# IMPROVING ABUNDANCE ESTIMATION BY COMBINING CAPTURE-RECAPTURE AND OCCUPANCY DATA

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**SUMMARY:** Abundance is a key quantity for conservation and management strategies but remains challenging to assess in the field. Capture-recapture (CR) methods are often used to estimate abundance while correcting for imperfect detection but these methods are costly. Occupancy, sometimes considered as a surrogate for abundance, is estimated through the collection of presence-absence data and is less costly while enabling to gather information at a large spatial scale. Building on the recent pieces of work on the combination of different data sources, we showed how abundance data can be complemented by presence-absence data and be analyzed conjointly to improve abundance estimates. Our approach relies on a hierarchical model that makes explicit the link between the abundance and occupancy state variables while formally accounting for imperfect detection. We used a population of Eurasian lynx in France monitored via camera-traps and a collection of presence signs as an illustration of our approach. Using a combination of capture-recapture and occupancy data, we demonstrate that we can efficiently improve abundance estimates without deploying a costly monitoring protocol. Combining different data sources has a great potential especially for monitoring elusive or species distributed over large areas and so difficult to monitor.

**KEYWORDS:** abundance, Bayesian approach, camera-trapping, population size, presence signs, site-occupancy.