The invasion of the freshwater diatom *Didymosphenia geminata* in Patagonia: prospects, strategies, and implications for biosecurity of invasive microorganisms in continental waters

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Abstract

The diatom *Didymosphenia geminata,* which forms nuisance blooms in low nutrient streams worldwide, was documented as an aggressive invader in South America in 2010 from the Futaleufú basin (43.2°S), in Chilean and Argentinean Patagonia. Within 1 year it was confirmed from 20 rivers distributed over 800 km. Driven by perceived economic impacts to tourism and recreation, a strong response ensued, with education, monitoring and nascent biosecurity efforts based on similar measures in New Zealand. Considering the difficulty in containment (potential range on New Zealand's South Island was occupied by *D. geminata* within 3 years), the much larger potential range, and limited resources or previous experience in managing invaders in continental waters in South America, it is unlikely that current biosecurity measures will produce significant results. Lacking a coordinated strategic approach or conservation priorities, existing efforts may divert resources from alternatives with greater potential for success, while potentially feeding the public perception that the problem is being addressed. We propose a conservation strategy based on best available but incomplete information on habitat requirements, and a conceptual model of invasion vectors to identify defensible conservation zones (islands and hydrographically isolated areas) with greater potential for being maintained invasion-free.

Introduction

Didymosphenia geminata (Lyngbye) M. Schmidt, a diatom native to mountain and boreal streams in the Northern Hemisphere, has recently attracted considerable attention as an aggressive invader (Whitton *et al*. 2009; Spaulding *et al*. 2010). Following the first Southern Hemisphere introduction to the South Island of New Zealand in 2004, Biosecurity New Zealand recognized *D. geminata* (DG) as a top priority due to its propensity for developing unusually high biomass in rivers despite low nutrient concentrations (Kilroy *et al*. 2009), and potential economic impacts to fly-fishing and tourism (Kilroy & Unwin 2011). DG proliferation is also characterized by novel biogeochemical processes, physical structure and microbial communities (Sundareshwar *et al*. 2011), may alter stream hydraulic properties (Larned *et al*. 2011) and benthic invertebrate abundance and community composition (Kilroy *et al*. 2009). Significant investment in monitoring, education/outreach and research, an existing biosecurity

