Response to Bergey and Spaulding

Bergey and Spaulding are correct that *Didymosphenia geminata* blooms are complicated. However, that all *D. geminata* blooms are caused by introductions is simplistic and untrue for most of the world's rivers (Taylor and Bothwell 2014). Ironically, the best data showing *D. geminata* blooms do not result from introductions alone comes from New Zealand. Kilroy and Bothwell (2012) found that blooms on the South Island of New Zealand are determined by dissolved phosphorus (P), even though cells have been detected in many rivers throughout the island. Furthermore, deliberate introductions of *D. geminata* covered substrates into tributaries consistently failed to produce blooms (Sutherland et al. 2007).

D. geminata is a large and distinct diatom, easily spotted in samples even when rare. We agree, however, that the more important issue is that sample sizes frequently used in surveys are inadequate to detect rare species (Kilroy and Dale 2006). Therefore, the native range of *D. geminata* has likely been underestimated. Bergey and Spaulding (2014) claim that Oklahoma is outside *D. geminata*'s native range. The model they cite indicates medium to high probabilities of occurrence in northern Oklahoma and adjacent Arkansas (Kumar et al. 2009). However, this niche model does not include streamwater nutrients, a fundamental determinant of bloom formation and diatom distributions. *D. geminata* is native to many regions of North America (Canada and the United States) and the Northern Hemisphere (Europe and Asia). Contemporaneous blooms of *D. geminata* were reported in Iceland, where the species is almost certainly native but sufficiently rare that it was reported as not being seen prior to the commencement of blooms (Jonsson et al. 2000). Therefore, statements about *D. geminata* expanding its range are premature.

Bergey and Spaulding (2014) include Bothwell and colleagues (2009) as evidence that blooms mainly occur in areas frequented by humans, but Bothwell has repudiated that publication with the truism that correlation is not causation (Bothwell et al. 2014). Moreover, additional studies show that blooms are not necessarily associated with humans (Corbett 2013).

Ballantine and Davies-Colley (2010) report increases in dissolved P primarily on North Island, where blooms do not presently occur, or near urbanized areas on South Island, New Zealand. Because the proximate cause of blooms is dissolved P concentration near or below analytical detection (Kilroy and Bothwell 2012), data connecting contemporaneous blooms to environmental changes are a challenge. We present four hypotheses, including climate change, to explain declines in dissolved P (Taylor and Bothwell 2014), and recent research has now linked blooms of *D. geminata* in North America to environmental changes resulting from climatic warming (Lavery et al. 2014).

We encourage research that advances the scientific understanding of *D. geminata* blooms and why blooms are now occurring with greater frequency. Focusing on the proximate and ultimate drivers of *D. geminata* stalk production is a start (Taylor and Bothwell 2014). Clean angling techniques should be promoted to restrict spreading potentially harmful species; however, tying *D. geminata* blooms to fishermen runs the risk of discrediting otherwise laudable *check, clean, and dry* programs when blooms are not curtailed.

BRAD W. TAYLOR
MAX L. BOTHWELL

Brad W. Taylor (brad.taylor@dartmouth.edu) is affiliated with the Department of Biological Sciences at Dartmouth College, in Hanover, New Hampshire, and with the Rocky Mountain Biological Laboratory, in Crested Butte, Colorado. Max L. Bothwell is affiliated with Environment Canada, in Nanaimo, British Columbia, Canada.

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