

# Annex 1

## TMAP Issues of Concern and Parameter Groups

### I Climate change

Change in climate includes rise in temperature and change in gale force and frequency.

#### I.1 Influence of changes in climate on physical conditions, rise in sea level, and on the stability and abiotic environment of plant, animal and man.

The change in climate can influence physical boundary conditions and may cause a rise in sea level. It affects the stability of the environment of plant, animal and man.

Hypotheses	TMAP-parameter groups	Guideline
Changes in climate can affect the water temperature, weather conditions, hydrological regime, flooding frequency, geomorphology and the geographical boundaries of the Wadden Sea.  Erosion processes and coastal protection will lead to changes in the zonation of the salt marsh vegetation.	<b>General parameters:</b>	
	Geomorphology	1.1
	Hydrology / flooding	1.2
	Weather conditions	1.3
	Coastal protection measures	1.5
	Coastline	-
	<b>Birds:</b>	
	Breeding birds (numbers and distribution)	7.1
	<b>Salt marshes:</b>	
	Salt marsh zonation	9.1

## II Input of pollutants

Pollutants are nutrients, heavy metals and organic micro-pollutants, and solid wastes. Inputs via all possible routes are to be taken into account. Pollutant inputs are considered to affect the chemistry of soils, sediments and the water column, the natural biological processes, the individual species and the communities of the ecosystem Wadden Sea. The efficiency of policy targets on the reduction of pollutants in water, sediment and biota has to be documented. How are reduction measures and changes in inputs of chemicals connected? Have the changes in inputs effects on the concentrations in sediment and water? Do changes in chemical processes result in changes in the distribution of substances?

<b>II.1 The changes in the chemistry of soils, sediments and the water column due to the input of pollutants</b>		
Hypotheses	TMAP-parameter groups	Guideline
Changes in input of nutrients and contaminants cause changes in the chemistry of the soil, sediments and the water column.	<b>Nutrients:</b>	
	Inorganic nutrients in water (incl. co-variables)	2.1
Changes in levels of nutrients and contaminants will affect bioavailability, fluxes and effects of nutrients and contaminants.	Organic nutrients	-
	<b>Contaminants in water and sediment:</b>	
	Metals in sediment (incl. normalization variables)	3.1
	TBT in water, SPM and sediment	-
	Sediment net sedimentation	-
	Sediment characteristics	3.1
	Atmospheric inputs and precipitation	-
	PCB and PAH in suspended matter and sediment	-
	Metals in suspended matter	-
	Pesticides (lindane, triazines) in water	-

<b>II.2 The response of natural processes in the ecosystem to changes in the pollutant level: Primary production, food chain fluxes, reproduction and decomposition.</b>		
Hypotheses	TMAP-parameter groups	Guideline
<p>Changes in concentrations of nutrients and contaminants affect the biological processes (primary and secondary production in the different food web levels, decomposition, reproduction and recruitment of key species).</p> <p>An increase of contaminants in the water column and sediment may lead to increased concentrations in biological tissues at the various food web levels.</p>	Decomposition processes	-
	Plankton:	
	Phytoplankton (species, biomass, primary production)	4.1
	Global radiation, UV-B	4.1
	Contaminants in phytoplankton	-
	Zooplankton (species, biomass)	4.2
	Contaminants in zooplankton	-
	Benthos:	
	Macroalgae (coverage)	5.1
	Benthic microalgae	-
	Contaminants in Nereis and Arenicola	-
	Mytilus (species parameters)	5.5
	Contaminants in Mytilus	5.6
	Crangon (species parameters)	-
	Contaminants in Crangon	-
	Fish:	
	Eelpout, Flounder, Plaice (species parameters)	6.1
	Contaminants in Eelpout and Flounder	6.2
	Birds:	
	Breeding birds: numbers and distribution	7.1
	Breeding birds: breeding success	7.2
	Breeding birds: recruitment and mortality outside the breeding season	-
	Contaminants in bird eggs	7.3
	Seals:	
	Seals (numbers and distribution)	8.1
	Contaminants in seals	-
	Salt marshes:	
	Salt marshes (vegetation, biomass)	9.1

<b>II.3 The response of species to changes in pollution levels</b>		
Hypotheses	TMAP-parameter groups	Guideline
<p>Changes in concentrations of nutrients and contaminants may affect the physiological functioning, growth and reproduction, recruitment and natural mortality of species leading to changes in the abundance and distribution of species.</p> <p>This has an effect on the different organizational level, e.g. cellular, organism, species and community.</p>	<b>Plankton:</b>	
	Zooplankton (species, biomass)	4.2
	Contaminants in zooplankton	-
	<b>Benthos:</b>	
	Macroalgae (coverage)	5.1
	Eelgrass (coverage)	5.2
	Contaminants in Arenicola and Nereis	-
	Mytilus (species parameters)	5.5
	Contaminants in Mytilus	5.6
	Crangon (species parameters)	-
	Contaminants in Crangon	-
	<b>Fish:</b>	
	Eelpout, Flounder, Plaice (species parameters)	6.1
	Contaminants in Eelpout and Flounder	6.2
	<b>Birds:</b>	
	Breeding birds (numbers and distribution)	7.1
	Breeding birds: breeding success	7.2
	Breeding success: recruitment, mortality outside the breeding season	-
	Contaminants in bird eggs	7.3
	Migratory birds (numbers and distribution)	7.4
	Migratory birds: percentage of young birds of staging waterbirds	-
	Beached (oiled) Birds Survey	7.5
	<b>Seals:</b>	
	Seals (number and distribution)	8.1
	Contaminants in seals	-

<b>II.4 The response of community occurrence and structure to pollutant inputs</b>		
Hypotheses	TMAP-parameter groups	Guideline
Changes in the nutrient and contaminant levels and in nutrient ratio cause changes in the occurrence, dominance structure and distribution patterns of ecological communities.	<b>Plankton:</b>	
	Phytoplankton (community parameters)	4.1
	Zooplankton (community parameters)	4.2
	<b>Benthos:</b>	
	Macroalgae (coverage)	5.1
	Eelgrass (coverage)	5.2
	Zoobenthos communities	5.3
	Zoobenthos: location and area of biotopes	-
	Blue mussel beds (location and area, community parameters)	5.5
	<b>Fish:</b>	
	Fish communities (demersal and pelagic)	-
	<b>Birds:</b>	
	Breeding birds (numbers and distribution)	7.1
	Migratory birds (numbers and distribution)	7.4
	Migratory birds (percentage of young birds of staging waterbirds)	-
	<b>Salt marshes:</b>	
	Salt marshes (location and area, vegetation types)	8.1
	Salt marsh vegetation (community parameters)	-
	Salt marsh invertebrate fauna	-

## II Commercial fisheries

<b>III.1 The response of species to fisheries in the Wadden Sea</b>		
Hypotheses	TMAP-parameter groups	Guideline
The cockle and mussel fishery on natural beds and establishment of blue mussel culture lots changes the benthic habitat and affects the occurrence and abundance of individual species and especially top predators (e.g. birds).	<b>Benthos:</b>	
	Cockles stocks (species parameter)	5.3
	Blue Mussel stocks (species parameter)	5.5
	Crangon stock size	-
	Crangon recruitment	-
	<b>Fish:</b>	
	Fish (key species)	6.1
	Fishery parameters	6.3
	<b>Birds:</b>	
	Breeding birds (recruitment, mortality outside the breeding season)	-
<b>III.2 The response of community occurrence and structure to the fisheries in the Wadden Sea</b>		
Hypotheses	TMAP-parameter groups	Guideline
Fisheries can affect the occurrence and structure of communities. This includes indirect effects through gear activity (sediments, disturbance) as well as resource depletion (food web links).	<b>Benthos:</b>	
	Zoobenthos (subtidal, with and without shrimping) (community parameters)	-
	Zoobenthos (location and area of biotopes)	-
	Blue Mussel beds (fished and unfished, intertidal and subtidal) (location and area, community parameters)	5.5
	Cockle areas (exploited and unexploited beds) (community parameters)	5.3
	Sabellaria reefs (location and development)	5.4
	<b>Fish:</b>	
	Fish communities (demersal and pelagic)	-
	<b>Birds:</b>	
	Breeding birds (numbers and distribution)	7.1
	Migratory birds (numbers and distribution)	7.4
	Migratory birds (percentage of young birds of staging waterbirds)	

## IV Recreation

Recreational activities include all tourist or leisure-oriented activities in the entire Wadden Sea (e.g., non-commercial shipping, wind-surfing, hunting, game fishing, bird watching, tourism, sight-seeing and individual aircraft traffic). The main impact of recreational activities is disturbance.

Hypotheses	TMAP-parameter groups	Guideline
Recreational activities can affect the occurrence and abundance of species. This includes the population size, growth and reproduction of species. The main impact of recreational activities may be related to the presence of visitors in the Wadden Sea area and their activities.	Groundwater level (on islands)	1.4
	<b>Birds:</b>	
	Breeding birds (numbers and distribution)	7.1
	Breeding success	7.2
	Breeding success: recruitment, mortality outside the breeding season	-
	Migratory birds (percentage of young birds of staging waterbirds)	7.4
	<b>Seals:</b>	
	Seals (number and distribution)	8.1
	<b>Recreation:</b>	
	Human activities on tidal flats, beaches, salt marshes	11.1
	Boats at sea , ships in marinas	11.1
	Air traffic (airports)	11.2
	Tourism general (socio-economic data)	-

## V Agricultural practice

<b>V.1 The response of salt marsh communities to agricultural utilization</b>		
Hypotheses	TMAP-parameter groups	Guideline
<p>Cattle grazing on salt marshes directly affects the natural occurrence and structure of plant and animal communities. It also affects the natural breeding and roosting habitats of birds.</p> <p>A reduction of grazing in conjunction with the restoration of tidal processes on salt marshes will lead to the reestablishment of the natural biotic communities.</p> <p>Natural salt marshes exposed to the tides function as natural filters of suspended solids and hence as a sink for adsorbed pollutants.</p>	<b>General parameters:</b>	
	Flooding of salt marshes	1.2
	Land use (rural areas)	1.6
	Soil parameters (e.g. sedimentation, organic matter)	-
	<b>Birds:</b>	
	Breeding birds (numbers and distribution)	7.1
	Migratory birds (numbers and distribution)	7.4
	Migratory birds (percentage of young birds of staging waterbirds)	-
	<b>Salt marshes:</b>	
	Salt marshes (location and area, vegetation types)	9.1
	No. of domestic animals (salt marshes, utilized)	9.2
	Salt marsh vegetation (community parameters)	-
	Salt marsh invertebrate fauna (community parameters)	-

## Annex 2

# Ecological Targets and Targets on Cultural and Historical Aspects

7th Trilateral Governmental Conference, Leeuwarden, 1994

A basic element in the elaboration of the Guiding Principle is the presence of the full scale of habitat types which belong to a natural and dynamic Wadden Sea. Each of these habitats needs a certain quality (natural dynamics, absence of anthropogenic disturbance, absence of pollution), which can be reached by proper management of the area.

The physical, biological, chemical and geomorphological quality of the habitats has been specified by means of Ecological Targets, in short Ecotargets, elaborated by the trilateral Eco-Target Group (ETG) in its Final Report.

The Ecotargets are valid for the whole area of the trilateral cooperation, be it with a differentiation in scale, place and time. The Ecotargets regarding the chemical quality have not been geographically differentiated.

In addition to the above Ecotargets, a number of targets on cultural aspects have been developed.

### **TARGETS ON HABITAT AND SPECIES**

#### **SALT MARSHES**

The habitat type salt marsh includes all mainland and island salt marshes, including the pioneer zone. Also the brackish marshes in the estuaries are considered part of this habitat type.

The following targets apply to salt marshes:

- an increased area of natural salt marsh;
- 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, including the pioneer zone, of artificial salt marshes.

## TIDAL AREAS

The tidal area covers all tidal flats and subtidal areas. The border to the North Sea side is determined by an artificial line between the tips of the islands. The borders to the estuaries are determined by the average 10 ‰ isohaline at high water in the winter situation.

The following targets are valid:

- a natural dynamic situation in the tidal area;
- an increased area of geomorphologically and biologically undisturbed tidal flats and subtidal areas;
- an increased area of, and a more natural distribution and development of natural mussel beds, *Sabellaria* reefs and *Zostera* fields;
- viable stocks and a natural reproduction capacity, including juvenile survival, of common seal and grey seal;
- favorable conditions for migrating and breeding birds:
  - = a favorable food availability;
  - = a natural breeding success;
  - = sufficiently large undisturbed roosting and moulting areas;
  - = natural flight distances.

## ESTUARIES

Estuaries include the estuaries of the rivers with a natural water exchange with the Wadden Sea. On the landward side, estuaries are delimited by the mean-brackish-water line. On the seaward side, the border is the average 10‰ isohaline at high water in the winter situation.

Estuaries will be protected and restored according to the conditions as agreed on in § 15.

## BEACHES AND DUNES

Beaches and dunes include beaches, primary dunes, beach plains, primary dune valleys, secondary dunes and heathland behind the dunes.

The following targets apply:

- 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.

## OFF-SHORE ZONE

The offshore zone ranges from the 3-sea-mile line to an artificial line connecting the outer tips of the islands. The border between the offshore zone and the beaches on the islands is determined by the average low-tide water mark.

The following targets apply to the offshore zone:

- 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.

## RURAL AREA

The rural area includes meadows and arable land on the islands and on the mainland where there is a strong ecological relationship with the Wadden Sea.

The following target applies:

- favorable conditions for flora and fauna, especially migrating and breeding birds.

## TARGETS ON THE QUALITY OF WATER AND SEDIMENT

### NUTRIENTS

- a Wadden Sea which can be regarded as a eutrophication non-problem area.

### NATURAL MICROPOLLUTANTS

- background concentrations in water, sediment and indicator species.

### MAN-MADE SUBSTANCES

- concentrations as resulting from zero discharges.

## TARGETS ON LANDSCAPE AND CULTURAL ASPECTS

Firstly, the Wadden Sea landscape with its special natural and characteristic impressions has to be conserved or developed as far as possible. Secondly, the typical features that remind us of its cultural and historic past should be maintained:

### IDENTITY

- to preserve, restore and develop the elements that contribute to the character, or identity, of the landscape.

### VARIETY

- to maintain the full variety of cultural landscapes, typical for the Wadden Sea landscape.

### HISTORY

- to conserve the cultural-historical heritage.

### SCENERY

- to pay special attention to the environmental perception of the landscape and the cultural-historical contributions in the context of management and planning.

