

Title:

A multi-event capture-recapture model to account for mark loss: comparison of monitoring protocols in the southern elephant seal as a case study.

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Abstract:

Monitoring of wild populations has generated a large number of studies investigating ecological processes, as well as conservation and management issues. In this approach, the monitoring protocol is a central element, balancing the information collected against the effort needed in the field. The quality and quantity of the data can set some limits to the analysis and lead to severe biases in conclusions about ecological systems if overlooked. However, the performance of population monitoring protocol has rarely been assessed in the long term. In individual-based capture-mark-recapture monitoring programs, data analysis relies on the assumptions that marks are not lost. However, this assumption is rarely met for a range of taxa. Although post hoc correction of demographic parameters for mark loss has been used to account for surviving animals that are not recognized, this approach has some limitations. Accurate mark loss rate may be difficult to estimate in the wild without additional experimental support. Also, it does not account for a potential influence of mark type or localization on observation parameters.

At Marion Island, southern elephant seals are individually marked with two tags that can be lost. A change in the monitoring protocol took place ten years ago to improve detection probability and reduce fieldwork effort. This offers a unique opportunity to compare different marking localization on a single wild population and to assess monitoring design in the long-term. Here we propose a multi-event capture-mark-recapture model to estimate the impact of the marking protocol on both state (mark loss) and observation (detection, uncertainty and error) parameters, while accounting for imperfect source of information (transience, imperfect detection and state uncertainty). We discuss our results to alert researchers and managers to the importance of choosing an appropriate protocol, depending on ecological constraints and monitoring objectives, in this and other populations.

Keywords:

capture-recapture, survey design and analysis