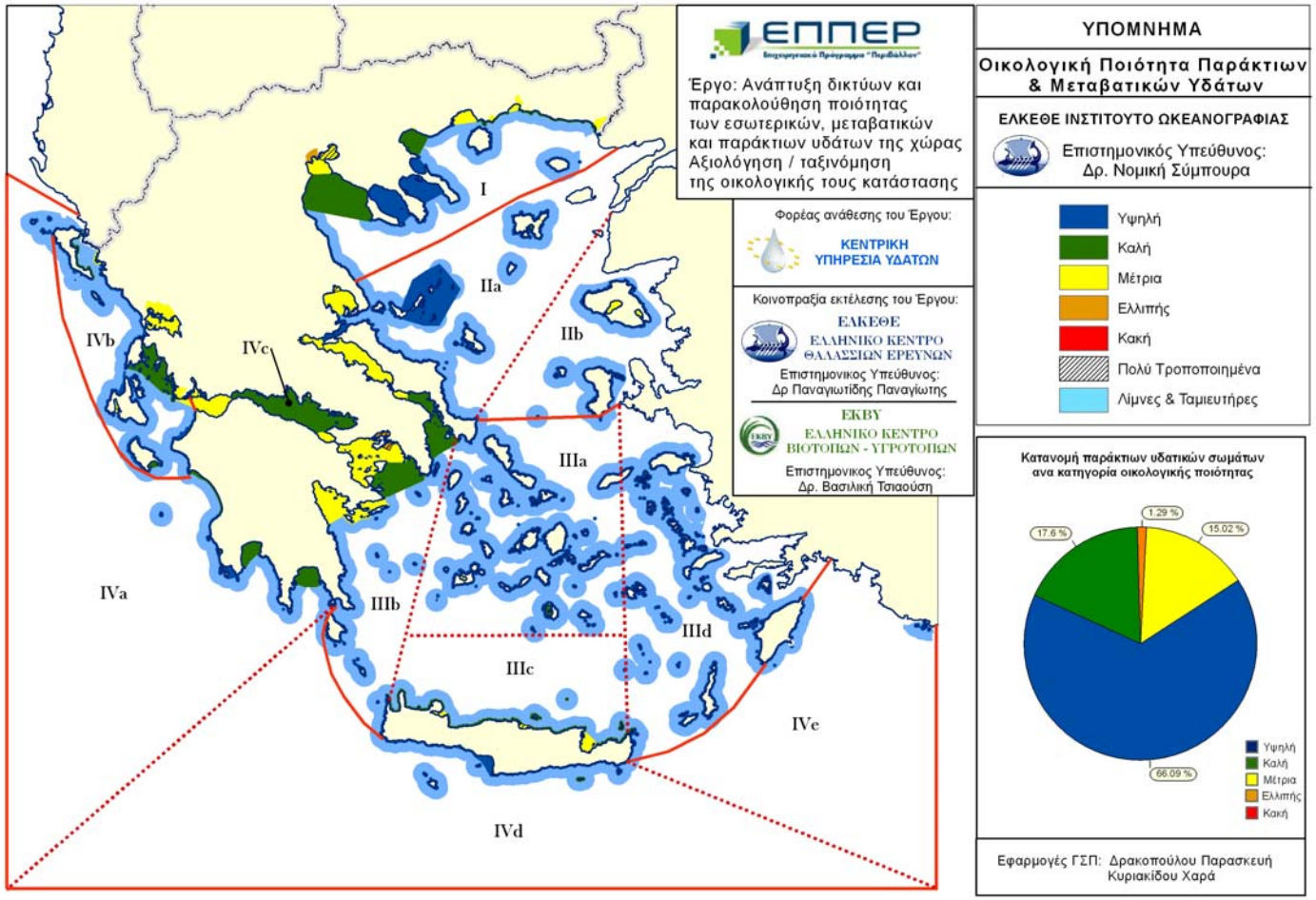
Targets of the Marine Strategy F D

- The Marine Strategy F D claims for a “good environmental status” of all water bodies **under EU jurisdiction** at 2020 the latest
- According to the text of the Marine Strategy F D *“Good Environmental Status”* is given by the synthesis of 11 descriptors

Implementing the Marine Strategy Framework Directive



Challenges of the Marine Strategy F D

- Bearing in mind uncertainties about the combined impacts of measures to be introduced by the new Marine Strategy FD and about their potential costs for key economic sectors, a provision on compulsory impact assessments and cost-benefit analyses is needed at the regional level.
- The new Marine Strategy FD is very ambitious project and for the European Oceanographer the challenge is huge.

11 descriptors of the Marine Strategy F D

- Descriptor 1: “Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions”

D.1. Biodiversity
Habitat diversity:
1.1. Abundance, extent and distribution of different habitat types
1.2. Community structure
1.3. Habitat quality (Habitat composition and relative proportions (seabed)), intactness of habitats
Species diversity:
1.4. Species richness, evenness
1.5. Species range and distribution
1.6. Trends in abundance (numbers and/or biomass)
1.7. Population structure
Diversity within species:
1.8. Non-genetic indicators (size-structure or subspecies distribution
1.9. Genetic indicators, as genetic structure (e.g. differences among populations) or genetic diversity (e.g. numbers of alleles)

11 descriptors of the Marine Strategy F D

- Descriptor 2: “Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems”

D.2. Non-indigenous sp

Trends (*):

2.1. Abundance of NIS / IAS and proportion of NIS to native species (improved reporting system)

Bio pollution Index BPI:

2.2. Effects of NIS/IAS on communities, habitats and on ecosystem functioning

NIS=non-indigenous sp.

IAS=invasive alien sp.

11 descriptors of the Marine Strategy F D

- Descriptor 3: “Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock”

D.3. Commercial fish
Sustainability of exploitation:
3.1. Fishing mortality related to a reference value
3.2. Trends in catches / biomass
Reproductive capacity:
3.3.Spawning Stock Biomass (SSB) related to a reference value
3.2. Trends in catches / biomass
Age and size distribution:
3.4. Log (abundance) related to a reference value
3.5. Trends in 95% percentile of the population length distribution

11 descriptors of the Marine Strategy F D

- Descriptor 4: “All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity”

D.4. **Food** webs

Energy flow:

4.1. Ratio production of pelagic / demersal fish

4.2. Ratio macro benthic invertebrates / demersal fish production

4.3. Ration zooplankton production required / zooplankton production

4.4. Ratio benthic production required / benthic production

4.5. Predator performance (*) (e.g. seal population size and reproduction or seabird breeding population size and breeding success)

4.6. Tropic Levels (Functional feeding groups)

4.7. Marine Tropic Index

Structure:

4.8. Body size (length, weight) in selected functional groups/species

4.9. % large fish

4.10 Abundance and spatial distributions of - species of fast turnover rates - fish targeted by fishery - habitat-defining groups/specie - species/groups tightly linked to other tropic levels

11 descriptors of the Marine Strategy F D

- Descriptor 5: “Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters.”

D.5. Eutrophication
Pressure:
5.1. Nutrient (phosphorus and nitrogen) load
5.2 Nutrient concentrations
Direct effects:
5.3. Primary production
5.4. Chlorophyll a
5.5. Opportunistic macroalgae
5.6. Nuisance / toxic algal blooms
5.7. Algal community structure
5.8 Submerged aquatic vegetation - spatial coverage and density of beds
Indirect effects:
5.9. Dissolved oxygen
5.10. Benthos - diversity and proportion of sensitive vs. non-sensitive species (e.g. P-R model)
5.11. Benthos / fish kills
HAB=harmful algal blooms

11 descriptors of the Marine Strategy F D

- Descriptor 6: "Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected”

D.6. Sea floor integrity

6.1. Structure of benthic habitats (% of area of invertebrates biomass and/or production above a given % of undisturbed areas

6.2. Abundance of bio-engineering species

6.3. Extent of habitats of bioengineers species

6.4. Extent of area with spatial or temporal hypoxia

6.5. Diversity and richness indices also taking into account species -area relationships

6.6. Proportion of number or biomass above a specified length

6.7. Biomass size spectrum

6.8. Shape of cumulative abundance curves of numbers of individuals by size group

6.9. Secondary production

6.10. Opportunistic-sensitive species proportion (eg. AMBI, P-R-medel)

6.11. Integration of indicators already used

11 descriptors of the Marine Strategy F D

- Descriptor 7: “Permanent alteration of hydrographical conditions does not adversely affect marine ecosystem”

D.7. Hydrographical conditions

7.1. Area of anoxic bottoms

7.2. Migrating fish/mammals

7.3. Changes in sedimentation

7.4. Changes in areas for fish/mammals reproduction

7.5. Changes in the benthic community

11 descriptors of the Marine Strategy F D

- Descriptor 8: “Concentrations of contaminants are at levels not giving rise to pollution effects”

D.8. Contaminants

Presence of contaminates:

8.1. Concentrations in water, sediments and biota

Effects of contaminants:

8.2. Levels of pollution effects, measured through available approaches/techniques, e.g. biological responses measurement, bio-assays etc

11 descriptors of the Marine Strategy F D

- Descriptor 9: "Contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards."

D.9. Contaminants in fish
9.1. frequency of levels exceeding regulatory levels (*)
9.2. Actual levels detected
9.3 Numbers of contaminants for which exceeding levels have been detected
9.4. Origin of contaminants (geological versus anthropogenic; local versus long distance)

11 descriptors of the Marine Strategy F D

- Descriptor 10: "Properties and quantities of marine litter do not cause harm to the coastal and marine environment”

D.10. Litter
Amount, composition and source of litter:
10.1. **Litter** washed ashore and/or deposited on coastlines
10.2 . **Litter** in the water columns, including floating and suspended litter on the sea floor
10.3. **Litter** ingested by marine animals/birds
10.4. **Litter** of microparticles (mainly mircroplastics) derived from degradation of litter
10.5 Impact rates of depredated litter on organisms
10.6. Potential chemical pollution resulting from degradated litter (plastic)

11 descriptors of the Marine Strategy F D

- Descriptor11:" Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment"

D.11. Energy (underwater noise)
11.1. The proportion of days in a calendar year in grid 15'N * 15'E/W rectangle that an anthropogenic impulsive sound of a frequency less than 10 kHz above 183 dB is made
11.2. The total number of vessels that are equipped with sonar systems generation sonar pulses below 200 kHz should decrease
11.3. Noise level within the 1/3 octave bands 63 and 125 Hz should not exceed the baseline values of year (2012) or 100 dB

MINISTRY OF DEVELOPMENT - GENERAL SECRETARIAT FOR RESEARCH AND TECHNOLOGY

H.C.M.R.
HELLENIC CENTRE FOR MARINE RESEARCH

Marine Strategy Framework Directive:

Descriptor 10: Properties and quantities of marine litter do not cause harm to the coastal and marine environment

Descriptor 11: Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment

Panayotis **PANAYOTIDIS**, research director

FIRST TRAINING SCHOOL FOR THE PROMOTION AND APPLICATION OF EU MARINE ENVIRONMENTAL POLICY FRAMEWORKS IN NON-EU MEDITERRANEAN AND BLACK SEA COUNTRIES
4-8 JUNE 2012, CHIOS ISLAND- GREECE

Implementing the Marine Strategy Framework Directive

- Descriptor 10: Properties and quantities of marine litter do not cause harm to the coastal and marine environment

Members of the Task Group 10 on Marine Litter

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Definition and scientific understanding of key concepts associated with the descriptor

- Marine litter is any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment

Definition and scientific understanding of key concepts associated with the descriptor

- Marine litter consists of items that have been made or used by people and deliberately discarded or unintentionally lost into the sea and on beaches including such materials transported into the marine environment from land by rivers, draining or sewage systems or winds

Definition and scientific understanding of key concepts associated with the descriptor.

For example, marine litter consists of:

Plastics, wood, metals, glass,

rubber, fishing gears, clothing, paper etc

This definition does not include semi-solid remains of for example mineral and vegetable oils, paraffin and chemicals that sometime litter sea and shores

Categories of “harm” by litter

- **Social** (reduction in aesthetic value and public safety),
- **Economic** (e.g. cost to tourism, damage to vessels, fishing gear and facilities, losses to fishery operations, cleaning costs) and
- **Ecological** (mortality or sublethal impacts to plants and animals through entanglements, captures and entanglement from ghost nets, physical damage and ingestion including uptake of microparticles (mainly microplastics) and chemical pollutants, facilitating the invasion of alien species, altering the benthic biocommunity structure)

What is good environmental status

- Definitions of the acceptable levels of harm in these categories and good environmental status must consider impacts as assessed by the amount of litter in different compartments of the marine environment (seabed, sea surface, water column, coastline), ecological effects of the litter (e.g. plastics ingested by marine organisms; entanglement rates) and problems associated with degradation of litter (microparticles) as well as social and economic aspects
- An overriding objective for marine litter pollution will be a measurable decrease in the total load of litter in the environment by 2020

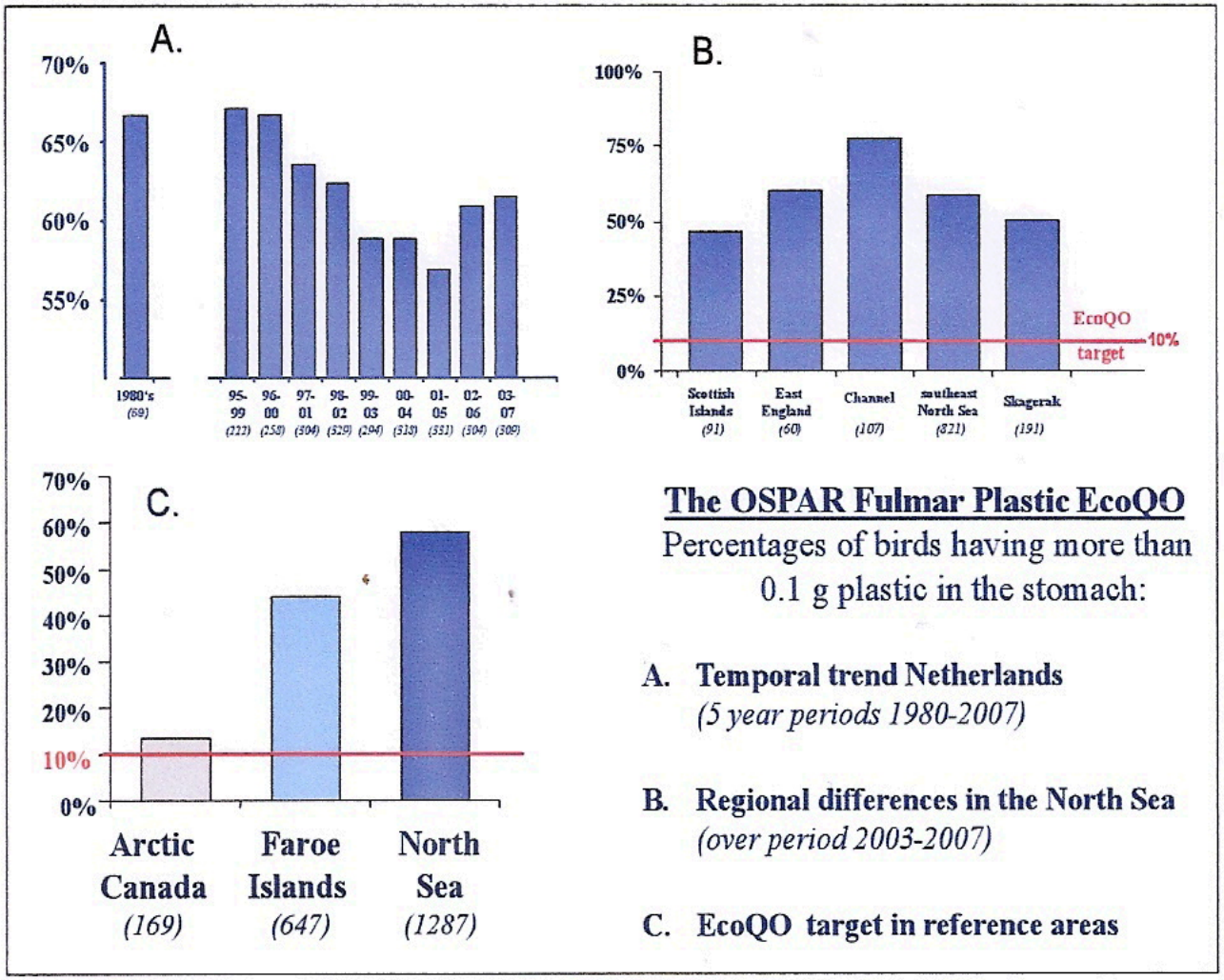


Figure 1: The OSPAR fulmar EcoQO

How we should scale the descriptor

- Working at the European scale will be possible for litter evaluation on beaches, at sea and measuring degradation processes using standard protocols.
- Evaluating the impact of litter on marine organisms will be done at regional or basin scale, enabling transposition of protocols to local species.
- Highly affected areas will be monitored locally. Temporal scales to be determined but taking account of seasonal variations seems logical.

Key attributes of the descriptor (1)

Amount, source and composition of litter washed ashore and/or deposited on coastlines

The attribute will indirectly measure inputs, impacts on aesthetic values, the presence of toxic compounds and Socio Economical damage

Key attributes of the descriptor (2)

Amount and composition of litter in the water column- including floating an suspended litter – and accumulation on the sea floor

The attribute will measure litter dynamics and potential interactions with marine life

Key attributes of the descriptor (3)

Amount and composition of litter ingested by marine animals

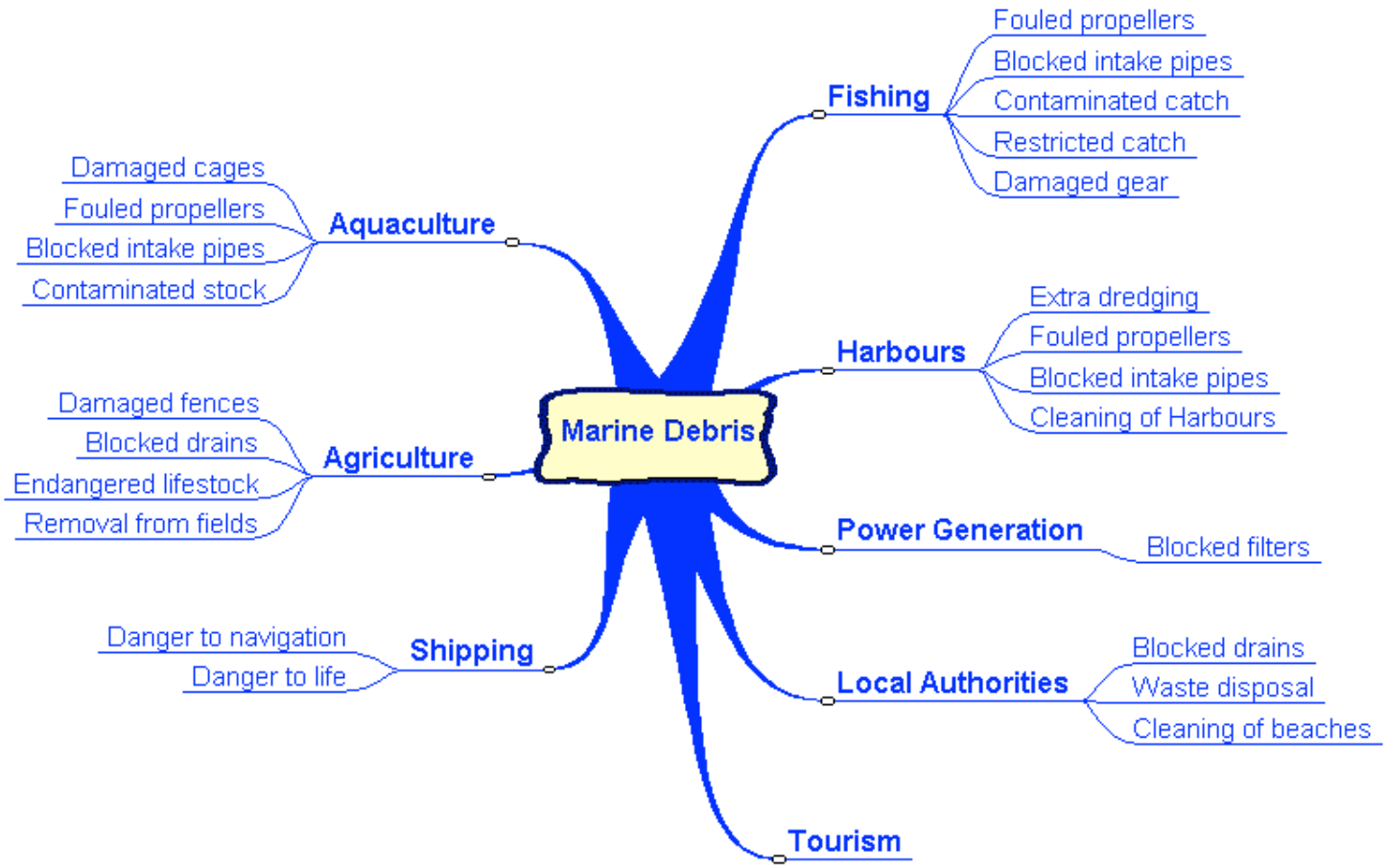
The attribute measures time-trends and spatial variation in inputs of litter and its impact on marine life

Key attributes of the descriptor (4)

Amount, distribution and composition of microparticles (mainly microplastics) derived from degradation of litter

The attribute will measure degradation processes and potential sources of contaminants

Sources of marine debris



Criteria; which subcomponent of the attribute reflect a gradient of degradation and why ?

- **Quantities, composition and distribution of litter**, including the distribution and concentrations of degradation products of litter (microparticles in sediments and the water column) as well as impact rates on organisms and the potential chemical pollution resulting from plastics are good (trends) indicators of degradation of marine litter and monitor direct harm to the marine environment

Criteria; which subcomponent of the attribute reflect a gradient of degradation and why ?

- **Monitoring the quantities and distribution of litter** in the different compartments of the marine environment will show actual and potential socio-economic and ecological impact of litter

- **Impact rates on organisms**, distribution and concentrations of microparticles and chemical pollution monitor direct harm to the marine ecosystem

Which human activities and pressures are closely linked to reflect by the attribute or specific subcomponents

- a) **Presence of point and diffuse sources** of litter such as municipal landfills, untreated sewage discharges, coastal industries, tourism and specific activities such as shipping, load of litter from ships, fishing, aquaculture and various offshore activities

Which human activities and pressures are closely linked to reflect by the attribute or specific subcomponents

- b) The origin, drift and fate of litter as a consequence of rains, rivers, currents, winds and geomorphological factors are important issues when evaluating effects as those will affect the distribution and abundance of litter

Methodological standards in Europe are currently available for

OSPAR QSR 2010 based regional approach which links pressures and activities to the quality of ecosystem components will be considered for implementation and extension to other areas

- Litter on coastlines
- Litter on the sea floor
- Litter in the water column
- Floating litter
- Density of particles from sediment samples
- Litter in seabird stomachs

Emergent messages about monitoring and research

- **An initial evaluation will be performed** in all accessible areas after which a temporal and spatial assessment will be made to define priority areas for research
- **Research will need** to include the improvement of knowledge concerning impacts on marine life, degradation processes at sea, the study of litter-related microparticles, the study of chemicals related to litter, the factors influencing the distribution and densities of litter at sea (human factors, hydrodynamics, geomorphology etc.), the normalization of methods and the determination of thresholds
- **The assessment of socio-economic harm will also need to be addressed**

Emergent messages about monitoring and research

Implementing the Marine Strategy Framework Directive

- Descriptor 11: Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment

Members of the Task Group 11 on energy & noise

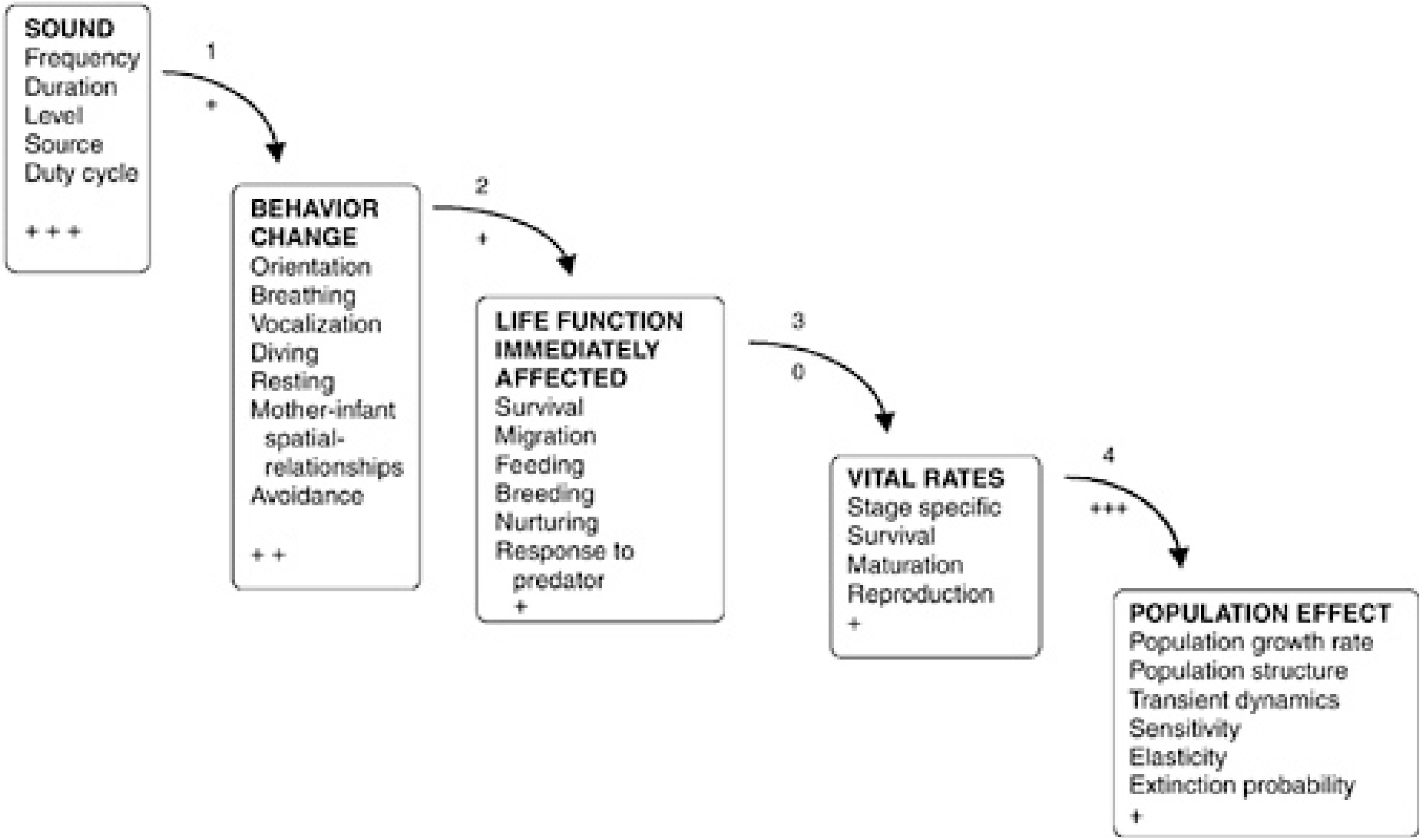
- Mark L. Tasker,
- Mats Amundin,
- Michel Andre,
- Anthony Hawkins,
- Bill Lang,
- Thomas Merck,
- Amy Scholik Schlomer,
- Jonas Teilmann,
- Frank Thomsen,
- Stephanie Werner and
- Manell Zakharia

Underwater noise

- Sound is a dominant feature of the underwater marine environment as a result of natural (biological sources, underwater earthquakes, wind) and human-made (anthropogenic) sound sources

Underwater noise

- Human activities introduce sound into the environment either incidentally (by-product of their activities e.g., shipping, construction) or intentionally for a particular purpose (e.g., airguns to locate oil deposits or active sonar to detect objects)

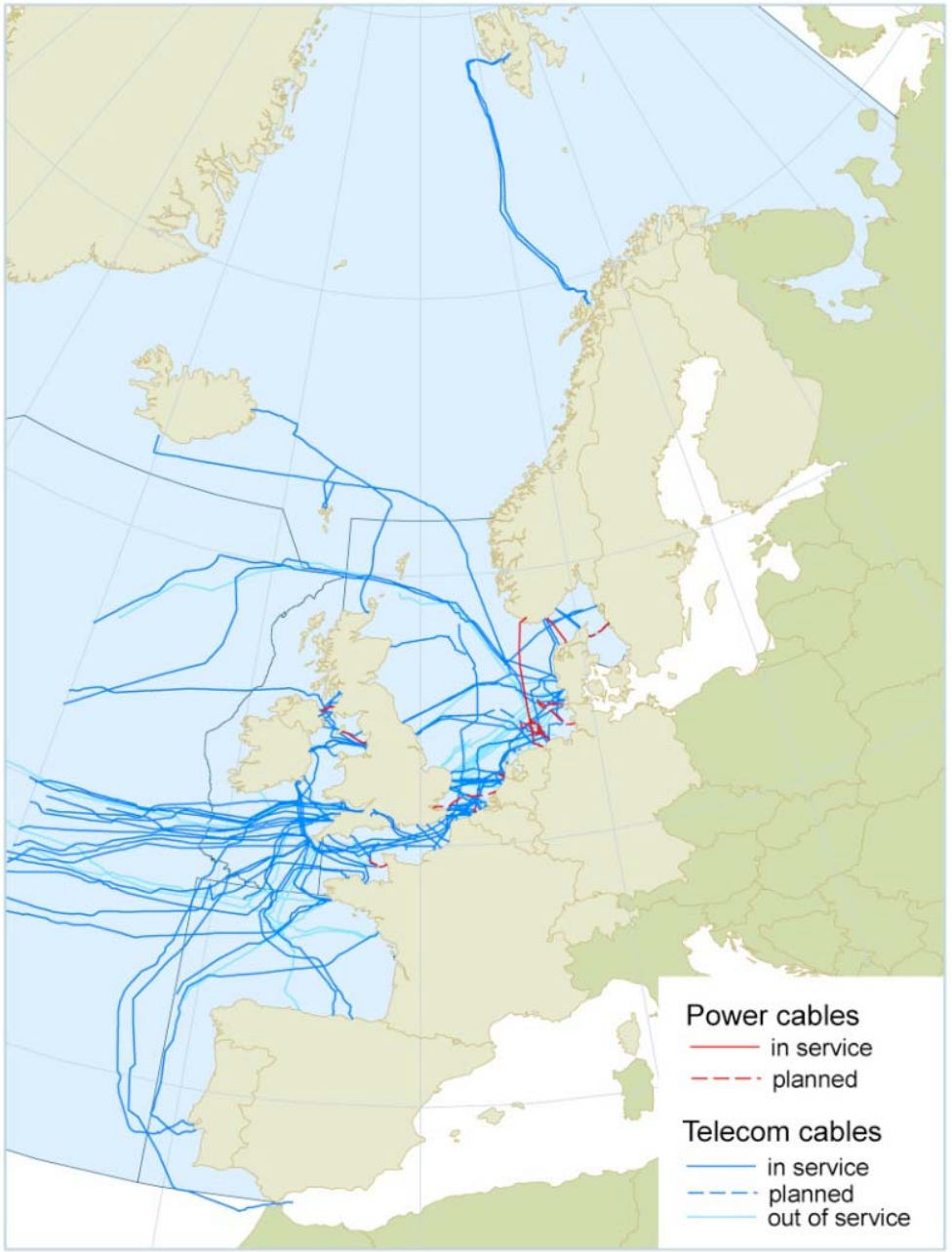

SOUND
Frequency
Duration
Level
Source
Duty cycle
+ + +
1
+
BEHAVIOR CHANGE
Orientation
Breathing
Vocalization
Diving
Resting
Mother-infant spatial-relationships
Avoidance
+ +
2
+
LIFE FUNCTION IMMEDIATELY AFFECTED
Survival
Migration
Feeding
Breeding
Nurturing
Response to predator
+
3
0
VITAL RATES
Stage specific
Survival
Maturation
Reproduction
+
4
+++
POPULATION EFFECT
Population growth rate
Population structure
Transient dynamics
Sensitivity
Elasticity
Extinction probability
+

Noise impact on marine mammals

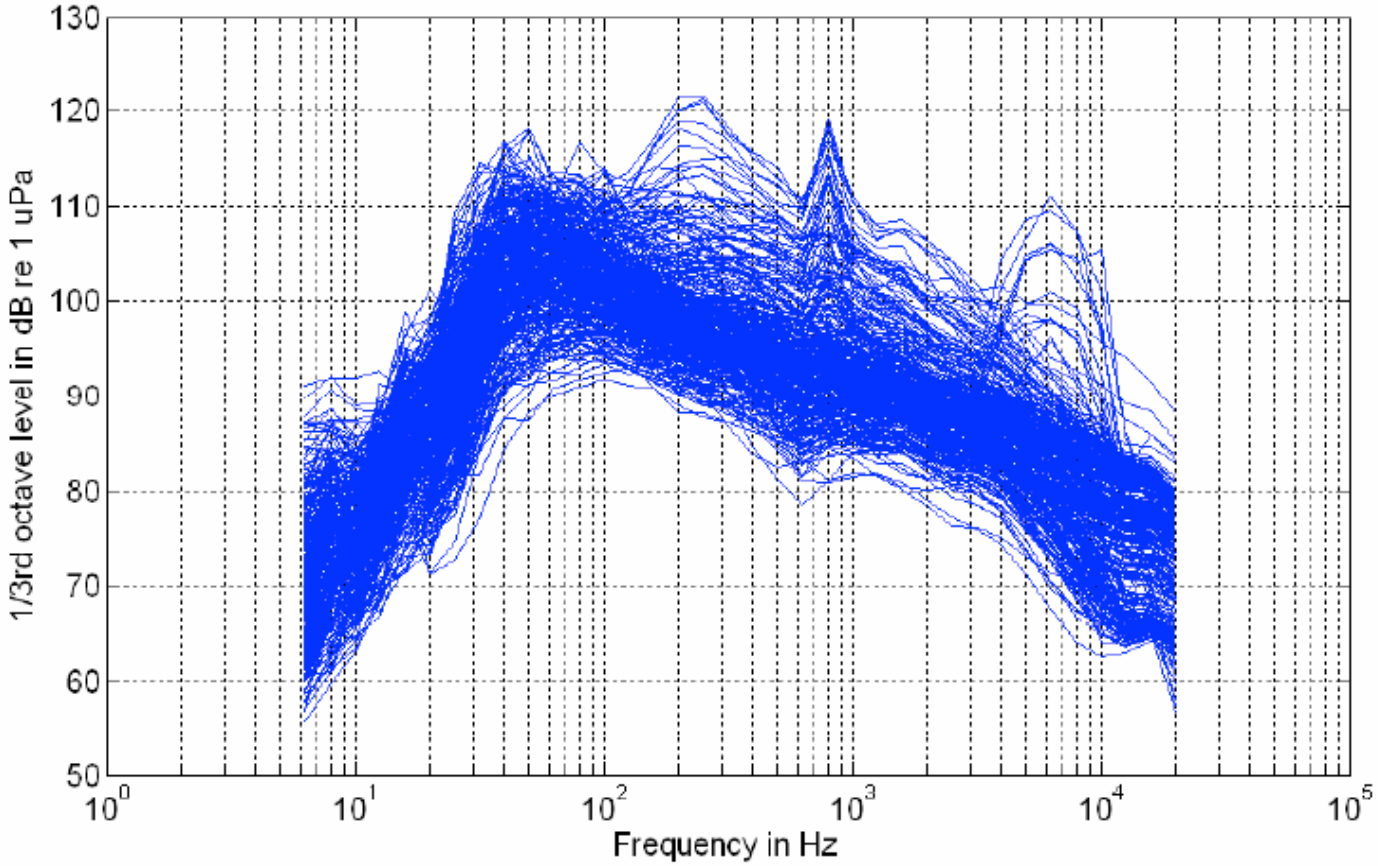
Species	Frequency range (kHz)	Recorded from Distance (km)
Sperm whale	0.1 - 30	37
Bowhead whale	0.025-3.5	17
Humpback whale	0.02-8.2	15 / 160
Fin whale	0.01-0.75	> 20
Blue whale	0.012-0.39	600 / 1,600

Species	Frequency range (kHz)	Active space
Bottlenose dolphin whistle	4 - > 20	20-25 max, 16 average
Killer whale call	1 - 20	26
Sperm whale click	0.1 - 30	60

Main shipping routes in the North Sea & the NE Atlantic



Spectra of ambient noise in a location near to a main shipping route in the North Sea



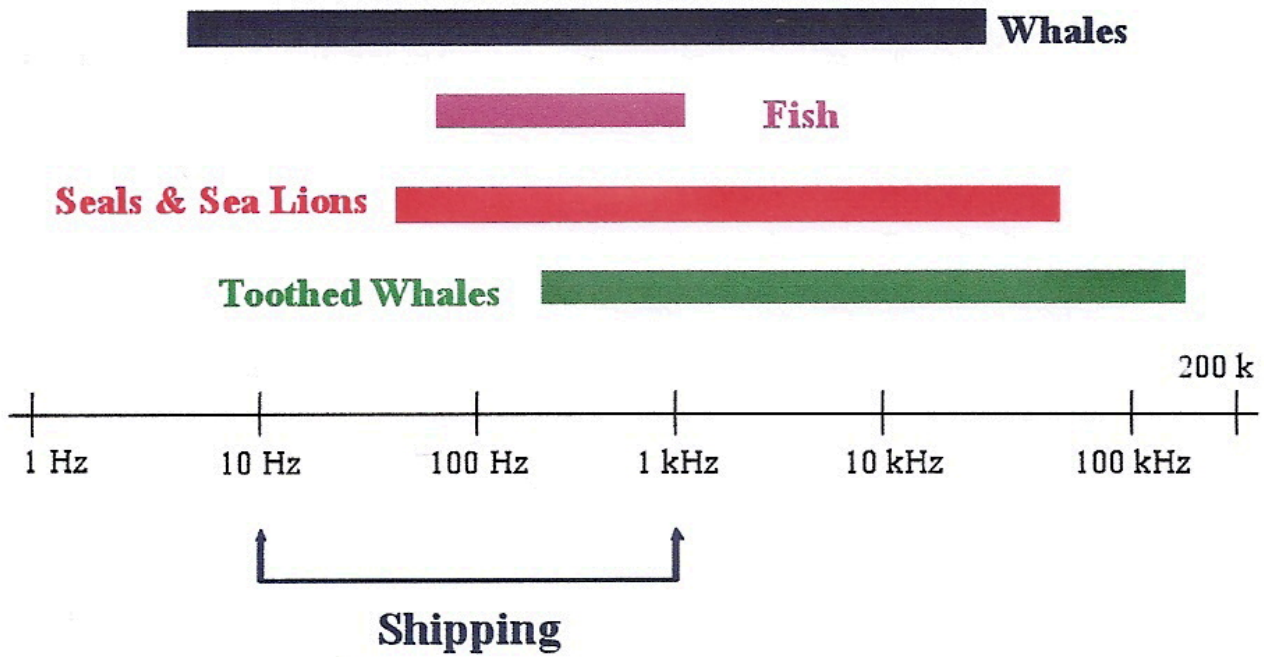


Figure 3 Typical frequency bands of sounds produced by marine mammals and fish compared with the nominal low-frequency sounds associated with commercial shipping (taken from OSPAR 2009b).

ATTRIBUTE	**Criteria** to assess the descriptor	**Indicators** to be measured
Underwater noise - Low and mid-frequency impulsive sound	High amplitude impulsive anthropogenic sound within a frequency band between 10Hz and 10 kHz, assessed using either sound energy over time (Sound Exposure Level SEL) or peak sound level of the sound source. Sound thresholds set following review of received levels likely to cause effects on dolphins; these levels unlikely to be appropriate for all marine biota. The indicator addresses time and spatial extent of these sounds.	The proportion of days within a calendar year, over areas of 15'N x 15'E/W in which anthropogenic sound sources exceed either of two levels, 183 dB re $1\mu Pa^2.s$ (i.e. measured as Sound Exposure Level, SEL) or 224 dB re $1\mu Pa_{peak}$ (i.e. measured as peak sound pressure level) when extrapolated to one metre, measured over the frequency band 10 Hz to 10 kHz.

ATTRIBUTE	**Criteria** to assess the descriptor	**Indicators** to be measured
Underwater noise – High frequency impulsive sounds	Sounds from sonar sources below 200 KHz that potentially have adverse effects, mostly on marine mammals, appears to be increasing. This indicator would enable trends to be followed.	The total number of vessels that are equipped with sonar systems generating sonar pulses below 200 kHz should decrease by at least *x*% per year starting in [2012].

ATTRIBUTE	**Criteria** to assess the descriptor	**Indicators** to be measured
Underwater noise – low frequency continuous sound	Background noise without distinguishable sources can lead to masking of biological relevant signals, alter communication signals of marine mammals, and through chronic exposure, may permanently impair important biological functions. Anthropogenic input to this background noise has been increasing. **This indicator requires a set of sound observatories and would enable trends in anthropogenic background noise to be followed**.	The ambient noise level measured by a statistical representative sets of observation stations in Regional Seas where noise within the 1/3 octave bands 63 and 125 Hz (centre frequency) should not exceed the baseline values of year [2012] or 100 dB (re 1µPa rms; average noise level in these octave bands over a year).

Thank you for your attention