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Monitoring Guidance on Ecological Objective 7: Alteration of hydrographical conditions

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1. INTRODUCTION

1.1 Identification of issues to address

Monitoring under this Ecological Objective is meant to address new large-scale human activities implemented by infrastructures such as wind farms, ocean energy device arrays, offshore airports, large artificial islands, and large scale aquaculture facilities that may permanently influence the hydrographical regime of currents, waves and sediments.

Comparatively smaller scale activities, such as aggregate extraction, capital dredging, discharges at sea of brines and refrigeration water, etc. can also result in hydrographical changes – albeit at a more local, site specific scale. Before implementing new plans or projects, carrying out an Environmental Impact Assessment (EIA) is compulsory for a range of such activities. If such works are part of a higher level strategic plan, a Strategic Environmental Impact Assessment (SEA) is often required. Hydrographical changes caused by these activities are therefore not considered under this Ecological Objective as they are, or should be, sufficiently covered by existing provisions for EIA or SEA, including national legislation and provisions of the LBS Protocol.

Monitoring under this Ecological Objective is meant to address permanent alterations in hydrographical conditions. Therefore, it is important to differentiate between permanent and temporary changes taking into consideration the potential for recovery, and the timescales involved need to be factored in. It is recommended that constructions lasting for more than 10 years should be considered to be permanent.

As mentioned above this Ecological Objective is meant to address new developments. For this reason it is pertinent to choose a baseline in the (very) near future from which monitoring for good status can be based upon. This does not mean that the current status can or should be maintained in all circumstances; it is important to recognise that there can be good reasons for an activity that changes the hydrographical conditions and some of these changes may only be temporary. Efforts should, however, be made to prevent further deterioration and to minimise any negative effects on the ecosystem.

1.2 Monitoring of physical characteristics

The physical characteristics to be monitored are considered to be: topography and bathymetry of the seabed, current velocity, upwelling, wave exposure, mixing characteristics, and turbidity. Also other complementary parameters such as sedimentology and sediment transport, maritime meteorology, and river flow can be relevant reliable reference data. The knowledge of parameter related local dominant time-scales of natural variability are a pre-condition for an authoritative assessment of change in the hydrographical background conditions.

Even though climate change is considered to be part of the prevailing environmental conditions and therefore not explicitly addressed through the EcAp, for the interpretation of monitoring data, the effects of climate change need to be taken into account. For this reason the existence of an adequate monitoring programme able to describe these background large-scale changes, together with a long time series dataset is an implicit requirement for this Ecological Objective and for the EcAp as a whole.

1.3 Evaluation of impacts

In order to evaluate the impacts, any monitoring programme tailored to meet the requirements of Ecological objective 07 should be designed to determine the extent and size of any changes in current and wave regimes resulting from human activities. This could be

undertaken within EIA. Changes in bottom shear stress, due to its consequences on changes on sediment re-suspension and nutrient enrichment, is an example of a good parameter of modifications of the dynamic environment of the seabed with effect on biota development. Direct measurements are not easy and it is usually deduced by wave motion measurements. Another good parameter could be the pressure variation range induced by waves at the seabed, where relevant. This repetitive process facilitates the erosion of crumbly sediments so that an increase in wave height may significantly increase the erosion of a specific habitat.

2. Monitoring Strategy

The monitoring of hydrographical conditions could be treated in two ways:

- Monitoring in order to give background information at different spatial and temporal scale on variations of hydrographical conditions which might not be connected (at least not directly) to the human activities;

- Specific monitoring for Ecological Objective 07 purposes to assess the extent of area affected by alterations and impacts with a focus on the list of areas where alterations could be expected due to new developments.

If the hydrographical conditions are unknown they are initially monitored over the entire marine area to characterize the hydrographical regime and to provide background information for physical characteristics and establishment of hydrographical models to be used in the assessment of human activities. Parameters, monitoring positions and frequencies are defined based on the local natural variability (both in time and space) but also with regard to the requirements specified by the needs of other Ecological Objectives/indicators for background information.

2.1 Selection of monitoring methods

The selection of monitoring methods for some hydrographical parameters could consider the following:

- Satellite products services can provide area wide near-real time data;

- Use of autonomous devices or scientific vessels allowing high-resolution data collection (currents, waves, mixing characteristics, etc.), including data about the development of vertical stratification, circulation, water masses distribution etc.;

- Use of numerical circulation and ecosystem models to characterize the conditions over the large sea areas and to forecast local changes due to direct human impacts;

- Other global or regional operational oceanographic observing systems that provide marine forecasts, can also be part of the ecological Objective 07 monitoring;

- Basin-wide assessment of hydrographical changes and local status reports can provide valuable information on long-term change.

Such an approach (with proper modifications) could also be generalized to other parameters describing hydrographical conditions.

It is recommended that the monitoring of the effects of hydrographical changes should not aim primarily at field based measurements in the affected area, but concentrate on modelling of the changes in currents, waves and bottom shear stress due to human activities in the

area (this may be undertaken within EIA), using appropriately calibrated models, validated with in situ datasets. This will make it possible to determine the extent of any parameter changes including how large the change will be in a certain area. From this starting point the effect on coastal and marine ecosystems can be determined. Field measurements will be necessary in areas where the changes are large enough to have significant effects on the marine ecosystem at which point ground-truthing will be considered appropriate. In such a situation on-going monitoring of changes in benthic habitats could be used to indicate any effects of permanent hydrographical alterations. Even when there is no clear indication that an activity will cause an important hydrographical alteration, some minimum field measurements will be needed to confirm the prediction of the models.

2.2 Considerations regarding the appropriate scale of monitoring for Ecological Objective 07

Ecological Objective 07 states that the alteration of hydrographical conditions should not adversely affect coastal and marine ecosystems. As human interventions on hydrographical conditions with regard to the potential impact on ecosystems are hardly visible on a very large scale, i.e. on the scale of the sub-region, (e.g. of the Western Mediterranean Sea), it will be necessary to consider smaller scales in the first instance in order to build a full picture of GES at the relevant scale. It should be noted that using very small scales to determine GES is not appropriate given that they cannot be connected directly to status of ecosystems, as required under the EcAp.

Annex I
Indicators Monitoring Fact Sheets on Ecological Objective 7: Alteration of hydrographical conditions

ECOLOGICAL OBJECTIVE 07: Alteration of hydrographical conditions does not adversely affect coastal and marine ecosystems

Indicator No as of COP18 Decision	Common Indicator	Operational Objective	State or impact	DESCRIPTION Parameters and/or Elements, matrix	Assessment Method	Monitoring Guidelines	Sampling and Analysis Reference Methods	QA/QC	Recommendations /Additional Data needed
7.2.2	Location and extent of the habitats[1] impacted directly by the alterations and/or the circulation changes induced by them: footprints of impacting structures	7.2 Alterations due to permanent constructions on the coast and watersheds, marine installations and seafloor anchored structures are minimised	Impact	Parameter: Area (e.g. km^2) where significant, regional scale changes in currents, waves, bottom shear stress, topography of the seabed, bathymetry and other hydrographical conditions occur or are expected (modeling or Semi-quantitative estimation).	Mapping of human activities that cause permanent alterations of hydrographical conditions (using i.e. existing EIA, SEA and Maritime Spatial Planning - MSP) and subsequent use of models. Modeling changes in the spatial extent of habitats				Implementation of the indicator by modeling the changes in hydrographical conditions such as currents, waves, bottom shear stress, topography of the seabed to assess the extent of the possible affected area and the intensity of the changes to determine the effect on habitats. Models should be supported by “in situ” monitoring datasets.

[1] To be chosen on the basis of the list determined under Ecological Objective 01

				Area of habitat and the proportion of the total habitat if that type is significantly affected by the permanent change for example in bottom shear stress, waves, topography of the seabed, bathymetry and other hydrographical conditions (modeling or semi - quantitative estimation.	affected by permanent alterations, using field data and validated model data. Main aim of the models is to assess changes in the condition and extent of areas affected by permanent alterations. Models should be calibrated and continuously supported and validated with "in situ" monitoring datasets.				