Supplement 1: Comparing the precision of density estimates using different-sized transects

The precision associated with the mean count of '*insider*' sharks (hence for instantaneous surveys only; see 'Instantaneous *vs* non-instantaneous surveys' section) was calculated for each different type and scale of replicate, using the double-resampling method proposed by Anderson & Santana-Garcon (2015). Following Andrew & Mapstone (1987), we defined a univariate precision as the standard error over the mean. This method allows precision to be evaluated with increasing numbers of replicates (*n*) or with changes in the spatial or temporal scale of the replicate unit (Andrew & Mapstone 1987, Anderson & Santana-Garcon 2015).

The method of collecting video footage along with GPS data allowed us to divide the larger transects into replicates of a range of different sizes. A transect of a certain length may be divided into many smaller-sized replicates (with fewer records of sharks per replicate, on average) or fewer larger-sized replicates. We trialled several sizes of replicates, defined by a fixed-time duration (1, 2, 4 or 6 min) or a set distance covered (25, 50, 100 or 200 m). For all sizes, the width and height of the survey window was kept constant at 5 m, and adjacent pairs of replicates were separated by a 5 s interval to reduce spatial non-independence. We examined the precision obtained each size of replicate across the range of sample sizes (*n*) that would be achieved across the full set of video surveys (Figure S1). We excluded videos that had fewer than 10 recorded sharks, as precision values for an estimated mean that is either equal to or very close to zero have little utility. The results from these analyses of precision guided our choice of replicate size and type for subsequent analyses presented in the main article.

Transects covering a time period of 1 min or a distance of 50 m provided the best precision for time-based or distance-based replicates, respectively (Figure S1). Both the 1-min and the 50-m replicates achieved similar average precision values of around 0.4 (Figure S1). The 1-min replicates were slightly shorter in length (39.1 ± 0.4 m, mean length ± SE) than the 50-m replicates. Our results accord with previous comparative studies that suggested higher numbers of shorter-length replicates will provide optimal precision in surveys of sharks (McCauley et al. 2012). Given that 50-m replicates are often used with both DOV and UVC surveys (McCauley et al. 2012, Goetze et al. 2019), and distance-based replicates are generally simpler to implement in the field, we recommend the use of 50-m replicates.

References

Anderson MJ, Santana Garcon J (2015) Measures of precision for dissimilarity based multivariate analysis of ecological communities. Ecol lett 18(1):66–73.

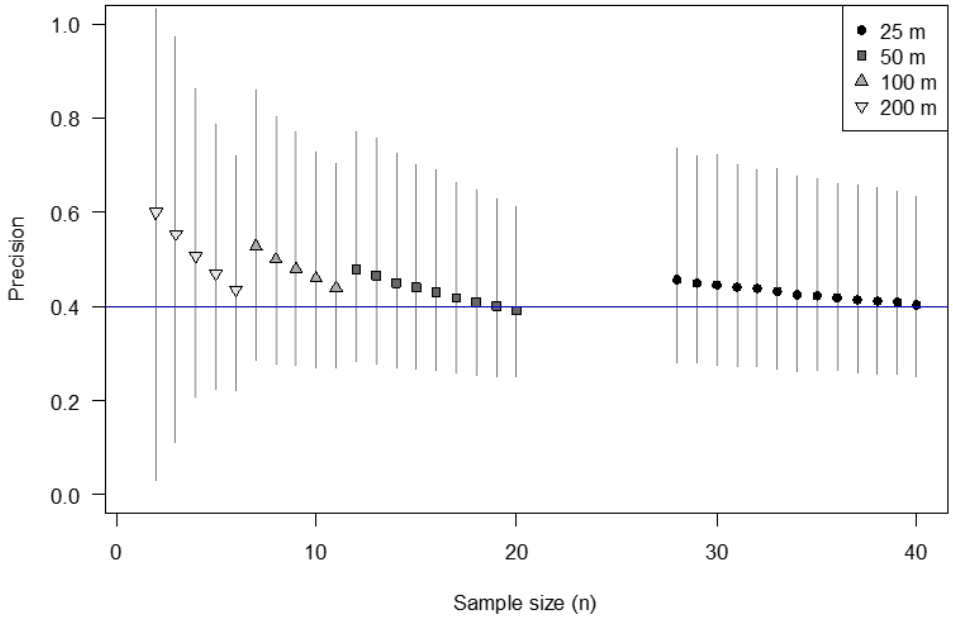
Andrew NL, Mapstone BD (1987) Sampling and the description of spatial pattern in marine ecology. Oceanogr Mar Biol 25:39–90.

McCauley DJ, McLean KA, Bauer J, Young HS, Micheli F (2012) Evaluating the performance of methods for estimating the abundance of rapidly declining coastal shark populations. Ecol Appl 22(2):385–392.

Goetze JS, Bond T, McLean DL, Saunders BJ, Langlois TJ, Lindfield S, Fullwood LAF, Driessen D, Shedrawi G & Harvey ES (2019) A field and video analysis guide for diver operated stereo-video. Methods Ecol Evol.

Santana-Garcon J, Braccini M, Langlois TJ, Newman SJ, McAuley RB, Harvey ES (2014) Calibration of pelagic stereo-BRUVs and scientific longline surveys for sampling sharks. Methods Ecol Evol 5(8):824–833.

A



B

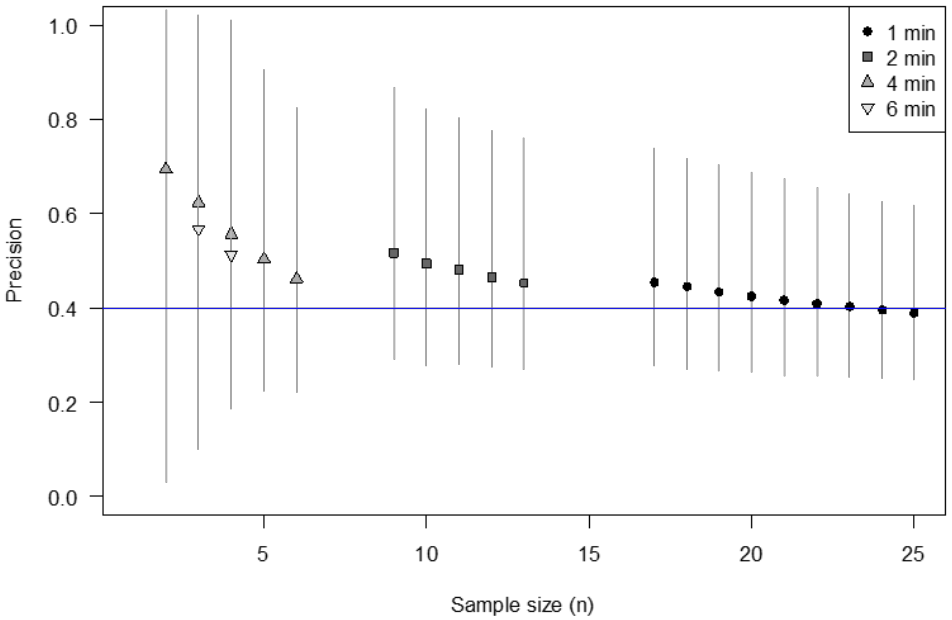


Figure S1. Precision (standard error over the mean) for estimating mean counts of sharks in instantaneous surveys as a function of sample size for the different (A) distance-based and (B) time-based replicates, using the double resampling method, with permutation-based means and bias-adjusted bootstrap-based error bars (with 10,000 resamples for each), as proposed by Anderson and Santana-Garcon (2015). A horizontal grey line corresponding to a precision of 0.4 is shown in both plots for comparative purposes.