Intertidal seagrass monitoring for Water Framework Directive (WFD) purposes

**Operational instruction** 214\_07 **Issued** 26**/**11**/**2014

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| What’s this document about? | This operational instruction explains how to:   * carry out intertidal seagrass surveys for Water Framework Directive (WFD) purposes.   It includes detail on:   * the preparation required for field work * what records must be taken during the surveys. |

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| Who does this apply to? | Environment Agency staff and external contractors undertaking seagrass surveys for WFD purposes:  Environmental Monitoring (Sample & Collection) teams  Environmental Monitoring (Analysis & Reporting) teams |

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| Contact for queries and feedback | * [Helpdesk Services](mailto:processhelpdesk@environment-agency.gov.uk) for queries about this document * Please give [anonymous feedback](http://intranet.ea.gov/policies/33345.aspx) for this document. |

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Introduction

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| WFD assessment | Seagrass (Zostera species) beds are monitored as part of the Water Framework Directive (WFD) requirement to assess the ecological status of estuarine and coastal waterbodies.  To achieve this assessment the following three criteria are used:   * extent of seagrass beds * species of seagrass present, including any Ruppia species * estimated shoot density of seagrass in each bed. |

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| Intertidal seagrass beds | This method applies to littoral beds, which are the beds between mean high and low water springs in the intertidal zone along estuaries and coasts. |

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| Pressure | We use this method particularly to assess the morphological pressures that dredging and shoreline reclamation place on water bodies. |

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| What approach is to be taken? | The size and density of beds is assessed when the seagrass is at peak growth. Plant shoot density is measured using percentage substrate cover in a representative number of quadrats. Size, or extent of beds is tracked (walking with GPS), or with aerial imagery combined with selected sites on the ground. |

Health and safety for field surveyors

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| H&S training courses | Complete the Water Safety training course prior to commencing work. |

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| H&S e-learning courses | All surveyors will have completed the [Tide table e-learning course](http://ldelearn-1/LMS7/SignIn.aspx?ReturnUrl=%2fLMS7%2fdefault.aspx) and will be able to demonstrate an understanding of tides and tide tables. |

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| !Important | Surveyors must be familiar with the risks and hazards associated with working in intertidal areas.   * [Intertidal soft sediment work risk assessment](http://ams.ea.gov/ams_root/2007/001_050/13_07.doc) and [Intertidal soft sediment work operational instruction](http://ams.ea.gov/ams_root/2007/001_050/13_07.doc) |

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| Generic risk assessments (GRA) | All surveyors involved with this work are familiar with the appropriate generic risk assessments and associated H&S documents:   * [Fieldwork generic risk assessment](http://intranet.ea.gov/ams_document_library/04/4_07_health_and_safety/hs_risk_assessments/37_04.doc) and [Fieldwork operational instruction](http://intranet.ea.gov/peoplematters/help/53798.aspx) * [Working in or near water generic risk assessment](http://intranet.ea.gov/ams_document_library/04/4_07_health_and_safety/hs_risk_assessments/426_05.doc) and [Working in and near water operational instruction](http://intranet.ea.gov/ams_document_library/2006/701_750/732_06.pdf) * [Lifejacket work instruction](http://intranet.ea.gov/ams_document_library/04/4_07_health_and_safety/hs_work_instructions/600_06.doc) |

Competency requirements for field surveyors

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| E-learning courses | All surveyors will have completed the marine ecology monitoring CD and [e-learning](http://intranet.ea.gov/knowledge/training/selflearning/default.aspx) assessment. |

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| Global positioning system (GPS) | You should be competent in the use of your GPS device and understand the sources of error and bias associated with the techniques that you use. The [Ecologist’s field Reference for Intertidal GPS use](https://www.ea-training.org/apps/canvas/view.php?id=34834) covers generic aspects of the use of GPS for mapping seagrass, macroalgae and saltmarsh. |

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| Environment Monitoring - Marine Community of Practice | You should consult the key documents and webinar recordings in the online Community of Practice (CoP). This will supplement your understanding of seagrass surveys.  Details on how to access the CoP are on the Easinet. |

Pre-planning surveys

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| Responsibility for seagrass surveys | Environmental Monitoring teams are responsible for planning, managing and completing all field sampling and will need to arrange aerial flights if these are required. |

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| Site risk assessments | Every site must have an up to date site risk assessment. The site risk assessment must be readily available for all surveyors to consult. |

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| Access and egress | Always plan surveys in advance. Ensure a safe method of getting to and from your seagrass beds is used and allow enough time for the survey.  Everyone on the survey must be aware of the safe egress route at all times.  Surveys should be delivered in daylight on a falling tide.  If the site cannot be accessed safely on foot, whether directly or by boat, consider the use of aerial photography. |

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| Monitoring site information system (MSIS) | MSIS is the national database that stores site location, access and health and safety details for all marine ecology monitoring sites.  You must check MSIS for seagrass site specific information before surveying and ensure the database is kept up to date with any new information. |

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| Aerial photography | Aerial photography can help map the extent of intertidal seagrass beds. Flights can be arranged locally, or with Estuaries and Coastal Monitoring and Assessment Service (ECMAS).  For further information on how to book flights and use aerial survey data refer to the WFD Estuarine and coastal Aerial Habitat & Plant Mapping guide. |

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| Working with vessels | Consider using vessels, such as small-boats or hovercraft, if this provides a safer means of accessing the seagrass beds.  If you need to carry out the survey from a boat, make sure you are familiar with the generic risk assessments and follow the [Boatwork instruction](http://ams.ea.gov/ams_root/2006/701_750/730_06.pdf). |

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| Hovercraft | Hovercrafts are extremely noisy and can be disruptive to birds, discuss the use of them with Natural England and gain the appropriate permission. Take care to ensure your impacts are minimal and that you follow the instructions on [Working near protected species or habitats](http://intranet.ea.gov/ams_document_library/2006/701_750/726_06.pdf).  For further information on how to book and use hovercrafts contact ECMAS. |

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| Permissions and licences | There are three UK species of the genus Zostera, all of which are rare and threatened and it is likely that the seagrass beds lie within protected sites.  It is essential you obtain any permissions needed to access the seagrass beds and carry out the survey, from the appropriate authorities.  Contact Natural England for guidance on any special permits and licences you may need to carry out these surveys.  Licences or permissions may take time to obtain. You should allow for this when planning your surveys. |

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| Invasive species | Invasive, non-native species occur in the marine environment. Ensure you are familiar with the risks for your sites and comply with the check, clean, dry campaign. |

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| Dynamic risk assessment (DRA) | You must carry out a dynamic risk assessment (DRA) on arrival at your seagrass beds.  Carry out further DRA’s, as you move between seagrass beds and whenever conditions change, including conditions underfoot or weather conditions. Adapt plans as necessary according to the conditions on the day. |

Survey requirements

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| Timing of surveys | The seagrass survey window is between 1st June and 30th September. Surveys must target the peak bloom period - this is likely to fall in August or early September for most parts of the UK. You will need to observe this to establish the optimal timing for your locality. |

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| Rule! | You should carry out surveys at the same time each year to limit the effect of seasonal variation. |

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| **Frequency of surveys** | Initially, intertidal seagrass monitoring needs to be delivered annually.  Once a reliable baseline of seagrass data has been established, for every bed in the waterbody, then monitoring continues for five consecutive years.  When 5 consecutive years' of reliable data from the baseline have been recorded, the frequency of surveys may be reduced.  Contact Environmental Monitoring and Telemetry Services (EMTS) via [Helpdesk Services](mailto:processhelpdesk@environment-agency.gov.uk), for advice on how to adapt the survey frequency in your waterbodies. |

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| Main monitoring metrics | The table below lists the three main monitoring metrics. All three sets of data must be collected to run the WFD status classification | |
| Monitoring metrics | Method of survey |
| Taxonomic composition | Seagrass species present. |
| Shoot density | Measured as the percentage cover of seagrass in an appropriate sized quadrat. |
| Bed extent | Measured as the area cover in hectares of:   * the continuous bed, deemed to have >5% shoot density, this is mandatory; and * where possible, the <5% shoot density area. |

Delivering field surveys

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| Planning the survey | Your survey plan must include the amount of work that you can achieve safely during low-tide.  For areas exposed for several hours at low tide, it may be possible to survey the whole site on one occasion. For very large seagrass beds, it may be appropriate to survey sub-sections of the bed at varying states of ebbing tide, over a period of several days.  To assist in planning your surveys follow the steps in the table below. | |
| Step | Action |
| 1 | Use recent images or habitat maps. |
| 2 | Speak to your local Flood and Coastal Risk Management (FCRM) team, for information on flights that may already be happening in your waterbody. |
| 3 | Contact ECMAS for historical seagrass data. |
| 4 | Contact Natural England for any new seagrass data. You will need to contact them anyway for permission to carry out fieldwork in protected areas. |

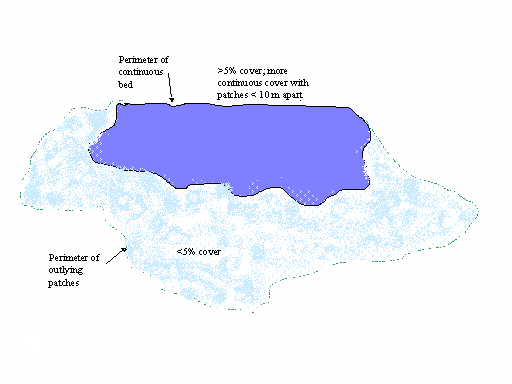
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| Quadrat size | The size of the quadrat used can vary according to the nature of the seagrass cover in the waterbody.   * ≥1m2 quadrats for discontinuous or mixed species seagrass meadows; * ≤1m2 quadrats (for example a 0.25m2, gridded quadrat) for continuous uniform meadows; * ≤1m2 quadrats should be used if a random stratified approach is applied in a waterbody which has patches with distinct areas of differing seagrass densities. |

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| Survey design for a new seagrass bed | This table lists the rules used to determine the number and location of sample quadrats for a new seagrass site. Contact [Helpdesk Services](mailto:processhelpdesk@environment-agency.gov.uk) for guidance if needed. | |
| Item | Rule |
| 1 | Ensure that the number and random placement of quadrats is representative of the percentage cover of the bed. |
| 2 | Within each discrete patch, take a minimum of three random quadrats. |
| 3 | Many more quadrats are required to measure a heterogenous area of seagrass, than a homogeneous one. You should aim to collect at least 30 quadrats per waterbody. |
| 4 | For very small patches of seagrass it may not be possible to collect a minimum of 30 quadrats. Seek advice from EMTS on how many quadrats to collect from very small patches. |

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| Survey design for a previously surveyed seagrass bed | Existing survey data should be used to calculate an appropriate number of quadrats needed to enable valid estimates of the variance in shoot density to be determined. | |
| Step | Action |
| 1 | Using the most recent survey data calculate the coefficient of variation for a selection of quadrats taken at random from the dataset. |
| 2 | Select the minimum number of quadrats, with the lowest appropriate co-efficient of variation, which still provide a representative average percentage cover. |

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| Mapping the extent of the bed | This table describes how to map the extent of the bed. | |
| Step | Action |
| 1 | You need to determine the area, the patchiness and the dimensions of the seagrass meadow with >5% density.  Record negative impacts affecting each patch within a bed. Enter these into Biosys in the comments field for each patch.  Such impacts include:   * general health and condition of the shoots * any evidence of wasting disease * opportunistic macroalgal cover * blow-outs (bare areas caused by natural physical disturbance) * bait digging holes, anchor-chain scour, litter, physical removal or vehicle tracks. |
| 2 | Aerial surveys are not used Map the perimeter of the continuous bed by walking the boundary. Use a differential GPS or other means of ensuring accurate mapping, for example reference to fixed points.  Where the precise edge of a bed is indistinct, make a subjective decision and support this with notes and photographs. |
| 3 | Aerial surveys are used Aerial imagery of the seagrass bed extent need to be confirmed by ground-truthing of the seagrass boundaries and percent cover estimated.  The un published WFD coastal and estuarine Aerial Habitat & Plant Mapping guide will contain information on ground-truthing and using aerial survey data. |
| 4 | Aerial survey used if bed is too soft/dangerous to access Where full field surveys are not possible, it is important to ground truth aerial imagery of seagrass beds.  Only if it is safe to do so:   * use a range finder to estimate the >5% patch edges. Record that the position was not fixed in situ and is a cursory point. * record estimates for areas of percentage cover and areas of negative impacts. |
| 5 | Many littoral seagrass beds have extensive areas of very low shoot density (<5%) around the periphery of the denser, continuous bed (>5%). See [Figure 1](#_Figure_1), of a Z. noltii bed mapped in this way.  Where access and resources allow, it is valuable to map the boundary of this peripheral, low shoot density area. Do not sample these areas with quadrats. |
| 6 | Under normal circumstances, intertidal and subtidal beds will not merge, so the edge of an intertidal bed will be defined by the low water mark. Zostera noltii occurs higher on the shore at the high tide mark. Zostera angustifolia is generally found at the mid to low tide mark or in damp runnels higher up the shore.  If the intertidal bed extends into the sublittoral and merges with a subtidal Zostera marina bed, make a note of this and indicate the state of the tide when you made this observation. Record this detail in Biosys, in the comments field. |

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| Figure 1 | Mapping a seagrass bed. |



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| Using quadrats | Sample the areas of >5% seagrass shoot density, using quadrats.  For each quadrat, record:   * the percentage of seagrass leaf cover; * the percentage of other plant species; and * the percentage of bare ground.   Biosys will only accept the direct input of seagrass leaf cover. Record all other species' percentage cover data for each quadrat in the comments field. |

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| Placement of quadrats | Sample randomly throughout the continuous seagrass bed (>5% shoot density).  Where the seagrass density varies over an area, use a random stratified design. Within each patch of differing density, still place quadrats randomly. | |
| Step | Action |
| 1 | For each quadrat, estimate the percentage cover of shoots, othr species and bare ground. |
| 2 | Take photos of 10% of quadrats to create a reference for future surveys. |
| 3 | Photos should be stored in your local G drive. The file path for the folder should be recorded in the comments field in Biosys.  Do not store quadrat photos in Biosys. |

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| Identifying Zostera | The three species of seagrass found in the UK are   * Zostera noltii - typical of the littoral habitat, can occur higher on the shore than Z. angustifolia, on mud and sand. Tolerant of dessication and will grow in areas that dry out at low tide. * Zostera angustifolia - generally occurs between the mid-low tide mark, prefers poorly-draining muddy sediments, particularly pools and creeks that are unlikely to entirely dry out during low tide * Zostera marina - predominantly a sublittoral species found in shallow, fully marine conditions, on relatively coarse sediment. Z. marina is not tolerant of desiccation. It may rarely grow in pools that do not dry out at low tide.   See MarLIN website [Marine life information network](http://www.marlin.ac.uk/habitatsbasicinfo.php?habitatid=266&code=1997) for pictures. |
| Identifying Ruppia | * Ruppia species are commonly known as wigeon grass. They are not seagrass, but can grow in seagrass beds.   See MarLIN website [Marine life information network](http://www.marlin.ac.uk/habitatsbasicinfo.php?habitatid=266&code=1997) for pictures. |

Data recording

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| Recording field data | Use the [Intertidal seagrass fieldsheet](http://ams-documents.ea.gov/2007/201_250/214_07_SD01.doc) for recording data for each survey. |

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| Handling data | Follow the guidance given in the [Biosys data entry guide – marine techniques](http://intranet/ams_document_library/2007/351_400/393_07.doc) when entering data about seagrass.  Record key information from the fieldsheets in the comments field in Biosys. | |
| Step | Action |
| 1 | Record the source of any aerial photographs and imagery and/or tracking data in Biosys comments field. Include reference to date, time and location of the aerial survey. |
| 2 | It is the responsibility of the area environmental monitoring teams to set up the stations and samples and maintain the data on Biosys. |

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| Rule! | All key field data including calculated total area of bed extent must be entered and audited in Biosys, by the end of October. |

Related documents

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| Links | * [Working in or near water risk assessment](http://intranet.ea.gov/ams_document_library/04/4_07_health_and_safety/hs_risk_assessments/426_05.doc) * [Intertidal soft sediment work risk assessment](http://ams.ea.gov/ams_root/2007/001_050/13_07.doc) * [Intertidal soft sediment work operational instruction](http://ams.ea.gov/ams_root/2007/001_050/13_07.doc) * [e-learning – Understanding tides and tide tables](http://ldelearn-1/LMS7/SCORMPackages/cbb09910-4359-ec01-e044-00110a8a6291/index.html) * [How do you know if you are working in a protected habitat or near protected species?](http://intranet.ea.gov/ams_document_library/2006/701_750/726_06.pdf) * [BIOSYS data entry guide - marine techniques](http://intranet/ams_document_library/2007/351_400/393_07.doc) * Hovercrafts for Intertidal Ecological Surveys * WFD Coastal Aerial habitat & Plant Mapping |