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LETTER

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Horizon scanning for potential invasive non-native species across the United Kingdom Overseas Territories

Wayne Dawson[1] | **Jodey M. Peyton**[2] | **Oliver L. Pescott**[2] | **Tim Adriaens**[3] | **Elizabeth J. Cottier-Cook**[4] | **Danielle S. Frohlich**[5] | **Gillian Key**[6] | **Chris Malumphy**[7] | **Angeliki F. Martinou**[8,9] | **Dan Minchin**[10,11] | **Niall Moore**[6] | **Wolfgang Rabitsch**[12] | **Stephanie L. Rorke**[2] | **Elena Tricarico**[13] | **Katharine M. A. Turvey**[2] | **Ian J. Winfield**[14] | **David K. A. Barnes**[15] | **Diane Baum**[16] | **Keith Bensusan**[17] | **Frederic J. Burton**[18] | **Peter Carr**[19] | **Peter Convey**[15] | **Alison I. Copeland**[1,20] | **Darren A. Fa**[21] | **Liza Fowler**[22] | **Emili García-Berthou**[23] | **Albert Gonzalez**[24] | **Pablo González-Moreno**[25,26] | **Alan Gray**[27] | **Richard W. Griffiths**[28] | **Rhian Guillem**[24] | **Antenor N. Guzman**[29] | **Jane Haakonsson**[17] | **Kevin A. Hughes**[15] | **Ross James**[30] | **Leslie Linares**[31] | **Norbert Maczey**[26] | **Stuart Mailer**[32] | **Bryan Naqqi Manco**[33] | **Stephanie Martin**[34] | **Andrea Monaco**[35] | **David G. Moverley**[36] | **Christine Rose-Smyth**[37] | **Jonathan Shanklin**[15] | **Natasha Stevens**[22] | **Alan J. Stewart**[38] | **Alexander G. C. Vaux**[39] | **Stephen J. Warr**[40] | **Victoria Werenkaut**[41] | **Helen E. Roy**[2]

[1]Department of Biosciences, Durham University, Durham, UK

[2]UK Centre for Ecology & Hydrology, Crowmarsh Gifford, UK

[3]Research Institute for Nature and Forest (INBO), Herman Teirlinckgebouw, Brussels, Belgium

[4]Scottish Association for Marine Science, Scottish Marine Institute, Oban, UK

[5]SWCA Environmental Consultants, Honolulu, Hawaii, USA

[6]GB Non-Native Species Secretariat, Animal and Plant Health Agency, York, UK

[7]Fera Science Limited, York, UK

[8]Joint Services Health Unit, British Forces Cyprus, Nicosia, Cyprus

[9]The Cyprus Institute, Nicosia, Cyprus

[10]Marine Research Institute, Klaipėda University, Klaipėda, Lithuania

[11]Marine Organism Investigations, Co Clare, Ireland

[12]Environment Agency Austria, Vienna, Austria

[13]Department of Biology, University of Florence, Sesto Fiorentino, Italy

[14]UK Centre for Ecology & Hydrology, Lancaster Environment Centre, Lancaster, UK

[15]British Antarctic Survey, NERC, Cambridge, UK

[16]Ascension Island Government, Ascension Island, South Atlantic Ocean

[17]Gibraltar Botanic Gardens Campus, 'The Alameda', University of Gibraltar, Gibraltar, Gibraltar
[18]Department of Environment, Cayman Islands Government, Grand Cayman, Cayman Islands
[19]Institute of Zoology, Zoological Society of London, London, UK
[20]Department of Environment and Natural Resources, Government of Bermuda, Hamilton Parish, Bermuda
[21]Natural Sciences and Environment Hub, Research Office, University of Gibraltar, Europa Point Campus, Gibraltar, Gibraltar
[22]St Helena National Trust, Jamestown, South Atlantic Ocean
[23]Institute of Aquatic Ecology, University of Girona, Girona, Spain
[24]Gibraltar Botanic Gardens, Gibraltar, Gibraltar
[25]Department of Forest Engineering, ERSAF, University of Cordoba, Córdoba, Spain
[26]CABI, Egham, UK
[27]UK Centre for Ecology and Hydrology, Penicuik, UK
[28]Island Conservation, Santa Cruz, California, USA
[29]U.S. Navy Support Facility Diego Garcia, Diego Garcia, British Indian Ocean Territory
[30]Government of South Georgia & the South Sandwich Islands, Government House, Stanley, Falkland Islands
[31]Field Centre, Jews' Gate, Gibraltar Ornithological & Natural History Society, Gibraltar, Gibraltar
[32]Dart Family Park, Grand Cayman, Cayman Islands
[33]Department of Environment and Coastal Resources, National Environmental Centre, Providenciales, Turks and Caicos Islands
[34]Government of Tristan da Cunha, Edinburgh of the Seven Seas, Tristan da Cunha
[35]Department of Life Sciences, University of Siena, Siena, Italy
[36]Secretariat of the Pacific Regional Environment Programme, Apia, Samoa
[37]Verdant Isle Orchid Research, Grand Cayman, Cayman Islands
[38]School of Life Sciences, University of Sussex, Brighton, UK
[39]Medical Entomology, UK Health Security Agency, Salisbury, UK
[40]Department of the Environment, HM Government of Gibraltar, Gibraltar, Gibraltar
[41]Laboratorio Ecotono, INIBIOMA-CONICET – Universidad Nacional del Comahue, San Carlos de Bariloche, Argentina

Correspondence
Wayne Dawson, Department of Biosciences, Durham University, Stockton Road, Durham DH1 3LE, UK.
Email: wayne.dawson@durham.ac.uk

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Abstract

Invasive non-native species (INNS) are recognized as a major threat to island biodiversity, ecosystems, and economies globally. Preventing high-risk INNS from being introduced is the most cost-effective way to avoid their adverse impacts. We applied a horizon scanning approach to identify potentially INNS in the United Kingdom Overseas Territories (OTs), ranging from Antarctica to the Caribbean, and from the Pacific to the Atlantic. High-risk species were identified according to their potential for arrival, establishment, and likely impacts on biodiversity and ecosystem function, economies, and human health. Across OTs, 231 taxa were included on high-risk lists. The highest ranking species were the Asian green mussel (*Perna viridis*), little fire ant (*Wasmannia auropunctata*), brown rat (*Rattus norvegicus*), and mesquite tree (*Prosopis juliflora*). Shipping containers were identified as the introduction pathway associated with the most species. The shared high-risk species and pathways identified provide a guide for other remote islands and archipelagos to focus ongoing biosecurity and surveillance aimed at preventing future incursions.

KEYWORDS
biological invasions, biosecurity, exotic species, horizon scanning, introduced species, islands, non-native species, risk assessment, U.K. Overseas Territories (UKOTs)

1 | INTRODUCTION

Remote islands harbor unique biodiversity, yet their small size and remoteness confer vulnerability resulting from small population sizes and limited genetic variation, limited options for dispersal, narrow ecological niches, and behavioral naivety. As a result, environmental change is causing more rapid and substantial impacts on islands compared to continental regions (Russell & Kueffer, 2019). On islands, biological invasions are an important driver of species extinctions (Bellard et al., 2017), and can substantially alter ecosystem function (Russell & Kueffer, 2019). Invasive non-native species (INNS) on islands also impact local economies (Hanley & Roberts, 2019) and human health (Neill & Arim, 2011). As transport networks and trade volumes continue to grow, the risk of introducing new potentially invasive species to islands is ever-present and increasing (Lenzner et al., 2020).

The United Kingdom Overseas Territories (OTs) are mostly islands and are widely distributed around the world, spanning the Atlantic, Indian, Pacific, and Southern Oceans and the Caribbean Sea (Figure 1), spanning a wide range of climates that largely reflect the diversity of small islands globally (Loft, 2021). Over 32,000 native species have been documented in the OTs, including 1500 endemic species (Churchyard et al., 2016), and are often rare (Hogg et al., 2011) and globally threatened (Churchyard et al., 2016). People living in the OTs are highly dependent on the natural environment for their economic and social well-being (Smith, 2019), but those natural environments are and will continue to be at risk from biological invasions (Key & Moore, 2019).

Prevention of biological invasions is most effective when high-risk INNS are identified before arrival, introduction is prevented through biosecurity measures, and incursions are detected and removed early through surveillance (Reaser et al., 2020). Prioritized lists of potential INNS are essential for informing prevention and control (McGeoch et al., 2016), but we often lack complete knowledge of species' ecology and impacts, and context dependency influences the outcomes of biological invasions. Despite the uncertainties, rapid evaluation of risks is still necessary to inform action (Roy et al., 2014). Horizon scanning is a process involving expert elicitation and consensus building that can bridge these knowledge gaps, allowing rapid assessment and ranking of invasive species' ability to arrive, establish, and cause impact (Hughes et al., 2020; Peyton et al., 2019; Roy, Bacher, et al., 2019; Roy et al., 2014).

Here, we report on the outcomes of a horizon scanning study (Roy, Peyton, et al., 2019), which identified the INNS posing an imminent invasion risk to 14 of the OTs (Figure 1; Table 1). Our main aims were to:

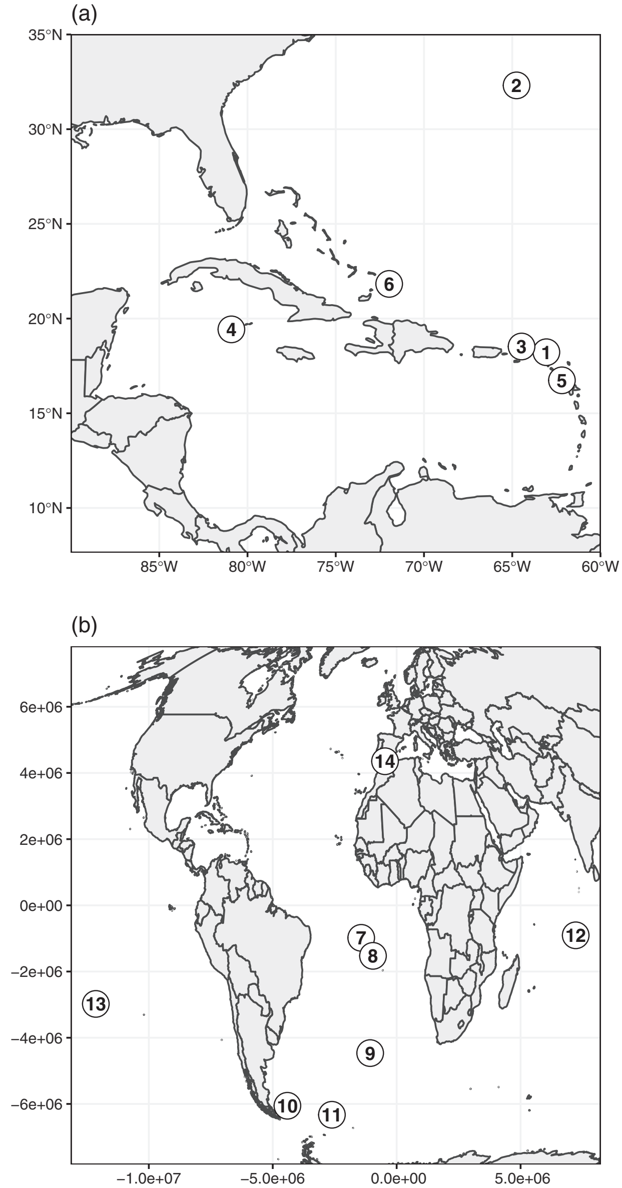

FIGURE 1 Locations of United Kingdom Overseas Territories in the Caribbean (a; Mercator projection) and elsewhere (b; Mollweide projection). 1 = Anguilla; 2 = Bermuda; 3 = British Virgin Islands; 4 = Cayman Islands; 5 = Montserrat; 6 = Turks & Caicos Islands; 7 = Ascension; 8 = Saint Helena; 9 = Tristan da Cunha; 10 = Falkland Islands; 11 = South Georgia and the South Sandwich Islands; 12 = British Indian Ocean Territory; 13 = Pitcairn; 14 = Gibraltar. All the OTs considered are islands/archipelagos, except Gibraltar

1. Identify high-risk INNS across the OTs, considering the potential for introduction, establishment, and impacts on biodiversity and ecosystem function, economies, and human health;
2. Determine the introduction pathways that pose the highest risk of introducing INNS to the territories.

TABLE 1 The United Kingdom Overseas Territories (UKOTs) and the number of species included on high-risk lists after horizon scanning, for three impact categories: B = Biodiversity and ecosystems, E = Economies, and H = Human Health

UKOT	Cluster	Area (km^2)[a]	Distance to Mainland (km)[b]	Human population[a]	B	E	H	Total
Anguilla	Caribbean	91	822	18,403	10	10	10	26
Bermuda	Caribbean[c]	54	1058	72,084	21	18	9	34
British Virgin Islands	Caribbean	151	856	37,891	11	25	15	37
Cayman Islands	Caribbean	264	487	63,131	14	13	5	23
Montserrat	Caribbean	102	658	5387	10	10	10	26
Turks & Caicos Islands	Caribbean	948	898	57,196	10	10	10	24
Ascension	Mid-Atlantic	88	1536	806	29	10	6	37
Saint Helena	Mid-Atlantic	122	1859	4577	40	20	8	55
Tristan da Cunha	Mid-Atlantic	184	2584	260	22	10	5	30
Falkland Islands	South Atlantic	12,173	400	3198	25	8	1	28
SGSSI	South Atlantic	3903	SG = 1753; SSI = 2314	0	20	3	0	20
BIOT	BIOT	60	1590	3000[d]	25	10	15	27
Pitcairn	Pitcairn	47	4963	50	23	17	7	32
Gibraltar	Gibraltar	7	0	29,516	41	23	11	59

Abbreviations: BIOT, British Indian Ocean Territory; SGSSI, South Georgia [SG] and the South Sandwich Islands [SSI].

[a]From the CIA World Factbook (https://www.cia.gov/the-world-factbook/, accessed 12/05/2021).

[b]Distance from polygon centroid to nearest continental coastline, using the Taxonomic Database Working Group shapefiles of region polygons (TDWG World Geographic Scheme for Recording Plant Distributions Committee, 2001).

[c]Geographically, Bermuda is not Caribbean, but was included in the Caribbean cluster due to relative proximity to Caribbean OTs and North America.

[d]Includes military personnel, support staff, and contractors on Diego Garcia.

2 | METHODS

We used a consensus method to derive ranked lists of potential INNS with high impact for 14 OTs, following guidelines on expert elicitation (Roy et al., 2020). Preliminary longlists of potential INNS were collated and included species that were not present as established alien species on a focal OT but may have been present already on other OTs (see File S1 for longlists of 2643 species). Species were scored, discussed, and ranked during workshops to agree on final high-risk lists per OT. The horizon scanning exercise was focused on identifying species that have not yet been introduced or escaped into the wild in the OTs, and therefore we do not consider species already established (i.e., with self-sustaining populations, *sensu* Blackburn et al., 2011), and thus informs pre- and early post-border biosecurity, including subsequent risk assessments.

The OTs are listed in Table 1 and shown in Figure 1. The Atlantic islands of Saint Helena and Ascension, and the island group of Tristan da Cunha (Tristan da Cunha, Gough, Inaccessible, and Nightingale Islands) were considered as three separate territories throughout the horizon scanning, while South Georgia and the South Sandwich Islands (SGSSI) form one administrative unit and were considered together.

2.1 | Taxonomic scope and expert teams

To ensure sufficient and appropriate use of knowledge for specific taxonomic groups and environments, we assigned participants to four broad thematic groups: terrestrial and freshwater plants, terrestrial and freshwater invertebrates, vertebrates, and marine species (including all marine invertebrates, vertebrates, and photosynthetic marine eukaryotes). Bacteria, fungi, and viruses were not considered. International experts and experts from each OT collaboratively drafted longlists of potential INNS for each thematic group and ultimately the final consensus lists. A total of 147 experts from 52 organizations were involved during the study (see Methods S1 for list).

The OTs were assigned to one of six clusters (Table 1) based on geographic proximity for the horizon scanning. This enabled collaboration among experts from each OT during subsequent workshops, while also maximizing attendance of visiting experts. The species longlists were created using structured literature searches (including academic journals, risk assessments, reports, other "gray" literature, and authoritative websites), checklists, floras, querying of INNS and other databases (Table S1), and expert knowledge. Additional criteria related to invasion history elsewhere and known potential pathways were also considered (see Methods S1 for details).

2.2 | Scoring of species

Experts within each thematic group scored each species for their separate likelihoods of (i) arrival, (ii) establishment, and (iii) magnitude of potential negative impact on biodiversity or ecosystems, economies, or human health for each OT. A timeframe for arrival, establishment, and impact within 10 years was set for scoring, because we wanted the focus to be on identifying, with sufficient certainty, those high-risk species that are highly likely to arrive and establish imminently (i.e., within a decade) to inform rapid decision-making and action. Scores were informed by initial discussion, overview of the trade and transport links to other countries in the region relevant to each OT (see Methods S1), and species information from database sources (Table S1). A 5-point scale was adopted (Table S2), and each score received a confidence level (High, Medium, and Low; Table S3). The product of the individual scores for arrival, establishment, and impact within an impact category (maximum = 125) provided guidance on ranking species' relative risk. During the workshops, all the ranked species lists from across the thematic groups were collated into single lists for each of the three impact categories. Experts were invited to justify scores, and all participants then reviewed and refined the scores and ranks through plenary discussion in a consensus-building stage (see Methods S1). Workshops concluded with three agreed ranked lists of high-risk INNS per impact category (biodiversity or ecosystem function, economies, or human health) for each territory.

2.3 | Information on pathways

Information was gathered throughout the workshops from existing sources (Table S1) and local expert knowledge as well as species' traits to assign species to likely pathways of arrival, using published Convention on Biological Diversity pathway classifications (Harrower et al., 2017) (Table S4). The pathways "Horticulture" and "Ornamental" were combined under "Ornamental" for the ornamental plant trade. Following the workshops, all participants were invited to review the pathway and taxonomic information for the high-risk INNS.

2.4 | Deriving an aggregate top 20 list

We synthesized information on high-risk INNS across the OTs to identify species of concern for multiple locations, providing a basis for coordinated biosecurity approaches across the OTs and highlighting high-risk species of relevance to multiple regions globally. We achieved this by generating a list of the top 20 high-risk species after the workshops, which involved summing the products of arrival, establishment, and impact scores across the three impact categories and all 14 OTs. These overall total scores were then ranked. All data processing, plotting, and analyses were carried out in R version 3.6.3 (R Development Core Team, 2020).

3 | RESULTS

3.1 | High-risk INNS

We listed 231 taxa as high risk across the three impact categories and the 14 OTs (five taxa were included as aggregate species due to taxonomic uncertainty, but all are treated hereafter as "species"; File S2). Totals of 74 terrestrial invertebrate, 46 vertebrate, 71 plant, and 40 marine species were included on high-risk lists. Almost half (114) of the taxa appeared solely on high-risk lists for biodiversity and ecosystems, while 64 species appeared on high-risk lists across all three impact categories (see File S3 for OT-specific high-risk lists).

Fifteen of the top 20 high-risk species were invertebrates (Table 2). Most species listed were terrestrial; however, the Asian green mussel *Perna viridis* was included on most lists of species posing a high risk to biodiversity and ecosystems (Figure 2a). The little fire ant *Wasmannia auropunctata* (Figure 2b) featured on the high-risk lists for eight OTs, and in all impact categories for six OTs. Among the four vertebrates, the brown rat (*Rattus norvegicus*; Figure 2c) appeared on high-risk lists for five OTs (Figure 2c). Only one high-risk plant species was in the top 20 list: the mesquite *Prosopis juliflora* (listed for five OTs; Figure 2d). Six plant species were among the top 50 species, compared to 12 terrestrial vertebrates, 21 terrestrial invertebrates, and 11 marine species (File S2).

3.2 | Comparison across OTs

Across the three impact categories, Gibraltar and Saint Helena had the most species considered to pose a high invasion risk, and St Helena had the most plant species listed among the OTs (Figure 3a). The Falkland Islands and Tristan da Cunha had more marine species listed as high risk than species from other environments. However, for the other 10 OTs, there were more terrestrial invertebrate

TABLE 2 Top 20 high-risk species across the United Kingdom Overseas Territories, for three impact categories: B = Biodiversity and ecosystems, E = Economies, and H = Human Health

Species	Taxon	Realm	# OTs	B	E	H	Pathways
Perna viridis	Mollusc	Marine	12	12	3	6	Ballast; Hull; Live; Nat; Other; Ship
Wasmannia auropunctata	Insect	Terrestrial	8	6	6	6	CNM; Container; Lug; Nat; Org; Ship; THM; Veh
Magallana gigas	Mollusc	Marine	8	4	2	4	Ballast; Hull; Nat; Other
Aedes albopictus	Insect	Terrestrial	8	0	3	8	Air; CNM; Container; Lug; Mach; Nat; Ship; THM; Veh
Mytilus galloprovincialis	Mollusc	Marine	7	6	2	1	Ballast; Hull; Nat; Other
Ceratitis capitata	Insect	Terrestrial	7	1	7	0	Con Plant; Food
Coptotermes formosanus	Insect	Terrestrial	7	0	7	0	Org; THM; TT
Tuta absoluta	Insect	Terrestrial	7	0	7	0	Con Plant; Food
Lissachatina fulica	Mollusc	Terrestrial	6	5	4	5	Con Plant; Container; Pet; Ship; THM
Psittacula krameri	Bird	Terrestrial	6	2	6	1	Nat; Pet
Bactrocera carambolae	Insect	Terrestrial	6	0	6	0	Con Plant; Food
Boa imperator	Reptile	Terrestrial	5	4	1	3	Pet
Rattus norvegicus	Mammal	Terrestrial	5	5	4	4	Container; Ship
Prosopis juliflora	Plant	Terrestrial	5	4	1	1	BZA; EC; For; Lug; Mach; Orn; Veh
Pterois miles	Fish	Marine	5	5	2	4	BZA; Nat; Pet
Aedes aegypti	Insect	Terrestrial	5	0	5	5	Air; CNM; Con Plant; Container; Lug; Mach; Ship; THM; Veh
Amblyomma cajennense	Tick	Terrestrial	5	0	3	5	Par Anim
Solenopsis invicta	Insect	Terrestrial	4	4	1	3	CNM; Container; Hort; Lug; Ship; THM; TT; Veh
Anoplolepis gracilipes	Insect	Terrestrial	4	4	0	1	CNM; Container; Lug; Ship; THM
Mytilus edulis	Mollusc	Marine	4	4	1	0	Hull; Other

Note: Numbers of OTs with species listed per impact category are shown: #OTs = number of overseas territories across all three impact categories for which a species was listed as high risk. Introduction pathways across OTs are also shown.

Introduction pathways: Air = Airplane hitchhiker; Ballast = ship ballast water; BZA = Botanic gardens/Zoos/Aquaria; CNM = Contaminant of nursery material; Con Plant = Contaminant on plants; Container = shipping containers; EC = Erosion Control; Food = Food contaminant; For = Forestry; Hull = Ship hull fouling; Live = Live food or bait; Lug = Luggage; Mach = Machinery/equipment; Nat = Natural dispersal; Org = Organic packing material; Orn = Ornamental plants/Horticulture; Other = Other intentional release; Par Anim = Parasites on animals; Pet = Pets; THM = Transportation of habitat material; Ship = hitchhiker on ship (excluding containers, ballast, hull fouling); TT = Timber trade; Veh = Vehicles.

species than other organisms listed as high risk, especially Bermuda (Figure 3a). For most OTs, the majority of high-risk species were only listed under one impact category (Figure 3b). For SGSSI, all high-risk species had a potential biodiversity and ecosystems impact, and none was listed for human health impacts (Figure 3b). Nine OTs listed species that posed a high risk for all three impact categories (Figure 3b). Across OTs, confidence scores tended to be low for biodiversity and ecosystem impact scores (Figure S1) and for marine and invertebrate species (Figure S2).

3.3 | Pathways

High-risk species were assigned pathways linked to escape from confinement for all OTs, except SGSSI, while species were assigned to unaided pathways for less than half of the OTs (Figure 4). Across all OTs, the pathway of arrival associated with the most species was shipping containers followed by ornamental plants, transport of habitat material, luggage, and vehicles (Figure 4). These pathways were commonly associated with high-risk species on Saint Helena, Ascension, Pitcairn, and Tristan da Cunha, but not for Anguilla and British Virgin Islands (Figure 4). A majority of high-risk species to Gibraltar were assigned to natural dispersal, while arrival on the hulls of boats and ships was considered the most common pathway for SGSSI (Figure 4).

Pathways varied across the four broad groups representing marine, terrestrial vertebrate, terrestrial invertebrate, and plant species (Figure S3). Across all OTs, the pathways associated with the highest number of potentially high-risk species were containers and contaminants of plants for terrestrial invertebrates (33 species each), hull fouling

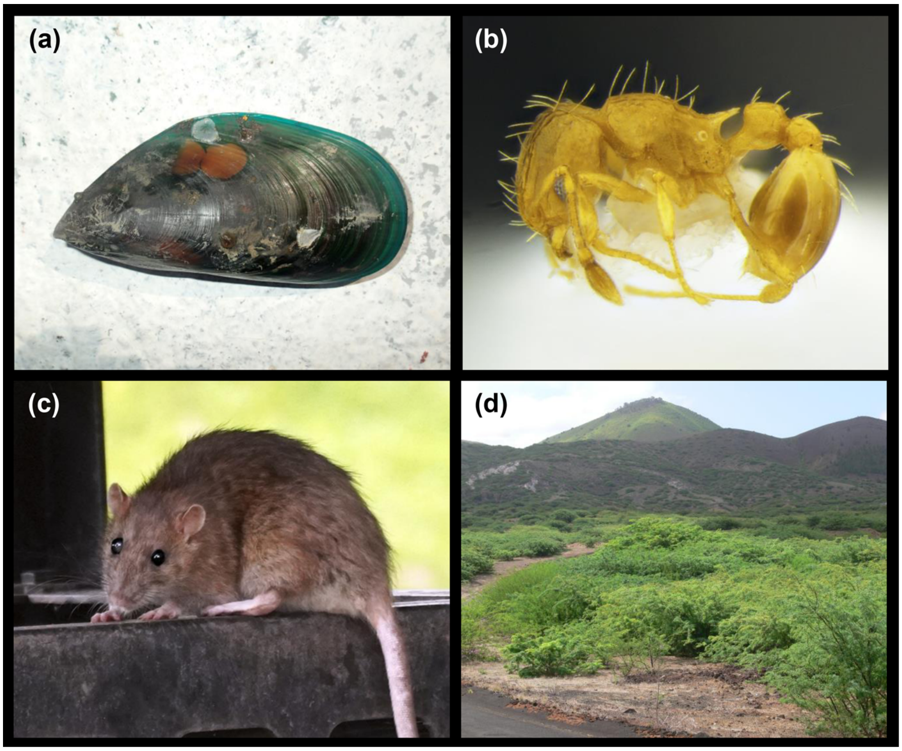

FIGURE 2 Species of highest biological invasion risk across the 14 United Kingdom Overseas Territories for each organism type: (a) *Perna viridis* (marine), (b) *Wasmannia auropunctata* (terrestrial invertebrate, (c) *Rattus norvegicus* (terrestrial vertebrate), and (d) *Prosopis juliflora* (terrestrial plant, pictured invading part of Ascension Island). Photo credits: (a) Dan Minchin, (b) Noel Tawatao, (c) Chris Malumphy, and (d) Norbert Maczey

for marine species (34 species), the ornamental plant trade for plant species (61 species), and pet trade for terrestrial vertebrates (28 species).

4 | DISCUSSION

The OTs are widely distributed around the world and represent a broad range of environmental conditions. Despite this variation, we identified a subset of INNS that posed a high risk to multiple OTs, including mostly invertebrates. These high-risk species are known to be invasive in many regions across the globe and will likely pose a threat to other islands and regions where they have yet to be introduced, and where environments and transport connections are similar to the OTs. The Asian green mussel was considered high risk for 12 OTs. This marine bivalve mollusc is spread via ballast water and ship hulls and forms dense colonies that clog power plant infrastructure (Rajagopal et al., 1997), reduce phytoplankton abundance, and outcompete other marine sedentary species (Baker et al., 2012). The little fire ant, the Pacific oyster, and the Asian tiger mosquito (*Aedes albopictus*) were listed as high risk for eight OTs. The little fire ant is an aggressive, stinging insect that has caused declines in native invertebrate and reptile abundance, and has negative impacts on agriculture and human well-being (Wetterer & Porter, 2003). The Pacific oyster can outcompete native marine species for food and space (Gutierrez et al., 2003) and transfer parasites, pathogens, and pest species (Galil & Zenetos, 2002). The Asian tiger mosquito is likely to have human health and economic impacts, as an aggressive day-time biter of people and livestock, and a human disease-agent vector (Eritja et al., 2005). The brown rat is a notorious invasive non-native vertebrate predator on islands (Drake & Hunt, 2009) and vector of disease agents (Costa et al., 2015). The mesquite tree was the only plant in the list of top-20 species. *Prosopis* species have been widely introduced globally and mesquite is a well-known invader in many tropical regions including Ascension (Varnham, 2006), and has well-documented negative impacts on biodiversity and economies (Shackleton et al., 2014). As a nitrogen fixing tree, *Prosopis* has the potential to alter nutrient cycling and transform vegetation.

While the species above pose a high risk to multiple territories, most species in the top-20 list pose a risk to only a few OTs each, especially for biodiversity and ecosystems and for plant species. While 1886 plant species were on the initial longlists, only 71 species made it onto high-risk

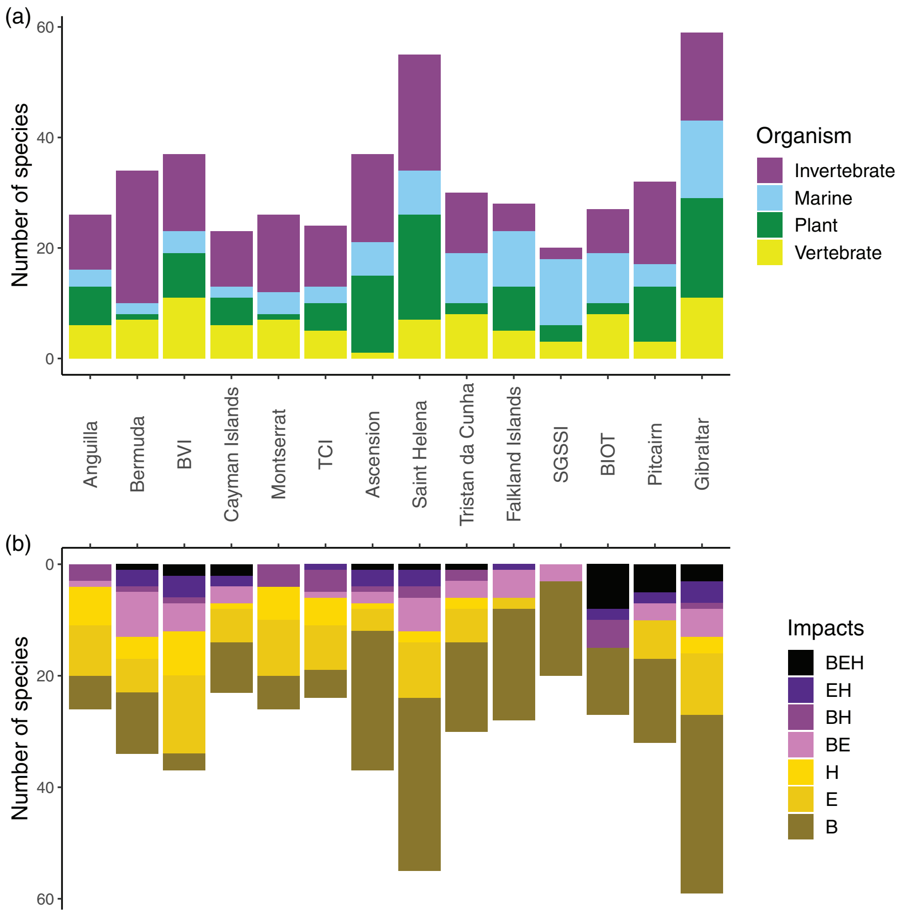

FIGURE 3 (a) The number of high-risk non-native species per organism type (terrestrial: plant, invertebrate, vertebrate; marine), across all impact categories for each United Kingdom Overseas Territories. (b) Number of species per Overseas Territories considered high risk for 1, 2, or all 3 impact categories (B = Biodiversity and Ecosystems, E = Economies, and H = Human Health). BVI, British Virgin Islands; TCI, Turks & Caicos Islands; SGSSI, South Georgia and the South Sandwich Islands; BIOT, British Indian Ocean Territory

lists across OTs. Many longlist invasive non-native plant species are already present on at least some OTs (Varnham, 2006), and climatic conditions would strongly determine which plant species are likely to be introduced and become established where currently absent.

Past experience and present perspectives might also help to shape horizon scanning outcomes. Plants were well represented among high-risk species for St Helena, where the vegetation is dominated by invasive non-native plants (Varnham, 2006). Bermuda was the only OT with invertebrates forming most high-risk species (Figure 3), where non-native scale insects devastated the endemic Bermuda Cedar, *Juniperus bermudiana* (Challinor & Wingate, 1971). The OTs also varied considerably in the number of high-risk marine species, which were broadly more numerous on high-risk lists for non-Caribbean OTs compared with Caribbean OTs (Figure S3). This may reflect environmental and economic concerns; SGSSI, British Indian Ocean Territory, and the Falkland Islands have marine ecosystems of international conservation importance while often supporting fisheries (Koldewey et al., 2010). Moreover, oceanic and south Atlantic OTs are vulnerable to introductions via international shipping and fishing boats, while Caribbean islands may be visited by smaller boats remaining within the region, have fewer vulnerable marine and coastal habitats, and have fewer perceived pathways for marine INNS introductions. For island states in general, we recommend detailed assessment of the types and origins of boat traffic they receive, in order to determine the most risky marine INNS and pathways.

Biosecurity approaches can be implemented across common pathways of potential introduction shared by many INNS. The high-risk pathways identified for OTs are dominated by those associated with transportation as stowaway (i.e., unintentional introductions), including shipping containers, transport of habitat material, luggage, and vehicles (Figure 4). These pathways are of major importance for many small-island economies that are particularly dependent on sea trade and transport (alongside aviation), for importation of goods, travel by residents, and tourism

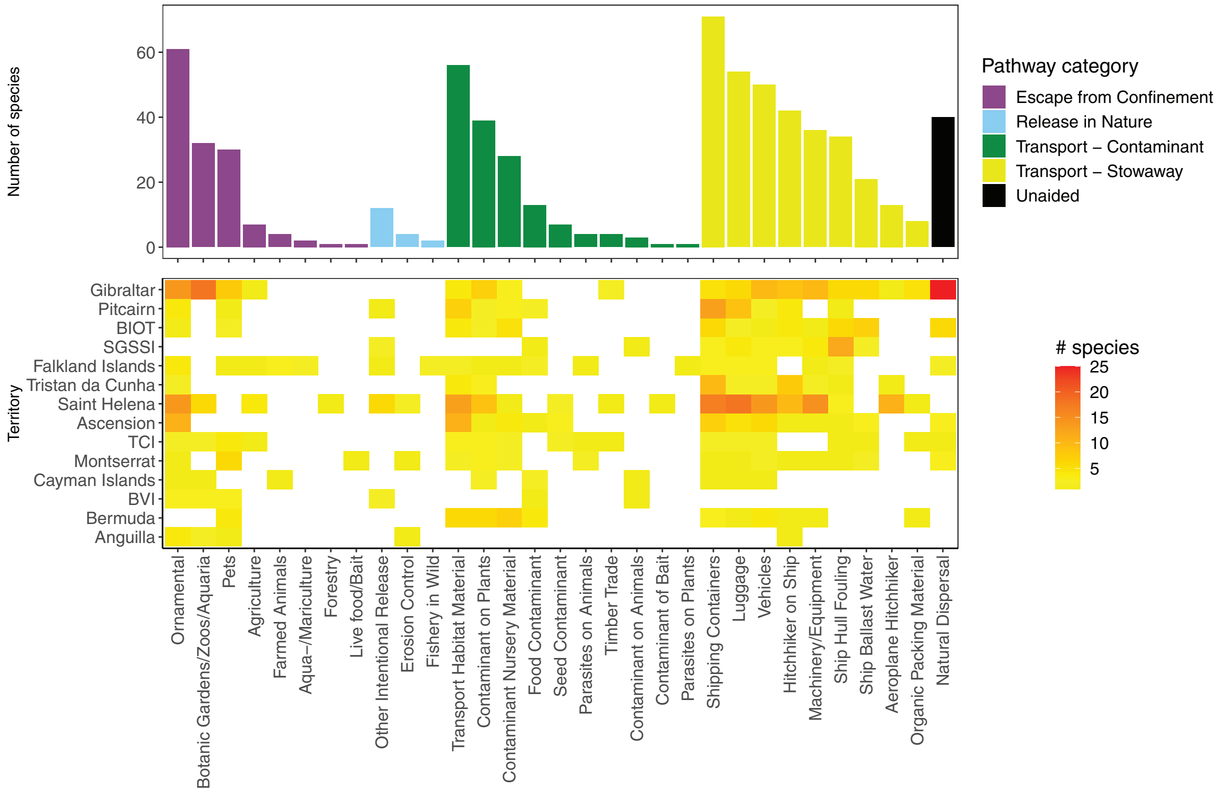

FIGURE 4 The total number of high-risk non-native species across all United Kingdom Overseas Territories (bar chart), and for each Territory separately (heat plot), that are associated with specific pathways of potential introduction. Bar chart colors indicate pathway categories. Territories ordered according to geographic clusters as in Table 1

(Russell et al., 2017). Hitchhiking on air travel was not considered a pathway for many species and OTs, but luggage (including people and their belongings on flights as well as boats) was recognized as a pathway for multiple plant and invertebrate species in most OTs (Figure S3). Among OTs, peninsular Gibraltar is an exception, being vulnerable to arrivals from captive plant and animal escapees and natural dispersal of non-native species from elsewhere in the Mediterranean (Katsanevakis et al., 2014) (Figure 4). The ornamental plant trade is obviously important for plant introductions generally, while the pet trade was identified as an introduction pathway for many vertebrate species in the Caribbean (Figure S3) and hull fouling for marine INNS in non-Caribbean OTs (Figure S3). These differences suggest that despite commonalities among locations, pathways are not uniformly relevant, and each location will require a subtly different biosecurity strategy to prevent introductions of INNS identified.

Delivering practical outcomes from horizon scanning necessitates imposing a time limit for the potential to arrive and establish. There may be a cost to having a longer timeframe than 10 years, because resulting biosecurity efforts might be more thinly spread over a greater number of species that make it onto a priority list, including species that pose a lower risk of arrival, establishment, and impact than others in the short term. However, invasion dynamics can play out over variable timescales in the face of global environmental change (Bonebrake et al., 2019). Horizon scanning also relies heavily on knowledge of species' introduction and invasion history elsewhere, while INNS with no known invasion history are increasing (Seebens et al., 2018). Accounting for these uncertainties could involve scoring under different scenarios of future climate suitability for each INNS (Pertierra et al., 2019), socioeconomic developments (Roura-Pascual et al., 2021), and using information on invasion history and ecological traits of known close relatives. However, future climate projections are currently too coarse in scale to be reliably applied to small areas such as the OTs (Baker et al., 2016), though regional projection may still be useful. Ultimately, horizon scanning should not be treated as a static, single-event process; we recommend it is repeated every 5–10 years, so that new information and potential INNS emerging over a longer timeframe can be considered. This may be particularly important for invasive non-native woody plant species with long generation times (Downey & Richardson, 2016).

Overall, horizon scanning provides a simple, consensus-driven approach to assess imminent biological invasion risks. This horizon scanning study provides a working guide for OTs to develop and implement new and existing policies aimed at preventing introduction of high-risk species. Ongoing biosecurity surveillance can be focused on key introduction pathways, and OT authorities now have the option to subject the high-risk species we have identified to full risk assessments and build them into existing biosecurity legislation. Knowledge exchange among a diverse group of experts from around the world is critical to underpinning a robust elicitation process (Roy et al., 2020), and perspectives of experts from within the OT communities were vital. We recommend that any assessment and prioritization process like horizon scanning should involve local experts and end-users throughout. Our high-risk species lists and identified pathways provide a foundation for the development of detailed pathway action plans for each OT. Many OTs and other small island states globally will have similar trade and transport links, and sometimes similar environmental conditions. Thus, it is likely that the high-risk species and pathways identified in this study will be relevant for many regions similar to the OTs. Undertaking horizon scanning exercises could assist other island communities to better target biosecurity and prevent future biological invasions, thereby helping to conserve their unique biodiversity and environments.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available in the Supporting Information.

ORCID

Wayne Dawson https://orcid.org/0000-0003-3402-0774
Tim Adriaens https://orcid.org/0000-0001-7268-4200
Emili García-Berthou https://orcid.org/0000-0001-8412-741X
Victoria Werenkaut https://orcid.org/0000-0003-2417-3953
Helen E. Roy https://orcid.org/0000-0001-6050-679X

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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