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Comparison of density estimates derived from strip transect and distance sampling for underwater visual censuses: a case study of Chaetodontidae and Pomacanthidae

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Abstract

Despite its wide use in terrestrial ecology, distance sampling is as yet rarely used in underwater visual censuses. The present study attempts to compare density estimators based on distance sampling and on strip transects. Three stations with increasing densities of Chaetodontidae and Pomacanthidae were sampled twice by two divers of unequal experience, using two different transect types. A total of 96 transects and 2970 records of Chaetodontidae and Pomacanthidae were analysed. Nine estimators based on distance sampling were calculated and only the best fit (DT estimator) was kept for comparison with other estimators. These were either based on the average distance of the fish to the transect (AD estimator), or a 3-m- or 5-m-wide strip transect estimator (FW3 and FW5, respectively). There were no significant differences between the means found by DT, AD and FW3. Lower density estimates were given by FW5 in all cases. FW3 and FW5 did not detect several significant differences between stations which were otherwise detected by DT or AD. The number of transects needed to detect a significant difference between stations was four to ten times higher with FW3 or FW5 than with DT or AD. Diver experience was found to be a significant factor in density estimates. However, this factor was less important than the choice of the density estimator. Transect type or the day of sampling had no consequence for the estimates. The distance distributions of fish were divided into three different patterns which may be explained by a combination of detectability function and a behavioural component.

Key words: Visual census / distance sampling / reef fish / density estimate / Chaetodontidae / Pomacanthidae

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4 Census Methods for Estimating Densities BACKGROUND FOR CALCULATIONS DERIVED FROM TRANSECT CENSUSES MEASUREMENTS FOR TRANSECT METHODS AND CALCULATION OF DENSITY The aim of a census is to estimate the density of a sample popula- tion in a defined area so that the total population of a larger census area can be estimated. Census Met hods for Estimating Densities 39 value that is beyond the distance within which one could normally detect animals. Burnham et al. (1980) reviewed census methods and tested several probability functions under the assumption that the prob- ability of detection can be best expressed by a family of probability curves. Solution: Recall that for a Poisson distribution we have E[X] = λ. Now to obtain the method of moments estimator we simply equate the rst population mean to the rst sample mean. (And then we need to “solve” this equation for λ. . .) E[X] = $\bar{X}$ λ = $\bar{X}$. Thus, after “solving” we obtain the method of moments estimator. September 1999 , pp. 315-325. Comparison of density estimates derived from strip transect and distance sampling for underwater visual censuses: a case study of Chaetodontidae and Pomacanthidae. Michel Kulbicki (a1) and Sébastien Sarramégna (a2). (a1). A total of 96 transects and 2970 records of Chaetodontidae and Pomacanthidae were analysed. Nine estimators based on distance sampling were calculated and only the best fit (DT estimator) was kept for comparison with other estimators. These were either based on the average distance of the fish to the transect (AD estimator), or a 3-m- or 5-m-wide strip transect estimator (FW3 and FW5, respectively). Underwater visual census (UVC) is the most common approach for estimating diversity, abundance and size of reef fishes in shallow and clear waters. Abundance estimation through UVC is particularly problematic in species occurring at low densities and/or highly aggregated because of their high variability at both spatial and temporal scales. The statistical power of experiments involving UVC techniques may be increased by augmenting the number of replicates or the area surveyed. Comparison of density estimates derived from strip transect and distance sampling for underwater visual censuses: a case study of Chaetodontidae and Pomacanthidae. M. Kulbicki, S. Sarramegna. Biology. Estimating abundance: line transects and distance methods. Chapter 5. Estimating abundance: line transects and distance methods. We can use plotless sampling to estimate the density of the population. On the other hand, if we know the density of a population, we can use plotless sampling to determine whether the spatial pattern is random, aggregated, or uniform. The census zone is surrounded by a boundary strip, and in some cases the nearest organism is located in the boundary strip. Two types of measurements can be taken: (1) A random point X is located in the census zone and the distance xi to the nearest organism is measured. (2) A random organism A is selected and the distance zi to the nearest neighbor B is measured.