HARBASINS

TMAP REVISION

Parameter Fact Sheets

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Common Wadden Sea Secretariat, Wilhelmshaven

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1. Status

The Trilateral Monitoring and Assessment Group (TMAG) has been requested to prepare a proposal for a revised TMAP, as outlined in § 22-23 of the Schiermonnikoog Declaration (SchD, 2005).

In November 2006, the TMAG presented a set of suitable parameters for a revised TMAP for approval at the TWG 06/2 meeting (TWG 06/2/6.1-1), resulting from a review of the TMAP Common Package carried out in 2005 and 2006 on the basis of

- The results of the Quality Status Report 2004,
- The recommendations from the Scientific Wadden Sea Symposium, Esbjerg, April 2005,
- Advice from the TMAP breeding and migratory bird monitoring groups (JMBB and JMMB) and the Trilateral Seal Expert Group (TSEG),
- Advice from four TMAP ad-hoc working groups in 2006 (hazardous substances, seagrass, fish, beaches & dunes).

The workshops were organized and financially supported by the **HARBASINS** project (Interreg IIIB).

The TWG 06/2 agreed:

- To endorse the TMAP parameters as listed in the summary table in **Annex 1** of this report, pending the assessment of the financial implications;
- To instruct the TMAG with the elaboration of the TMAP guidelines for these parameters, including a more detailed argumentation and an indication of financial implications;
- That the final decision on the implementation of TMAP guidelines, together with an assessment of the financial implications, would be taken by the TWG at its next meeting (spring 2007).

The TMAG 07/1 (6-7 March 2007) prepared a fact sheet for each parameter group together with a proposal for monitoring locations and frequencies which is attached in **Annex 2** of this report. It covers:

- The information needs for management and reporting with regard to the implementation of the Wadden Sea Plan,
- The reporting requirements of the relevant EC Directives (Birds, Habitats, Water Framework) taking into account that regional differences with regard to priority setting in implementation of the EC Directives occur,
- The explanation for inclusion of this parameter group in the revised TMAP,
- The technical feasibility of the proposed parameters (whether appropriate monitoring methods are in place or whether additional technical work is required).

2. Results

2.1 Revised TMAP

An overview of the proposed parameters has been compiled in the summary table in **Annex 1**. It makes clear that most of the proposed TMAP parameters are part of existing or planned monitoring programs in the three countries and already cover the requirements of the EC Directives and other international agreements.

What remains unchanged?
A number of TMAP parameters have been coordinated trilaterally and successfully harmonized for a long time already (breeding and migratory birds, harbour seals, blue mussels, salt marshes, contaminants in bird eggs) and provide a good basis for the Wadden Sea monitoring in the three countries. They have proven their value for Target assessment (QSR 2004) and for national and international reporting obligations (such as Ramsar, OSPAR, EC Directives) and are continued in the revised TMAP. Technical adaptations which may be necessary in future can be integrated in the regular TMAP work.

Where are changes necessary?
For some parameter groups, new monitoring strategies still have to be developed in the future. This concerns especially monitoring of subtidal habitats and monitoring in the Offshore Area (up to 12 sm), for example for seabirds and harbour porpoise. For these parameters, an indication of costs can not yet been given.

Further technical adaptations of TMAP parameters (such as locations, frequencies, methods) to the HD and WFD assessment schemes, which are recently under development, have also to be considered in future. This concerns mainly the parameters on macrozoobenthos, macrophytes, fish and chemical substances and may have financial consequences for national monitoring programs. The assessment schemes of the HD (definition of conservation objectives and favorable conservation status) and WFD (reference condition and a classification scheme for good ecological status) will also to be linked with the further development of the Wadden Sea Plan (§6 SchD, 2005).

The parameter groups “fishery”, “recreational activities” and “general parameters” are re-organized in the revised TMAP. The information for parameter groups “fishery”, “recreational activities” and “general parameters” will be obtained from existing data sources outside the TMAP (such as economic statistics, weather agencies, land use data) rather than to establish a separate, cost-intensive monitoring program. Additional data on human (economic) activities which may also have an impact will be compiled regularly in the framework of the QSR. In case the data is easily available in all countries and can be transferred to the TMAP Data Units, the data compilation in the TMAP will be continued. No additional costs for the TMAP regarding these parameters are expected.

What is new?
The parameter “breeding success” is proposed to be included in the revised TMAP as a new parameter assessing the Target of a “natural breeding success”. It will complement the existing bird monitoring program with an “early warning” aspect and allows a better and integrated assessment of the status of breeding bird populations. The practical applicability has already been demonstrated during a trilateral pilot project in 1996 – 1997.

Are there changes in data management?
The current TMAP data management scheme is flexible enough to implement the changes of the monitoring program (modified or additional parameters) into the TMAP Data Units within

the regular work program and maintenance of the system. Therefore, additional costs for the TMAP data handling resulting from the TMAP revision are not expected.

2.2 How to proceed

a. Technical elaboration
Further work on the technical elaboration can be included in the regular TMAP work and will be carried out by the TMAG and the trilateral monitoring expert groups, such as the bird and seal groups. Topical ad-hoc expert meeting, for examples in the framework of the QSR preparation, can also support this work to technically adapt the TMAP in the future.
The next QSR will give also the opportunity to develop standard procedures for compilation of data on human (economic) activities and general data and to enhance the comparability of these data further.

b. New parameter "breeding success"
The implementation into a regular monitoring will require additional financial resources. A project proposal elaborated by the TMAG in 2001 calculated total costs of 82,200 Euro (about 6350 Euro per monitoring site per year); this figure, however, has to be updated to the present situation (TMAP Evaluation Report, 2001). The parameter can be made operational in spring 2008 which gives an opportunity to include the results into the next QSR. On a basis of a detailed implementation plan, the actual financial consequences have to be assessed on the national and TWG level. Denmark has already indicated that an inclusion of a new parameter will result in a reduction of other TMAP parameters.

c. Connection to the further development of the Wadden Sea Plan
The revised TMAP is strongly linked to the Wadden Sea Plan Target as demonstrated in the QSRs 1999 and 2004. However, in some cases, specific assessment procedures have not yet been developed to assess the Target implementation in detail, or monitoring alone was not able to deliver the required information for a Target assessment.
The Wadden Sea Plan (WSP) is currently being further developed "within our Shared Vision, Principles and Targets … into a management plan for the Wadden Sea Area in accordance with the stipulations entailed in the Habitats, Birds and the Water Framework Directives and other European Union directives and regulations, in particular Article 6 (1) of the Habitats Directive" (§6 SchD, 2005). This process gives an opportunity to integrate the TMAP in a broader conceptual approach into the trilateral management framework.

3. Trilateral Agreement

The meeting of the Trilateral Working Group (TWG 07/1, Delfzijl, NL, 18 – 19 April 2007) agreed

1. To adopt the pragmatic approach of a revised TMAP, as elaborated by HARBASINS in detail in Annex 2 of the document as a starting point of the further technical and financial elaboration in close cooperation with the development of the monitoring programs on the national level and the further development of the Wadden Sea Plan, and to integrate these developments into the revised program,
2. To instruct the TMAG and JMBB with the preparation of an implementation plan for the parameter breeding success for the next TWG meeting in 2007,
3. For important developments, such as Pacific Oyster spreading or migratory birds decline, the TMAG is instructed to propose practical solutions to integrate such items into the TMAP.

ANNEX 1 Overview of the revised TMAP

Topic	Parameter	Method	Remarks	Costs
Targets on quality of water and sediment				
1. Eutrophication	- nutrient inputs (river, atmosph.) - nutrients in water - chlorophyll a - phytoplankton - macroalgae - macrozoobenthos	According OSPAR Common Procedure (see QSR 2004), and WFD guidance	The TMAP parameters cover the existing or planned monitoring programs in the three countries.	No additional costs expected for the TMAP
2. Natural micro-pollutants (metals, PAH)	- metals in sediment and biota (mussel, flounder, bird eggs) - PAH (water, sediment, mussel) - Beached (oiled) birds	According JAMP guidelines and WFD guidance. According OSPAR resp. TMAP/TBBS guidelines	WFD priority substances to be monitored in the water column according risk analysis for individual water bodies.	No additional costs expected for the TMAP
3. Man-made sub-stances (xenobiotics)	- organochlorines in sediment and biota (mussel, flounder, bird eggs) - TBT (sediment, biota)	According JAMP guidelines and WFD guidance	WFD priority substances to be monitored in the water column according risk analysis for individual water bodies.	No additional costs expected for the TMAP
4. Targets on Salt Marshes	- area, - vegetation - selected typical species, - grazing, - drainage	Vegetation mapping (aerial photographs and ground truth); Field surveys (permanent plots or stratified random sampling)	Existing monitoring schemes to be continued. Common TMAP typology can be applied.	No additional costs expected for the TMAP
5. Targets on Tidal Area (1)				
5.1 Geomorphology	- area of tidal flats - sediment type distribution,	Remote sensing and field sampling	Comparability of methods to be enhanced.	No additional costs expected for the TMAP
5.2 Macrozoobenthos	- species composition - abundance - biomass - age [not mandatory]	Field surveys and transects, national WFD guidelines.		No additional costs expected for the TMAP
5.3 Biogenic structures:				
a. seagrass	- area and distribution - coverage	Mapping of intertidal seagrass beds (aerial mapping and field surveys).	Revised TMAP guidelines prepared by seagrass group in 2006.	No additional costs expected for the TMAP
b. mussel beds	- area and distribution - biomass - coverage	Mapping of intertidal blue mussel beds (aerial photographs and field surveys)		No additional costs expected for the TMAP
c. Sabellaria reefs	- area and distribution	Methods for subtidal habitats under development.	From research projects on subtidal mapping in Lower Saxony, Schleswig-Holstein and The Netherlands.	Cost indication not yet possible.
5.4. Fish	- distribution and abundance of species in the Wadden Sea	Existing surveys for demersal fish (IMARES, BfA Fisch.) and pelagic fish (Schl.-Holstein)	Wadden Sea fish assessment tool in preparation (similar to WFD tool in transitional waters).	No additional costs expected for the TMAP
	- distribution and abundance of species in transitional waters	Stow net fishery (pelagic fish), 3-4 stations in Ems, Weser, Elbe	Guidelines developed for WFD monitoring (obligatory)	Additional costs covered by WFD budget

Topic	Parameter	Method	Remarks	Costs
Targets on Beaches & Dunes				
6. Dunes	- area - vegetation - selected typical species - nitrogen deposition, - land use	Vegetation mapping (aerial photographs and ground truth); Field surveys (permanent plots or stratified random sampling)	Existing monitoring schemes to be continued. Common TMAP typology can be applied. Comparability of field survey methods to be enhanced.	No additional costs expected for the TMAP
7. Targets on Offshore zone (1) (from baseline to 3 resp. 12 sm)	- selected chemicals, - area and location of sand banks and reefs, - selected typical species (birds) - marine mammals	According OSPAR guidelines and WFD standards. Methods for subtidal habitats under development in HD. Methods for BD and HD species under development	Research projects on subtidal mapping area carried out in NL and D.	Cost indication not possible
8. Targets on Birds	- number and distribution of breeding birds	According JMBB/TMAP guidelines	Existing monitoring schemes to be continued. Adaptation to 6-year reporting cycle.	No additional costs expected for the TMAP. Additional costs if inclusion of new species.
	- breeding success	JMBB/TMAP Pilot project	Financing possibility for “breeding success” to be assessed	New parameter, about 6350 Euro per site (2001)
	- number and distribution of migratory birds	According JMMB(TMAP guidelines	Existing monitoring schemes to be continued. Adapted to 6-year reporting cycle. Projects to be initiated to assess Targets (food availability, roosting and moulting areas, natural flight distances.)	No additional costs expected, inclusion of additional species within existing budget. Extra budget for projects required to assess targets.
9.Target on Marine mammals*	- numbers and distribution of harbour seals (adults & pups)	According TSEG / TMAP guidelines	Existing monitoring scheme to be continued.	No additional costs expected for the TMAP
	- numbers and distribution of grey seals	National surveys	Harmonization of existing monitoring (ongoing by TSEG)	No additional costs expected for the TMAP
	- numbers and distribution harbour porpoise	National and/or North Sea wide surveys according to national HD obligations	Await MINOS results (German project) for possible Wadden Sea monitoring.	Cost indication not possible
10. Human activities	- fishery - recreational activities	According TMAP guidelines.	Also available data on all other human activities relevant for assessment should be compiled.	No additional costs expected for the TMAP
11. General parameters	- costal protection measures - flooding/hydrology - land use - weather conditions	All relevant available data from existing sources	Compilation in connection with trilateral assessment (QSR)	No additional costs expected for the TMAP

ANNEX 2 Parameters of the Revised TMAP

1. Eutrophication

Requirements

Wadden Sea Plan
Target: A Wadden Sea which can be regarded as a eutrophication non-problem area.

Habitats Directive (HD)
No specific requirements for eutrophication monitoring.

Water Framework Directive (WFD)
Annex 5, chapter 1.2.4
CIS Guidance document on eutrophication assessment in the context of European Water Policies (November 2005)

OSPAR
OSPAR Strategy to Combat Eutrophication
OSPAR Eutrophication Monitoring Programme (Agreement 2005-04)
OSPAR Common Procedure for the Identification of the Eutrophication Status of the Maritime Area (Agreement 2005-03),
Ecological Quality Objectives (EcoQO):
9. Eutrophication: 9.1 Eutrophication Status of the North Sea (winter nutrient concentration, phytoplankton chlorophyll, phytoplankton indicator species, oxygen, kills in zoobenthos, changes in zoobenthos).

Explanation
The TMAP approach has been based on the OSPAR strategy which is currently tuned with the WFD (EMMA activities, GIC Guidance on eutrophication). The Wadden Sea is still regarded as “eutrophication problem area” under OSPAR. It is likely that the “good ecological status” under the WFD will not be reached until 2015 because of high nutrient inputs.
Information basis for trilateral assessment are national monitoring programs which have been established under OSPAR and the WFD. These can be regarded as sufficient to assess the eutrophication status and the Target implementation (see Tab. 1).

Table 1: Eutrophication Monitoring in the revised TMAP

Parameter		Location*	Frequency	WFD	BHD	OSPAR	Remark
Riverine nutrient inputs (t/a)	Nitrate, Nitrite, Ammonium, Phosphate	Existing river sampling stations	Annual mean input	X	-	X	Annual mean input
Atmospheric inputs	N P	Existing stations					Modelling
Nutrients in water	Nitrate, Nitrite, Ammonium, Phosphate	1-6 stations per region	1/week - 1/month	X	-	X	Winter concentrations and seasonal cycle
Chlorophyll a	Chl-a	1-6 stations per region	1/week - 1/month	X		X	
Phytoplankton	Species composition, abundance	1-6 stations per region	1/week - 1/month	X		X	
Macroalgae	Area covered, Species composition, abundance, biomass	1-6 stations per region	1/y	X		X	According methods in national programs
Macrozoobenthos	Species composition,	1-6 stations /transects per		X		X	See “Tidal Area”

	abundance	region					

* Number of stations per region depends on number of WFD water body typed to be covered. Regions: NL, Nds/HH, S-H, DK

Sampling locations

For each of the four region (The Netherlands, Niedersachsen/Hamburg, Schleswig-Holstein, Dennmark), at least one sampling location per WFD water body type should be established. The existing time series should be continued.

Monitoring Guidelines

The OSPAR „JAMP eutrophication monitoring guidelines" are also valid within the TMAP (TMAP Manual, June 2000).
TMAP Manual II-2.1 Nutrients in water
TMAP Manual II-4.1 Phytoplankton
TMAP Manual II-5.1 Macroalgae
TMAP Manual II-5.3 Macrozoobenthos

2. Natural Micropollutants (metals, PAH) and man-made substances (xenobiotics)

Requirements

Wadden Sea Plan
Targets:

- Background concentrations of natural micropollutants
- Concentrations of man-made substances as resulting from zero-discharges

Habitats Directive (HD)
No specific requirements for chemical monitoring.

Water Framework Directive (WFD)
Article 8
Annex V,
Annex VIII: Indicative List of Main Pollutants
Annex X: List of Priority Substances
Objectives: Article 4: No deterioration, good status by 2015, reduction of pollutants, achievement of objectives set for protected areas in EC legislation. Good chemical status of surface water according WFD Annex V
WFD CIS Guidance on Chemical Monitoring (draft version Nov. 2006)

OSPAR
The OSPAR Hazardous Substances Strategy sets the objective of preventing pollution of the maritime area by continuously reducing discharges, emissions and losses of hazardous substances, with the ultimate aim of achieving concentrations in the marine environment near background values for naturally occurring substances and close to zero for man-made synthetic substances.
OSPAR List of Chemicals for Priority Action (Update 2006) (Ref 2004-12)
OSPAR Coordinated Environmental Monitoring Programme (CEMP) (Ref. 2006 -1)
Ecological Quality Objectives (EcoQO):

3.2) mercury concentrations in seabird eggs,
3.3) organochlorine concentrations in seabird eggs,

Explanation

The TMAP approach has been based on the OSPAR strategy and is now adapted to the WFD requirements with regard to matrix selection, sampling locations and frequencies. Only

substances which occur in relevant concentrations in coastal waters have been included into the common monitoring program for the Wadden Sea.
Selection of priority substances and the specific WFD monitoring strategy (selection of water body, operational and surveillance monitoring) depends on risk analysis and occurrence of PS and has to be carried out for individual water bodies by the member states.
The TMAP ad-hoc working group hazardous substances (2006) prepared a proposal for chemical monitoring in the TMAP. Monitoring of WFD priority substances in water for reporting under the WFD reporting should be done at the national level (depending on the risk analysis of individual water bodies) and not in the TMAP.

Sampling locations
For each of the four region (The Netherlands, Niedersachsen/Hamburg, Schleswig-Holstein, Denmark), at least one sampling location per WFD water body type should be established. The existing time series should be continued.

Monitoring Guidelines
The OSPAR guidelines are also valid within the TMAP (TMAP Manual, June 2000):

- JAMP guidelines for monitoring contaminants in biota (Technical Annex 1 – determination of organic contaminants, Technical Annex 2 – determination of metals, Technical Annex 3 – determination of PAHs) and
- JAMP guidelines for monitoring contaminants in sediments (Technical Annex 1 – statistical aspects, Technical Annex 2 – determination of CBs, Technical Annex 3 – determination of PAHs, Technical Annex 4 – determination of TBT, Technical Annex 5 – normalisation of contaminant concentrations, Technical Annex 6 – Determination of metals – analytical methods).

The WFD CIS Guidance on Chemical Monitoring Activities (CMA) (draft version November 2006) is currently under preparation. It covers amongst other guidance on the selection of substances, matrix (water, suspended matter, sediment, biota) and frequencies. With regard to coastal waters the guidance refers to the OSPAR Guidelines.

Monitoring Matrix
The TMAP focuses on monitoring of hazardous substances in sediment and biota because the high variability in the water column and the fact that concentrations in marine waters are often below detection limit makes it almost impossible to assess temporal and spatial trends along the Wadden Sea coast. The approach of monitoring in sediment and biota as main matrix is also followed by OSPAR and recommended by the WFD-CMA guidance for hydrophobic substances.
Monitoring of hazardous substances in the water according WFD depends on the individual risk analysis to be carried out for each water body by the member states.

Monitoring Frequency
Selection of frequencies has to be carried out separately for each substance, matrix and station taking into account short-term and long-term fluctuations and the specific objective.
In general, intensive monitoring (high frequencies such as annually) should preferably be done in biota, whereas less intensive monitoring (such as every 3 – 6 years) is more suitable for sediment monitoring. For a short term trend analyses, higher frequencies are necessary e.g. annual measurements at selected stations (decreased geographical coverage and/or focus on “hot spots”).

Table 2 Chemical Monitoring in the revised TMAP – Matrix Sediment

Parameters Sediment		Location*	Frequency	WFD	BHD	OSPAR	Remark
Metals	As, Cr, Zn, Ni, Cu, Cd, Hg, Pb	1-6 stations per region	3 – 6 years (1/y at few stations)	X**	-	X	
PAH	(CEMP, WFD-PS)	1-6 stations per region	3 – 6 years (1/y at few	X**	-	X	

			stations)				
PCBs	28, 52, 101, 118, 138, 153, 180	1-6 stations per region	3 – 6 years (1/y at few stations)	X**	-	X	
Organochlorines	DDTs HCHs HCB	1-6 stations per region	3 – 6 years (1/y at few stations)	X**	-	X	
Organotin	TBT, DBT, MBT, TPT	1-6 stations per region	3 – 6 years (1/y at few stations)	X**	-	X	
Brominated flame retardants	(BDE 47, 99, 100, 153) [1)]	1-6 stations per region	3 – 6 years (1/y at few stations)	X**	-	X	

* Number of stations per region depends on number of WFD water body types to be covered.
** According CIS Guidance on Chemical Monitoring / Netherlands: No WFD chemical monitoring in sediment
1) BDE on voluntary basis

Table 3: Chemical Monitoring in the revised TMAP – Matrix Biota: blue mussel

Parameters Biota		**Location***	**Frequency**	**WFD**	**BHD**	**OSPAR**	**Remark**
Blue Mussel							
Metals	Zn, Ni, Cu, Cd, Hg, Pb	1-6 stations per region	1/y or every 2 years	X**	-	X	
PAH	(CEMP, WFD-PS)	1-6 stations per region	1/y or every 2 years	X**	-	X	
PCBs	28, 52, 101, 118, 138, 153, 180	1-6 stations per region	1/y or every 2 years	X**	-	X	
Organochlorines	DDTs HCHs HCB	1-6 stations per region	1/y or every 2 years	X**		X	
Organotin	TBT, DBT, MBT, TPT	1-6 stations per region	1/y or every 2 years	X**		X	
Brominated flame retardants	(BDE 47, 99, 100, 153) [1)]	1-6 stations per region	1/y or every 2 years	X**		X	

* Number of stations per region depends on number of WFD water body typed to be covered.
** According CIS Guidance on Chemical Monitoring / Netherlands: No WFD chemical monitoring in biota
1) BDE on voluntary basis

Table 4 Chemical Monitoring in the revised TMAP – Matrix Biota: fish (flounder, optional: eelpout)

Parameters Biota		**Location***	**Frequency**	**WFD**	**BHD**	**OSPAR**	**Remark**
Fish (flounder, eelpout)							
Metals	Zn, Ni, Cu, Cd, Hg, Pb	1-6 stations per region	1/y or every 2 years	X**	-	X	Hg in muscle, other in liver
PAH	(CEMP, WFD-PS)	1-6 stations per region	1/y or every 2 years	X**	-	X	
PCBs	28, 52, 101, 118, 138, 153, 180	1-6 stations per region	1/y or every 2 years	X**	-	X	62 PCBs are analyzed
Organochlorines	DDTs HCHs HCB	1-6 stations per region	1/y or every 2 years	X**		X	
Organotin	TBT, DBT, MBT, TPT	1-6 stations per region	1/y or every 2 years	X**		X	
Brominated flame retardants	(BDE 47, 99, 100, 153) [1)]	1-6 stations per region	1/y or every 2 years	X**		X	

* Number of stations per region depends on number of WFD water body typed to be covered.
** According CIS Guidance on Chemical Monitoring / Netherlands: No WFD chemical monitoring in biota
1) BDE on voluntary basis

Table 5 Chemical Monitoring in the revised TMAP – Matrix Biota: Bird eggs (Common Tern, Oystercatcher)

Parameters Biota		**Location***	**Frequency**	**WFD**	**BHD**	**OSPAR**	**Remark**
Bird eggs (Common Tern, Oystercatcher)							
Metals	Hg	1-6 stations per region	1/y	X**	-	X	
PCBs	28, 52, 101, 118, 138, 153, 180	1-6 stations per region	1/y	X**	-	X	
Organochlorines	DDTs HCHs HCB	1-6 stations per region	1/y	X**		X	
Brominated flame retardants	(BDE 47, 99, 100, 153) [1)]	1-6 stations per region	1/y	X**		X	

* Selection of representative stations per region depends on location of bird colonies and feeding range of birds.
** According CIS Guidance on Chemical Monitoring / Netherlands: No WFD chemical monitoring in biota
1) BDE on voluntary basis

3. Beached Birds Survey (TBBS)

Requirements

Wadden Sea Plan
Targets:

- Background concentrations of natural micropollutants
- Concentrations of man-made substances as resulting from zero-discharges

OSPAR
Ecological Quality Objective (EcoQO):

3.1) proportion of oiled common guillemots among those found dead or dying on beaches. The proportion of such birds should be 10% or less of the total found dead or dying, in all areas of the North Sea.

Explanation
Monitoring beached oiled seabirds is carried out to assess

- the existing level of chronic oil and chemical pollution in the maritime area (using rate of oiled beached birds as indicator),
- the effectiveness of measures taken for the reduction of chronic oil pollution (using rate of oiled beached birds as indicator),
- the effect of oil pollution incidents on water birds and seabirds.

The existing monitoring program of beached birds has been carried out since 1984 and was valuable tool to assess extent and trends in chronic oil pollution (QSR 2004) and the effectiveness of measures to combat chronic oil pollution. The TBBS covers all typical Wadden Sea avifauna, and other abundant seabirds, such as scoter.

Table 6: Chemical Monitoring in the revised TMAP – Trilateral Beached Birds Survey (TBBS)

Parameters		Location	Frequency	WFD	BHD	OSPAR	Remark
Trilateral Beached Birds Survey (TBBS)	No. of beached birds per species; oil rate per specie,	representative stretches per countries	1-3/y (winter)	-		X	According national existing program and OSPAR
Oil analysis (not mandatory)	Oil type (fingerprint)	Selected sites		-		X	Oil analysis to be carried out on voluntary basis (e.g. to identify source of oil)

Monitoring guidelines
The relevant guidelines were elaborated in the framework of the JAMP by The Netherlands and Germany as lead countries in 1995 (JAMP Guidelines on standard methodology for the use of oiled beached birds as indicators of marine oil pollution, 1995).

4. Salt marshes

Requirements

Wadden Sea Plan
Targets:

- an increased area of natural salt marshes;
- an increased natural morphology and dynamics, including natural drainage patterns of artificial salt marshes, under the condition that the present surface area is not reduced;
- an improved natural vegetation structure of artificial salt marshes, including the pioneer zone.

Habitats Directive (HD)
Favorable conservation status of salt marsh habitat types (1310 Salicornia, 1320 Spartina, 1330 Atlantic salt meadows)
Article 11 Surveillance of conservation status of habitats and species
Article 17: Assessment, monitoring and reporting

Water Framework Directive (WFD)
Article 8, Annex V, Quality element: Angiosperms

OSPAR
No specific requirements for salt marsh monitoring.

Explanation
Monitoring of salt marshes is carried out in all countries on a regular basis. Different national vegetation keys are in use (e.g. the Dutch SALT97) which are translated into a common TMAP key (QSR 2004). It allows a trilateral comparable assessment of the salt marsh vegetation on the basis of the existing monitoring schemes. The vegetation reflects the important salt marsh zonation types (pioneer zone, low marsh, high marsh, green beaches, brackish marsh) and human interference including drainage, groynes and land use (Bakker et al. 2005). It can be applied

- to assess long-term and short term changes in the vegetation also with respect to animal life, especially with regard to birds,
- to assess the development of single vegetation types or typical species,
- to analyze the distribution pattern of the vegetation in relation to land use.

The TMAP vegetation key can also be used as a basis for an assessment within the WFD (Bewertungsmatrix WRRL, NLWKN, 19.2.2007).
Further parameters may be selected on national level depending on local pressures and risk assessment procedures under HD and WFD.

Table 7 Salt Marsh Monitoring in the revised TMAP

Parameters		Location	Frequency	WFD	BHD	OSPAR	Remark
Area	Size and location (ha)	Entire area	6 years	X*	X	-	
Vegetation	HD types (ha)	Entire area	6 years	X*	X	-	HD type Spartina not in DK
	Vegetation types (ha)	Entire area	6 years (selected sites: annually)	X*	X	-	TMAP key in NL + D
Species	Abundance and composition of typical species	Selected areas	Annually	X*	X**	-	Not mandatory
Land use	Cutting, grazing	Entire area	6 years	-	X	-	

	(intensive, moderate, none)						
Drainage measures	3 types (none, within last 10 years, more than 10 y ago)	Entire area	6 years	X	X	-	

* DK: Salt marshes not part of WFD monitoring. NL: Mainland salt marshes not part of WFD monitoring
**Under discussion in national HD and WFD monitoring

Monitoring guidelines

Guidelines for monitoring of salt marshes are available in the TMAP Manual (Chapter II-9.1 & 9.2) (version June 2000). The TMAP vegetation key (and related vegetation zonation and HD) is published in the QSR 2004, the technical guidance was elaborated by the TMAP salt marsh experts.

5. Tidal Area

5.1 Geomorphology

Requirements

Wadden Sea Cooperation
Targets:

- a natural dynamic situation in the Tidal Area
- an increased area of geomorphologically and biologically undisturbed tidal flats and subtidal areas;

Habitats Directive (HD)
Monitoring of geomorphological features for habitat types in the Tidal Area:.
Favorable conservation status of habitat types:

- Sandbanks (1110)
- Estuaries (1130)
- Mudflats (1140)
- Lagoons (1150)
- Shallow inlets and bays (1160)
- Reefs (1170)

Water Framework Directive (WFD)
Article 8
Annex V, Chapter 1.2.3 and 1.2.4: Morphological conditions

OSPAR
No specific requirements for geomorphological monitoring.

Explanation
Monitoring of geomorphologic characteristics in the TMAP is carried out to assess possible changes due to changes in climate and the effect of these changes on habitats, species and communities. Information on area of tidal flats and sediment type distribution can be obtained from remote sensing surveys and in combination with existing field sampling (such as benthos monitoring).

Table 8 Geomorphology Monitoring in the revised TMAP

Parameters		Location	Frequency	WFD	BHD	OSPAR	Remark
Area of tidal flats	Size and location (ha)	Entire area	6 years	X	X	-	
Sediment type distribution	Location and area of sediment types (sand, mixed, mud)	Entire area and/or selected sites	6 years	X	X	-	

Monitoring guidelines
Guidelines for monitoring of geomorphology are available in the TMAP Manual (Chapter II-1 General Parameters).

5.2 Macrozoobenthos

Requirements

Wadden Sea Plan
Targets:

- an increased area of geomorphologically and biologically undisturbed tidal flats and subtidal areas;

Habitats Directive (HD)
Macrozoobenthos species as characteristic species of habitat types. Favorable conservation status of habitat types:

- Sandbanks (1110)
- Estuaries (1130)
- Mudflats (1140)
- Lagoons (1150)
- Shallow inlets and bays (1160)
- Reefs (1170)

Article 11 Surveillance of conservation status of habitats and species
Article 17: Assessment, monitoring and reporting

Water Framework Directive (WFD)
Article 8
Annex V, Chapter 1.2.3 and 1.2.4: Morphological conditions

OSPAR
OSPAR Common/Comprehensive procedure
JAMP Eutrophication Monitoring Guidelines: Benthos (1997)
JAMP Theme B. Biological Diversity and ecosystems
OSPAR List of Threatened and/or Declining Species and Habitats

Explanation
Long-time series in the Wadden Sea during the last 30 years have prooved their value in indicating changes in species composition and biomass although large interannual fluctuations have occurred (e.g. due to high spatfall of bivalves) (QSR 2004) and regional differences were observed. The existing time series should be continued with an annual frequency at locations representative for a specific Wadden Sea region (or water body) and, if necessary, supplemented with locations monitored every 3 years to assess the macrozoobenthos development for a larger area (entire tidal basins or water body).

Table 9 Macrozoobenthos Monitoring in the revised TMAP

Parameters		Location	Frequency	WFD	BHD	OSPAR	Remark
Species composition	Number of species	1 – 2 transects per region	1/y,to 3 y	X	X*	X	
Abundance	Number of individuals per species per m²	1 – 2 transects per region	1/y,to 3 y	X	X*	X	
Biomass	g AFDW per m²	1 – 2 transects per region	1/y,to 3 y	X	X*	X	
Age	Age frequency distribution for selected species	1 – 2 transects per region	1/y,to 3 y	X	X*	X	Not mandatory

* Contribution to assessment of favorable conservation status of habitat types.

Monitoring guidelines

Guidelines for monitoring of macrozoobenthos are available in TMAP Manual (Chapter II-5.3 Macrozoobenthos) (version June 2000) and OSPAR (JAMP Eutrophication Monitoring Guidelines).

5.3 Seagrass

Requirements

Wadden Sea Plan
Wadden Sea Plan: Targets on "Tidal Area"

- An increased area of, and a more natural distribution and development of … *Zostera* fields.

Habitats Directive (HD)
Article 11 Monitoring of habitat types
Seagrass is a characteristic feature of habitat types "1110 Sandbanks" 1140" Mudflats and sandflats" and "1160 Large shallow inlets and bays"

Water Framework Directive (WFD)
Annex 5, chapter 1.2.4
Article 4: No deterioration, good status by 2015, reduction of pollutants, achievement of objectives set for protected areas in EC legislation.
Good ecological status of surface water: biological quality element "Angiosperms"

OSPAR
Biological Diversity and Ecosystems Strategy, Annex V and Appendix 3
Initial OSPAR List of Threatened and/or Declining Species and Habitats (Ref-Nr. 2004-06): Zostera beds.
EcoQO Issue 8 "threatened and/or declining habitats": presence and extent of habitats in the North Sea as shown on the Initial OSPAR List: "Zostera beds"

Explanation
A draft TMAP guideline with common definitions and a classification of seagrass beds was developed in 2006 which allows a common interpretation of monitoring results of the entire Wadden Sea. Because of the extreme uneven distribution of intertidal seagrass, different monitoring methods are in use. Complete mapping (see A.) of the entire tidal flats is done every year in areas with dense seagrass beds (which can easily be identified by airborne surveys). In areas with sparse coverage, annual monitoring is done in field survey on transects; in a complete mapping of the entire tidal flats is done at least every 6 years. In both cases detailed monitoring (see B.) is carried at selected sites to monitor further characteristics of the bed (as required by WFD and HD), these parameters are optional for the TMAP.

Table 10 Seagrass Monitoring in the revised TMAP

Parameters		Location	Frequency	WFD	BHD*	OSPAR	Remark
A. Distribution of intertidal seagrass beds:		Entire Area and representative areas	Entire area: at least 6 y Selected sites: 1/y				
-area	size of seagrass beds (km²)			X	X	X	
- location	coordinates of seagrass beds (GIS polygon)			X	X	X	
- coverage	Seagrass coverage of the beds (%)			X	X	X	
B. Characteristics of sea grass beds:		Selected sites	1/y				Optional for TMAP
- species composition	Zostera marina Z. noltii, Ruppia maritima, green			X	X		

	macroalgae, others						
- biomass				X	X		
- sediment characteristics				X	x		

* Seagrass as characteristic feature of habitat types “1110 Sandbanks” 1140” Mudflats and sandflats” and “1160 Large shallow inlets and bays”

Monitoring guidelines

Draft TMAP Guidelines prepared by the TMAP ad hoc expert group seagrass monitoring (2006).

5.4 Mussel Beds

Requirements

Wadden Sea Cooperation
Wadden Sea Plan: Targets on "Tidal Area"

- An increased area of, and a more natural distribution and development of …natural mussel beds.

Habitats Directive (HD)
Article 11 Monitoring of habitat types
Habitat type 1170 Reefs,
(*Note*: designation of blue mussels beds differs in the countries:
- The Netherlands: blue mussel beds are integrated 1110 and 1140 and not designated as reefs
- Germany: blue mussel beds are designated as reefs
- Denmark:: blue mussel beds are not designated as reefs)

Blue mussel bed are characteristic features of habitat types are "1110 Sandbanks" 1140" Mudflats and sandflats" and "1160 Large shallow inlets and bays".

Water Framework Directive (WFD)
Annex 5, chapter 1.2.4
Article 4: No deterioration, good status by 2015, reduction of pollutants, achievement of objectives set for protected areas in EC legislation.
Good ecological status of surface water: biological quality element "Macrozoobenthos"

OSPAR
Biological Diversity and Ecosystems Strategy, Annex V and Appendix 3
Initial OSPAR List of Threatened and/or Declining Species and Habitats (Ref-Nr. 2004-06): "Intertidal *Mytilus edulis* beds on mixed and sandy sediments".
EcoQO Issue 8 "threatened and/or declining habitats": presence and extent of habitats in the North Sea as shown on the Initial OSPAR List: "Intertidal *Mytilus edulis* beds"

Explanation
The existing national monitoring programs have been tuned to enable a trilateral assessment for the entire area (e.g. by GIS tools) with regard to size and biomass of intertidal mussel. Information on the development of individual mussel beds is also collected to assess status of these beds.
Due to irregular spatfall, larger interannual fluctuations may occur on regional level which requires monitoring with an annual frequency.
Subtidal blue mussel beds are monitored in NL, SH, and DK in the framework of the fishery management and have not yet been integrated in the TMAP.

Table 11 Intertidal Blue Mussel Monitoring in the revised TMAP

Parameters		Location	Frequency	WFD	BHD	OSPAR	Remark
Area and distribution of intertidal blue mussel beds:	size of blue mussel beds (km^2), coordinates of mussel beds (GIS polygon)	Entire intertidal area	1/y	X	X*	X	
Biomass	Tons fresh weight	Entire intertidal area	1/y	X	X*		Calculated from selected beds
Coverage	mussel	Entire intertidal	1/y	X	X`*		Calculated

	coverage of the beds (%)	area					from selected beds
Additional parameters for individual beds:	length frequency distribution, condition index, structure of bed						Not mandatory (according TMAP guidelines)

* blue mussel beds as reefs or as characteristic feature of habitat types.

Monitoring guidelines

TMAP Manual Chapter II-5.5 Blue Mussels.

5.5 Sabellaria Reefs

Requirements

Wadden Sea Cooperation
Wadden Sea Plan: Targets on "Tidal Area"

- An increased area of, and a more natural distribution and development of …Sabellaria reefs

Habitats Directive (HD)
Article 11 Monitoring of habitat types
Habitat type 1170 Reefs,
Other relevant habitat types are "1110 Sandbanks" 1140" Mudflats and sandflats" and "1160 Large shallow inlets and bays" (Sabellaria reefs as characteristic feature).

Water Framework Directive (WFD)
Annex 5, chapter 1.2.4
Article 4: No deterioration, good status by 2015, reduction of pollutants, achievement of objectives set for protected areas in EC legislation.
Good ecological status of surface water: biological quality element "Macrozoobenthos"

OSPAR
Biological Diversity and Ecosystems Strategy, Annex V and Appendix 3
Initial OSPAR List of Threatened and/or Declining Species and Habitats (Ref-Nr. 2004-06): *Sabellaria spinulosa* reefs.
EcoQO Issue 8 "threatened and/or declining habitats": presence and extent of habitats in the North Sea as shown on the Initial OSPAR List: "*Sabellaria spinulosa* reefs"

Explanation
Information concerning the existing reefs is unsatisfactory and based on single surveys several years ago. Methods for routine subtidal habitat monitoring are not yet available. There are research projects on subtidal mapping in Lower Saxony, Schleswig-Holstein and The Netherlands with the aim to develop appropriate methods. Results from these projects will provide information about the existing reefs and how to approach subtidal monitoring in the TMAP

Monitoring guidelines
TMAP Manual Chapter II-5.4 Sabellaria Reefs (methods for subtidal habitat monitoring to be developed).

5.6 Fish

Requirements

Wadden Sea Cooperation
Target "Tidal Area"

- an increased area of geomorphologically and biologically undisturbed tidal flats and subtidal areas;

Habitats Directive (HD)
Article 11 Monitoring of species and habitat types
Fish species listed in Annex II, IV, V: twaite shad, allis shad, river lamprey, sea lamprey, salmon, houting). Fish as characteristic species of "1110 Sandbanks" 1140" Mudflats and sandflats" and "1160 Large shallow inlets and bays" (*Note*: Still under discussion on national level)

Water Framework Directive (WFD)
Annex 5, chapter 1.2.4
Article 4: No deterioration, good status by 2015, reduction of pollutants, achievement of objectives set for protected areas in EC legislation.
Good ecological status of transitional water: biological quality element "Fish"

OSPAR
Biological Diversity and Ecosystems Strategy, Annex V and Appendix 3
Initial OSPAR List of Threatened and/or Declining Species and Habitats (Ref-Nr. 2004-06): Fish species.
EcoQO Issues:
1. Commercial fish species: 1.1. Spawning stock biomass,
4. Fish communities: 4.1 Changes in proportion of large fish,
7. Threatened and/or declining species: 7.1 Presence and extent of threatened and/or declining species in the North Sea as shown on the Initial OSPAR List: Fish species

Explanation
Monitoring programs of demersal fish in the Wadden Sea have been carried out on a regular basis for over 30 years. Pelagic fish monitoring has been carried out in Schleswig-Holstein since 1991. In the QSR 2004 these results have been published for the entire Wadden Sea for the first time. Because fish are an important element of the Wadden Sea ecosystem and require also reporting under the Habitats Directive, the existing monitoring (covering the Dutch and German Wadden Sea) are integrated in the TMAP. A TMAP assessment tool is under preparation (species composition, temporal and spatial distribution of selected fish species) which has been based on the existing monitoring programs and is directly connected to the assessment tool developed for transitional waters. A linkage can be made with the newly established WFD pelagic fish monitoring in the transitional waters of Ems, Weser, Elbe and Eider.
Proposals for the development fish targets have been developed and should be discussed in connection with the further development of the Wadden Sea Plan (§6 SchD).

Table 12 Fish Monitoring in the Wadden Sea

Parameters		Location	Frequency	WFD	BHD	OSPAR	Remark
distribution and abundance of species (Tidal and Offshore Area)	Abundance of species (demersal, pelagic)	Existing locations (demersal; NL + D; pelagic: SH)	1/y		X	X	Demersal fish: NL: DFS, D: DYFS Pelagic: SH
distribution and abundance of	Abundance of species	3 -4 sites from fresh to marine	1/y to 2y	X	X	X	WFD monitoring in

species in transitional waters (Tidal Area / Estuaries)	(pelagic)	waters					Ems, Weser, Elbe, Eider

Monitoring guidelines

TMAP Manual Chapter II-6.1 Monitoring of Eelpout, Flounder and Plaice.

6. Beaches and Dunes

Requirements

Wadden Sea Cooperation

Target “Beaches and Dunes”

- increased natural dynamics of beaches, primary dunes, beach planes and primary dune valleys in connection with the offshore zone;
- an increased presence of a complete natural vegetation succession;
- favorable conditions for migrating and breeding birds.

Habitats Directive (HD)

Article 11 Monitoring of species and habitat types. Relevant habitat types are:

2110 Embryonic shifting dunes
2120 Shifting dunes along the shoreline with Ammophila arenaria (“white dunes”)
2130 *Fixed dunes with herbaceous vegetation ("grey dunes")
2140 *Decalcified dunes with Empetrum nigrum (brown dunes)
2150 *Atlantic decalcified fixed dunes (Calluno-Ulicetea)
2160 Dunes with Hippophae rhamnoides
2170 Dunes with Salix repens ssp argentea (Salicion arenariae)
2180 Wooded dunes of the Atlantic, Continental and Boreal regions
2190 Humid dune slacks
(*Note*: In the Netherland, habitat type 1140-b covers the beaches)

Water Framework Directive (WFD)

(not relevant)

OSPAR

(not relevant)

Explanation

The TMAP dune typology is an appropriate tool to combine monitoring data obtained by different methods into a common system with different levels of detail (such as specific vegetation types in the Netherlands and Lower Saxony and HD types 2110-2190 for all countries). Existing national mapping of dunes should be continued in order to assess the overall occurrence of dune types in the Wadden Sea and to deliver input into the TMAP dune typology.

A detailed monitoring for assessing structure and function, species and communities according to the HD and pressure indicators (such as the critical load approach in the Danish NOVANA) is carried out in all countries using different methods. The results will be used for the trilateral assessment.

Beach monitoring could not yet be implemented in the TMAP because of lacking knowledge and methods.

Table 13 Dune Monitoring in the revised TMAP

Parameters		Location	Frequency	WFD	BHD	OSPAR	Remark
Location and area	a. HD-types (ha) b. Vegetation types (ha)	a. Entire area b Entire area / selected stations	6-10y		X		Transfer into TMAP dune typology
Vegetation	Species composition	Selected sites	1/y		X		
Selected typical species	Abundance	Selected sites	1/y		X		
Land use	Area covered by settlements and infrastructure	Entire area	6 y		X		Indicator for recreational pressure on dunes

Nitrogen deposition	a. kg N/ha/y b. lichen cover in grey dunes	a. Entire area b. DK islands	1/y		X		a. Modeling b. pilot

Monitoring guidelines

TMAP Manual Chapter II-10.1 Location and Area of Beaches and Dunes.
TMAP dune typology (QSR 2004),
TMAP ad hoc expert group 2006.

7. Offshore Area

(Offshore Area: from baseline to seaward border of Cooperation Area, up to 3 resp. 12 sm)

Requirements

Wadden Sea Cooperation

Target "Offshore Area"

- an increased natural morphology, including the outer deltas between the islands,
- a favorable food availability for birds,
- viable stocks and a natural reproduction capacity of the common seal, grey seal and harbor porpoise

Habitats Directive (HD)

Article 11 Monitoring of species and habitat types
Species according Annex 1 and 2
Relevant habitat types "1110 Sandbanks" and 1170" Reefs (Note: inclusion of 1160 "shallow inlets and bays" in the Offshore Area is under discussion in Germany)

Water Framework Directive (WFD)

Annex 5, chapter 1.2.4
Article 4: No deterioration, good status by 2015, reduction of pollutants, achievement of objectives set for protected areas in EC legislation.
Good ecological status of surface water (up to 1 sm)
Good chemical status of surface waters (up 12 sm)

OSPAR

Biological Diversity and Ecosystems Strategy, Annex V and Appendix 3
Initial OSPAR List of Threatened and/or Declining Species and Habitats (Ref-Nr. 2004-06)
EcoQO Issues:
1. Commercial fish species: 1.1. Spawning stock biomass,
2. Marine Mammal: 2.1 Seal population trends, 2.2 By-catch of harbour porpoise
3. Seabirds: 3.1 Oiled birds, 3.4 Plastic particles in stomachs, 3.5 Seabird population trends
4. Fish communities: 4.1 Changes in proportion of large fish,
7. Threatened and/or declining species: 7.1 Presence and extent of threatened and/or declining species in the North Sea as shown on the Initial OSPAR List,
8. Threatened and/or declining habitats: 8.1 Restore and/or maintain presence and extent of habitats in the North Sea as shown on the Initial OSPAR List,

Explanation

There is only limited information available for the offshore area (up to 12 sm from the baseline) which is often based on single surveys, research or wind-farm project studies. More regular monitoring is necessary with regard to the chemical status (WFD) and status of species and habitats. There is currently no proposal how to establish such a program especially for seabirds and subtidal habitats (For the North Sea, the Seabirds on Sea project has developed method). Monitoring of harbor porpoise is carried out irregularly with the North Sea wide SCANS and MINOS project.

Table 14 Offshore Monitoring in the revised TMAP

Parameters		Location	Frequency	WFD	BHD	OSPAR	Remark
Selected chemicals	(see chapter 3.2)	Stations according WFD	1-6 y	X			According WFD
Area and location of sandbanks and reefs	HD types (ha) (1110, 1170)		To be determined	X	X	X	Research projects on subtidal mapping in

							NL and D
Occurrence of selected typical species (birds)	Numbers and distribution		To be determined		X		
Marine mammals: Harbour porpoise	Aerial counts and/or acoustic detection (T-POD)	Entire area as relevant	To be determined		X	X	MINOS project

Monitoring guidelines

SCANS method available

"Seabird-on-Sea" methods for the entire North Sea.

8. Birds

Requirements

Wadden Sea Cooperation
Wadden Sea Plan: Targets on "Birds":
Favorable conditions for migratory and breeding birds

- favorable food availability,
- natural breeding success,
- sufficiently large undisturbed roosting and moulting areas,
- natural flight distances.

Birds Directive (BD)
Article 2: Measure to maintain the bird population
Article 3: Measure to preserve, maintain or reestablish a sufficient diversity and area of habitats
Article 4: Special conservation measures for Annex I species and for regularly occurring migratory species not listed in Annex I.
Article 10: Research as basis for protection, management
Annex I List of species
Annex V: List of endangered species, important areas, data on population level, taking of wild birds, species as indicators of pollution, effects of chemical pollution.

Habitats Directive (HD)
Birds are characteristic species of marine habitat types and are part of HD monitoring and reporting scheme.

Water Framework Directive (WFD)
Not relevant

OSPAR
Biological Diversity and Ecosystems Strategy, Annex V and Appendix 3
Ecological Quality Objectives:
EcoQO Issue 3:
3.1 Proportion of oiled guillemots among those found dead or dying on beaches (see Beached Birds Suvey, Table 6).
3.2 Mercury concentrations in seabird eggs. 3.3 Organohalogen concentrations in seabird eggs (see Table 5)
3.4 Plastic particle in stomachs of seabirds
3.5 Local sand eel availability to black-legged kittiwakes (breeding success in various UK regions)
3.6 Seabird population trends as an index of seabird community health.
EcoQO Issue 7 "threatened and/or declining species": presence and extent of species in the North Sea as shown on the Initial OSPAR List-

Ramsar
„Monitoring and analysis of the ecological character of the site and for assessing the status and trends of wetlands … of […], flora and fauna, […], conservation measures and potential threats."

AEWA
Regional Agreement under the Bonn Convention.
Annex 3 Action Plan:
Article 5:

"endeavour to monitor the populations listed in Table 1. The results … shall be published or sent to appropriate international organizations, to enable reviews of population status and trends.
- … cooperate with a view to determining the migration routes of all populations listed in Table 1, using available knowledge of breeding and non-breeding season distributions and census results, and by participating in coordinated ringing programmes."

Explanation:
The existing Joint Monitoring programs of Breeding Birds (JMBB) and Migratory Birds (JMMB) have been successful for over 15 years and should be continued. The frequency for monitoring and reporting will be linked to the 6-year reporting period (in accordance with the HD, BD) by the bird expert groups.

The proposed parameters "breeding success" is a suitable parameter and should be included in the TMAP. It is the most important indicator to assess the state of a bird population, acts as an "early warning signal" and complements the other bird monitoring parameters. The additional costs depend on the number of monitoring sites and species; in 2001 it was estimated to about 6350 Euro per site (TMAP Evaluation Report 2001), this figure, however, has to be updated to the recent situation. The financial implications have to be assessed at a later stage.

The JMMB and JMBB groups investigated whether monitoring and assessment of songbirds (5–7 species relevant for the Wadden Sea Area, according to the BD), other migratory and breeding bird species (according to the BD) and species of the trilateral Offshore Area (divers, seaducks, according to the BD) can be carried out in a coordinated way on a trilateral level.
It was concluded that additional migratory bird species can be included into the TMAP within the existing budget. With regard to the inclusion of breeding bird species, however, it can already be foreseen that this will have financial consequences, because of necessary additional field observations of the concerned species. More detailed technical and financial investigations are necessary to find a practical approach for the TMAP.

With regard to the assessment of the Targets concerning food availability (breeding and migratory birds), roosting and moulting areas (migratory birds), natural flight distances (breeding and migratory birds), specific projects should be initiated instead of inclusion of new parameters into the revised TMAP.

Table 15 Bird Monitoring in the revised TMAP

Parameters		**Location**	**Frequency**	**Other**	**BHD**	**OSPAR**	**Remark**
Breeding Birds							
Number and distribution of breeding birds	a. census areas, b. complete surveys of selected species c. periodical counts of a larger range of species within the entire area.	According TMAP /JMBB guidelines	According TMAP /JMBB guidelines	X	X		Inclusion of additional species in preparation by JMBB. Financial implications to be assessed
Breeding success	According TMAP pilot project	2-4 sites per region	Annually	X	X		Financial implications to be assessed
Migratory Birds							
Number and distribution of migratory birds	According TMAP guidelines	According TMAP /JMMB guidelines	According TMAP / JMMB guidelines	X	X		Additional species can be included (species selection by JMMB),

							within budget
Occurrence of selected typical species (birds)	Numbers and distribution	Offshore Area	To be determined		X		See Table Offshore Area
Moulting birds (selected species)							Species selection by JMMB in preparation

Monitoring guidelines

TMAP Manual Chapter II-7.1 Numbers and distribution of breeding birds (JMBB)
TMAP Manual Chapter II-7.2 Breeding success
TMAP Manual Chapter II-7.4 Monitoring of migratory birds (JMMB)

Appendix

The requirements of the **EC Birds Directive** which are related to monitoring are as follows:

Article 2
Member States shall take the requisite measures to maintain the population of the species referred to in article 1 at a level which corresponds in particular to ecological, scientific and cultural requirements, while taking account of economic and recreational requirements, or to adapt the population of these species to that level.

Article 3
1. In the light of the requirements referred to in Article 2, Member States shall take the requisite measures to preserve, maintain or reestablish a sufficient diversity and area of habitats for all the species of birds referred to in Article 1.

2. The preservation, maintenance and re-establishment of biotopes and habitats shall include primarily the following measures:
(a) creation of protected areas;
(b) upkeep and management in accordance with the ecological needs of habitats inside and outside the protected zones;
(c) re-establishment of destroyed biotopes;
(d) creation of biotopes.

Article 4
1. The species mentioned in Annex I shall be the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution. In this connection, account shall be taken of:
(a) species in danger of extinction;
(b) species vulnerable to specific changes in their habitat;
(c) species considered rare because of small populations or restricted local distribution;
(d) other species requiring particular attention for reasons of the specific nature of their habitat.

Trends and variations in population levels shall be taken into account as a background for evaluations. Member States shall classify in particular the most suitable territories in number and size as special protection areas for the conservation of these species, taking into account their protection requirements in the geographical sea and land area where this Directive applies.

2. Member States shall take similar measures for regularly occurring migratory species not listed in Annex I, bearing in mind their need for protection in the geographical sea and land area where this Directive applies, as regards their breeding, moulting and wintering areas and staging posts along their migration routes. To this end, Member States shall pay particular attention to the protection of wetlands and particularly to wetlands of international importance.

Article 10
1. Member States shall encourage research and any work required as a basis for the protection, management and use of the population of all species of bird referred to in Article 1.

2. Particular attention shall be paid to research and work on the subjects listed in Annex V. …

ANNEX V
(a) National lists of species in danger of extinction or particularly endangered species, taking into account their geographical distribution.
(b) Listing and ecological description of areas particularly important to migratory species on their migratory routes and as wintering and nesting grounds.
(c) Listing of data on the population levels of migratory species as shown by ringing.
(d) Assessing the influence of methods of taking wild birds on population levels.
(e) Developing or refining ecological methods for preventing the type of damage caused by birds.
(f) Determining the role of certain species as indicators of pollution.
(g) Studying the adverse effect of chemical pollution on population levels of bird species.

9. Marine Mammals

Requirements

Wadden Sea Cooperation
Wadden Sea Plan: Targets on "Marine Mammals":

- Viable stocks and a natural reproduction capacity of common/harbour seal, grey seal and harbour porpoise in the tidal areas and the offshore zone.

Habitats Directive (HD)
Article 11: Monitoring of conservation status of habitat types and species.
Species in Annex II, IV, V, according Article 1 (e)

- Harbour seal - Phoca vitulina (Annex II, V)
- Grey seal - Halichoerus grypus (Annex II, V)
- Harbour porpoise - Phocoena phocoena (Annex II, V)

Water Framework Directive (WFD)
Not relevant

OSPAR
Biological Diversity and Ecosystems Strategy, Annex V and Appendix 3
Initial OSPAR List of Threatened and/or Declining Species and Habitats (Ref-Nr. 2004-06): Harbour porpoise.
Ecological Quality Objectives:
EcoQO Issue 2: Marine mammals
2.1 Seal population trends in the North Sea

- Habour seal population size (no decline in population size of >10% as represented in a five-year running mean)
- Grey seal pup production (no decline in pup production of >10% as represented in a five-year running mean)

2.2 By-catch of harbour porpoises (annual by-catch level below 1.7%)
EcoQO 7.1 Presence and extent of threatened and declining species in the North Sea: Harbor Porpoise.

ASCOBANS
(Only relevant for Harbour Porpoise).
Achieve and maintain a favourable conservation status for small cetaceans.
Annex "Conservation and management plan"
1. Habitat Conservation and management
2. Surveys and research
   Investigation shall be conducted in order to
   (a) assess the status and seasonal movements of the populations and stocks concerned,
   (b) locate areas of special importance to their survival, and
   (c) identify present and potential threats to the different species.
3. Use of by-catches and stranding
   - reporting and retrieving by-catches and stranded specimens
   - carry out full autopsies (collect tissues for further studies, reveal possible causes of death, document food composition)
   - information shall be made available in an international database.

CMS – Seal Agreement
Seal Agreement 1991: first agreement of the Convention on the Conservation of Migratory Species of Wild Animals (CMS-Bonn Convention):

- Contracting Parties: The Netherlands, Germany, Denmark.
- Aim: to cooperate closely in achieving and maintaining a favorable conservation status for the harbour seal population in the Wadden Sea
- Provisions: amongst others, on research and monitoring, (implemented in the Seal Management Plan)
- TSEG in charge of the coordination, supervision of the implementation of the monitoring activities and assessment of the results.

Explanation:
All three marine mammals species occurring in the Wadden Sea Area, harbour seal, grey seal and harbour porpoise, are relevant for an assessment of the Targets and reporting for the HD, CMS, and ASCOBANS; however, regional differences occur.

The existing monitoring scheme for harbour seals should be continued and the current monitoring of grey seals should further be coordinated and trilaterally harmonized by the TSEG.

Monitoring of harbour porpoise should be done within a North Sea wide framework. The results of the MINOS project in Schleswig-Holstein should be awaited before deciding whether it is useful to include the harbour porpoise monitoring in the TMAP; this concerns the trilateral Offshore Area of the Schleswig-Holstein and the Lower Saxon Wadden Sea.

Table 16 Marine Mammal Monitoring in the revised TMAP

Parameters		**Location**	**Frequency**	**WFD**	**BHD**	**SMP**	**Remark**
numbers and distribution of harbour seals (adults & pups)	No of counted seals / counting area	Entire area	1/y (5 flights)		X	X	According Seal Management Plan (SMP)
numbers and distribution of grey seal	No of grey seal / counting area (adults and pups)	Entire area	1/y		X	X	National surveys (to be continued trilaterally coordinated)
numbers and distribution harbour porpoise	No of harbour porpoises / counting area	Offshore Area as relevant	Await MINOS results		X		National and/or North Sea wide surveys according to national HD obligations

Monitoring guidelines
TMAP Manual Chapter II-8.1 Seals
SCANS

10. Human Activities

Requirements

Wadden Sea Cooperation
Wadden Sea Plan: ecological targets, management of human activities.

Habitats Directive (HD)
Article 11 Monitoring of habitat types
Favourable conservation status of habitats and species: assessment of impacts from human activities.

Water Framework Directive (WFD)
Article 4: No deterioration, good status by 2015, reduction of pollutants, achievement of objectives set for protected areas in EC legislation.

OSPAR
No specific requirements. Assessment of impacts from human activities.

Explanation
The parameter groups “fishery” (landings) and “recreational activities” (boats, flat walkers, air traffic) will be continued in a revised TMAP using the available regional or national data sources. In addition, tourism data, as far as they are available, will be compiled from existing data sources.

Additional data on human (economic) activities which may have also an impact (harbors and shipping, hunting, military, gas and oil, wind energy, extraction, dumping¸ as listed in chapter 2 of the QSR) will be compiled regularly in the framework of the QSR. The TMAP will continue to refer to data from other sources as it was done in the QSR 2004. In case the data are easily available in all countries and can be transferred to the TMAP Data Units, the data compilation should be taken into account.

Table 17 Monitoring Human activities in the revised TMAP

Parameters		Location	Frequency	WFD	BHD	OSPAR	Remark
Fishery	Landings: Blue mussels Cockles Shrimps	Per country or region	1/y	X	X		From fishery statistics, according TMAP guideline
Recreational activities	Tourism data (overnight stays, number of beds / visitors) number of flat walker, boats, air traffic)	Per country or region	1/y		X		From existing statistics, according TMAP guideline
Human (economic activities)	harbors and shipping, hunting, military, gas and oil, wind energy, extraction, dumping	Per country or region	(as appropriate, in QSR)	X	x		Data on other human activities relevant for assessment should be compiled if available.

Monitoring guidelines
TMAP Manual Chapter II-11.1 Human activities
TMAP Manual Chapter II-11.2 Air traffic

11. General Parameters

Requirements

Wadden Sea Cooperation
No specific requirements from the Wadden Sea Plan. Assessment of climate change impacts

Habitats Directive (HD)
No specific requirements.

Water Framework Directive (WFD)
Article 4: No deterioration, good status by 2015, reduction of pollutants, achievement of objectives set for protected areas in EC legislation.
Hydromorphological quality elements: Tidal regime (direction of dominant current, freshwater flow).

OSPAR
No specific requirements.

Explanation
The following parameter groups are currently part of the TMAP "General parameters":

- coastal protection measures
- geomorphology
- flooding
- land use
- weather conditions
- hydrology

The geomorphological parameters "size of intertidal flats" and "sediment types" can be regarded as a simple indicator to assess the overall and long-term development for the entire Wadden Sea Area (see Tidal Area Table: 8).

A trilateral assessment which addresses coastal protection, flooding and hydrology in a more integrated way will require more effort and involvement of appropriate expertise, such as by the trilateral work group on Coastal Protection and Sea Level rise (CPSL) and can not be covered by an operational monitoring program. These parameter groups will therefore not be part of a revised TMAP anymore. Available data obtained in other programs on national/regional level should be made available for trilateral assessment.
The data regarding land use (agricultural use) and weather conditions (such as water and air temperature, wind conditions) are also obtained from other sources such as land use statistics or weather agencies. In case the data is easily available in all countries and can be transferred to the TMAP Data Units, the data compilation should be continued.

Monitoring guidelines
TMAP Manual Chapter II-1 General Parameters

ANNEX 3 – Map

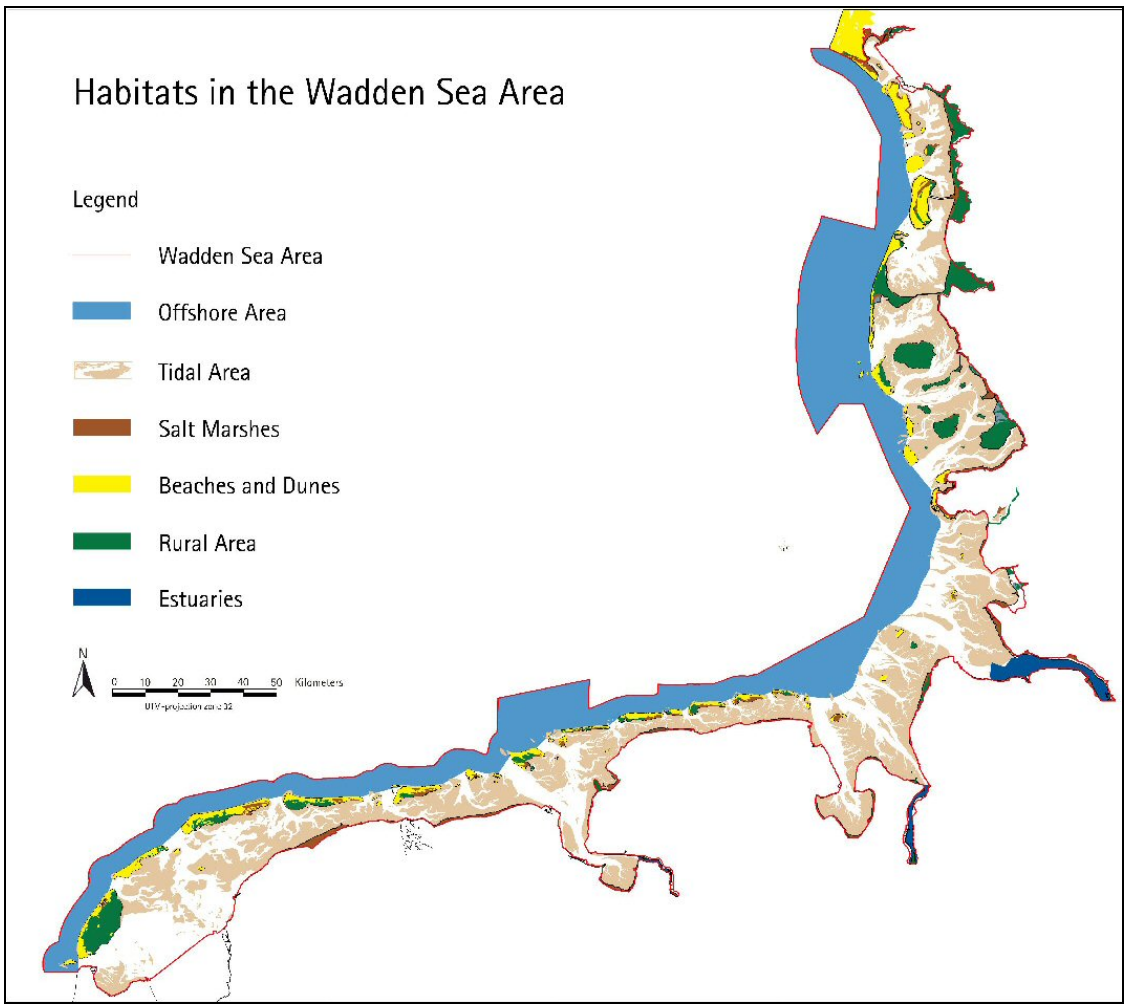

*Figure 1**: Overview of Wadden Sea habitats according to the Wadden Sea Plan***