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JOINT NATURE CONSERVATION COMMITTEE

Marine Monitoring Handbook
March 2001

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UK Marine SACs Project

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Contents

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Procedural Guideline No. 3-3 *In situ* survey of subtidal (epibiota) biotopes and species using diving techniques

Rohan Holt and Bill Sanderson, Countryside Council for Wales[1]

Background

These methods are adapted from standard Marine Nature Conservation Review procedures (Connor and Hiscock 1996) and methods developed during monitoring trials in 1998–1999 (Sanderson *et al.* 2000).

In order for data to be analysed over a time series and to monitor biotope/species richness, it is considered necessary to account for or standardise recording effort because the number of biotopes/species recorded will be linked to effort (see species–effort curves, e.g. Hawkins and Hartnoll 1980). Similar rules apply to counting individuals of one species. Effort recording through, for example, timed swims is too inexact because divers would see more or less depending on the visibility, and swim at different speeds and travel differing distances depending on fitness and any prevailing current at the time.

Effort limitation has previously been utilised by divers for benthic survey for recording species (e.g. see Wilson 1994). Here, a modified version of a technique used by Wilson (1994) is described (Figure 1) that has a number of applications relevant to biotope and species monitoring and/or surveillance.

Purpose

- identification of biotopes
- gathering data to describe biotopes/biotope composition
- determination of an index of biotope richness within a defined area
- determination of an index of species richness from within a defined area
- describing the extent and distribution of biotopes
- describing the extent and distribution of species
- describing the extent and distribution of other seabed features (e.g. burrows)

Note that a combination of the above can be nested within one survey. For example, the primary aim may be to gauge biotope richness within an area, but with suitable adjustments to the methodology, the data can also provide biotope descriptions, species richness and biotope distribution.

Logistics

Equipment

- Appropriate transport – inflatable boats or RIBs (Rigid-hulled Inflatable Boats) are adequate for most diving operations.
- Diving equipment and safety equipment (e.g. full diving kit, surface marker buoys, nitrox breathing gas if appropriate).

1 Plas Penrhos, Ffordd Penrhos, Bangor, Gwynedd, LL57 2LQ, Wales.

- Position locating equipment and/or notes (e.g. dGPS co-ordinates and transit marks).
- Checklist of species (e.g. MNCR form[2]) and abundance scales.
- Writing boards (perhaps with waterproofed checklist, abundance scales and guidance notes attached).
- Collecting equipment for reference specimens (plastic bags, lidded buckets, fine net).
- Stills camera/video camera to supplement written records.
- Seabed guide ropes, 'roll-out transect' equipment or similar for effort-limited survey technique (Figure 1). The pole is designed to measure a fixed transect width and therefore, in combination with the fixed distance travelled, limit the area surveyed. In field trials in North Wales the guide pole length was chosen to be 3m because the visibility was unlikely ever to be worse than 1.5m (each diver would need to be able to survey the area on one side of the pole). Visibility could therefore be eliminated as a major source of variance over a time-series of data. The actual length of the transect should be based on previous experience and survey at the site. In Pen Llyn cSAC, for example, previous studies (Brazier *et al.* 1999a; Bunker 1999) suggested the total intended survey area of $150m^2$ (50 x 3m) would be sufficient to record adequately at least one biotope (probably two).

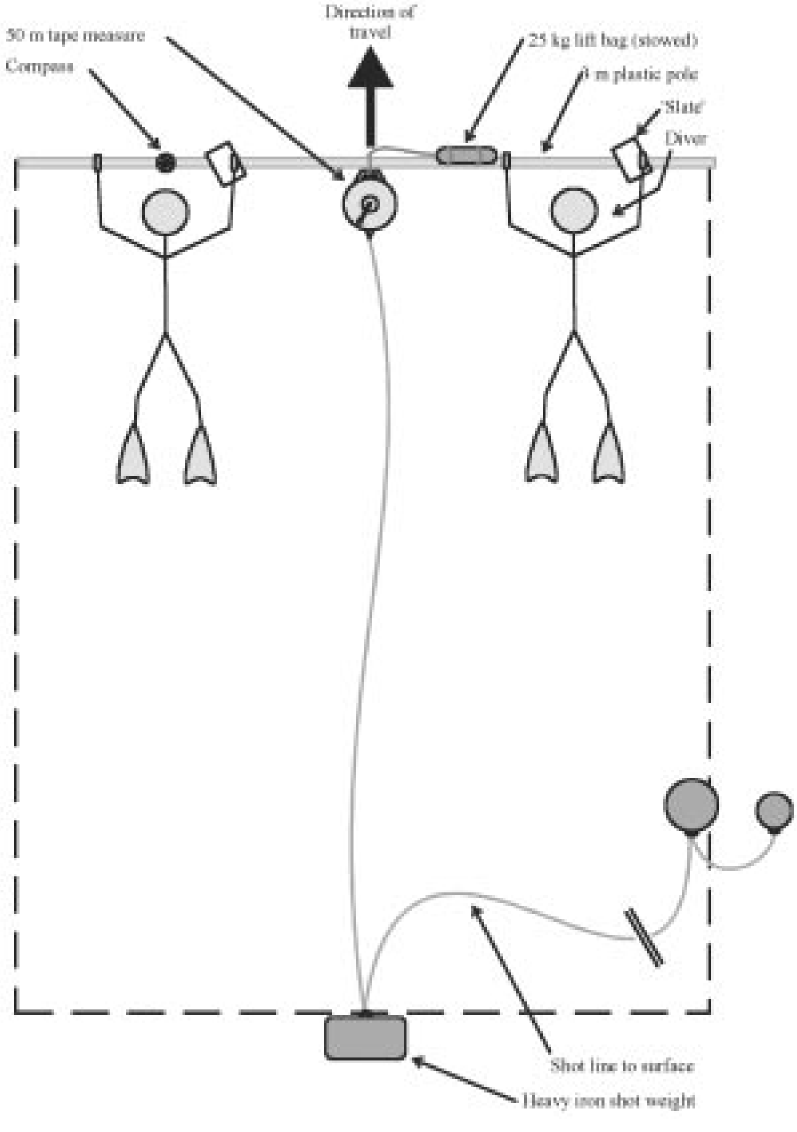

Figure 1 An effort-limited diver survey technique – the box enclosed by the dotted lines represents the area surveyed.

Personnel

All divers to be fully qualified (see 'Health and safety') with appropriate experience in biological recording. Minimum team size three in benign conditions; normally four for most survey situations.

2 A copy may be downloaded from: **http://www.jncc.gov.uk/**

Best time of year for sampling

Calm conditions, reasonably clear water (suggest 1.5–2m minimum underwater visibility), and little or no current are ideal, although not always practicable or attainable at all locations. The best times of year for suitable conditions tend to be spring, summer and autumn on open coasts (although consider the impact of springtime plankton blooms in some locations). Strongly tide-swept areas should be surveyed at the time of slack water – the duration of which is normally (but not always) longest during neap tides.

The timing of a survey should also consider seasonal changes in the benthos. For example, hydroids and bryozoans may be heavily grazed late in the summer and red algae may be obscured by growth of epiphytes. Repeat surveys as part of a time-series data set should be collected at the same time of year.

Method

Site location

This depends on the main purpose of the monitoring exercise. Sites may be chosen to target particular habitat types (e.g. by referring to charts or AGDS or sidescan survey maps) or chosen via a random/semi-random (stratified random) technique, for example, as part of a sampling strategy to investigate biotope richness.

GPS/DGPS co-ordinates are normally used to locate previously unmarked sites at sea. A buoy attached to a weighted shotline, supplemented with a small anchor, should be used in order to deliver the divers as close as possible to an unmarked seabed location, particularly where currents and/or deep water are anticipated. Exact location/relocation of a subtidal site far away from surface features (e.g. the shoreline) is not possible without deploying permanent markers and guidelines (see site marking PG) and therefore is not normally considered practicable for this type of survey.

Diving survey

See Figure 1.

A pair of divers descend the shotline down which the tape and guide pole have already been deployed (see also Figure 4).

The divers then begin surveying as they reel out the tape from a pole travelling in a straight line. A compass fixed to the centre of one side of the transect pole can be used to assist in 'hands-free' navigation (Figure 1).

Species and abundances are recorded *in situ* using standard recording protocols (see Hiscock 1996). The level of detail to be recorded by the divers must be decided before they start the survey. For example, they can limit recording to the most conspicuous and characterising features of a biotope, or even count single species within the boundary of the transect. This may be particularly important for saving time, to ensure that even the deep sites are surveyed completely. It may be appropriate to develop a checklist of species to assist recording.

If recording biotope richness the divers will have to make judgements on where one biotope ends and the next one begins (and when they are in 'transition zones') and also make decisions on whether they are surveying from within a definable biotope. This decision is aided by applying a simple rule: only record biotopes that exceed a minimum area (e.g. biotopes that cover less than $5m^2$ are disregarded). This avoids creating 'new' biotope records for small features such as the epifauna found on a few scattered boulders (although their presence can be noted) or when a transition occurs in the last metre of a transect.

On completion of the transect the pole and line are sent to the surface using a 25 kg lifting bag/marker inflated by the divers. The divers are then free to make their ascent utilising their own surface marker buoy (Figure 2).

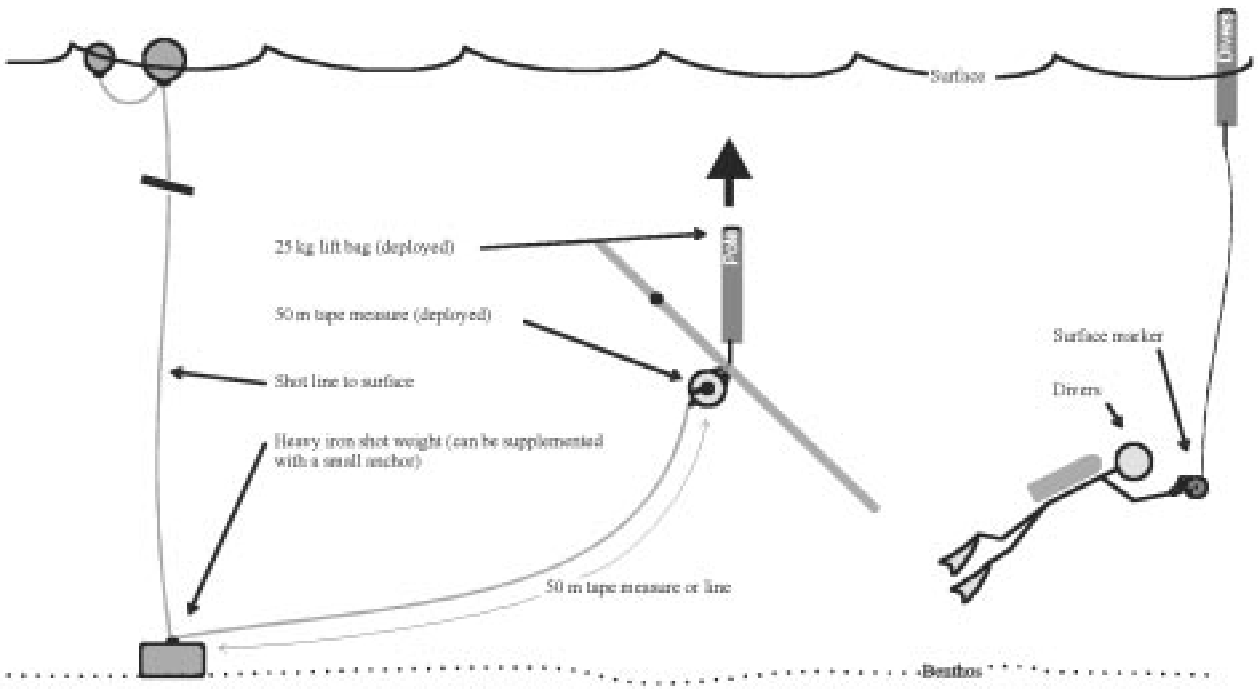

Figure 2 Recovery of the transect equipment

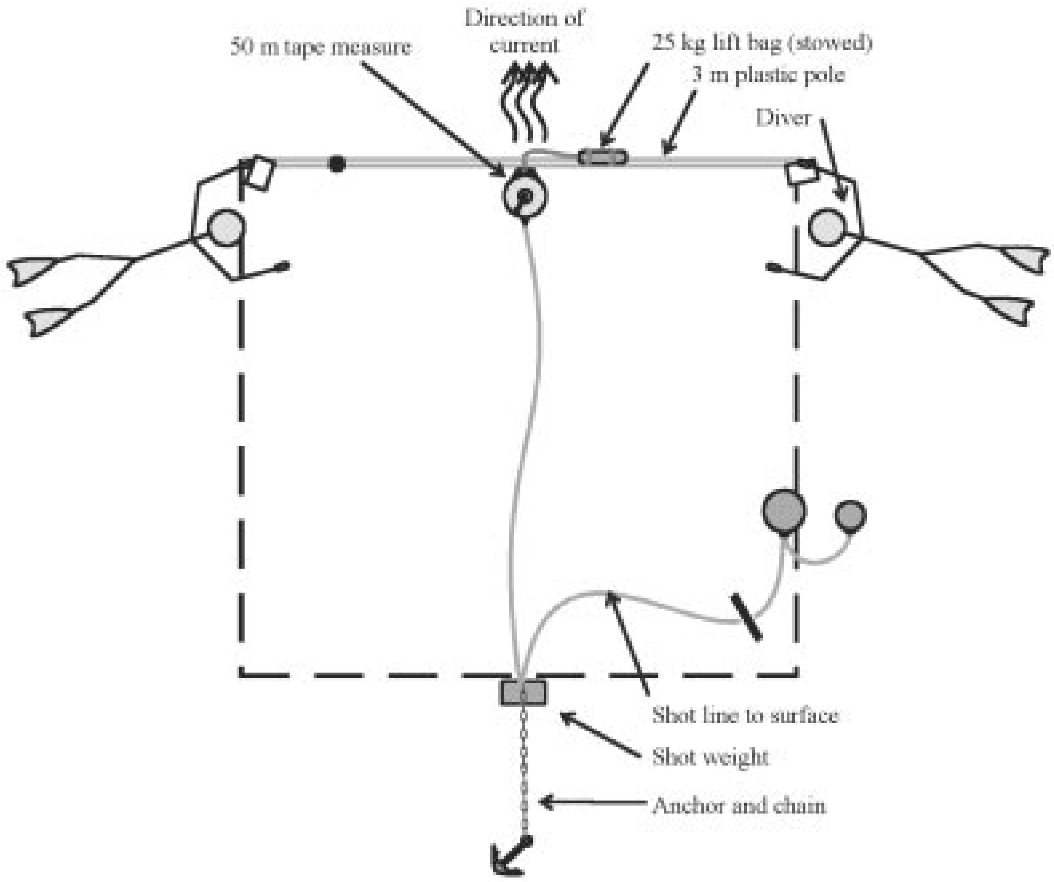

Figure 3 The effort limited transect modified for tideswept conditions

A variation of this method could be used in moderate tidal streams, whereby the divers hold on to the ends of the pole and face each other. Providing the current is not too strong to prevent the divers maintaining station on the seabed when required, records can by made as the current carries the divers over the seabed (Figure 3). A small anchor is used to supplement the shot weight and therefore prevent the divers dislodging the shot from its intended position (Figure 4).

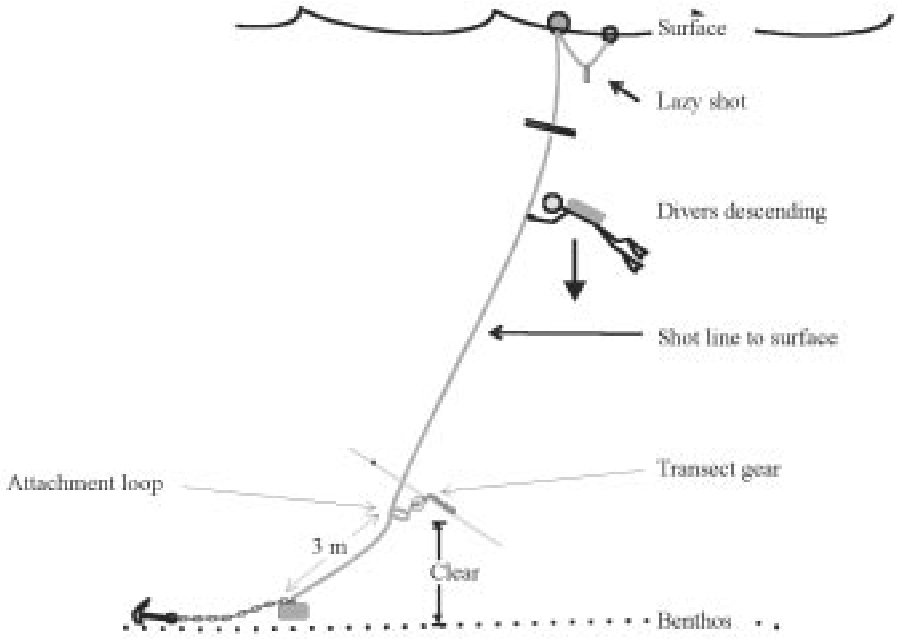

Figure 4 Modified deployment of the effort-limited survey technique

Data analysis

Data can be transferred to standard recording forms (e.g. the MNCR forms – Connor and Hiscock 1996) and later entered into a database (e.g. the MNCR database – MacDonald and Mills 1996, or Recorder 2000).

Accuracy testing

Biotopes assigned in the field should be carefully re-examined by an experienced operator to ensure that all biotopes have been correctly assigned to the national classification (Connor *et al.* 1997) and/or a regional classification.[3] It may be necessary to adapt the national biotope descriptions to fully reflect their representation within an SAC to overcome any ambiguities between biotopes, and thereby improve the accuracy of sample assignments.

QA/QC

The subjective element of abundance scale data can lead to inter-recorder variability and therefore are not appropriate for species monitoring/surveillance, even if the survey method has been effort limited in some way (Hiscock 1988).

Where the objective of a transect survey is to record sufficient information to *identify* biotopes present (and not necessarily describe or create biotope descriptions), specimen collection and recording of minor components of the fauna and flora will not be necessary (but can be conducted if time allows). However, specimen collections will be necessary when detailed records are required and when 'new' species or species difficult to identify *in situ* are encountered.

Expert knowledge is required (see Connor and Hiscock 1996) if the aim of the survey is to identify all conspicuous macrofauna. However, surveillance and monitoring surveys, depending on their aim, do not necessarily require every species to be identified. Less taxonomic expertise is required if the aims are simplified so that the surveyor needs only to record a few species. For example, a relatively inexperienced surveyor (although nonetheless an experienced diver) can be quickly trained to identify a few key species of sponge, alga or ascidian (e.g. using the checklist idea described by Hiscock 1998).

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3 A regional classification must have explicit links to the National Biotope Classification.

Photography and video techniques can be used as a back-up to the data recorded in situ. However, taking pictures can distract a diver from the aim of the survey unless time limits are not an issue (rarely the case).

It is necessary to minimise inter-worker variation in recording techniques and taxonomic identification to improve the quality control of records. Methods for reducing such variation include bespoke training/familiarisation sessions prior to the field recording, clearly defining the recording procedures (via a Standard Operating Procedure) and/or using standardised biotope descriptions or species check-lists.

Data products

Biotope survey data will be in the form of MNCR Phase 2 recording forms compatible with the MNCR database. Abundance is expressed as semi-quantitative abundance scales.

Data collected in other formats, such as counts of individual organisms, can be expressed as counts per m^2, actual counts, percentage cover or frequency (see Section 5 in the Monitoring Handbook for the pros and cons of each). Such data are more amenable to statistical analysis and tests than abundance scale data.

Cost and time

Cost

The costs of a dive team can vary depending on expertise and whether in-house or contract staff are used. The minimum team size required for most diving operations is four. The current daily rate (Autumn 2000) for an experienced diving marine biologist contractor is approximately £150–300 per day. Other costs to be taken into account are transport (vehicle and boat fuel, boat hire/charter or purchase), equipment (diving equipment and breathing gas) and time taken to train staff to carry out the proposed task (whether the training is in diving techniques or identification skills).

Time

A four-person diving team can normally complete four to six transect surveys in one day depending on depth, duration of slack water, if required, and the time taken to make adequate records on the seabed. A 50m x 3m transect over a simple uniform seabed with only a few species to record may take around 20–40 minutes, whereas it may take over 90 minutes to search for an inconspicuous alga. Ideally the objectives and methodology should be adjusted to allow the full transect to be completed within the no-stop time of the maximum depth likely to be encountered.

Health and safety

Diving survey is limited by physiological demands on the diver's body (a function of time and depth) and the risks associated with contracting decompression illness (the 'bends'). Current working practices within the country agencies limit divers to three dives per day (unless working in exceptionally shallow water ~ <6 m – see Holt 1998). All diving operations are subject to the procedures described in the Diving at Work Regulations 1997[4] and must follow the Scientific and Archaeological Approved Code of Practice.[5]

All small boat use should comply with existing codes of practice and each diving operation or project will require a site-specific risk assessment.

4 The Diving at Work Regulations 1997 SI 1997/2776. The Stationery Office 1997. ISBN 0 11 065170 7
See: **http://www.hse.gov.uk/spd/spddivex.htm**

5 Scientific and Archaeological diving projects: The Diving at Work Regulations 1997.Approved Code of Practice and Guidance - L107. HSE Books 1998. ISBN 0 7176 1498 0.
See: **http://www.hse.gov.uk/spd/spdacop.htm - a**

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