

Accounting for Partial Overlap of Observation Zones and Lack of Independence in MRDS, with Application to Abundance Estimation of Hector's Dolphin.

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Abstract: In most double observer mark-recapture distance sampling applications, it is anticipated that each observer will search the same area within a transect. However this is not always possible depending on the resources available, as was the case in a recent fixed-wing aerial line-transect survey for Hector's dolphin (*Cephalorhynchus hectori hectori*) off the north and east coasts of the New Zealand's South Island. There, the rear observer could search the full transect width through a bubble window while the front observer could not search within 70 m of the trackline as a flat window was mounted in that section of the aircraft. In order to make full use of the available data, current methods were extended to account for the partial overlap of the observation zones. Furthermore, a lack of independence between sightings from each observer position can lead to an underestimate of abundance and, following Buckland et al. (2010), we wished to consider different forms of dependence in our analysis, although using an alternative parameterization. This new parameterization is intuitive and amounts to including the sighting record of one observer as a detection covariate for the other. Simulation results suggest that the new approach works well for the scenarios considered and when applied to the 2013 summer and winter surveys for Hector's dolphin, abundance is estimated to be in the order of several thousand dolphins within 20 nm of the north and east coasts of the South Island. There is good agreement between the abundance estimates using the full data and a reduced data set using only sightings from within the common search area.

References

Buckland, S. T., Laake, J. L., & Borchers, D. L. (2010). Double-Observer Line Transect Methods: Levels of Independence. *Biometrics*, 66(1):169–177.