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Edited by Jon Davies (senior editor), John Baxter, Martin Bradley, David Connor, Janet Khan, Eleanor Murray, William Sanderson, Caroline Turnbull and Malcolm Vincent

UK Marine SACs Project

Contents

Procedural Guideline No. 1-6 Monitoring Biotope Richness using Remote Video

Jon Moore[1] & Francis Bunker[2]

[1] CALM, Tí Cara, Point Lane, Cosheston, Pembroke Dock, Pembrokeshire, SA72 4UN, UK

[1] MarineSeen, Estuary Cottage, Bentlass, Pembroke, Pembrokeshire, SA71 5RN, UK

Background

Remote video can be collected by a number of different methods; drop-down video, ROV and towed sledge. The technique also provides video footage of many locations within the defined area, with GPS coordinates for relocation. This material may be very useful when selecting sites for more detailed monitoring by other methods (e.g. divers or grab sampling) and for pre-survey acquaintance for divers carrying out such monitoring.

This procedural guideline should be read in conjunction with two previous guidelines that describe most of the fieldwork elements:

Donnan (in prep.) Procedural guideline No. 3-4. Descriptive and quantitative surveys using remote operated vehicles (ROV).

Holt and Sanderson (2000) Procedural guideline No. 3-5. Identifying biotopes using video recordings.

Both of the above techniques have been used extensively in recent years for descriptive surveys of large areas of seabed; often in association with acoustic ground discrimination systems (AGDS) (see also Foster-Smith et al. (2001) Procedural guideline No. 1-3. Seabed mapping using acoustic ground discrimination interpreted with ground truthing). However, the above techniques were not originally designed as monitoring methods, and this guideline has been developed to show how the remote video methods can be adjusted for monitoring biotope composition and extent. It is therefore an expansion of the two previous guidelines and the reader is referred to them for more details on many aspects of the methodology.

Development and testing of the technique is described in Moore and Bunker (2001).

Purpose

This technique is applicable to the monitoring of the following attributes

- Biotope composition
- Presence of representative or notable biotopes
- Distribution and/or spatial pattern of biotopes
- Extent of representative or notable biotopes
- Presence and/or abundance of specified species

The technique is most appropriate for monitoring biotope composition and extent across a large area of seabed which includes at least some hard substrata; and when it is necessary to provide quantitative data that have been collected in a consistent and repeatable way:

- Biotope composition is measured by providing a list of the biotopes recorded in the defined area. Biotope mapping should be undertaken to provide baseline information and to guide the undertaking of more detailed targeted studies. Subsequent monitoring cycles could use a point sampling strategy (e.g. based on a grid) to compare the present situation with the baseline condition. This variety is then maintained by repeated assessment and reference to the biotope maps of the area.
- Biotope extent can be measured in absolute terms, using an index approach such as point sampling over a grid, or by inference i.e. by providing relative proportions (percentages) of each biotope within the defined area using a defined sampling strategy.
- Distribution and/or spatial pattern of biotopes can be measured using maps prepared by this technique which roughly show the distribution of biotopes within the area. These maps will not show biotope boundaries as accurately as those prepared from AGDS data, but can be used to illustrate the distribution of gross changes.

The type of measure used should be linked to the known or likely threats posed by anthropogenic activities and take into account necessary consideration of dynamic processes and natural cyclical processes. Measurements can be repeated at appropriate intervals to detect gross changes in the biotope assemblages present in the area.

This technique is applicable to the following survey objectives

- inventory of seabed biotopes within a defined area
- reconnaissance survey prior to deployment of other methodologies
- ground truth AGDS information
- estimating the approximate distribution and relative extent of habitats
- estimating the approximate distribution and relative extent of biotopes
- making observations beyond the depth limits of normal scuba diving
- estimating biotope composition within a defined area

Advantages

- Use of remote video, as opposed to divers, has fewer safety risks and allows for multiple descents/ascents which divers cannot do. It is therefore possible to cover more ground per day of survey.
- Remote video can also be used in areas that are beyond diving depth or polluted.
- The video provides a permanent record which can be reviewed at any time, enabling quality assurance checks or re-analysis of biotopes by other staff.
- The biotope identification technique is non-destructive.
- The fieldwork element (i.e. the collection of the video footage) could be carried out by personnel who are not experienced marine biologists, although more options are available if they are.
- The method can produce quantitative data in a fairly consistent and repeatable way.
- Remote (drop-down) video systems on their own are less expensive and easier to use than acoustic ground discrimination systems (which also require drop-down video for ground-truthing).

Disadvantages

- Remote video does not have the discriminatory powers of a diver, particularly if key characteristics of the biotope are hidden by algae, require digging or other manipulation.
- Remote video cannot cover the ground as quickly as acoustic ground discrimination systems and is more limited by poor visibility.
- Classification of biotopes can therefore be a very imprecise process, especially when it comes to sediment, mixed substrata and regional variants of national classification types and assignment of biotope codes to the images shown on the screen can be very difficult. Biotope identification must therefore be carried out by marine biologists who are familiar with the method and the characteristics of the biotopes.
- Remote video equipment requires a hard boat for its deployment (although small portable drop-down video systems are becoming increasingly available).
- The quality of the pictures can be found to be too poor for accurate biotope identification (due to poor visibility and image clarity, and reduced resolution of VHS)

Logistics

Survey planning

The technique requires that sampling site locations are pre-defined using a stratified random or fixed grid design. The best available (most detailed and informative) admiralty charts of the area should therefore be acquired. Random sampling sites will be most easily defined using a programmable GIS package like MapInfo or ArcView.

Survey equipment

The main survey equipment requirements are as described in the two previous procedural guidelines (i.e. (Donnan (in prep) and Holt and Sanderson (2000)), whichever is most appropriate for the area being surveyed. Drop-down video will be appropriate for most areas, but ROV may be more appropriate in deep areas with a rugged or steep rocky topography.

Post-survey analysis and presentation

Post-processing of the video requires the use of appropriate equipment for viewing the videos and pre-designed recording forms, as described in Donnan (in prep) and Holt and Sanderson (2000).

Analysis of the biotope data can be carried out in any basic spreadsheet package, although some simple statistical facilities may also be useful.

If biotope maps are to be produced from the data, then a GIS package would be an advantage.

Personnel

The number of staff required for the fieldwork will be defined by the equipment used (see Donnan (in prep) and Holt and Sanderson (2000)), but will normally be one experienced marine biologists, an experienced assistant, plus boat crew. If no biotope assessment is to be carried out at the time of the survey, then there will be no requirement for an experienced marine biologist during the fieldwork.

Analysis of the video may be carried out by one experienced marine biologist, but it is recommended that some quality assurance checks are carried out by a second experienced marine biologist.

Method

Pre-survey planning

Approximately divide the defined area into probable zones/major habitats/biotope complexes (e.g. sublittoral fringe zone, infralittoral zone, circalittoral zone, rock platforms, sediment plains, dredged channels etc.) based on pre-survey information (e.g. bathymetry, other charted information, known uses of the area, and existing survey data). Note: an Admiralty chart backdrop in a GIS package can assist this process.

Use GIS to generate table of random site positions within each of these 'zones'. An alternative and simpler approach would be to generate a grid pattern of sites in each zone, but this may limit the opportunities for unbiased statistical analysis of the data (regular arrangement may contravene the assumptions of some statistical tests). If such tests are not required or are fairly robust then a regular grid data may be more appropriate.

Field survey

The main field survey methods are as described in Donnan (in prep) and Holt and Sanderson (2000), whichever is most appropriate for the area being surveyed.

Preferably carry out surveys of the spot sites within each zone in a random or semi-random order; rather than simply starting at one end and progressing towards the other end. You can then take advantage of the possibility that the seabed biotopes are relatively homogenous, in which case you can limit the number of sites with the following technique. Continue to survey sites from each zone until:

i) you have not found any additional biotopes for the zone in the last 3 surveyed sites; and

ii) you have at least 4 times as many sites as there are biotopes in the zone.

The above technique obviously requires that the survey is carried out by an experienced marine biologist; although it should be noted that they do not need to identify the biotopes, only to recognise when they see a different biotope. If this cannot be guaranteed then it will be necessary to simply survey a fixed number of sites in each zone. The number of sites required for each zone should be defined after an assessment of the heterogeneity of the seabed, i.e. by an experienced marine biologist who has studied the data from the baseline survey.

Record actual positions of survey sites alongside the intended random/grid positions, so that it is possible to map the data accurately and relocate the sites if required..

Note: If you want to get a better understanding of the typical zonation patterns, depth profiles of biotopes and heterogeneity of the seabed in the survey area; a series of long tows of the video across the area will provide useful information to aid the mapping process. However, it will be difficult to fix positions of biotopes and to handle the data from such tows, so it may not be possible to map it directly.

Data analysis

Post-processing of video

Detailed descriptions of this process are given in Donnan (in prep) and Holt and Sanderson (2000). The following text expands on those descriptions to ensure that a consistent dataset is compiled.

To use the video records for monitoring biotope extent will require a high degree of consistency if it is to produce valid results. Improvements in recording are possible if one develops rules and crib notes to help the surveyors recognise biotope characteristics and make decisions in borderline cases. Video frame capture images can also be used to assist this process, and were found to be very useful during the Loch Maddy 1999 survey. These notes and photographs should be retained for the duration of the monitoring programme.

A useful protocol for tagging records according to the heterogeneity of the seabed (from Foster-Smith *et al*. (2000)) is given in Table 1. below. This protocol handles video records that include more than one biotope by tagging them with more than one biotope (usually a primary/predominant biotope and one or two subsidiary biotopes, with percentage cover recorded for each). Mapping records that are tagged with more than one biotope can make mapping more complicated; however, it is considered important that the data on subsidiary biotopes are recorded. If the data are to be mapped it would also be very useful if video records which happened to include a transitional biotope, or a boundary between two biotopes, was tagged as such.

During the process of compiling biotope data from the video the recorder should be mindful of the need for consistency and should make notes of any biotopes that may not be distinguished reliably. If the video is from a repeat survey it may be useful to compare video shots from previous years with those from the present year to aid biotope identification.

Once the recording has been completed, decide on a list of biotopes and biotope complexes that is a reasonable compromise between consistency / accuracy of recording and the need to maximise the information content. It is possible that this process will require some additional viewing and comparison of video from selected sites where identification was difficult. The more that the surveyors carry out such comparisons, the better they will get at making the decisions. It is important that as much of this experience as is reasonably possible should be written down in the form of guidelines and simple procedures for future use.

Table 1 Protocol for tagging samples according to the heterogeneity of the seabed as viewed from the video. (modified slightly from Foster-Smith et al. 2000).

Heterogeneity of the video	Protocol for tagging samples
1. Recording is of one single, unambiguous biotope representing 100% of the record.	One biotope tag.
2. Record is of two or more biotopes along a tow, but the biotopes are separated from each other by distance (heterogeneity at the video tow scale)	Tow is divided into two or more records and the position of each record estimated from time that elapsed between the start of the tow, the total time of the tow and the total distance of the tow. Each record given one biotope tag.
3. The viewer is uncertain as to which biotope tag to use because of poor correspondence with biotope classes in Manual.	The most favoured option is used to tag the record provisionally, but other possible classes noted. Examples of records should be referred to a biologist with knowledge of the biotopes in the region.
4. Key features or species cannot be recognised from the video.	The record is tagged with higher class, life form category or sediment type as appropriate.
5. The record shows a mixture of two or more biotopes arranged patchily* within a single video frame (heterogeneity at a video frame scale).	The record is tagged with the predominant biotope but an estimate given as a percentage of the constituent biotopes. The record is also tagged as containing a boundary between biotopes (to distinguish from 6).
6. The record has features which indicate that it could be regarded as lying between two or more biotope classes**. For example, very small quantities of *Laminaria saccharina* on sand could be considered as partially belonging to both a kelp and a sandy biotope.	The record is tagged with the most likely biotope, but an estimate of the degree of membership to each biotope given as a percentage value. If the record is patchy, these percentages are estimates of cover. The record is also tagged as containing a transitional biotope (to distinguish from 5).
Note that both patchy biotopes* and biotopes laying along a continuum** can be expressed as percentages which are estimates of the degree of membership to the component biotope classes.	

Finally, edit the table of records with the revised biotope/ biotope complex codes, and sort the table into a logical order based on biotope types.

Monitoring surveys – use the same list of biotopes and biotope complexes. If changes to the biotope complexes are required, re-analyse the video from previous surveys with new definitions.

Analysis of biotope data

The biotope data requires very little further analysis:

- The list of biotopes/biotope complexes recorded provides a measure of biotope richness which can be compared from survey to survey.
- The relative proportions of each biotope/biotope complex in the whole area or in each stratified zone can be calculated from the percentage cover measurements of all the primary and subsidiary biotopes recorded.

However, further statistical analysis of the data can be used to compare the relative proportions of each biotope between surveys. The simplest technique would be to use a non-parametric test (e.g. Wilcoxin signed rank test), but parametric tests may be feasible if randomly generated subsets of the data were created. Either method can be used to calculate a probability that changes have occurred. If changes were identified, it may then be appropriate to create maps from the data to highlight the areas where the changes occurred and focus further studies on those areas.

Mapping biotopes/biotope groups

If a biotope map is required, the following method may be used:

1. Assign colour codes to the biotopes groups, based on the standard colour chart in the biotope manual (Connor et al., 1997) or other appropriate colour chart.
2. Import table into MapInfo and use colour codes to label spot sites.
3. Draw polygons around sites of the same colour to approximate the boundaries between the biotopes. It is important that this process is based on first hand knowledge of the relevant biotopes (i.e. their typical habitat preferences and depth profiles), preferably with experience of the local conditions. Use bathymetry information in the Admiralty chart backdrop to assist with the process. Colour the polygons according to the colour chart and appropriate pattern styles.

QA/QC

The technique requires a considerable emphasis on consistent biotope identification between surveys, and procedures to maintain this consistency are described in the above section on 'Post-processing of video'. If a high level of consistency is imperative, it is recommended that an independent review of 5 or 10% of the video records is carried out by another experienced marine biologist.

The previous procedural guidelines (Donnan (in prep) and Holt and Sanderson (2000)) give additional recommendations for quality assurance.

Data Products

- Original video tapes
- A shot list with details of: tape time, survey date and time, site/zone name or number, station number, biotope(s) recorded and percentage cover of each recorded biotope.
- A list of the stations, with site/zone number, station number, planned position coordinates and actual position coordinates (Lat/Long or Grid Ref.).

Cost and time

The typical costs and time required for this technique should not be much different from those described in the previous procedural guidelines (Donnan (in prep) and Holt and Sanderson (2000)); although the QA procedures described above may increase the time required for post-processing of the video.

Health and Safety

Refer to the appropriate Health & Safety sections of the previous procedural guidelines (Donnan (in prep) and Holt and Sanderson (2000)).

References

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