(Provisional) checklist for monitoring and diagnosis of *Undesirable Disturbance* (v.2.7)
in relation to sensitive areas under the
EC URBAN WASTE WATER TREATMENT & NITRATE DIRECTIVES,
in relation to OSPAR's strategy to combat eutrophication,
and in relation to *ecological status* under the WATER FRAMEWORK DIRECTIVE.

Name and position/extent of ecosystem/waterbody:

map attached ☐

Identification of water bodies or shores at risk from anthropogenic nutrient enrichment:

☐ winter nutrient concentrations ***above*** reference levels ☐ (insufficient data)
☐ summer nutrient inputs ***above*** reference levels ☐ (insufficient data)
☐ ***significant trend*** of increase in winter concentrations or summer inputs, even if present values not above reference levels

If any of these boxes ticked, including insufficient data, complete section A, at least one of sections B-E, and the summary in section F.

A. IDENTIFICATION OF ECOHYDRODYNAMIC TYPE

A.1) Most of the seabed would be **within the euphotic zone** under reference conditions:

☐ • yes: phytobenthic biome; go to B
☐ • no: biome dominated by pelagic production; continue to A.2
☐ • mixed type; consider under all relevant headings; go to B and then A.2

A.2) Type of water :

☐ • transitional or coastal water of restricted exchange: go to C (RRE)
☐ • a mixed, optically deep, water where phytoplankton cannot grow: NOT AT RISK
☐ • a coastal or near-coastal offshore water with a substantial freshwater content and variable haline stratification including estuarine plume fronts: go to A.3, then D (ROFI)
☐ • a deeper offshore water with seasonal thermal stratification, or, a deeper coastal or offshore water that has an extended season of haline or thermohaline stratification: go to A.3, then E (STRATIFIED)
☐ • an oceanic water with a permanent thermocline: NOT DEALT WITH HERE

A.3) If the water body contains a key station, tick if time-series data being collected

☐ • to characterize plankton and allow calculation of a plankton community index;
☐ • to characterize macrobenthos and allow calculation of a benthic community index;
☐ • to track nutrient concentrations for study of correlation to biological changes;
☐ • to track physical changes resulting from climate change.

B. PHYTOBENTHIC BIOMES -- *shore* includes sublittoral within euphotic zone

B.1) The phytobenthos is:

☐ characterized by seagrasses: go to B.2 and then B.3
☐ an open-coast rocky shore characterized by fucoids or attached invertebrates: LOW RISK of NUTRIENT INDUCED DISTURBANCE.
☐ a shore in a RRE where fucoid/laminarian cover expected: go to B.2 and then B.4.
☐ a soft sedimentshore with some (or much) opportunistic algal cover: go to B.4.
☐ a shore with soft sediments and dominant microphytobenthos: NOT DEALT WITH.

B.2) Transparency

☐ Water transparency is decreasing; ☐ correlates to nutrient increase
☐ Lower limit of phytobenthos is shallowing; ☐ correlates to nutrient increase
Insufficient data: ☐ transparency; ☐ phytobenthos; ☐ nutrients;

Diagnosis:
☐ TREND (if change and correlation); ☐ insufficient data.

B.3) Status of seagrass community:

☐ decrease in extent of seagrass bed ☐ correlates to nutrient increase
☐ decrease in mean areal biomass of seagrass ☐ correlates to nutrient increase
☐ increase in filiamentous or epiphytic algae ☐ correlates to nutrient increase
☐ increase in wasting disease ☐ correlates to nutrient increase
Insufficient data: ☐ biology; ☐ nutrients

Diagnosis:
☐ UNDESIRABLE DISTURBANCE (if change and correlation, or insufficient data).

B.4) Soft sediment shores or RRE shores:

(a) Present status
☐ maximum seasonal cover of opportunistic seaweeds exceeds 25% of available area;
☐ maximum biomass of opportunistic seaweeds exceeds 1 kg m^{-2};
☐ evidence of widespread macrobenthic death or anoxic sediment beneath seaweed.
☐ no quantitative data but obvious change/impact; ☐ no information;

(b) Trends
☐ increasing cover of opportunistic seaweeds ☐ correlates to nutrient increase
☐ increasing biomass of opportunists ☐ correlates to nutrient increase
Insufficient data: ☐ biology; ☐ nutrients

Diagnosis:
☐ UNDESIRABLE DISTURBANCE (any ticks in (a));
☐ TREND (if change and correlation in (b)); ☐ insufficient data in (b).

C. REGIONS OF RESTRICTED EXCHANGE (RREs)

C.1) Hydrodynamic type identified :

☐ mixed estuary
☐ salt wedge estuary
☐ shallow fjord without basin deep water
☐ deep fjord with basin deep water
☐ ria
☐ lagoon
☐ coastal embayment

C.2) Conditions in superficial waters

(a) present conditions:

☐ CSTT procedure identifies present risk of high chlorophyll due to anthropogenic nutrient enrichment (☐ insufficient data)

☐ HABs occur frequently (☐ insufficient data)

(b) trends:

☐ CSTT procedure identifies future risk of high chlorophyll as a result of trend in anthropogenic nutrient enrichment (☐ insufficient trend data)

Diagnosis:

☐ UNDESIRABLE DISTURBANCE (both rows ticked in (a))
☐ projected TREND (tick in (b))

C.3) Basin deep water

(a) occurrence of isolated basin deep water:

☐i typically persists for periods of a few weeks
☐ii typically persists for several months or longer (MOST AT RISK)

(b) oxygen concentrations

☐iii insufficient data;
☐iv minimum less than 4 mg L^{-1} ☐v substantially due to nutrients

(c) trends:

☐vi downwards trend in mean or minimum oxygen, or increase in consumption rate
☐vii trend correlates with increasing nutrients (☐viii insufficient trend data)

Diagnosis:

☐ TREND (vi+vii ticked); ☐ AT RISK and insufficient data (ii+viii ticked);
☐ UNDESIRABLE DISTURBANCE (iv+v or ii+iii ticked).

D. REGIONS OF FRESHWATER INFLUENCE (ROFIs)

D.1) Phytoplankton biomass and blooms

(a) present conditions

☐ observed chlorophyll concentration above reference (☐ insufficient data)
☐ HABs are widespread and frequent (☐ insufficient data)

(b) trends

☐ trend of increasing chlorophyll conc. ☐ correlates with nutrient trend
☐ trend of increase in HABs ☐ correlates with nutrient trend
(☐ insufficient trend data)

Diagnosis: j

☐ MAY BE DISTURBED (if ticks in both rows under (a)) - continue to D.2 and D.3;
☐ presumed UNDESIRABLY DISTURBED instead of continuing;
☐ TREND (if any correlated trend in (b); ☐ insufficient trend data.

D.2) Primary production

(a) present conditions - production in range:

☐ 0 - 99 g C m^{-2} yr^{-1} (oligotrophic) ☐ 100 - 199 g C m^{-2} yr^{-1}
☐ 200 - 299 g C m^{-2} yr^{-1} ☐ >300 g C m^{-2} yr^{-1}
(☐ insufficient data)

(b) trend

☐ trend of increasing primary production ☐ correlates with nutrient trend
(☐ insufficient data)

Diagnosis:

☐ NMP exceeds 200 g C m^{-2} yr^{-1}:consider possibility of DYSTROPHY;
☐ TREND (if correlated).

D.3) Plankton community structure

☐ i substantial deviation from community structure or PCI in reference condition;
☐ ii no substantial deviation from community structure or PCI in reference condition;
☐ iii insufficient data.

Diagnosis:

☐ UNDESIRABLE DISTURBANCE (if i or iii + possible dystrophy or trend under D.2)
☐ ii: not undesirable disturbance, irrespective of other indicators.

E. STRATIFIED WATERS

E.1) Phytoplankton biomass and blooms

(a) present conditions

☐ observed chlorophyll concentration above reference (☐ insufficient data)
☐ HABs are widespread and frequent (☐ insufficient data)

(b) trends

☐ trend of increasing chlorophyll conc. ☐ correlates with nutrient trend
☐ trend of increase in HABs ☐ correlates with nutrient trend
(☐ insufficient trend data)

Diagnosis: j

☐ MAY BE DISTURBED (if ticks in both rows under (a)) - continue;
☐ presumed UNDESIRABLY DISTURBED instead of continuing;
☐ TREND (if any correlated trend in (b); ☐ insufficient trend data.

E.2) Primary production

(a) present conditions - production in range:

☐ 0 - 99 g C m^{-2} yr^{-1} (oligotrophic) ☐ 100 - 199 g C m^{-2} yr^{-1}
☐ 200 - 299 g C m^{-2} yr^{-1} ☐ >300 g C m^{-2} yr^{-1}
(☐ insufficient data)

(b) trend

☐ trend of increasing primary production ☐ correlates with nutrient trend
(☐ insufficient data)

Diagnosis:

☐ NMP exceeds 200 g C m^{-2} yr^{-1}:consider possibility of DYSTROPHY;
☐ TREND (if correlated).

E.3) Plankton community structure

☐i substantial deviation from community structure or PCI in reference condition;
☐ii no substantial deviation from community structure or PCI in reference condition;
☐iii insufficient data.

Diagnosis:

☐ UNDESIRABLE DISTURBANCE (if i or iii + possible dystrophy or trend under E.2);
☐ ii: not undesirable disturbance of surface waters, irrespective of other indicators, but continue to consider other parts of ecosystem.

E.4) Deep water oxygen (under conditions of stratification)

(a) physical conditions:

☐i thin bottom layer; ☐ii thick bottom layer;
☐iii seasonal deep water; ☐iv basin deep water;

(b) oxygen concentrations:

☐v insufficient data;
☐vi minimum less than 4 mg L^{-1}; ☐vii substantially due to nutrients;

(c) trends:

☐viii downwards trend in mean or minimum oxygen, or increase in consumption rate;
☐ix trend correlates with increasing nutrients; (☐x insufficient trend data);

Diagnosis:

☐ TREND (if viii+ix);
☐ UNDESIRABLE DISTURBANCE (if vi+vii);
☐ lack of data in water of concern (if i+v or iv+v).

E.5) Depth of RPD (sediment redox potential discontinuity):

☐ trend of shallowing RPD; (☐ insufficient data);
☐ correlates with increasing nutrient; ☐ correlates with increasing chlorophyll;

Diagnosis:

☐ TREND (if any correlation).

E.6) Macrobenthic community structure:

(a) present structure:

☐i substantial deviation from community structure or BCI of reference condition ;
☐ii not explicable by fishing gear disturbance ;
☐iii no substantial deviation from community structure or BCI of reference condition;
(☐iv insufficient data);

(b) trends:

☐ trend of deterioriation in BCI; ☐ correlates with nutrient trend;
☐ correlates with chlorophyll trend; ☐ correlates with RPD trend;
(☐ insufficient trend data);

Diagnosis:

☐ UNDESIRABLE DISTURBANCE (if i+ii or iv with other positive indicators);
☐ possibly not undesirable disturbance of benthos, irrespective of other indicators, if iii
☐ TREND (with correlation).

E.7) Population size of *Nephrops norvegicus* at deep mud sites:

☐ significant trend of decrease ; (☐ insufficient data);
☐ correlates with increasing nutrient; ☐ correlates with increasing chlorophyll;
(☐ insufficient trend data) ;

Diagnosis:

☐ UNDESIRABLE DISTURBANCE (if correlated trend).

F. SUMMARY for water body or shore that could be at risk of Undesirable Disturbance due to anthropogenic nutrient enrichment

F.1) An ecosystem or water body dealt with in part(s):

☐ B ☐ C ☐ D ☐ E

F.2) Outcomes requiring no further action for the present:

☐ No part is at more than low risk of undesirable disturbance (because of hydrodynamic conditions)
☐ Includes water or shore type(s) not dealt with by this scheme
☐ All necessary data are available and indicate neither trends of concern nor undesirable disturbance (compatible with high primary production in F.3)

F.3) Outcomes requiring further action:

☐ Lack of required data which is being remedied
☐ UNDESIRABLE DISTURBANCE presumed because of lack of data in sensitive conditions and/or with some indicators of disturbance
☐ Primary production known to exceed 200 g C m^{-2} yr^{-1}
☐ TRENDS correlated to nutrient enrichment have been demonstrated
☐ UNDESIRABLE DISTURBANCE has been shown to occur