

MODELS OF EXTINCTION OF GENOTYPES IN CLOSED POPULATIONS

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ABSTRACT. *In this paper we show that the concept of a closed and stable population has inherent difficulties. We use a simple Markov model based on a variant of the Polya Urn to show that genetic diversity is not a reasonable expectation in such a setting.*

Keywords: Extinction, Markov process, Polya urn

1. **Introduction.** The problem investigated in this paper originated in an environmental project at Texas Tech University. We begin by describing the general project. In the southwest United States there are small transient lakes called “playas.” These lakes are in their own watersheds and sometimes remain filled for a number of years; however, they may not receive any moisture for several years. When they are full they have a rich ecology. Several amphibians (11 species), dragonflies (an unknown number of species), water birds (ducks, avocets, etc), many invertebrates and a rich flora community comprise the biota. It is extremely rare for a water connection to exist between the playas. A major goal of this project is to understand the genetic communication that takes place between these isolated ecological systems. For birds, dragonflies and some amphibians it is quite possible for them to travel between playas. However, for some species of amphibians it is difficult to imagine that they could survive the transect between playas. In particular, the tiger salamander of the High Plains (*Ambystoma tigrinum mavortium*) requires moisture or its skin dries, resulting in death. This salamander is common in playas with long hydroperiods. When the playas become dry the resident fauna must migrate, estivate, or lay eggs which are capable of surviving a dry period that may last several years. The salamander survives by estivation for it is highly unlikely that they can survive a transect that may be several kilometers in length and it is thought that the majority die before the playa is again flooded. One question to be answered is the genetic diversity in the salamander population [2], and in particular if there is genetic flow between playas.