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JOINT NATURE CONSERVATION COMMITTEE

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Procedural Guideline No. 3-14 *In situ* survey of sublittoral epibiota using towed sledge video and still photography

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Background

Towed video sledge and still photography techniques provide a means to visually survey large areas of seafloor without the depth or time constraints usually associated with other techniques such as scuba-diving. In the past, techniques such as this have been used to monitor the condition of features in candidate Special Areas of Conservation (SAC) (Sanderson *et al.* 1999; Magorrian 1996). Towed video sledge data can be used to estimate the relative abundance of epibenthic species using the Visual Fast Count (VFC) technique (Kimmel 1985).

Purpose

Video and still camera surveys are appropriate for attributes concerning the presence and extent of biotopes, and their quality in terms of the richness and the abundance of associated species. These techniques can be used to:

- Evaluate the variety and number of the different biotopes or biotope complexes, without compromising other important features.
- Determine the quantity of particular species of conservation importance (rare, fragile, declining species – those for which the site is 'special') – provided they can be identified.
- Estimate the extent of the area occupied by all or selected biotopes or biotope complexes in a defined area.
- Record/re-record the numbers or cover of named conspicuous species.

Advantages

- Able to survey large areas of seafloor quickly
- Allows precise density measurements of features/species of interest
- No depth or time restraints (in coastal waters)
- Robust and generally reliable equipment
- Provides a permanent record (in the form of video/photograph)
- Equipment is readily available

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Disadvantages

- Equipment is cumbersome and requires a large launch/research vessel with dry space
- Equipment is in contact with and may damage fragile habitats and biota
- Sledge can only be used on relatively level seabed: unsuitable for use on excessively rocky reefs
- Equipment is expensive
- Unless an acoustic transducer is fitted to the sledge to give a position relative to the vessel, significant error may occur in calculating the position of the sledge

Logistics

Equipment

Sledge

The towed video and camera sledge described here and shown in Figure 1 is a modified version of the SOAEFD Marine Laboratory sledge (Shand and Priestly 1999). The use of other sledges is not precluded but the version illustrated has proved durable and robust.

The sledge is fitted with floats or buoyancy tank on top to help maintain an upright position during deployment. A buoy is attached to an appropriate length of rope (at least twice the operational water depth), which is attached at the rear of the sledge to aid retrieval in the event of entanglement, and to provide a drag force which reduces the yaw of the sledge.

Video and camera equipment

- Example equipment used by authors:
- Photosea (California) 1000A 35mm U/W camera
- Photosea (California) 1500S strobe
- Kongsberg Simrad (Aberdeen, UK) U/W colour video camera
- Sony Trinitron colour video monitor
- Panasonic SuperVHS video recorder

Still and video cameras can be mounted in a number of different configurations. In the configuration described here a colour video camera and a 35mm stills camera are mounted at 45°, with the stills camera pointing slightly behind the video (this allows the video to act as a remote viewfinder for the stills camera). Video lights and flash strobe point vertically downwards. While it may be argued that mounting the video and stills vertically may produce a more quantifiable image in terms of measurable area, experience suggests that taxonomic identification is easier from images produced in the former configuration.

The video and stills images should be time and date stamped. It is also possible to imprint GPS Navigation data on the video using a proprietary system such as Trakview®.

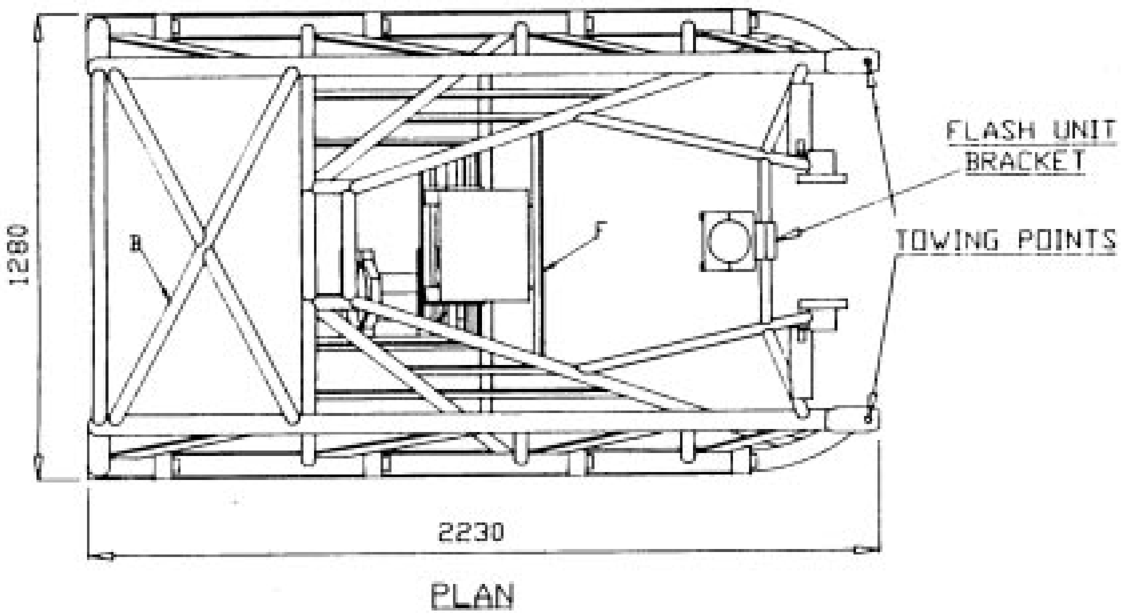
Camera and video equipment immersed in seawater should be washed and dried on return to base. Care should be taken when changing bulbs/film, etc. to ensure that o-rings are cleaned and lubricated sparingly with silicone grease on reassembly.

Video is recorded in the SuperVHS format using a Panasonic SVHS video recorder connected to the video camera control unit.

The vessel should be suitable for work in the locality with adequate (dry) cabin space for electronic equipment.

Suitable winch for towing camera sledge (normally 8mm wire is optimum). Pot haulers and rope may be used as an alternative. Vessels with extensive freeboard should be avoided.

When undertaking towed sledge studies it is important to use a vessel capable of maintaining steerage at low speeds. A master experienced in towing at low speeds is essential. Tow speeds of 0.75 knots or less at slack water are recommended for optimum video analysis.



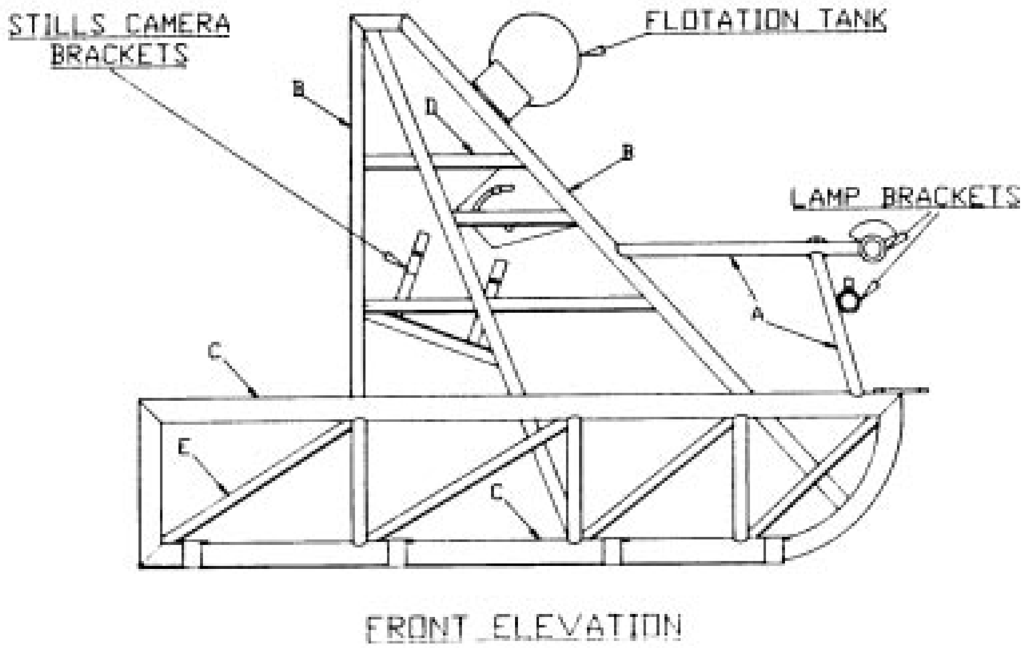


Figure 1 Plan and front (side) elevation drawings of a sledge based on one developed by the Marine Laboratory in Aberdeen. Measurements are in millimetres. (A–F refer to materials not described here).

Power supply

Power supply to power the video cameras, lights and recorders must be available.

Checks must be made that the power supply is adequate to power the systems under full load.

If a portable generator is used an emergency stop and thermal overload switch should be fitted and operators made aware of the health and safety implications of using such equipment in this environment. Ear protection is advised.

Navigation system

A dGPS Navigation system should be used for recording the position of the tow track.

However, it should be noted that in most towed video surveys the position logged is that of the vessel itself, not the camera sledge. This layback of the sledge can be corrected by fitting acoustic transponders to the sledge (O.R.E Inc. LXT Tracking System). Alternatively, the layback can be calculated using 'Pythagoras', from the water depth, angle of towing wire and length of wire deployed.

Personnel/time

Normally two skilled and experienced operators are required plus the assistance of one deckhand.

The video operator should be experienced in the taxonomic identification of marine species and biotopes.

The time to sample is usually related to ensuring best likelihood of calm conditions and the same time of year as for previous surveys. Therefore, summer is usually best on the open coast

Method

Field

If the control umbilical of the camera is not load bearing, the sledge should be deployed over the side or rear of the survey vessel and attached to the wire warp by cable ties. Weak links may be used between the sledge and the umbilical. An emergency recovery buoy should be attached to the rear of the sledge as described in Shand and Priestly (1999).

The vessel should maintain slight forward way to allow the camera sledge to stream out behind. Once in the water the video camera and lights can be switched on and the video operator can monitor the descent. Once the sledge is on the bottom the winch operator and master should be advised.

It is normally necessary to pay out further cable (2–3 times depth) until the progress of the sledge is stabilised. Vessel speed at this point should be about 1 knot or less.

Once a good quality image is being produced the vessel's position should be noted and the VCR set to record. Following this, the vessel position should be logged every minute (either manually or electronically) and an experienced biologist should make appropriately referenced field notes.

If a still camera is fitted, stills can be taken at set time intervals or when an event of interest is viewed on the video monitor. The position of each still should be noted along with a description of the image.

The duration of the tow will depend on the extent of the area of interest and objective. Tows are normally 1 to 1.5 hours' duration, although certain operational conditions may allow longer tows. The length of cable deployed may be shortened or lengthened during the tow if the water depth changes appreciably.

Once the survey is completed the video and lights should be switched off and the cables winched in. Side-cutters will normally be required to cut the cable ties and care must be taken to recover spent ties. Film should be recovered from the still camera and labelled. Completed videos should be labelled and the security tabs removed.

Videos should be copied to protect the original during analysis. A good quality SVHS camera, recorder and tape should be used. If possible, the use of digital camera technology, as used by Sanderson *et al.* (1999), could be explored, although these are relatively expensive.

A running commentary should be maintained, recording changes in seabed type and biotopes, which is synchronised with the video

Mapping studies

Run parallel transects at intervals of between 100 and 250 metres (depending on detail required) across the area to be surveyed. Ensure that the position of the boat (or the sledge if differential can be calculated automatically) is recorded, preferably on the video image. If the position of the sledge has to be calculated after the run, ensure that records of depth of the sledge and length of towing line are kept.

Note the bottom type and/or biotopes along the transect and where boundaries or transitions occur. Re-survey boundaries if there is any possibility of error.

Recording change in species abundance or biotope composition

Run transects along lines which can be relocated in future years or which were run in previous years. Record the abundance of species as described below.

Data analysis

Video analysis for quantitative counts of species abundance.

The reader may find it helpful to refer to Magorrian and Service (1998) for detailed methodology of the VFC technique (Kimmel, 1985).

Underwater visual data provide immediate qualitative descriptions of epibenthic communities. However, management and monitoring requires quantitative visual data. Video tends to be recorded in the form of long continuous strips which need to be broken down into segments to extract more detailed information. Changes in altitude, pitch and roll result in variable or unknown fields of view of the images produced. Michalopoulos, Auster and Malatesta (1992) demonstrate that videotapes with such problems, that are not useful for density estimates, can be enumerated using species-time techniques. These techniques substitute time for area and produce estimates of relative abundance of species based on time. One such technique is the Rapid Visual Count (RVC) method. Here time is broken down into five regular time intervals and a species is recorded as present in the interval where it is first seen. RVC species scores are based on a weighted order of encounter that does not take abundance into account. If a species was seen during the first segment, it received a score of 5, in the second segment a score of 4, third segment 3 and so on. Relative abundance was calculated by dividing the score of the species by the sum of scores of all species (Kimmel 1985; Michalopoulos *et al.* 1992). However, DeMartini and Roberts (1982) suggest that the RVC technique is inaccurate because the species are scored solely on the basis of encounter and it makes no provision for varying spatial distribution of different species. Another technique, the Visual Fast Count (VFC), involves counting the actual number of individuals during each time interval. Each time interval is given a score which represents expected frequency of occurrence instead of arbitrary interval scores, and abundance estimates are based on the product of individual species counts and the time interval score (Kimmel 1985). Kimmel compared three visual techniques and found that RVC relative abundancies were significantly different from those of the VFC and transect methods. He suggests that if transect methods (performed by divers) are assumed to be the most accurate, then VFC yields more accurate relative abundancies. Michalopoulos, Auster and Malatesta (1992) also found VFC to be more closely correlated with the transect method than the RVC method. Visual analysis may underestimate abundancies of small and cryptic species.

While the method described here will allow analysis using video data only, considerable extra information may be gained from the use of still photography (see below). The increasing developments in digital imaging processing should also be noted.

Each video is replayed and field notes are expanded to include more detailed descriptions of the bottom type, benthic communities, and dominant epifauna.

Short time sections of video with limited water turbidity, a slow tow speed, constant bottom contact and no weed obscuring the view, should then be selected for further analysis using the VFC technique.

Each section of videotape analysed can be treated as a separate sample, which may be used for statistical procedures. If the Bray–Curtis similarity coefficient is used its sensitivity to skewed species distribution and domination by species with higher abundances should be noted. In order to reduce this effect the data should be transformed using a double square root transformation.

Random samples may be selected using random number generators.

Quantitative analysis of still (35mm colour transparency) photographs

Each still photograph (mounted) is projected in turn onto the screen of a portable slide projector. An acetate grid of 1cm squares, the same size as the image, is overlaid on the screen. The percentage cover of each species is estimated by counting the number of squares in which each species occurred and then dividing this by the total number of squares.

If sediment, weed or poor resolution rendered a square unreadable then that square should discarded and the percentage cover based on the remaining number of squares.

If individuals of certain species were clearly distinguishable then they can be counted and the number included alongside their percentage cover estimate.

Accuracy testing

A weak link in the analysis of video data is the identification of biotopes. Where possible, external validation of the video data should be pursued, ideally by someone who has knowledge of the survey site.

QA/QC

- Videotapes and films should be clearly labelled with date, site and associated field notes.
- Tows should only go ahead when horizontal visibility is >3m.
- Tow speeds should be <1 knot.
- Analysis – see 'Accuracy testing'.

Data products

Video data

Following the VFC technique, each section of tape analysed is assigned a habitat category score, derived from the qualitative video descriptions.

Stills data

The percentage cover of each species in a particular still frame should be obtained.
Stills should be archived, recording survey date, time and equipment.

Details	*Cost per day (unless specified)*
Sledge and camera equipment	£250
Boat hire	from £300
Scientific officer	from £143
Boat crew	from £85

Cost and time

Approximate time to complete a 1 kilometre sledge tow is 2 hours, depending on sea conditions. This does not include time taken to deploy and retrieve the sledge.

Allow half a day for video analysis of a 1-kilometre tow (also dependent on habitat type).

Allow half a day for stills analysis of a 1-kilometre tow (also dependent on habitat type).

Health and safety

- Standard shipboard safety including wearing of hard hats, life jackets and steel capped boots by deck operatives. Preferably, field staff should have attended an appropriate sea survival course such as provided by the SeaFish Industry Training Board.
- Take particular care when launching and recovering the sledge not to be pulled or fall overboard: use boat hooks and steadying ropes.
- Normal precautions should be taken when using electrical equipment including generators on a boat.
- Ear defenders should be worn when using a generator.
- Staff should be made aware of manual handling precautions, especially when loading and unloading the vessel.

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