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Anostracan (Crustacea: Branchiopoda) zoogeography II. Relating distribution to geochemical substrate properties in the USA

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Abstract

Anostracan zoogeography, biogeography, and habitat preferences have predominately been studied as related to the water quality parameters of their seasonally astatic wetland habitats. However, since water quality in seasonally astatic wetlands can fluctuate dramatically over a range of time scales, water quality data are generally of limited usefulness. Anostracan taxa occurrences in each of the nine North American anostracan bioregions across the United States of America were examined in relation to basic substrate geochemistry parameters (%CaSO₄*H₂O, %CaCO₃, salinity, and dominate salt cations), and substrate type. Relationships between these parameters and the distributions of all 63 US species were discovered. Most anostracan species occurred only in habitats with specific geochemical ranges and attributes unique to that species. Additionally, three widespread species were found to occur in very different habitat types in different regions. Upon closer examination, these three taxa were each found to be comprised of more than one species.

Key words: distribution, Fairy shrimp, Island Biogeography, Monopolization Hypothesis, Seasonal Wetlands

Introduction

Anostracans or fairy shrimp are obligate denizens of seasonally astatic wetlands and salt lakes on all continents (Belk 1996, Brendonck *et al.* 2008, Rogers 2009). Nine North American anostracan bioregions were defined by Rogers (2014a). All nine bioregions occur within the United States of America at least in part.

Each bioregion is delineated in terms of anostracan community assemblage and potential habitat availability. Typically, anostracan habitat preferences have been described using standard water quality measurements as typically used in limnological studies (e.g., Sublette and Sublette 1967, McCarraher 1970, Hartland-Rowe 1972, Horne 1974, Colie and Lathrop 1976, Keely 1984, Eriksen and Belk 1999, Coronel *et al.* 2004, Waterkeyn *et al.* 2010). Ecological isolation studies on the halophilic anostracan genus *Artemia* demonstrates that although this genus is limited to habitats high in sodium salts (hypersaline), some species require high CaCO₃ concentrations while others require little to none (Mason 1967, Bowen *et al.* 1984). However, it is the substrate geochemistry that drives the concentrations of salts and carbonates in these habitats. No anostracans have been associated with geochemical conditions. It would seem that the broader substrate chemistry should have a greater bearing on anostracan biogeography in general. Therefore, I examined anostracan habitats to determine if anostracan distribution could be correlated with local geochemical characteristics. Substrate geochemistry should drive water chemistry as it is the geochemical components that dissolve into the water column during the hydroperiod.

Specific anostracan occurrences in each of the nine bioregions and substrate geochemical parameters for each anostracan species are examined in detail. Unfortunately, detailed geochemical data was not available for all localities examined in Rogers (2014a), nor was these data available for Canada and Mexico. Thus, this study focuses just on those habitats in the nine North American anostracan bioregions within the USA where such data were available.

many of which are restricted to these same habitats and probably have similar geochemical tolerances that are important in their ecology and conservation.

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