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Editorial

The 'grand scheme of things': biological invasions, their detection, impacts and management

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Paul Colinvaux in his wonderfully accessible collection of essays, 'Why Big Fierce Animals Are Rare', discusses that seemingly increasingly outdated concept of the niche. His opening statement in his essay on the concept is that 'Every species has its niche, its place in the grand scheme of things'. Although the term 'niche' summons up ideas of a nook, cranny or hidey-hole tucked away inside an old gothic church or cathedral, it might be interesting to consider this concept in relation to ongoing and increasing threats from biological invasion. For instance, when considering the detection, possible management and impact of invaders, one could be looking at the interplay between the fundamental and realised niches of these species. Management and detection relies on scientists possessing fundamental baseline knowledge about the sensitivities, tolerances and behaviour of the invasive species they are focussed on. One of the obvious problems is that invasive species tend to have very large fundamental niches, capable of surviving a wide range of physico-chemical conditions and adapting to diverse habitat templates. Unfortunately how wide these fundamental niches might actually be, sometimes is only 'brought home' to environmental managers once an invader starts to spread within and beyond its new territory. For instance, this has happened in the recent invasion of the United Kingdom by the 'killer shrimp' *Dikerogammarus villosus*, as this invader seems to have surprised many of the powers that be, in its rapid range expansion throughout southern England and the massive population sizes currently being witnessed in many areas. Many invasive species such as *D. villosus*, can also be highly predatory and/or aggressive, replacing many resident species via biotic interactions as their realised niches are 'established'. Climate change, pollution and habitat degradation may all only serve to favour more tolerant invaders in their interactions with more sensitive residents.

This special edition of *Management of Biological Invasions* (MBI) contains research papers presented at the 18th International Conference on Aquatic Invasive Species (ICAIS), which was held in April 2013 in Niagara Falls, Ontario, Canada. Our sister journal, *Aquatic Invasions* (AI), has focussed on the science lead ICAIS papers, with a thorough review of all of the conference papers presented by Lucy and Panov (2014). Thankfully, there seems to be no longer any debate amongst policy-makers and protection agencies that invasive species represent one of the greatest threats to biodiversity in aquatic ecosystems, with the ICAIS conference and its proceedings reflecting this. Many of the contributions dealt with detection (e.g., the use of vital stains to detect freshwater taxa [Adams et al. 2014]; sampling effort [Ram et al. 2014]; predictors for environmental suitability [Prescott et al. 2014]; and environmental DNA techniques for Asian Carp [Wilson et al. 2014]) and risk assessment

(e.g., Champion et al.'s 2014 aquatic weed risk assessment; and Baier et al.'s 2014 biofilm assessment) acknowledging that the best way to 'manage' a biological invasion is to stop it happening in the first place. However, if an invader evades biosecurity protocols and mitigation (e.g., ballast water filtration issues [Briski et al. 2014]; and methods to mitigate green crab impact [Best et al. 2014]) and control measures fail (e.g., harvest incentives [Pasko and Goldberg 2014]; or the use of microbial biocides such as Zequanox [Meehan et al. 2014]) and then starts to spread out and establish itself, it is here that the old fashioned niche concept perhaps comes into its own. The consequences for biodiversity, fisheries (as illustrated by Nienhuis et al. 2014), trophic chains and even water quality monitoring (as discussed by MacNeil 2014) can be far-reaching as the niches of these invaders are 'realised'.

It is clear that forums such as ICAIS, MBI and AI are invaluable for sharing information on aquatic invasive species, whether this is on detection, control or impact. Such a resource for sharing knowledge will only become more important as government protection agencies deal with increasingly stringent budget cuts. Ever scarcer research money will also require targeting, without replicating work already done. To conclude, invasive species do have their 'place in the grand scheme of things' and unfortunately for government protection agencies and environmental managers, their place is getting larger and larger.

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