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Crayfishes (Decapoda : Cambaridae) of Oklahoma: identification, distributions, and natural history

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Abstract

We furnish an updated crayfish species list for the state of Oklahoma (United States of America), including an updated and illustrated dichotomous key. In addition, we include species accounts that summarize general characteristics, life coloration, similar species, distribution and habitat, life history, and syntopic species. Current and potential distributions were analyzed using ecological niche models to provide a critical resource for the identification of areas with conservation priorities and potential susceptibility to invasive species. Currently, Oklahoma harbors 30 species of crayfish, two of which were recently discovered. Eastern Oklahoma has the highest species diversity, as this area represents the western distribution extent for several species. The work herein provides baseline data for future work on crayfish biology and conservation in Oklahoma and surrounding states.

Key words: Cambaridae, Crayfish, Crustacean, Dichotomous Key, Ecological Niche Modeling

Introduction

Crayfish are freshwater crustaceans of the families Astacidae, Cambaridae, and Parastacidae, and are native to every continent except for Antarctica and Africa (Hobbs, 1988). They inhabit a wide variety of aquatic habitats including streams, rivers, lakes, reservoirs, swamps, roadside ditches, wet pastures, and fields (Bouchard, 1978). In many habitats, crayfish play important roles in ecosystem functioning and can comprise the majority of invertebrate biomass (Momot *et al.*, 1978; Rabeni *et al.*, 1995). They are typically considered omnivores, exploiting a diversity of food sources from particulate organic matter to aquatic vertebrates and fish, and occupy an intermediate trophic position between other invertebrate consumers and fish (Schofield *et al.*, 2001; Taylor & Soucek, 2010; Whitledge & Rabeni, 1997). Furthermore, crayfish have a substantial economic impact in the southern United States, particularly in Louisiana, where nearly $45 million worth of crayfish have been exported annually since the early 1980's (Walls, 2009).

Over 75% of the known crayfish species diversity (roughly 406 species and subspecies) occur in North America (Taylor, 2002). Two families of crayfish inhabit North America, Astacidae with 4 species is restricted to the Pacific Northwest (Larson & Olden, 2011), and Cambaridae distributed east of the Rocky Mountains, with two-thirds of its species endemic to the southeastern United States (Taylor *et al.*, 2007). Cambarids are classified into two subfamilies, Cambarellinae including a single genus (*Cambarellus*) and Cambarinae, which contains ten genera. Three of the ten Cambarinae genera (*Cambarus*, *Orconectes*, and *Procambarus*) encompass 85% of all crayfish species and subspecies known in North America; *Procambarus* alone includes 163 described species and represents the most species-rich genus worldwide (Taylor, 2002; Taylor *et al.*, 2007). The species level diversity of crayfishes is relatively well documented, but new species are continuously being described (e.g., Schuster, 2008; Taylor & Soucek, 2010; Taylor *et al.*, 2006). In addition, a host of studies over the past decades have started to elucidate the phylogenetic relationships among North American taxa (e.g., Crandall, 2006; Fetzner & Crandall, 2002).

Nonetheless, relatively little information is available about the ecology and life history of many species, even though there is a growing interest in crayfish biology, particularly because of their increasing need for conservation. A recent review indicated that nearly 50% of all crayfish north of Mexico are imperiled (Taylor *et al.*, 2007). Crayfish are particularly threatened because of loss or degradation of suitable habitats and the introduction of nonindigenous species, which is often exacerbated by narrow distributional ranges and high levels of endemism (Larson & Olden, 2011; Taylor *et al.*, 2007; Welsh *et al.*, 2010). While habitat loss and degradation have caused many detrimental impacts to crayfish, the introduction of nonindigenous species is likely the biggest threat (Gherardi, 2006; Holdich *et al.*, 2009; Lodge *et al.*, 2012; Lodge *et al.*, 2000; Morehouse & Tobler, 2013). For example, nonindigenous crayfish introductions have caused drastic changes to ecosystems both through competitive exclusion of native congeners and physical habitat alterations (Morehouse & Tobler, 2013; Olden *et al.*, 2009; Olden *et al.*, 2006). In addition, nonindigenous crayfish species have been documented to negatively impact primary production and affect macroinvertebrate community structure in some systems (Lodge *et al.*, 2012; Lodge *et al.*, 1994; McCarthy *et al.*, 2006).

On the ground conservation efforts for crayfish are often hindered by the lack of basic knowledge about resident crayfish species and their ecology: (1) Crayfish can be difficult to identify, particularly for non-specialists. While species are typically delineated based on multiple morphological characters (Hobbs, 1989), the structures of