CRUSTACEAN ZOOPLANKTON IN CHILEAN EPHEMERAL POOLS: AN EXAMPLE FOR THE STUDY OF METAPOPULATIONS AND METACOMMUNITIES

BY

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ABSTRACT

The ecological concepts “metapopulation” and “metacommunity” encompass the existence of integrated systems of populations and communities, as units that experience continuous exchange of individuals through migratory activity. These concepts could be applied to crustaceans that inhabit systems of pools situated closely to each other. This study presents field observations of species associations of planktonic Crustacea sampled from shallow water bodies in the Patagonian plains (38-53°S). A species presence-absence matrix was created for calculating the Jaccard Index of community similarity and for testing null models of species associations, with the aim of determining whether species associations are random or not. The results of the calculations for the Jaccard Index indicated the existence of distinct groups according to the geographical zones involved, i.e., the pools of Kon-Aikén, Balmaceda, and Puaucho. The groups of pools thus recognized showed similarities between the Kon-Aikén and Balmaceda assemblages. The results of the null model analysis exhibited the presence of regulating factors in all simulations that are designed to discover an absence of regulating factors in species associations. The Jaccard indices and the significant outcomes of the null model analysis all agree with previous ecological observations. The ecology and biogeography of the communities studied are also discussed.

RESUMEN

En ecología se han propuesto los conceptos de metapoblación y metacomunidad que involucran la existencia de sistemas integrados de subunidades de poblaciones y comunidades con continuo intercambio de individuos por actividad migratoria. Estos conceptos serían aplicados a crustáceos que viven en sistemas de lagunas superficiales cercanas. Este estudio presenta observaciones en terreno de asociaciones de especies de crustáceos muestreadas de diferentes lagunas superficiales en planicies patagónicas (38-53°S). Se aplicó una matriz de presencia y ausencia de especies para calcular un índice de Jaccard de similitud de comunidades y probar un modelo nulo de asociaciones de especies con el objetivo de determinar si las asociaciones de especies son aleatorias. Los resultados del índice de Jaccard indicaron la existencia de grupos definidos cercanos según la
zona geográfica (lagunas de Kon-Aikén, Balmaceda y Puaucho), de estos grupos, hubo similitudes entre los grupos de lagunas de Kon-Aikén y Puaucho. Los resultados del modelo nulo denotaron la presencia de factores reguladores en todas las simulaciones, lo que indica la presencia de factores reguladores en las asociaciones de especies. El índice de Jaccard y el análisis de modelo nulo concuerda con las descripciones ecológicas previas. Se discute la ecología y biogeografía de estas comunidades.

INTRODUCTION

The ecological concepts “metapopulation” and “metacommunity” involve the existence of groups of populations and communities in which exchange of individuals has ecological implications at the population level, such as colonization and extinction (Hanski, 2001; Leibold et al., 2004). In this scenario, it is clear that genetic exchange will be associated with the exchange of individuals, and that this genetic exchange is bound to generate variations at the phenotypic level, for example, in morphological characteristics (Gajardo et al., 2004). At the community level, the implications consist of, e.g., fluctuations in the numbers of species, with obvious consequences for the actual functioning of a community under the influence of, for instance, an increase or decrease in species that fulfil significant roles as either predator, or prey (Leibold et al., 2004). According to a recent paper (Alttermatt, 2008) such conditions will also apply to species constituting the crustacean zooplankton.

From a biogeographical point of view, migrations and the exchange of individuals would explain the geographical distribution of species, the occurrence of endemism, and the presence of zones that show and expansion of species’ distributional areas (Morrone, 2009). An example on a regional scale is found in species of crustacean zooplankton that occur in ephemeral pools in the region of the so-called “Magallanes” plains. Those pools are present during the local rainy periods in winter, and disappear (by evaporation) during the dry summer periods (De los Ríos et al., 2008a, b; De los Ríos-Escalante, 2010). The scenario encompasses pools in close proximity to each other, in which the species composition is relatively similar (Blaustein & Schwartz, 2001).

The copepod genus Boeckella constitutes the dominant zooplankton in South America (Menu-Marque et al., 2000) and the species contained in it can produce dormant cysts (Hall & Burns, 2001). These observations would explain the existence of similar species assemblages in regions such as southern Patagonia, due to dispersion and colonization (Menu-Marque et al., 2000). The aims of the present study were to describe the species assemblages of micro-crustaceans inhabiting shallow waterbodies in the coastal zone of the Araucania region and in the central and southern Patagonian plains, by using null models to explain the patterns of metapopulations and metacommunities there found.