

UKTAG TRANSITIONAL AND COASTAL WATER ASSESSMENT
METHODS
ANGIOSPERMS

SEAGRASS (ZOSTERA) BED ASSESSMENT

by

Water Framework Directive - United Kingdom Technical Advisory Group
(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.

UKTAG TRANSITIONAL AND COASTAL WATER ASSESSMENT METHODS ANGIOSPERMS

SEAGRASS (ZOSTERA) BED ASSESSMENT

1. INTRODUCTION

This method statement describes a 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, "angiosperms", 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 on seagrass of general physical disturbance, nutrients, or both.

1.4. Parameters used to assess the quality element

The method uses a multi-parameter index, "Seagrass bed assessment Index" for the purpose of assessing the condition of the quality element. The Index is based on three parameters:

Taxonomic composition loss;

Shoot density loss;

Spatial extent loss (of the seagrass bed).

2. SAMPLING AND ANALYSIS

Within this method, "sampling" means the identification and quantification of seagrass communities within beds at sites in the intertidal zone of shores of transitional or coastal waters for the purpose of estimating the Ecological Quality Ratio.

Sampling should conform to the standards of EN 14996.

2.1. Sampling method

2.1.1. Sampling Sites

Sampling sites should be chosen to be representative of the undisturbed and disturbed parts of the intertidal zone of a water body in respect of its seagrass community composition and patchiness, and seagrass shoot density and extent.

2.1.2. Method

Each site should be sampled visually or photographically, and with a quadrat grid. The extent of seagrass beds may in some cases be measured by remote imagery.

2.1.2.1. Presence or absence of seagrass

The presence and absence of species of *Zostera* and *Ruppia* should be determined visually at the chosen site.

2.1.2.2. Seagrass shoot density

Quadrats, of sufficient number to obtain a representative estimate of seagrass shoot density (the proportion of area covered by seagrass) should be used to cover the seagrass bed. At least three stratified randomized quadrats should be used per discrete patch of seagrass, unless the patch is less than three quadrats in area.

2.1.2.3. Seagrass bed spatial extent

The spatial extent of continuous bed (that bed where shoot density exceeds 5%) should be recorded. Estimates based on aerial photography should be checked by ground observation.

2.1.3. Sample number, timing and frequency

Seagrass beds should be sampled in the peak bloom period (usually July to September inclusive). The change in spatial extent of a seagrass bed from baseline surveys should be derived.

2.2. Analytical method

2.2.1. Taxonomic composition

The presence or absence of the indigenous and expected indicator species should be determined by taxonomic inspection. The indicator species are listed in Annex A.

2.2.2. Density (percentage cover)

The density in each quadrat should be estimated as the fractional spatial cover of the quadrat by seagrass. The density at a site should be estimated as the average fractional spatial cover of the quadrats.

2.2.3. Spatial extent of bed

The area of the continuous seagrass bed should be estimated photographically, visually or by mapped survey.

3. PROCEDURE FOR DERIVING THE ECOLOGICAL QUALITY RATIO FOR THE PARAMETERS

3.1. Calculation of the observed values for each parameter

3.1.1. Taxonomic composition

The parameter, taxonomic composition loss (TCL), should be derived from the number (N_S) of seagrass species present in the bed relative to the number (N_E) of historically expected and indigenous species, according to equation (1):

$$TCL = 100 \times [1 - (N_S \div N_E)]\% \quad \text{Equation (1)}$$

3.1.2. Shoot loss

The parameter, shoot loss (SL), should be calculated as the fractional loss of cover according to equation (2 or 2a).

$$SL = 100 \times [(reference\ value - observed\ annual\ cover) \div (reference\ value)]\% \quad \text{Equation (2)}$$

If sufficient data covering five years are available, the shoot loss may be calculated according to equation 2a.

$$SL = 100 \times [(reference\ value - present\ 5\text{-year\ rolling\ mean\ of\ cover}) \div (reference\ value)]\% \quad \text{Equation (2a)}$$

3.1.3. Extent loss

The parameter, spatial extent loss (SEL), should be estimated as the fractional loss of spatial extent according to equation (3).

$$SEL = 100 \times [(reference\ value - area\ of\ continuous\ bed) \div (reference\ value)]\% \quad \text{Equation (3)}$$

3.2. Reference values for each parameter

Reference conditions will be derived using a combination of historic data and expert judgement. The values in Column 2 of Table A should be applied as the reference conditions for the corresponding parameters listed in Column 1 of that Table.

Table 1: Reference values for each parameter	
Column 1	Column 2
Parameter	Reference values
Taxonomic composition loss (TCL) (%)	25
Annual shoot loss (SL _{Yr}) (%)	10
Five year shoot loss (SL _{5yr}) (%)	5
Spatial extent loss (SEL) (%)	10

3.3. Calculation of the ecological quality ratio for each parameter

The ecological quality ratio (EQR_{TCL}) for the parameter, taxonomic composition loss, should be calculated using the following equation:

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

The ecological quality ratio ($EQR_{SL_{Yr}}$) for the parameter, annual shoot loss, should be calculated using the following equation:

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

The ecological quality ratio ($EQR_{SL_{5yr}}$) for the parameter, five year shoot loss, should be calculated using the following equation:

$$EQR_{SL_{5yr}} = [100 - \text{observed value for parameter}] \div [100 - \text{reference value for parameter}]$$

The ecological quality ratio (EQR_{SEL}) for the parameter, spatial extent loss, should be calculated using the following equation:

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

Annex A LISTING INDICATORS

The indicators of the method are the species:

Zostera noltii, *Zostera marina* & *Zostera marina var angustifolia* and the genus *Ruppia* (*R. maritima* and *R. cirrhosa*).

Annex B WORKED EXAMPLE

A.1 MEASUREMENTS

A site in south-west England was sampled in June with the following results:

Zostera noltii was present.

The shoot density at the site as the average of quadrat shoot density measurements was 49%.

Historically the previous shoot density had been estimated at 67%

The area of the continuous angiosperm bed at the site was 0.15 km².

The area of continuous angiosperm bed on the previous survey was 0.22 km².

A.2 TAXONOMIC COMPOSITION

The number of species present (N_S) was one (*Zostera noltii*).

Historically, the site supported *Zostera noltii* and *Z. angustifolia*: the number of expected and indigenous species (N_E) is two.

The taxonomic composition loss was derived from 3.1.1:

TCL

$$= 100 \times [1 - (N_S \div N_E)] \%$$

$$= 100 \times [1 - (1 \div 2)] \%$$

$$= 50\%$$

A.3 SHOOT LOSS

The shoot density was 49%.

The shoot loss was estimated according to 3.1.2:

SL

$$= 100 \times [(previous\ annual\ cover - observed\ annual\ cover) \div (previous\ annual\ cover)] \%$$

$$= 100 [(67 - 49) \div (67)]$$

$$= 27\%$$

A.4 EXTENT LOSS

The extent loss was estimated according to 3.1.3

SEL

$$= 100 \times [(area\ of\ continuous\ bed\ in\ previous\ survey - area\ of\ continuous\ bed) \div (area\ of\ continuous\ bed\ in\ previous\ survey)] \%$$

$$= 100 \times [(0.22 - 0.15) \div (0.22)] \%$$

$$= 32\%$$

Annex C FURTHER READING

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