



## USE OF NULL MODELS TO EXPLAIN CRUSTACEAN ZOOPLANKTON ASSEMBLAGES IN WATERBODIES OF ALERCE ANDINO NATIONAL PARK (41°S, CHILE)

BY

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### ABSTRACT

The zooplankton assemblages in deep, mostly oligotrophic northern Patagonian lakes are characterized by low species numbers and a marked dominance of calanoid copepods. In the present study, data collected in field work on six water bodies located in Alerce Andino National Park (41°S) were analysed using the Jaccard Index of community similarity and a co-occurrence of null models, and such with the aim of determining potential regulating factors for the observed crustacean assemblages, using a presence-absence matrix. A significant correlation between species number and surface area was found. The null model used species co-occurrence, and the basis of this model is that the species associations observed are random. The results revealed the absence of regulating factors and indicate that the sites are relatively homogeneous, with low species numbers and similar plankton assemblages at all studied sites. This finding is in accordance with similar descriptions for zooplankton assemblages in other Chilean Patagonian lakes.

### RESUMEN

Los ensambles zooplanctónicos en lagos del norte de la Patagonia se caracterizan por su bajo número de especies y marcada dominancia de copépodos calanoideos. En el presente trabajo se colectaron datos de seis cuerpos de agua del Parque Nacional Alerce Andino, los cuales se analizaron usando un índice de similitud de comunidades de Jaccard y un modelo nulo de co-ocurrencia y con el mismo se determinaron los factores reguladores potenciales para explicar los ensambles zooplanctónicos usando una matriz de presencia y ausencia de especies. Este modelo nulo usó la co-ocurrencia de especies y parte de la base que las asociaciones de especies son aleatorias. Se observó una asociación significativa entre número de especies y superficie. Los resultados obtenidos indican la ausencia de factores reguladores en la mayoría de los análisis, lo que se debería a que los sitios

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son homogéneos, y al bajo número de especies reportadas las que además presentaron pocas especies repetidas en prácticamente todos los sitios estudiados. Estos resultados coinciden con descripciones similares para ensambles zooplanctónicos para otros lagos y lagunas de la Patagonia chilena.

## INTRODUCTION

The zooplankton assemblages in deep, oligotrophic northern Patagonian lakes are characterized by their low species numbers and their marked dominance of calanoid copepods (Soto & Zúñiga, 1991; De los Ríos & Soto, 2006, 2007; De los Ríos-Escalante, 2011). Studies on littoral microcrustaceans in Chilean lakes are restricted to copepods and cladocerans (Araya & Zúñiga, 1985; Soto & Zúñiga, 1991), and it is probable that other crustaceans, like amphipods, are present (González, 2003) as well. Nevertheless, a correlation between total microcrustaceans (littoral and pelagic) and trophic status has not been determined until now (De los Ríos et al., 2007; De los Ríos & Roa, 2010).

However, it is not clear whether there exists a regulating factor for the observed pelagic and littoral microcrustacean assemblages in lakes with a similar trophic status. To study the presence of a regulating factor, ecologists have proposed null models using presence/absence data in order to find out whether the observed distribution pattern is random or not (Gotelli, 2000, 2001; Tondoh, 2006; Tiho & Johens, 2007; Gotelli & Entsminger, 2009). Although null models have mostly been applied to terrestrial ecosystems until now (Tondoh, 2006; Tiho & Johens, 2007), recently they were also extended to be used in microcrustacean communities of inland waters (De los Ríos, 2008; De los Ríos et al., 2008). These null models were based mainly on species co-occurrence and revealed for shallow southern Patagonian lakes that zooplankton associations there are random, due to the homogeneity of the environmental conditions of the studied sites. They all showed low species numbers and a similar distribution of the taxa over the sites (De los Ríos, 2008; De los Ríos et al., 2008; De los Ríos & Soto, 2009; De los Ríos & Roa, 2010).

The present study was performed in Alerce Andino National Park, a Chilean government protected area, characterized by mountains with *Nothofagus pumilio* (Poepp. & Endl.) Krasser, *N. dombeyi* (Mirb.) Oerst., *N. nitida* (Phil.) Krasser, and *Fitzroya cupressoides* (Molina) Johnst. This park of 39,255 ha has numerous oligotrophic lakes (Steinhart et al., 1999, 2002), four of which can be accessed via mountain roads, while these are also located at least 4 km from the two main entrances to the park. The importance of these water bodies is their condition of being practically unpolluted and pristine, due to the low human intervention (Steinhart et al., 1999, 2002). Thus, the native fauna can be studied under conditions of non-intervention. The aim of the present study was to apply null model analysis in order to explain the composition of the zooplankton assemblages