

UKTAG TRANSITIONAL AND COASTAL WATER ASSESSMENT METHODS MACROALGAE

MACROALGAL BLOOM ASSESSMENT (OPPORTUNISTIC MACROALGAE)

by

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(WFD-UKTAG)

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HEALTH AND SAFETY STATEMENT

WARNING— working in or around water is inherently dangerous; persons using this standard should be familiar with normal laboratory and field practice. This published monitoring system does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate health and safety practices and to ensure compliance with any national regulatory guidelines.

It is also the responsibility of the user if seeking to practise the method outlined here, to gain appropriate permissions for access to watercourses and their biological sampling.

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1. INTRODUCTION

This method statement describes a monitoring system for monitoring, assessing and classifying transitional waters and coastal waters in accordance with the requirements of Article 8; Section 1.3 of Annex II; and Annex V of the Water Framework Directive (2000/60/EC).

1.1. Geographic application of the method

The method can be applied to transitional waters and coastal waters in England, Northern Ireland, Scotland and Wales.

1.2. Quality element assessed by the method

The method enables an assessment of the condition of the quality element, "macroalgae", listed in Tables 1.2.3 and 1.2.4 of Annex V to the Water Framework Directive.

1.3. Pressures to which the method is known to be sensitive

The method has been designed to detect the impact of nutrient enrichment on the quality element.

1.4. Parameters used to assess the quality element

The method uses a multi-parameter index, the "Macroalgal Bloom Index" for the purpose of assessing the condition of the quality element, macroalgae.

The Index is based on five parameters:

- total extent of macroalgal bed;
- cover of available intertidal habitat;
- biomass of opportunistic macroalgal mats;
- biomass over the available intertidal habitat;
- proportion of entrained algae.

The parameters are calculated using information on opportunistic macroalgal species or groups of such species. Annex 1 provides an indicative but not exclusive list of such species and groups of species.

2. SAMPLING AND ANALYSIS

2.1. Sampling method

Within this method, “sampling” means the identification and collection for measurement of macroalgal bloom algae (opportunistic nuisance weed) at a shore site, for the purpose of estimating the Ecological Quality Ratio at that site.

The method used should conform to international standard EN 14996 Water Quality - Guidance on assuring the quality of biological and ecological assessments in the aquatic environment.

2.1.1. Sampling sites

Sampling sites should be chosen by stratified random sampling within the intertidal zone. Sites should consist only of mud, muddy sand, sandy mud, sand, stony mud and mussel beds between the mean high water of spring tides and the mean low water of spring tides. They should not include areas of permanent rock or cobbles.

2.1.2. Algal sampling method

Macroalgae should be sampled in a randomly stratified manner (in respect of cover), with a statistically appropriate number of quadrats per macroalgal patch. Quadrats should be chosen to represent the variation in cover and in biomass, and the persistence of algae within the underlying sediment.

2.1.3. Cover of available intertidal habitat

The fraction (percentage) of superficial area of each quadrat covered by macroalgae should be estimated to within 5%.

2.1.4. Biomass measurement

Wet macroalgae should be cut and peeled from the surface of each quadrat and should be washed and weighed wet.

2.1.5. Sample number, timing and frequency

Sites should be sampled in the time of peak bloom period (normally from June to September inclusive).

2.2. Analytical Method

Appropriate and contemporary taxonomic keys and literature should be used to identify specimens by species or by genus.

2.2.1. Total extent of macroalgal bed

The total affected area of the algal bloom patches should be measured in hectares and be based on the external perimeter of the bloom. The external perimeter of the bloom should coincide with the contour within which the algal cover is estimated to be greater than 5%.

2.2.2. Cover of available intertidal habitat

The fractional (percentage) cover of algae should be estimated as an average of quadrat measurements made over the available intertidal habitat according to 2.1.3.

2.2.3. Biomass of opportunistic macroalgal mats

The average biomass of algae over the affected area should be expressed in g.m^{-2} .

2.2.4. Biomass over the available intertidal habitat

The biomass in each quadrat should be expressed as the wet weight of peeled and cut algae in g.m^{-2} . The average biomass of available intertidal habitat should be estimated as the average biomass of algae over the whole of the available intertidal habitat, expressed in g.m^{-2} .

2.2.5. Proportion of entrained algae

The proportion of entrained algae should be estimated as the fractional (percentage) of quadrats where algae are seen to be growing into the underlying sediment.

3. PROCEDURE FOR DERIVING THE ECOLOGICAL QUALITY RATIO

3.1. Calculation of the observed values for each of the parameters

The observed values of the parameters should be derived according to the analysis described in Section 2.2.

3.2. Reference values for each parameter

Reference conditions have been derived using a combination of historic data and expert judgement.

The values in Column 2 of Table 2 should be applied as the reference conditions for the corresponding parameters listed in Column 1 of that Table.

Table 2: Reference values for each parameter	
Column 1	Column 2
Parameter	Reference values
Total extent of macroalgal bed (TE) (hectares)	10
Cover of available intertidal habitat (CAIH) (%)	5
biomass of opportunistic macroalgal mats (BAA) (g.m^{-2})	100
biomass over the available intertidal habitat (BAIH) (g.m^{-2})	100
Proportion of entrained algae (PEA) (% of quadrats)	1

3.3. Calculation of the ecological quality ratio for each parameter

The ecological quality ratio (EQR_{TE}) for the parameter, total extent of macroalgal bed, should be calculated using the following equation:

$$EQR_{TE} = [551 - \text{observed value for parameter}] \div [551 - \text{reference value for parameter}]$$

The ecological quality ratio (EQR_{CAIH}) for the parameter, cover of available intertidal habitat, should be calculated using the following equation:

$$EQR_{CAIH} = [100 - \text{observed value for parameter}] \div [100 - \text{reference value for parameter}]$$

The ecological quality ratio (EQR_{BAA}) for the parameter, biomass of opportunistic macroalgal mats, should be calculated using the following equation:

$$EQR_{BAA} = [6000 - \text{observed value for parameter}] \div [6000 - \text{reference value for parameter}]$$

The ecological quality ratio (EQR_{BAIH}) for the parameter, biomass over the available intertidal habitat, should be calculated using the following equation:

$$EQR_{BAIH} = [6000 - \text{observed value for parameter}] \div [6000 - \text{reference value for parameter}]$$

The ecological quality ratio (EQR_{PEA}) for the parameter, proportion of entrained algae, should be calculated using the following equation:

$$EQR_{PEA} = [100 - \text{observed value for parameter}] \div [100 - \text{reference value for parameter}]$$

Annex A Indicative list of opportunistic macroalgal species and groups of species

Green algae -

Enteromorpha (= *Ulva* tubular form)

Ulva,

Chaetomorpha,

Cladophora;

Red algae -

Ceramium,

Porphyra;

Brown algae -

Ectocarpus,

Pilayella.

Annex B FURTHER READING

Abbott, I.A. and Hollenburgh, G.J. 1976. Marine Algae of California. Stanford University Press, Standford C.A. pp827

Wells, E., Best, M., Scanlan C., Holt S and Foden F. Water Framework Directive Marine Plants Task Team. Tools Paper. Opportunistic macroalgae – Abundance. Draft version 2. Paper No: MPTT/MAT01.

Wilkinson, M. and Wood, P. (2003) Type-specific reference conditions for macroalgae and angiosperms in Scottish transitional and coastal waters: Final report. SEPA Project Reference 230/4136. Heriot-Watt University, Edinburgh, 105pp.

BS EN 14996:2006 : Water quality. Guidance on assuring the quality of biological and ecological assessments in the aquatic environment