

## **Direct assessment of the effects of capturing and marking animals on post-release survival**

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Population parameter estimates obtained from capture-recapture models are predicated on the assumption that capturing and marking animals does not affect their post-release survival. Sampling-related mortality is likely to occur after animals are released, making it difficult to assess. Past methods for evaluating sampling-related mortality have included both experimental and analytical approaches. However, quantifying post-release mortality attributable to capture and marking has often been impossible because of the need for a control group of animals that are captured using a method with no associated mortality. We present a novel approach for quantifying mortality due to capture and marking by incorporating both active sampling and passive re-encounter data. The critical element of the approach is to compare survival probabilities of both newly marked and actively recaptured individuals to a control group of individuals that are only passively re-encountered. A model selection approach is used for inference based on a set of competing models and estimates of effect size are based on model-averaged survival estimates. The effects of important variables such as holding time, tagging location, personnel experience, and animal size are easily incorporated and quantified using model covariates. We demonstrate the approach by estimating mortality due to capturing and tagging for two endangered catostomids in the Klamath Basin of Oregon and California.