

# Challenges of Ecological Monitoring: Estimating Population Abundance From Scarce Trap Counts

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## Abstract

Ecological monitoring aims to provide estimates of pest species abundance, this information being then used for making decisions about means of control. For invertebrate species, population size estimates are often based on trap counts which provide the value of the population density at the traps location. However, use of traps in large numbers is problematic as it is costly and may also be disruptive to agricultural procedures. Therefore, the challenge is to obtain a reliable population size estimate from a scarce spatial data. This is a largely open problem that has been poorly studied in literature. The approach we develop in this paper is based on the ideas of numerical integration on a coarse grid. We investigate several methods of numerical integration in order to understand how badly the lack of spatial data can affect the accuracy of results. We first test our approach with simulation data obtained from a population dynamics model. We show that, rather counter-intuitively, a robust estimate of the population size can be obtained basing on trap catches from as few as just several traps, even when the population spatial distribution has a highly complicated structure. We then apply our approach to field data to confirm that the number of trap/sampling locations can be much less than it has been used in many monitoring problems.

**Keywords:** ecological monitoring, pest control, scarce data, coarse grid, numerical integration

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