The hip-chain transect method for underwater visual census (UVC)

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Underwater visual census (UVC) benthic surveys are typically done by laying out rope or lines on the sea bottom. A diver then follows and count species of interest. Such rope transects are slow to deploy and retrieve, limiting the number of transects that can be completed and, therefore, the precision of the survey. Most benthic species have a patchy distribution, meaning that a high number of sites must be surveyed.

Several methods for carrying out UVC surveys without using transect lines have been developed in order to increase the efficiency of sampling. Timed swims (Hart 2006), manta-tows (Moran and De'ath 1992) and flow meters (Conand pers comm. 2007) are very efficient methods, however, all are subject to some uncertainty with regard to transect dimensions, especially transect length.

The hip-chain transect method, which uses a thread-release measuring device, has the advantage of providing an accurate measure of transect length, while also being very efficient because it eliminates the need to lay and retrieve a transect line. The diver lays the transect line as he swims, using a biodegradable cotton thread, with the distance from the point of origin measured as the thread is released. This has the added advantage of allowing access by divers into areas that boats cannot access, due to draught restraints or the presence of navigational hazards.

Using the hip-chain method dramatically increases the number of samples that can be completed during limited (and often expensive) field programmes; this in turn can increase the precision, accuracy and extent of marine surveys. The hip-chain method is an improvement on existing technology and will allow for greater accuracy and a broader focus for future marine survey-based studies.

Description

The hip-chain method relies on a "Chainman" brand thread-release measuring device modified for use in saltwater to measure transect length. The hip-chain device has a reel of biodegradable cotton that goes through a calibrated gear wheel, which measures the distance in meters.

Prior to using the device in saltwater the hip-chain needs to be modified by replacing the spool mechanism with a stainless steel bolt and drilling a hole in the body of the counter to allow for the addition of lubricant (e.g. WD40) to prevent corrosion.

The hip-chain device, pole, tally counter and compass are all assembled with wire, cable ties and/or hose clamps into a sampling assembly. Half of a clipboard is also added in order to hold a data sheet for divers to record habitat, depth, date, time and species counts. A pencil is attached using a leash of twisted tape. Periodic calibration of the hip-chain device is recommended. This can be done on land and is a fairly basic process. An example of a version of the hip-chain sampling assembly used for sampling holothurians is shown in Figure 1.

At the starting point for the transect, the diver ties the cotton thread to a piece of rock or coral at the bottom by means of a small wire stake. As the diver swims along the transect, the hip-chain device accurately measures the distance swum. When the diver reaches the desired transect length, the cotton thread is broken off and left on the bottom to degrade. The diver counts species of interest along the transect using the tally counter. For multiple species assessments, tally counters with up to six banks may be used.

A diver can control transect width by holding a pole in front of him while swimming the transect. The feasible maximum width of a transect is restricted by the field of view available to the diver as determined by water clarity and the increased difficulty in searching and governing boundary effects with distance. A 2 m-wide transect has been used successfully in open substrates, with a narrower, 1.25 m-wide transect used in more cryptic habitats to survey highly abundant species, due to the greater difficulty in obtaining accurate counts in this circumstance.

Because the transect line is laid while the diver is swimming the transect, it is important that the

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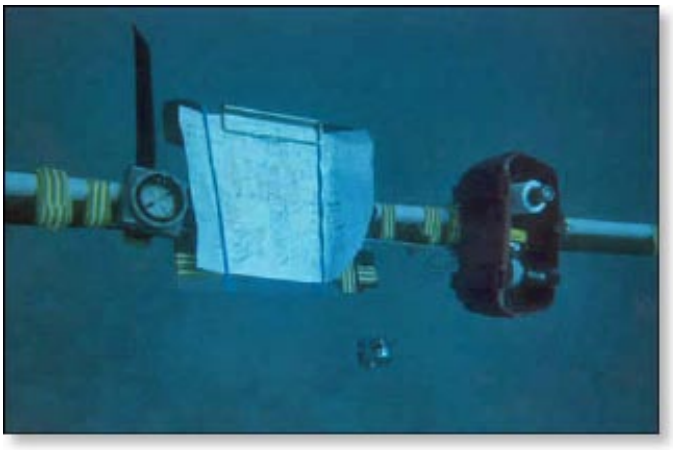

Figure 1. Detail of a hip-chain sampling assembly used to survey holothurians.

transect path is carefully followed to reduce the possibility of bias caused by the diver swimming towards species/objects of interest. This can be achieved by diver training and objective direction-setting techniques, such as the diver swimming the transect according to a predetermined compass bearing. A waterproof compass can be attached to the hip-chain assembly to facilitate this. A discussion of observer-induced bias in transect-based surveys can be found in McGarvey (2006). Boundary effects (animals that traverse the transect boundary on either side of the diver) can be dealt with according to a standard practice (Andrew and Mapstone 1987; Thompson and Mapstone 1997). Again, sufficient diver training is necessary to ensure the boundary effects of inclusions and/or exclusions are adequately addressed.

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References

Andrew N.L. and Mapstone B.D. 1987. Sampling and the description of spatial pattern in marine ecology. Oceanography and Marine Biology: An Annual Review 25:39–90.

Hart A.M. 2006. Review of paua research surveys. Unpublished report to the New Zealand Ministry of Fisheries. 20 p.

McGarvey R. 2006. Assessing survey methods for greenlip abalone in South Australia. South Australian Research and Development Institute (Aquatic Sciences), Adelaide, RD04/0152-2. SARDI Research Report Series No. 184. 195 p.

Moran P.J. and De'ath G. 1992. Suitability of the manta tow technique for estimating relative and absolute abundances of crown-of-thorns starfish (*Acanthaster planci* L.) and corals. Australian Journal of Marine and Freswater Research 43:357–378.

Thompson A.A. and Mapstone B.D. 1997. Observer effects and training in underwater visual surveys of reef fishes. Marine Ecology Progress Series 154:53–63.