## The Canadian Field-Naturalist

### Note

# Introduction of Southern White River Crayfish (*Procambarus zonangulus*) to New Brunswick

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McAlpine D.F., C.B. Connell, and P.D. Seymour. 2020. Introduction of Southern White River Crayfish (*Procambarus zonangulus*) to New Brunswick. Canadian Field-Naturalist 134(4): 375–378. https://doi.org/10.22621/cfn.v134i4.2575

#### Abstract

Southern White River Crayfish (*Procambarus zonangulus*), an aquatic, potentially invasive species, is documented from New Brunswick for the first time. It was found in a small, privately owned, lake in the Saint John River system that was apparently stocked for recreational purposes with non-native fish and the crayfish. *Procambarus zonangulus* has successfully overwintered at the site for at least a year and, more likely, for several years. This is the third species of non-native crayfish recorded in New Brunswick, joining Spiny-cheeked Crayfish (*Faxonius limosus*) and Virile Crayfish (*Faxonius virilis*). This is also the first persisting introduction for the genus *Procambarus* in Canada of which we are aware.

Key words: Aquatic invasive species; introduced species; Maritime Canada; Procambarus zonangulus; Southern White River Crayfish

Although Bell (1859) was the earliest to remark on the presence of crayfish in the Maritimes, Ganong (1887, 1898) was the first to report at length on the presence of the only crayfish native to the Maritimes, Appalachian Brook Crayfish (Cambarus bartonii). The species is widely distributed in New Brunswick freshwaters, but is absent from Nova Scotia and Prince Edward Island. More recently, two species of non-native crayfishes, Spiny-cheeked Crayfish (Faxonius limosus) and Virile Crayfish (Faxonius virilis; both formerly genus Orconectes), have been documented as established in New Brunswick (McAlpine et al. 1991, 1999). Faxonius limosus is restricted to the St. Croix River and tributaries, while F. virilis has been reported in the upper Saint John River of western New Brunswick and the Black River along the eastern coast of the province (McAlpine et al. 2007). Faxonius virilis has also been introduced into Cape Breton Highlands National Park, Nova Scotia (Lambert et al. 2007). Here we report the presence of a third non-native crayfish, Southern White River Crayfish (Procambarus zonangulus), in New

Brunswick and the first occurrence of a persisting introduction for the genus *Procambarus* in Canada.

On the basis of reports first received in February 2019 of the presence of non-native Largemouth Bass (Micropterus salmoides), Black Crappie (Pomoxis nigromaculatus), and Walleye (Sander vitreus) in privately owned Big Lake (46.131910°N, 67.226059°W, 156 m above sea level), York County, New Brunswick, about 49 km north-northwest of Fredericton (2.3 km west of Millville), C.B.C. and P.D.S. set a fyke net at the lake on 4 July 2019. Two adult female crayfish were captured (New Brunswick Museum accession numbers: NBM 11441.1, NBM 11441.2; telsontail length 101.9 mm and 111.8 mm; Figure 1). Efforts in September 2019 (12 baited minnow traps set for 4 h during daylight, wading, and dip netting) and June 2020 (daylight electrofishing) to collect additional material were unsuccessful.

Specimens were initially identified as *Procambarus* sp. using Pflieger (1996), Swecker *et al.* (2019), and the collections of the New Brunswick Museum. A single claw from NBM 11441.1 was then sent to the



**FIGURE 1.** a. Big Lake, York County, New Brunswick, site of a population of the non-native Southern White River Crayfish (*Procambarus zonangulus*). b. Female specimen of *P. zonangulus*, Big Lake, New Brunswick, Canada (NBM 11441.1). Photos: D.F. McAlpine.

Canadian Centre for DNA Barcoding, University of Guelph, Guelph, Ontario, Canada. A full-length DNA barcode of 558 base pairs was generated and compared with records in the species sequence reference library in the Barcode of Life Data System (BOLD) available at http://www.boldsystems.org/. The recovered sequence was a 99.64–98.92% match with multiple BOLD reference records representing *P. zonangulus*.

Although *Procambarus* is a large genus with at least 128 species native to North America (Thomas 2016; Crandall and De Grave 2017), none of the species is native to Canada. No *Procambarus* species have been recorded previously as introduced to Canada, although Red Swamp Crayfish (*Procambarus clarkii*) is now one of the mostly widely introduced crayfish species in the world (Loureiro *et al.* 2015). Although proposed as a likely eventual introduction to Ontario (Hamr 1998), little of the Great Lakes region would appear to provide suitable habitat for *P. clarkii* (Egly *et al.* 2019). First form males are required to differentiate *P. zonangulus* morphologically from the naturally more northern ranging White River Crayfish (*Procambarus acutus*; Swecker *et al.* 2019), hence the DNA barcoding reported above.

The native range of P. zonangulus is confined to the coastal plains of the Gulf of Mexico, but it is poorly understood, perhaps in part because this species was formerly grouped with P. acutus, a species with a wide distribution across the United States (Hobbs and Hobbs 1990; Taylor et al. 2007). Simon (2011) reports the native range for P. zonangulus as Alabama, Louisiana, Mississippi, Texas, and Virginia, with introductions in Maryland and West Virginia. However, Durland Donahou (2018) reports the native range as the Gulf Coast Plains of Texas and Louisiana and perhaps parts of southern Arkansas, with introductions in Maryland and West Virginia and probably Alabama, Louisiana, and Mississippi. The species is economically important in aquaculture (Taylor and Schuster 2004), and, with a taxonomic history confused with P. acutus, both species may have native and introduced ranges that are larger-or smaller, if P. acutus is determined to consist of a complex of species-than reported (Walls 2009).

Big Lake is 340 m at its greatest length by 140 m

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at its greatest width (area 3.4 ha) and has a maximum depth of about 8 m. The lake is surrounded by industrial woodland and is drained via a circuitous route through wetlands to the Nashwaak River, a tributary of the Saint John River system. A single residence, usually seasonally occupied, is present on the north shore. Unfortunately, the full history of the introduction of P. zonangulus to Big Lake is uncertain. The current owner took possession of Big Lake in October 2018. The previous owner, a New England resident, held the property from 2006 to 2018. It was during this latter period of ownership that crayfish (and non-native fishes) are believed to have been introduced into Big Lake, perhaps from aquaculture stock now present in Maryland or West Virginia. Procambarus zonangulus does not appear to be abundant in Big Lake, nor is there any indication that the species has expanded outside the confines of the lake. Procambarus zonangulus is frequently cultured with P. clarkii in many parts of the United States and was part of the aquaculture seed stock introduced into Maryland in the 1980s (Kilian et al. 2010). Efforts to contact the previous owner of Big Lake to confirm the details of the New Brunswick introduction have been unsuccessful, but P. zonangulus has successfully overwintered at the site for at least a year, and more likely, for several years.

Huner (2002) has reviewed some of the management and conservation issues surrounding the introduction of Procambarus (including P. zonangulus) outside their native range, noting standing stocks that can reach 1000 kg/ha. Although the persistence of P. zonangulus in Big Lake, New Brunswick, may be short-lived, Vesely et al. (2015) found that some species of "warm water" crayfish have the potential to become invasive in temperate waters (including P. clarkii). Currently, it appears that P. zonangulus in New Brunswick is restricted to Big Lake. However, the species' presence in the province over a period of at least a year, combined with the work of Vesely et al. (2015), suggests that the introduction of even southern species of crayfish into New Brunswick should be of concern to wetland, species at risk, and fisheries managers in the region.

#### **Author Contributions**

Writing – Original Draft: D.F.M.; Writing – Review and Editing: D.F.M., C.B.C., and P.D.S.; Investigation: C.B.C., P.D.S., and D.F.M.; Visualization: D.F.M.

#### Acknowledgements

We thank John Coates, current owner of Big Lake, for access to his property and for facilitating our sampling at the site. A number of local fishermen alerted us to the presence of non-native fish species at Big Lake. The Canadian Centre for DNA Barcoding (CCDB), Guelph, Ontario, provided efficient and professional DNA sequencing services. Thanks to Sarah Dolynskyj and Natalia Ivanova of the CCDB. Reviewers Scott Reid and Bronwyn Williams provided useful comments on the manuscript that led to its improvement.

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Received 30 June 2020 Accepted 24 December 2020

Associate Editor: P.M. Catling