Constraints on Population Growth: The Case of the Polynesian Outlier Atolls in the Precontact Period

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A model of the subsistence economy of an insular population is proposed in which the various factors that might influence the potential carrying capacity of the environment are made explicit as a set of ecological and cultural constraints on subsistence production. The application of the model to the Polynesian Outlier Atolls is discussed, and a formula is suggested whereby the population potential of any stable and bounded ecosystem can be calculated, using data on agricultural area, productivity, and diets. The actual size of precontact populations of the Outliers and other atolls appears to have been 70-80% of the predicted carrying capacity, which accords well with ethnographic evidence for population homeostasis.

INTRODUCTION

There have been a number of recent studies in which archeologists, anthropologists, and geographers have approached the estimation of past population levels through an analysis of the economic basis of society (e.g., Thompson, 1966; Shawcross, 1970; Odner, 1972; Thomas, 1972; Marcus, 1973; Kirkby, 1973). The usual sources in historical and prehistoric demography — such as contemporary documents or enumerations and the evidence of settlement sites and patterns — are often ambiguous, incomplete, or absent. In these circumstances, a more explicitly ecological approach can be more profitable. If one can assess the maximum carrying capacity of a population’s environment under a given system of resource management, then one can also define the limits beyond which the population could not grow without cultural changes taking

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place. The population potential of an economic system can be compared with estimates of population levels derived from other sources, and in this way new hypotheses can be suggested about the efficiency of land use and the extent of social rather than environmental sources of population regulation.

In this paper, an outline is given of the various constraints on the human carrying capacity of islands. Attention is then focused on the North-Central Atolls of the Polynesian Outliers during the period immediately prior to European contact. A method is proposed through which the maximum potential population of the atoll environment can be estimated. Finally, possible applications of the carrying capacity approach for other atolls are discussed.

THE POLYNESIAN OUTLIER ATOLLS

The argument presented in this paper is based in part on data collected during fieldwork on Ontong Java atoll in 1970-1972. Ontong Java is the largest of a scattered group of seven atolls located to the north and east of the Solomon Islands and New Ireland (see Fig. 1). Six of these atolls — Sikaiana, Ontong Java, Nukumanu, Takuu, Nakuria, and Malum — have Polynesian-speaking populations, and they also have a certain cultural unity that has long been recognized (Parkinson, 1897; Thilenius, 1902). The group is termed here the North-Central Atolls of the Polynesian Outliers. In pre-European times, these populations were all in intermittent communication with each other, and Sikaiana also had contacts with the Reef Islands to the east. In addition, almost all the atolls have traditions of contact with western Polynesia, as well as with the Micronesian Caroline and Gilbert Islands and with islands in Melanesia (Bayard, 1966). It seems probable, however, that such contacts were accidental or very occasional, even among the outliers themselves, and that in demographic terms each atoll functioned effectively as a closed system. In total size, they are ranked as follows: Ontong Java, Nukumanu, Takuu, Sikaiana, Nakuria, Malum. For land area, Sikaiana is larger than Takuu (see Table II), but otherwise the ranking is the same. Malum, the smallest atoll, has been without a permanent resident population at least since the early colonial period, and in view of its close proximity to Nakuria is best regarded merely as a satellite of the latter.

THE CARRYING CAPACITY OF ISLANDS

Most previous workers who have studied the historical demography of Pacific islands have relied on an assessment of the early estimates and censuses

2Two periods of fieldwork were conducted on Ontong Java, between June 1970 and May 1971, and from July to September 1972. The research was financed by the Social Science Research Council and the Harvard Solomon Islands Biomedical Project, respectively.