

Non-wind sea use functions

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Jan Tjalling van der Wal

Spatial Deployment of offshore WIND Energy in Europe (WINDSPEED)
WP 3 Other sea use functions and interactions with offshore wind energy

WP3 objectives

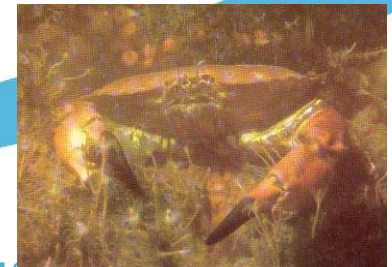
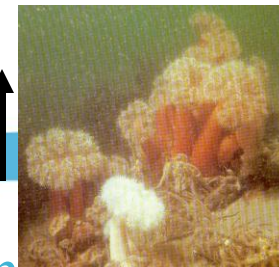
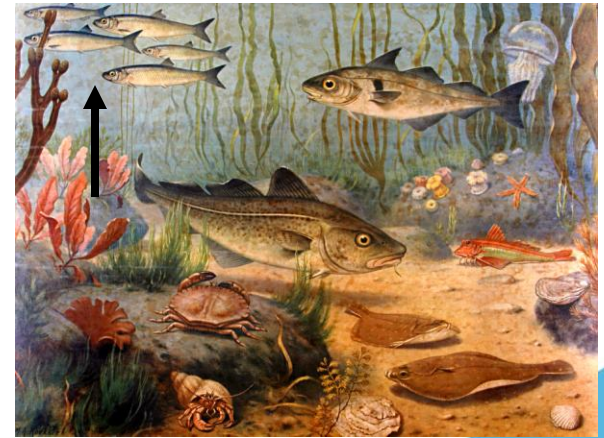
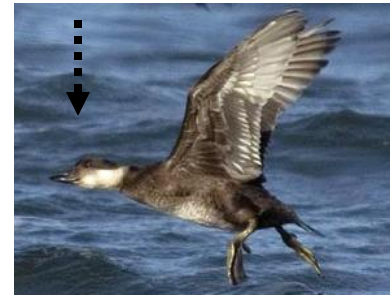
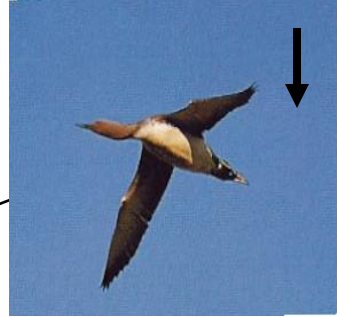
- Inventory and description of non-wind sea functions currently at stake in the area
- Inventory of development scenarios for these functions up to 2030, including resulting spatial claims
- Inventory of known positive and negative interactions between offshore wind and other functions
- Translation into calculation rules

Present use functions on the North Sea

- Shipping
- Oil and gas extraction
- Fisheries
- Cables and pipelines
- Defence activities
- Nature conservation
- Sand extraction
- Sludge disposal areas (not included)
- Recreation (not included)

except the wind energy use which is quantified in WP2

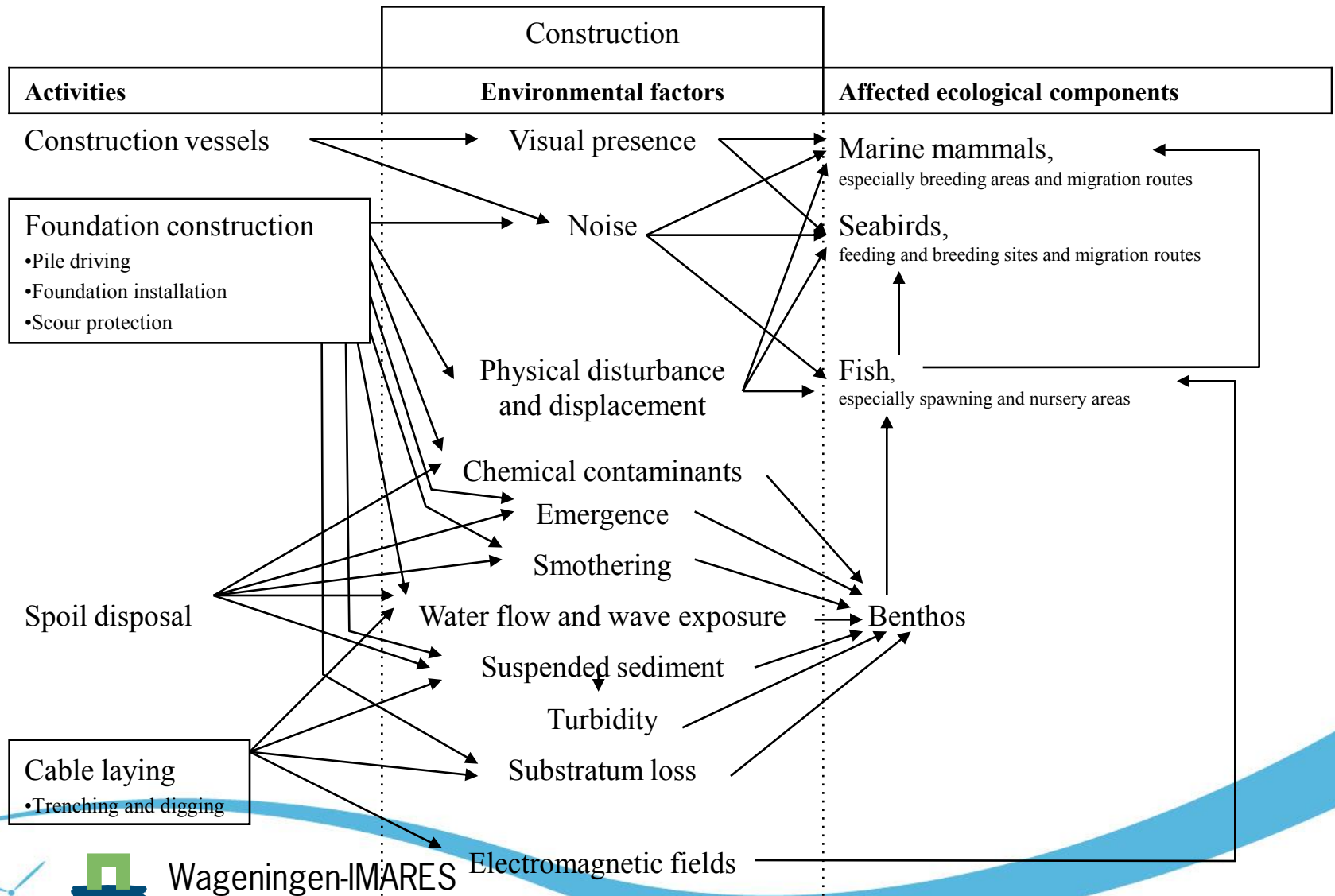
A wind park is a different habitat



Non-wind sea use functions

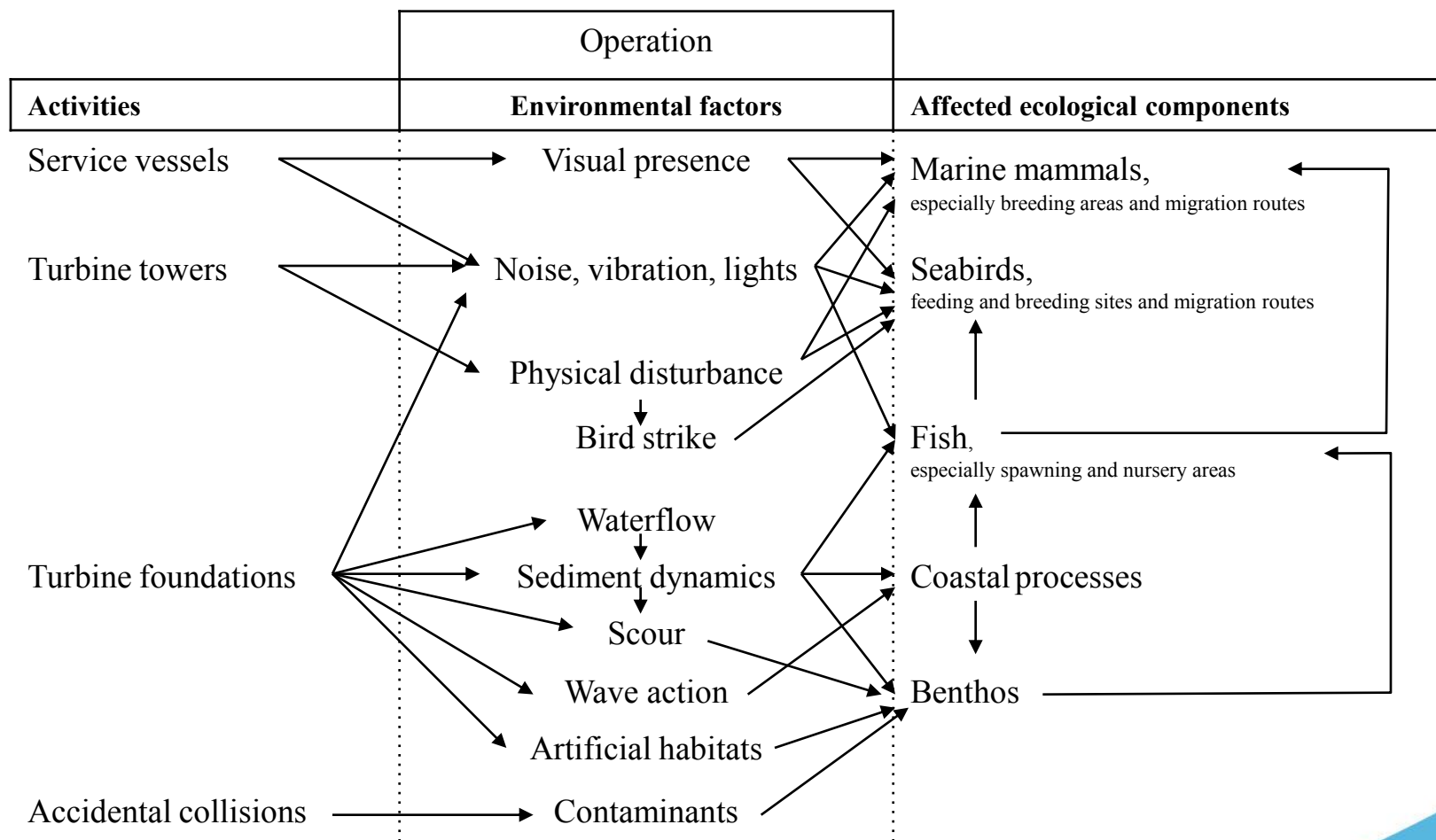


Construction of Offshore Wind Turbine Parks



Scheme according to Hiscock *et al.*, 2002 and Michel *et al.*, 2007.

Operation of Offshore Wind Turbine Parks



Scheme according to Hiscock *et al.*, 2002 and Michel *et al.*, 2007.

Most important ecological effects of OWPs

Construction phase of OWPs

- Underwater sound (sea mammals and fish larvae)
- Habitat change (disturbance of soft substrate and associated organisms)

Operational phase of OWPs

- Habitat change (introduction of hard substrate)
- Barrier effect ((migratory) birds)
- Indirect positive and negative effects via change in human activities (fishery reduction, aquaculture opportunities, maintenance activities)

Calculation rules for sea use functions

Types of calculations rules

1. Exclusions
2. Spatial suitability values
3. Economic values
4. Refinements to reduce heterogeneity

Calculation rules

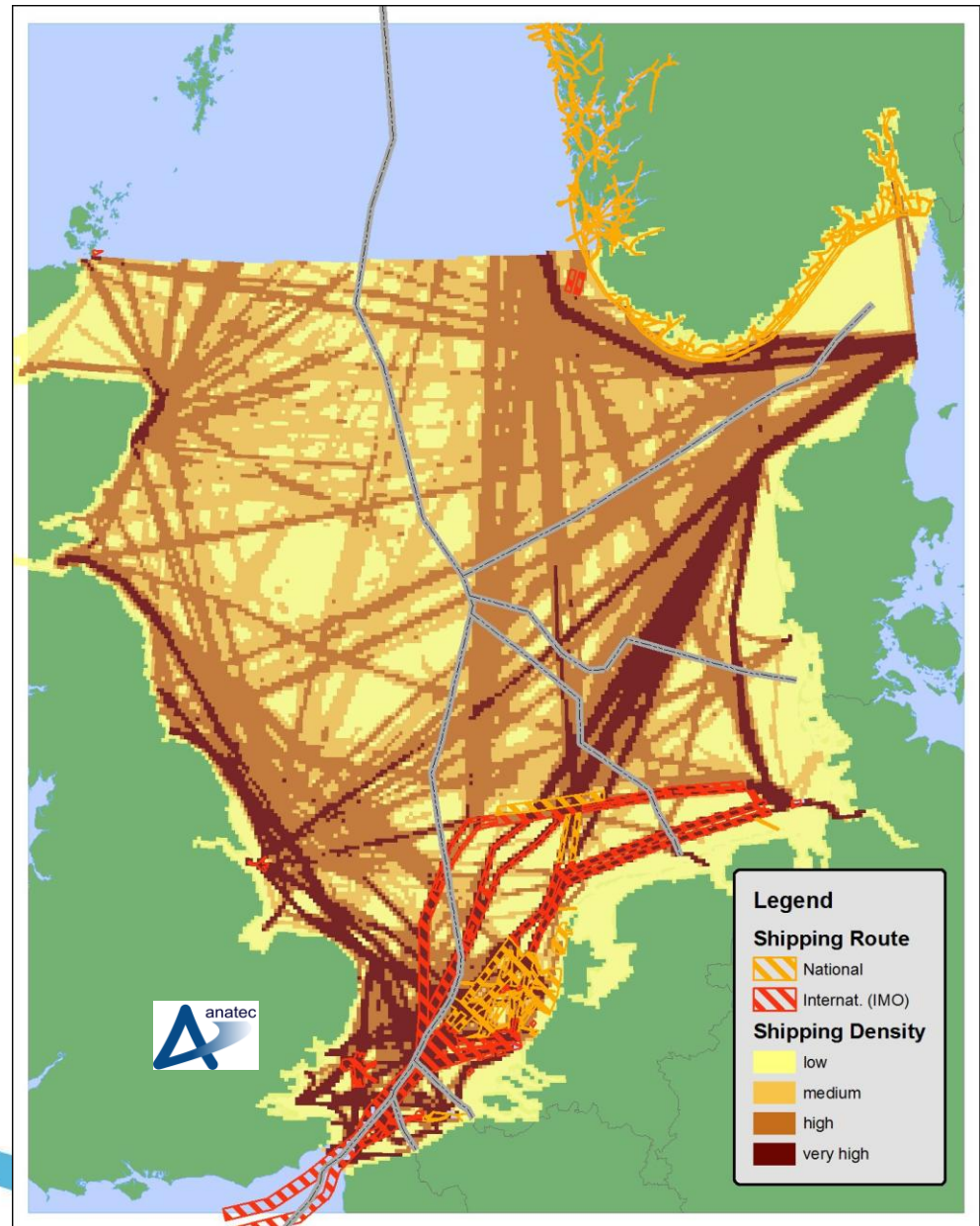
Type 1: Exclusions

- Shipping routes
- Oil and gas production platforms
- Part of the military use categories

Shipping – routes & density

Routes constrict shipping

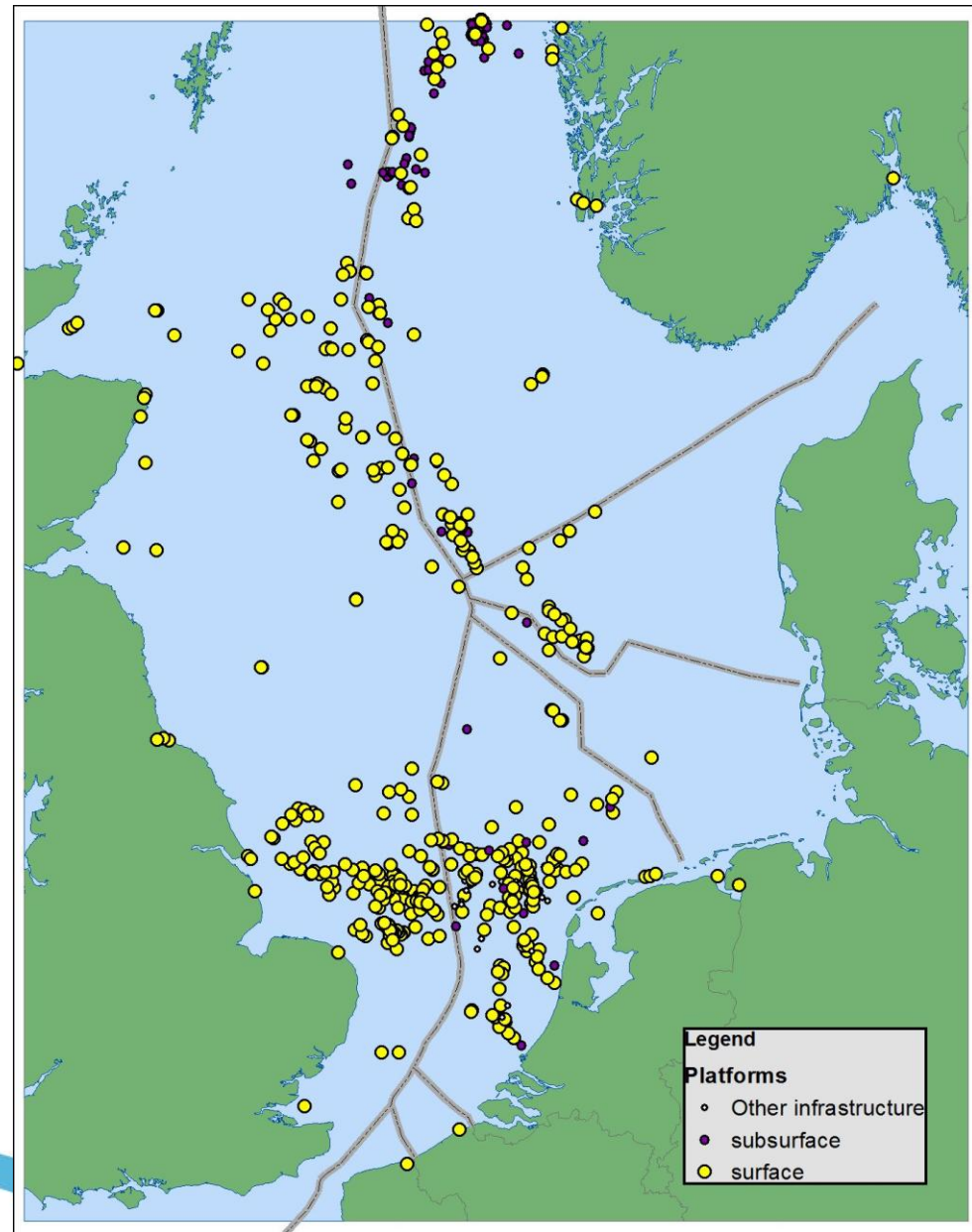
Outside routes ships travel in straight lines to their port of destination.



Offshore oil & gas platforms

Southern cluster: gas

Northern cluster: oil (and gas)



Safety zones of sea use functions in the WindSpeed EEZs

- Shipping: 500 m; 2 sea miles with respect to OWPs
- Oil and Gas: 500 m
- Defense: no safety zones outside established areas?
- Fisheries: no safety zones
- Cables & pipelines: 500 m
- Nature: no safety zones outside established areas
- OWP:
 - 2 nautical miles with respect to shipping
 - 500 m with respect to oil & gas
 - 5 nautical miles with respect to helicopters
 - >12 nautical miles from the coast (UK, DK closer as well)
 - exclude the area south of the Euro-Maas geul

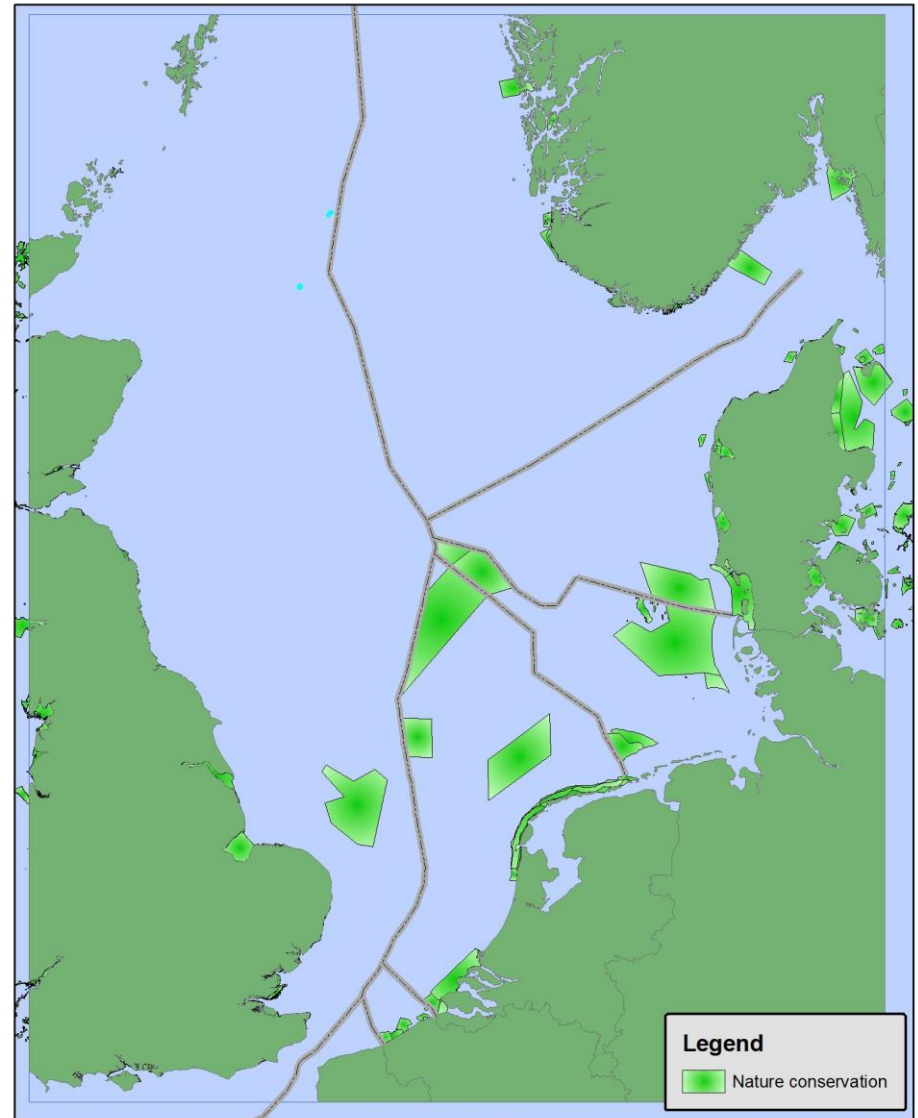
Calculation rules

Type 2: Spatial suitability values

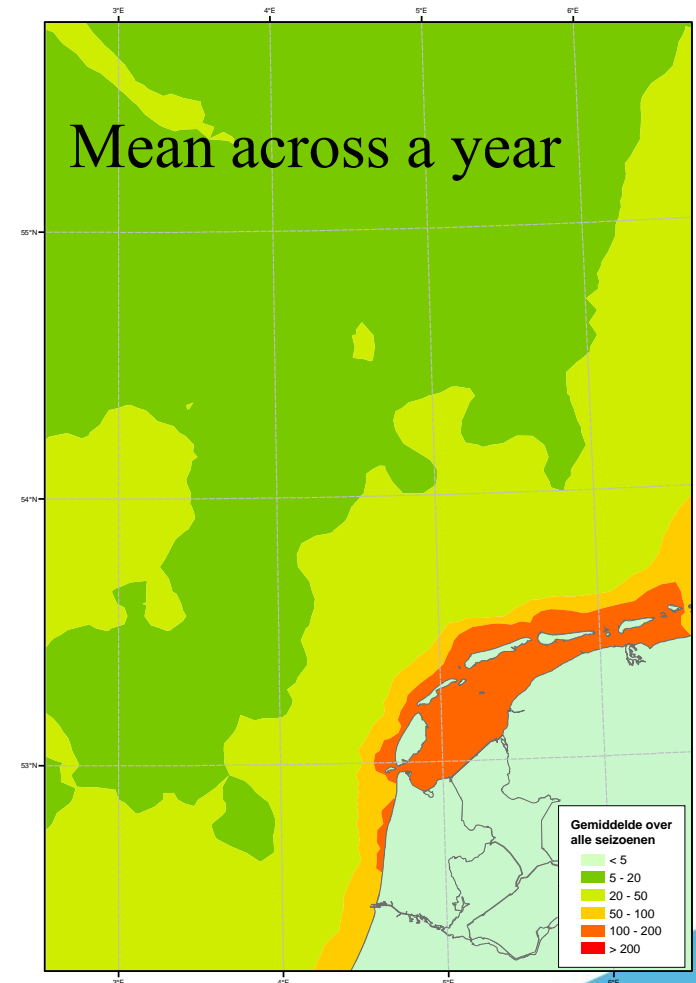
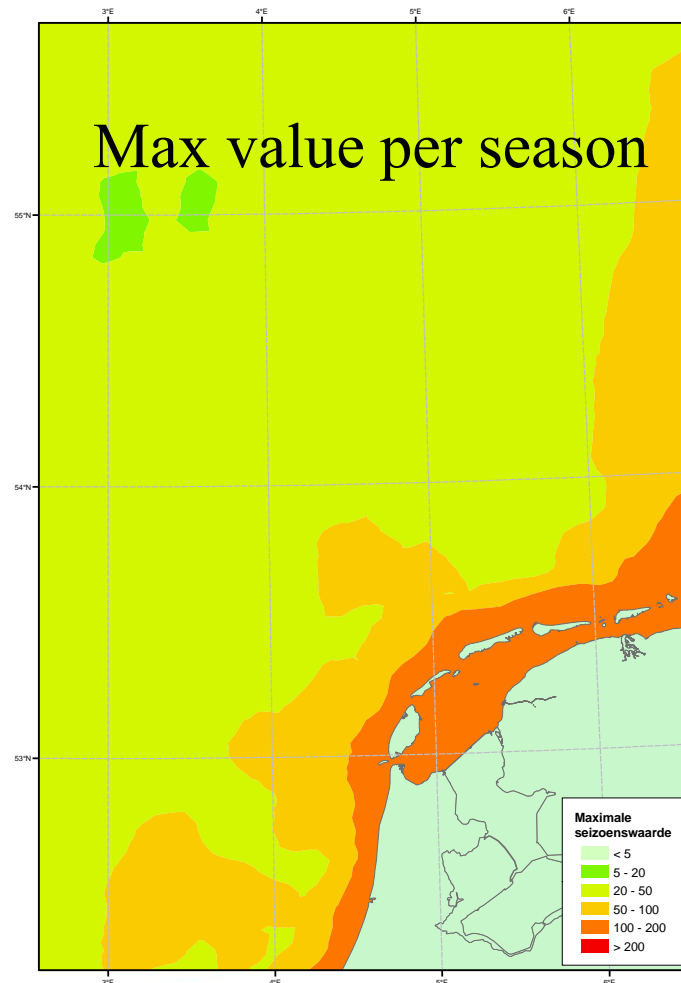
- OWP sensitivity of birds in the North Sea (map)
- Fish species richness in the North Sea (map)
- Fish species rareness in the North Sea (map)

Nature conservation areas

- Natura 2000
 - Bird directive
 - Habitat directive
- OSPAR
- National

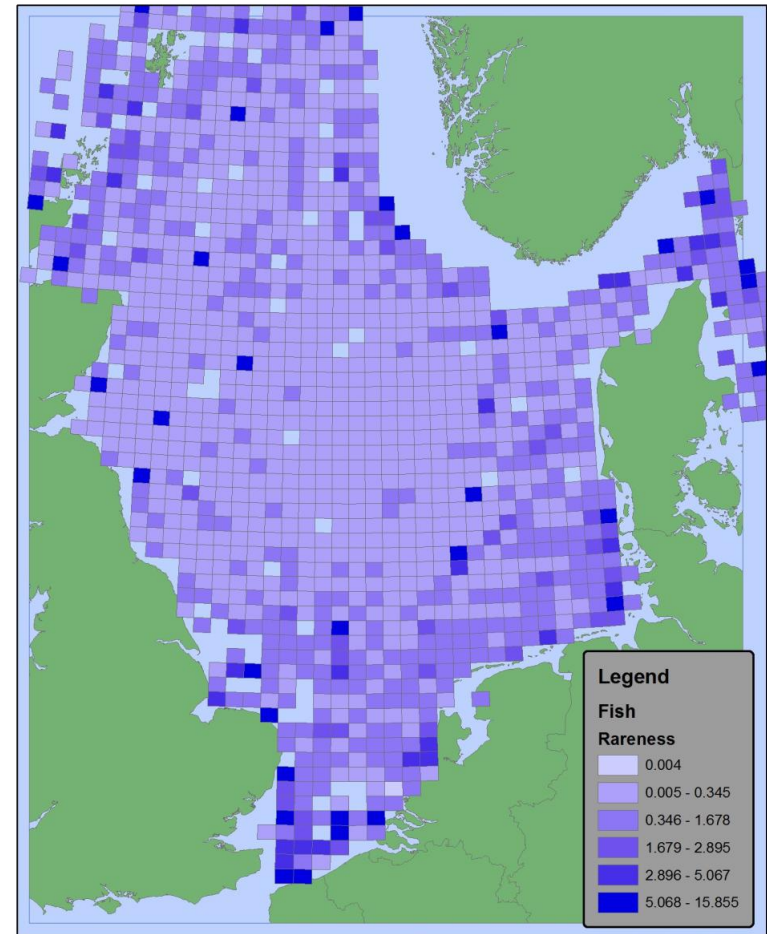
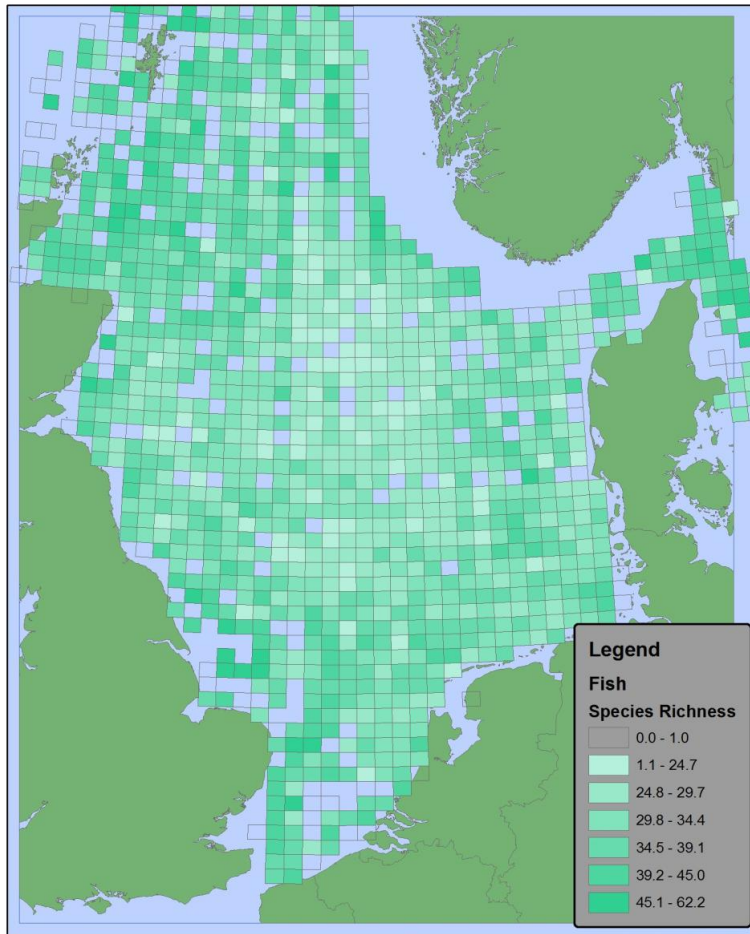


OWP sensitivity of birds : Value maps



Method uses approach developed by Garthe & Hüppop (*Journal of Applied Ecology*, 2004)

Fish community: Species richness and/or Rareness

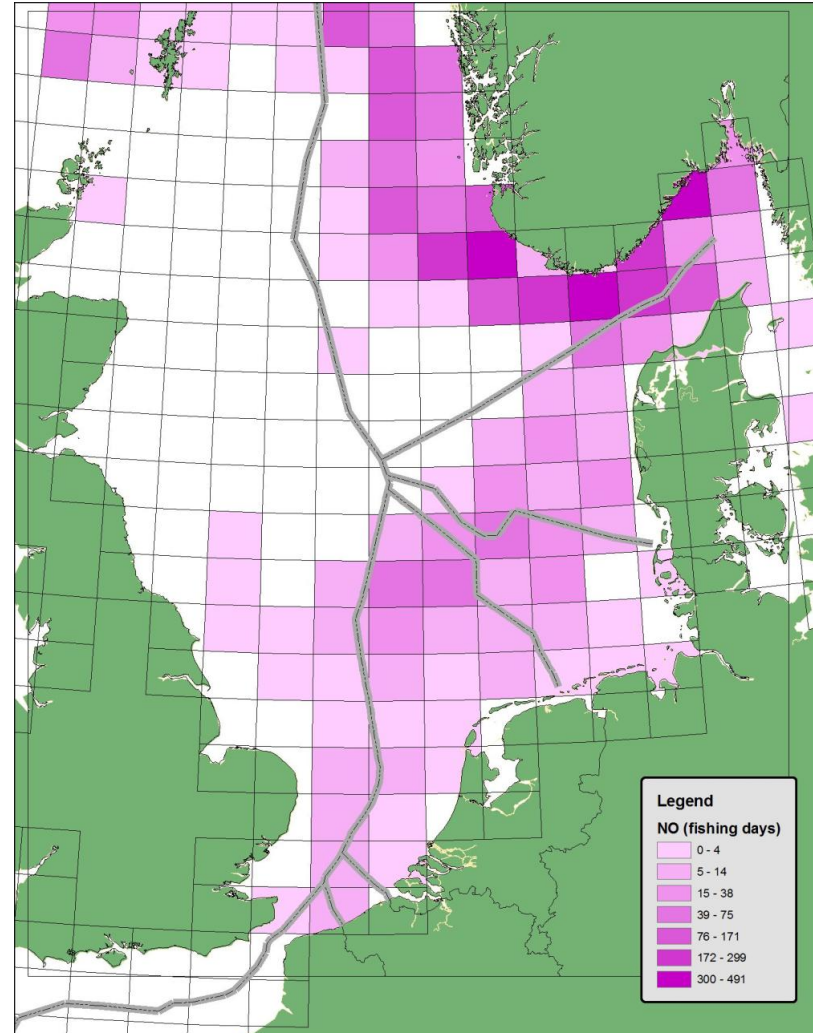
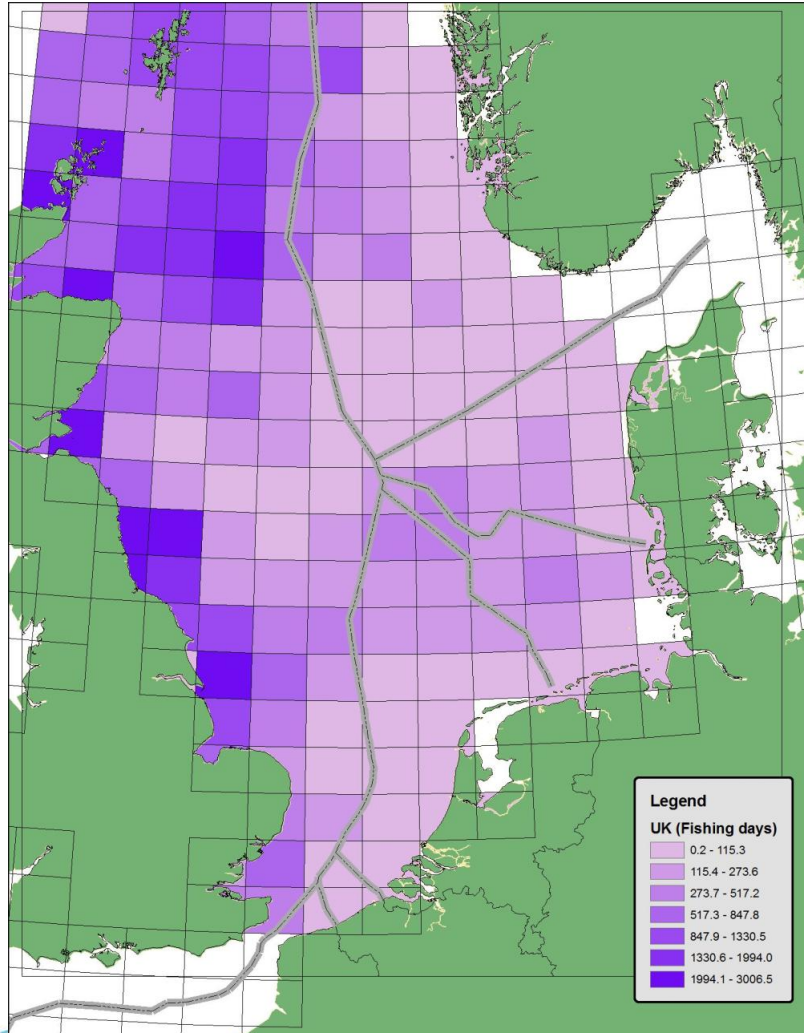


Calculation rules

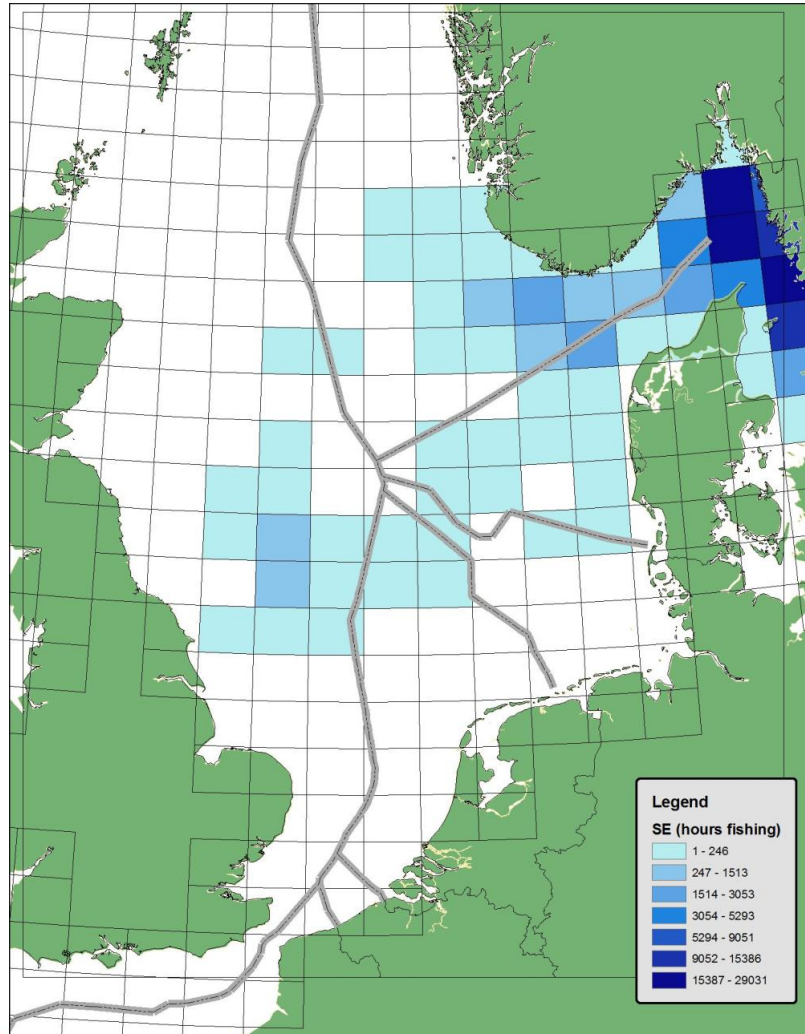
Type 3: Economic values

- Fisheries on the North Sea
 - Effort of fishery (for each country and total)
- Will be made economical based on either:
 - Revenue of fishery (gross value)
 - Profit of fishery (net value)

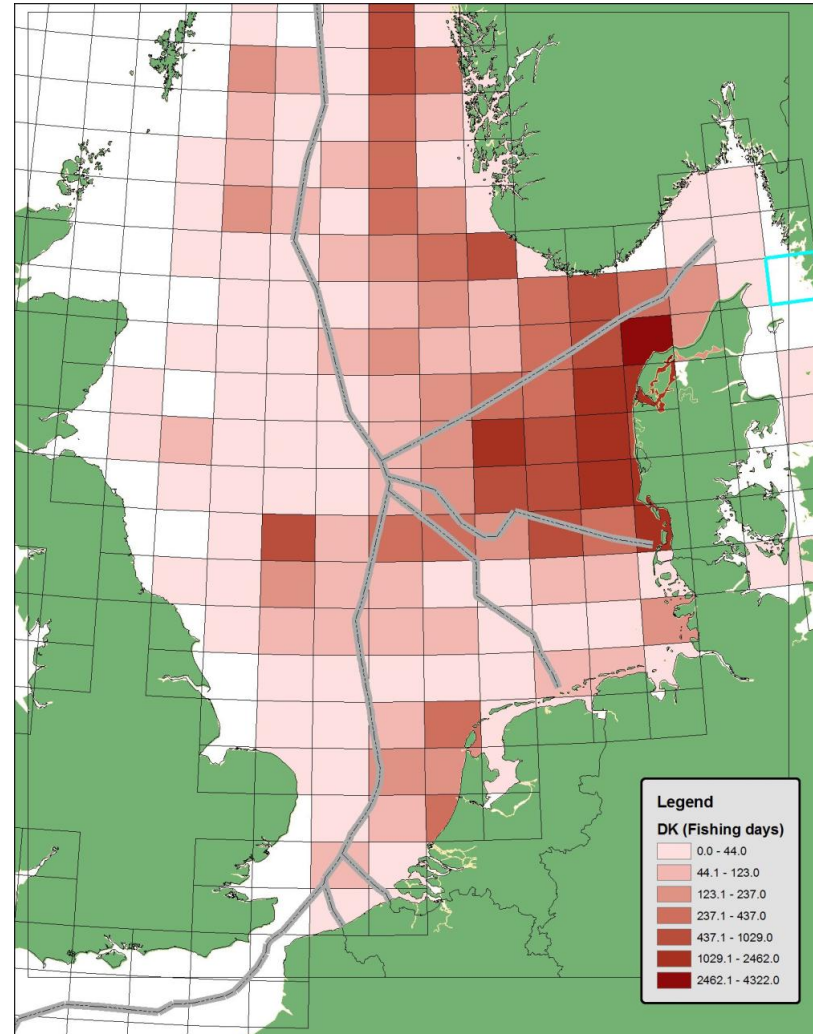
Fishing effort United Kingdom and Norway



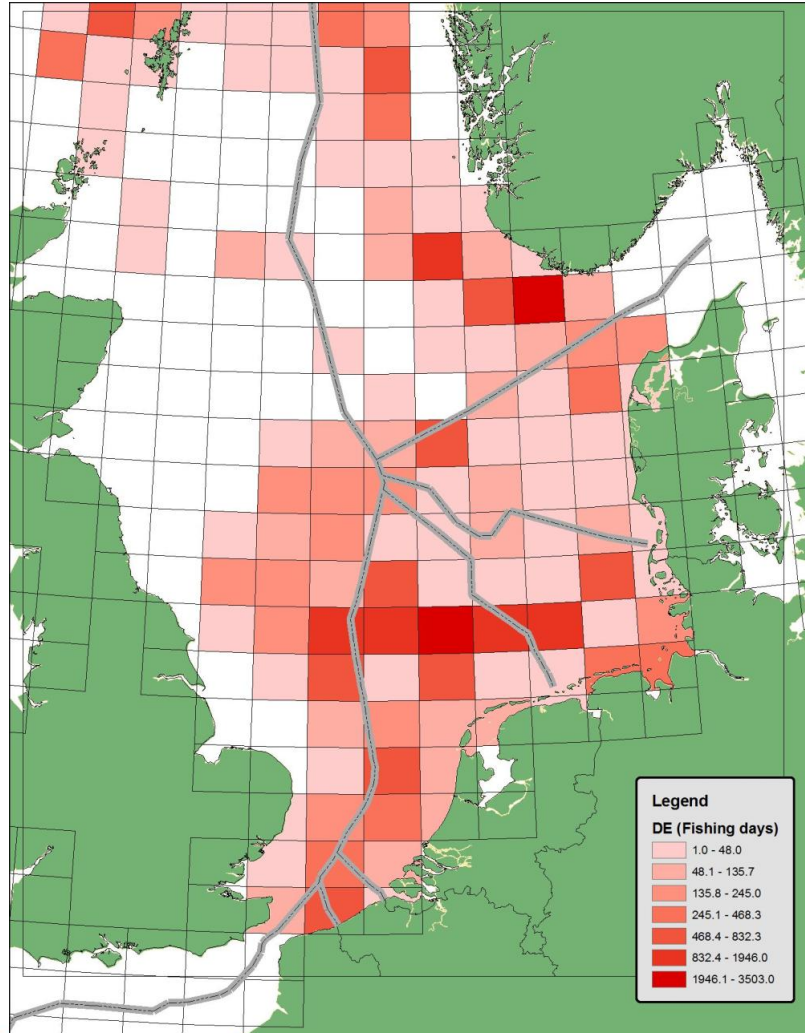
Fishing effort Sweden



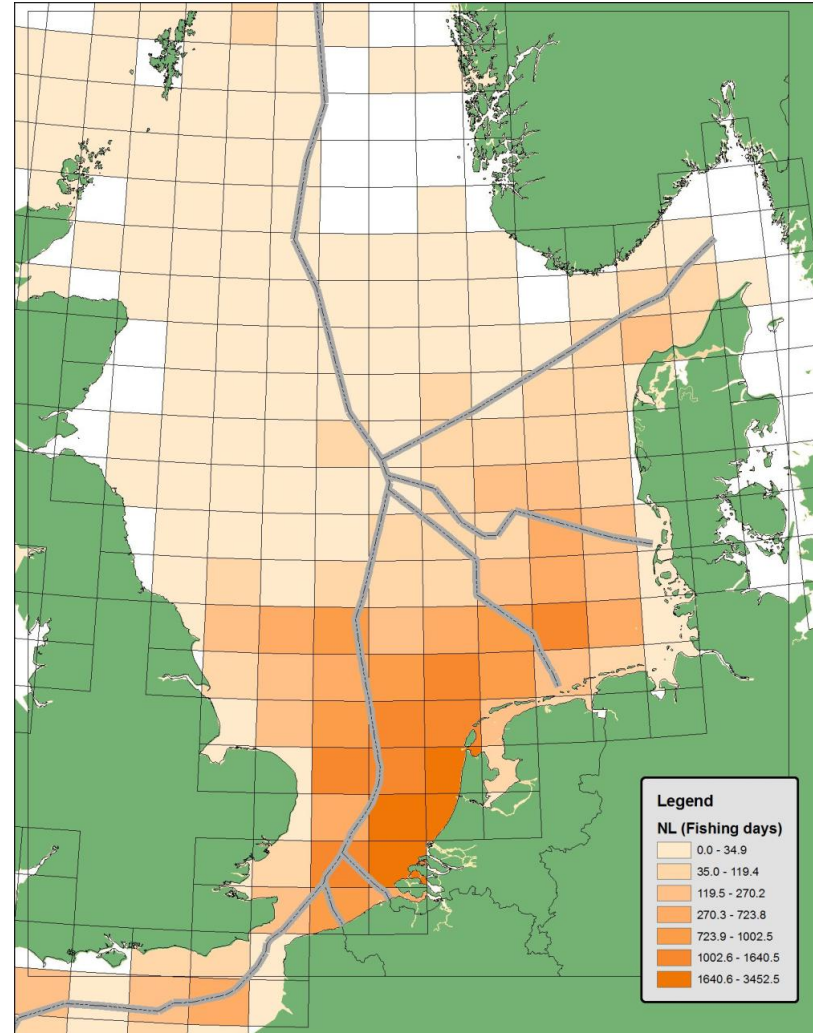
and Denmark



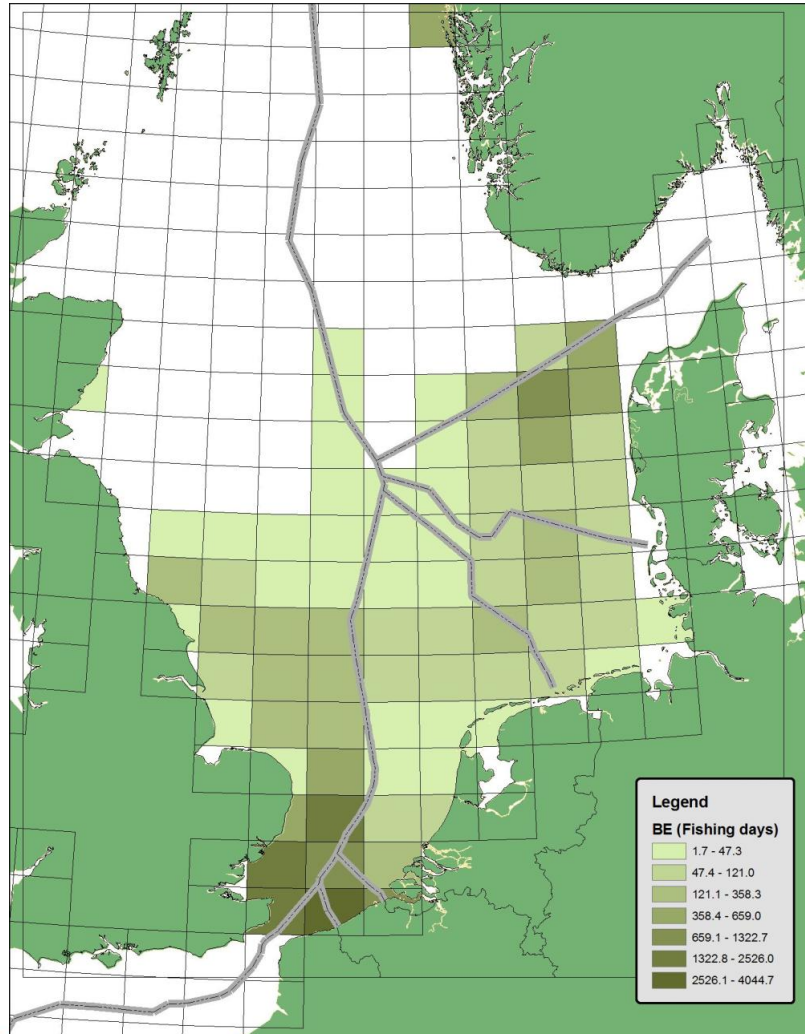
Fishing effort Germany



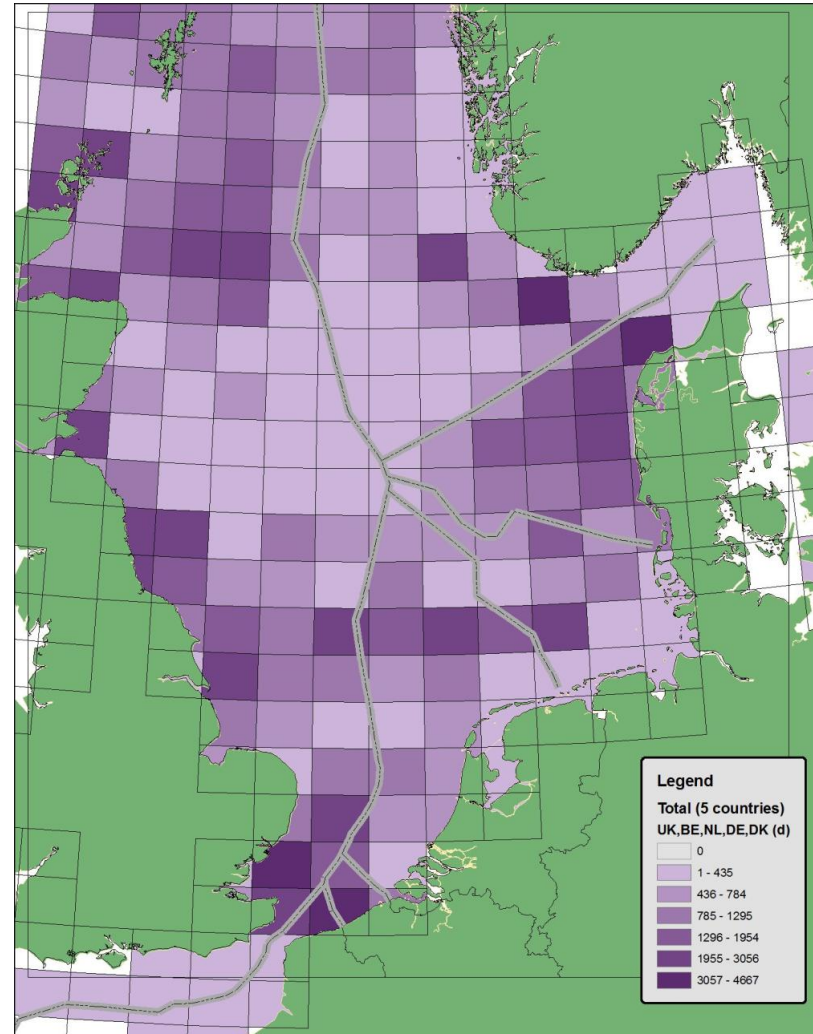
and the Netherlands



Fishing effort Belgium



and Total for 5 countries



Calculation rules

Type 4: Refinement to reduce heterogeneity

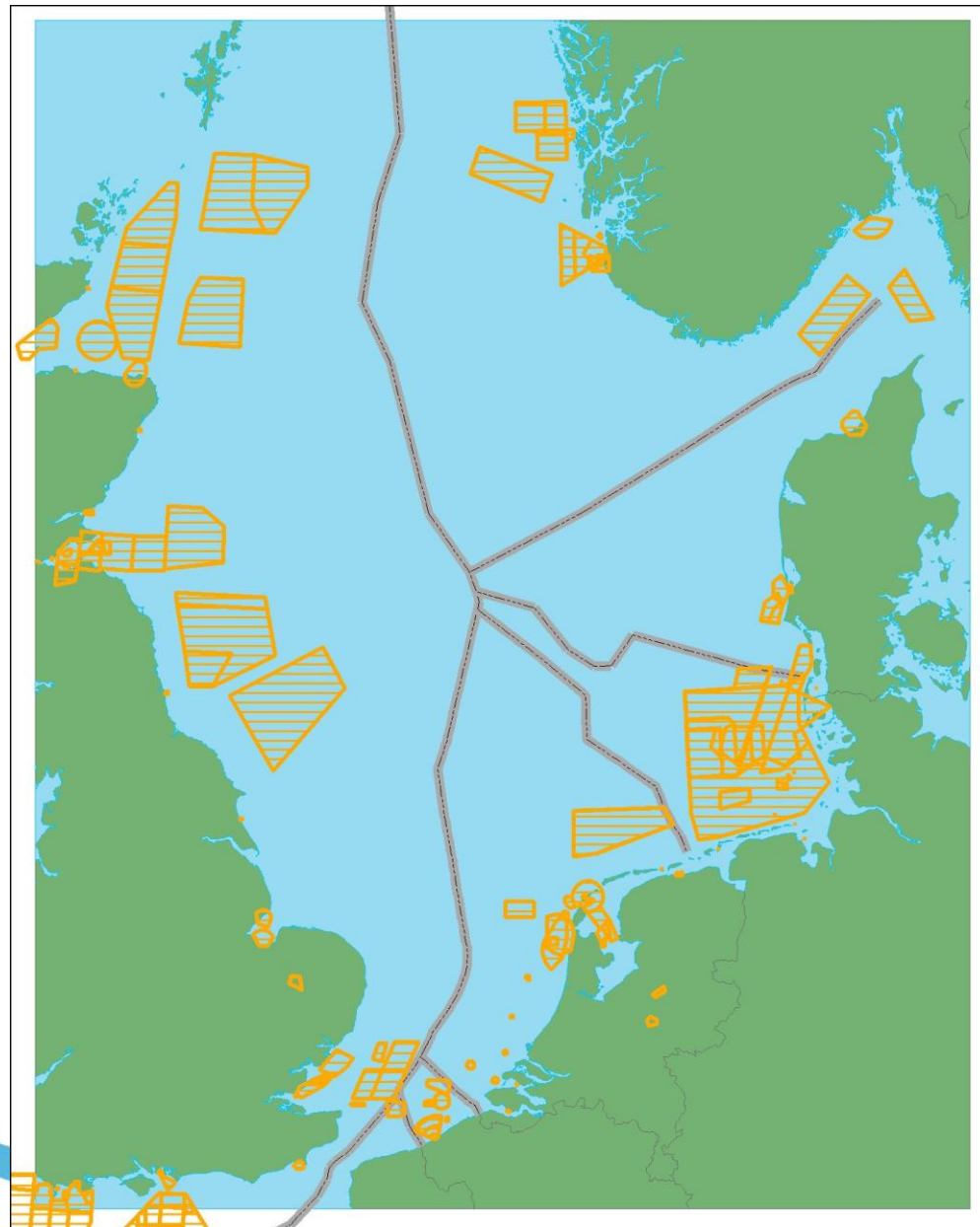
- Military use: defining subcategories
- Policy for activities allowed in nature conservation areas (differences among countries)

Military use.

Undifferentiated in this map.

Usage types include:

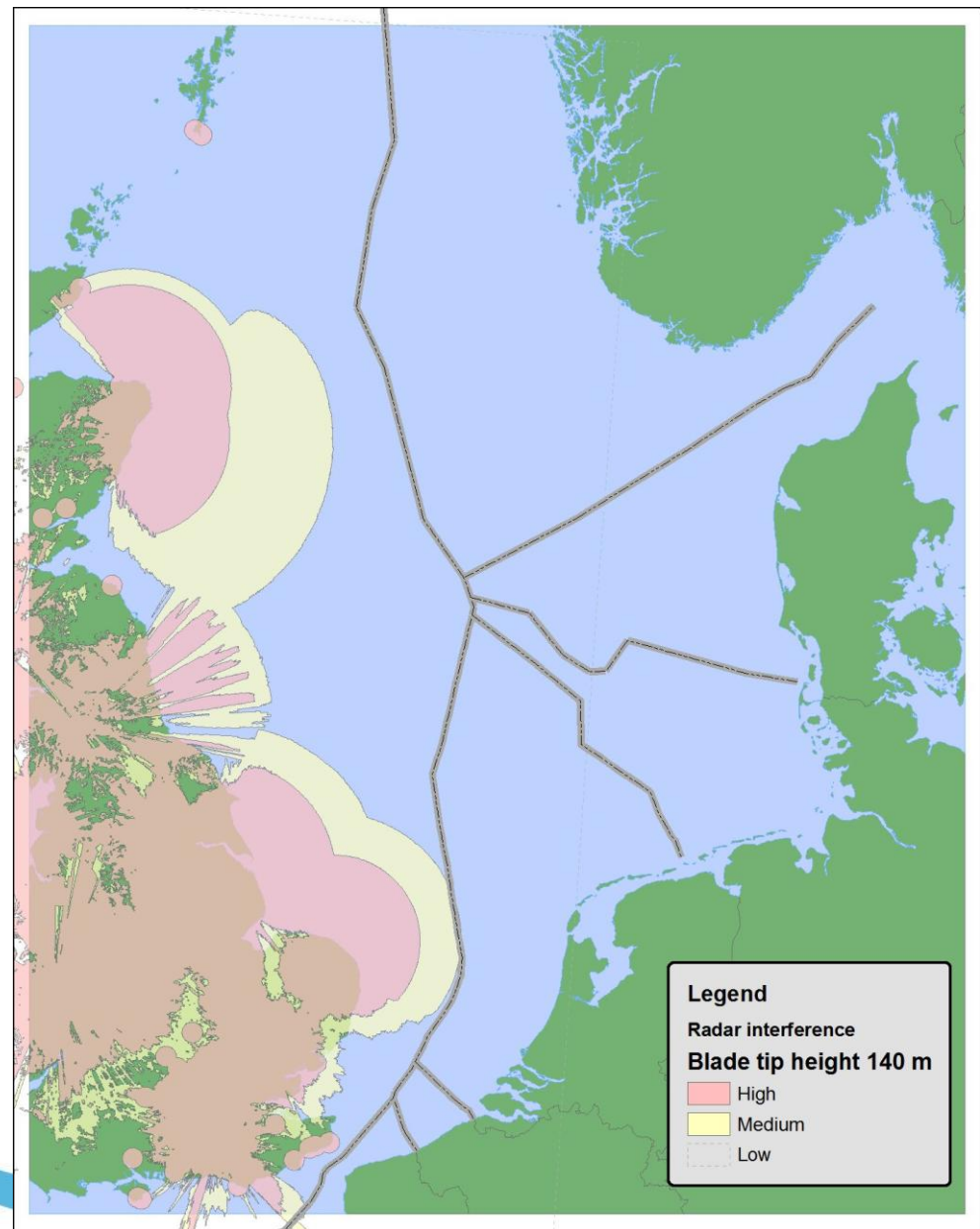
- Shooting ranges (0)
- Ship maneuvers (-)
- Submarine exercise (-)
- Aircraft maneuvers (+)
- Ammunition dumping sites (-)



Radar interference

NATS En Route Plc ("NERL") is responsible for the safe and expeditious movement in the en-route phase of flight for aircraft operating in controlled airspace in the UK. To undertake this responsibility NERL has a comprehensive infrastructure of radars, communication systems and navigational aids throughout the UK, all of which could be compromised by the establishment of a windfarm. In this respect NERL is responsible for safeguarding this infrastructure to ensure its integrity to provide the required services to Air Traffic Control (ATC).

The Dutch Ministry of Defence also sees this as a serious matter. This will most likely also be the case in the other countries.



Interactions between sea use functions

- General:
 - co-existence
 - separation with safety zones
- Specific:
 - effects of OWPs on nature and species

Space sharing by sea use functions

	OWP	Sand Extraction	Nature (protected)	Cables & Pipelines	Fisheries	Defense	Oil & Gas	Shipping
Shipping	< routes	✓	~	✓ anchoring	✓ routes	~	^	✓
Oil & Gas	<	<	^	#	<	<	*	
Defense	O priorities	~	~	✓	✓	✓		
Fisheries	^ 1	✓	<	^	✓	1 outside prime fishing areas		
Cables & pipelines	< 2	<	✓	*	2 existing and in use cables & pipelines			
Nature (protected)	~	~	✓					
Sand extraction	^	~						
OWP	*	* First come first served. Additional activities will have to negotiate						

Future use on the North Sea

Sea use function	Trend	Preference	Required area
Shipping	Increase	Short routes with sufficient depth (present routes)	Sufficient up to 2015
Oil and gas	Decrease	At sites with oil and gas resources	
Defense	Constant	License awarded for 2004-2014	7% of EEZ
Fisheries	Decrease	Fish dense areas	Major part of EEZ
Cables and pipelines	Decrease	To be clustered and not deep (maintenance)	Can be reduced
Nature	Increase	Natura2000 areas, high bird, sea mammal and fish density areas	Natura200 areas (establ. and in prep.)
Sand extraction	Increase	Zone between -20 m depth & the 12 nm line	2000 km ² in 2040
OWP	Increase	Near coast and landing locations	1000-2000 km ² for 6000 MW (NL)
Wave and tidal energy generation	Increase	Areas with high wave resp. strong tidal currents, and same as OWP	?



Wageningen-IMARES

Intelligent Energy Europe

Non-wind sea use functions

Monitoring programs & OWP

- Different approach in each country
- Little learning effect from earlier programs
- Access to and availability of resulting data
- Monitor t0 for longer than one year (suggested from OWEZ)
- Allow for adjustments as knowledge and methods improve
- Above point may conflict with comparability of data from year to year, therefore a safeguard needs to be in place
- International data gathering? Species do not respect borders
- Centralised approach? Monitoring of individual OWP cannot address cumulative effects

Based on a Dutch workshop held by Min.Transport 03-03-2009

Required information and discussion

Information of safety zones for sea use functions (for all countries)

Most countries have the same or very similar thoughts on most of these.

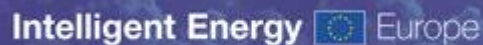
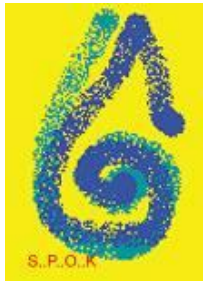
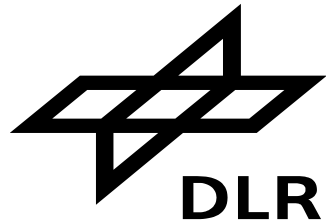
How do you see the future development for the sea use functions:

- Volume/extent (increase, decrease, constant)
- Intensity
- Spatial use (locations, high preferred area, low preferred area)

Monitoring programmes around OWP?

- Are we learning the right lessons from our monitoring efforts?
- Are there results that we can use to feed into the knowledge base of WindSpeed?

Thank you for your attention!



Non-wind sea use functions

Data sources I

- Shipping:
 - Kystverket, NO
 - ANATEC/GH, UK
 - MUMM, BE
 - RWS, NL
- Oil & Gas
 - NPD, NO
 - DTI/BERR, UK
 - KMS, DK
 - RWS, NL
- Pipelines
 - NPD, NO,
 - DTI/BERR (GH), UK
 - KMS, DK
 - MUMM, BE
 - RWS, NL
- Cables
 - MUMM, BE
 - RWS, NL

Data sources II

- Fisheries:
 - Germany: vTI-SF
 - Scotland: FRS
 - England & Wales: Cefas
 - Belgium: ILVO
 - Denmark: DTU-Aqua
 - Norway: IMR
 - Sweden: Fiskeriverket
- Military Use
 - (Garrad Hassan), UK
 - RWS, NL
 - BSH-WMS, DE
- Nature conservation
 - JNCC, UK
 - Direktoratet for Naturforvaltning, NO
 - Miljøministeriet, BLST, DK
 - BfN, DE
 - MUMM, BE
 - RWS, NL
- Sand extraction
 - Miljøministeriet, BLST, DK
 - RWS, NL

Data sources III

- Fish community
 - IMARES, NL
- Sea mammals
 - OBIS-SEAMAP (1994)
- Bird value
 - IMARES, NL
- Benthos
 - JNCC, UK
 - Uni Vechta, DE
 - IMARES, NL
- Nature conservation
 - JNCC, UK
 - Direktoratet for Naturforvaltning, NO
 - Miljøministeriet, BLST, DK
 - BfN, DE
 - MUMM, BE
 - RWS, NL
- Sand extraction
 - Miljøministeriet, BLST, DK
 - RWS, NL

Required information

- Allocation rules for future development for each use function
 - Depending on the expected development (increase or decrease)
 - Indicate locations and intensities

Discussion: benefits of international spatial planning

- Political possibility for sharing use categories
- Reduction of interactions between use categories
- Economic consequences

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Wageningen-IMARES

Intelligent Energy  Europe

Non-wind sea use functions

Data collection

Country> Use Function	Norway	Denmark	Germany	Netherlands	Belgium	United Kingdom
Shipping	+	+	+	+	+	+
Oil & Gas	+	+	+	+	#	+
Fisheries	+	+	+	+	+	+
Cables & Pipelines	? +	- +	? ?	+	+	(+) +
Defense Activities	(+)	(+)	(+)	+	+	+
Nature conservation	+	+	+	+	+	+
Sand extraction		(+)	!	+	+	

Key to table

- “+” Okay
- “(+)” Sufficient, but may need better data
- “-” Data needed
- “?” Better data needed
- “!” Possible data need, when activity is present.
- “#” Okay, activity not present.

Data use and access

Country> Use Function	Norway	Denmark	Germany	Netherlands	Belgium	United Kingdom
Shipping	W	-	?	F	W	GH
Oil & Gas	W	F	?	F	W	W
Fisheries	f	f	f	f	f	f
Cables & Pipelines	- W	- F	? ?	F F	W W	? GH
Defense Activities	-	-	?	F	W	GH
Nature conservation	W	W	DLR	F	W	W
<i>Sand extraction</i>	-	W	?	F	W	-

Key to the table:

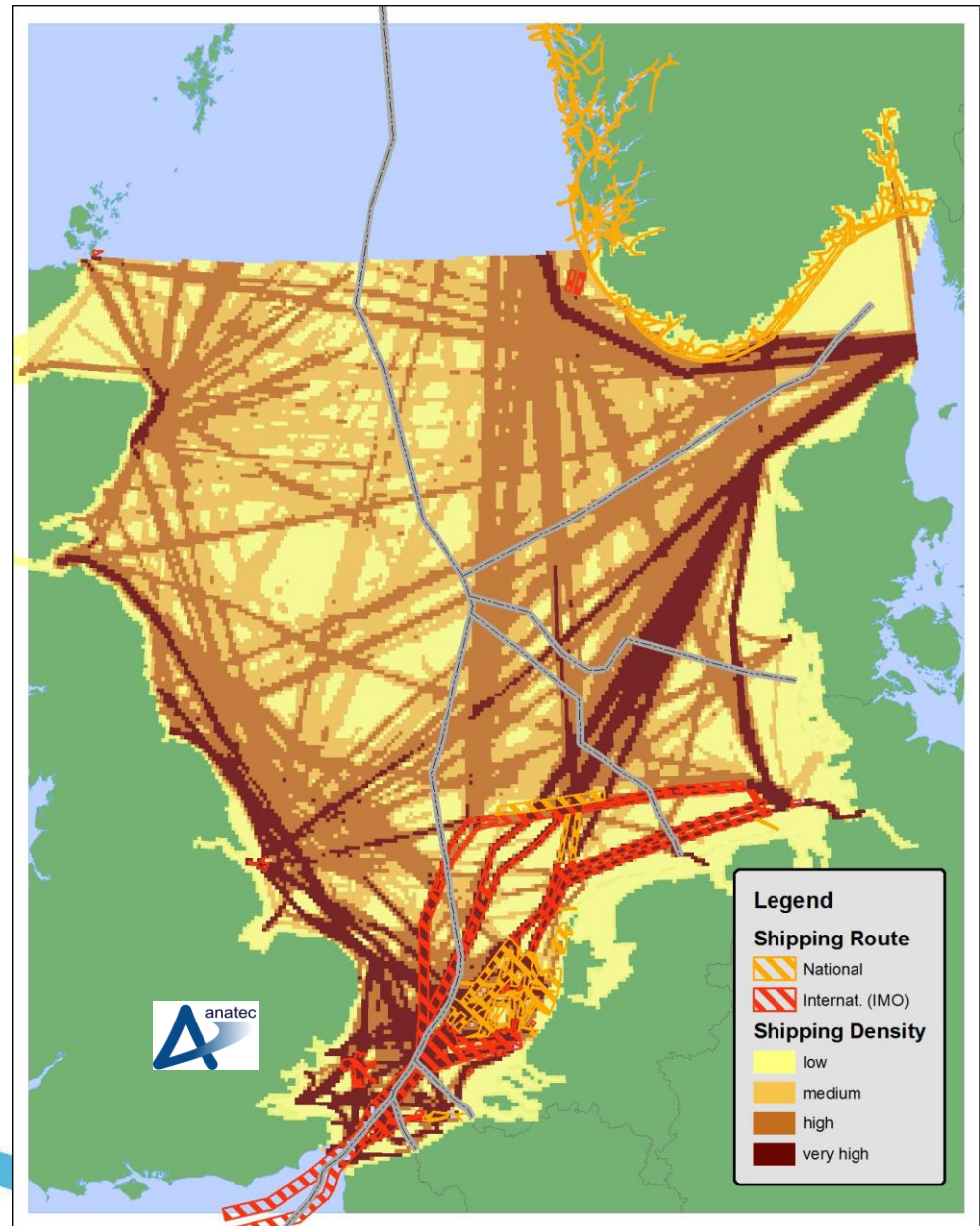
W, download from the web, F/f free for use, with acknowledgement of source,

? Undetermined, possible restriction apply, DLR/GH status to be clarified by partner

Shipping – routes & density

Routes constrict shipping

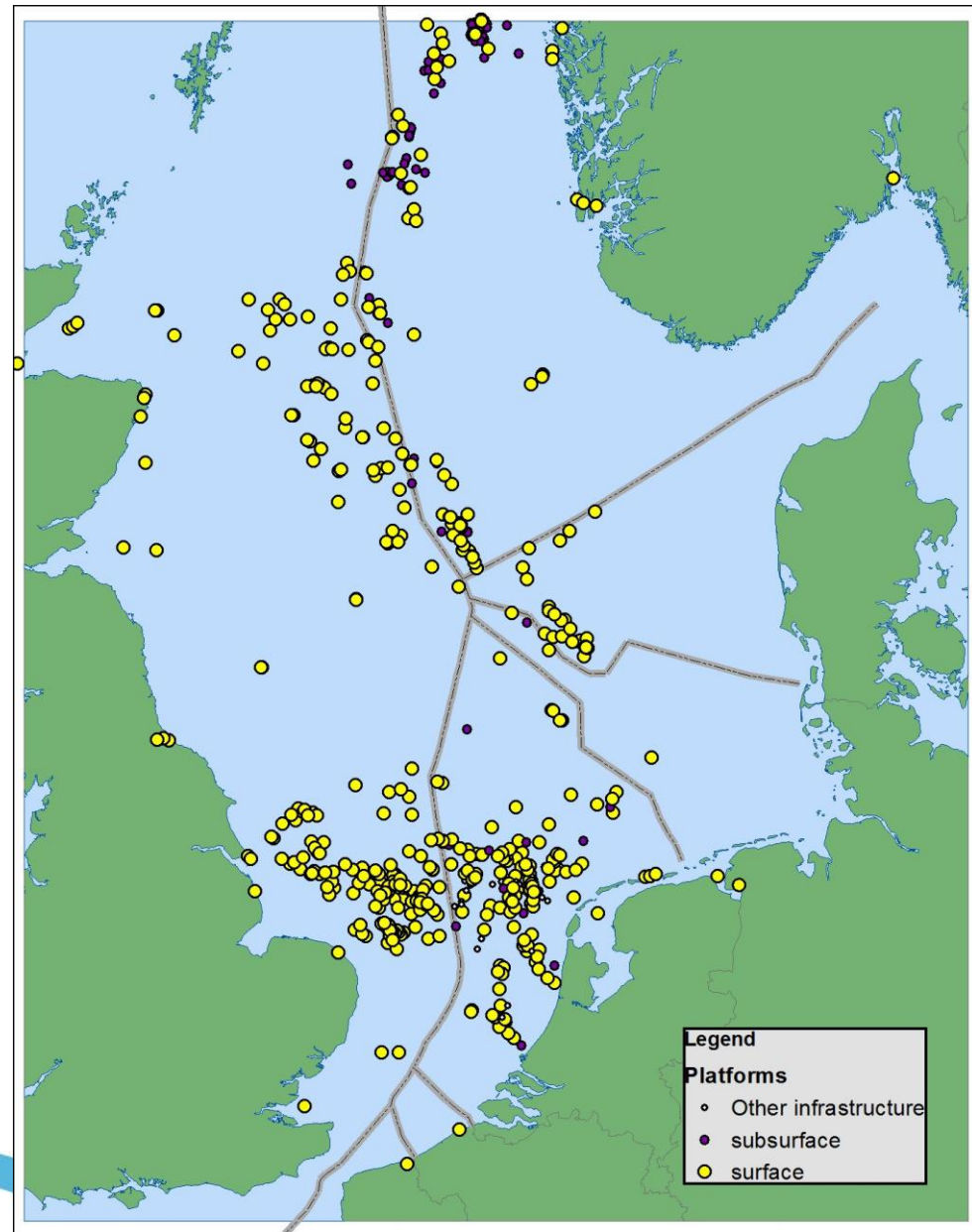
Outside routes ships travel in straight lines to their port of destination.



Offshore oil & gas platforms

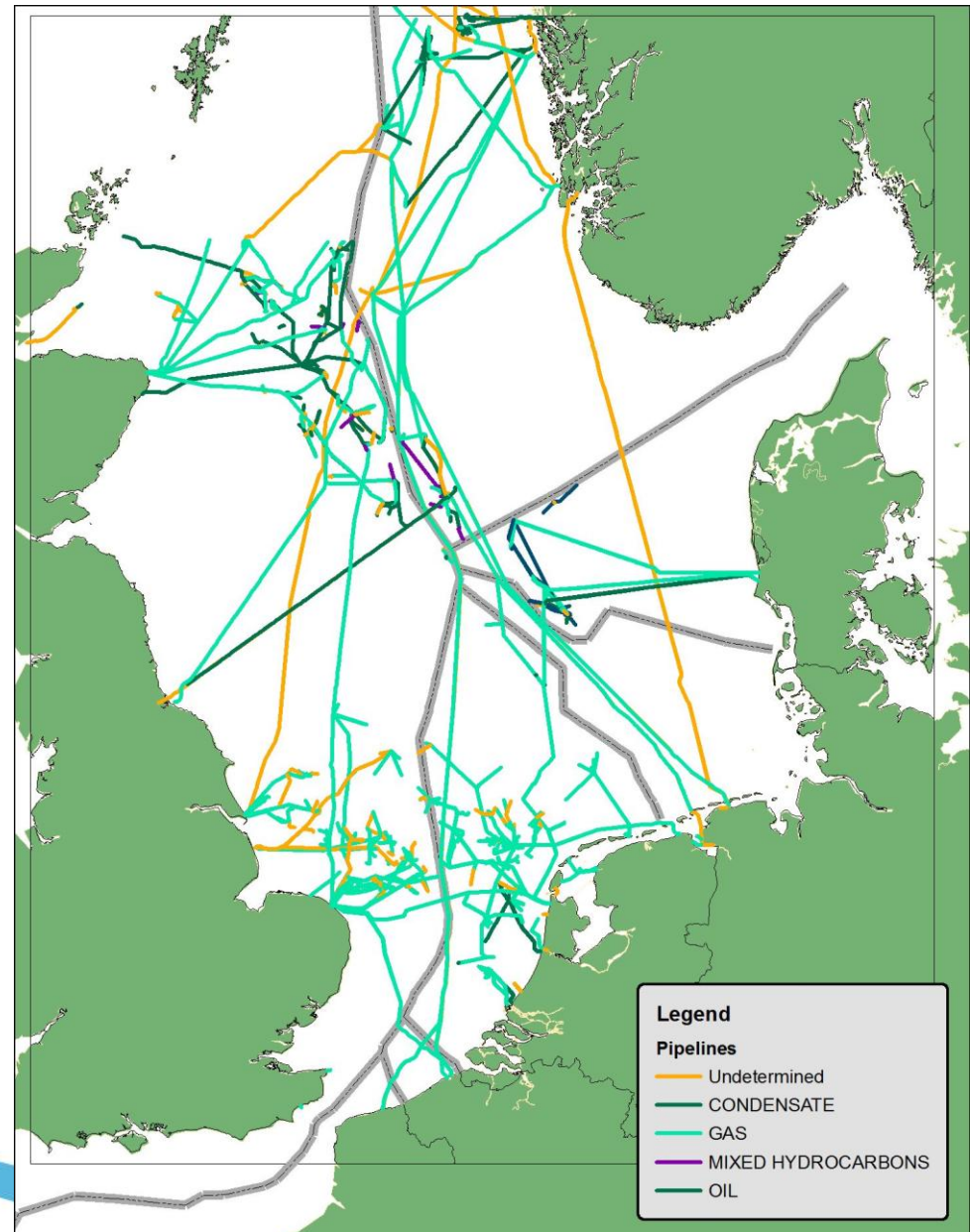
Southern cluster: gas

Northern cluster: oil (and gas)



Pipelines

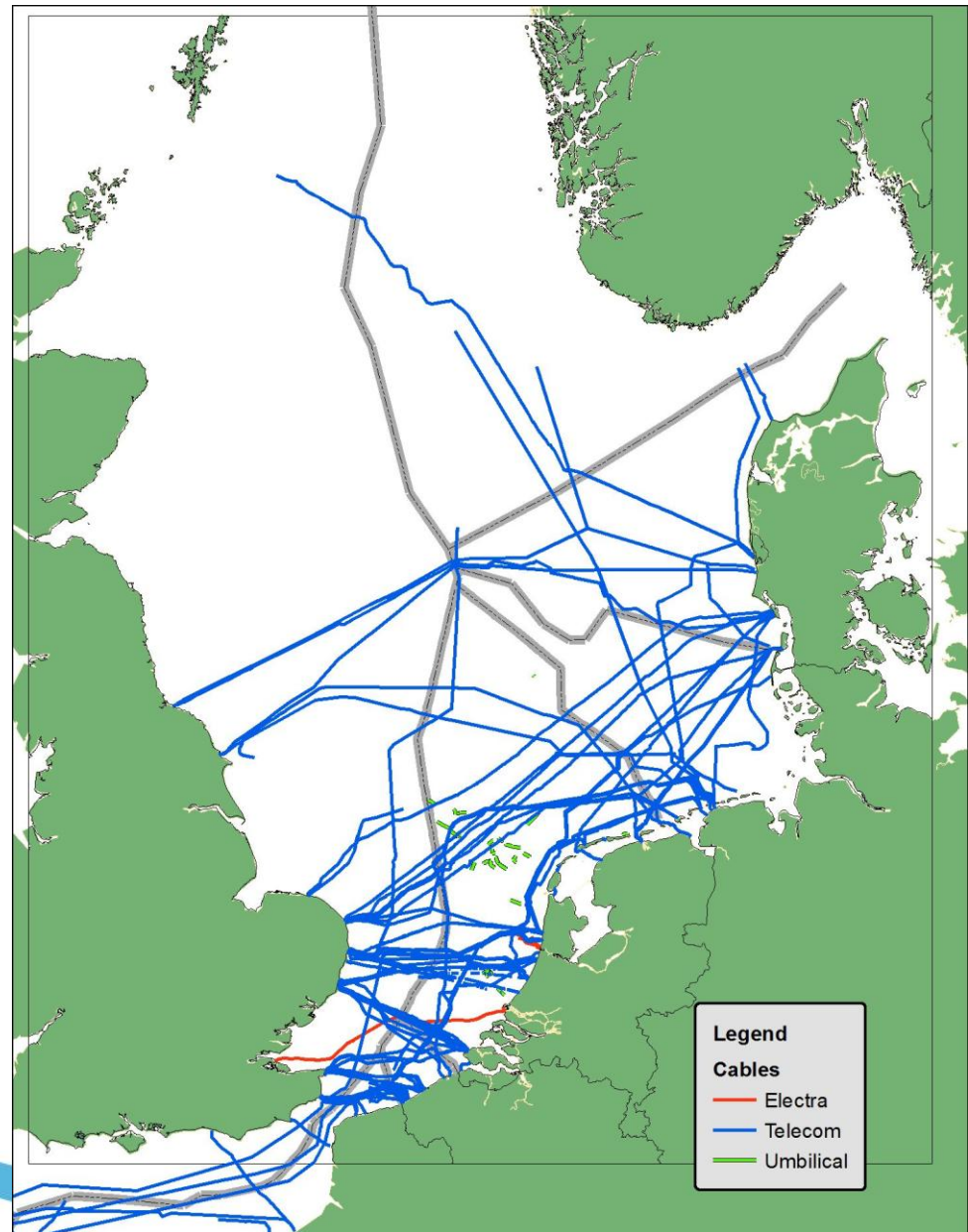
- From platforms to shore
- Between countries



Non-wind sea use functions

Cables

- Electrical cables
(only few)
- Telecommunications cables
(many)
- Umbilical (short)
(connect offshore installations)



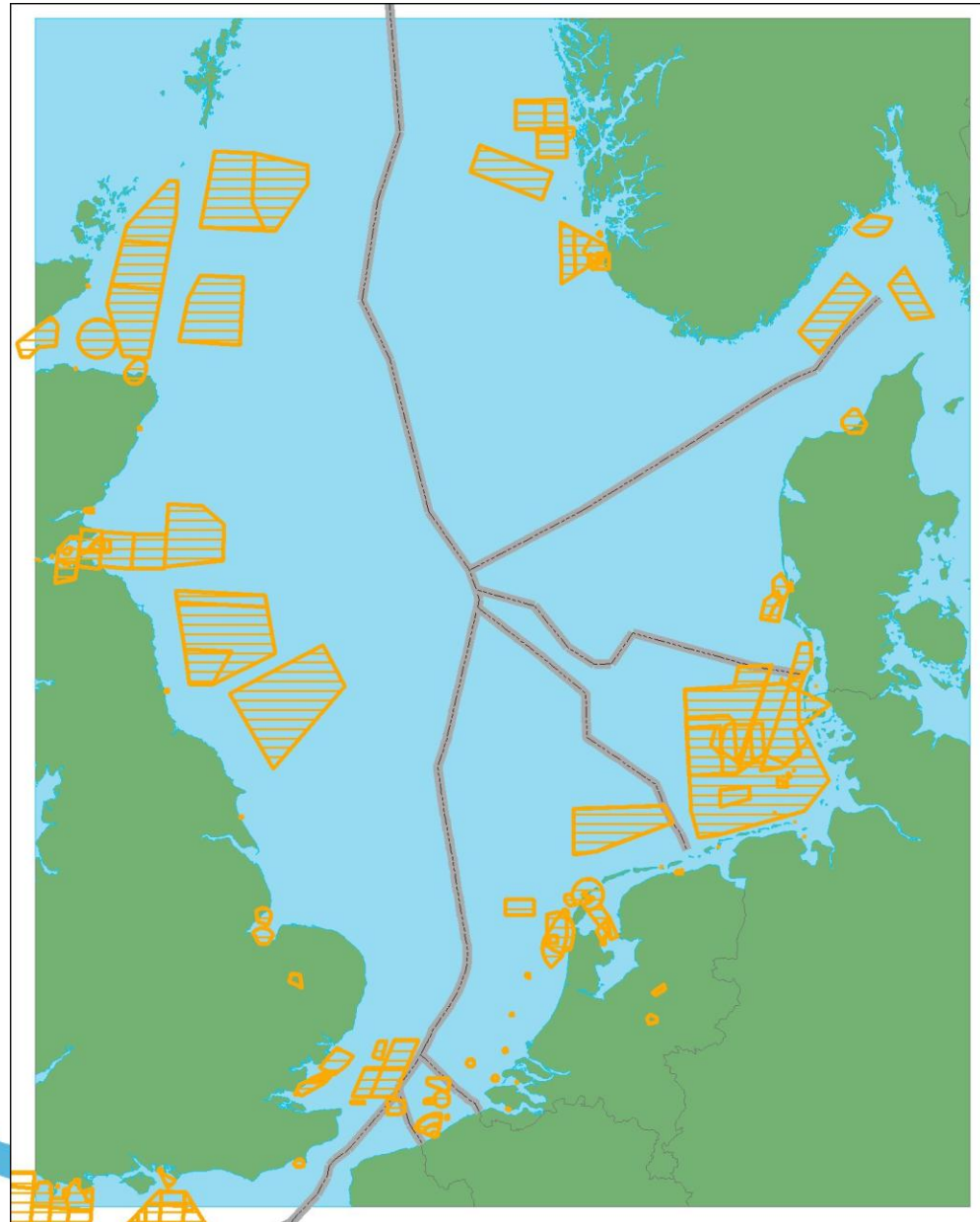
Non-wind sea use functions

Military use.

Undifferentiated in this map.

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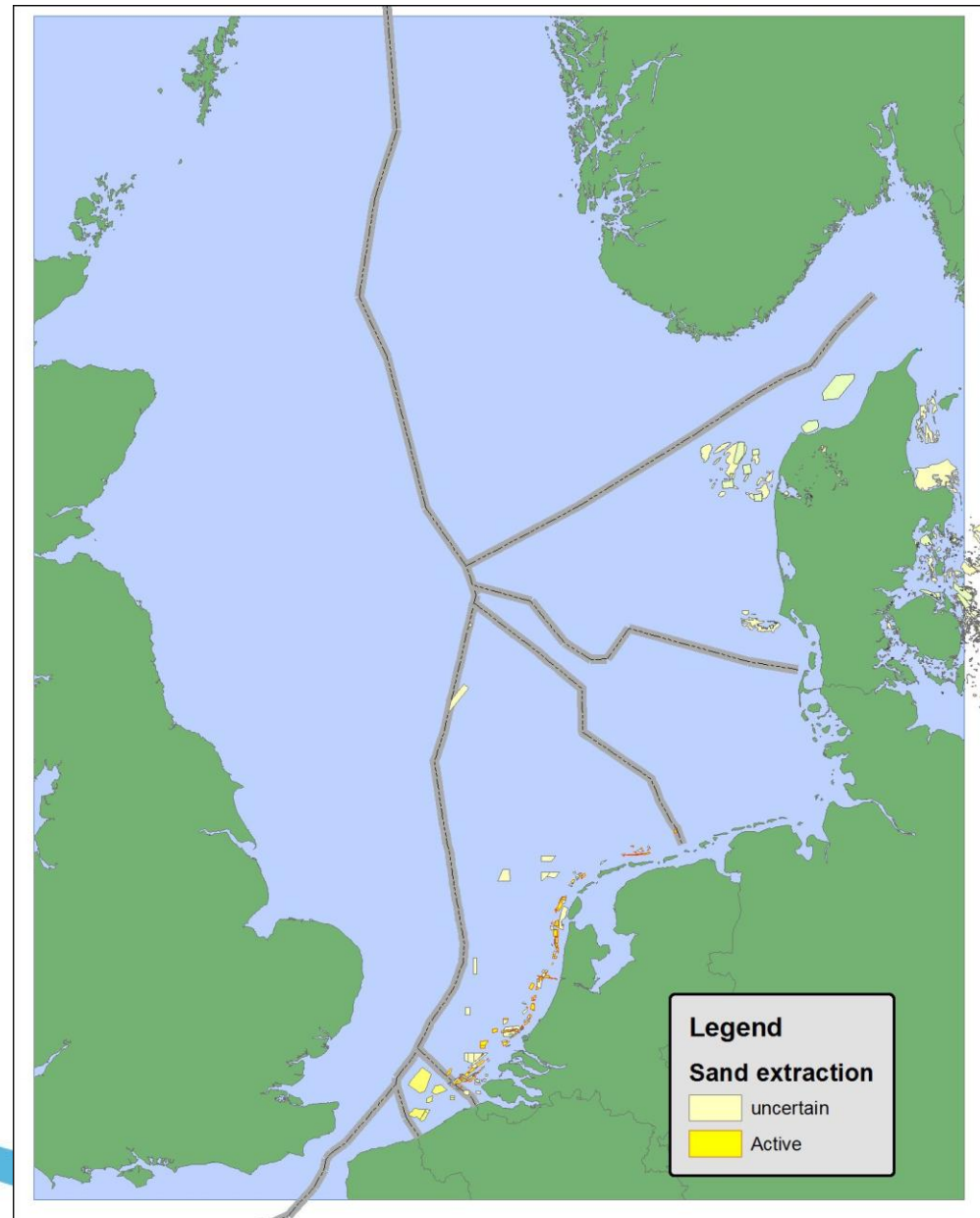
- Shooting ranges
- Ship maneuvers
- Submarine exercise
- Aircraft maneuvers
- Ammunition dumping sites



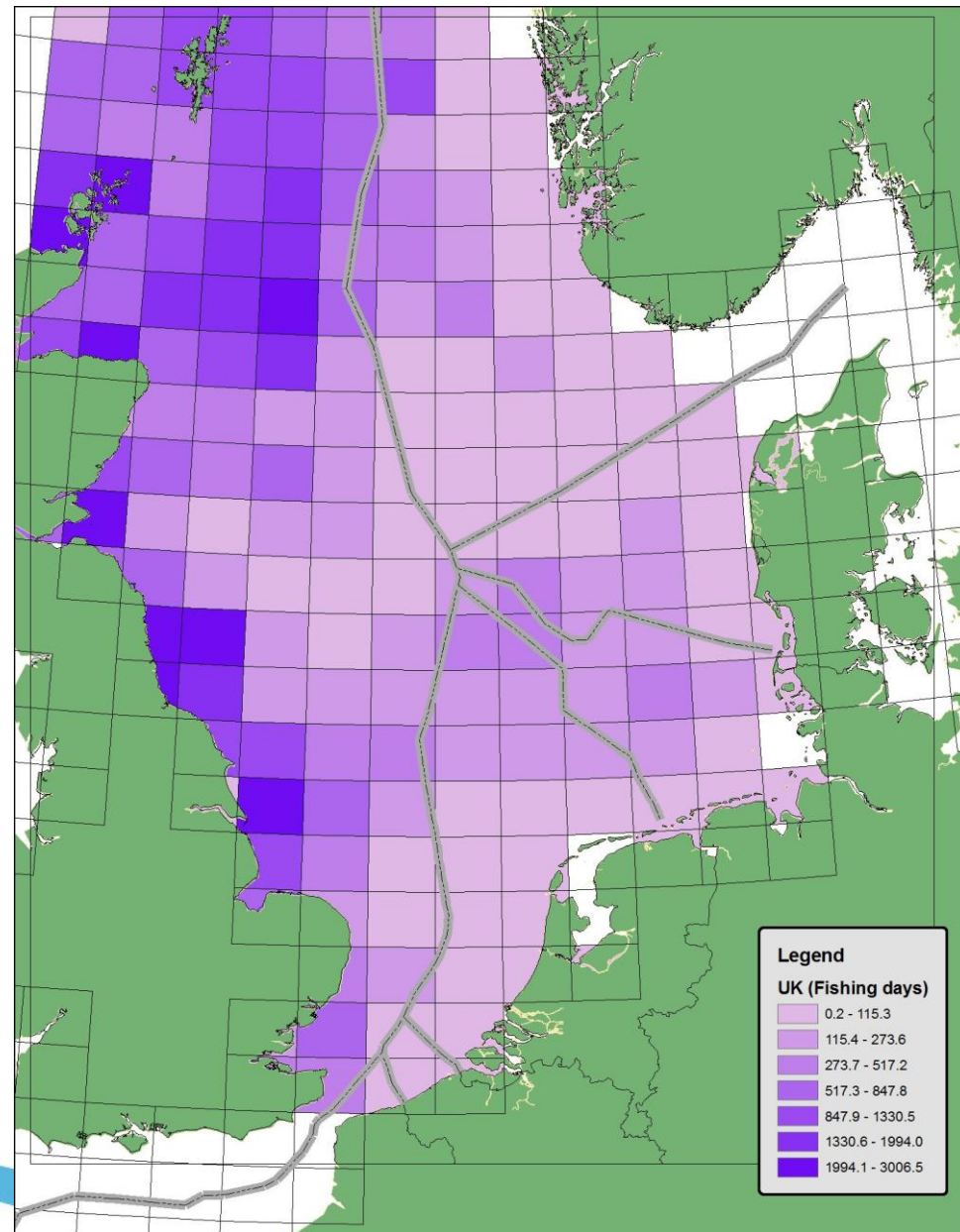
Sand extraction

Sand is extracted from the sea for use as building material, but large amounts are also used for coastal defense.

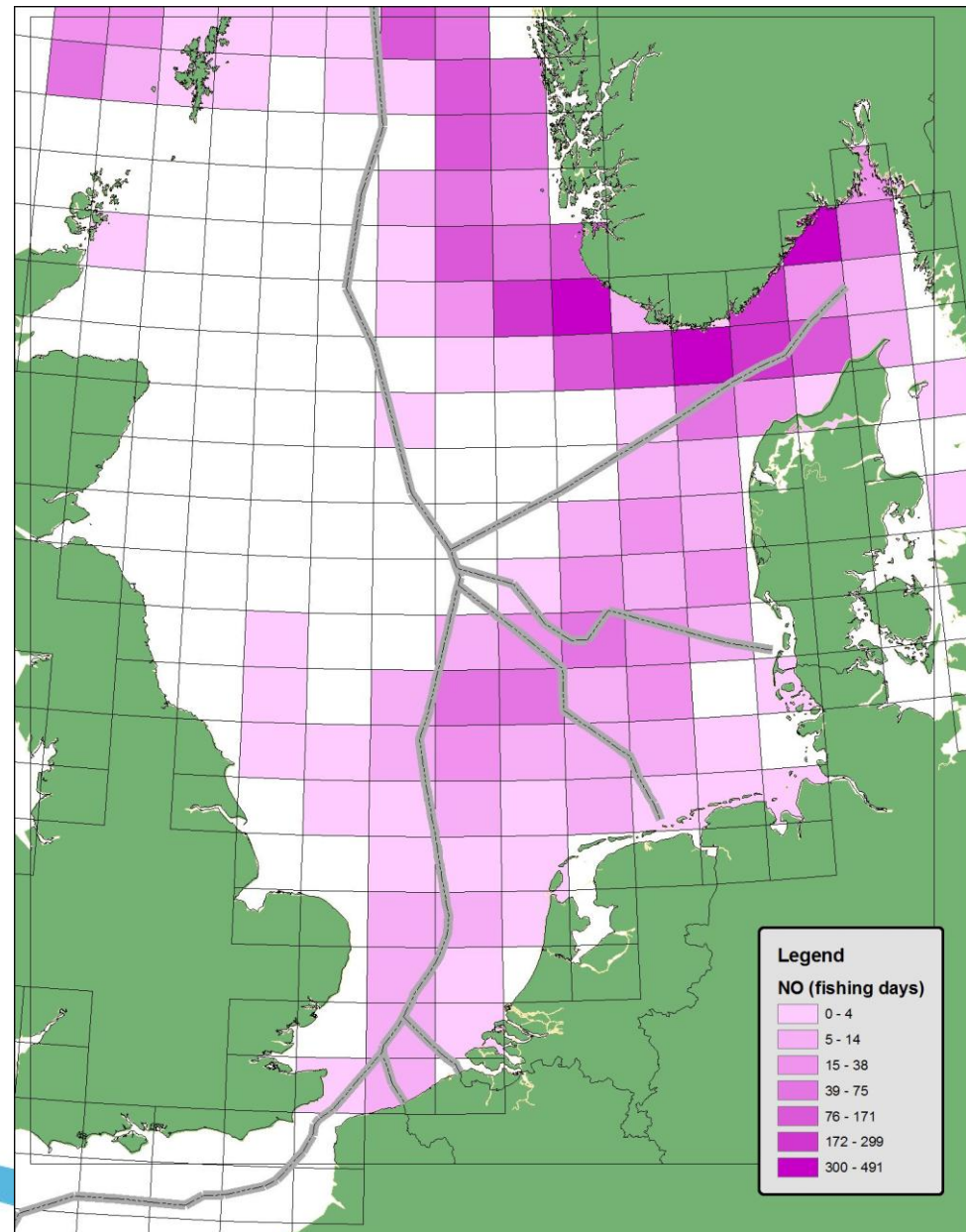
Beach and foreshore replenishment is done in a.o. the Netherlands and Denmark.



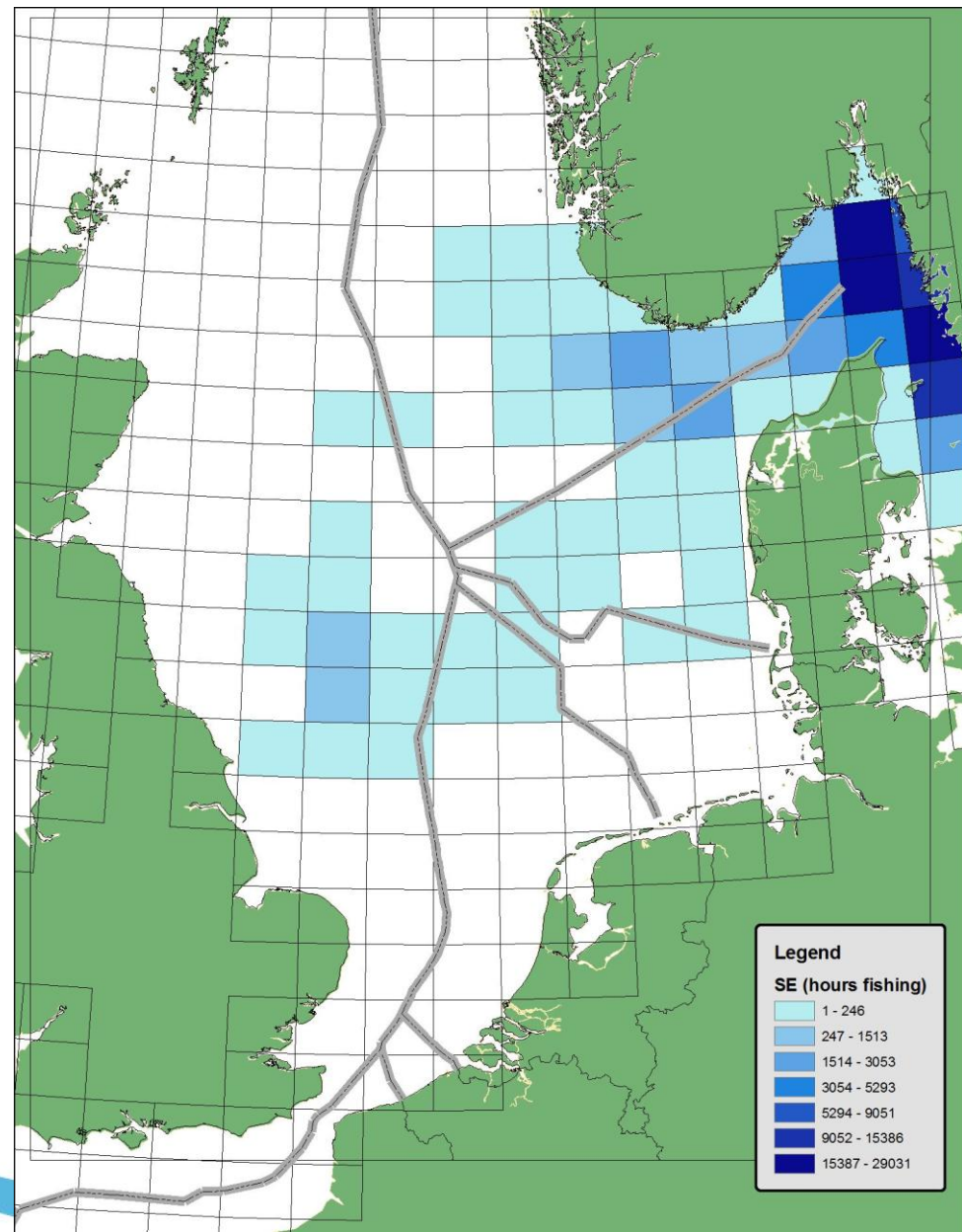
Fishing effort United Kingdom



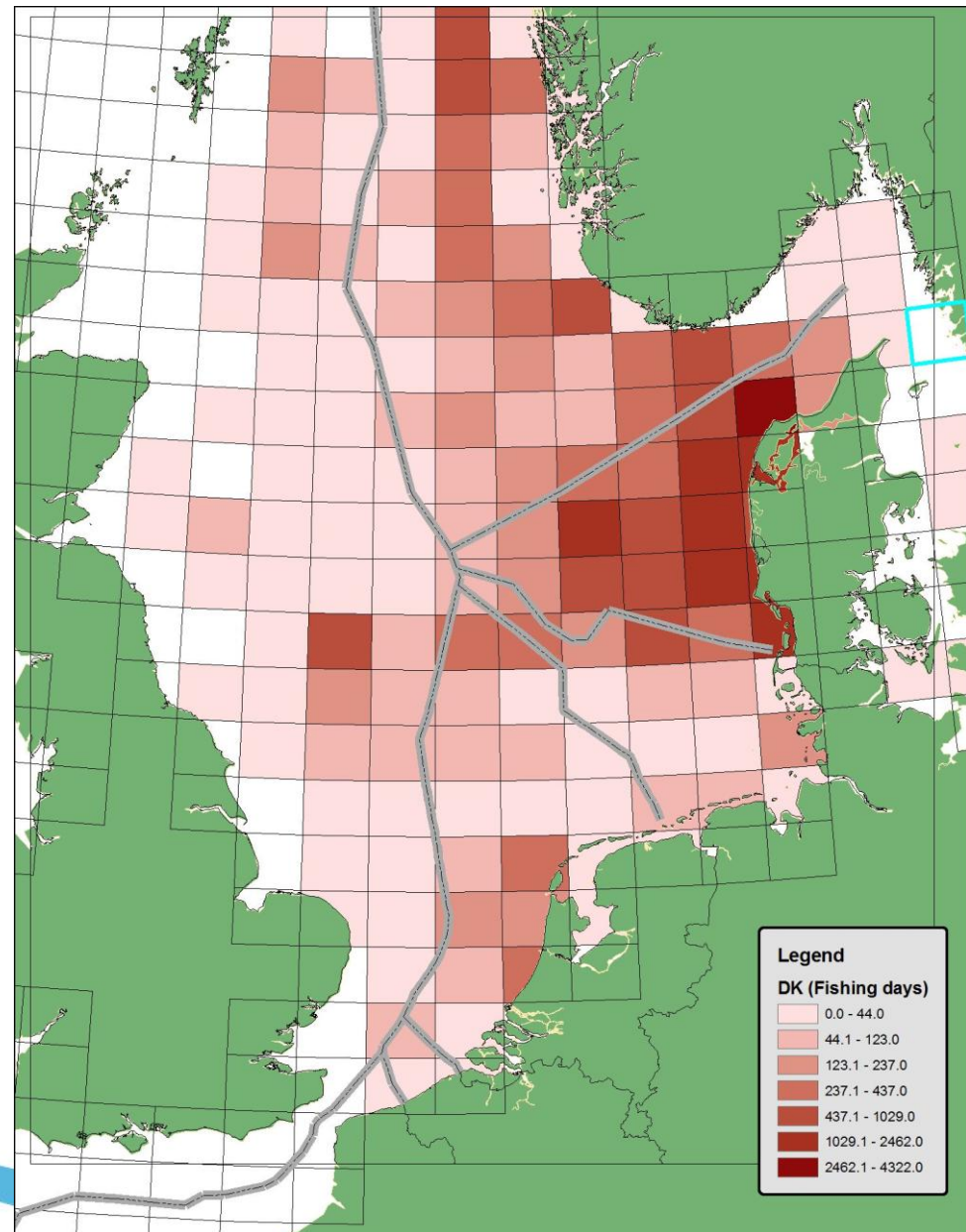
Fishing effort Norway



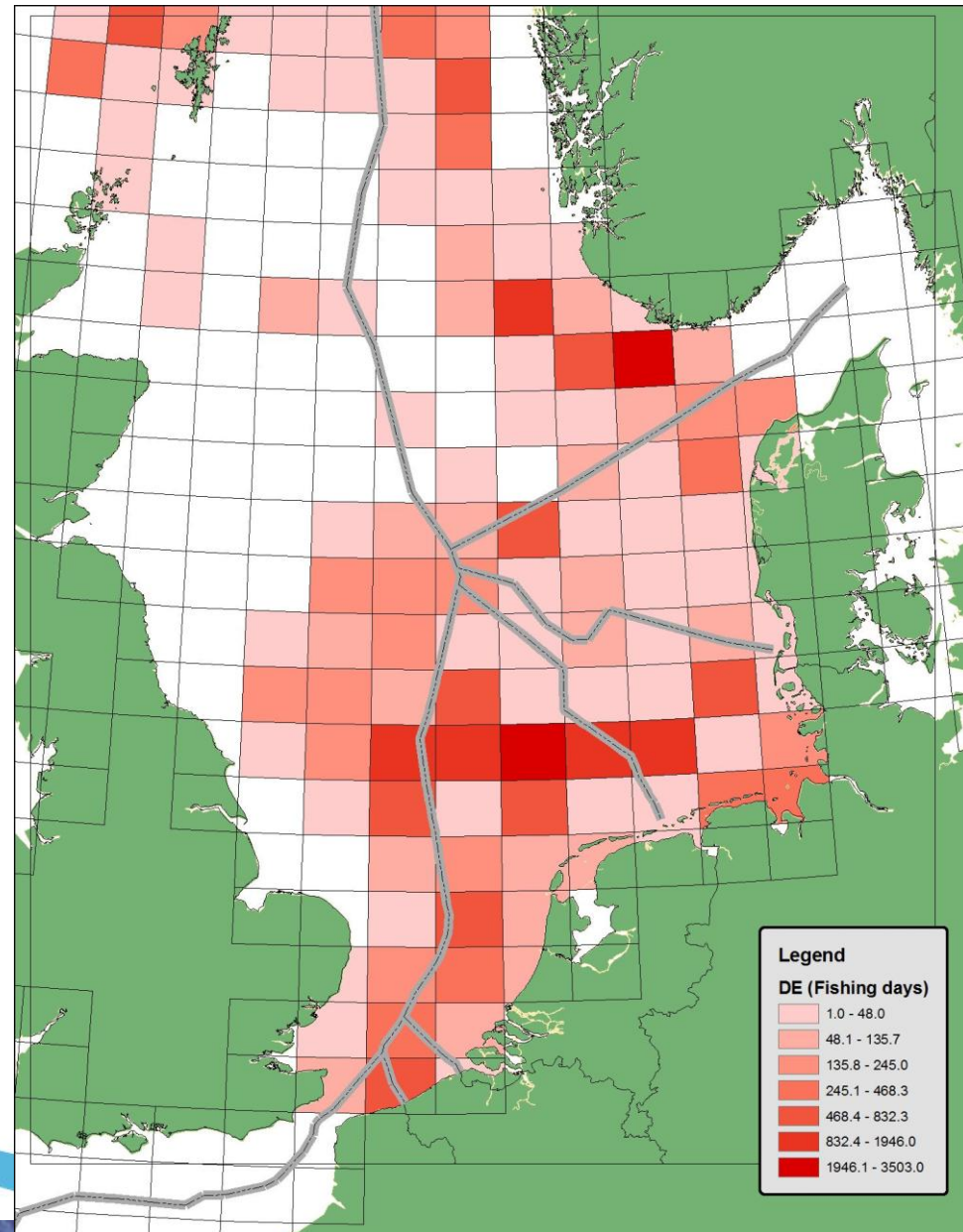
Fishing effort Sweden



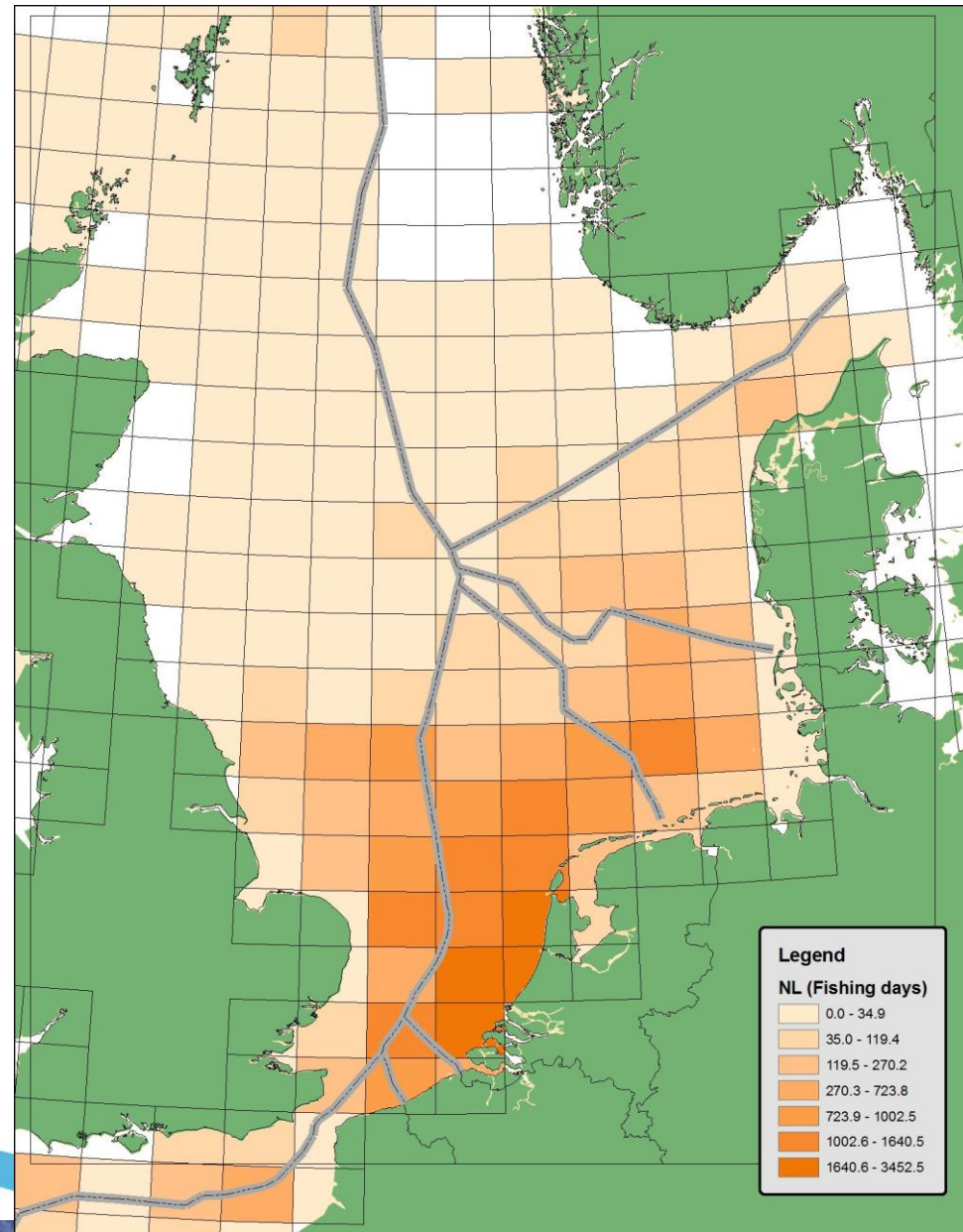
Fishing effort Denmark



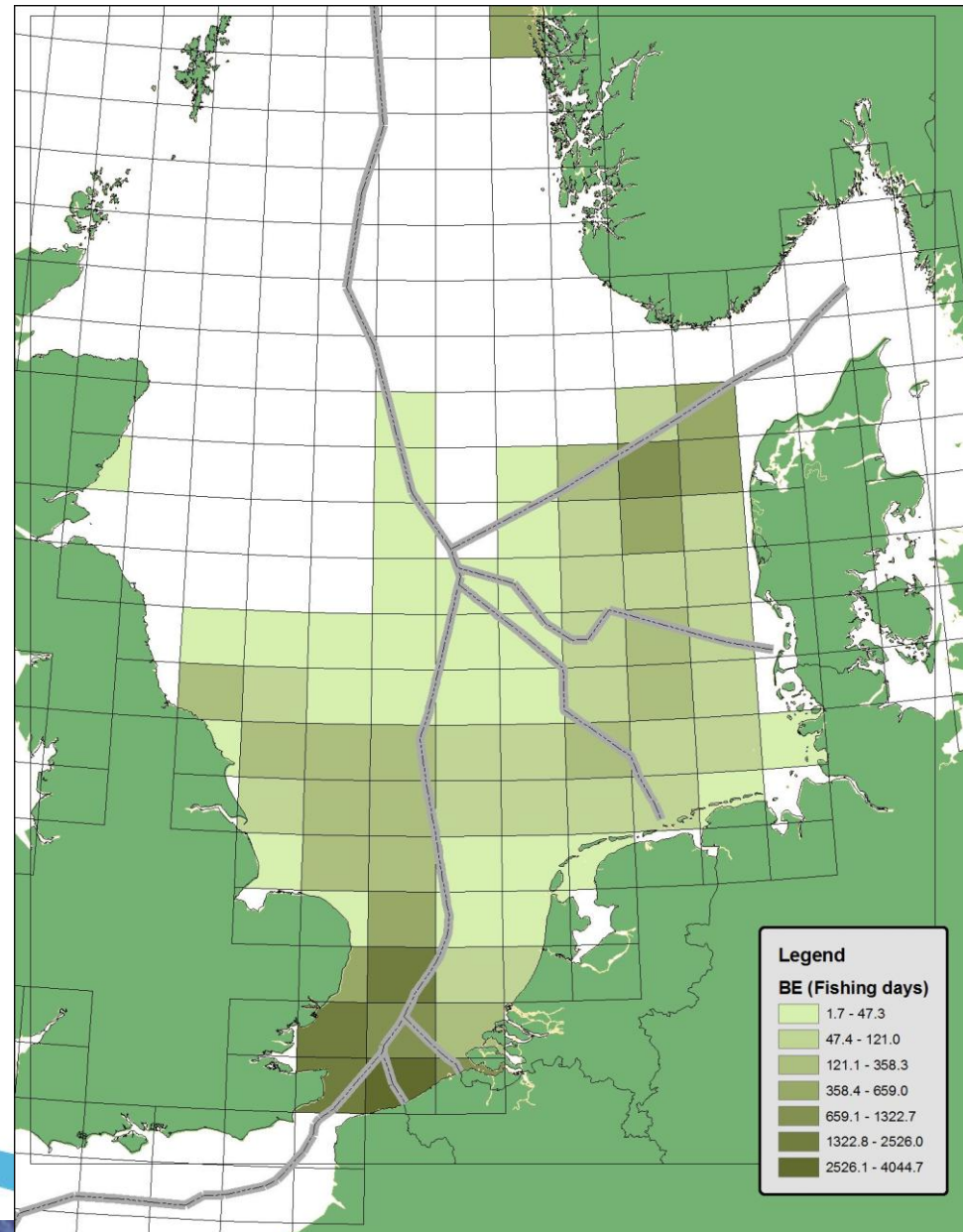
Fishing effort Germany

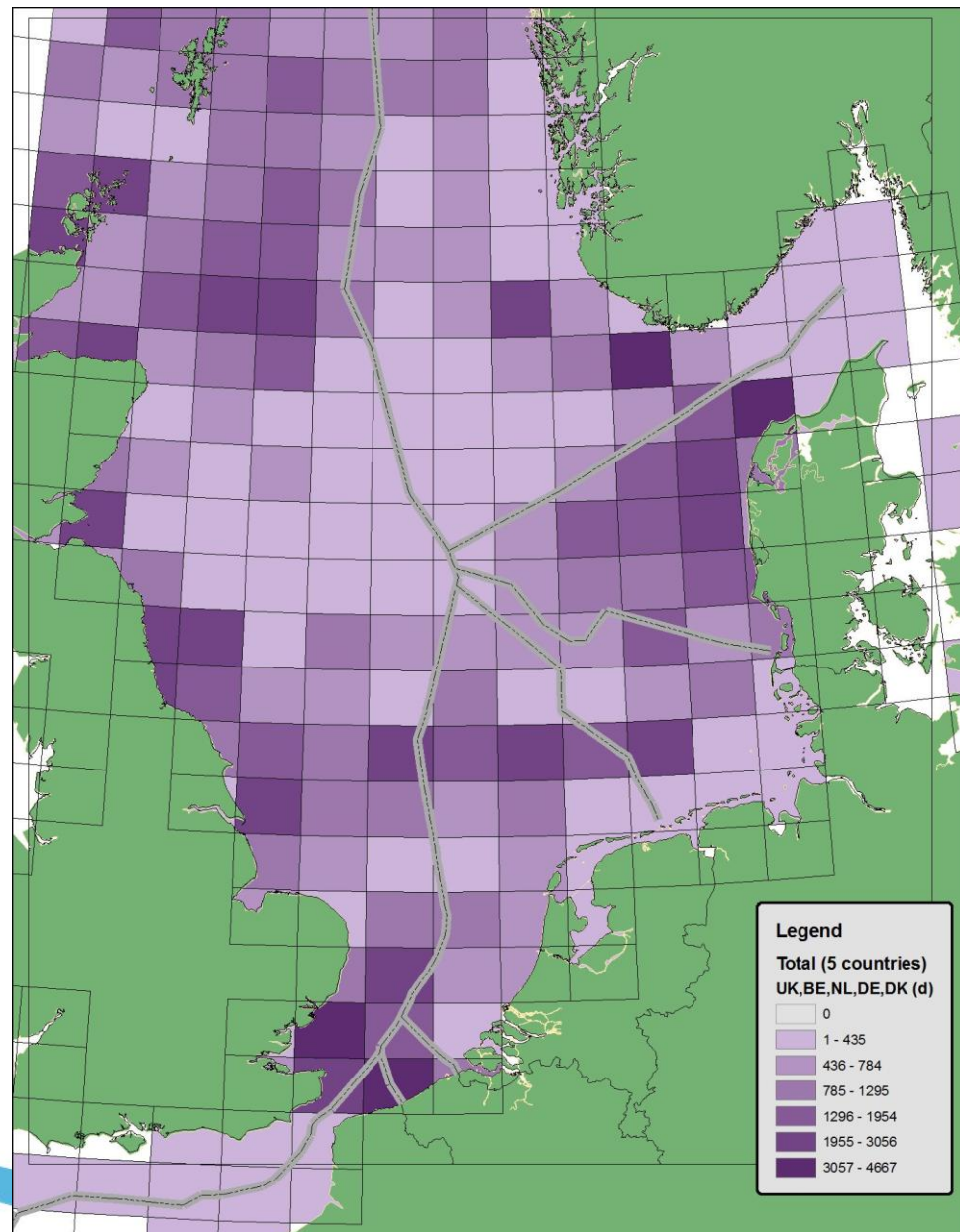


Fishing effort Netherlands



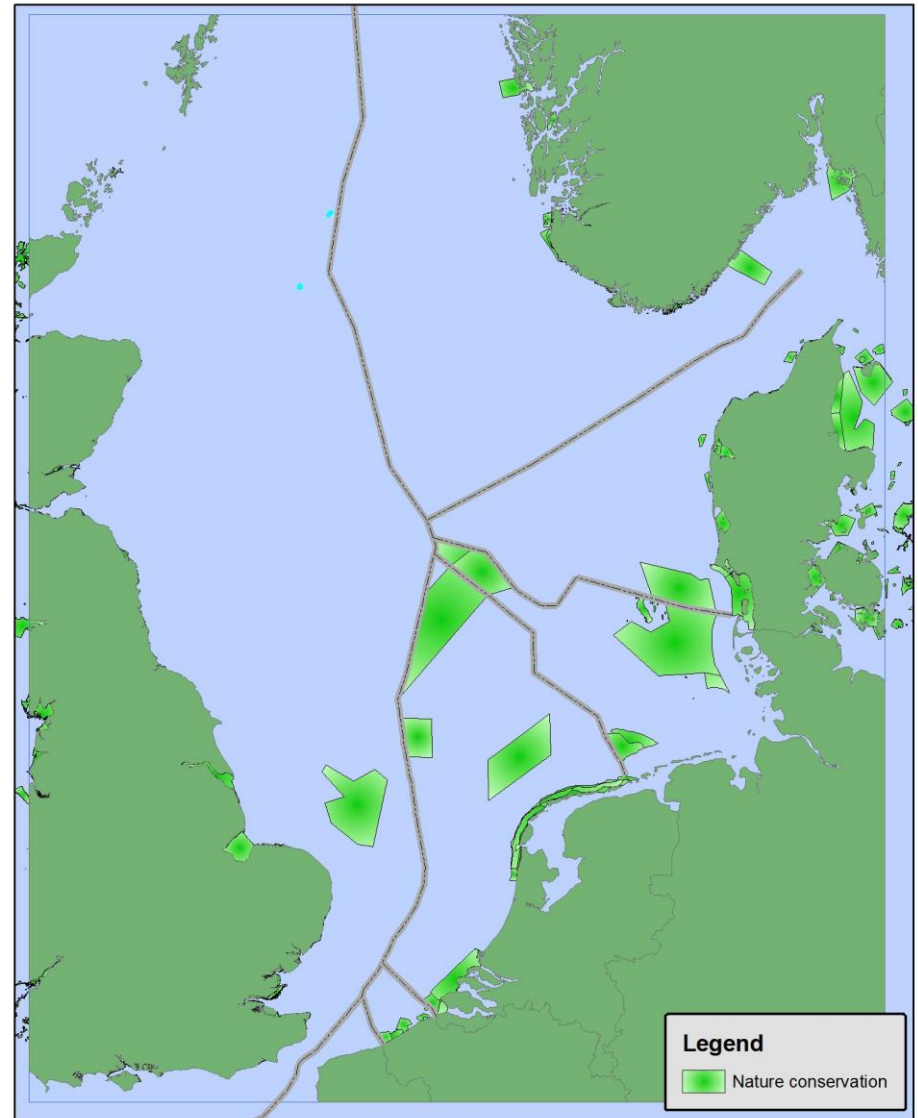
Fishing effort Belgium



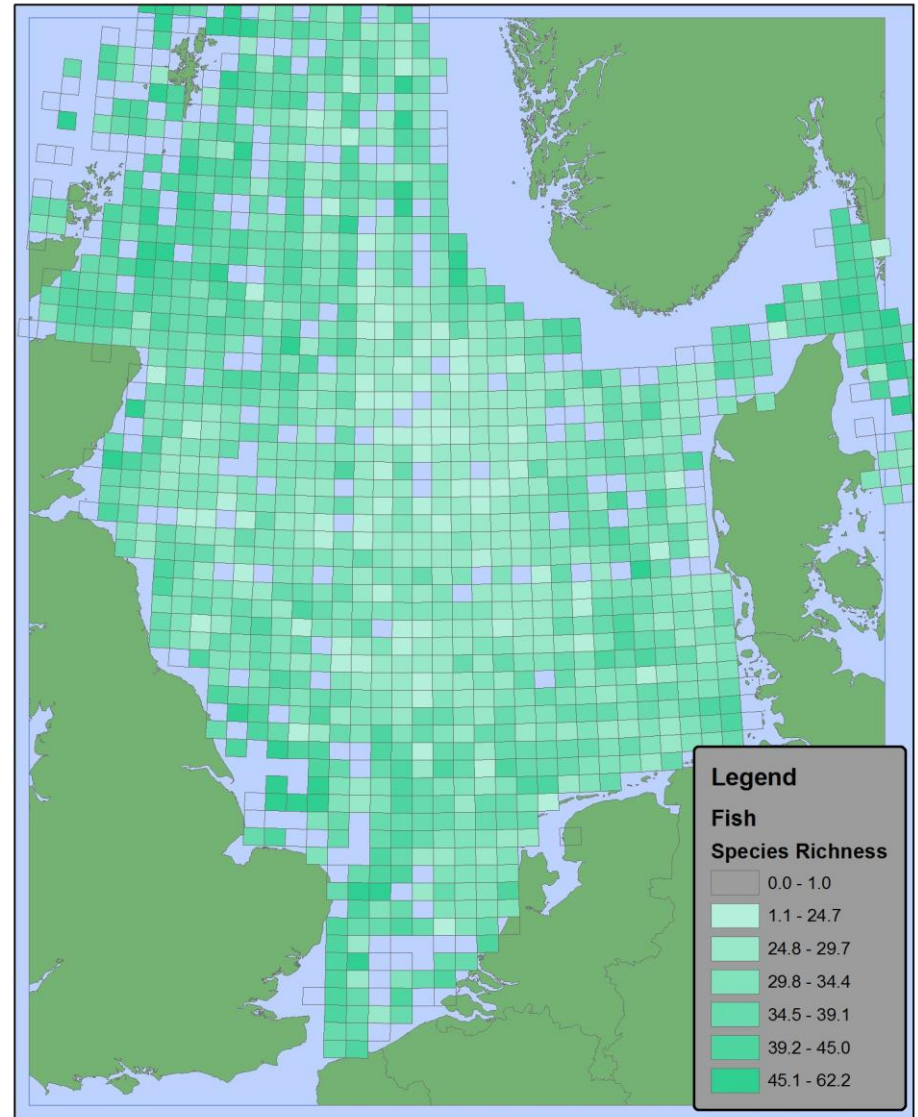


Nature conservation areas

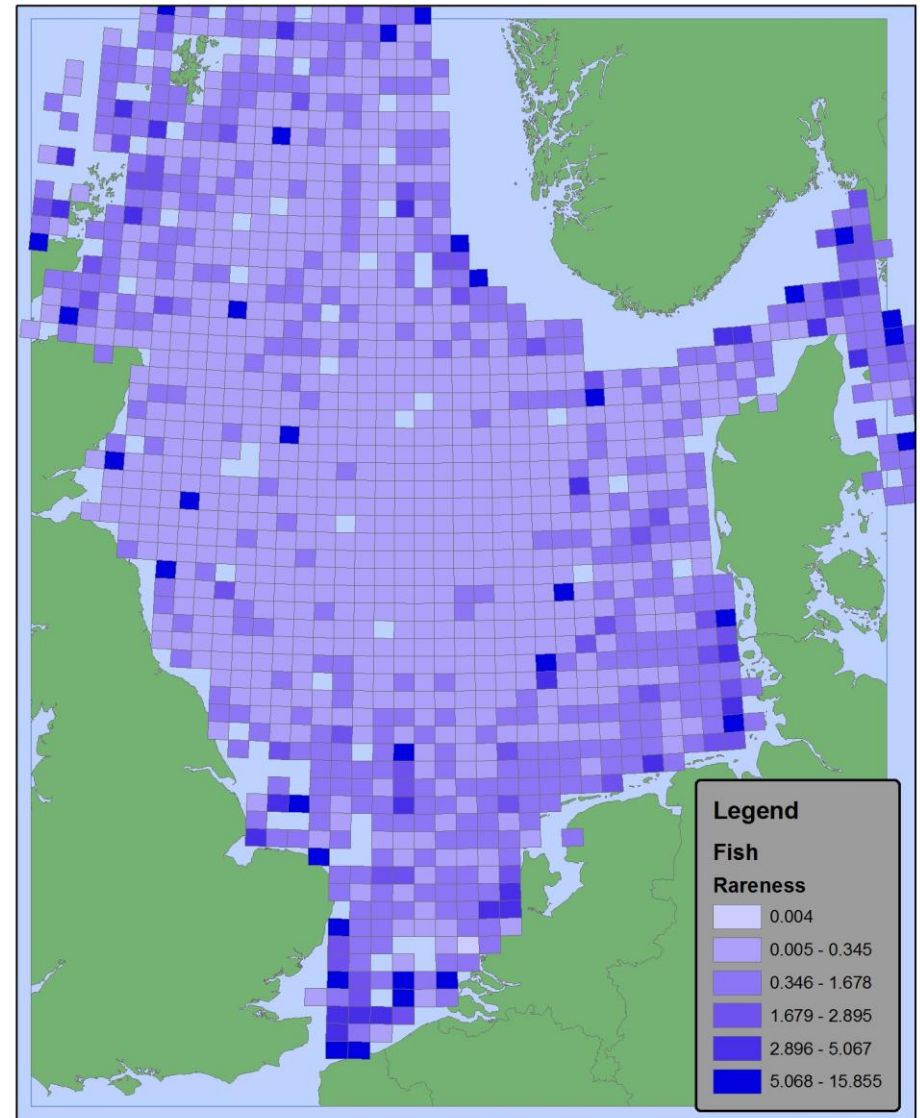
- Natura 2000
 - Bird directive
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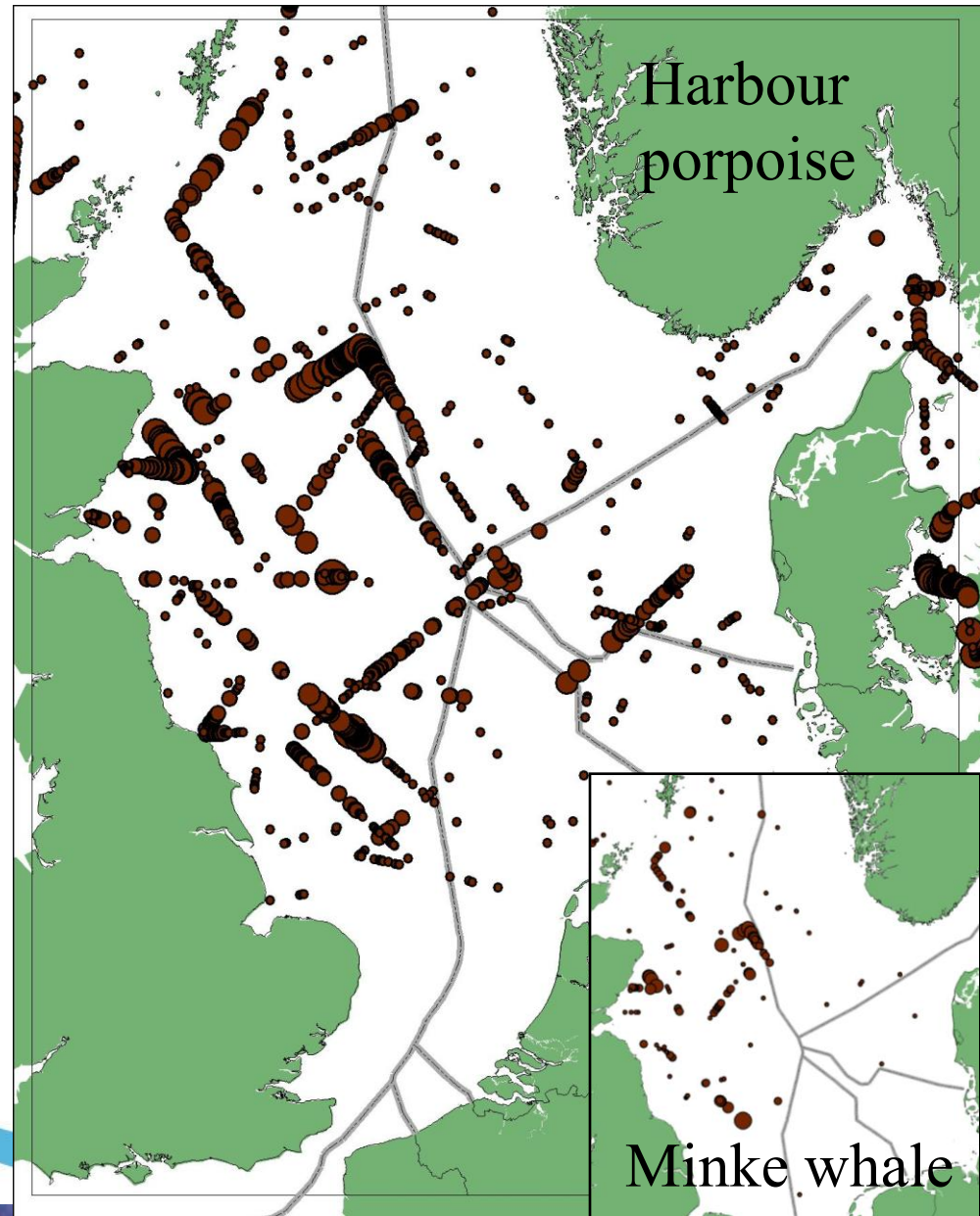
Fish community: Species richness



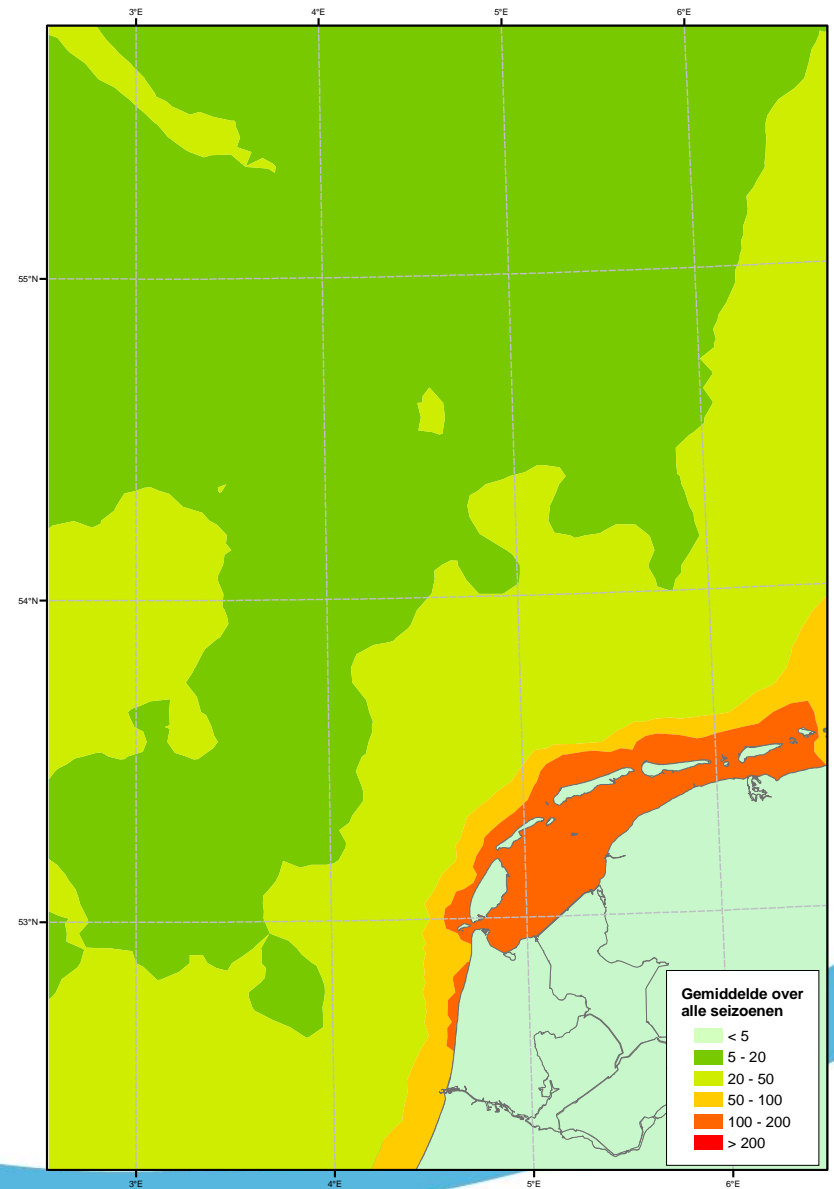
Fish community: Rareness



Sea mammals: Distribution of two species.

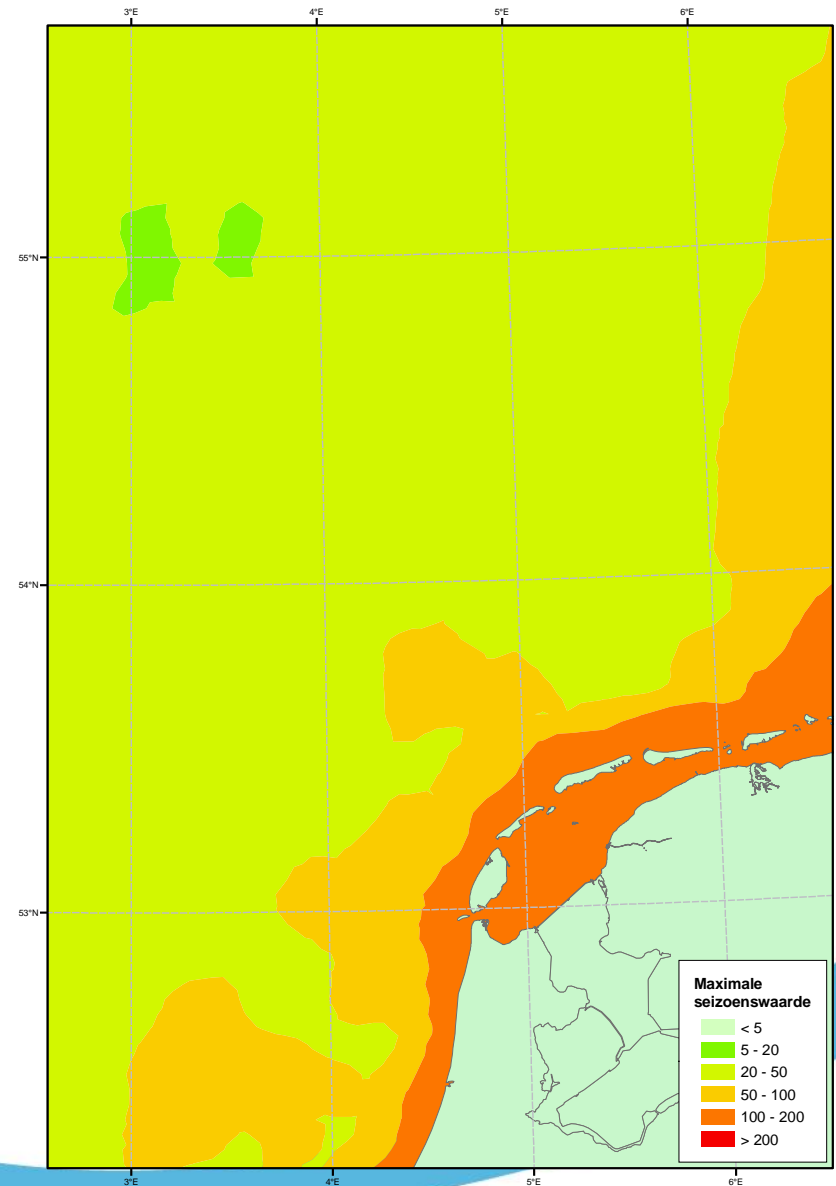


Bird value map I



Non-wind sea use functions

Bird value map II



Benthos:

UK:

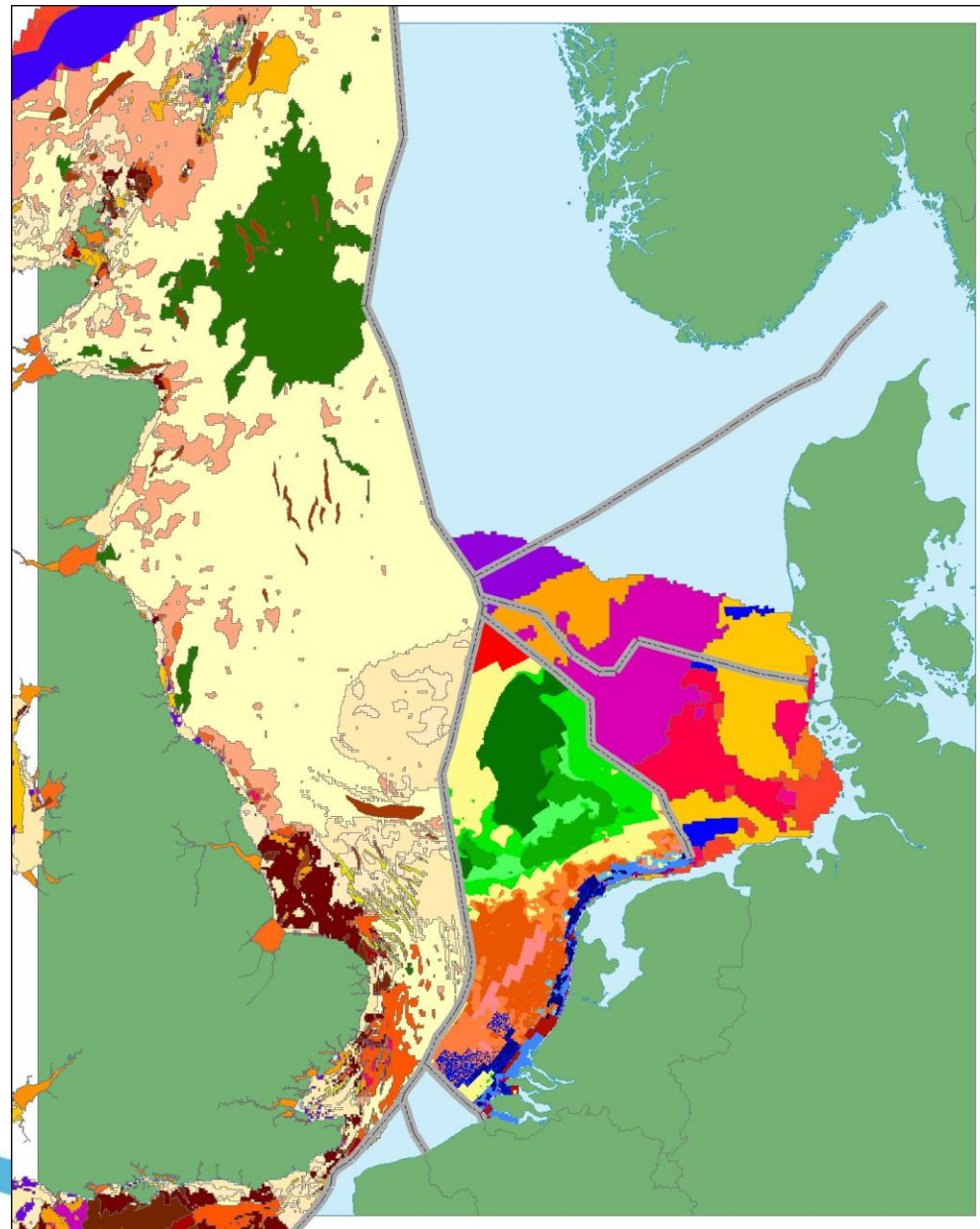
Marine landscapes

= physical environment

DE and NL:

Predicted habitat maps

= biological communities
predicted from relation with
physical environment.



Data sources I

- Shipping:
 - Kystverket, NO
 - ANATEC/GH, UK
 - MUMM, BE
 - RWS, NL
- Oil & Gas
 - NPD, NO
 - DTI/BERR, UK
 - KMS, DK
 - RWS, NL
- Pipelines
 - NPD, NO,
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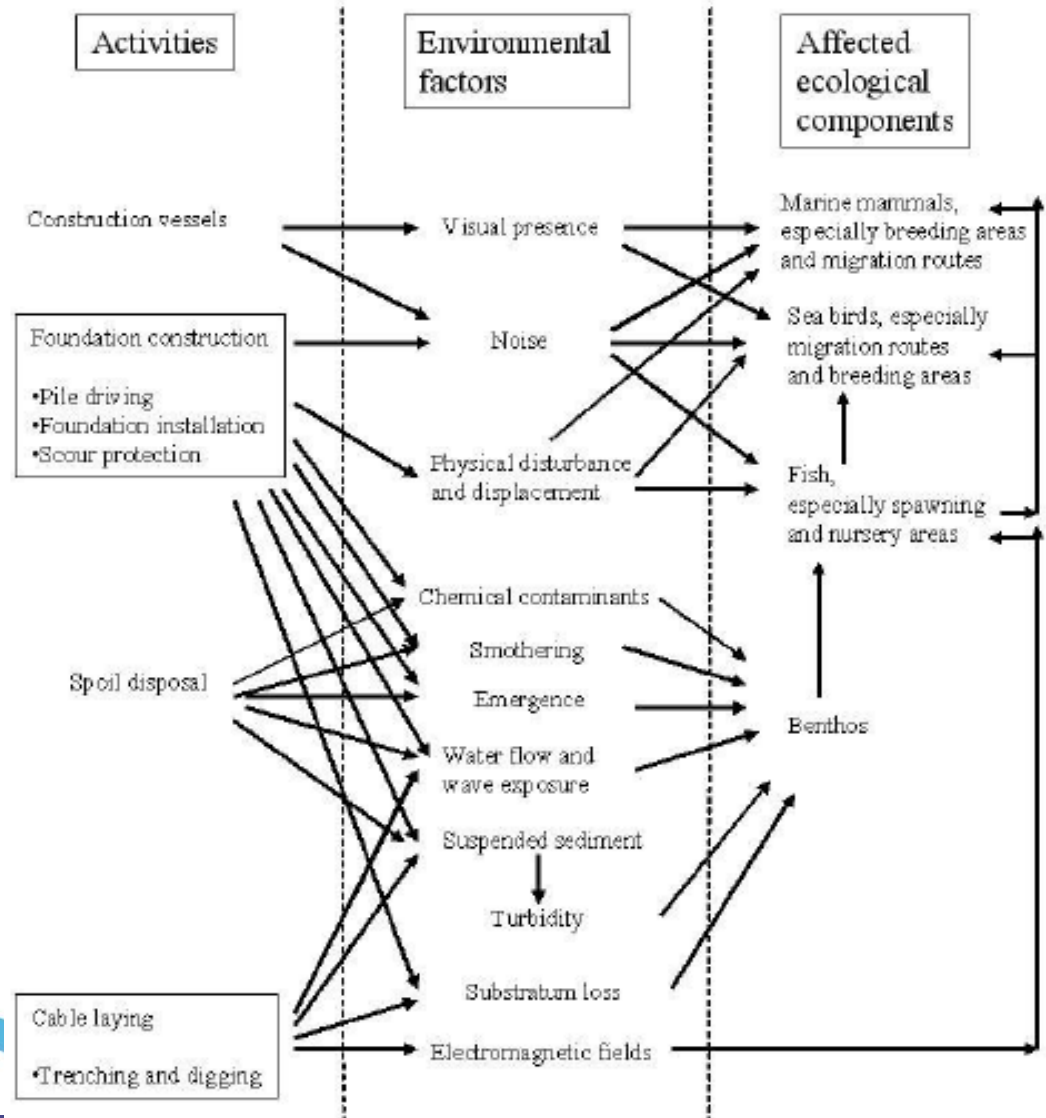
Data sources II

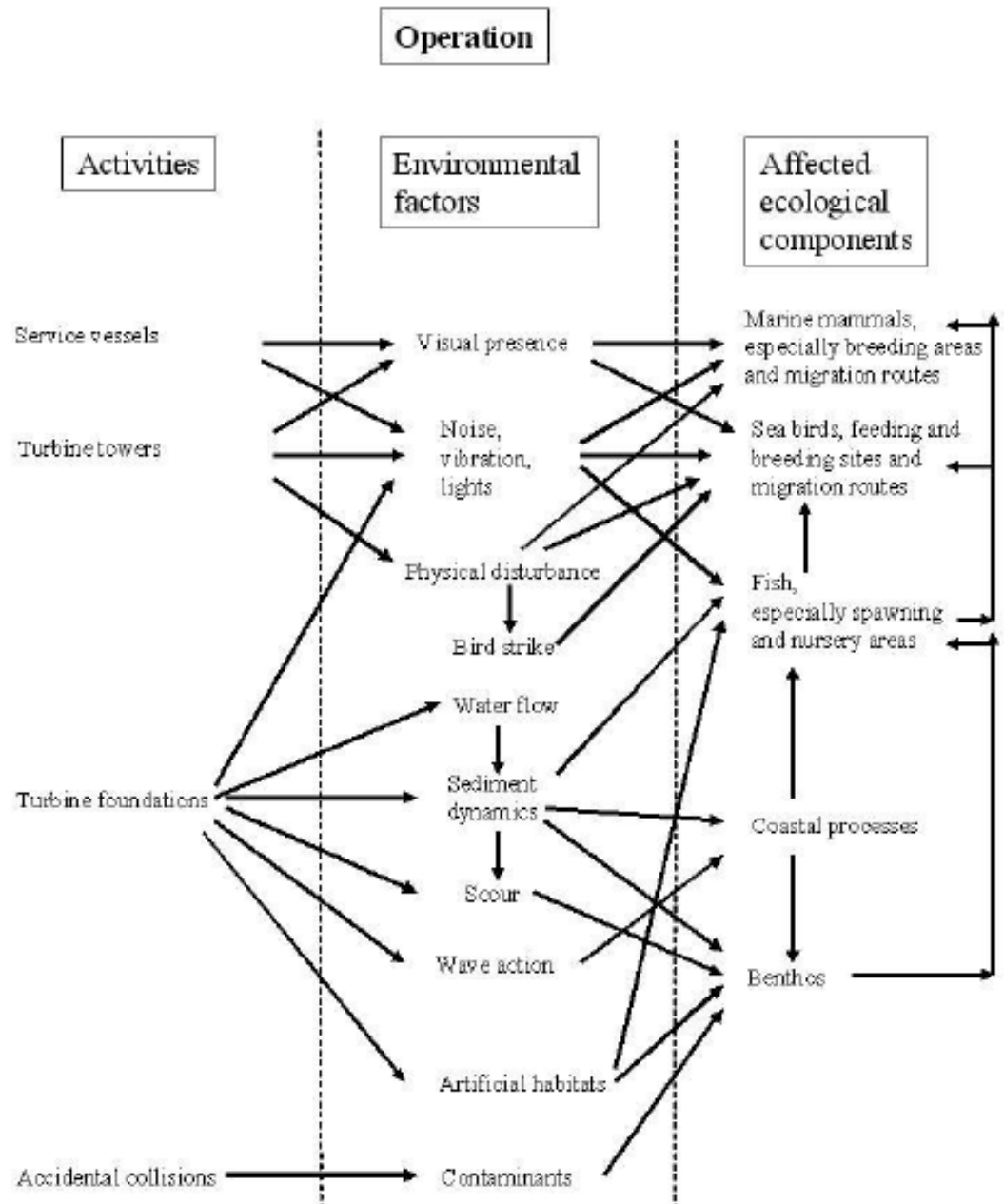
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Construction



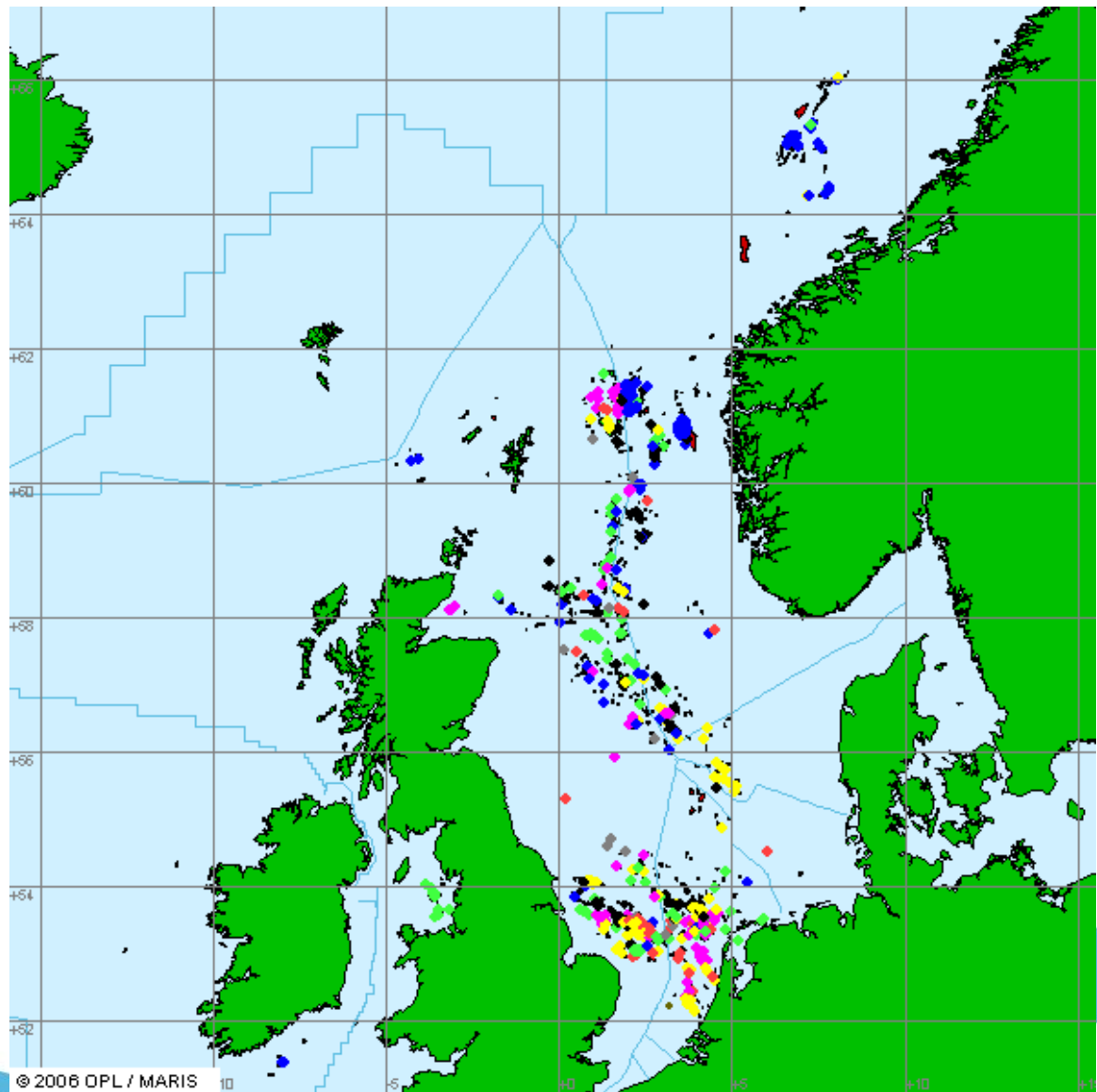


Decommisioning of offshore oil and gas platforms.

(www.decomplatform.com)

Year out of production

- 2001-2005
- 2006-2010
- 2011-2015
- 2016-2020
- >2021
- Unknown



Nature values on the Dutch EZ

- Protected areas
 - Natura 2000 areas
 - Other valuable areas
- Protected species
 - Bird and Habitat directives
 - OSPAR

Average sound exposure estimated: 247 dB re 1 μ Pa

This would cause a permanent shift
to the hearing sense of harbour porpoise
when present within a radius of 600-1100 m

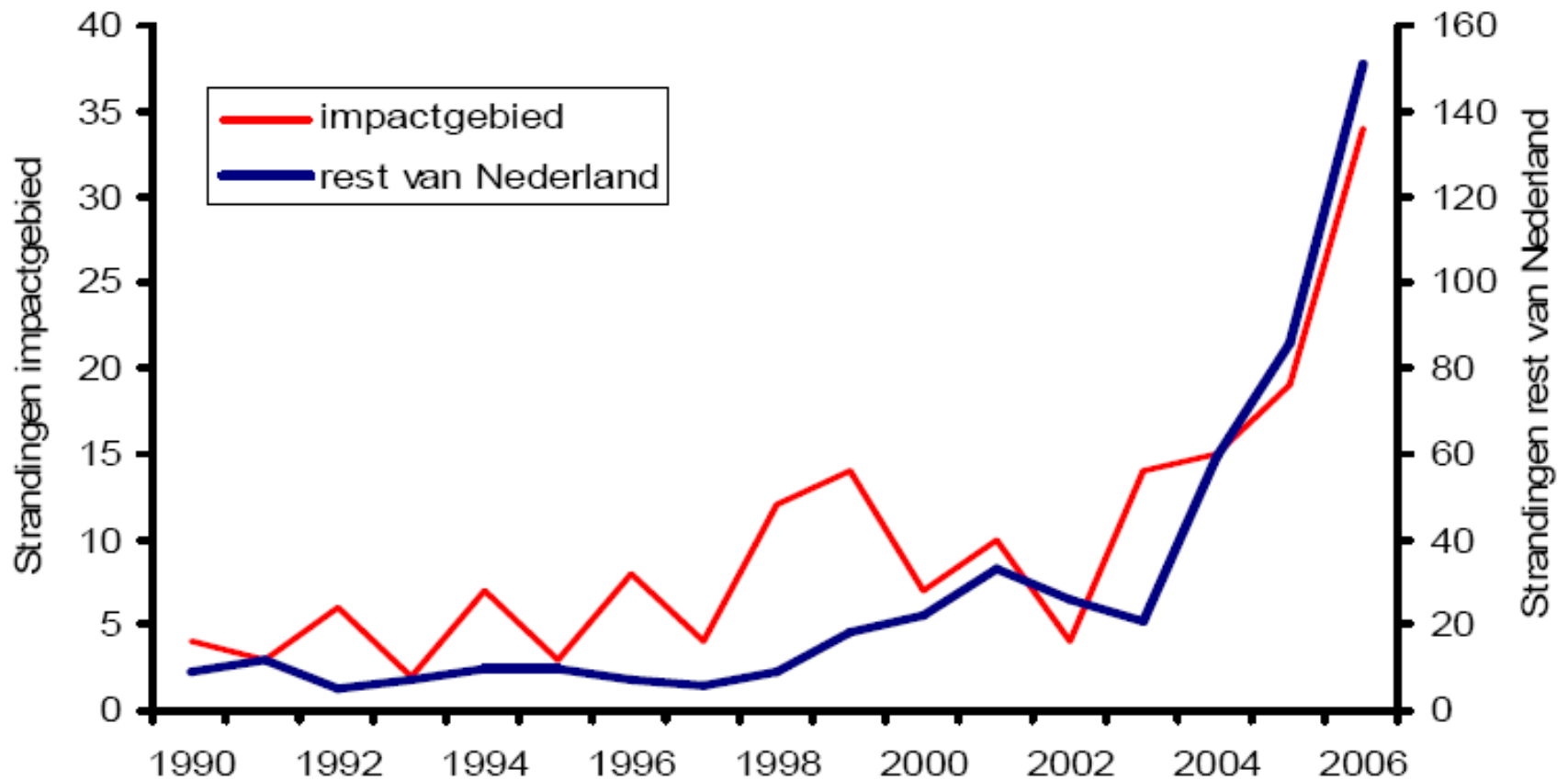
And a temporary threshold shift within
a radius of 3300-7200 m from the source,





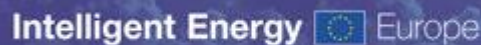
Did pile driving impact porpoises ?

No evidence found



Research Offshore Windpark Egmond aan Zee and We@Sea:

- Local birds
- Flying birds
- Sound
- Seals
- Porpoises
- Fish
- Benthos



Non-wind sea use functions

Monitoring program for Horns Rev and Nysted (DK)

(source: N.E. Clausen (2009))

- Hydrography & coastal morphology
- Sea floor flora & fauna
- Introduction of hard substrate habitat
- Fish
- Electromagnetic fields
- Sand eels
- Birds
- Seals
- Harbour porpoises
- Socio and environmental economic effects

Monitoring program for Horns Rev and Nysted (DK) (source: N.E. Clausen (2009))

Temporal variation

- EIA/Baseline
- Construction
- Operation

Spatial variation

- Impact area (wind farms)
- Reference area

Monitoring program for Horns Rev and Nysted (DK) (source: N.E. Clausen (2009))

Conclusions

- In general little impact found on marine life
- Birds seem to adjust and apparently habitat loss can be avoided
- Migrating birds avoid flying into OWPs (low collision risk)
- Harbour porpoises return to the site after construction
- Seal behaviour is not affected
- Artificial reef leads to added biodiversity
- In general public acceptance
- Study cumulative effects in case of planning more OWPs in an area

Issues of special attention from an ecological perspective (source: Lindeboom, 2009)

- Building techniques
- OWP planning
- Cumulative effects
- International coordination

Recommendations for spatial planning of OWPs from an ecological perspective (source: Prins, 2008)

OWPs more than a few tenths of kilometers from the coast because:

- less effects on fish larvae
- reduce chance of disturbance of seal migration routes by ramming
- reduced habitat loss for coastal birds and migratory sea birds
- reduced risk for bird deaths due to collisions