JOINT NATURE CONSERVATION COMMITTEE

Marine Monitoring Handbook
March 2001

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UK Marine SACs Project

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Procedural Guideline No. 3-1 *In situ* intertidal biotope recording

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Background

CCW has been engaged in a programme of survey and mapping of biotopes in the intertidal zone around Wales since 1996. This programme was initially stimulated by the EC Habitats Directive SAC designation requirements , since implementation of the directive in the UK requires that appropriate adjacent intertidal land must be notified as a Site of Special Scientific Interest (SSSI) before it can be included as part of an SAC.

Monitoring and surveillance using intertidal mapping techniques on rocky shores was trialed in Pembrokeshire following the *Sea Empress* oil spill (Bunker and Bunker 1997). In this work, biotopes were described spatially and boundaries determined. Bunker (1998) concluded that although intertidal Phase 1 mapping was not originally designed for surveillance or monitoring, the mapping and recording of observations on biotopes can have a useful role in surveillance and, additionally, in the planning of monitoring strategies.

The resolution of intertidal mapping (on which this procedural guideline is based) lies between Phase 1 terrestrial mapping (JNCC 1993) and Marine Nature Conservation Review (MNCR) Phase 2 marine survey methodologies (Hiscock 1996). During intertidal mapping, surveyors walk along the shore in order to identify and map the extent and distribution of biotopes.[2] Biotope identification is carried out in the field and, in addition, species lists are taken where necessary. The technique has been developed to enable rapid survey of the coastline (average 0.17km^2/hr for a pair of surveyors).

The survey technique outlined below was developed as part of the UK Marine SACS Project and tested in the Mawddach Estuary, west Wales. Biotopes were identified at designated sampling points laid out in a 200m grid over the site because of the inherent problems associated with repeatable boundary determination in those communities. The scale of the grid was set so that all the major biotopes in the estuary (those biotopes that make up a substantial proportion of the site and are important to the feature) would be visited five times, and all the minor biotopes (those biotopes that are locally rare or, though otherwise important, are not adequately covered by the grid) were visited twice.

Purpose

The strategy outlined here has been designed to provide a means of measuring certain attributes, with consideration of the scale and resolution at which Phase 1 survey can be achieved. The grid sampling strategy provides sufficient distributional information on biotopes to be able to draw conclusions about the following:

- distribution of selected biotopes/biotope types throughout a site
- relative proportion of selected biotopes/biotope types throughout a site
- presence/absence of selected biotopes/biotope types throughout a site

Advantages

- a rapid method for monitoring certain attributes of a site
- no expensive or specialist survey equipment required

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2 A fuller description of this methodology can be found in the *CCW Handbook for Marine Intertidal Phase 1 Survey and Mapping* (Wyn *et al.* 2000), and summarised in Procedural guideline 1-1.

- an inexpensive and straightforward method for monitoring certain attributes of a site representing a fraction of the costs of more detailed Phase 2 survey
- no expensive post-survey species identification and data analysis required
- no assumptions made about the accuracy with which biotope boundaries are marked or about the stability of biotope boundaries over time

Disadvantages

- resolution of *in situ* recording may be inadequate for some monitoring objectives
- no quantitative samples taken that can be re-examined at a later date
- depending on the monitoring objectives and survey strategy, some habitats or biotopes may be overlooked without initial, more detailed baseline survey of the monitoring area
- no map with accurate boundaries can be drawn from the data

Equipment

The following are required in the field:

- clipboard
- map of site with grid points and their co-ordinates marked
- waterproof survey forms, rubber and sharpener
- Ordnance Survey map
- laminated MNCR biotope manual
- collecting equipment for voucher specimens (small pots and labels)
- camera (weather-proof)
- safety equipment including mobile phone, PPE (including a dry suit), first aid kit, and flares
- tide tables
- spade and 0.5mm mesh sieve for sediment shores
- differential/non-differential GPS

Further equipment required for post-survey analysis includes simple word-processing and spreadsheet software packages.

Personnel/time

The minimum survey team requirements are for:

- two staff (for safety reasons); of whom
- both need to be experienced intertidal surveyors familiar with the application of the biotope classification to the intended survey locality.

Method

An evenly spaced grid of sampling stations is set up across the site from high water springs down to low water springs; this process is a simple operation for a Geographical Information System. If an existing biotope map is a available, the grid can be scaled to allow for at least five sampling stations on each of the major intertidal biotopes (from Connor *et al.* 1997).

Prior to the survey a risk assessment is completed, information is gathered on times and height of tides, and a map and table of the locations of the grid sample stations on the site are prepared. Access points, land ownership and local knowledge of the conditions on the site must also be collated.

The survey should begin at least two hours before spring tide low water (daylight permitting). This provides a sufficiently long time in which to work. The actual route taken across a site depends upon the topography and the tidal regime that exists at that site. Each intended grid sample station is located

3 See Procedural guideline 6-1.

using a differential Geographic Positioning System (GPS) accurate to within 1 metre.[3] The sample station number, GPS position, habitat and biotope details are recorded on a standard pro forma for each sample station. Different habitat types are surveyed as follows:

- *Sediment biotopes*. These are sampled within $1m^2$ of the grid station and sieved *in situ*. This involves collecting two spade loads (approximately $0.02m^2$) of sediment, dug to a depth of 20–25cm and sieved through a 0.5mm mesh sieve. At some sample stations it may be necessary to repeat where infauna are scarce. Species present and their abundance are recorded. Specimens are taken of species that are considered important to identify the biotope and not identified in the field. These are subsequently identified in the laboratory. For conspicuous species such as bivalves and *Arenicola marina*, it is straightforward to count the number of individuals per m^2. For bivalves such as *Macoma balthica* this will involve digging over $1m^2$ (or $0.1m^2$ if there are high densities). The presence of *Cerastoderma edule* can be gauged by dragging the tip of a spade through the surface of the sand and 'feeling' the shells immediately below the surface. For *Mya arenaria* and *Scrobicularia plana* surface siphon holes per m^2 are counted. For *A. marina* surface casts per m^2 are counted.
- *Rock and mixed biotopes*. The species found and their abundance are recorded within $1m^2$ of the sample station and a biotope code assigned using the Marine Biotope Classification for Britain and Ireland.[4]
- *Saltmarsh grid points*. Grid points falling within higher and pioneer saltmarsh communities are sampled in one of two ways. If the $1m^2$ around the sample station contains more than 5% cover of saltmarsh plants then it is classed as saltmarsh and the epifauna/floral species, their abundance and percentage cover are recorded but the sediment infauna are not sampled. If, however, the $1m^2$ contains less than 5% cover of saltmarsh plants the infauna and surface species are recorded as for other sediment biotopes. In all cases, the abundance and % cover of saltmarsh species is recorded. The distinction above is necessary in order to ensure consistency of recording in a time series, i.e. 'saltmarsh' is still the same entity from one monitoring episode to another. There does not appear to be clear guidance on this within the NVC classification for coastal vegetation communities (Rodwell 2000).
- *Submerged sample stations*. Due to the dynamic nature of a site, the channel position within it may change over time. This means that some sampling stations from a previous year may be submerged or visa versa. Grid sample stations falling within the river channel are not sampled and account must be made for this during subsequent analysis of the data.

Additional information of the more widely dispersed species and habitat details are recorded from a 5m radius around each sample station. Some sample stations may initially be located in areas of small-scale heterogeneity. On such occasions, biotope features are recorded as usual, from within a 5m radius of the sample station, but are restricted to the specific biotope present at the exact centre of the sample station. For example, a grid sample station located on a 1m wide strip of sheltered littoral rock with *Pelvetia canaliculata* (SLR.Pel) would involve a search 5m either side of the station for additional species but not above in the lichen zone and not below in the *Fucus vesiculosus* zone. Similarly, this system of recording was applied to areas of sediment with steep profiles, where biotopes were arranged linearly and changed within small spatial scales (e.g. saltmarsh channel banks).

The following points should be taken into account during survey:

- Monitoring of sediment sample stations should not be carried out in or immediately after heavy rain due to the loss of surface features.
- A sufficiently large volume of sediment should be sieved to adequately characterise the biotope. This is important to account for the more dispersed but diagnostic infauna.
- The survey should be carried out between April and October and during periods of spring low tides.
- Surveyors should familiarise themselves with all intertidal and sublittoral fringe biotopes and especially with those previously recorded from the site.
- Estuary sediments are prone to disturbance by erosion and deposition, sometimes in direct response to human activities. If a sample station is too disturbed or unstable then it will be unsuitable for biotope identification and should be recorded as such.
- Further sample stations may have to be added to ensure that there are sufficient numbers of both the major and minor biotopes chosen for a site in order to achieve monitoring objectives. Sampling may need to be stratified to adequately represent the biotopes to be monitored.
- For monitoring sediment biotopes, infaunal species collected in the sieve should be recorded as actual or estimated numbers, not as abundances which are less precise.

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4 Using the most recent version: Connor et al. (1997) at the time of printing

- The impact of sampling should be considered in the sampling strategy. Good practice is to fill in holes at sediment sample stations to minimise the impact from monitoring. Additional considerations must be made for sensitive or limited habitats such as saline lagoons.
- For inter-survey consistency, the same version of the national biotope classification must be used to avoid 'translational' difficulties between Phase 1 datasets in a monitoring time series.
- For more precise identification of biotopes at a particular site, it is advisable that the survey team clarify the key habitat and species characteristics of each biotope within the specific site in order to improve the differentiation of biotopes. This can be done by writing an additional (location specific) paragraph in the biotope description that explains local variation of the character of the biotope from the national character.

Data analysis

The analyses that are completed will be specific to the objectives of the monitoring programme, but would be expected to include a measure of the different proportions of biotopes or biotope types and an account of changes found across a time series.

Accuracy

Survey results should always be produced with as much accuracy and consistency as time and resources will allow. If there is a detailed and accurate baseline map of the site, then the accuracy of an intertidal biotope survey can be validated against this at the time of preparation of the baseline data. Inaccuracies during surveys should be presented and discussed in full in the survey report and the validity of the results assessed in view of them.

QA/QC

When planning any survey, it is vital to include provision for quality control (QC). QC depends upon ensuring good survey technique and standards through training and quality assurance procedures. Good survey technique relies on accurate identification of species and biotopes, precise orientation skills, attention to detail and thorough survey preparation.

Verification of species identification with the specimen collection and biotopes identified on the shore must be carried out to ensure the quality of the data.

To ensure consistency, surveys (in whole or part) should be repeated periodically. This procedure can be used to identify aspects for improvement as well as providing an understanding of the limits of the methodology. Initially, repeat surveys should be done frequently to ensure consistency and accuracy between surveyors and to remove any problems associated with a new survey method. Once survey teams are fully experienced, a proportion of their work should be checked: about 5% of sites in-house and 2% by experienced external surveyors.

Data products

Data products are likely to be datasets held on database or GIS, according to the monitoring objectives.

Cost and time

The survey of the Mawddach estuary in 1999 required a mean effort of 7.5 person-minutes per station in contrast to 48.9 person-minutes per station for a quantitative survey using cores.[5] The following costing/timing was incurred during the survey of 141 sample grid points in the Mawddach estuary.

5 Wyn *et al.* (2000)

Initial Phase 1 survey: 30 person days

Methodology and specification development: 5 person days

Survey on foot: 32 person days (2 persons x 16 days)

Additional boathandler: 1 person day

Survey preparation: 1 person day

Survey write up: 10 person days

Total 44 person days (excluding the development and initial phase 1)

Health and safety

Due to the dangers of working in the marine environment and the amount of data to be gathered, surveyors should always work in pairs. The lone worker policy should be adhered to in order to provide additional backup should both surveyors become trapped or incapacitated. Risk assessments should be prepared for each location to be surveyed in order to account for local conditions.[6]

In addition, safety manuals issued by the UK government conservation agencies provide advice and recommendations for shore survey work, as well as for dealing with wild and domestic animals; information is also provided about first aid for sunburn, heat exhaustion and hypothermia.

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6 Example risk assessments for intertidal survey are provided in Wyn *et al.* (2000).