Biodiversity and Conservation (2020) 29:3091–3093
https://doi.org/10.1007/s10531-020-02011-8

LETTER TO THE EDITOR

Aquatic biosecurity remains a damp squib

Neil E. Coughlan[1,2] · Ross N. Cuthbert[2,3] · Jaimie T. A. Dick[2]

Received: 13 April 2020 / Revised: 18 June 2020 / Accepted: 26 June 2020 /
Published online: 30 June 2020

Inaction concerning the dispersal of invasive alien species (IAS) via their adherence to anthropogenic vectors remains a global issue for the conservation of aquatic ecosystems (Piria et al. 2017; Ulman et al. 2019; Smith et al. 2020). Although IAS can have detrimental effects on biodiversity and ecosystem functioning across terrestrial and aquatic environments, given their exposure to multiple transport pathways, aquatic ecosystems are considered especially vulnerable to biological invasions and their impacts (Ricciardi and MacIsaac 2011). In addition, unlike terrestrial ecosystems, submerged aquatic environments are particularly difficult to monitor and, consequently, invasions are often well advanced before they become readily apparent (Beric and MacIsaac 2015).

Since 2014, European Union (EU) Regulation no. 1143 has provided the basis for improved spread-prevention, control and eradication of IAS amongst Member States (EU 2014). This legislation commendably targets the transportation, exchanging, keeping and releasing of selected problematic invaders, known as Species of Union Concern. In effect, for these 'black-listed' species, trade, deliberate transport, cultivation/breeding, release and ownership is now prohibited within EU territories. In addition, Articles 7(2) and 13 of the Regulation emphasise the requirement for Member States to take all necessary steps to prevent the unintentional introduction or spread of Species of Unions Concern. As of August 2019, this list has grown to encompass 66 IAS, including some thirty aquatic or semi-aquatic species. For the most part, Species of Union Concern designations have

Communicated by Angus Jackson.

✉ Neil E. Coughlan
neil.coughlan.zoology@gmail.com

Ross N. Cuthbert
rossnoelcuthbert@gmail.com

Jaimie T. A. Dick
j.dick@qub.ac.uk

[1] School of Biological, Earth & Environmental Sciences, University College Cork, Distillery Fields, North Mall, Cork, Ireland

[2] Institute for Global Food Security, School of Biological Sciences, Queen's University Belfast, 19 Chlorine Gardens, Belfast BT9 5DL, Northern Ireland, UK

[3] GEOMAR Helmholtz- Zentrum für Ozeanforschung Kiel, 24105 Kiel, Germany

focused on species which are traded for commercial purposes (e.g., pet and ornamental), whilst many other damaging non-traded IAS have remained overlooked. In particular, aquatic IAS which inadvertently 'hitchhike' on or biofoul anthropogenic vectors, such as fishing and boating equipment, continue to proliferate unchecked amongst EU territories (Ulman et al. 2019). Indeed, prohibition of trade, deliberate transport and ownership will not inhibit sustained dispersal of these insidious invaders, especially small-bodied aquatic invertebrates and plant propagules, which are often difficult to visually detect and readily transportable by accidental means. Accordingly, to better comply with Articles 7(2) and 13 and to address the spread of problematic invaders not currently categorised as of Union Concern, a more proactive approach towards the spread-prevention of IAS is required, and the lack of a unified approach amounts to a missed opportunity for the improved conservation of aquatic ecosystems.

Although awareness campaigns such as 'Check, Clean, Dry' promote best-practice biosecurity protocols to curtail IAS, these techniques remain underutilised, underfinanced, and data-deficient (Piria et al. 2017; Smith et al. 2020). Nevertheless, simple decontamination techniques can improve the integrity of aquatic biosecurity protocols (Joyce et al. 2019; Bradbeer et al. 2020). For example, rapid exposure to direct steam and disinfectant treatments have shown promise in biosecurity trials targeting multiple taxonomic groups (see Joyce et al. 2019; Bradbeer et al. 2020, and references therein). However, a current lack of legislation to underpin decontamination undermines the principles of EU Regulation no. 1143, as well as other national and international agreements, such as the United States of America Executive Order 13751 "Safeguarding the Nation from the Impacts of Invasive Species" (EO 2016), and the Ballast Water Management Convention (BWMC 2004). Therefore, in addition to prohibition of IAS, legislative and financial support are urgently needed to enforce and promote management policies with cross-cutting strategic actions, such as unambiguous biosecurity guidelines with multilateral enforcement and the adequate provision of decontamination facilities at major points of waterbody egress (e.g. angling stations, boat ramps and marinas) (Bradbeer et al. 2020; Coughlan et al. 2020).

Enhanced spread-prevention strategies are particularly pertinent given that control or eradication costs following invader establishment can be several orders of magnitude higher compared to spread-preventions, are frequently unsuccessful, and can be damaging to non-target species (see Piria et al. 2017 for discussion). As high-risk IAS do not recognise geopolitical borders, to better improve conservation programmes for aquatic ecosystems, biosecurity protocols designed to target all aquatic IAS should be used to thoroughly decontaminate vectors of adhering organisms. Therefore, regardless of an organism's black-list designation, ease of visual detectability, known invasion history or likely impact, the risk of further IAS spread can be substantially reduced, if not eliminated, through the adoption of systematic, cheap, readily available and effective decontamination procedures. Nevertheless, further research and increased funding support are still required to develop new, and improve existing, decontamination techniques. In particular, the affordability and application duration times of decontamination treatments remain barriers to user-uptake, especially for larger equipment such as boats, whilst the lack of universally approved guidelines for systematic decontamination continue to inhibit optimal prevention of aquatic IAS.

References

Beric B, MacIsaac HJ (2015) Determinants of rapid response success for alien invasive species in aquatic ecosystems. Biol Invasions 17:3327–3335

Bradbeer SJ, Coughlan NE, Cuthbert RN, Crane K, Dick JTA et al (2020) The effectiveness of disinfectant and steam exposure treatments to prevent the spread of highly invasive killer shrimp *Dikerogammarus villosus*. Sci Rep 10:1919

BWMC (2004) International maritime organization, "international convention for the control and management of ships' Ballast Water and Sediments (BWM)". https://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships'-Ballast-Water-and-Sediments-(BWM).aspx. Accessed 1 Apr 2020

Coughlan NE, Armstrong F, Cuthbert RN, Eagling LE, Kregting L, Dick JTA, MacIsaac HJ, Crane K (2020) Dead and gone: steam exposure kills layered clumps of invasive *Lagarosiphon major*. Aquat Bot 162:103204

EO (2016) Executive order 13751, "safeguarding the nation from the impacts of invasive species". https://www.hsdl.org/?abstract&did=797231. Accessed 1 Apr 2020

EU (2014) European union regulation no 1143/2014 on the prevention and management of the introduction and spread of invasive alien. Off J Eur Union 317:35–55

Joyce PWS, Cuthbert RN, Kregting L, Crane K, Vong GYW, Cunningham EM, Dick JTA, Coughlan NE (2019) Stay clean: direct steam exposure to manage biofouling risks. Mar Pollut Bull 142:465–469

Piria M, Copp GH, Dick JTA, Duplić A, Groom Q, Jelić D et al (2017) Tackling invasive alien species in Europe II: threats and opportunities until 2020. Manage Biol Invasions 8:273–286

Ricciardi A, MacIsaac HJ (2011) Impacts of biological invasions on freshwater ecosystems. In: Richardson DM (ed) Fifty years of invasion ecology: the legacy of Charles Elton. Blackwell Publishing Ltd, New York, pp 211–223

Smith ERC, Bennion H, Sayer CD, Aldridge DC, Owen M (2020) Recreational angling as a pathway for invasive non-native species spread: awareness of biosecurity and the risk of long distance movement into Great Britain. Biol Invasions 22:1135–1159

Ulman A, Ferrario J, Forcada A, Seebens H, Arvanitidis C, Occhipinti-Ambrogi A, Marchini A (2019) Alien species spreading *via* biofouling on recreational vessels in the Mediterranean Sea. J Appl Ecol 56:2620–2629