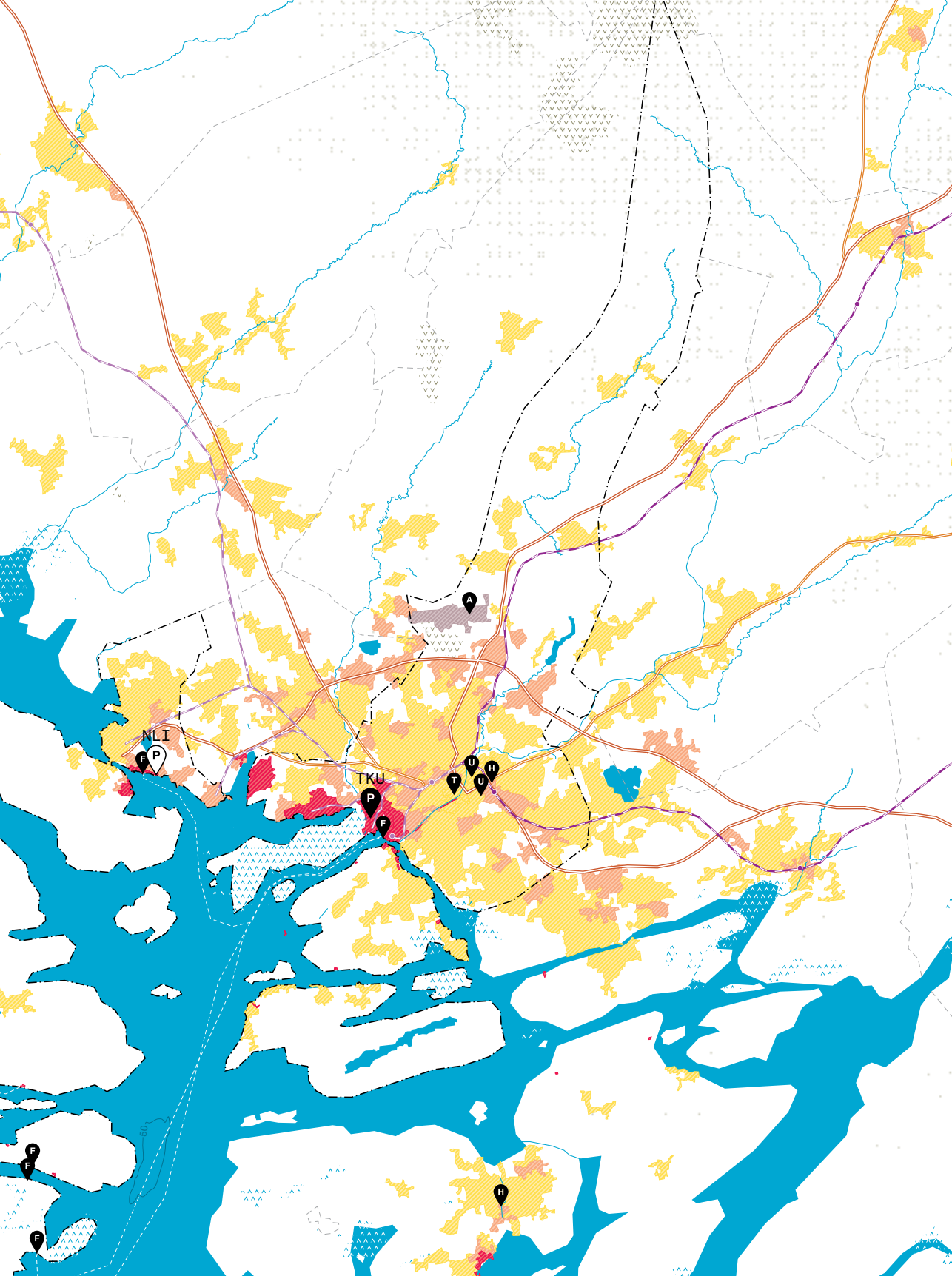
	Turku TKU	Naantali / Nådendal NLI
→ Capital national (km)		
→ Helsinki	154	164
→ Capital regional (km)		
Area (km²)	246	295
Built-up area (km²)	73	20
Density (per km²)	776	65
Population	191,331	19,245
Population structure (%)	15 65 12.8 66.7 20.5	15 65 18.0 54.9 27.1
Distribution built area (%)	B A I P 72 3 19 6	B I P 80 18 2

TERRITORY

	Varsinais-Suomi TKU	Varsinais-Suomi NLI
Area (km²)	10,598	10,598
Density (per km²)	45	45
Population	478,582	478,582
Natura2000 (km²)	M T 3,639 223	M T 3,639 223






NLI
TKU
50

Helsinki, FI

PORT

	HEL (%)
	28.7
	71.1
	0.1

	HEL
Liquid	62
Dry bulk	68
Container	705
Specialized General	6,867
Cruise ship Passenger	628
Other	
Vessels	8,035

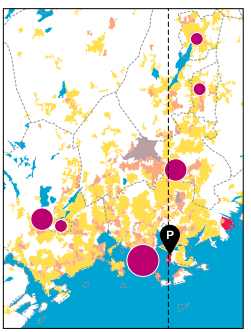
	HEL
Liquid bulk	138
Dry bulk	1,544
Containers	3,719
RoRo	8,017
Other	952
Cargo (t)	14,370
Passengers	11,619

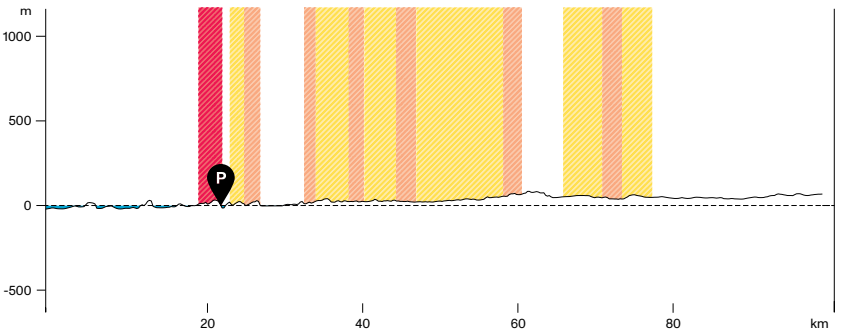
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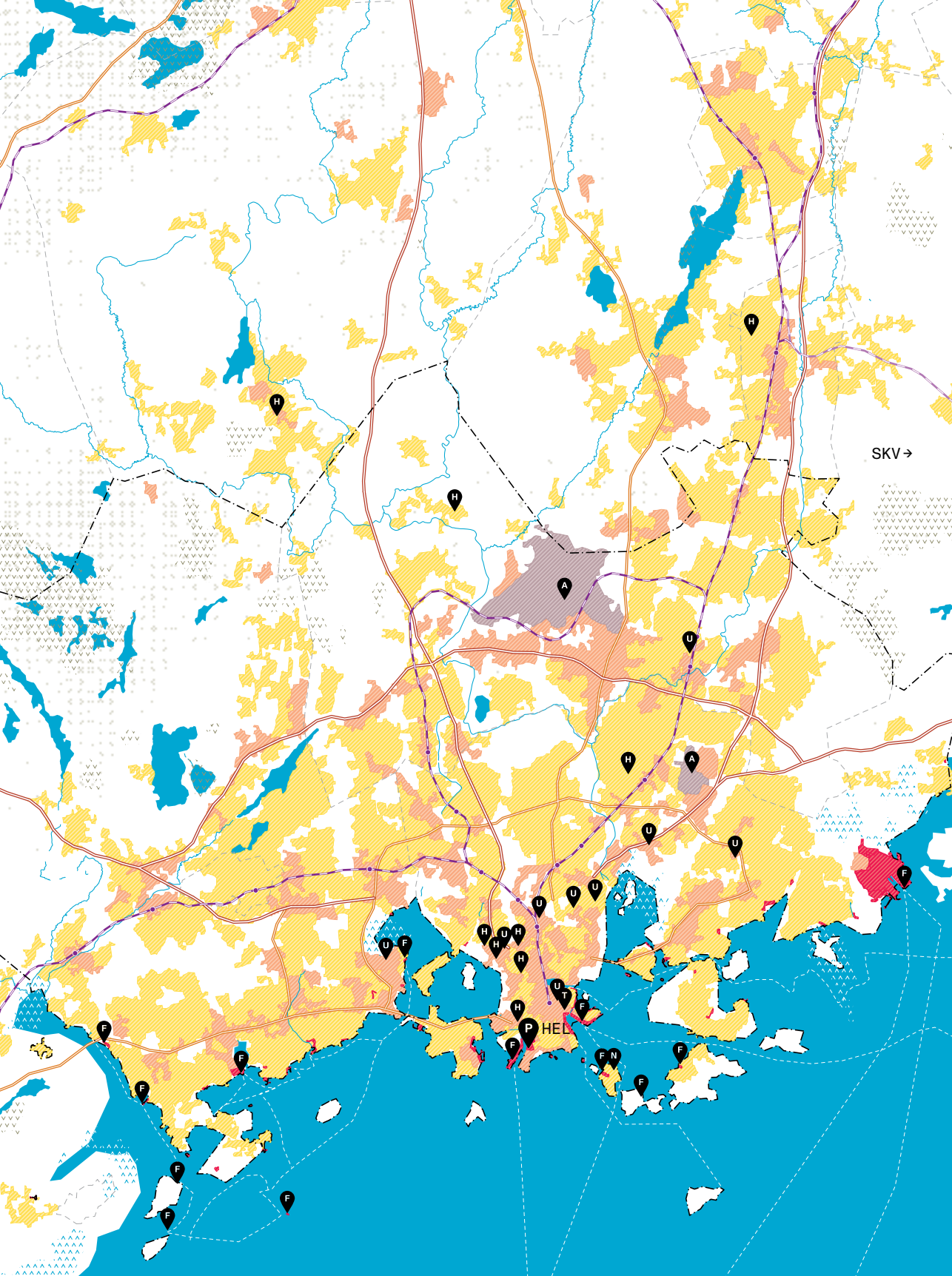
	Helsinki Greater city HEL
→ Capital national (km)	→ Helsinki 0
→ Capital regional (km)	
Area (km²)	779
Built-up area (km²)	364
Density (per km²)	1,482
Population	1,154,967
Population structure (%)	15 65 16.3 67.8 15.9
Distribution built area (%)	B A I P 76 4 19 1

TERRITORY

	Helsinki-Uusimaa HEL
Area (km²)	9,420
Density (per km²)	177
Population	1,671,024
Natura2000 (km²)	M T 3,925 245






SKV→
HEL

Sköldvik, FI

PORT

SKV (%)

	SKV
Liquid	1,251
Dry bulk	
Container	
Specialized	
General	
Cruise ship	
Passenger	
Other	2
Vessels	1,253

67.4 32.6

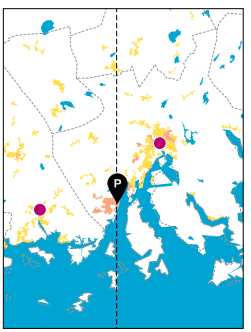
	SKV
Liquid bulk	25,160
Dry bulk	
Containers	
RoRo	
Other	38
Cargo (t)	25,198
Passengers	

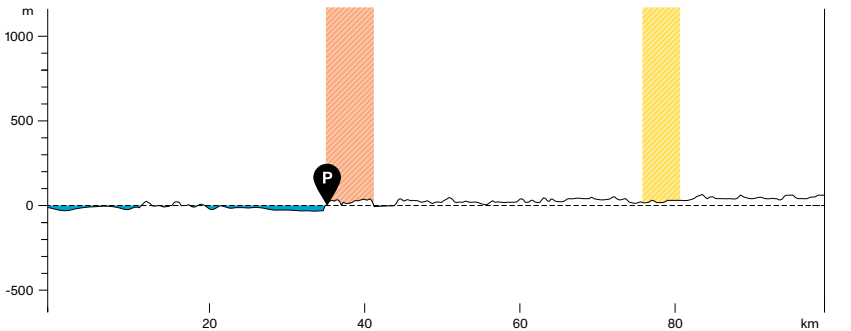
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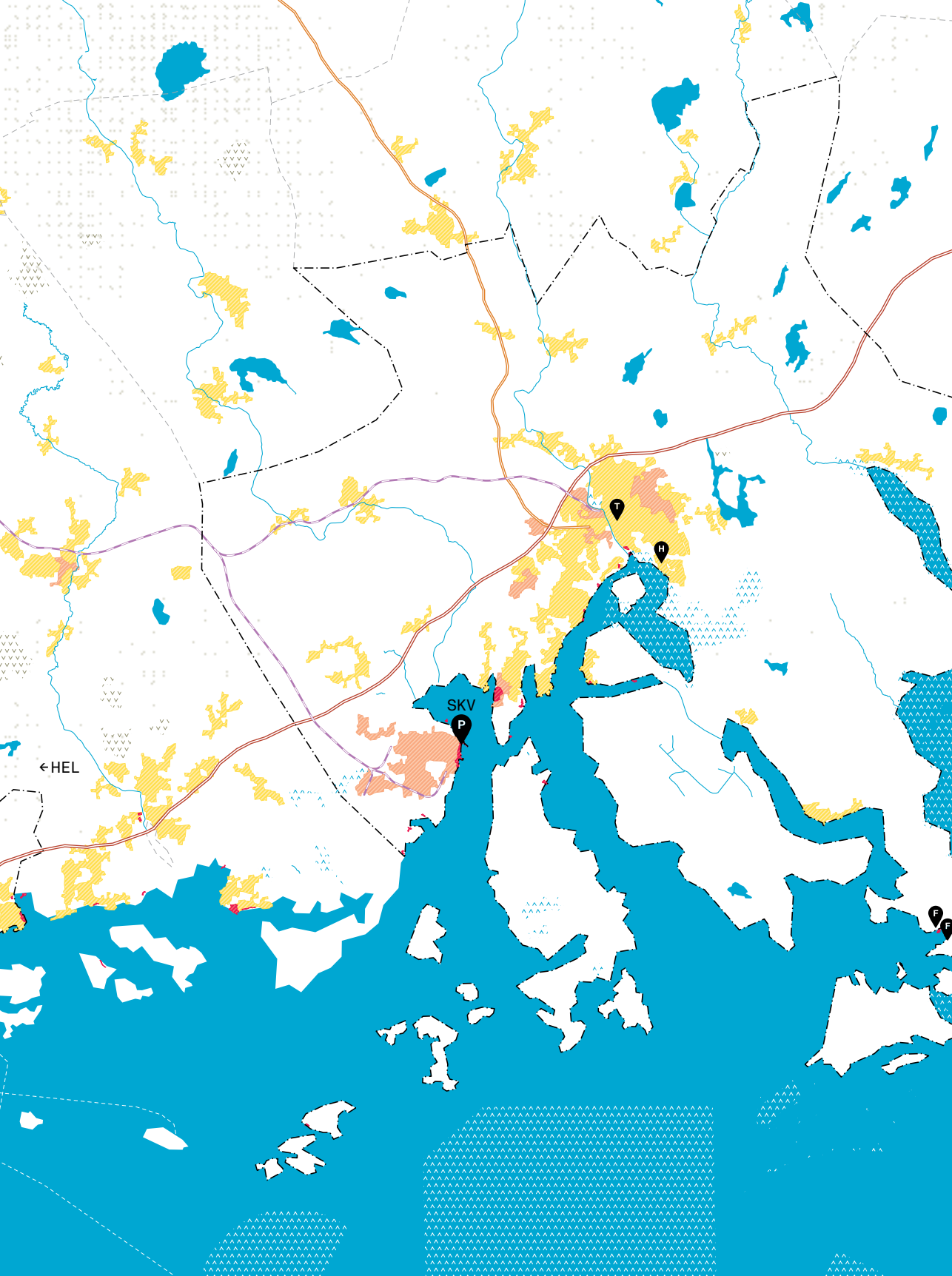
	Porvoo
→ Capital national (km)	
→ Capital regional (km)	→ Helsinki 38
Area (km²)	646
Built-up area (km²)	39
Density (per km²)	78
Population	50,262
Population structure (%)	17 65 / 20.4 57.5 22.2
Distribution built area (%)	B I P / 73 26 1

TERRITORY

	Helsinki-Uusimaa
Area (km²)	9,420
Density (per km²)	177
Population	1,671,024
Natura2000 (km²)	M T / 3,925 245






SKV
HEL

SLM

Sillamäe, EE

Narva Bay

PORT

SLM (%) 100

	ABC
Liquid	523
Dry bulk	278
Container	
Specialized	
General	
Cruise ship	
Passenger	
Other	3
Vessels	804

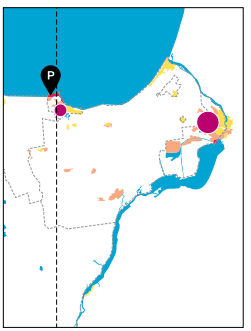
	SLM
Liquid bulk	7,712
Dry bulk	2,465
Containers	130
RoRo	
Other	185
Cargo (t)	10,492
Passengers	

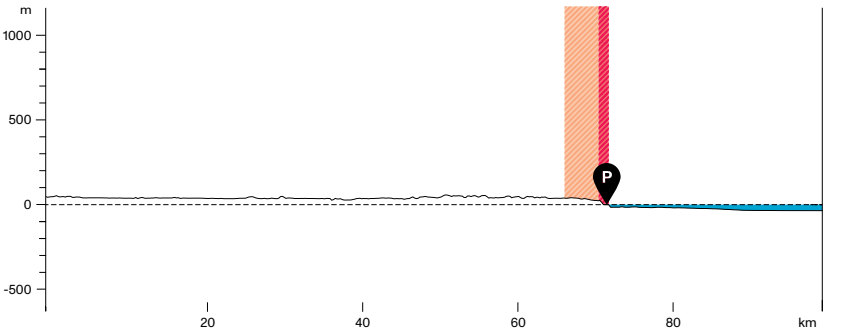
CITY

	SLM
	Sillamäe linn
→ Capital national (km)	→ Tallinn 170
→ Capital regional (km)	→ St. Petersburg 159
Area (km²)	12
Built-up area (km²)	5
Density (per km²)	1,068
Population	12,719
Population structure (%)	17 65 14.0 58.0 28.0
Distribution built area (%)	B I P 38 45 17

TERRITORY

	SLM
	Kirde-Eesti
Area (km²)	3,457
Density (per km²)	629
Population	140,506
Natura2000 (km²)	M T 99 911






SLM
P
T

TLL

Tallinn, EE

Tallinn Bay

PORT

TLL (%) 50.5 20.1 29.4

	TLL
Liquid	397
Dry bulk	111
Container	342
Specialized	
General	6,561
Cruise ship	361
Passenger	
Other	20
Vessels	7,792

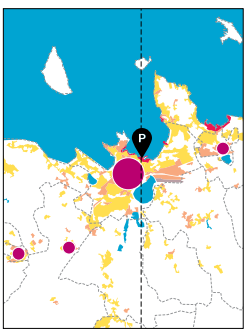
	TLL
Liquid bulk	7,368
Dry bulk	4,516
Containers	1,834
RoRo	5,365
Other	553
Cargo (t)	19,636
Passengers	9,961

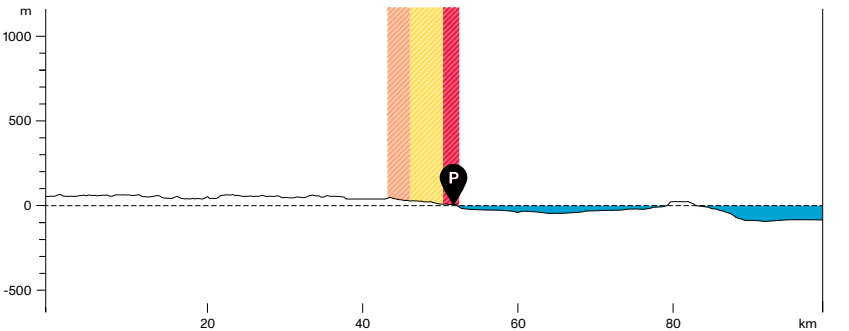
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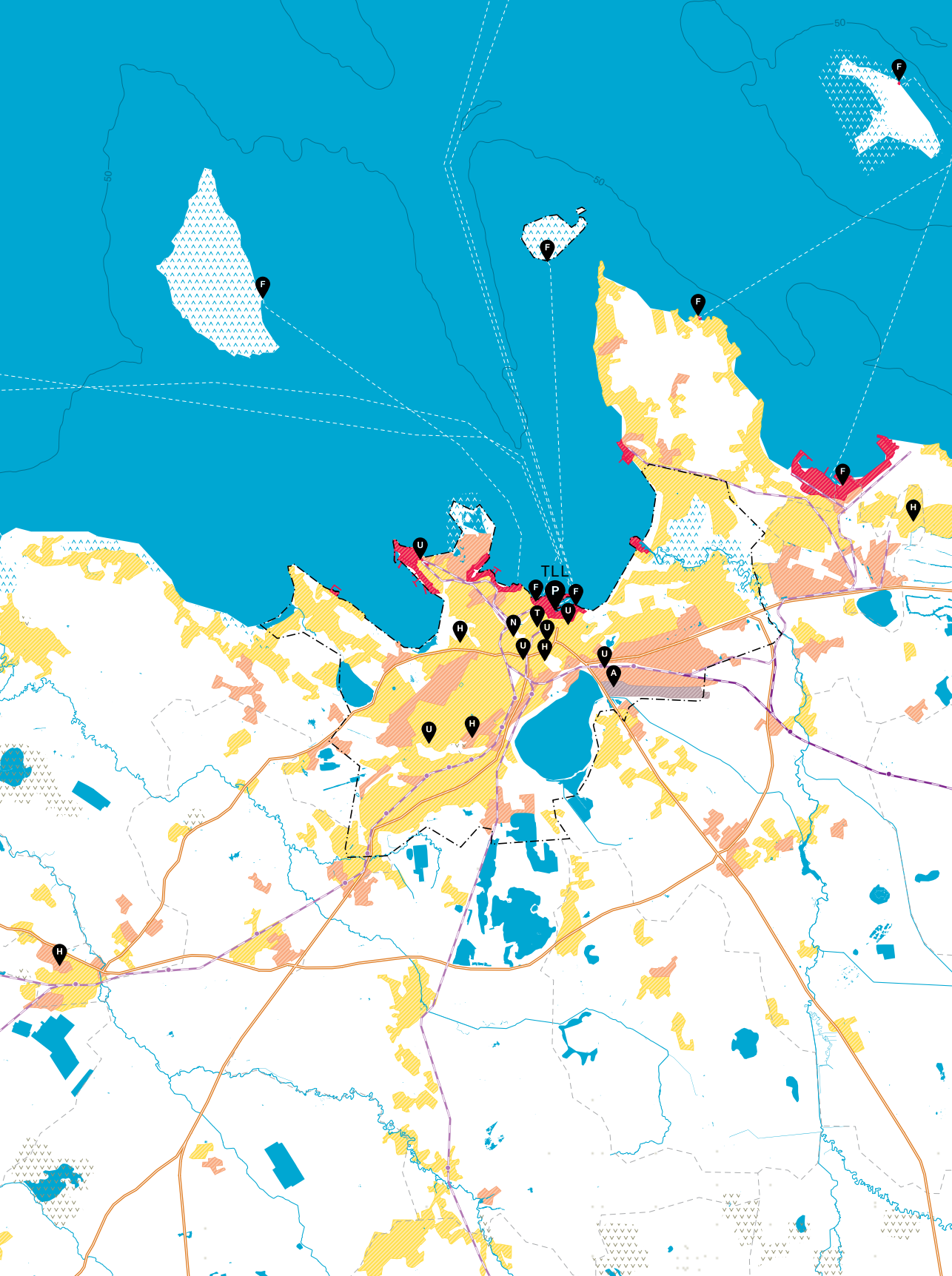
	Tallinn TLL
→ Capital national (km)	
→ Tallinn	0
→ Capital regional (km)	
Area (km²)	159
Built-up area (km²)	91
Density (per km²)	2,728
Population	434,562
Population structure (%)	15 65 16.0 65.6 18.4
Distribution built area (%)	B A I P 71 2 25 2

TERRITORY

	Põhja-Eesti TLL
Area (km²)	4,328
Density (per km²)	139
Population	599,478
Natura2000 (km²)	M T 1,104 1,218






50
50
50
TLL

Riga, LV

Gulf of Riga

PORT

RIX (%)

100

	RIX
Liquid	373
Dry bulk	1,941
Container	536
Specialized	28
General	12
Cruise ship	81
Passenger	359
Other	33
Vessels	3,363

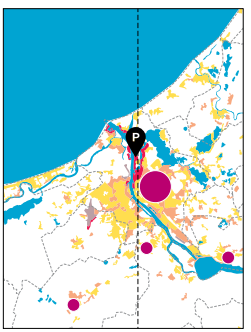
	RIX
Liquid bulk	3,748
Dry bulk	20,103
Containers	3,851
RoRo	143
Other	2,783
Cargo (t)	30,628
Passengers	799

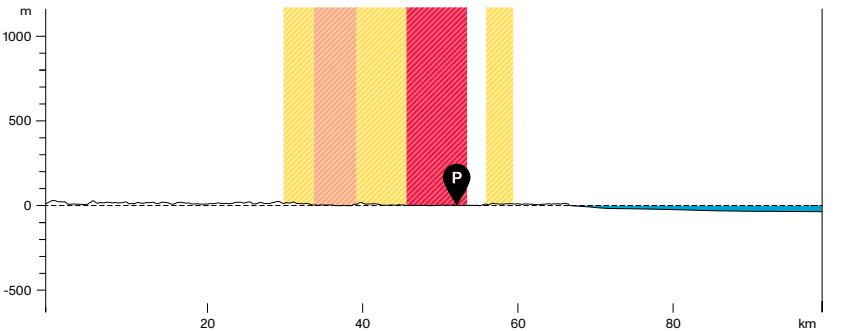
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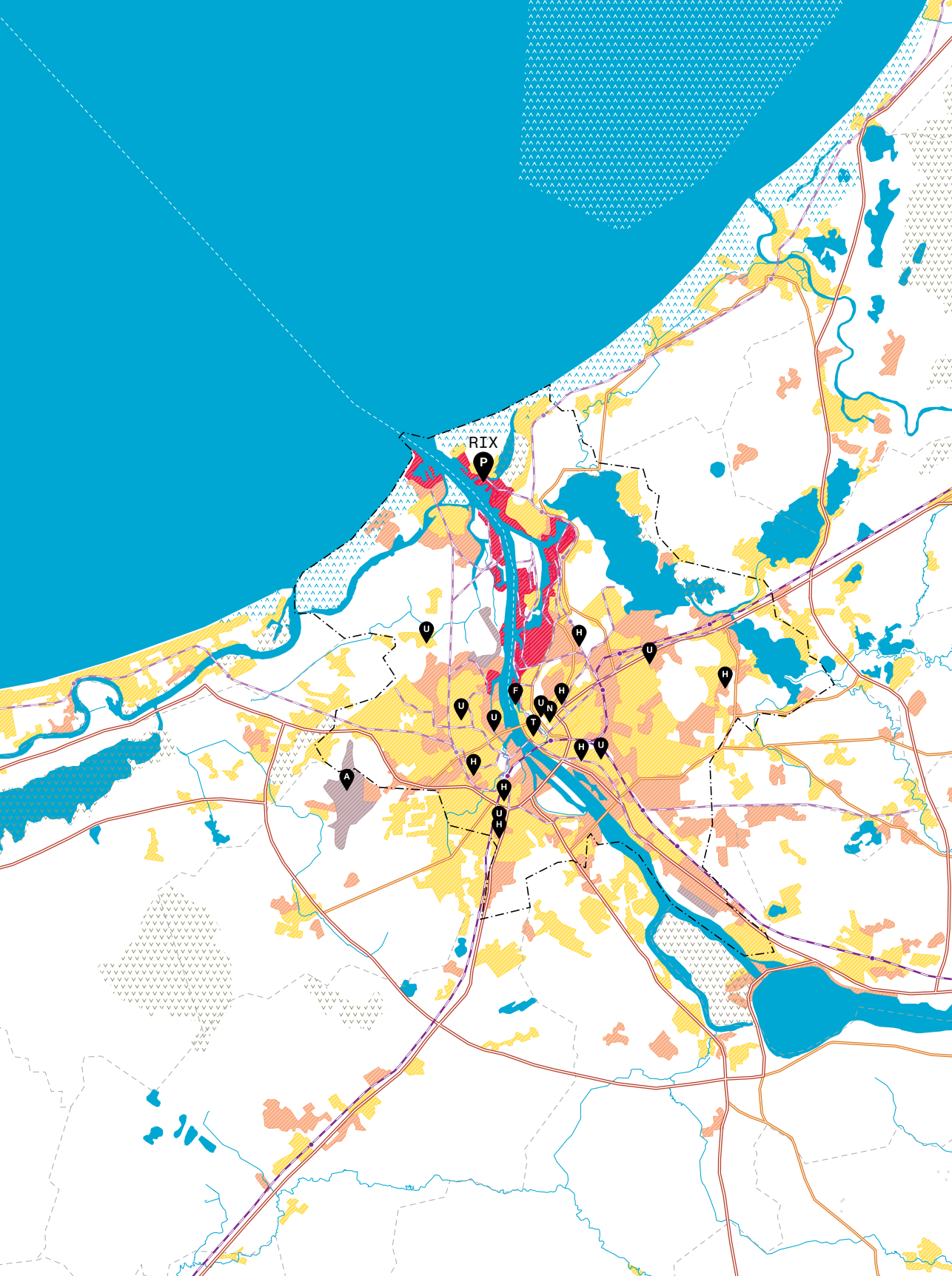
	Rīga
→ Capital national (km)	0
→ Capital regional (km)	
Area (km²)	304
Built-up area (km²)	144
Density (per km²)	2,059
Population	626,147
Population structure (%)	15.4 / 64.1 / 20.6
Distribution built area (%)	B 58 / A 1 / I 34 / P 7

TERRITORY

	Rīga
Area (km²)	304
Density (per km²)	2,081
Population	632,614
Natura2000 (km²)	M 443 / T 9






RIX

VNT

Ventspils, LV

Baltic Sea

PORT

VNT (%) 100

	VNT
Liquid	456
Dry bulk	442
Container	
Specialized	
General	
Cruise ship	
Passenger	602
Other	8
Vessels	1,508

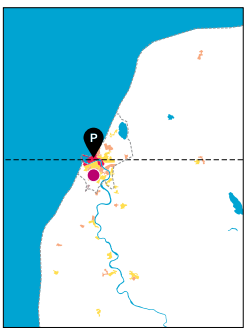
	VNT
Liquid bulk	10,231
Dry bulk	7,438
Containers	
RoRo	1,302
Other	626
Cargo (t)	19,600
Passengers	232

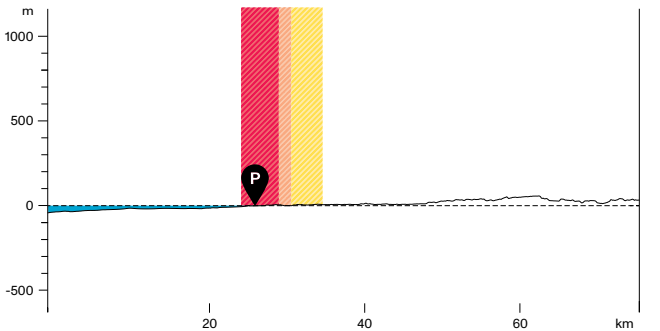
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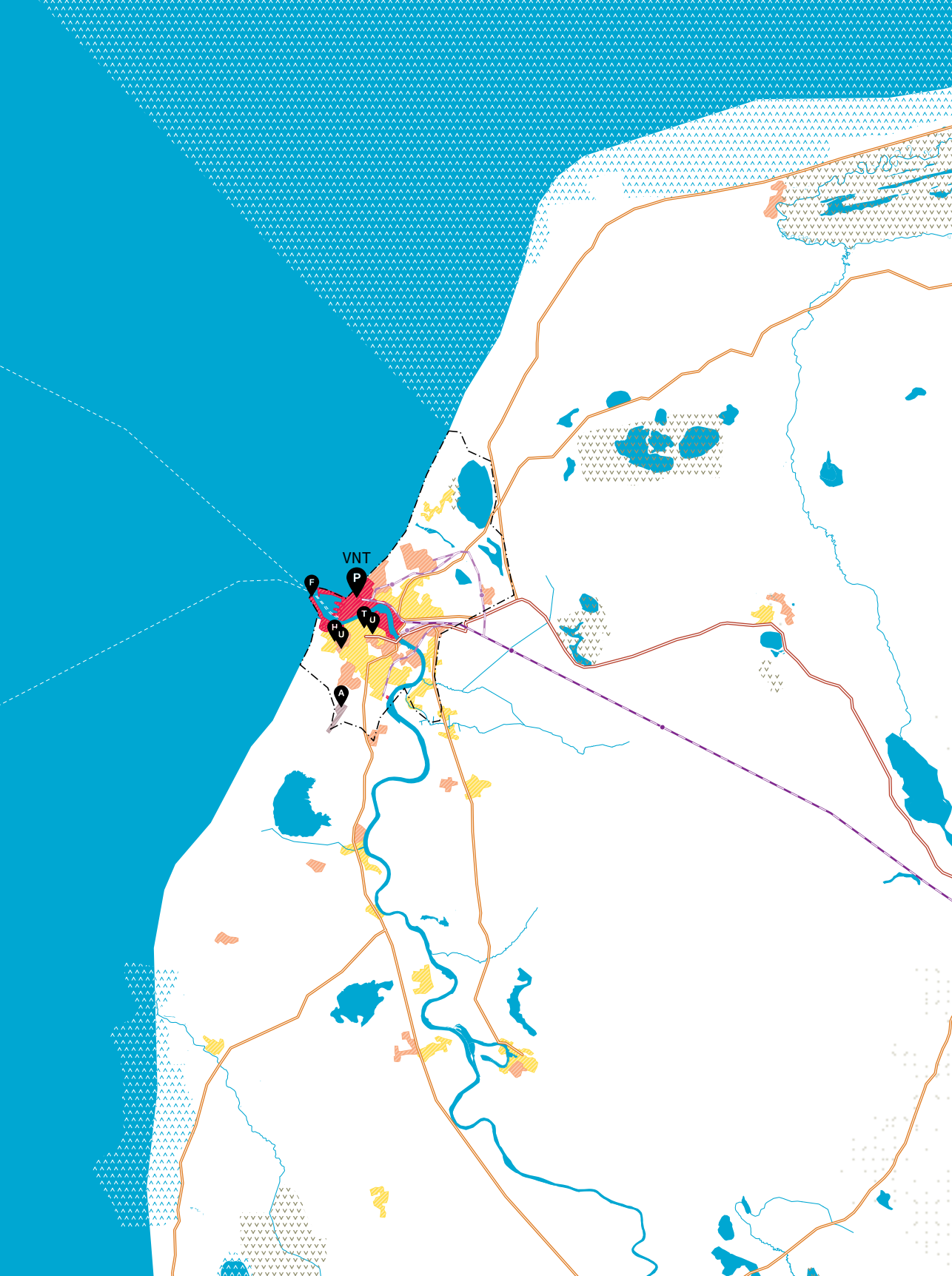
	Ventspils
→ Capital national (km)	
→ Capital regional (km)	→ Riga 161
Area (km²)	58
Built-up area (km²)	19
Density (per km²)	593
Population	34,377
Population structure (%)	15 65 / 15.2 61.4 23.4
Distribution built area (%)	B A I P / 53 1 29 17

TERRITORY

	Kurzeme
Area (km²)	13,604
Density (per km²)	18
Population	240,113
Natura2000 (km²)	M T / 3,837 853






VNT
P
F
T
U
H
U
A

Liepaja, LV

PORT

LPX (%) 100

	LPX
Liquid	163
Dry bulk	1,124
Container	8
Specialized	
General	
Cruise ship	
Passenger	254
Other	8
Vessels	1,557

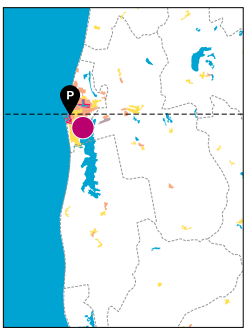
	LPX
Liquid bulk	566
Dry bulk	5,489
Containers	36
RoRo	471
Other	463
Cargo (t)	7,025
Passengers	40

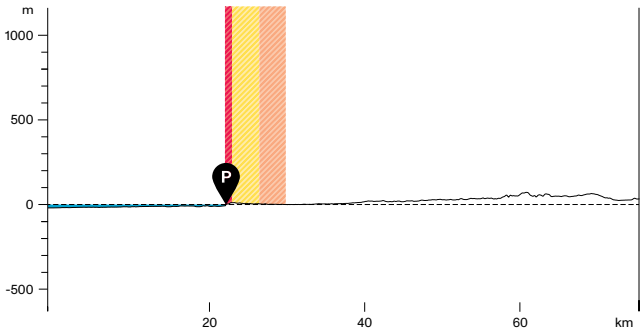
CITY

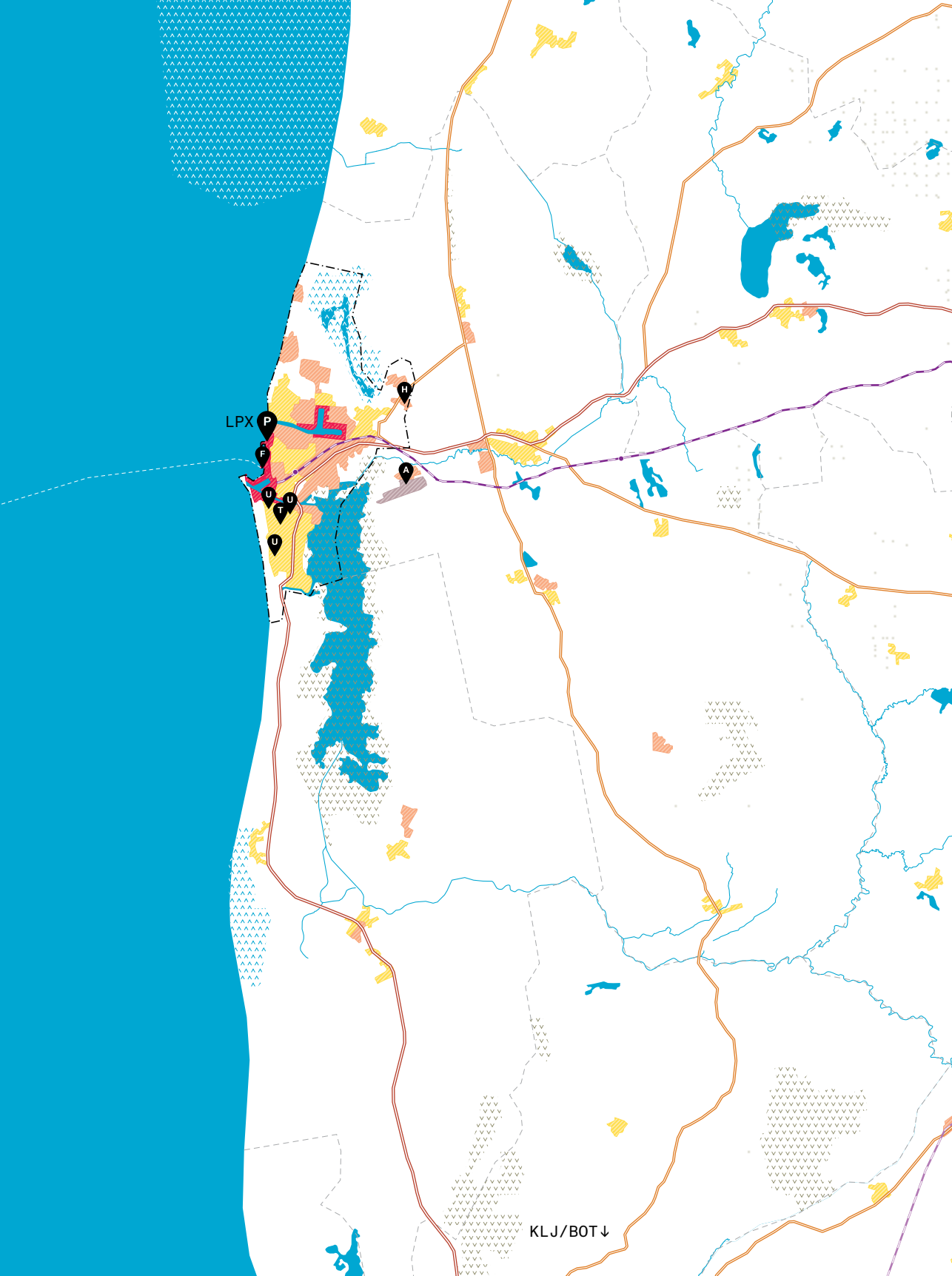
	Liepāja	LPX
→ Capital national (km)	→ Vilnius	339
→ Capital regional (km)	→ Kaliningrad	206
Area (km²)		61
Built-up area (km²)		26
Density (per km²)		1,124
Population		68,569
Population structure (%)		15 65 / 17.2 61.5 21.3
Distribution built area (%)		B I P / 46 45 9

TERRITORY

	Kurzeme	LPX
Area (km²)		13,604
Density (per km²)		18
Population		240,113
Natura2000 (km²)		M T / 3,837 853






LPX
KLJ/BOT↓

KLJ

BOT

Klaipeda, LT
Butinge, LT

Baltic Sea

Baltic Sea

PORT

	KLJ	BOT
KLJ / BOT (%)	20.0	44.6

	KLJ	BOT
Liquid	603	97
Dry bulk	438	
Container	823	
Specialized	7	
General	2,991	
Cruise ship		
Passenger		
Other	123	
Vessels	4,978	97

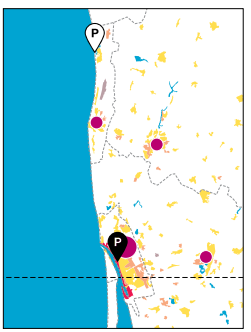
	KLJ	BOT
	29.1	6.3
Liquid bulk	10,400	9,542
Dry bulk	20,667	
Containers	6,657	
RoRo	3,305	
Other	1,676	
Cargo (t)	42,705	9,542
Passengers	343	0

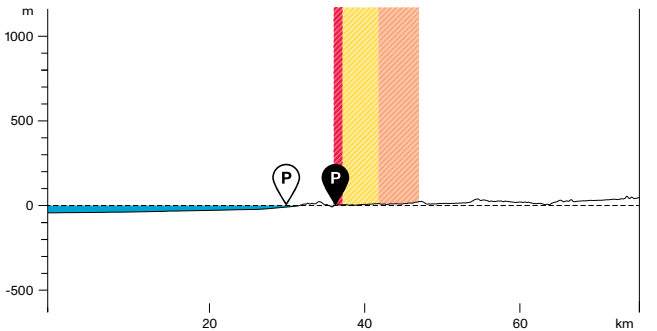
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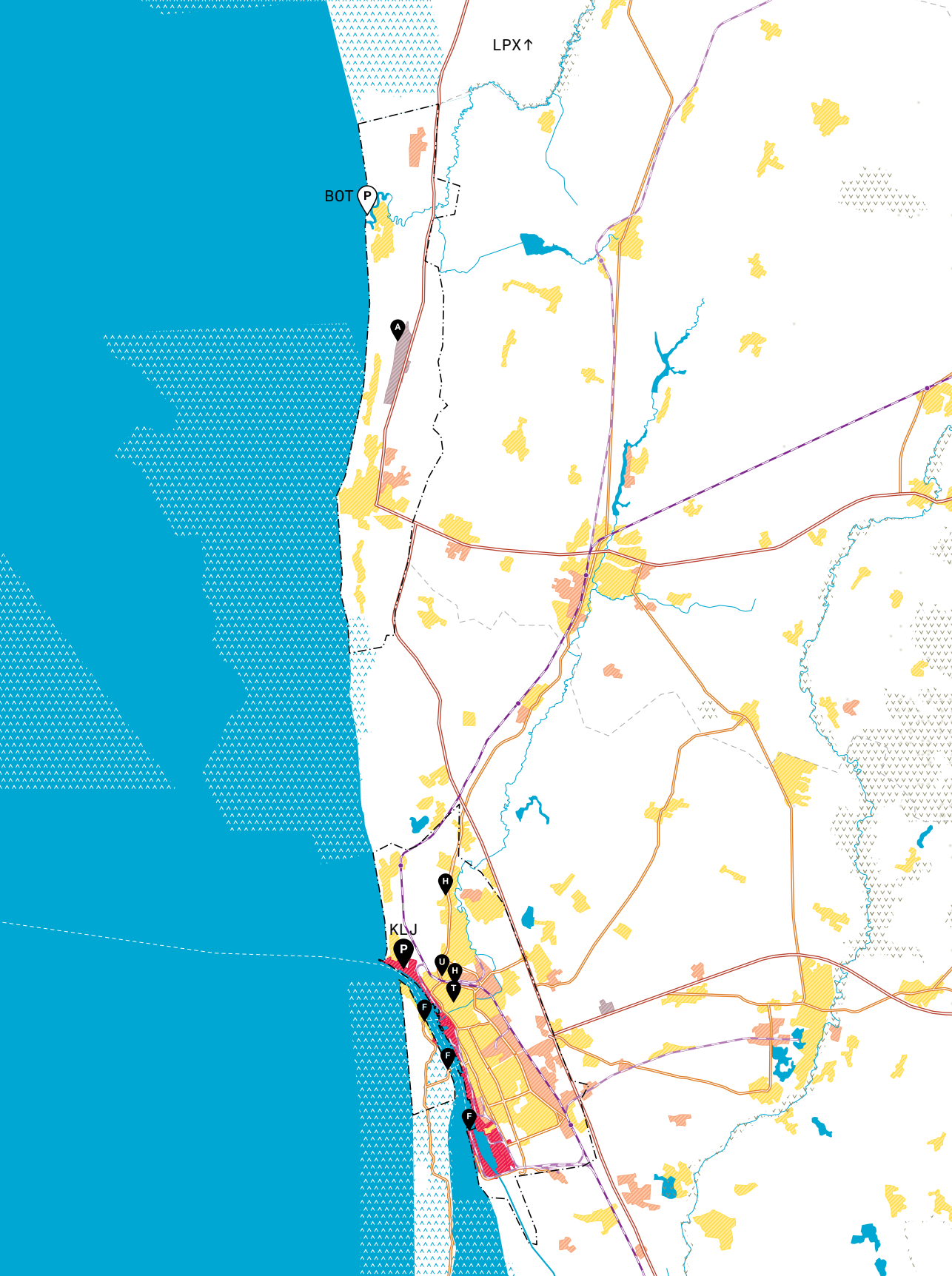
	KLJ	BOT
	Klaipėda	Palanga City Municipality
→ Capital national (km)	→ Vilnius 287	→ Vilnius 117
→ Capital regional (km)	→ Kaliningrad 306	→ Kaliningrad 152
Area (km²)	88	79
Built-up area (km²)	39	12
Density (per km²)	1,675	199
Population	147,892	15,664
Population structure (%)	15 16.4 / 65 63.9 / 19.5	
Distribution built area (%)	B 65 / I 23 / P 12	B 70 / A 15 / I 15

TERRITORY

	KLJ	BOT
	Klaipėdos apskritis	Klaipėdos apskritis
Area (km²)	4,819	4,819
Density (per km²)	66	66
Population	317,722	317,722
Natura2000 (km²)	M 2,455 / T 410	M 2,455 / T 410






LPX↑
BOT
P
A
H
KLJ
P
U
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T
F
F
F

GDN

GDY

Gdansk, PL
Gdynia, PL

Gdansk Bay

Gdansk Bay

PORT

GDN / GDY (%) 20.7 66.4 | 76.5 24.0 | 2.8 0.2 | 9.3

	GDN	GDY
Liquid	763	303
Dry bulk	276	263
Container	663	1,074
Specialized	114	26
General	1,213	1,873
Cruise ship		
Passenger		472
Other	715	73
Vessels	3,738	4,084

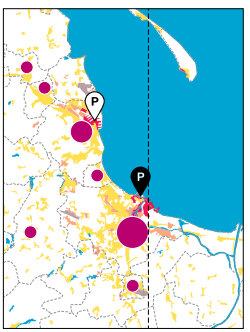
	GDN	GDY
Liquid bulk	18,000	2,500
Dry bulk	10,952	7,355
Containers	15,358	7,153
RoRo	394	2,298
Other	816	1,245
Cargo (t)	45,520	20,551
Passengers	289	791

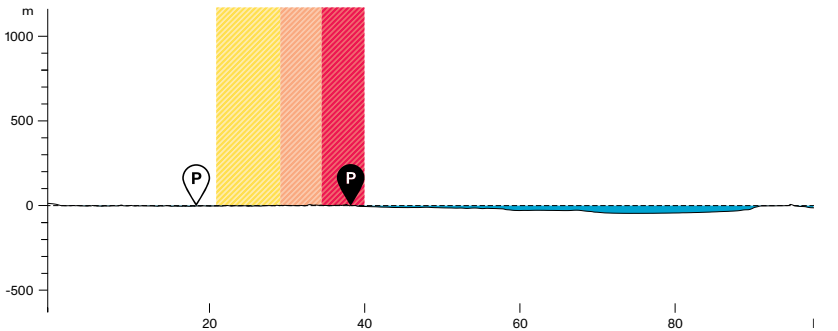
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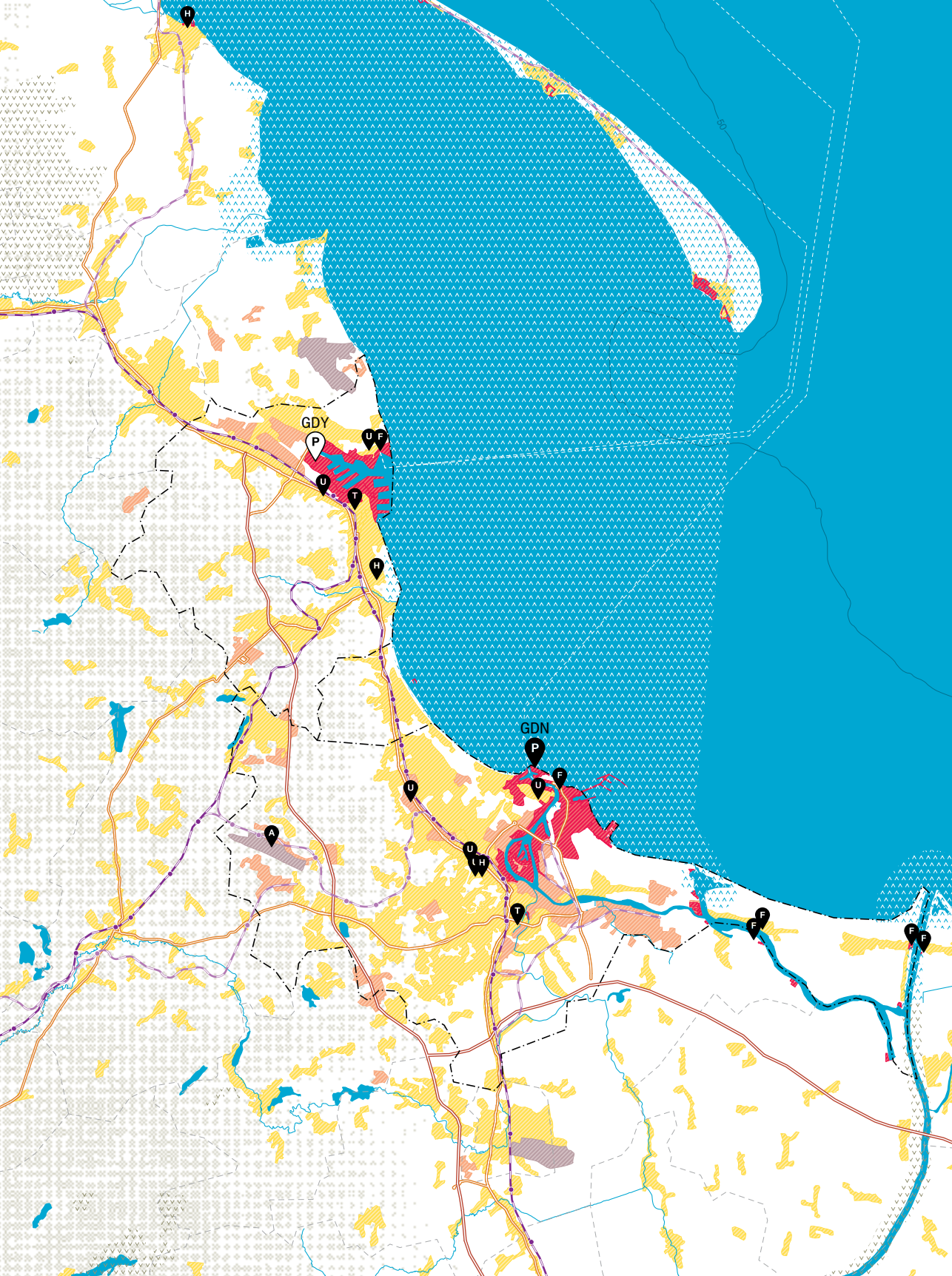
	M. Gdańsk GDN	M. Gdynia GDY
→ Capital national (km)	→ Warsaw 284	→ Warsaw 303
→ Capital regional (km)	→ Kaliningrad 126	→ Kaliningrad 128
Area (km²)	262	135
Built-up area (km²)	98	42
Density (per km²)	1,783	1,823
Population	466,631	246,309
Population structure (%)	15 65 15.2 64.8 20.1	15 65 13.8 64.8 21.4
Distribution built area (%)	B A I P 69 2 23 6	B A I P 75 1 14 10

TERRITORY

	Trójmiejski GDN	Trójmiejski GDY
Area (km²)	416	416
Density (per km²)	1,795	1,795
Population	745,972	745,972
Natura2000 (km²)	M T 1,330 108	M T 1,330 108






GDY
GDN
50

Szczecin, PL

River Oder

PORT

SZZ (%) 100

	SZZ
Liquid	676
Dry bulk	482
Container	134
Specialized	9
General	1,226
Cruise ship	116
Passenger	
Other	103
Vessels	2,746

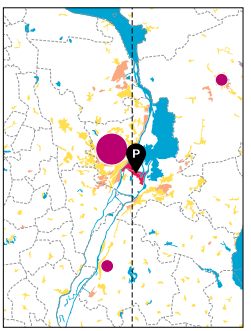
	SZZ
Liquid bulk	1,418
Dry bulk	4,999
Containers	555
RoRo	7
Other	2,604
Cargo (t)	9,583
Passengers	6

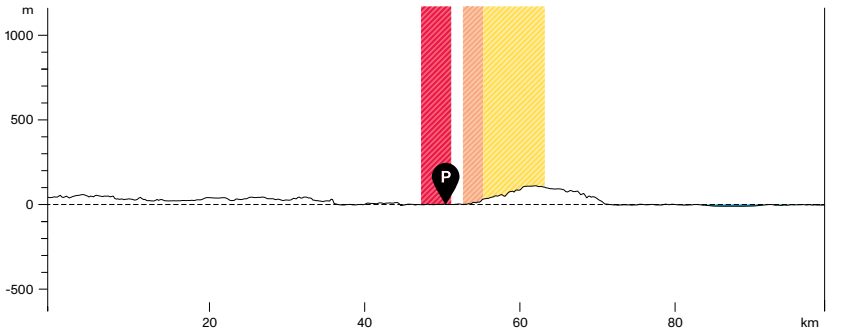
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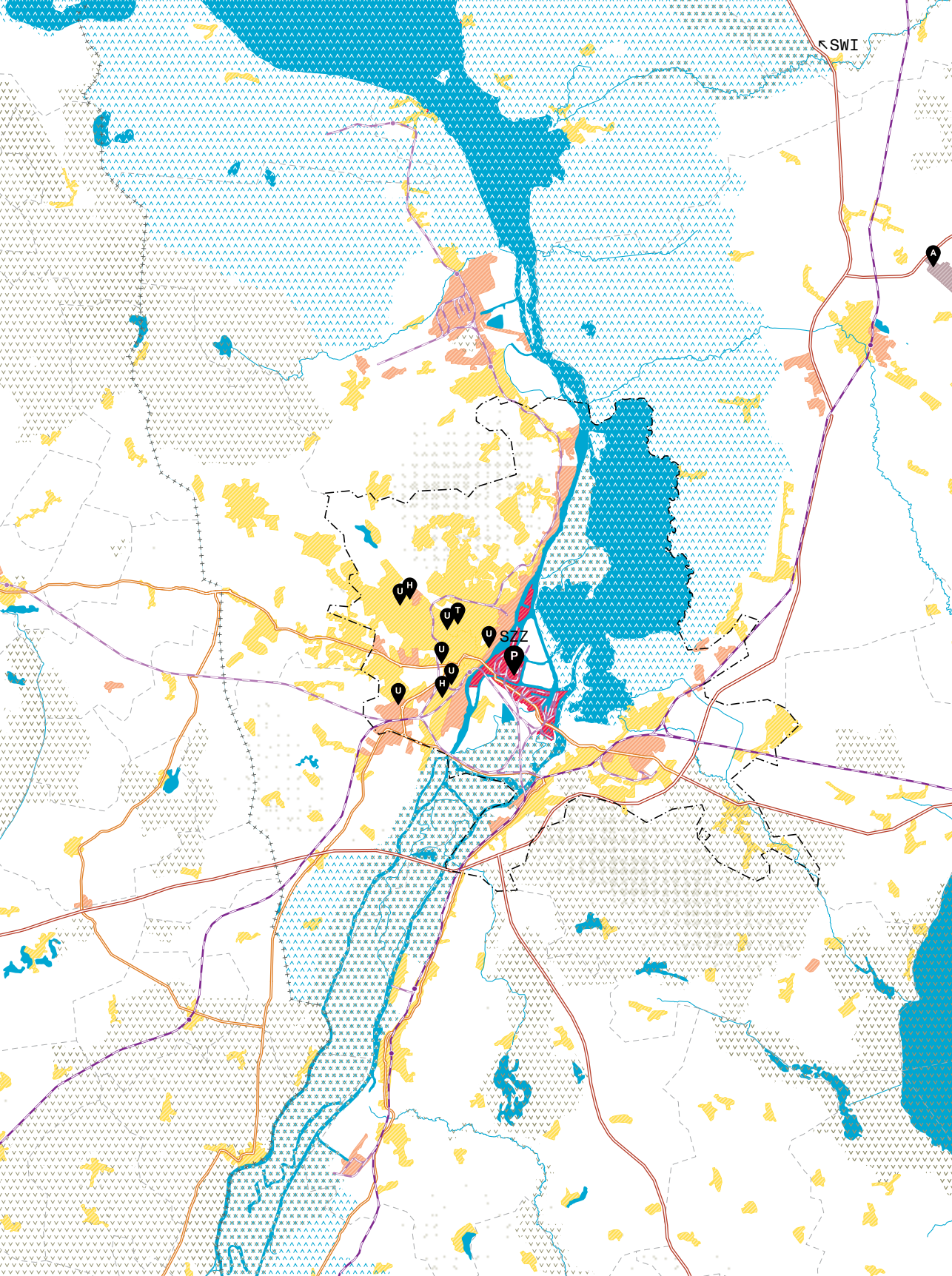
	Miasto Szczecin	SZZ
→ Capital national (km)	→ Warsaw	454
→ Capital regional (km)	→ Hamburg	303
Area (km²)		301
Built-up area (km²)		78
Density (per km²)		1,339
Population		402,465
Population structure (%)	15 / 65	13.6 / 65.9 / 20.5
Distribution built area (%)	B / I / P	72 / 20 / 8

TERRITORY

	Miasto Szczecin	SZZ
Area (km²)		300
Density (per km²)		1,335
Population		400,859
Natura2000 (km²)	M / T	2,127 / 401






SWI
SZZ

SWI

Swinoujscie, PL

Swine

PORT







SWI (%)

	SWI
Liquid	585
Dry bulk	111
Container	17
Specialized	
General	4,034
Cruise ship	47
Passenger	1,357
Other	1
Vessels	6,152

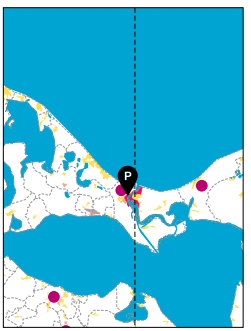
	SWI
Liquid bulk	4,830
Dry bulk	4,442
Containers	19
RoRo	6,227
Other	419
Cargo (t)	15,937
Passengers	1,170

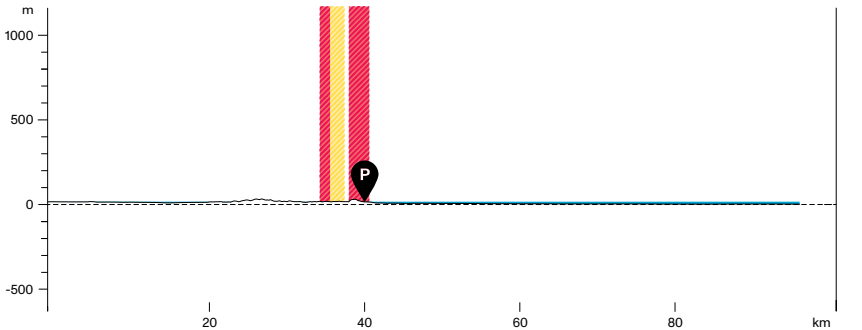
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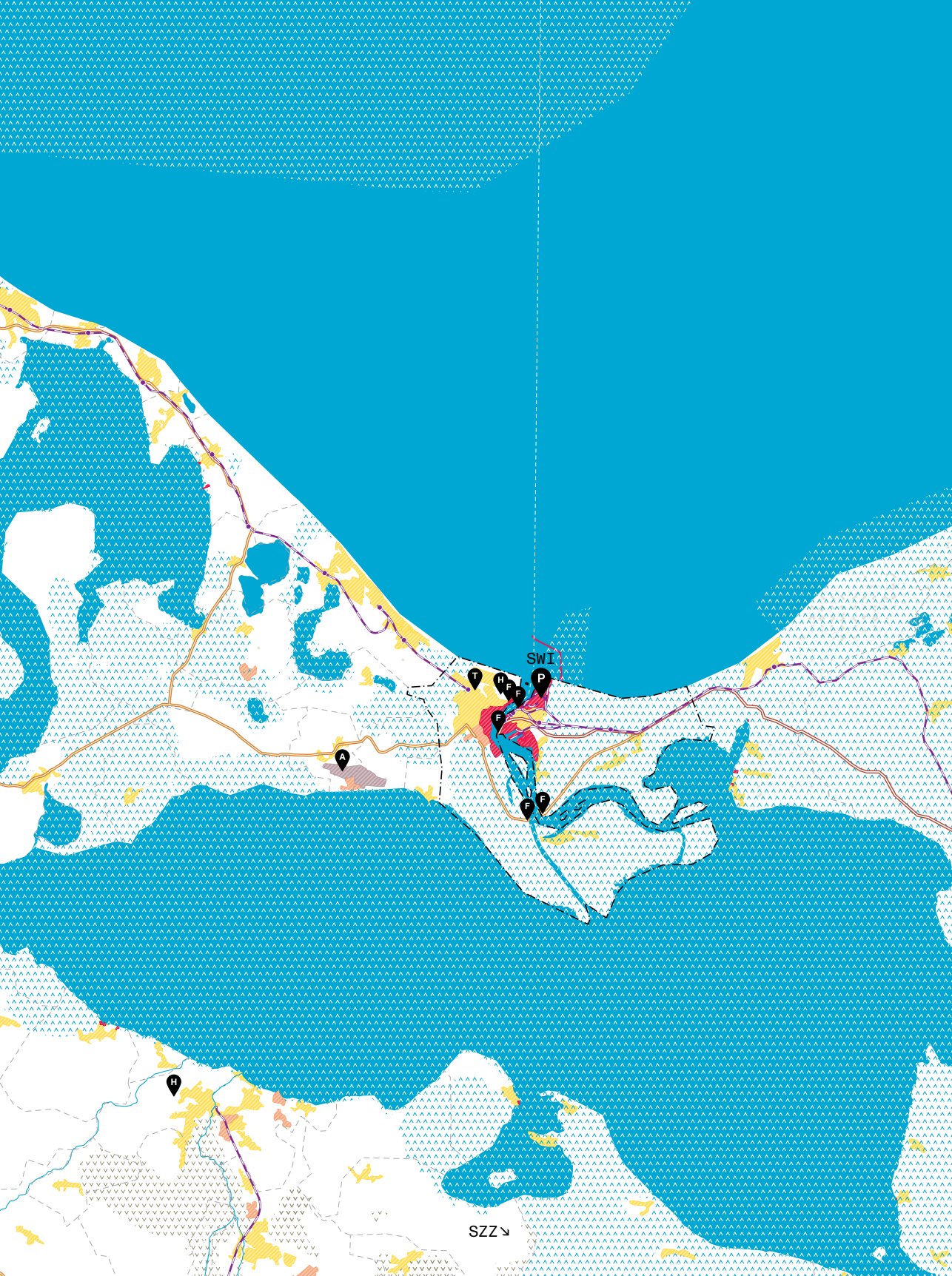
	Świnoujście
→ Capital national (km)	→ Warsaw 489
→ Capital regional (km)	→ Hamburg 284
Area (km²)	101
Built-up area (km²)	12
Density (per km²)	404
Population	40,910
Population structure (%)	17 65 14.6 62.9 22.6
Distribution built area (%)	B I P 65 5 30

TERRITORY

	Szczeciński
Area (km²)	7,441
Density (per km²)	68
Population	506,021
Natura2000 (km²)	M T 6,636 2,032






SWI
SZZ↘

RSK

Rostock, DE

Unterwarnow

PORT

RSK (%) 0.7

	RSK
Liquid	256
Dry bulk	48
Container	5
Specialized	9
General	6,660
Cruise ship	
Passenger	
Other	217
Vessels	7,195

55.3 4.3 39.7

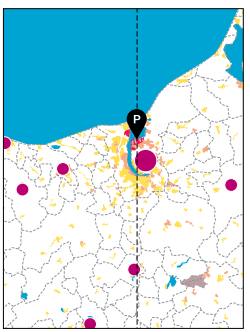
	RSK
Liquid bulk	3,816
Dry bulk	6,289
Containers	22
RoRo	7,987
Other	1,819
Cargo (t)	19,993
Passengers	3,394

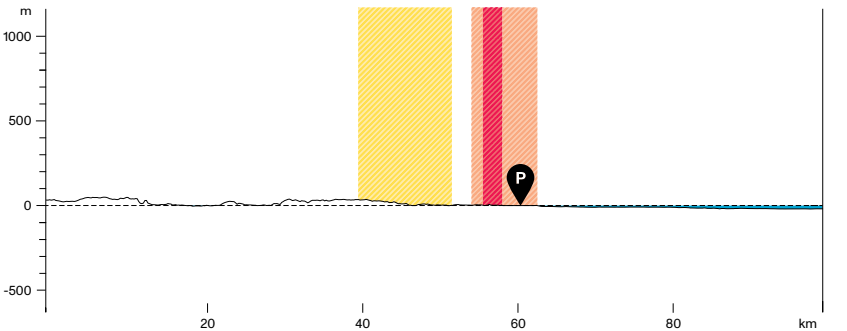
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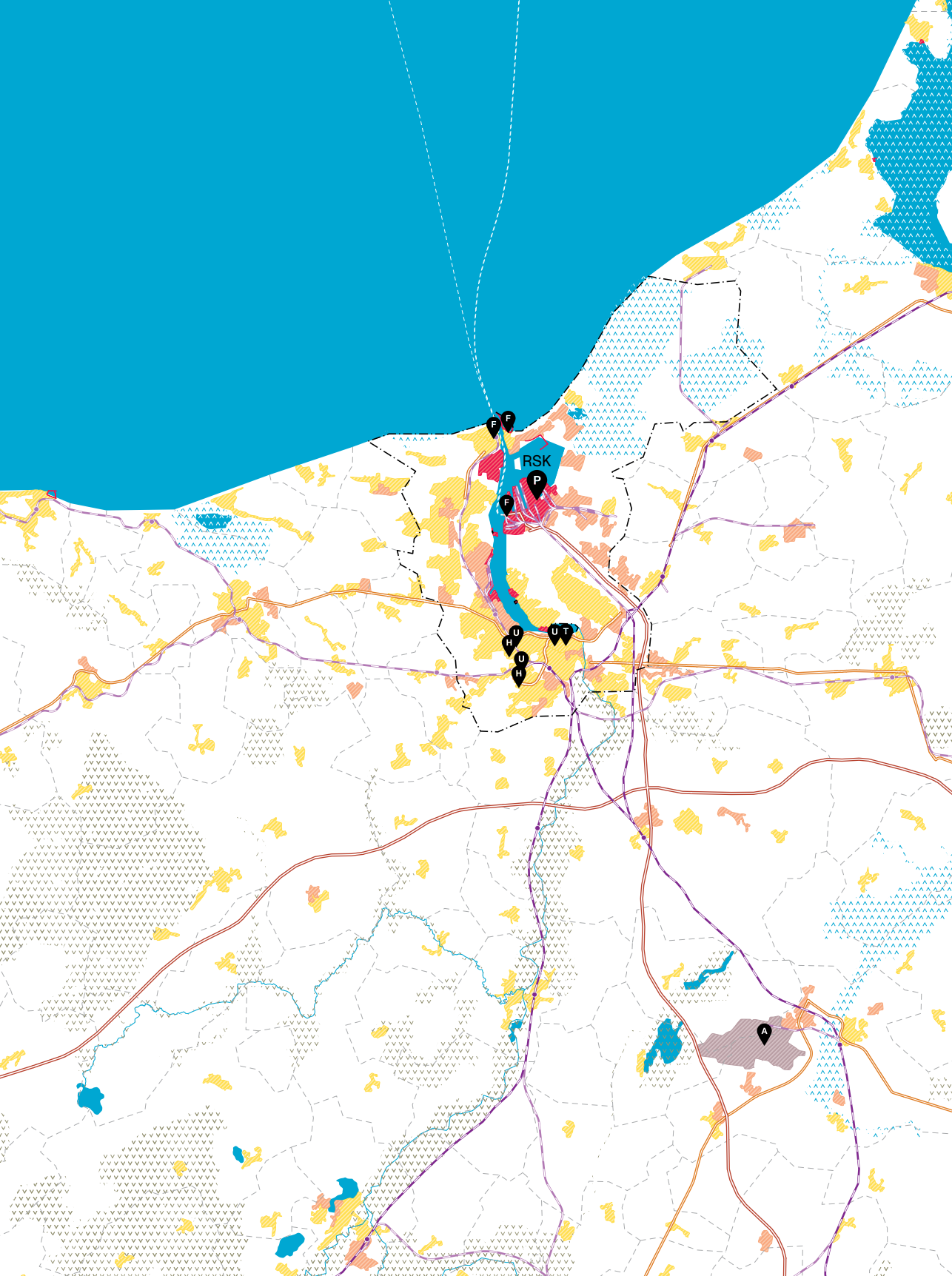
	Rostock RSK
→ Capital national (km)	
→ Capital regional (km)	
→ Berlin	195
→ Hamburg	154
Area (km²)	169
Built-up area (km²)	51
Density (per km²)	1,233
Population	208,886
Population structure (%)	15 65 12.0 64.5 23.6
Distribution built area (%)	B I P 63 30 7

TERRITORY

	Rostock, Kreisfreie Stadt RSK
Area (km²)	169
Density (per km²)	1,234
Population	208,886
Natura2000 (km²)	M T 2,125 136






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ROF
PUT

Rødby, DK
Puttgarden, DE

Fehmarnbelt
Fehmarnbelt

PORT

ROF / PUT (%)

12.3 0.2

87.7 99.8

	ROF	PUT
Liquid		
Dry bulk		
Container		
Specialized		
General	17,378	17,378
Cruise ship		
Passenger		
Other		
Vessels	17,378	17,378

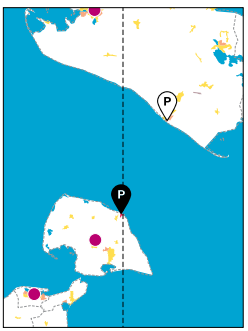
	ROF	PUT
Liquid bulk		
Dry bulk		
Containers		
RoRo	8,394	5,375
Other		
Cargo (t)	8,394	5,375
Passengers	0	6,007

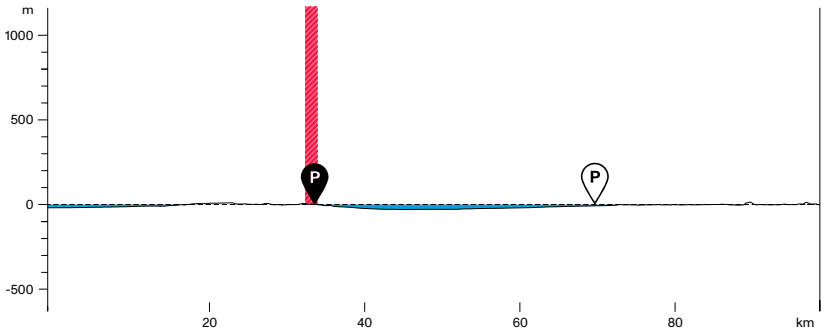
CITY

	ROF	PUT
	Lolland	Fehmarn, Stadt
→ Capital national (km)	→ Copenhagen 142	→ Berlin 264
→ Capital regional (km)		→ Hamburg 134
Area (km²)	724	182
Built-up area (km²)	23	6
Density (per km²)	46	69
Population	41,615	12,592
Population structure (%)	17 65 15.2 51.2 33.6	17 65 13.6 58.1 28.3
Distribution built area (%)	B A I P 83 1 14 2	B I P 85 8 7

TERRITORY

	ROF	PUT
	Vest- og Sydsjælland	Ostholstein
Area (km²)	6,507	1,386
Density (per km²)	90	145
Population	587,379	200,581
Natura2000 (km²)	M T 7,884 188	M T 2,808 180





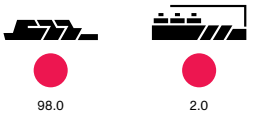

H
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LBC

Lübeck, DE

Trave

PORT



LBC (%)

	LBC
Liquid	6
Dry bulk	29
Container	167
Specialized	
General	3,883
Cruise ship	
Passenger	
Other	14
Vessels	4,099

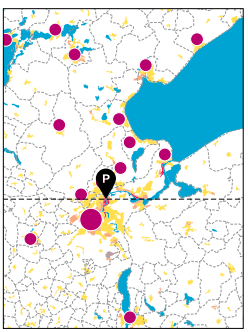
	LBC
Liquid bulk	29
Dry bulk	984
Containers	1,827
RoRo	12,717
Other	465
Cargo (t)	16,022
Passengers	458

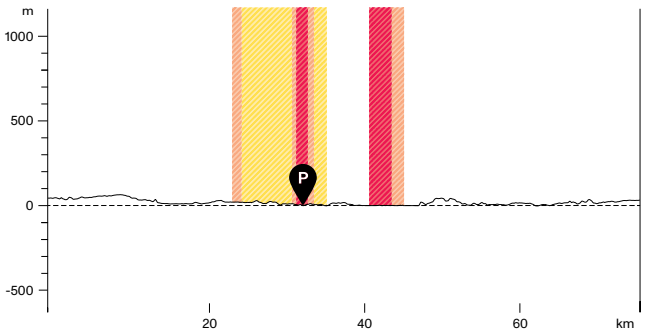
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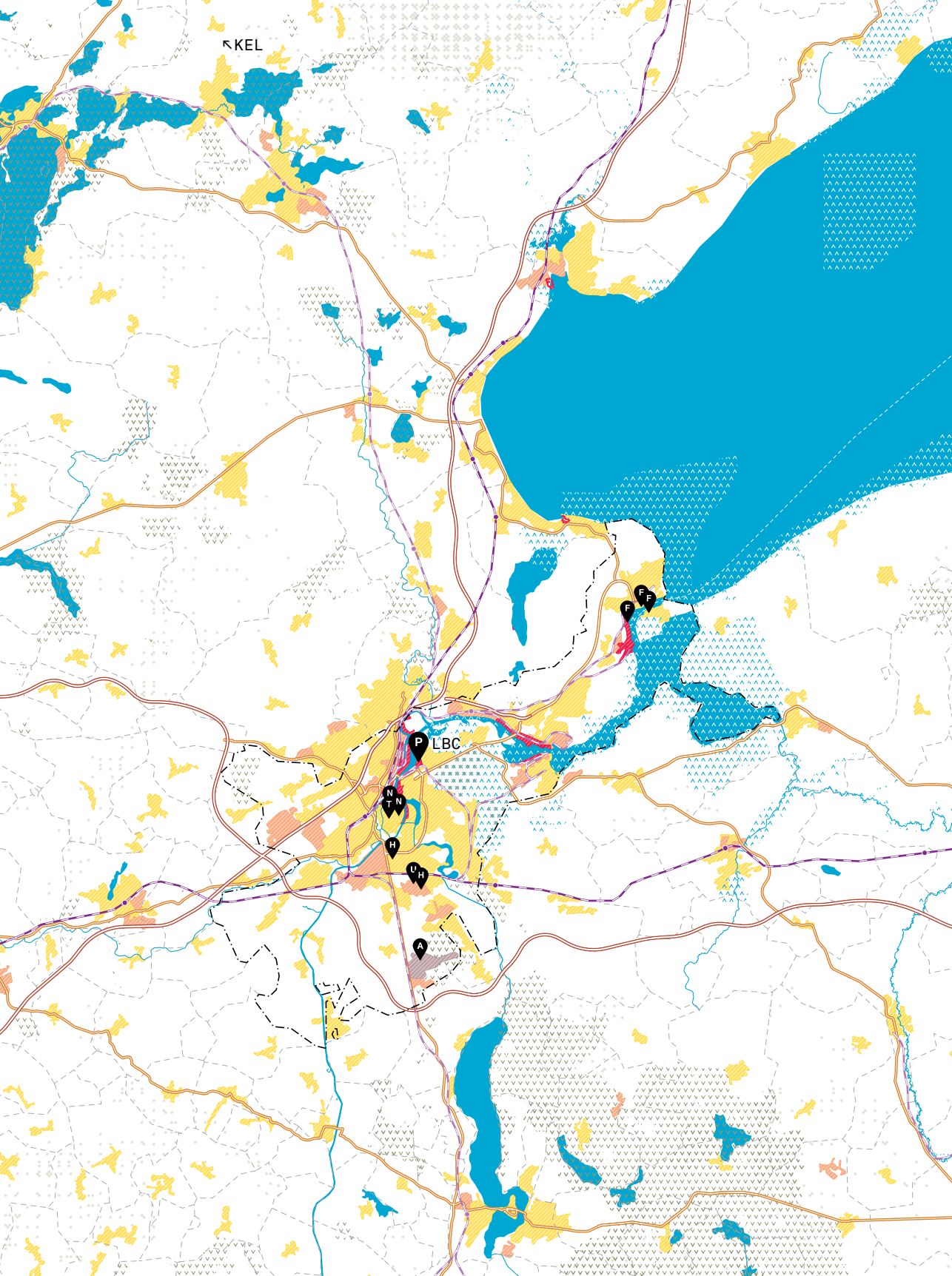
	Lübeck LBC
→ Capital national (km)	
→ Capital regional (km)	→ Berlin 237
Area (km²)	→ Hamburg 57
Built-up area (km²)	212
Density (per km²)	66
Population	1,025
Population structure (%)	217,198
Distribution built area (%)	15 65 12.5 64.2 23.2 B A I P 75 2 19 4

TERRITORY

	Lübeck, Kreisfreie Stadt LBC
Area (km²)	212
Density (per km²)	1,025
Population	217,198
Natura2000 (km²)	M T 604 19






KEL
P
LBC
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KEL

Kiel, DE

Kiel Fjord

PORT

	KEL (%)	3.7
Liquid	9	
Dry bulk	30	
Container		
Specialized		
General	1,403	
Cruise ship		
Passenger		
Other	161	
Vessels	1,603	

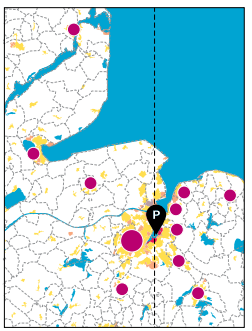
	0.4	44.6	51.3
	KEL		
Liquid bulk	50		
Dry bulk	721		
Containers	370		
RoRo	2,713		
Other	965		
Cargo (t)	4,819		
Passengers	2,331		

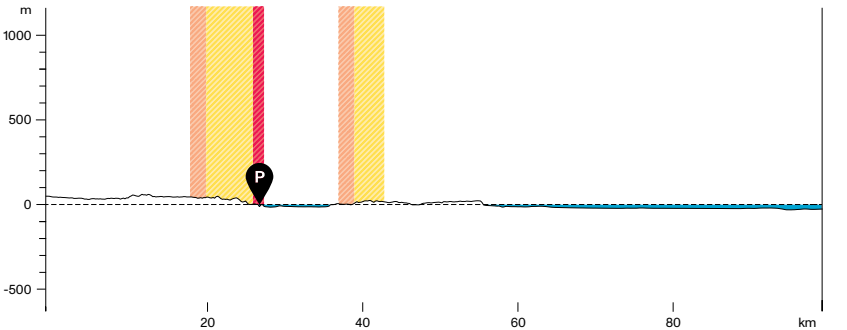
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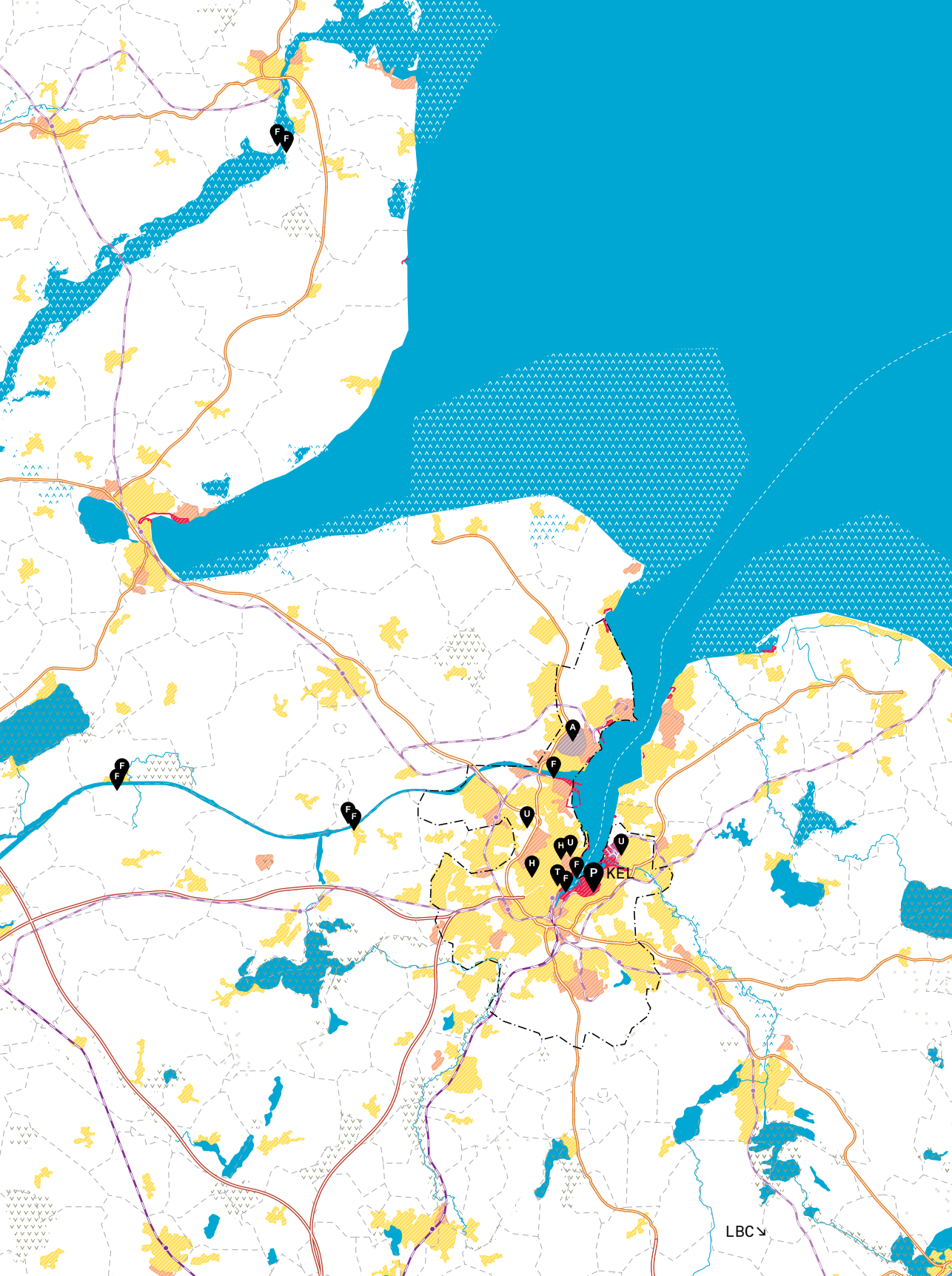
	Kiel	KEL
→ Capital national (km)	→ Berlin	295
→ Capital regional (km)	→ Hamburg	87
Area (km²)		112
Built-up area (km²)		57
Density (per km²)		2,204
Population		247,548
Population structure (%)	15 / 65	12.3 / 69.1 / 18.5
Distribution built area (%)	B / A / I / P	78 / 2 / 17 / 3

TERRITORY

	Kiel, Kreisfreie Stadt	KEL
Area (km²)		113
Density (per km²)		2,186
Population		247,548
Natura2000 (km²)	M / T	981 / 25






KEL
LBC

Fredericia, DK

PORT

FRC (%)

	FRC
Liquid	353
Dry bulk	30
Container	211
Specialized	87
General	280
Cruise ship	
Passenger	
Other	21
Vessels	982

100

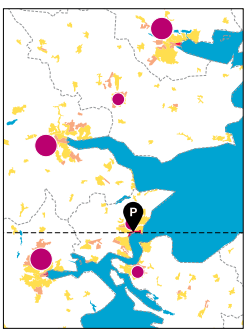
	FRC
Liquid bulk	4,846
Dry bulk	950
Containers	694
RoRo	327
Other	52
Cargo (t)	6,869
Passengers	0

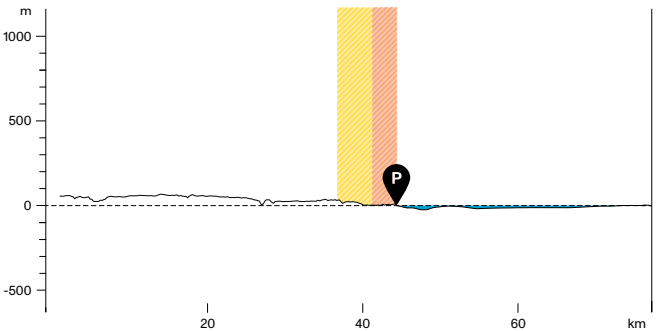
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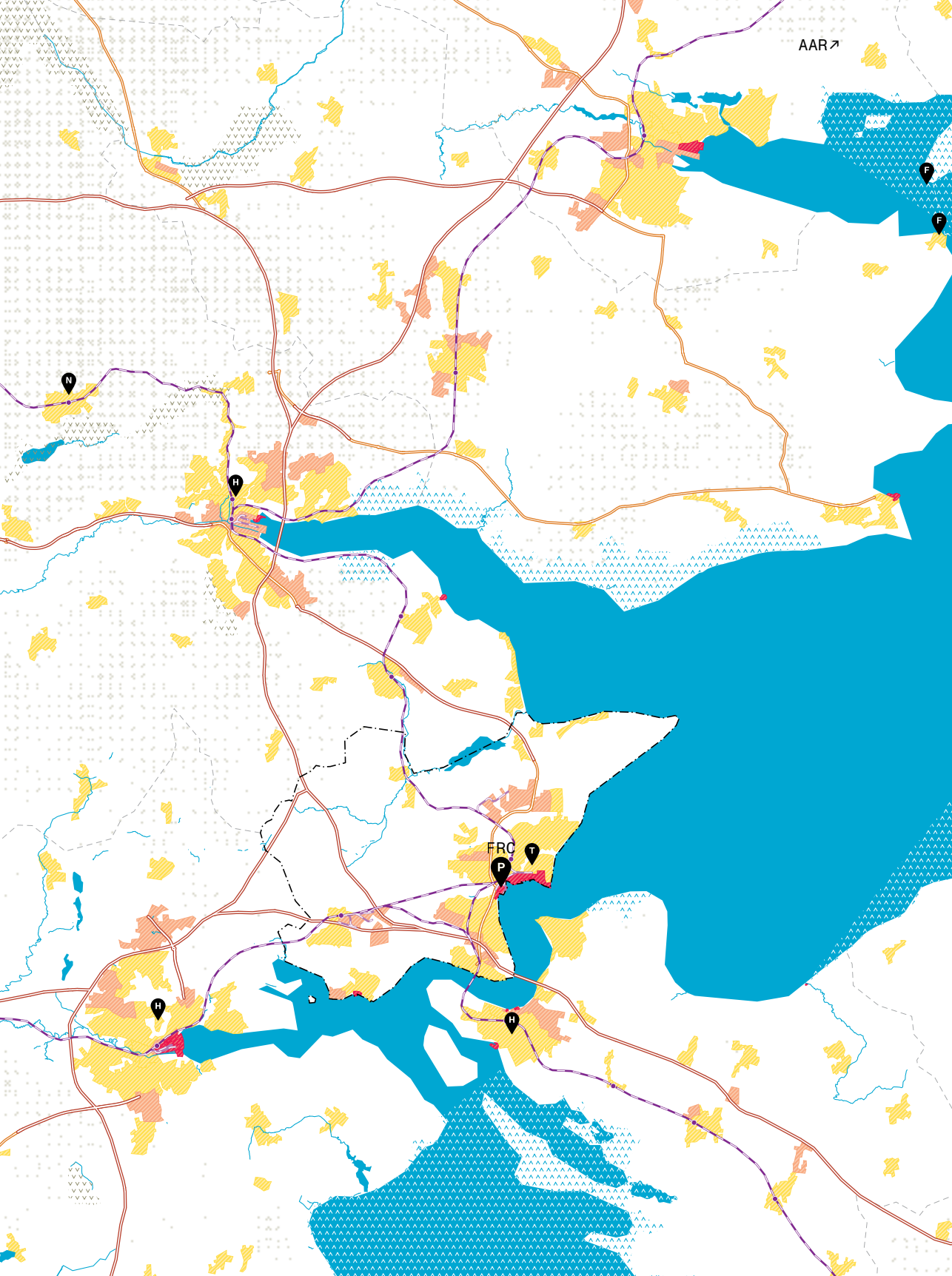
	FRC
	Fredericia
→ Capital national (km)	→ Copenhagen 178
→ Capital regional (km)	→ Hamburg 224
Area (km²)	135
Built-up area (km²)	28
Density (per km²)	380
Population	51,427
Population structure (%)	17 65 19.5 58.8 21.7
Distribution built area (%)	B I P 73 24 3

TERRITORY

	FRC
	Sydjylland
Area (km²)	8,661
Density (per km²)	84
Population	724,867
Natura2000 (km²)	M T 8,796 234






AAR↗
F
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H

AAR

Århus, DK

Aarhus Bay

PORT

AAR (%) 22.7

	AAR
Liquid	332
Dry bulk	667
Container	788
Specialized	34
General	3,849
Cruise ship	
Passenger	
Other	35
Vessels	5,705

77.3

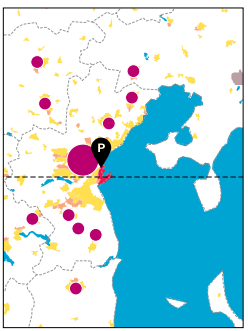
	AAR
Liquid bulk	1,435
Dry bulk	3,010
Containers	3,808
RoRo	345
Other	19
Cargo (t)	8,617
Passengers	3,385

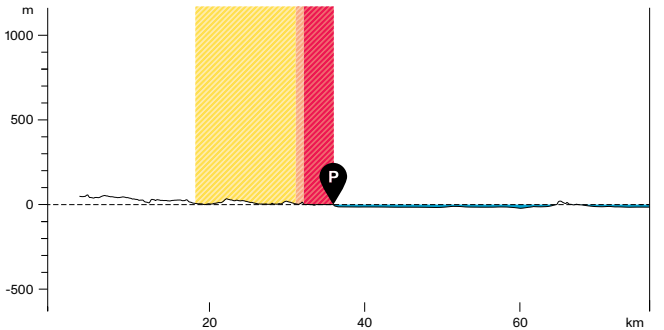
CITY

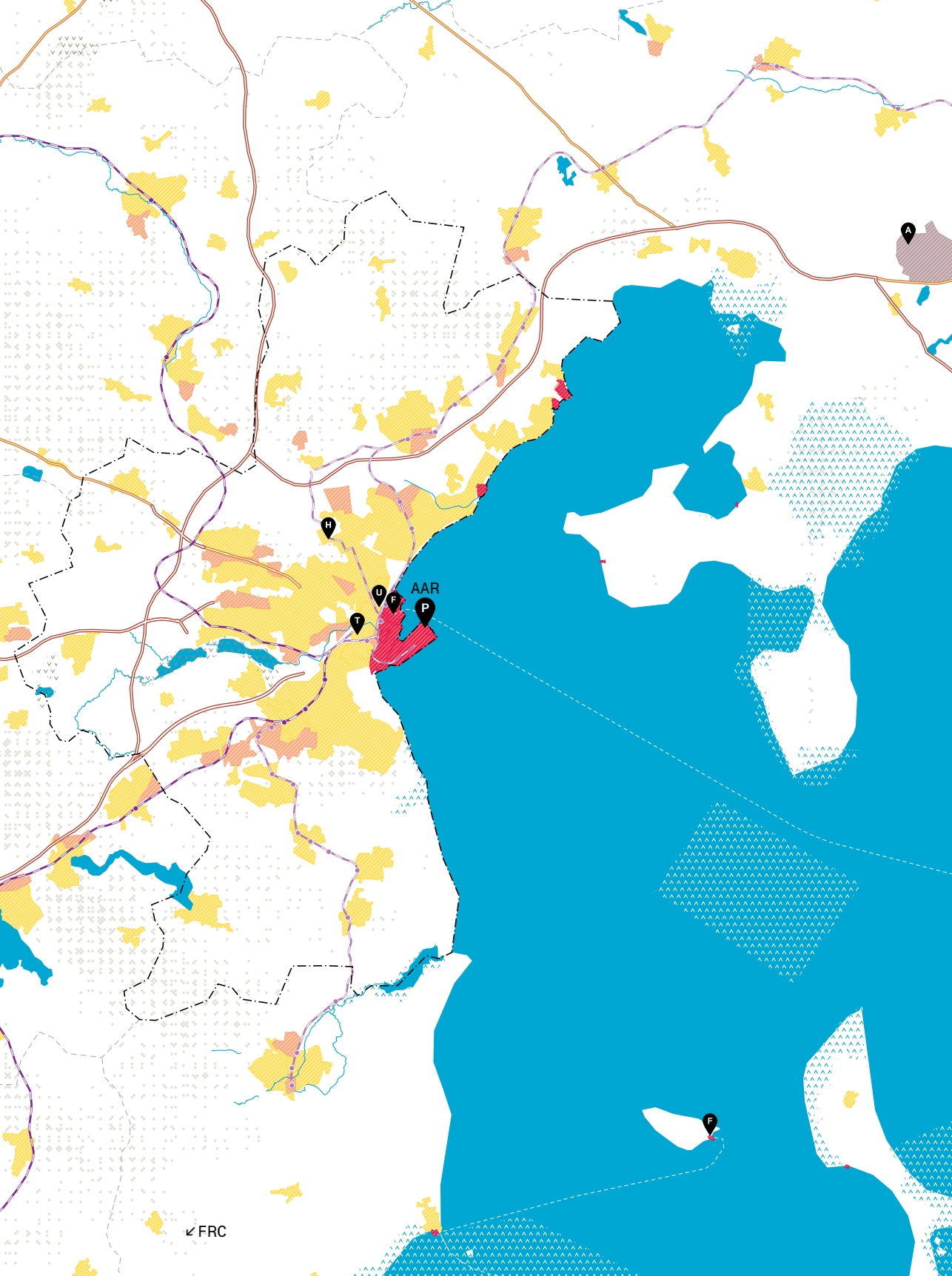
	Århus AAR
→ Capital national (km)	
→ Capital regional (km)	→ Copenhagen 154
Area (km²)	473
Built-up area (km²)	105
Density (per km²)	675
Population	319,094
Population structure (%)	15 65 16.1 70.5 13.5
Distribution built area (%)	B I P 83 10 7

TERRITORY

	Østjylland AAR
Area (km²)	5,929
Density (per km²)	150
Population	890,567
Natura2000 (km²)	M T 4,567 261






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AAR
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SST

SJ0

Statoil-Havnen, DK
Sjaellands Odde, DK

Sejerø Bay

Kalundborg Fjord

PORT

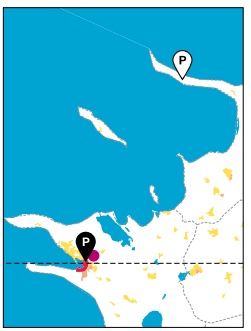
SST / SJ0 (%) 96.6 100 3.4

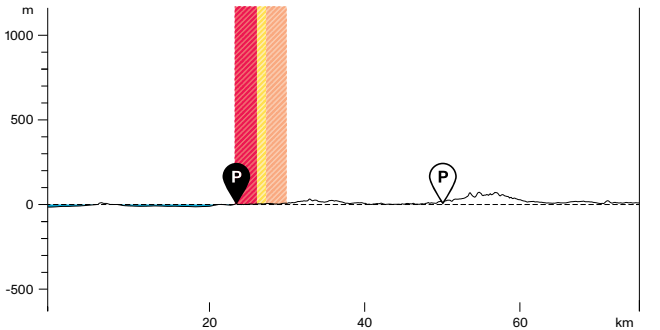
	SST	SJ0
Liquid	492	
Dry bulk		
Container		
Specialized		
General		3,821
Cruise ship		
Passenger		
Other		
Vessels	492	3,821

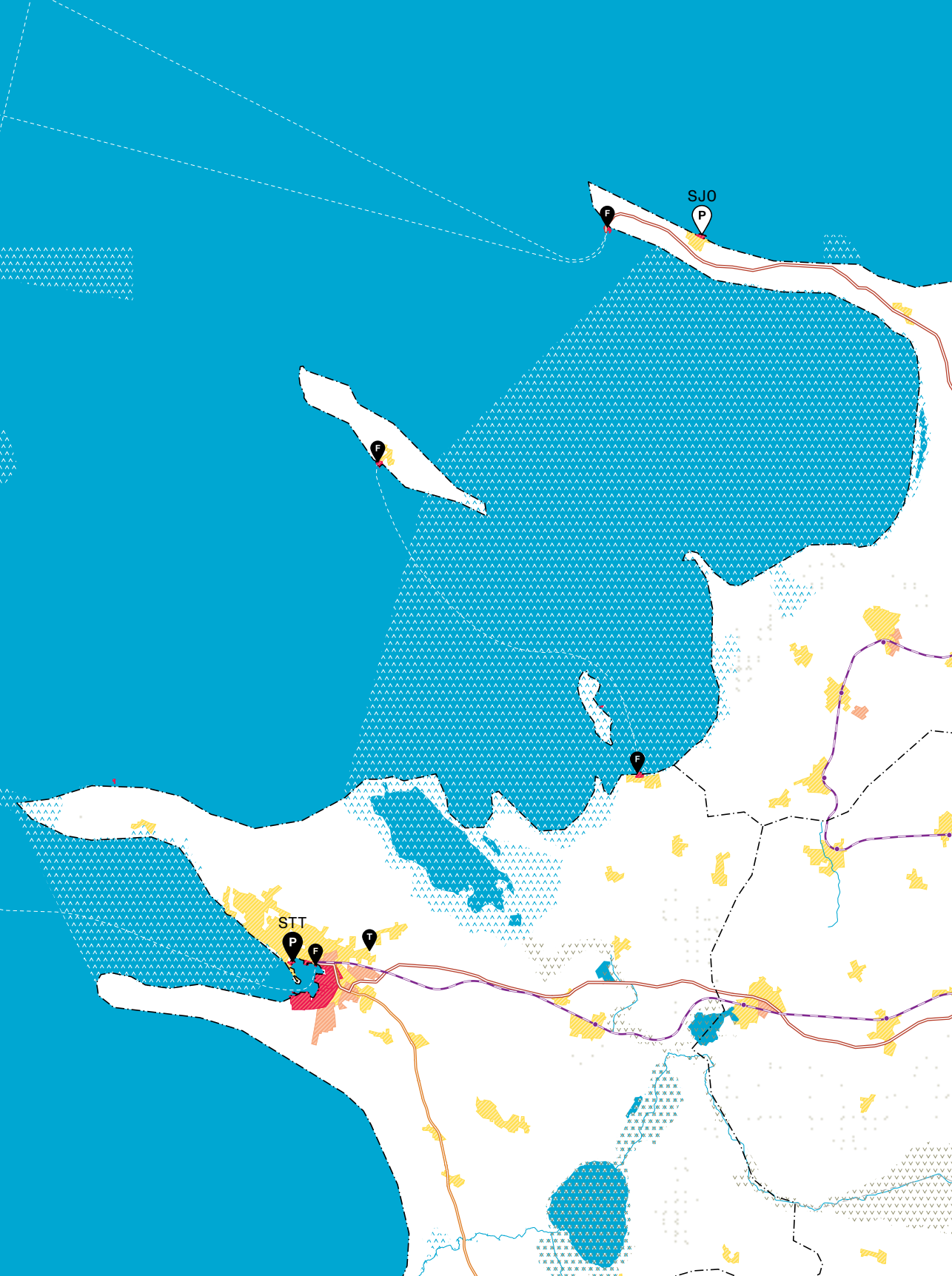
	SST	SJ0
Liquid bulk	7,900	
Dry bulk		
Containers		
RoRo		
Other		
Cargo (t)	7,900	0
Passengers		3,493

CITY	SST	SJ0
	Kalundborg	Sjaellands Odde
→ Capital national (km)	→ Copenhagen 92	→ Copenhagen 85
→ Capital regional (km)		
Area (km²)	607	359
Built-up area (km²)	30	10
Density (per km²)	80	92
Population	48,681	33,122
Population structure (%)	17 65 / 18.4 56.4 25.2	17 65 / 15.3 52.5 32.2
Distribution built area (%)	B I P / 66 13 21	B I P / 93 6 1

TERRITORY	SST	SJ0
	Vest- og Sydsjælland	Vest- og Sydsjælland
Area (km²)	6,507	6,507
Density (per km²)	90	90
Population	587,379	587,379
Natura2000 (km²)	M T / 7,884 188	M T / 7,884 188



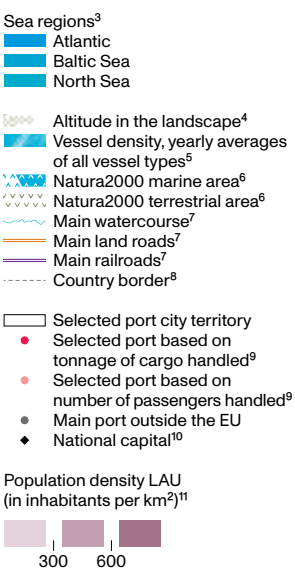



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North Sea Map and Statistics

ID	Port name	[1]	[2]
AAL	Aalborg, DK	2,994	0
FDH	Frederikshavn, DK	2,568	1,960
HIR	Hirtshals, DK	1,948	2,541
EJB	Esbjerg, DK	4,310	1,824
BRB	Brunsbüttel, DE	10,131	0
HAM	Hamburg, DE	117,154	847
BRE	Bremen, DE	12,123	2
WVN	Wilhelmshaven, DE	28,869	13
BRV	Bremerhaven, DE	47,586	248
DZL	Delfzijl, NL	6,063	26
EME	Emden, DE	4,428	1,137
AMS	Amsterdam, NL	103,911	614
RTM	Rotterdam, NL	439,631	1,333
ANR	Antwerp, BE	214,025	61
GNE	Ghent, BE	33,336	4
ZEE	Zeebrugge, BE	28,993	1,022
DKK	Dunkirk, FR	42,555	2,330
DVR	Dover, UK	23,432	11,025
CQF	Calais, FR	18,099	8,478
MED	Medway, UK	13,137	0
LON	London, UK	54,034	112
FXT	Felixstowe, UK	25,344	9
HRW	Harwich, UK	4,275	692
IPS	Ipswich, UK	2,367	0
IMM	Immingham, UK	54,084	95
HUL	Hull, UK	9927	827
MME	Tees & Hartlepool, UK	28,154	2
TYN	Tyne, UK	4,679	670
FOR	Forth (Edinburgh), UK	25,221	25
BGO	Bergen, NO	44,174	169
TON	Tønsberg, NO	10,709	0
OSL	Oslo, NO	6,039	2,362
GOT	Göteborg, SE	38,890	1,675

1 Total tonnage of cargo in thousands and in relation to the other selected European ports. Eurostat, 2019.
2 Total number of passengers in thousands and in relation to other selected European ports. Eurostat, 2019.
3 EMODnet Human Activities: Regional Advisory Councils, 2014.
4 EEA EuroGeographics EuroDEM, 2022.
5 EMODnet Human Activities, Vessel Density Map 2019.
6 ———, Environment, Natura2000, 2015.
7 Based on Eurogeographics, (2020). EuroGlobalMap. Version 2020 Eurogeographics. Retrieved from https://eurogeographics.org/maps-for-europe/open-data.
8 Eurostat NUTS 1 data.
9 Eurostat Maritime transport data, 2019.
10 Natural Earth.
11 Eurostat, GISCO LAU, 2019.




BGO
Oslo
OSL
TON
HIR/FDH
GOT
AAL
Kattegat
North Sea
Copenhagen
EBJ
FOR
MME/TYN
HUL/IMM
Dublin
WVN/BRV
BRB
HAM
DZL/EME
BRE
AMS
Amsterdam
Berlin
RTM
IPS/HRW/FXT
London
DVR/COF
LON
MED
ZEE
GNE
ANR
Brussels
Strait of Dover
DKK
Prague
Luxembourg
Paris

AAL

Aalborg, DK

Limfjord

PORT

AAL (%) 71.6

3.1

25.2

	AAL
Liquid	138
Dry bulk	102
Container	108
Specialized	23
General	405
Cruise ship	33
Passenger	
Other	8
Vessels	817

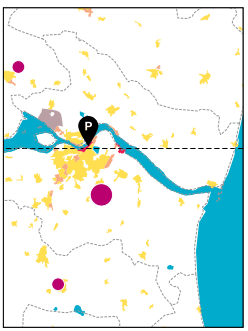
	AAL
Liquid bulk	1,003
Dry bulk	1,332
Containers	427
RoRo	
Other	232
Cargo (t)	2,994
Passengers	0

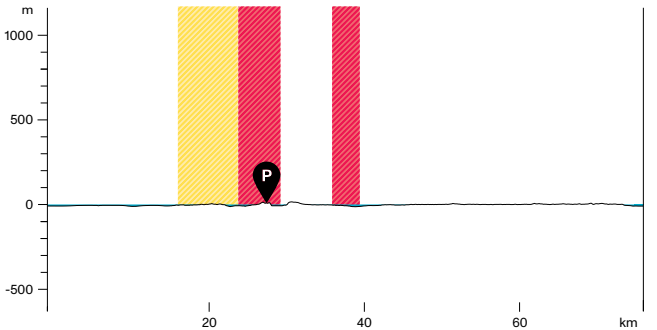
CITY

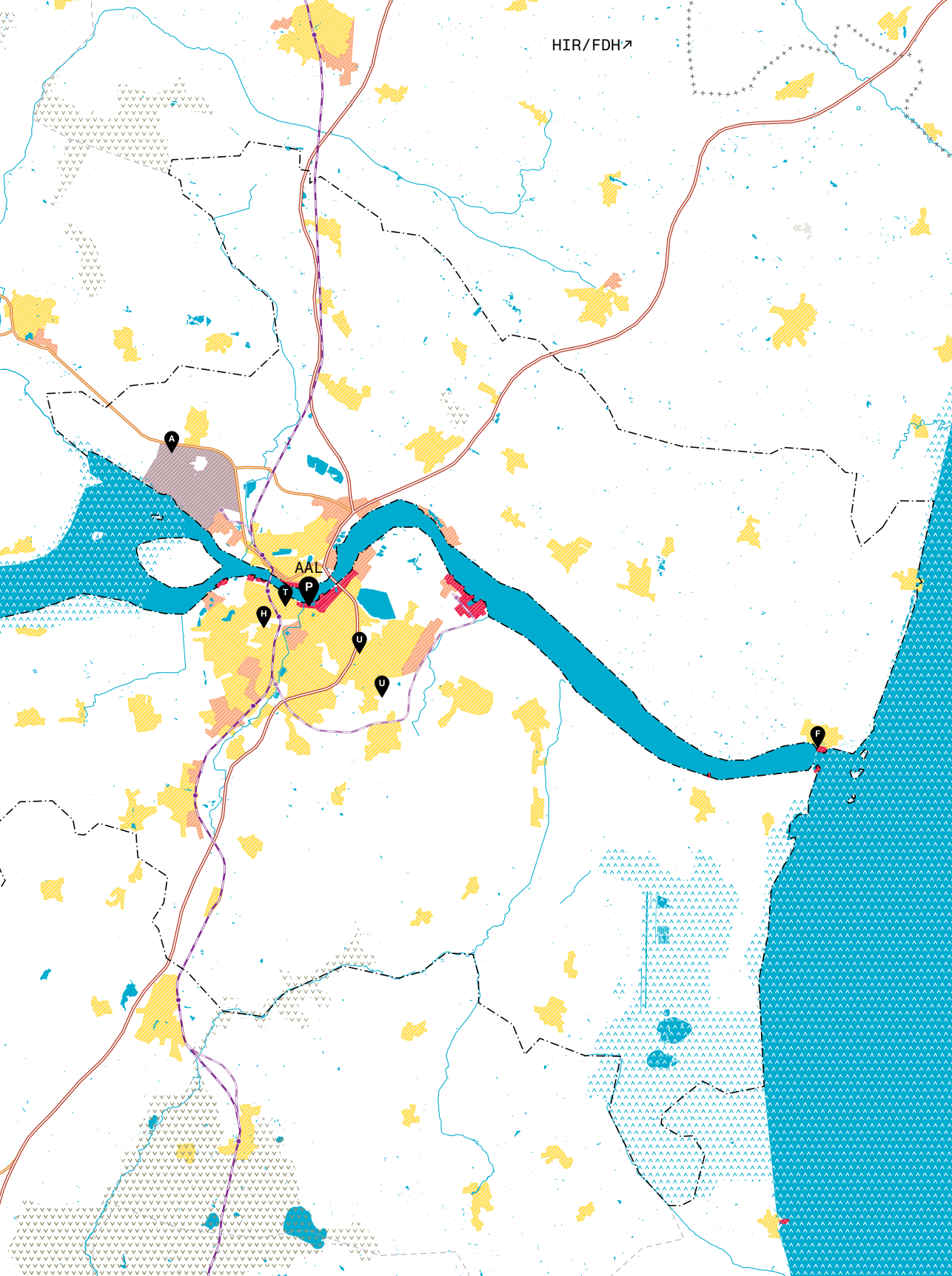
	Aalborg AAL
→ Capital national (km)	
→ Capital regional (km)	→ Copenhagen 222
Area (km²)	1,142
Built-up area (km²)	99
Density (per km²)	178
Population	203,448
Population structure (%)	15 65 15.9 67.3 16.9
Distribution built area (%)	B A I P 76 10 12 2

TERRITORY

	Nordjylland AAL
Area (km²)	7,944
Density (per km²)	74
Population	589,755
Natura2000 (km²)	M T 7,642 252






HIR/FDH↗
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FDH
HIR

Frederikshavn, DK
Hirtshals, DK

Skaggerak

Skaggerak

PORT

FDH / HIR (%) 64.0 100

36.0

	FDH	HIR
Liquid	14	67
Dry bulk	94	
Container		
Specialized		
General	3,769	2,293
Cruise ship		
Passenger		
Other		
Vessels	3,877	2,360

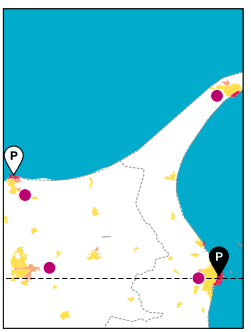
	FDH	HIR
Liquid bulk	70	69
Dry bulk	291	4
Containers		
RoRo	2,146	1,704
Other	61	171
Cargo (t)	2,568	1,948
Passengers	1,960	2,541

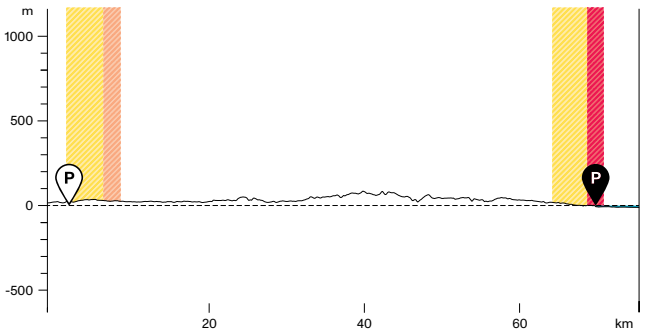
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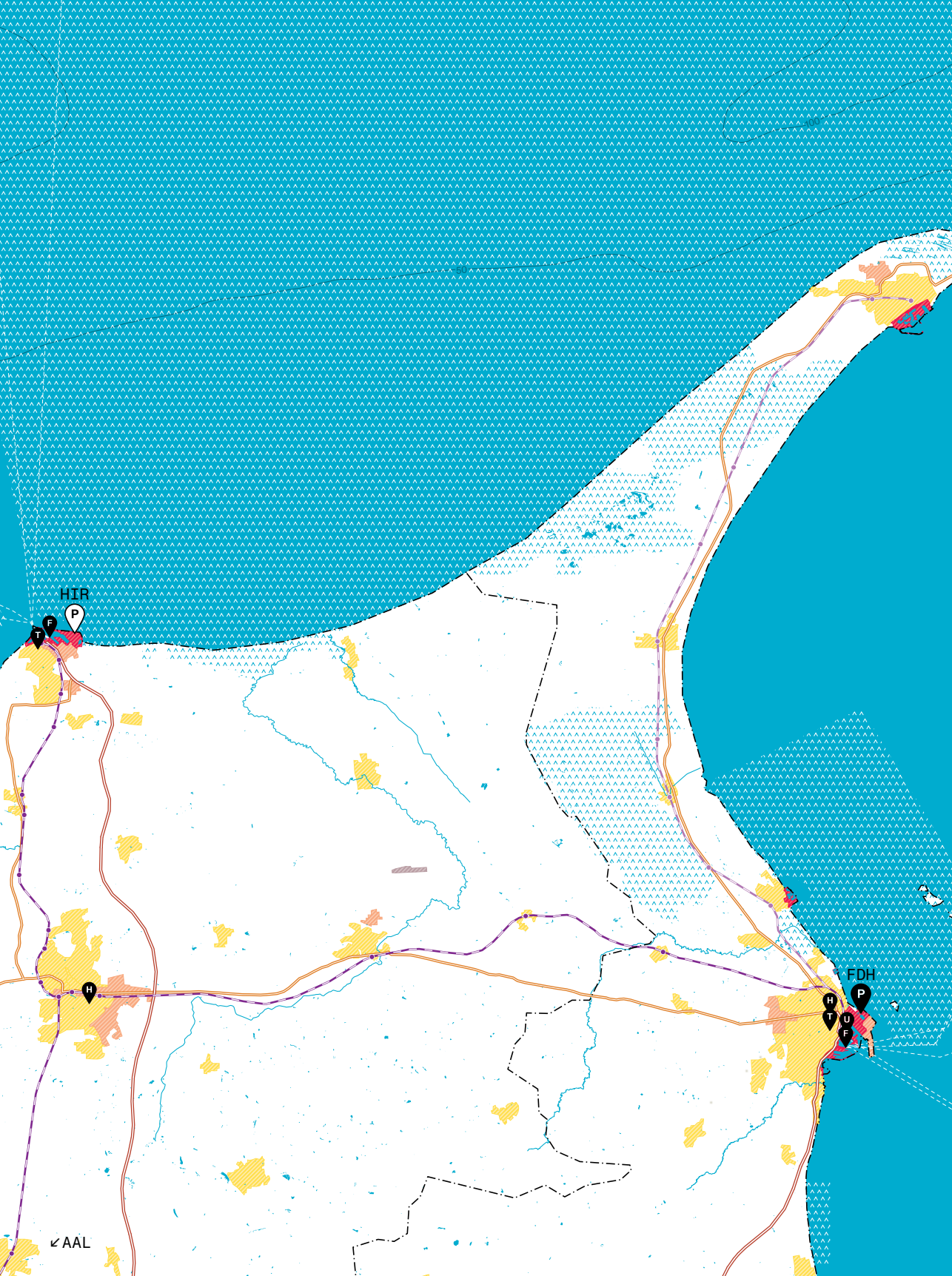
	Frederikshavn FDH	Hjørring HIR
→ Capital national (km)		
→ Copenhagen	229	267
→ Capital regional (km)		
Area (km²)	652	929
Built-up area (km²)	34	31
Density (per km²)	92	70
Population	59,987	64,665
Population structure (%)	17 65 17.2 55.0 27.8	17 65 19.0 56.1 24.9
Distribution built area (%)	B I P 86 6 8	B A I P 82 1 15 2

TERRITORY

	Nordjylland FDH	Nordjylland HIR
Area (km²)	7,944	7,944
Density (per km²)	74	74
Population	589,755	589,755
Natura2000 (km²)	M T 7,642 252	M T 7,642 252






HIR
FDH
AAL

Esbjerg, DK

PORT

EJB (%) 100

	EJB
Liquid	140
Dry bulk	14
Container	33
Specialized	685
General	17,124
Cruise ship	
Passenger	
Other	10
Vessels	18,006

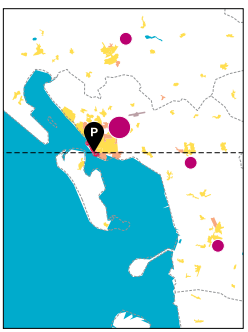
	EJB
Liquid bulk	540
Dry bulk	1,119
Containers	209
RoRo	1,789
Other	653
Cargo (t)	4,310
Passengers	1,824

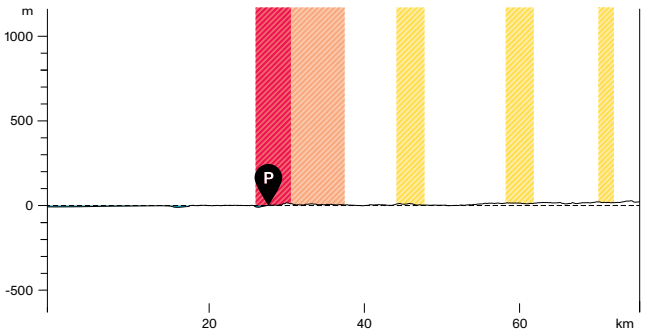
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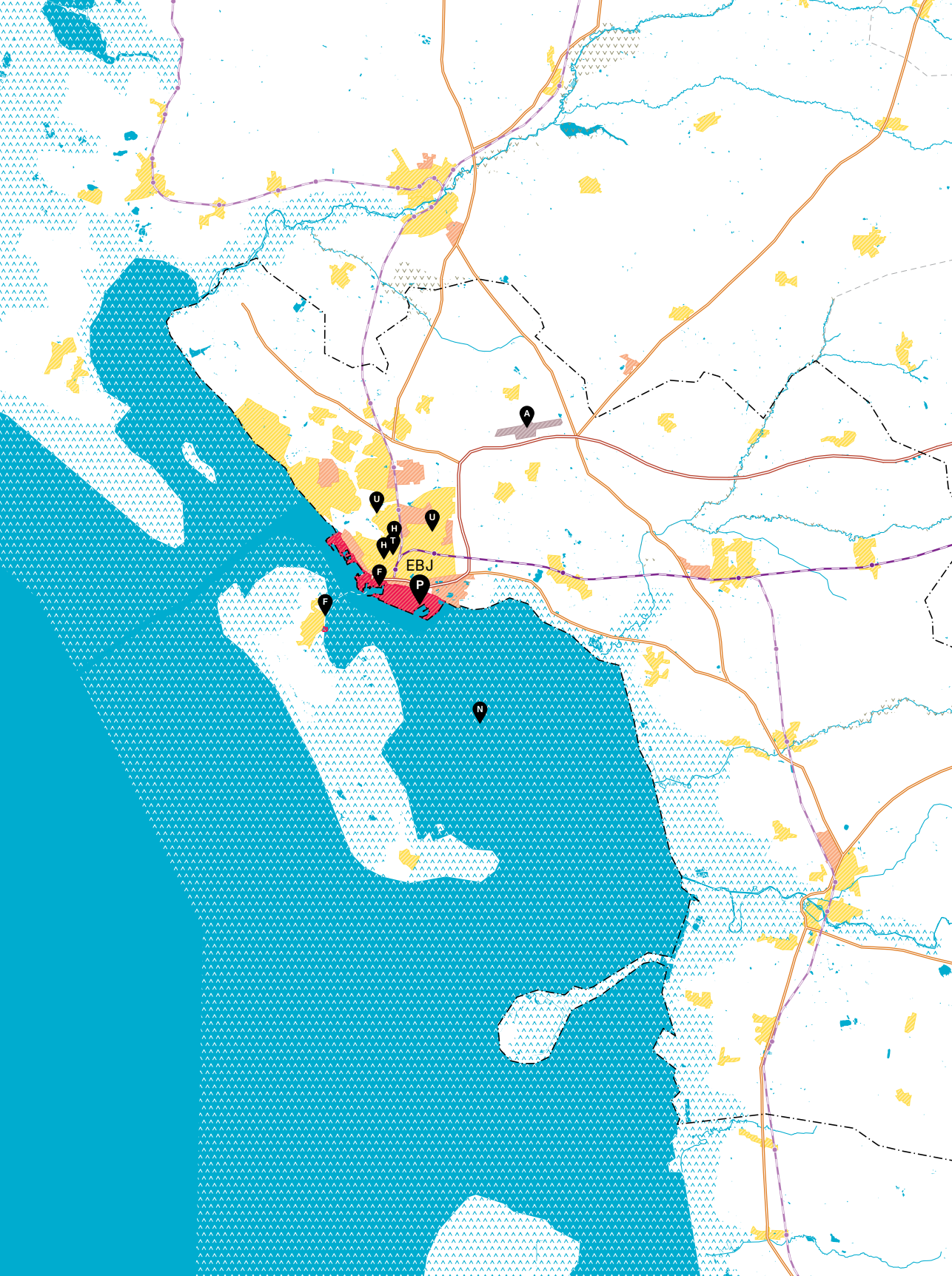
	Esbjerg	EJB
→ Capital national (km)	→ Copenhagen	262
→ Capital regional (km)	→ Hamburg	239
Area (km²)		759
Built-up area (km²)		59
Density (per km²)		152
Population		115,652
Population structure (%)	17 / 65	
	23.1 / 55.3 / 21.6	
Distribution built area (%)	B / A / I / P	
	79 / 1 / 15 / 5	

TERRITORY

	Sydjylland	EJB
Area (km²)		8,661
Density (per km²)		84
Population		724,867
Natura2000 (km²)	M / T	
	8,796 / 234	






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Brunsbüttel, DE

Elbe

PORT

BRB (%) 100

	BRB
Liquid	158
Dry bulk	102
Container	
Specialized	
General	62
Cruise ship	
Passenger	
Other	
Vessels	322

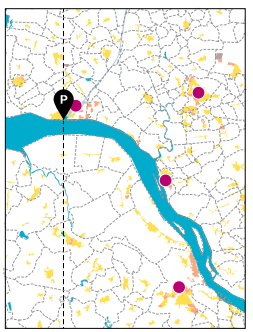
	BRB
Liquid bulk	6,128
Dry bulk	3,980
Containers	
RoRo	
Other	23
Cargo (t)	10,131
Passengers	0

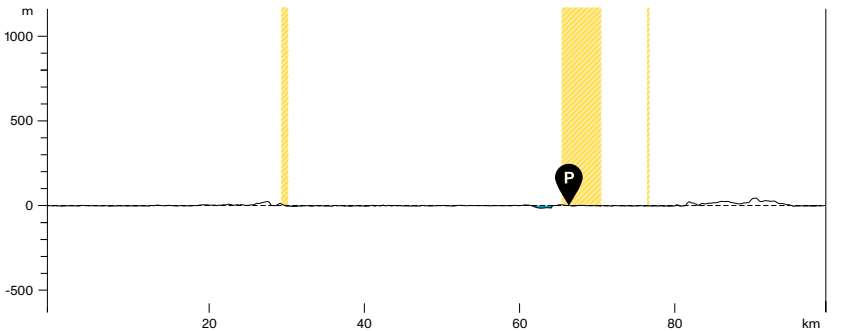
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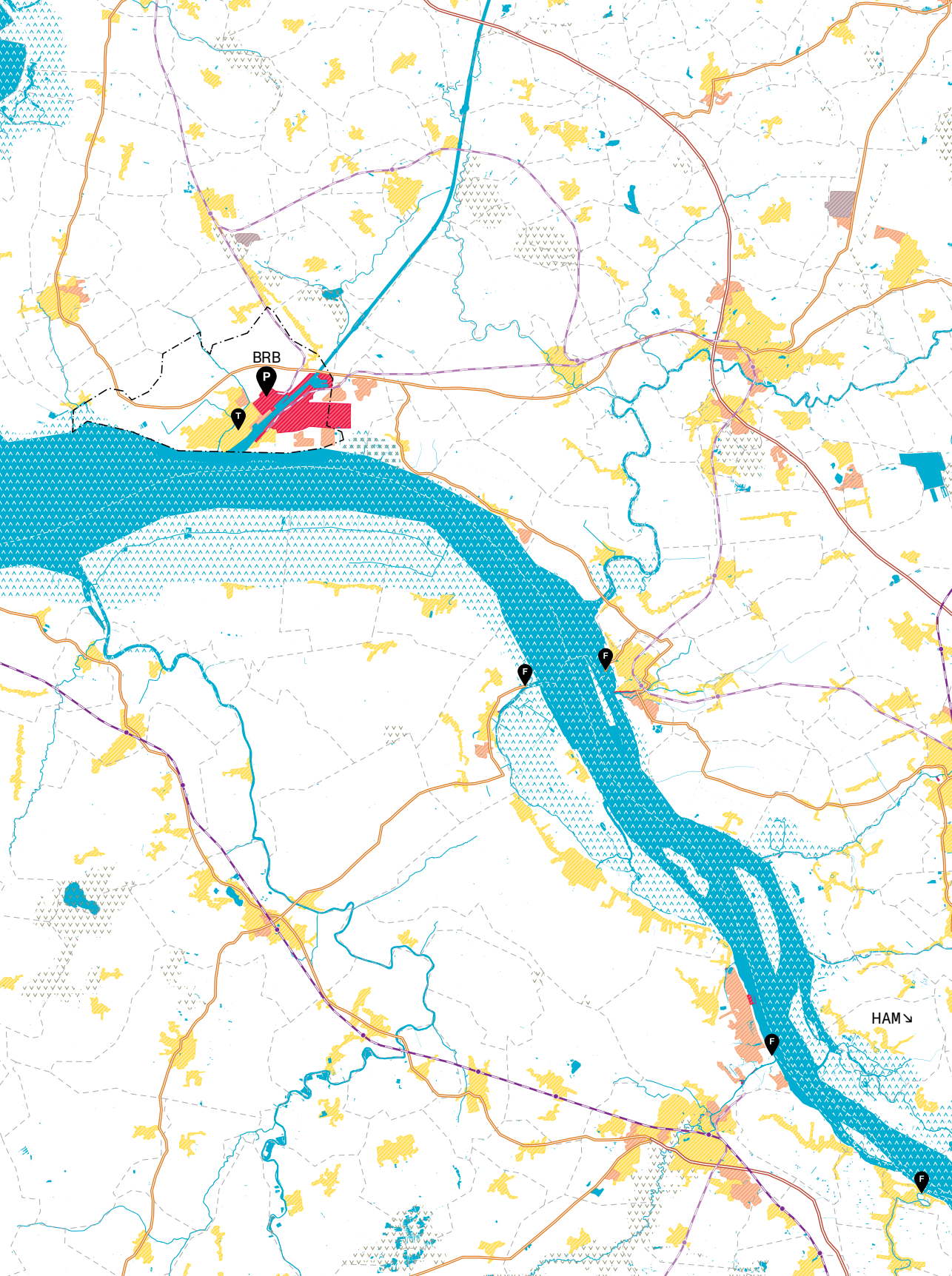
	BRB
	Brunsbüttel, Stadt
→ Capital national (km)	→ Berlin 323
→ Capital regional (km)	→ Hamburg 68
Area (km²)	49
Built-up area (km²)	13
Density (per km²)	255
Population	12,554
Population structure (%)	17 / 65 / 15.5 / 58.0 / 26.4
Distribution built area (%)	B / I / P 48 / 10 / 42

TERRITORY

	BRB
	Dithmarschen
Area (km²)	1,442
Density (per km²)	92
Population	133,210
Natura2000 (km²)	M / T 9,764 / 201






BRB
P
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F
F
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