Procedural Guideline No. 3-13 *In situ* surveys of sublittoral epibiota using hand-held video

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Background

Video and computer technologies are continually advancing, and consequently it is inevitable that parts of these Guidelines will become out-of-date quite rapidly. Given this changing technology, details concerning specific camcorder and housing models have been kept to a minimum. It is suggested that anyone considering purchasing video equipment for biological monitoring should seek advice on current formats and equipment around the time of purchase.

Like all skilled tasks, producing consistently good video recordings, in terms of image quality and details of biota and habitat, is not achieved by reading a set of guidelines. There is no substitute for a thorough understanding of the strengths and weaknesses of the medium you are working with, and only experience will tell you how different environmental conditions will affect results. These are simply guidelines, and are not in any way intended to be used as a set of instructions on 'how to survey using video'.

In the past few years digital video formats have largely superseded analogue and give slightly better resolution than hi-band analogue formats such as SVHS or Hi8. This change has not significantly altered the methods for recording video footage underwater, and so the guidance below is equally applicable to digital and analogue formats.

Similar techniques to those described here have been developed for monitoring on the Great Barrier Reef. Christie *et al.* (1996) describe that work and the associated operating procedures with a much greater level of detail than in the present Guideline.[2]

Purpose

Video survey using a hand-held camera will be appropriate for attributes relating to biotope presence and extent of biotopes, where these biotopes are defined by conspicuous species or life-form types. Generic attributes for which video may be useful include:

- Measuring the range and types of biotopes present in an area.
- Measuring the extent of the different biotopes, for classified groups of biotopes or biotope complexes at the site (without compromising other important features).
- Counting the quantity of particular species of conservation importance (rare, fragile, declining species – those for which the site is 'special'). (Only conspicuous epibiota for video survey.)

Advantages

- Video can provide very wide-angle images and resolves images well in poor light;
- It provides a moving image record across a site;
- It generally gives a better 'overall appearance' view of sites than wide-angle still photography;
- Archived video data, from the same site over a period of time, can be particularly useful for detecting subtle changes in a habitat, e.g. increases in sediment cover within areas of mixed substrate, decline in foliose algal cover, etc.;

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2 See: **http://www.aims.gov.au/pages/research/reef-monitoring/ltm/mon-sop2/sop2-00.html**

- Video allows rapid, visual comparison of extensive sites; it is non-destructive and non-invasive.

Disadvantages

Image resolution is significantly poorer than that of film for two reasons. Firstly, film has significantly greater detail and tonal resolution than even broadcast quality digibeta videotape; and secondly, expensive (consumer) digital camcorders are supplied with cheap plastic lenses, whilst still cameras tend to have very high quality glass lenses fitted. Consequently video is less suitable for recording and counting small or cryptic organisms.

Logistics

Equipment

Camcorder, underwater housing, underwater video lights (unless in shallow and clear water), videotapes, standard SCUBA equipment.

Personnel/time

A full HSE dive team is generally required. Time requirement will be very dependent on the precise objective of the study.

Method

The method will vary depending on the specific objectives. However, general points are given below:

(1) Generally, the greatest focal depth will be required during video recording to ensure that erect biota and crustose species will be in focus. The following recommendations are given:

- Wider angle zoom settings give a greater depth of field (however, very wide angle shots will distort the image, if measurements are required).
- Auto-focus setting is not generally recommended. This can cause 'hunting' (the lens shuttling back and forth between objects), creates additional power drain on the battery and may result in the camcorder focusing on particles in water column. Wide-angle, fixed focus, with the focus pre-set to around 0.3m, appears to work well for habitat recording.
- Depth of field is a function of lens angle of acceptance, shutter speed and aperture size (the smaller the aperture, the greater the depth of field). Most underwater housings do not allow either shutter speed or aperture size to be controlled manually underwater, aperture size being adjusted automatically to control exposure. The shutter speed should therefore be pre-set to the slowest practical speed (normally around 1/50th) to ensure greatest depth of field.

(2) Many video cameras automatically adjust exposure based on the average brightness of the image. Videotape does not handle contrast as well as film. Consequently, a small dark 'object of interest' against a light background will appear very dark on the recorded image, similarly a light object against a dark background will 'burn out'. To record detail in such objects, they must fill the majority of the frame.

(3) Avoid jerky movements when recording.

(4) Switch the video to record a few seconds before recording the objects/area of interest; this gives time for the mechanical delay (pre-roll) of the camcorder and provides additional frames if tape editing is required.

(5) Use lights to bring colour back to images from deeper water, and to sharpen up images (by increasing depth of field and reducing signal noise from excessive gain). However, if the aperture size is reduced, the area outside that illuminated by artificial light will become very dark on the recording, and thus the viewable area will be substantially reduced.

(6) 'Burn' the date and time onto the original tape at the time of recording (i.e. through camcorder settings). This will greatly aid subsequent sorting and object (on tape) identification, especially when many tapes are recorded.

Data analysis

This is a developing area. The simplest method is direct observation of video image, recording notes as the video is viewed. Two monitors are recommended for comparative data analysis, which allows simultaneous viewing of monitoring tapes from successive monitoring periods. Image analysis software is available for video images, but its use for biological monitoring is currently very limited.

Accuracy testing

Independent review of samples of videotape, and re-checking of a sub-set of sites (to confirm positional accuracy, site marking and biotope data) are useful methods for testing accuracy.

QA/QC

Much of the above applies to this section. On-site QA will very much depend on the study requirements and prevailing conditions at the study site. As a guide, it is suggested that it is used only in horizontal visibilities of greater than 3m. Swimming speeds should be kept low. Ensure that the date and site are logged and recorded on each videotape.

Differences in height above the seabed from which the video is shot, the angle at which it is shot and the direction (if along a fixed transect) can create dramatic differences in images between monitoring records. These should be noted during the baseline recording and prescribed for subsequent monitoring.

Data products

The key product will be the recorded videotape. To minimise the risk of damage to or loss of original data, it is suggested that the recorded master tape is duplicated (either onto tape, or onto computer media such as hard disc drive, CD, DVD, Zip or Jazz drives). The master should be securely stored and analysis conducted using copies. Storage on disc can be advantageous in that 'clips' can be copied, retrieved and reviewed (on a computer) in a non-sequential fashion, and stills extracted easily. However, high-resolution video requires large amounts of disc storage space. At the time of writing, the largest PC hard drives available were around 75Gb; 1Gb will hold around 3.5 minutes of DV quality video footage. DVD will hold 5.2Gb of data and CD will hold 650 Mb.

Cost and time

Cost

Purchase of a video system, including camcorder, housing and lights, is currently around £5000.

Time

Time in the field will depend on how extensive the site is. Essentially, all that is required is to relocate the site(s) and swim slowly across the defined route, recording as one swims. Data analysis will take considerably longer than recording. Four hours to review one 90-minute tape is a fair rule of thumb, but this will vary considerably depending on the complexity of the site and objectives.

Health and safety

All diving operations are subject to the procedures described in the Diving at Work Regulations 1997[3] and must follow the Scientific and Archaeological Approved Code of Practice.[4] There are no specific

3 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**

4 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**

additional risks associated with hand-held video operation.

References

Christie, C A, Bass, D K, Neale, S J, Osborne, K, and Oxley, W G (1996) *Surveys of sessile benthic communities using the video technique. Long-term monitoring of the Great Barrier Reef Standard Operational Procedure Number 2*. Australian Institute of Marine Science, Townsville.

Websites

http://www.aims.gov.au/pages/research/reef-monitoring/ltm/mon-sop2/sop2-00.html – AIMS standard operational procedure for surveys of sessile benthic communities using the video technique.

http://www.sli.unimelb.edu.au/research/mers/Irene_AMSA/index.htm – Measurement of benthic species using drop-video platforms: comparative uses of stereo and single video systems.