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DISTRIBUTION OF CRAYFISH SPECIES IN SELECT NORTH DAKOTA STREAMS

Cari-Ann Hayer

Terrance L. Velazquez

McLain S. Johnson

Brian Graeb

DISTRIBUTION OF CRAYFISH SPECIES IN SELECT NORTH DAKOTA STREAMS— Crayfish have an integral role in aquatic ecosystems, serving as herbivores, predators, detritivores, and prey for fishes and other aquatic and terrestrial animals (Momot 1995, Taylor et al. 1996, Martin 1997). Many crayfish populations are currently declining as a result of habitat alteration (Taylor et al. 1996) and invasive predators (e.g., rusty crayfish *Orconectes rusticus* [Girard; Lodge et al. 2000]). Knowledge of crayfish distribution and biology in North America and specifically North Dakota is sparse or lacking (Taylor et al. 1996) and baseline information is necessary to identify effects of anthropogenic alterations. Early inventories documented 3 crayfish species in North Dakota: calico crayfish *Orconectes immunis* (Hagen), virile crayfish, *O. virilis* (Hagen), and devil crayfish, *Cambarus diogenes* Girard (Harris 1903, Crocker and Barr 1968, Hobbs 1989, Taylor et al. 1996); however an extensive statewide crayfish survey with site specific information has not been conducted. Additionally, the rusty crayfish is present in the surrounding states of Minnesota and South Dakota (Olden et al. 2006) and in southern Manitoba (Phillips et al. 2009). This invasive species has been known to displace native crayfishes (Hill and Lodge 1999) and cause severe ecological alterations that can affect fishes. The rusty crayfish can limit macrophyte growth which can remove habitat and alter nutrient cycles (Hill and Lodge 1999, Byron and Wilson 2001). Our objectives were to document presence and distribution of native and non-native crayfish species in central and western North Dakota.

Two geomorphic provinces, the Northern Great Plains and the Central Lowlands comprised our North Dakota study area (Galat et al. 2005). All streams within these geomorphic provinces were prairie streams (Matthews 1988), distinguished by unpredictable discharge with distinct annual wet and dry cycles (Resh et al. 1988).

We collected crayfish as bycatch during stream fish surveys completed at 73 sites in summer 2008 (Hayer et al. 2009, North Dakota Game and Fish, unpublished report). Watersheds sampled were chosen based on a suite of objectives for a study examining the status and distribution of fishes in select North Dakota rivers and streams (Johnson et al. 2011, North Dakota Game and Fish, unpublished report) and encompassed 19 of 31 watersheds in North Dakota (excluding the Red River Basin). Our sample sites were based on historical fish sampling locations, availability of access to public and private lands, and favorability of discharge levels and habitat conditions to sampling gear.

We used a combination of 1 or all of the following gears for fish collection and consequent crayfish bycatch: bag seines (1.2-m deep, 9.5-mm^2 knotless netting, 4.6 m or 9.1 m in length), cloverleaf traps (0.4 m tall, 6.4 mm wire mesh), hoop nets (0.6 m diameter, 4 hoop, 6.4 mm mesh diameter), and small minnow traps (6.4 mm mesh). We stretched seines across as much of the channel as possible. We pulled seines mostly in a downstream direction for at least 100 m. If possible, we conducted ≥3 seine hauls at each site that incorporated multiple habitat types (riffles, runs, pools, and backwater areas). We set passive, unbaited gear overnight in deep, slow flowing, non-wadeable habitats. Our primary focus was to document presence or absence of crayfish, thus we did not record efficiency of sampling methods. However, anecdotally seining indicated better detection of crayfish than other gears; seines also have been used for collection of crayfish in other studies (Rach and Dawson 1991). We preserved crayfish in 10% formalin and later transferred collected specimens to 75% ethanol for identification in the laboratory.

We identified mature male crayfish to species using the key by Hobbs (1972). We identified specimens by inspecting the first left pleopod of mature males under a dissecting microscope. Due to the difficulty of identification (Hobbs 1972), we were unable to identify female and juvenile crayfish to species.

We collected a total of 426 (209 females, 217 males) crayfish from 36 of 73 sites in summer 2008. Of 217 males, 116 were identified to species from 11 watersheds (9 from the Northern Great Plains and 2 from the Central Lowlands). Identified samples were composed of 2 species native to North Dakota, surrounding states, and Canada, including virile crayfish (n = 25) and calico crayfish (n = 91). Calico crayfish was detected at 27% of total sample sites and was more widely distributed in our samples than virile crayfish, which was collected at 15% of sample sites (Fig. 1). The virile crayfish has a wide distribution, inhabiting the southern half of Alberta, Saskatchewan, Manitoba, Ontario, and Quebec, Canada (Phillips et al. 2009), the Midwest, and portions of the west extending to Montana (Martin 1997). The calico crayfish also is distributed widely across North America inhabiting areas from New England to Wyoming, and from Ontario to Alabama (Martin 1997). Although both species occur in the same regions, they are ecologically isolated and prefer different habitats. Presence of these species overlapped within the James River at only 3 sites. The virile crayfish is a generalized feeder, preferring streams and lakes with rocky bottoms and can inhabit deeper waters than other crayfishes (Crocker and Barr 1968). The calico crayfish is herbivorous and inhabits stagnant ponds and sluggish streams where the bottom is comprised of mud and aquatic macrophytes (Crocker and Barr 1968, Martin 1997). Populations of both species are considered stable across their ranges (Taylor et al. 1996). The devil crayfish was not detected during our study but known to occur in North Dakota (Wilson 2004). This species typically inhabits wet meadows and marshes (Crocker and Barr 1968), which we did not sample during our study. This crayfish is a burrowing species and habitat preferences may have hindered our ability to capture them with our sampling methods. Additionally, we did not collect rusty crayfish during our field sampling efforts, despite this species occurring sympatrically with northern crayfish (Crocker and

Barr 1968). Routine monitoring and future research examining impacts of anthropogenic alterations on crayfish populations (such as rusty crayfish) throughout the Northern Great Plains is warranted.

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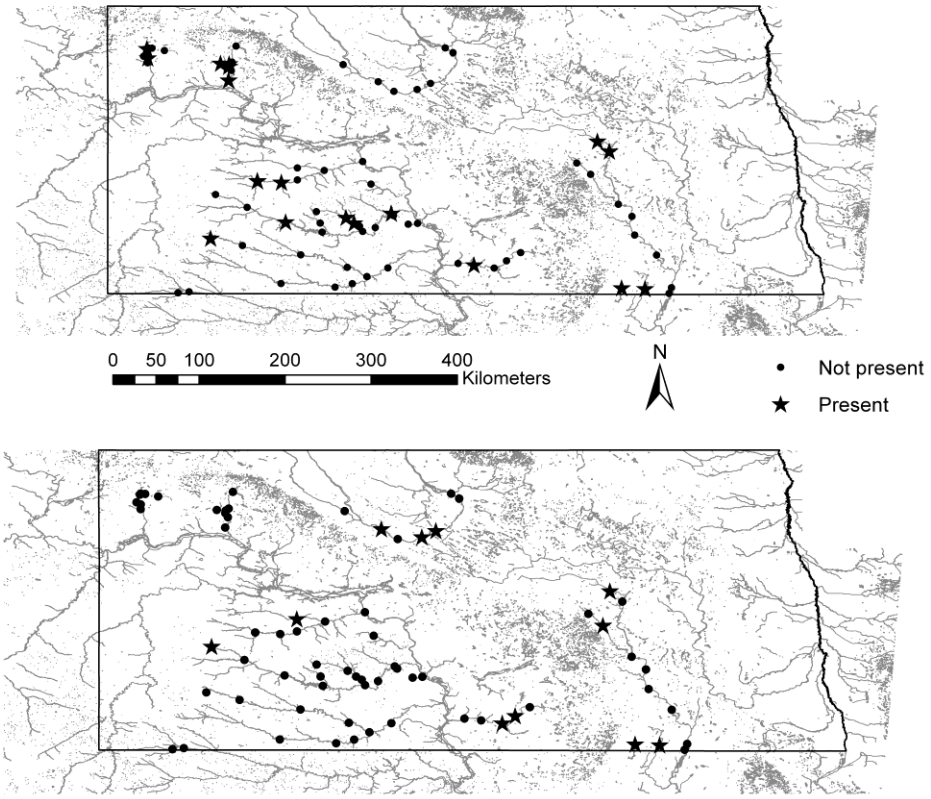

Figure 1. Presence and absence of calico crayfish (top) and virile crayfish (bottom) during electrofishing and seining sampling across central and western North Dakota, summer 2008.

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