The Estimation of Density Using the Adaptive Searching Observation in Quadrat Sampling

Pyong Namkung

Professor, Dept. of Statistics, Sungkyunkwan University

Chong-no-ku,Seoul 110-745, Korea

namkung@skku.ac.kr

Jong Seok Byun

Associate Professor, Dept. of Statistics and Information, Hanshin University

Osan, Kyunggi-Do, Korea

jsbyun@hucc.hanshin.ac.kr

1. Introduction

The spatial population existing in a plane area, like an animal or aerial population, have certain relationships among regions which are located within a fixed distance from one selected region. With some populations it is impracticable or impossible to count the animals over the whole area because of the disturbance caused or the number of personnel required. In this case a sampling scheme is required whereby total counts are made on randomly chosen sample areas. An estimated of total population size is then obtained by multiplying the average density per unit area, estimated from the sample area, by the total area of the population.

Quadrat sampling and strip transects are particularly useful to estimate population size and density. In quadrat sampling, small, manageable areas of know dimensions are designated as the sample unit. A number of quadrats will be selected to provide the data needed to estimate the population parameters of interest. Usually everything of interest within the quadrat is counted, collected, and the responses recorded represent the total for the whole quadrat. The spatial sampling is to select sample points that is representative of a coordinate as sampling units in a plane area. Bellhouse (1977) and Koop (1990) described the sampling methods of sample points in a two-dimensional space. And the adaptive searching observation is to observe the neighboring sample points when the current sample point satisfies the condition of an adaptive searching principle (Byun and Namkung, 1996, 2001).

In this paper we shall be concerned with the estimation by the adaptive searching observation in a quadrat sampling plan for the purpose of estimating the population size and density in a spatial population.

2. Estimators

In quadrat sampling plan, square plots should be used for most populations. And the universe is divided into n quadrats of equal area. We propose the estimation of population size using the adaptive searching observation and quadrat sampling plan in a spatial population. When m quadrats is observed by the adaptive searching observation and n-m quadrats is not observed, we may estimate population size and area in a spatial population using the adaptive searching observation. And If the density of interest is D, The density estimator hatD is as followed:

(1) The population area estimator : $\hat{A} = \hat{A}_m + \hat{A}_{n-m}$

(2) The population size estimator : $\hat{C} = \hat{C}_m + \hat{C}_{n-m}$

(3) The Density estimator : $\hat{D} = \hat{A} / \hat{C}$

REFERENCES

Bellhouse, D. R. (1977). "Some optimal designs for sampling in two dimensions," *Biometrika*, 64, 605-612.

Byun, J. S. and Namkung, P. (1996). "Estimation using the method of adaptive searching observation," *The Korean Journal of Applied Statistics*, 9 (2), 145-159.

Byun, J. S. and Namkung, P. (2001). "Optimal Design of the adaptive searching Estimation in spatial sampling," *The Korean Communications in Statistics*, 8 (1), 73-85.

Koop, J. C. (1990). "Systematic sampling of two-dimensional surfaces and related problems," *Commun. Statist. - Theory and Methods*, 9 (5), 1701-1750.

Seber, G. A. F. (1982). *The Estimation of Animal Abundance and Related Parameters,* (2nd ed.), London : Griffin.

Thompson, S. K. and Seber, G. A. F. (1996). *Adaptive Sampling*, New York : Wiley.

Resume

Nous serons concerné par l'évaluation par l'observation de recherche adoptive dans un plan de prélèvement de quadrat afin d'estimer la taille et la densité de population dans une population spatiale.