



INSTITUTE OF MARINE RESEARCH



Feedback on the Estonian monitoring programme and the programme of measures

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Outline of the presentation:

Feedback on the newly developed Estonian programme

Norwegian approach to

Marine protected areas

Underwater noise

Marine litter

Feedback on the Estonian MFSD programme

- Generally, the Estonian Marine Strategy programme and the new proposed measures is feasible and provides severe improvements on the basis of sound scientific knowledge and expertise !
- Your experts have certainly conducted a very high quality activity!
- Those measures will certainly complement the already developed programme which are although with some lacking issues on a high international standard and become more in line with international activities within the last years.

Feedback on the newly developed Estonian programme

- From time to time the ambition of the programme of measures is quite high in view of establishing the aimed changes in quite a short time frame for reaching the GES in 2018/2020
- It is important to continue with the activities also after this project now is coming to an end.
- the continuation of the established programme and the improvement that is proposed as well as the incorporation of the new measures is not conducted and supported financially by itself
- It was challenging with only little english material available to effectively contribute to the improvement of the programme. Latest the newly developed measures provided, seem to be not consistent with what was presented today
- So, in case you will welcome the feedback of the international community also in future, it would be helpful to improve the programme descriptive information that is available

Feedback on the newly developed Estonian programme

Cont'd

New measures:

- 1. Protected Marine Areas
 - Plan to establish at least two protected areas by 2020
 - Ambitious plan taken into account the activities to be conducted until establishment
 - The plan is missing to formulate an aim for the extend of the Protected Marine Area
 - Out from the formulation it remains difficult to examine, whether you would like to establish an MPA with the international specifications
- 2. The ringed seal protection plan
 - For the english description it remains desireable to make the relation between this measure and the Protected Marine Area measure more clear

Feedback II

New measures:

- 3. Aquaculture
 - This measure deals with a very important subject and is necessary to ensure the limitation of the environmental impact on wild living resources in the aquacultural regions.
 - Also here the aim to implement the measure is an ambitious plan taken into account the activities to be conducted until establishment in 2020

Feedback III

New measures:

- 4. Non indigious species
 - The recommendation for that measure is to extend the information to the shipping sector and also to the general public, maybe via flyers that are distributed at the same time as size limits for recreational fishing is distributed
- 5. Implementation of the Ballast Water Convention
- 6. Catch limitation
 - Both measures are timely, especially the introduction of catch limitation may have a large positive impact when the measure is effective.
 - Maybe closing of especially vulnerable spawning areas should be considered
 - The Mean Maximum length indicator for the different species seem to be questionable

Feedback IV

- 9. Marking fishing gear
- 10. LNG as ship fuel
- 11. Reduction of dumping untreated wastewater from ships into the sea
- 12. Treatment of stormwater before release into sea
- All the measures reduce the impact on the environment and are fully supported to be established without change

Feedback V

New measures:

- 7. Use of low value fish
 - The incorporation of support for developing higher level products from low value fish (cosmetics etc) seems to be recommendable.
- 8. Optimising fishing capacities
 - This measure has had a quite successful application in terms of recovering of the pelagic and demersal fish species in the North Sea region where now the most of the species are at the limit reference points after halving the fishing pressure and so fishing on F_{MSY}

Feedback VI

New measures

- 13. Control of impact by ship-generated waves
 - That is surely an important issue, but nevertheless it remains unclear for an foreigner whether it is worth being part of the content of the Marine Strategy measures programme
- 14. Improving marine pollution control capability
 - This measure deals with an very important issue of technical infrastructure limiting the potential hazardous impacts of accidents and is necessary to be implemented
- 15. Control of bunkering environmental risks
 - Important for the avoidance of harm for the Nature near bunkering.
 - Is the financial support implemented in the actual budget ?

Feedback VII

New measures

- 16. Action plan on marine litter reception
 - Important measure. It is especially welcomed that it is desirable to incorporate the aim for establishment of a common standard
- 17. Information dissemination and preventive activity related to marine litter
- 18 Marine litter chapter of the Waste Management Plan
 - Both important measures to be incorporated into the management plans !
- 19. Establishment of an impulsive sound register
 - Important measure to improve knowledge on the impact of underwater noise on resources. Recommended to be incorporated without changes.
 - Impulsive noise should be avoided when important species are spawning

Feedback VII

- Facing that the nature is actual subject to change caused by Changing Climate it is recommended to include measures dealing with this issue
- Some measures are more expensive by its nature, so it seem to be unfair to use socioeconomic impact studies, where the more costintensive measures are declining in their score at least what is understand from the information given

Outline of the presentation:

Feedback on the newly developed Estonian programme

Norwegian approach to

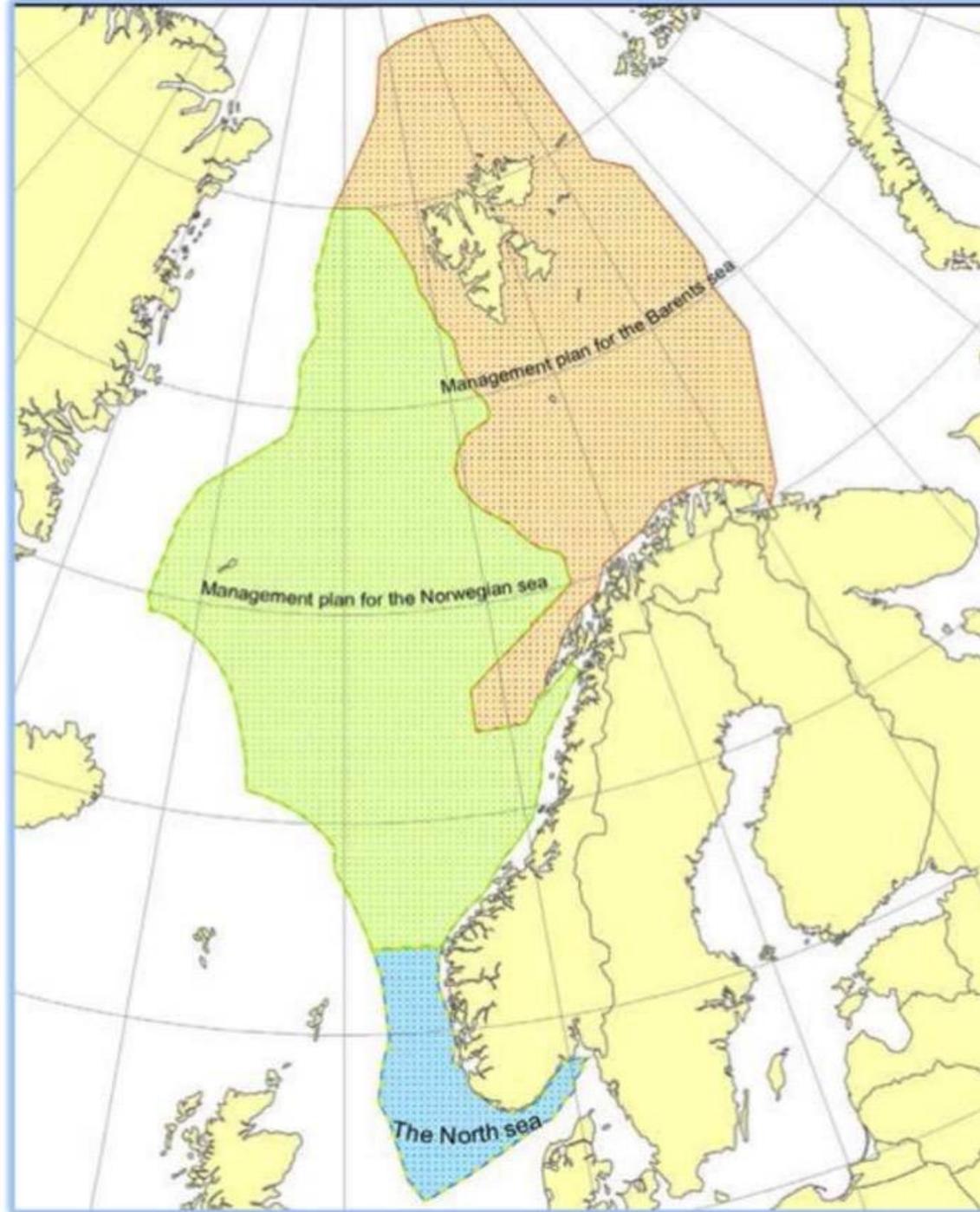
Marine protected areas

Underwater noise

Marine litter

- Norway has not implemented the MSFD
 - Nor is Norway bound to do so.
 - However Norway has since 2002 worked on developing holistic management plans, with an indicator based monitoring program for its marine areas.
- Developed management plans for the three Norwegian areas
 - The Barents Sea and the Lofoten area (first version adopted by the Norwegian Parliament in 2006, updated 2010),
 - The Norwegian Sea (adopted by parliament in 2009, scheduled update 2015) and
 - The North Sea and Skagerrak (adopted by parliament in 2013).
 - A lot of figures taken from the management plan for the presentation

The Norwegian management plan areas



Marine Protected Areas OSPAR

a total of 282 sites nominated
territorial waters, 276 sites

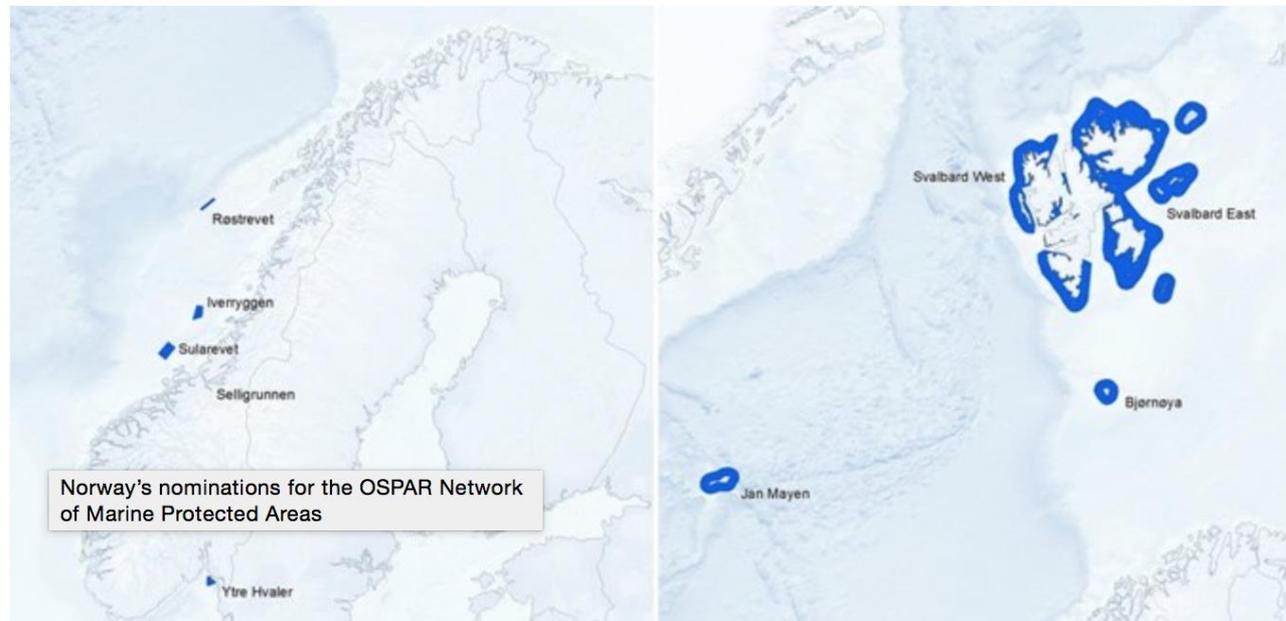
Rest of 6

four under split jurisdiction and two in areas beyond national jurisdiction.

total area of 476 198 km².

area of 189 128 km²

area of 287 070 km²:



Norway's nominations for the OSPAR Network of Marine Protected Areas

OSPAR's goal was to achieve an ecologically coherent network of well-managed Marine Protected Areas by 2015.

This has not yet been achieved.

2005
36 Norwegian areas considered
Total area 84898 km²

Svalbard and Bjørnøya
Coral reef complexes
Ytre Hvaler
Jan Mayen

Particularly vulnerable areas (SVO)

1. *Bremanger-Ytre Sula*
2. *Korsfjorden*
3. *Karmøyfeltet bank area*
4. *Outer Boknafjorden/Jærestrendene protected landscape*
5. *Listastrendene protected landscape*
6. *Siragrunnen bank area*
7. *Skagerrak transect*
8. *Outer Oslofjord*
9. *The Skagerrak*
10. *Sandeel habitat north*
11. *and south*
12. *Mackerel spawning grounds*



Bremanger-Ytre Sula (1): breeding, feeding, moulting, passage and wintering area for seabirds, common seal whelping area. **Listastrendene protected landscape (5):** very important passage and wintering area for seabirds, wide variety of habitats.



Korsfjorden: good example of islands and skerries along Western Norway's coastline, with shell sand deposits and large stands of kelp forest (habitat and shelter for fish larvae).



Karmøyfeltet (3) and Siragrunnen (6) bank areas: high biological production, spawning grounds for Norwegian spring-spawning herring and retention areas for eggs and larvae. Important feeding areas for predators. Karmøyfeltet is a regularly used shrimp fishing ground, and Siragrunnen one of the most important lobster areas in the region.

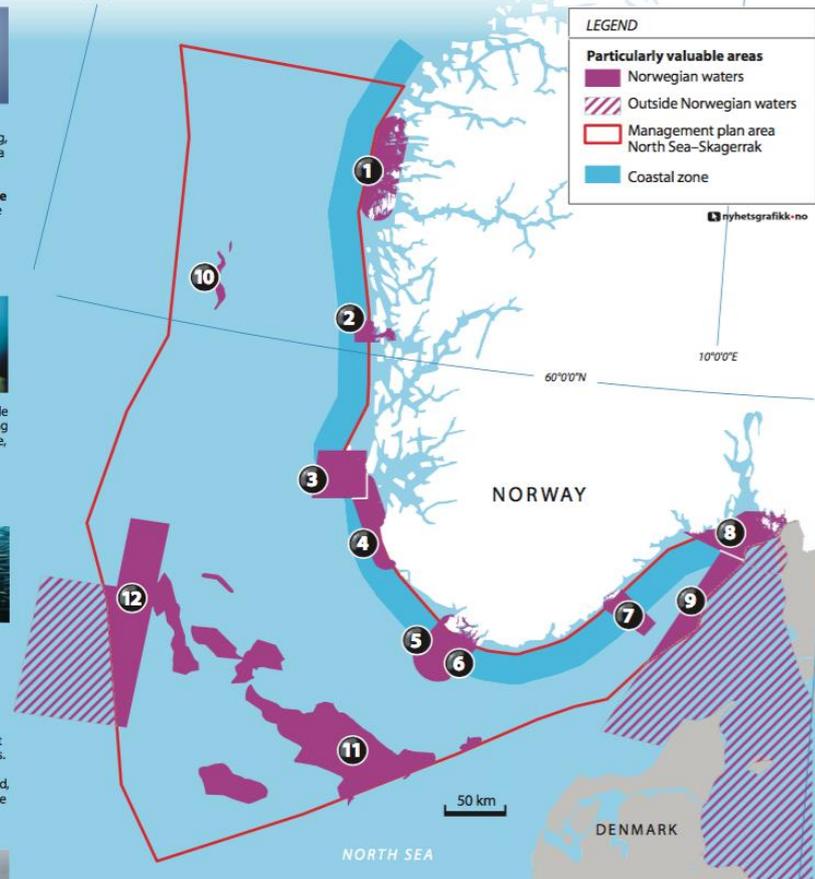


Outer Boknafjorden/Jærestrendene protected landscape: important breeding, feeding, moulting, passage and wintering area for seabirds, whelping ground for common and grey seal.



Skagerrak transect: habitat diversity, landscapes, cultural history, geology and bird life representative of the Skagerrak as a whole. Includes intertidal zone, brackish water, seaweed zone, eelgrass beds, soft-bottom areas, hard-bottom areas with kelp forests and corals.

0°0'0"



Outer Oslofjord: includes Ormø-Færder protected landscape and Ytre Hvaler national park. Breeding, passage and wintering areas for seabirds, and the world's largest inshore cold-water coral reef (Ytre Hvaler).



Skagerrak: moulting and wintering area for a variety of seabirds. Particularly important for common guillemot, a critically endangered species.



Outer Oslofjord: includes Ormø-Færder protected landscape and Ytre Hvaler national park. Breeding, passage and wintering areas for seabirds, and the world's largest inshore cold-water coral reef (Ytre Hvaler).



Mackerel spawning grounds: areas where mackerel spawn and eggs and larvae drift with the currents. Mackerel spawn and feed very near the surface and are vulnerable to surface pollution.

LEGEND	
	Particularly valuable areas
	Norwegian waters
	Outside Norwegian waters
	Management plan area North Sea-Skagerrak
	Coastal zone

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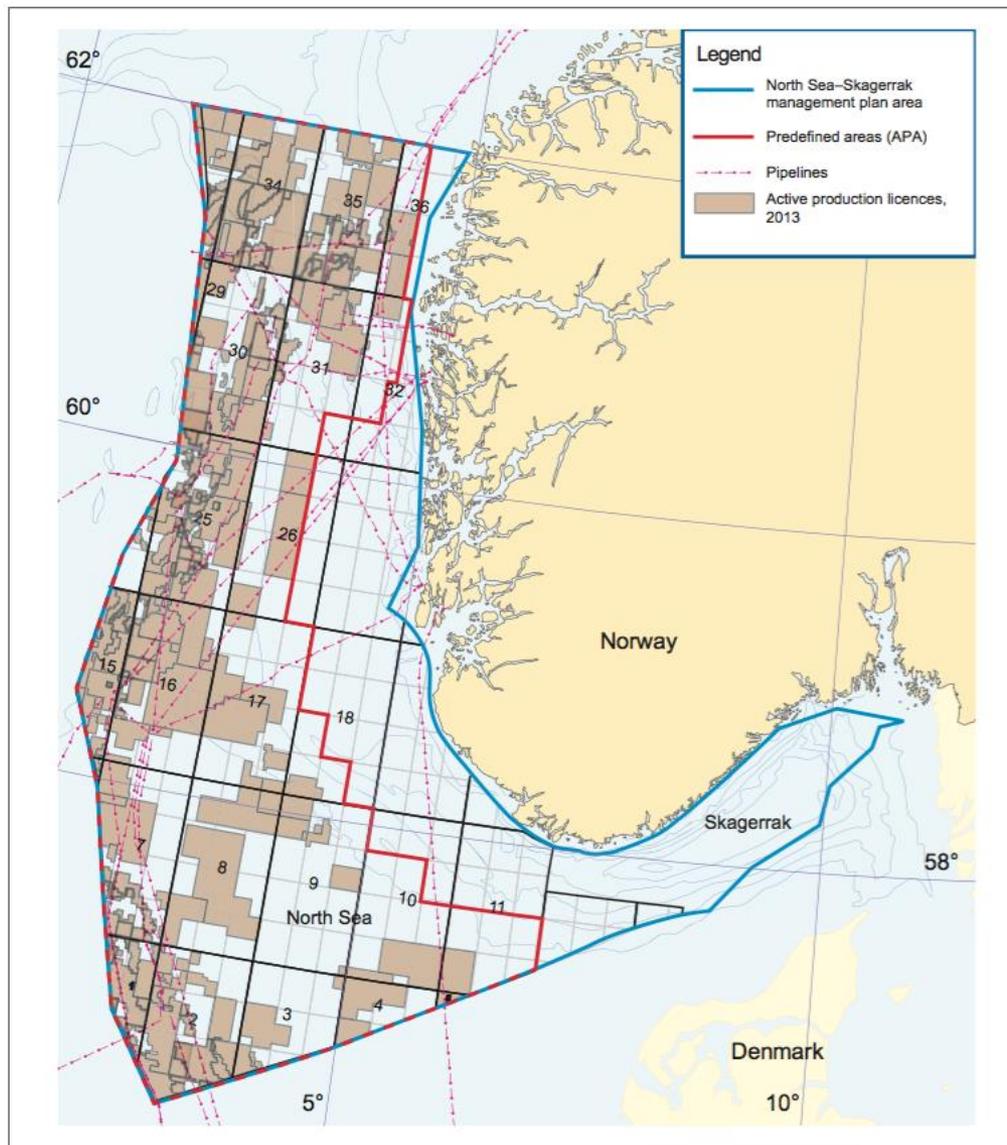
Particularly valuable and vulnerable area	Why area is classified as valuable	Vulnerability to oil spills
1. Bremanger–Ytre Sula	Breeding, feeding, moulting, passage and wintering area for seabirds; common seal whelping area	High
2. Korsfjorden	Representative of islands and skerries off Western Norway: wide variation in habitat types, landscapes, geology, history; kelp forests, birds	Less vulnerable than areas 1, 4, 5, 8 and 9
3. Karmøyfeltet bank area	High biological production; spawning grounds for Norwegian spring-spawning herring	Vulnerable, but less so than areas 1, 4, 5, 8 and 9
4. Boknafjorden/Jærstrendene protected landscape	Breeding, feeding, moulting, passage and wintering area for seabirds; whelping ground for seals	High
5. Listastrendene protected landscape	Wide variety of landscape and habitat types; passage and wintering area for seabirds	High
6. Siragrunnen bank area	Spawning grounds for Norwegian spring-spawning herring and retention areas for eggs and larvae; feeding area for birds	Vulnerable, but less so than areas 1, 4, 5, 8 and 9
7. Skagerrak transect	Representative of the Skagerrak. Variety of habitats and landscapes; geologically and historically important; important for kelp and birds	Less vulnerable than areas 1, 4, 5, 8 and 9
8. Outer Oslofjord	Breeding, passage and wintering area for seabirds; world's largest known inshore cold-water coral reef	High
9. Skagerrak	Moulting and wintering area for seabirds	High
10. Sandeel habitat north (Viking Bank)	Habitat and spawning grounds for sandeels and feeding area for whales	Vulnerable, but less so than areas 1, 4, 5, 8 and 9
11. Sandeel habitat south	Habitat and spawning grounds for sandeels and feeding area for whales	Vulnerable, but less so than areas 1, 4, 5, 8 and 9
12. Mackerel spawning grounds	Spawning grounds for mackerel	Vulnerable, but less so than areas 1, 4, 5, 8 and 9

- Focal point of the Norwegian activities to reduce the potential impact lie on on the vulnerability of particularly valuable areas to:
 - petroleum activities
 - maritime transport
 - Fisheries
 - New energies in the ocean
 - land-based and coastal activities
 - Climate and long-range transboundary pollution.

Noise pollution		Environmental impacts	Comments
Petroleum (seismic)	Seismic and sonar	<i>Minor</i> impacts on plankton, fish (sandeel, Norway pout, saithe, herring, cod, mackerel, haddock)	
Petroleum	Pile-driving, propeller noise, etc	<i>Minor</i> impacts on plankton, fish (sandeel, Norway pout, saithe, herring, cod, mackerel, haddock)	
Shipping		<i>Minor</i> impacts on marine mammals (propeller noise)	Limited knowledge base
Offshore renewable energy production		<i>Minor</i> impacts on marine mammals, plankton	Establishment of offshore wind farms may cause noise pollution, especially during construction. Little is known about the impacts, and they have only been assessed for marine mammals and plankton. Impacts on fish not assessed
Land-based and coastal activities	Disturbance during the breeding season	<i>Moderate</i> impacts on seabirds (gulls, cormorant/shag and common eider)	Applies to coastal seabirds that are disturbed by people during the breeding season

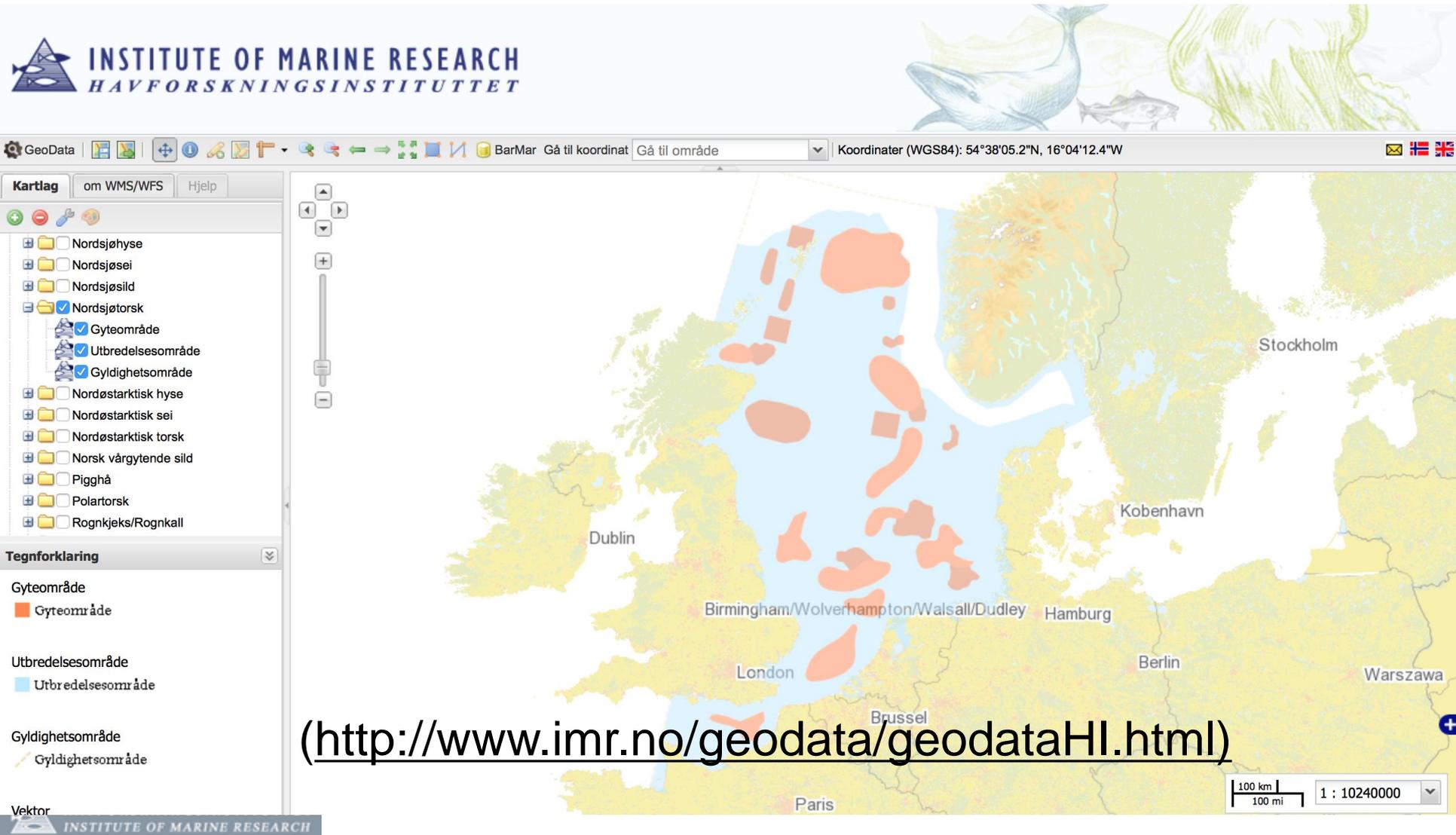
Active petrol production in the North Sea (Norwegian area) 2013

All those fields are seismically surveyed for observing changes in bottom and reservoir structure left capacity etc



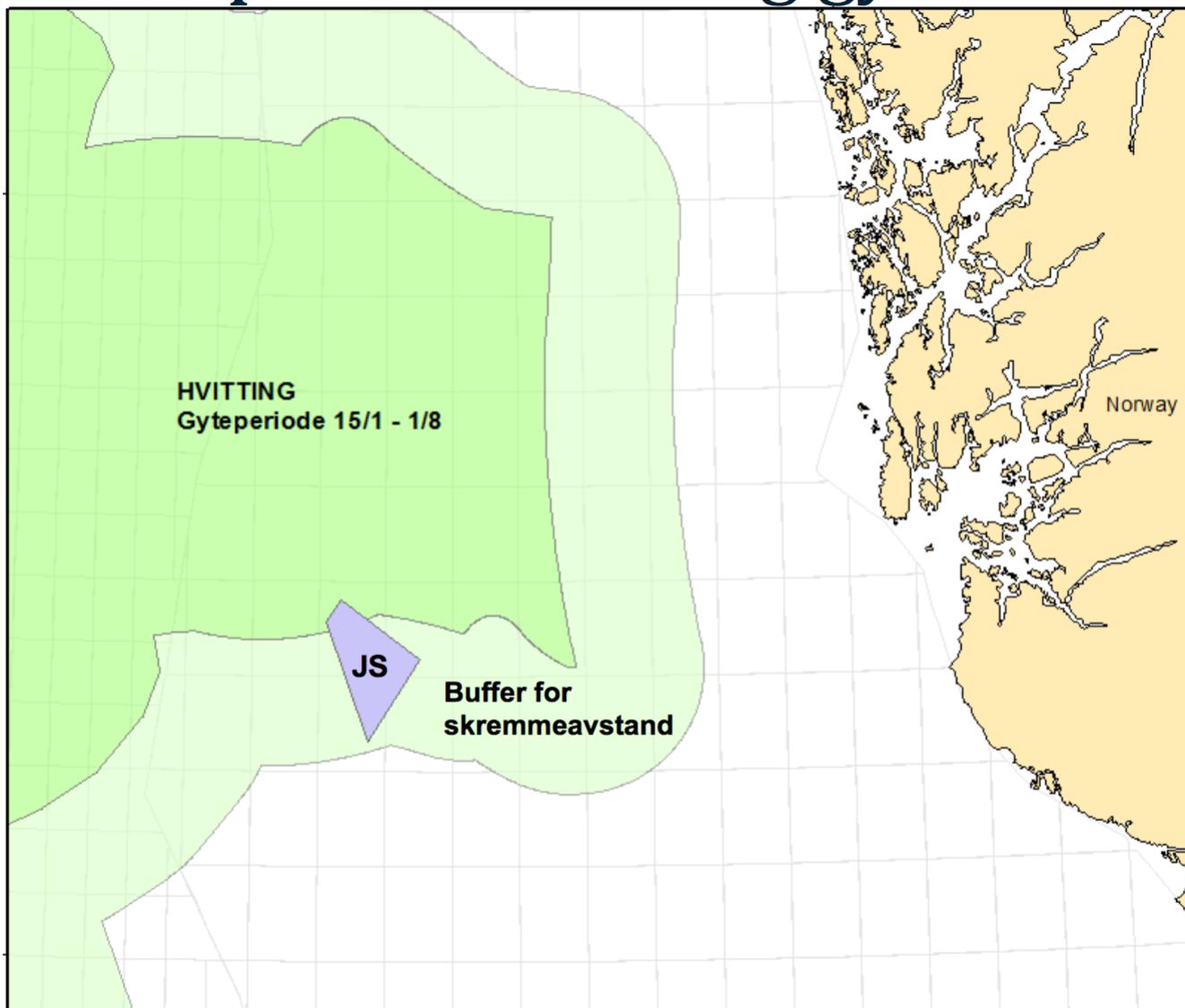
Spawning grounds and distribution maps

Example North Sea Cod



<http://www.imr.no/geodata/geodataHI.html>

Overlapping seismic with spawning fields



Whiting

18 NM
Scare
distance

Noise caused by Shipstraffic

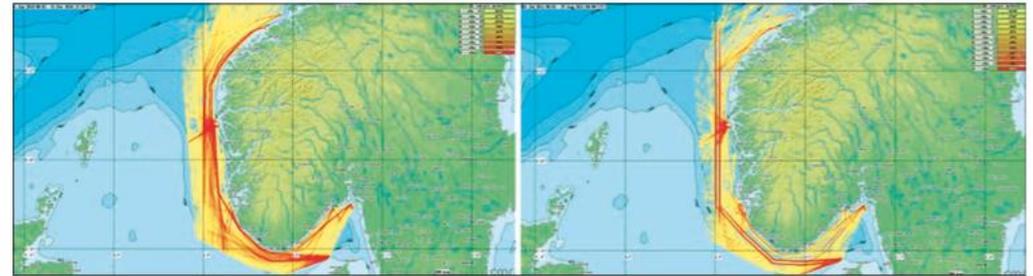
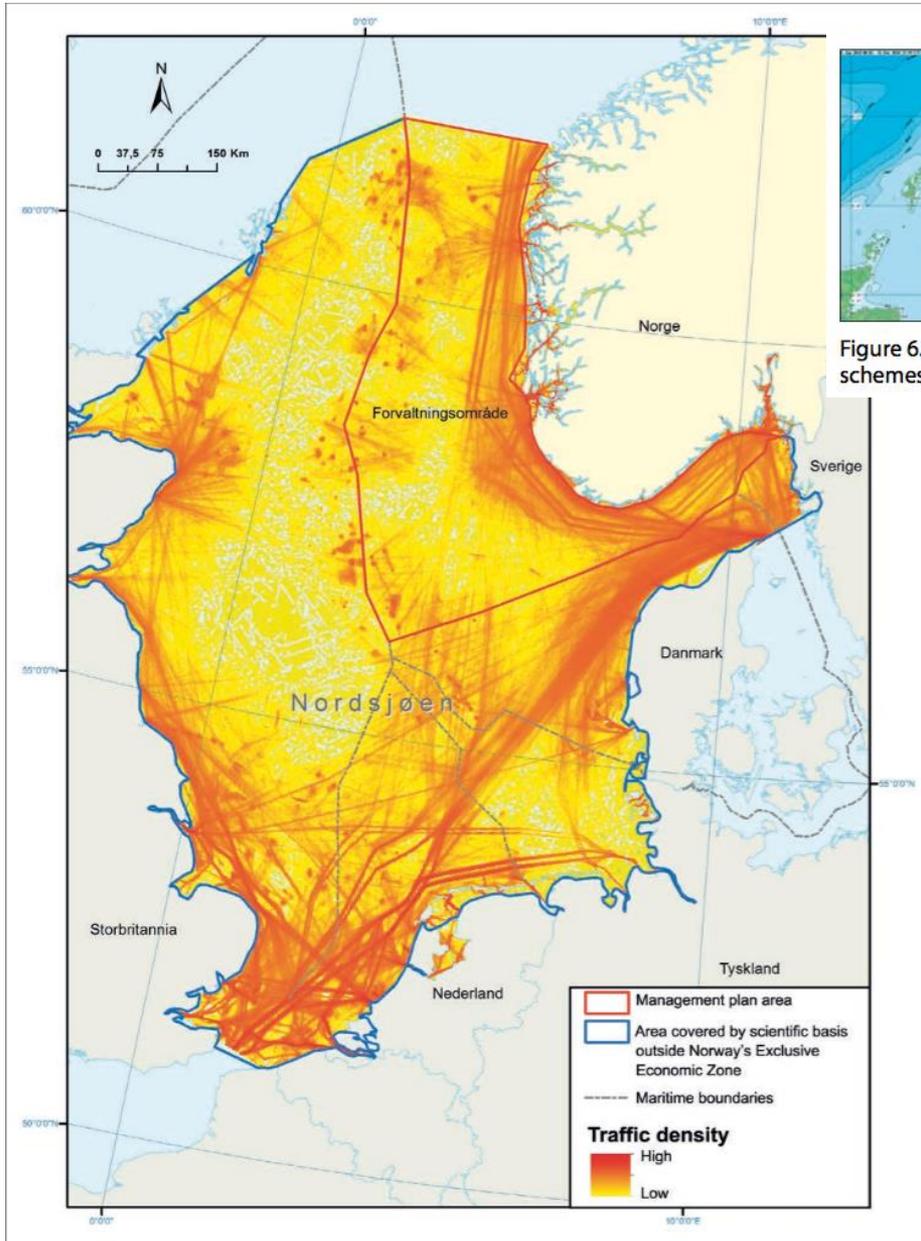


Figure 6.1 Traffic patterns before (left) and after (right) the introduction of the traffic separation schemes

Reduction of noise caused by shipstraffic after the introduction of measures such as traffic separation

→ smaller areas impacted

Impact of Fisheries

Closing of areas
for Fishery such as
for the sandeel
SVO

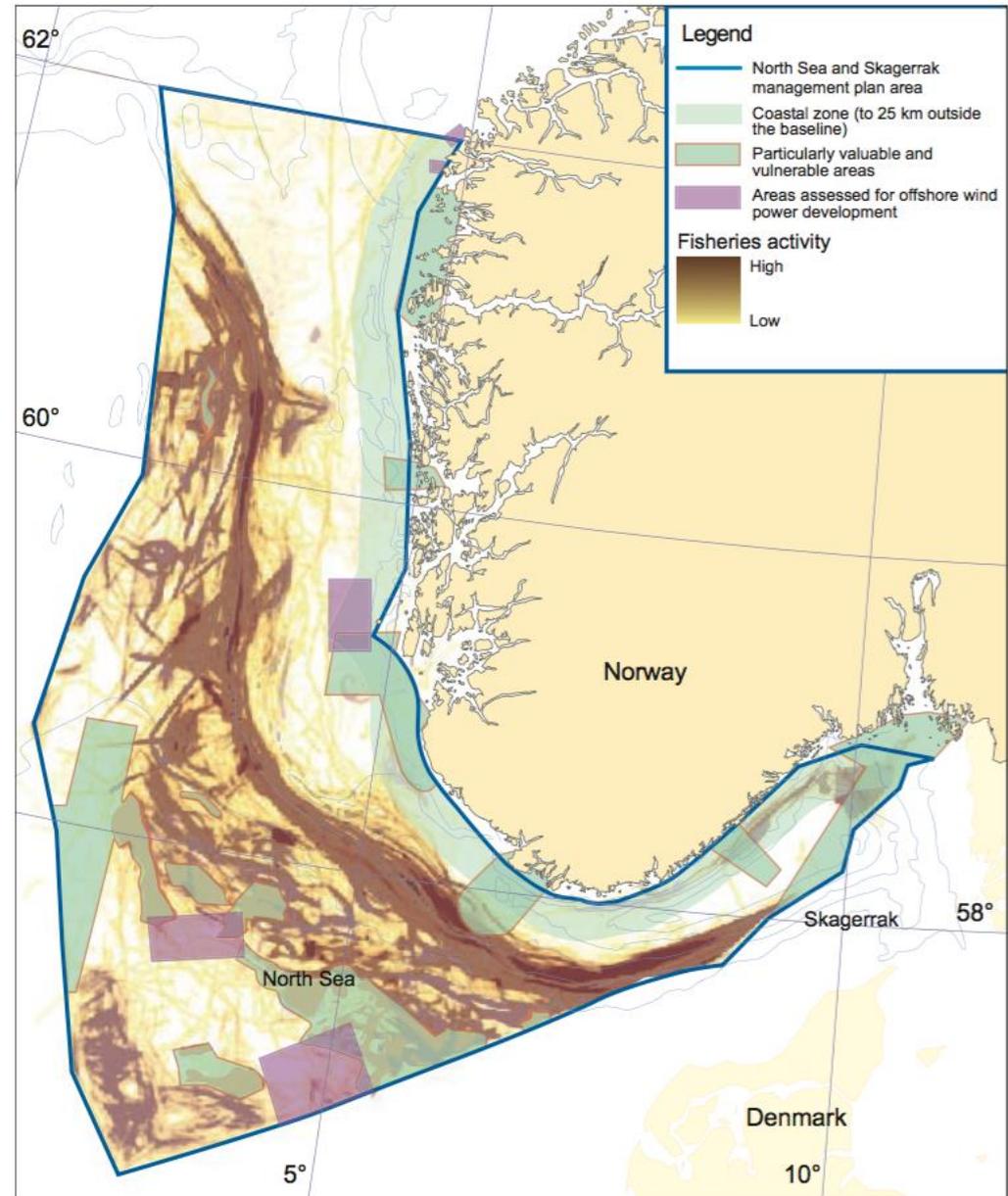


Table 7.2 Environmental impacts of different biological pressures. Based on the report *Cumulative Environmental Effects*, part of the scientific basis for the management plan (Climate and Pollution Agency 2012), with supplementary information.

Biological pressure		Known environmental impacts	Comments
Shipping	Alien species (ballast water, hull fouling)	<i>Major</i> impacts at ecosystem level	Low probability of introductions but if a species becomes established, it may have major impacts
Fisheries	Harvesting	<i>Minor</i> impacts on blue whiting, Norway pout, plaice, North Sea herring, saithe <i>Moderate</i> impacts on shrimps, mackerel, sandeel, cod	
Fisheries	Bycatches	<i>Minor to moderate</i> impacts on seabirds <i>Moderate</i> impacts on marine mammals (seals)	Impacts on non-commercial fish species are uncertain
Fisheries	Changes in food availability for other species	Impacts on seabirds are uncertain	High uncertainty in assessment of both pressure and impacts. Inadequate knowledge base

Challenge: Impact of discard ban at EU level
Norway established in the 1980's

Table 7.8 Environmental impacts of physical loss and damage. Based on the report *Cumulative Environmental Effects*, part of the scientific basis for the management plan (Climate and Pollution Agency 2012), with supplementary information. Stars in the third column refer to the starred comments in the fourth column.

Physical loss and damage		Environmental impacts	Comments
Petroleum	Drill cuttings on the seabed Installations Pipelines	<i>Minor</i> impacts on benthic communities, fish (sandeel, Norway pout, saithe, herring, cod, mackerel, haddock)	There is some uncertainty about the impacts of large piles of drill cuttings previously deposited after drilling using oil-based drill cuttings.
Fisheries	Bottom trawling	<i>Minor</i> impacts on corals and sponges <i>Moderate to major</i> impacts on benthic communities*	*Moderate to major impacts in areas that are trawled frequently. Minor impacts on the management plan area as a whole
Offshore renewable energy production	Occupation and disturbance of areas of seabed by installations and burial of pipelines. Artificial reef effects.	<i>Minor</i> impacts on benthic communities and habitats, corals, plankton, current conditions	A wind farm with fixed installations occupies areas both on the surface and on the seabed. The scale of pressures and impacts is very uncertain and dependent on the technology used No coral reefs registered in the areas assessed for offshore wind power Strategic impact assessment concluded that impacts on fish would generally be minor except in the areas Southern North Sea I, Stadthavet and Frøya-banken. Impacts can be reduced by remedial measures or avoiding parts of the areas assessed



New energies and Areas impacted by activities and installations at seabed such as bottom trawling, exploration wells pipelines etc

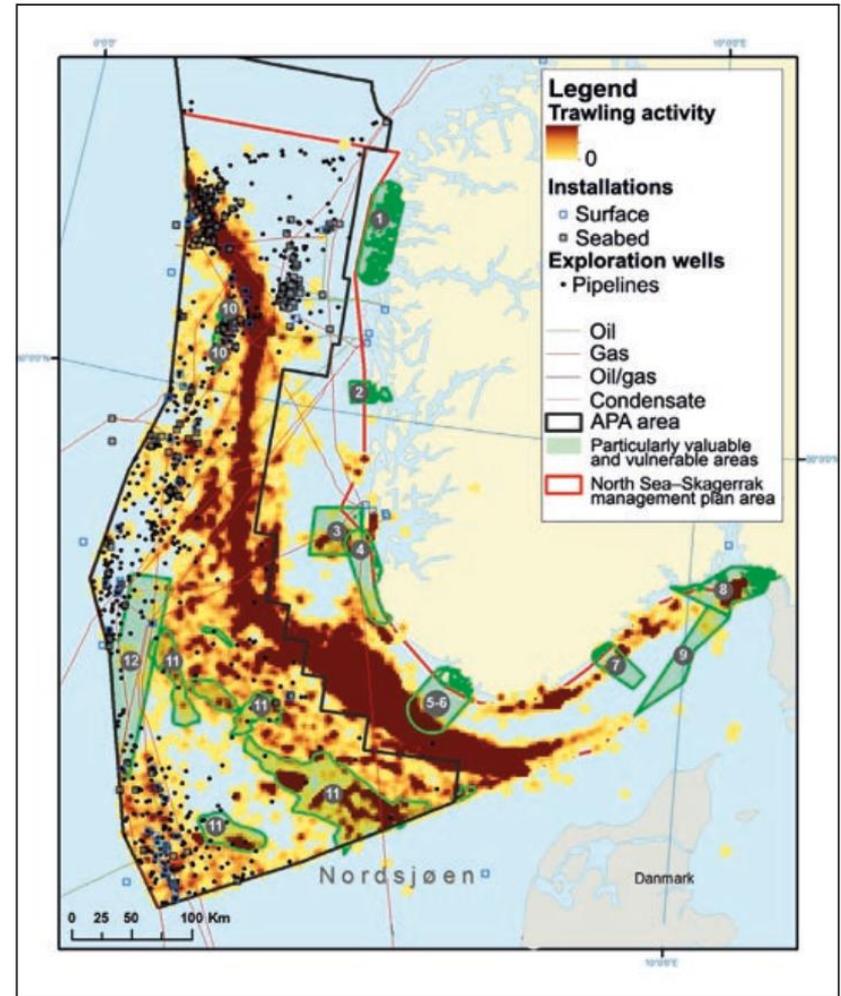


Figure 7.7 Activities and installations in the management plan area with impacts on the seabed (bottom trawling, petroleum installations, exploration wells, pipelines).

Overall figure of activities for the North Sea/Skagerrak area

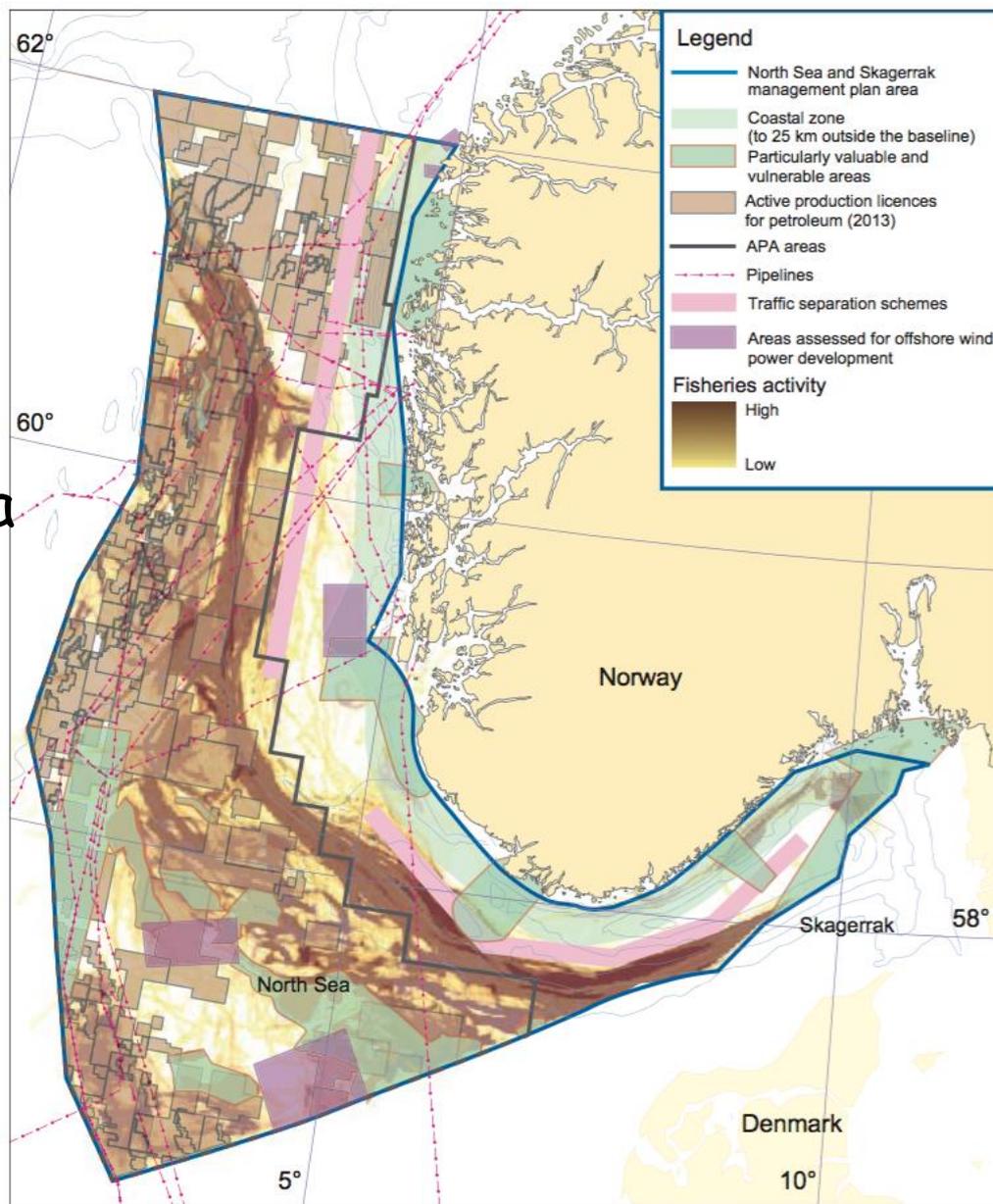


Figure 5.4 Overview of activities in the North Sea and Skagerrak

Source: Petroleum Directorate, Directorate of Fisheries, Directorate for Nature Management, Water Resources and Energy Directorate, Norwegian Coastal Administration, Norwegian Mapping Authority

Table 7.7 Environmental impacts of marine litter. Based on the report *Cumulative Environmental Effects* (Climate and Pollution Agency 2012).

Marine litter		Environmental impacts	Comments
Fisheries	Lost fishing gear	Concentrations of marine litter in the North Sea and Skagerrak are the highest recorded in the Northeast Atlantic.	Quantities of lost fishing gear in management plan area not investigated. Scale and impacts assessed as minor.
Shipping	Illegally discarded marine litter	Various sectors contribute to the problem in the management plan area, and there are inputs of litter from other countries' sea areas. We have only limited knowledge of the exact scale and sources of marine litter in Norway. This makes it difficult to assess the environmental impacts of litter from individual sectors. The impacts on seabirds are assessed as <i>moderate</i> , based on findings of considerable quantities of plastics in the stomachs of fulmars.	Applies in the event of illegal discharges.
Land-based and coastal activities			Assessed as having minor impacts.
Long-range transboundary pollution			Assessed as having minor impacts on all ecosystem components, but moderate impacts on seabirds. Impacts on ecological relationships and in particularly valuable areas are unknown.

- Litter:
- Monitoring data display that 60-90 % of the litter is from plastic products



Gjenstand	2011	2012	2013
Udefinerbare plastobjekter	8813	33285	101 611
Tau under 50 cm	5664	11679	16303
Isopor	2799	10885	19988
Korker (plast og metall)	5445	7774	19212
Plastposer	2783	5614	7874
Plaskflasker/drikkeflasker	1888	4296	10312
Sigaretter	2993	3567	6744
Tau over 50 cm	2299	3344	7238
Byggematerialer	1752	2460	3561
Matemballasje	854	2401	6005

- Marine litter

- Beach litter
- floating litter, including surface
- deposited on sea floor
- Accumulated/taken in in biota
- in particular micro plastic particles, covering sediment, water column and biota



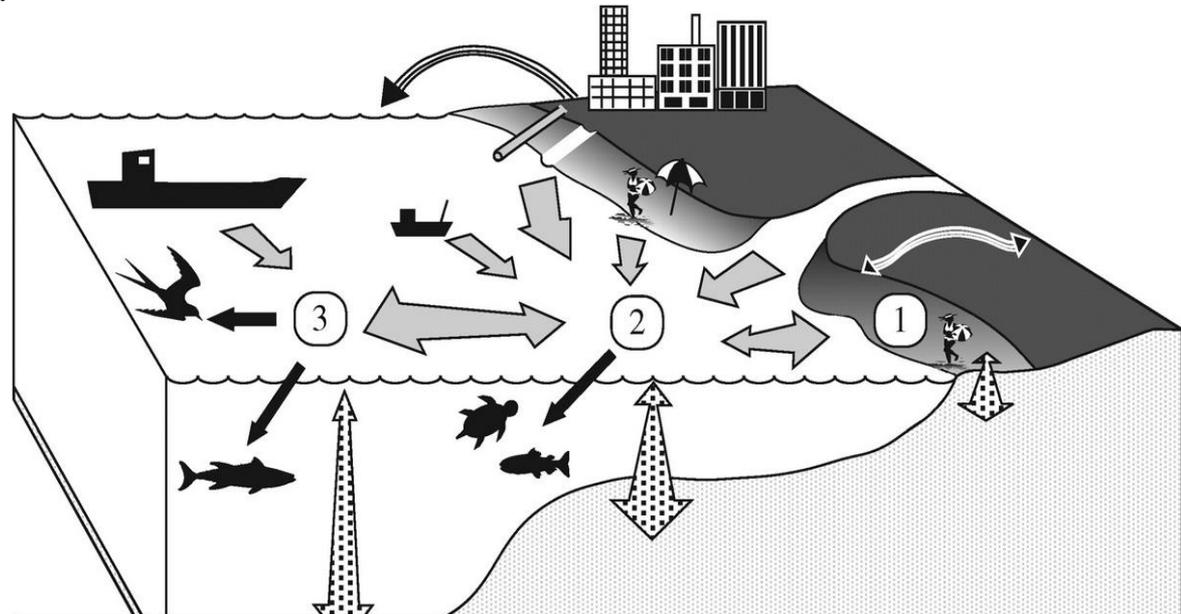
- Litter Types

Table 1. Litter classification system for all surveys where litter is collected or identified *in situ*; the Remote Litter Classes (RLCs) are further detailed in Table 3.

CLASS	MATERIAL COMPOSTION	LITTER CODE	LITTER FORM (and examples)	RLC
1	Plastic	PL01	Bottle caps & lids	RL01
2	Plastic	PL02	Bottles < 2 L	RL02
3	Plastic	PL03	Bottles, drums, jerrycans & buckets > 2 L	RL03
4	Plastic	PL04	Knives, forks, spoons, straws, stirrers, (cutlery)	RL26
5	Plastic	PL05	Drink package rings, six-pack rings, ring carriers	RL11
6	Plastic	PL06	Food containers (fast food, cups, lunch boxes & similar)	RL09
7	Plastic	PL07	Plastic bags (opaque & clear)	RL15
8	Plastic	PL08	Toys & party poppers	RL27
9	Plastic	PL09	Gloves	RL25
10	Plastic	PL10	Cigarette lighters	RL20
11	Plastic	PL11	Cigarettes, butts & filters	RL19

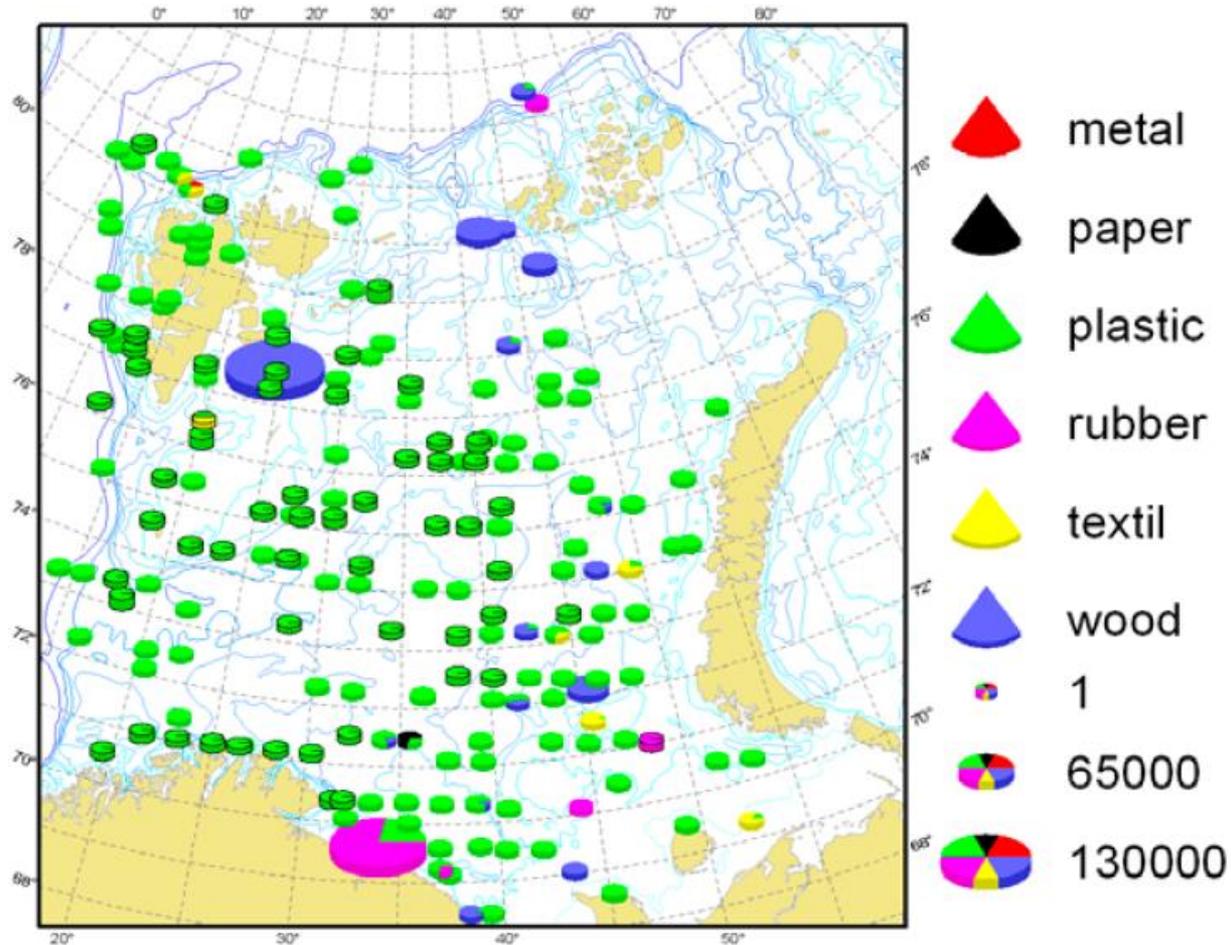
Sources – transport and distribution

- ca 80% of marine litter originates from land based sources, 20% from the ocean
- Ocean based sources: Litter from boats, Fishing related activity, legal and illegal dumping (offshore related activity)
- Landbased sources: Individuals (tourism, littering), landbased industry (ports, agriculture industry), public activity (dumping, deponi, etc)
- Large uncertainty on the amount of annual litter into the ocean (6,4 -25 mill tonn per year globally)



Schematic diagram showing the main sources and movement pathways for plastics in the marine environment, with sinks occurring (1) on beaches, (2) in coastal waters and their sediments and (3) in the open ocean. Curved arrows depict wind-blown litter, grey arrows water-borne litter, stippled arrows vertical movement through the water column (including burial in sediments) and black arrows ingestion by marine organisms.

- Litter on the ocean bottom
 - Data from registrations in bottom and pelagic trawl (IMR)

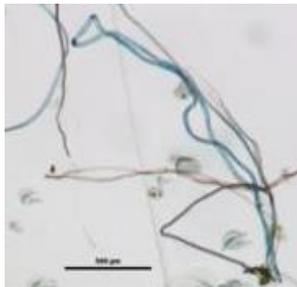


- Floating macro - litter
 - No published data from the Nordic countries
 - Present some information from visual observation of vessels
- Cumulative / recorded in biota (macro - litter)
 - Few publications, some individual studies , no monitoring
 - The exception is Fulmar (OSPAR indicator)

Type, Method	Sea region	Country	Year(s)	Reference
Litter in Fulmar	NS, SK, NA	DK/NO/SE, FO	2002-2011	Van Franeker, 2011; OSPAR 2014
Litter in Fulmar	NS, NA	NO	2003-2013	Anker-Nilssen, 2014
Litter in Fulmar	NA	NO	2013-2014	Trevail, pers. comm.
Litter in Fulmar	NA	IS	2011	Kühn & van Franeker, 2012
Litter in Thick-billed murre	NA	GL	1988-1989	Falk & Durinck, 1993
Entanglement of Northern gannet	No systematic registration, only observations			
Litter in nests of Kittiwake	NS	DK	1992, 2005	Hartwig et al., 2007
Entanglement of fish and crabs in ghost nets	NA	NO	19xx-2011	Norwegian Directorate of Fisheries, 2011

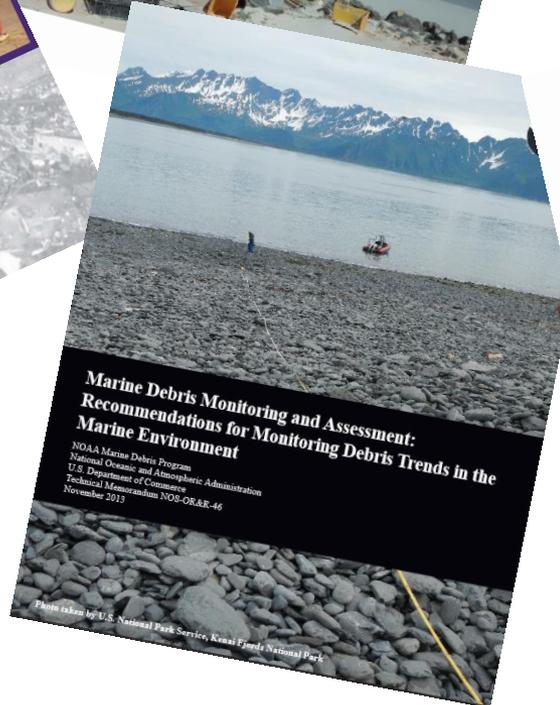
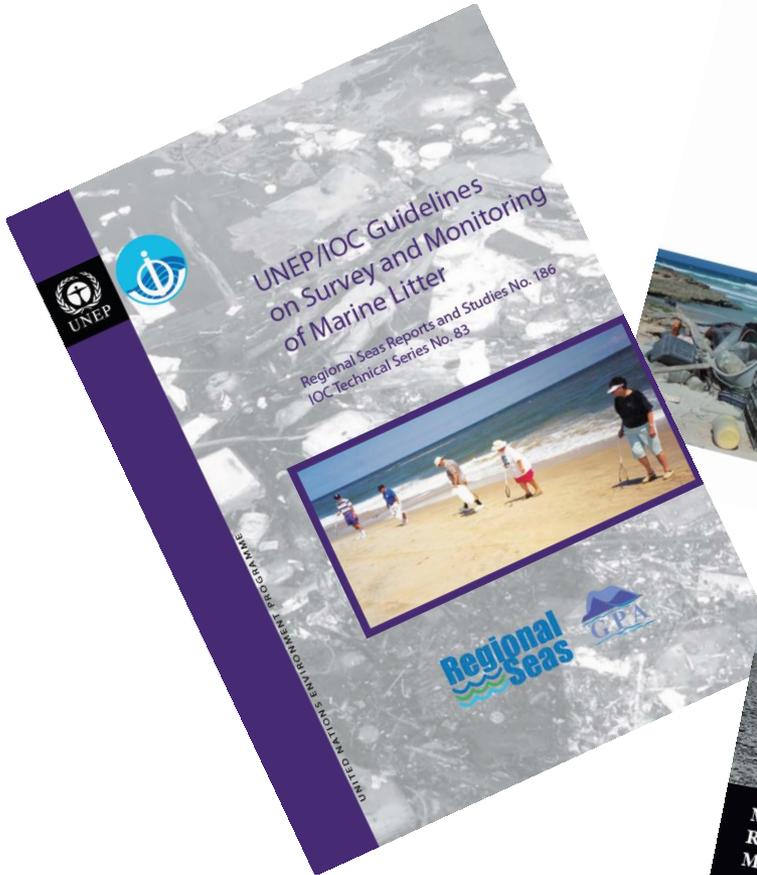


- Microplastic
- Few investigations from sediment, biota and water column
 - Different methodology used



Type, Method	Sea region	Country	Year(s)	Reference
Water column	SK, BS	SE	2007, 2010	Norén, 2007 ; Norén & Magnusson, 2011
Water column	SK	NO	2010	Norén & Naustvoll 2011
Water column	BS	FI	2012	Setälä, unpubl.
Water column	BS	FI	2013	Magnusson, 2014
Tidal sediment and beach sand	NS	DK	2009-2010	Derksen et al. 2012
Tidal sediment and beach sand	NA	IS	2011	Dippo, 2012
Sub-tidal sediment	SK	SE	2010	Johansson, 2011
Brittlestars, faeces	SK	SE	2010	Johansson, 2011
Mussels and fish	BS	DK	2013	Agersnap 2013
Fish	BS	DK	2013	Sørensen et al. 2013

No common Methodology



Marine Litter Technical Recommendations for the Implementation of MSFD Requirements

MSFD GES Technical Subgroup on Marine Litter



MARine Litter in Europe Seas: Social Awareness and CO-Responsibility

D1.2 SUMMARY OF CURRENT METHODS OF MONITORING AND ASSESSMENT FOR MARINE LITTER



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Table 4.1. Summary table of indicators selected in national monitoring plans for the coming years as presented by representatives of national EPAs at the 2nd Nordic workshop “Marine litter – monitoring and management in the Nordic context”, 6-7 November 2014.

Country	Indicator	Scheduled monitoring activity
Denmark	Beach litter:	2 stations in Baltic sea, 2 stations in North Sea/Skagerrak
	Seafloor:	2 yearly bottom trawl surveys in both Baltic Sea and North Sea /Skagerrak. Coordinated with fishery surveys (BITS/IBTS),
	Biota:	Investigate uptake in fish
	Micro-litter:	Microplastic in sediments (18 stations), coordinated with contaminant monitoring,
Finland	Beach litter:	3 stations in Gulf of Finland, 5 stations in Archipelago sea
	Seafloor:	-
	Biota:	-
	Micro-litter:	Surface water micro-litter (>330µm) from open waters
Iceland	Beach litter:	2 stations
	Seafloor:	-
	Biota:	-
	Micro-litter:	-
Norway	Beach litter:	5 stations at Norwegian mainland, 2 stations at Svalbard
	Seafloor:	Bottom trawl surveys (Barents Sea)
	Biota:	Plastic ingestion by fulmar (North Sea)
	Micro-litter:	-
Sweden	Beach litter:	6 stations in Skagerrak, 10 stations in Baltic Sea and Kattegat
	Seafloor:	Bottom trawl surveys in both Baltic Sea and North Sea /Skagerrak. Coordinated with fishery surveys (BITS/IBTS),
	Biota:	Investigate indicator species (bird or fish) for SE conditions (2016)
	Micro-litter:	Limited surveys of micro particles in water column + sediment and biota (2020), Assessment on point sources for micro litter (2018)

1: Impact assessments for these sectors and external pressures:

- Petroleum activities
- Shipping
- Fisheries and aquaculture
- Land-based and coastal activities
- Offshore renewable energy production
- Climate change, ocean acidification, long-range transport of pollutants

2: Environmental pressures considered for each sector/external pressure:

- Physical pressures
- Inputs of hazardous substances
- Inputs of nutrients and organic matter
- Biological pressures
- Other pressures (marine litter, noise, collisions, etc)

3: Environmental impacts of each pressure assessed for these ecosystem components:

- Plankton
- Benthic communities
- Fish (including seafood safety)
- Seabirds
- Marine mammals
- Coastal waters and shore zone
- Particularly valuable areas

Sector	Biological pressures (Table 7.2)	Physical pressures (Table 7.8)	Releases of hazardous substances (Table 7.4 and 7.5)	Releases of nutrients and organic matter (Table 7.6)	Marine litter (Table 7.7)	Noise (Table 7.9)
Petroleum activities		Drill cuttings on the seabed Installations Pipelines	Produced water Drill cuttings Oil spills			Seismic data acquisition
Shipping	Introduction of alien species		Operational discharges Oil spills		Marine litter	Propeller noise
Fisheries	Harvesting Bycatches	Damage to seabed from trawling			Marine litter	
Offshore renewable energy	Artificial reefs	Installations				Noise in construction period
Land-based and coastal activities	Selective harvesting of species Introduction of alien species	Disturbance in seal whelping season and bird breeding season	Inputs of hazardous substances, including radioactivity	Inputs of nutrients and organic matter	Marine litter	
Climate change, ocean acidification (Table 7.10)	Climate change may affect species and habitat distribution		Changes in temperature and salinity may affect metabolism, uptake and toxicity of these substances	Climate change may affect inputs and metabolism of nutrients		



TÄNAN !

Thanks for listening !