

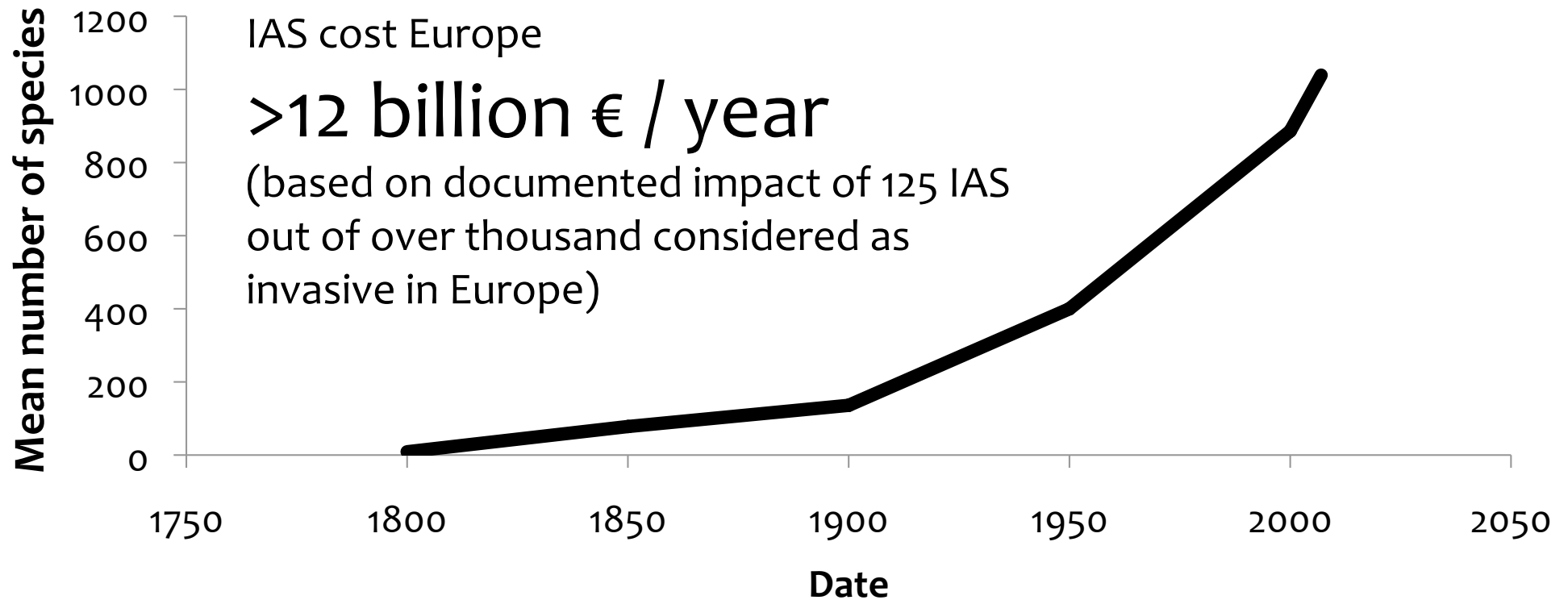
# Biological invasions: a major environmental & societal challenge calling for research across borders

Helen Roy

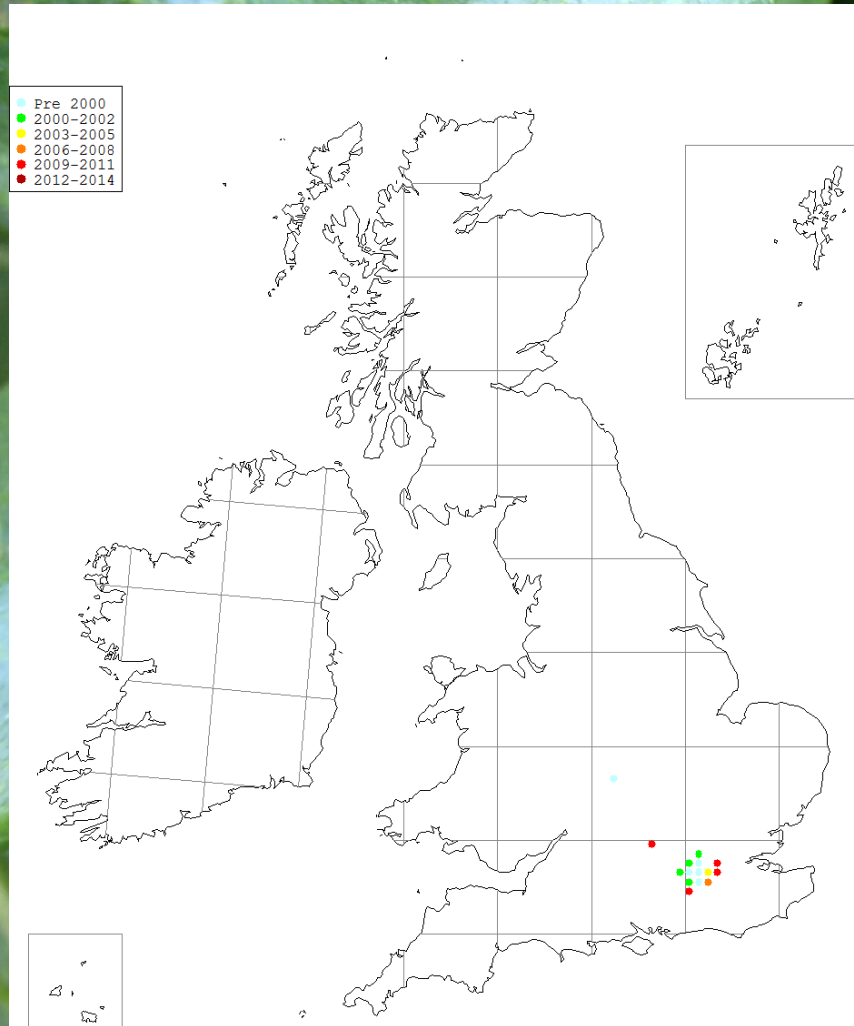


# Invasive Alien Species in Europe

**The problem:** rate of invasion of alien species is increasing, and so are the associated costs to society, the economy and biological diversity



# The good – bryony ladybird



*Henosepilachna argus*



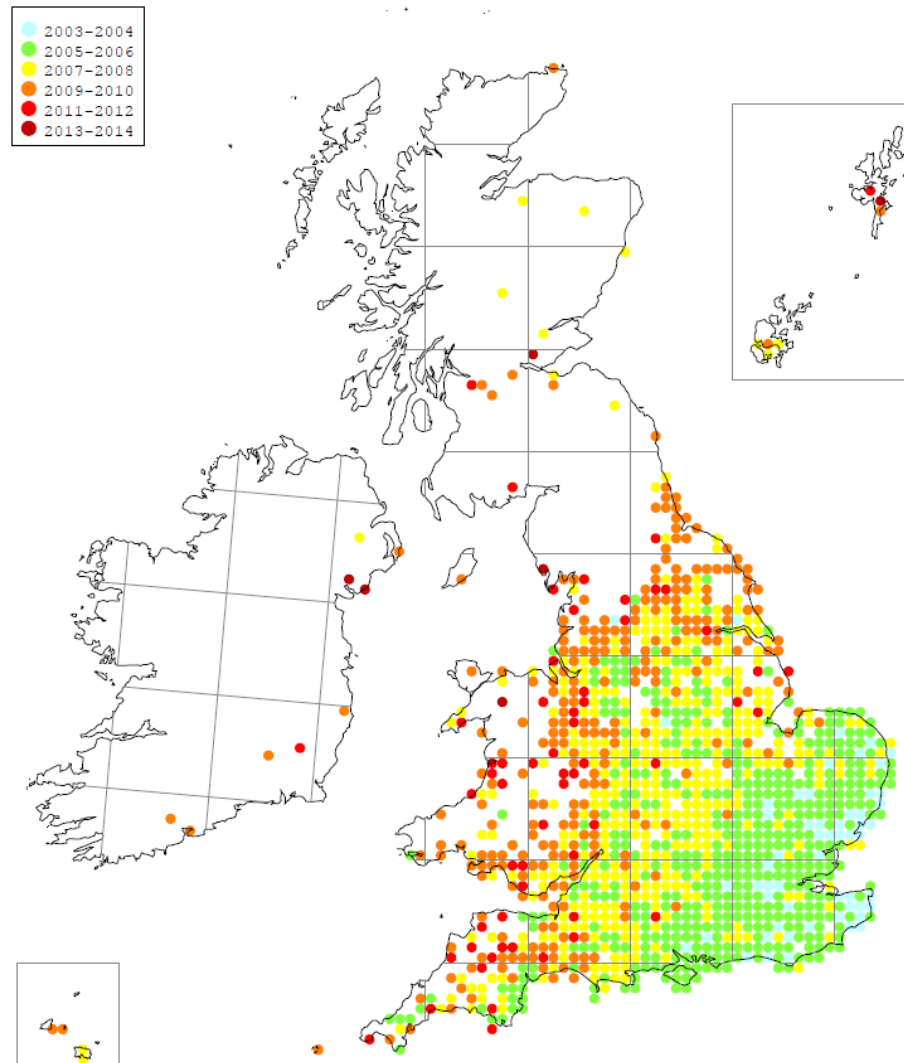
# The bad – killer shrimp



*Dikerogammarus villosus*  
Environment Agency



# The bad – Harlequin ladybird

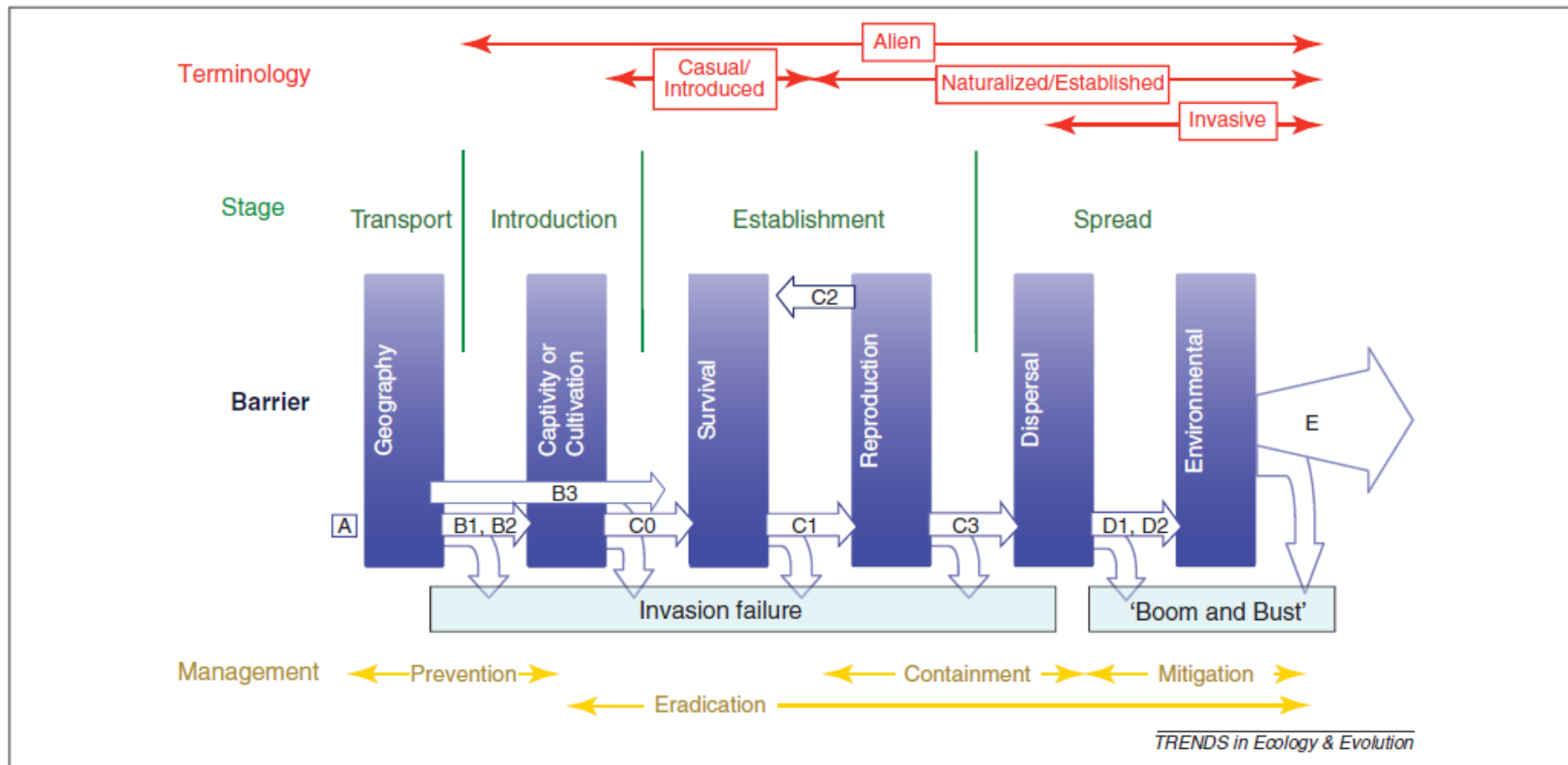


*Harmonia axyridis*

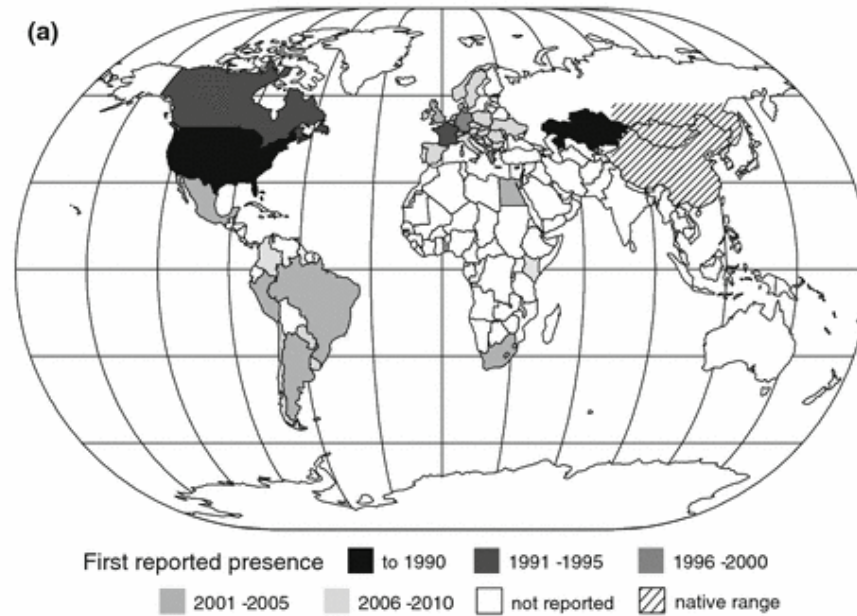
# Understanding invasions

Opinion

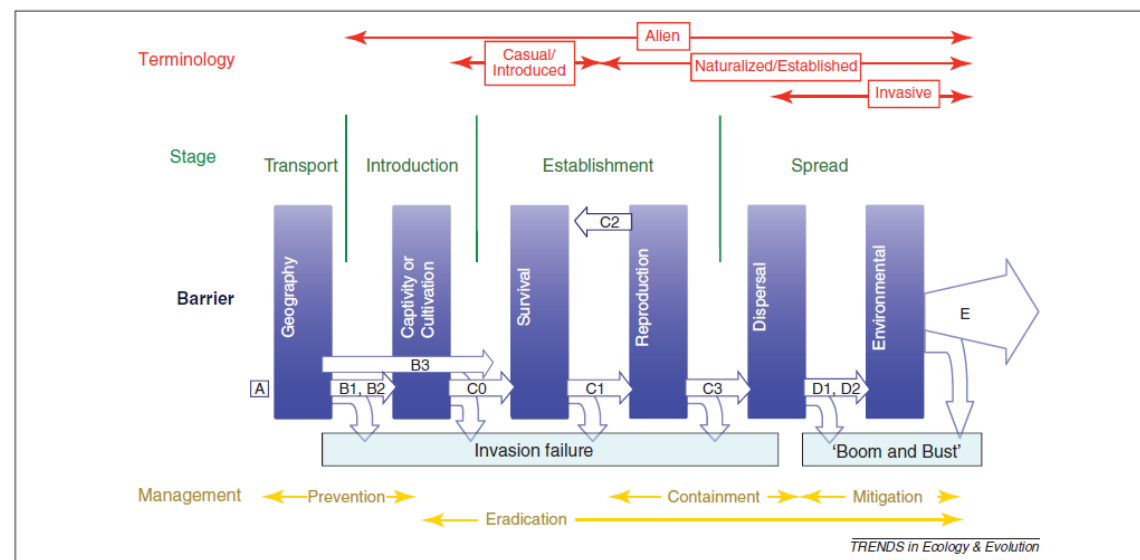
*Trends in Ecology and Evolution* July 2011, Vol. 26, No. 7



# Global invasion by *Harmonia axyridis*



Brown et al. (2011) *BioControl*





# A ladybird perspective



Jennifer Lewington



# *Harmonia axyridis*

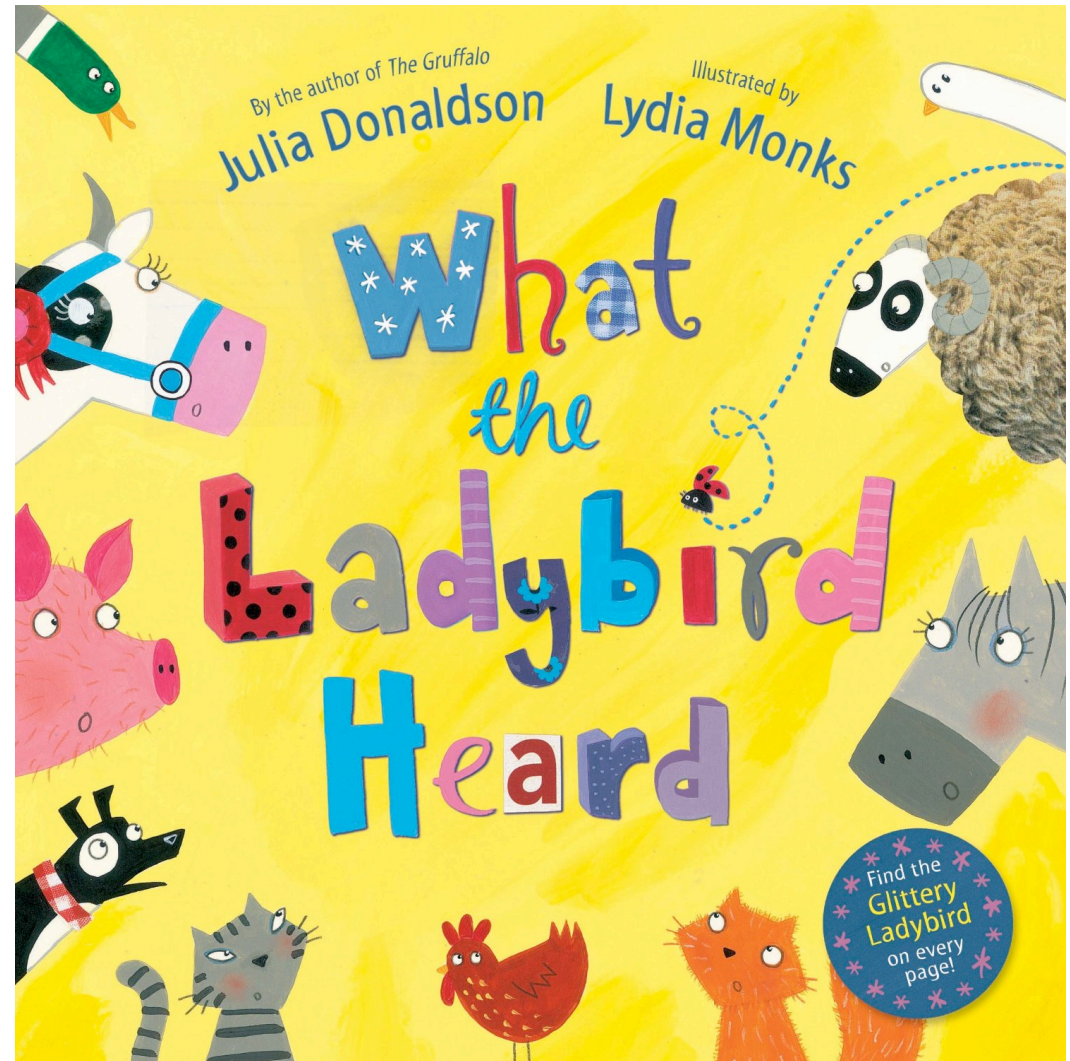
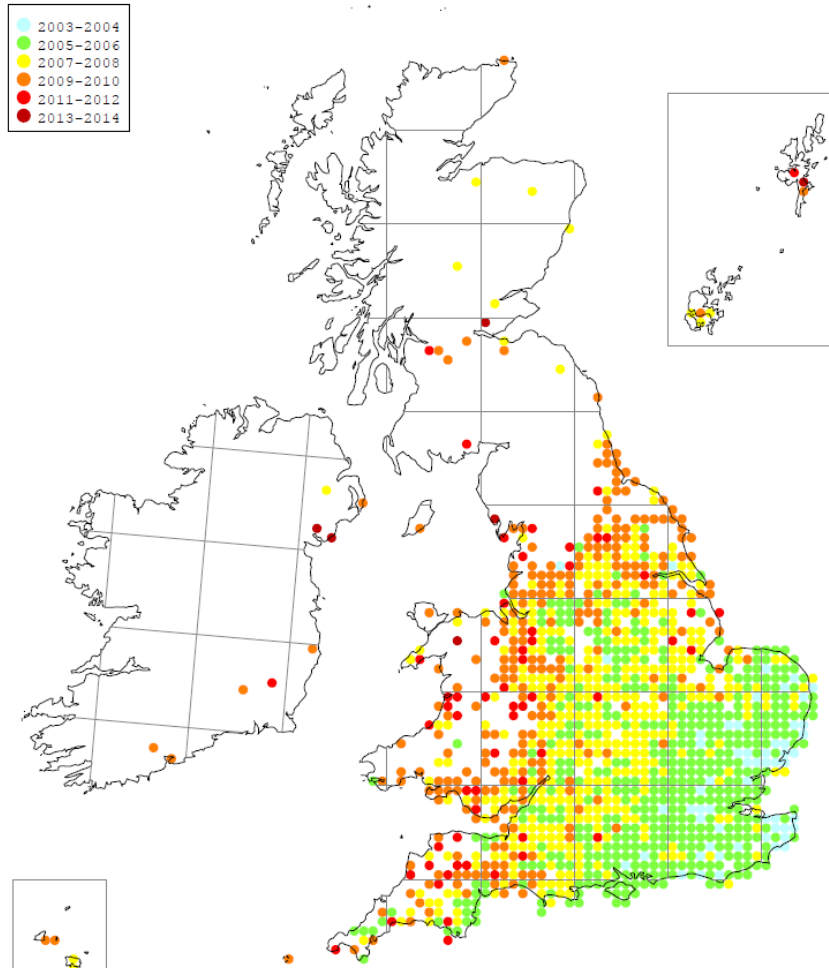


## **“The Ladybird has Landed!”**

A new ladybird has arrived in Britain. But not just any ladybird: this is *Harmonia axyridis*, the most invasive ladybird on Earth.”

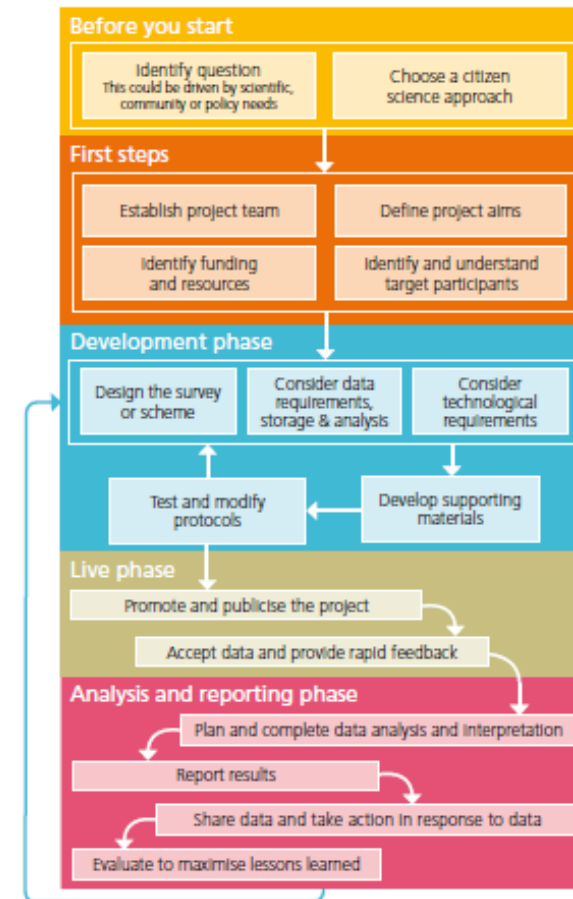
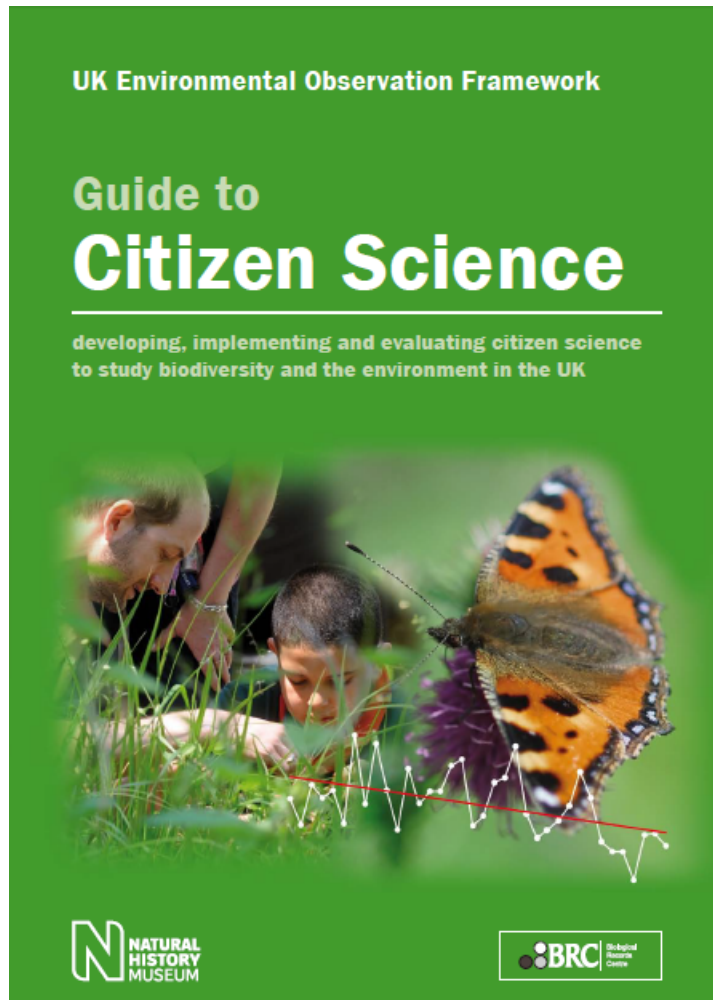
Press Release  
5<sup>th</sup> October 2004

# Importance of communication





# Citizen science perspectives





More than 50 000 records received by  
the UK Ladybird Survey





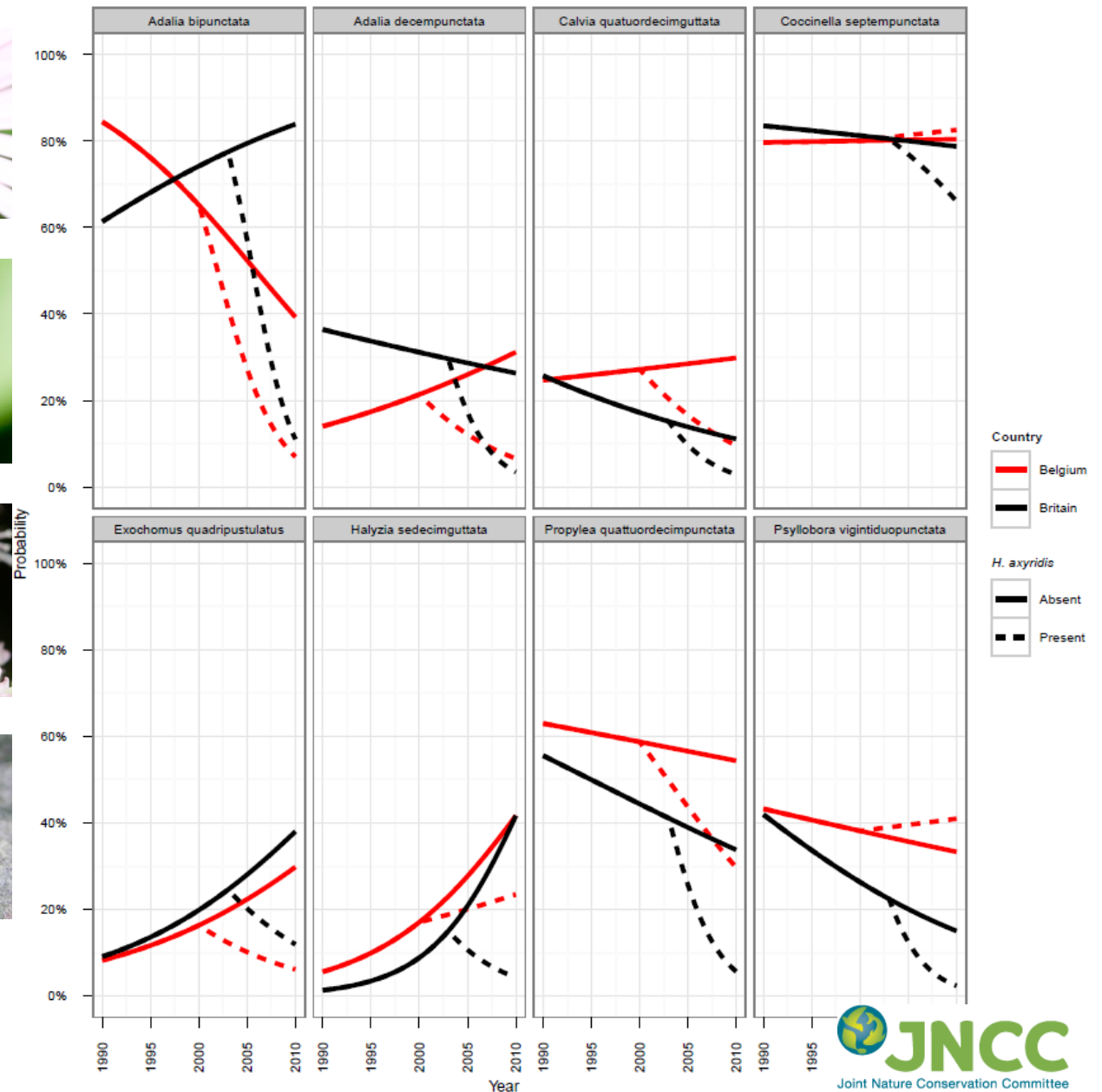
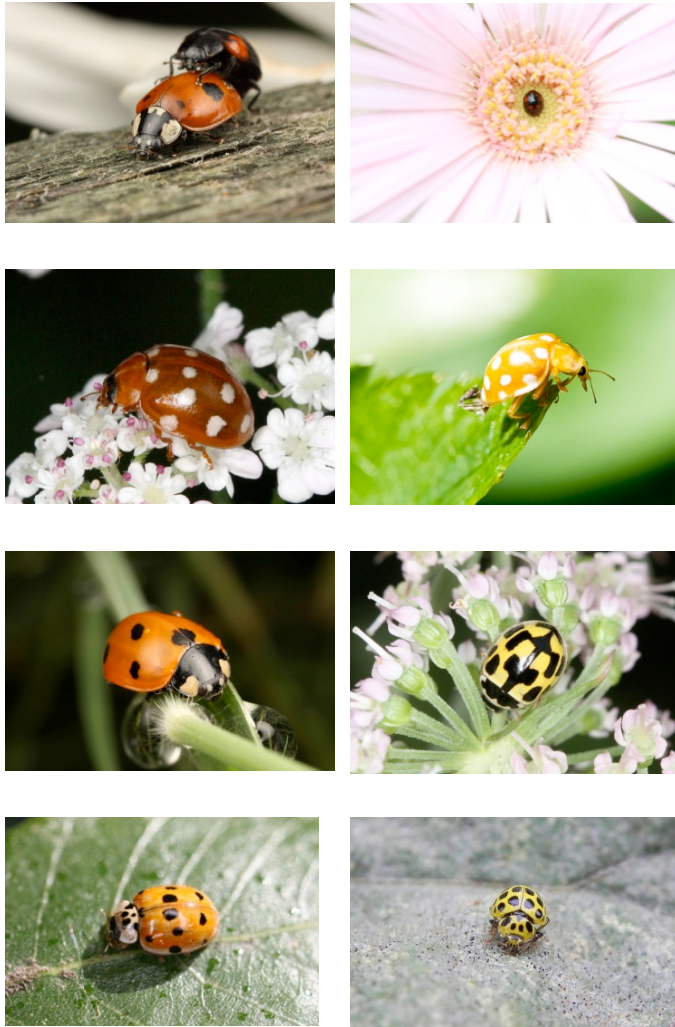
# One winner, one thousand losers



Majerus, M.E.N. et al. (2006) *Ecological Entomology*



# Declines in native ladybirds



# Linking trends with traits, climate and habitat



Biol Invasions  
DOI 10.1007/s10530-013-0628-3

ORIGINAL PAPER

## Ecological correlates of local extinction and colonisation in the British ladybird beetles (Coleoptera: Coccinellidae)

Richard F. Comont · Helen E. Roy ·  
Richard Harrington · Christopher R. Shortall ·  
Bethan V. Purse



# Escape from natural enemies

*Insect Conservation and Diversity* (2013) doi: 10.1111/ica.12060

## Escape from parasitism by the invasive alien ladybird, *Harmonia axyridis*

RICHARD F. COMONT,<sup>1,2</sup> BETHAN V. PURSE,<sup>1</sup> WILLIAM PHILLIPS,<sup>3</sup> WILLIAM E. KUNIN,<sup>4</sup> MATTHEW HANSON,<sup>4</sup> OWEN T. LEWIS,<sup>2</sup> RICHARD HARRINGTON,<sup>5</sup> CHRISTOPHER R. SHORTALL,<sup>5</sup> GABRIELE RONDONI<sup>6</sup> and HELEN E. ROY<sup>1</sup>  
<sup>1</sup>NERC Centre for Ecology & Hydrology, Oxfordshire, UK,  
<sup>2</sup>Department of Zoology, University of Oxford, Oxford, UK, <sup>3</sup>4 Archer Close, Gorse Meadow, Loughborough, UK,  
<sup>4</sup>School of Biology, Faculty of Biological Sciences, University of Leeds, Leeds, UK, <sup>5</sup>Rothamsted Insect Survey, Department of AgroEcology, Rothamsted Research, Harpenden, UK and <sup>6</sup>Department of Agricultural and Environmental Sciences, University of Perugia, Perugia, Italy

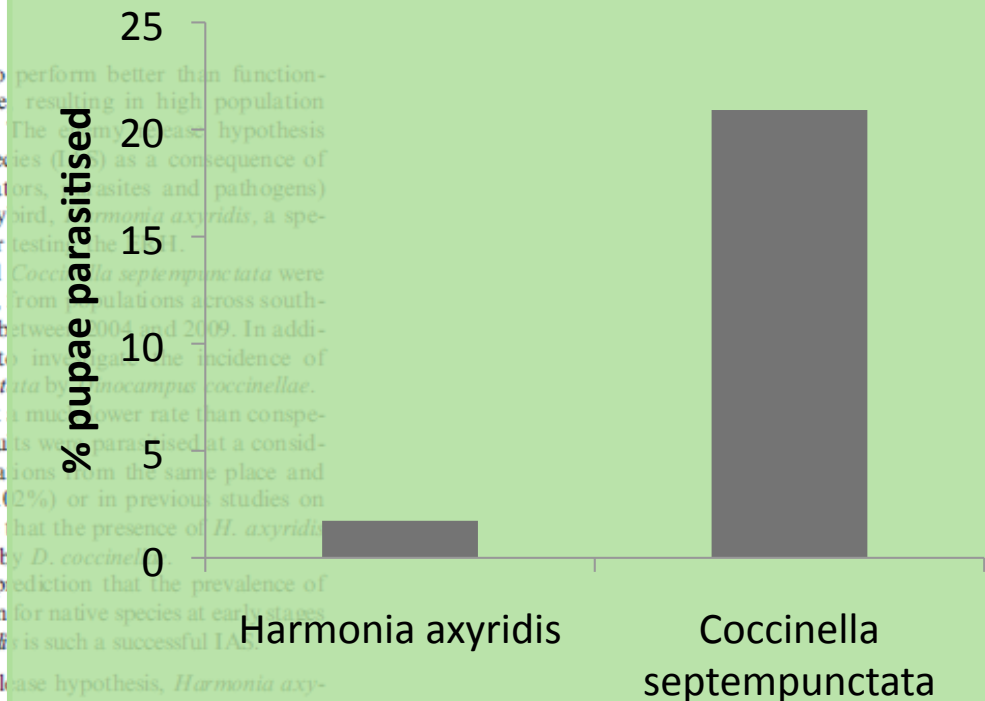
**Abstract.** 1. Alien species are often reported to perform better than functionally similar species native to the invaded range, resulting in high population densities, and a tendency to become invasive. The enemy release hypothesis (ERH) explains the success of invasive alien species as a consequence of reduced mortality from natural enemies (predators, parasites and pathogens) compared with native species. The harlequin ladybird, *Harmonia axyridis*, a species alien to Britain, provides a model system for testing the ERH.

2. Pupae of *H. axyridis* and the native ladybird *Coccinella septempunctata* were monitored for parasitism between 2008 and 2011, from populations across southern England in areas first invaded by *H. axyridis* between 2004 and 2009. In addition, a semi-field experiment was established to investigate the incidence of parasitism of adult *H. axyridis* and *C. septempunctata* by *Anisotoma coccinellae*.

3. *Harmonia axyridis* pupae were parasitised at a much lower rate than conspecifics in the native range, and both pupae and adults were parasitised at a considerably lower rate than *C. septempunctata* populations from the same place and time (*H. axyridis*: 1.67%; *C. septempunctata*: 18.02%) or in previous studies on Asian *H. axyridis* (2–7%). We found no evidence that the presence of *H. axyridis* affected the parasitism rate of *C. septempunctata*.

4. Our results are consistent with the general prediction that the prevalence of natural enemies is lower for introduced species than for native species at early stages of invasion. This may partly explain why *H. axyridis* is such a successful IAS.

**Key words.** *Coccinella septempunctata*, enemy release hypothesis, *Harmonia axyridis*, invasive alien species, native species, natural enemies.





Does colour form influence spread?



Colour morphs spread to similar extents though increased sunshine significantly enhanced the spread of form *succinea*

# Invasive alien species lists

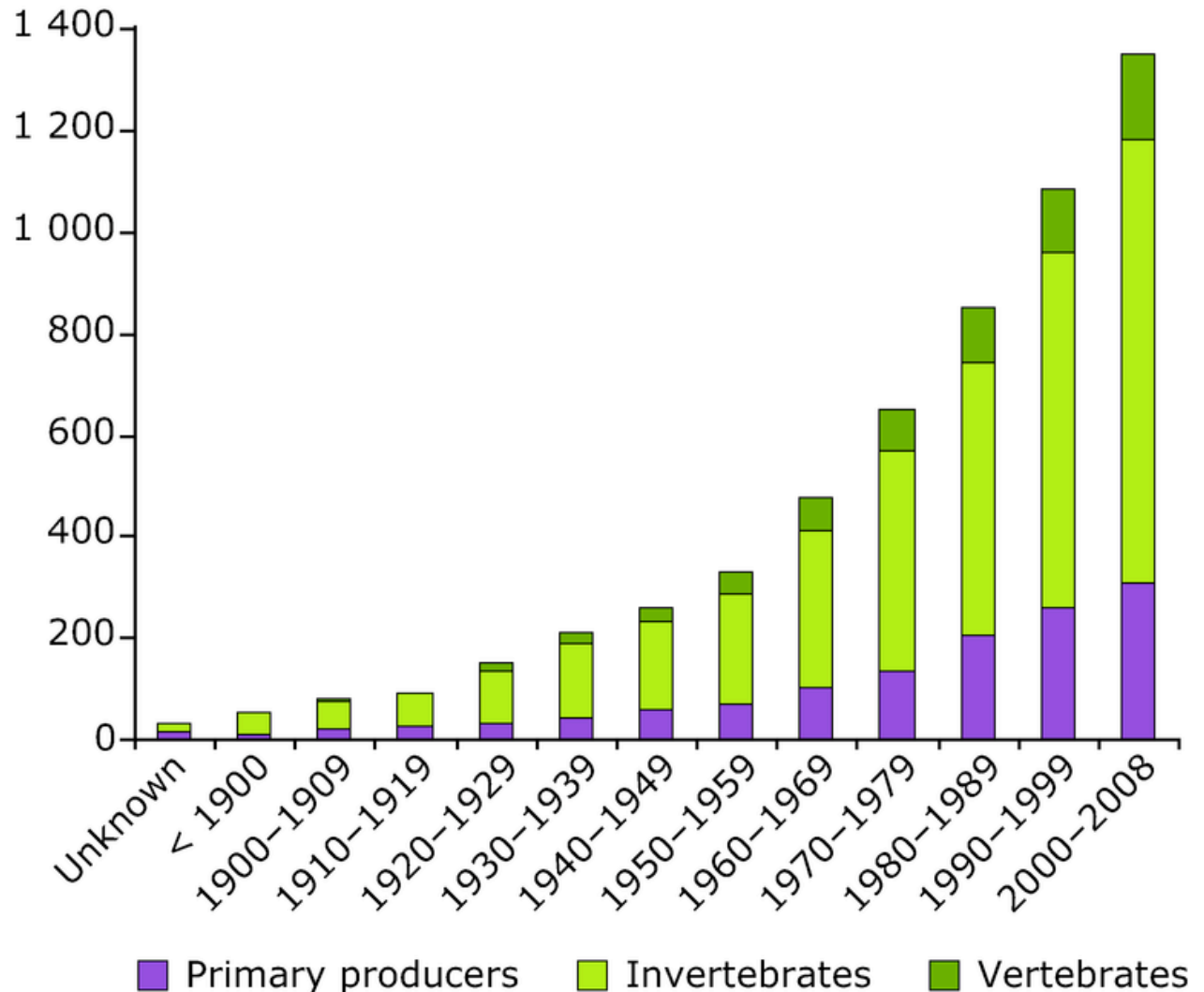
- Lists of NNS are seen as an essential tool in the management of biological invasions
  - increased understanding particularly in relation to pathways of arrival and impacts on biodiversity
  - implementation of policy and legislation is often based on NNS lists
  - early warning, prevention and control measures for INNS rely on information such as identity, associated biology and distribution

# Alien species in European marine waters

Data sources:

SEBI 2010 Expert Group on invasive alien species, based on national data sets (Belgium, Denmark, Germany, Malta and the **United Kingdom**) available online; review papers (Netherlands and Turkey); NEMO database for the Baltic; Black Sea database; HCMR data base for the Mediterranean; project reports (ALIENS, **DAISIE**); and the contributions of experts from France, Spain and Russia made during a dedicated workshop.

Cumulative number of species







© Sergej Olenin

» ***Crepidula fornicata***

one of the 100 worst alien species in Europe,  
click [here](#) to see the full list.

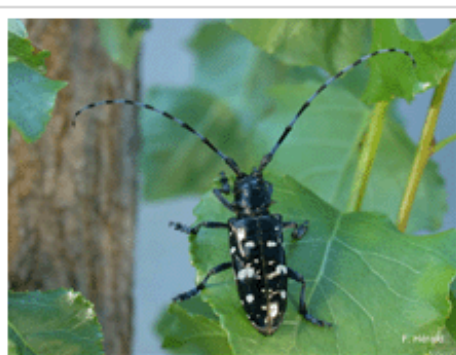
## Delivering Alien Invasive Species Inventories for Europe

Biological invasions by non-native or 'alien' species are one of the greatest threats to the ecological and economic well-being of the planet. Alien species can act as vectors for new diseases, alter ecosystem processes, change biodiversity, disrupt cultural landscapes, reduce the value of land and water for human activities and cause other socio-economic consequences for man.

To help those tackling the invasive species challenge, this website provides a 'one-stop-shop' for information on biological invasions in Europe. Please note that the DAISIE database behind this website is continually being updated. Read [more about DAISIE](#).

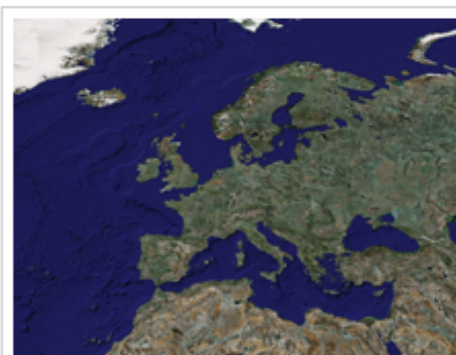
**DAISIE Handbook of alien species in Europe available**

### Search Species



Search for information on one of the 12046  
alien species occurring in Europe.

### Search Regions



Search regions to explore the alien species  
threats across Europe, for 81 inland and 57  
coastal and marine areas.

### Search Experts



Search for one of the 2530 experts on  
biological invasions in Europe

# Geographical and taxonomic biases in invasion ecology

Petr Pyšek<sup>1,2</sup>, David M. Richardson<sup>3</sup>, Jan Pergl<sup>1</sup>, Vojtěch Jarošík<sup>1,2</sup>, Zuzana Sixtová<sup>1</sup> and Ewald Weber<sup>4</sup>

INAS

## Disentangling the role of environmental and human pressures on biological invasions across Europe

Petr Pyšek<sup>a,b,1</sup>, Vojtěch Jarošík<sup>a,b</sup>, Philip E. Hulme<sup>c</sup>, Ingolf Kühn<sup>d</sup>, Jan Wild<sup>a</sup>, Margarita Arianoutsou<sup>e</sup>, Sven Bacher<sup>f</sup>, François Chiron<sup>g</sup>, Viktoras Didžiulis<sup>h</sup>, Franz Essl<sup>i</sup>, Piero Genovesi<sup>j</sup>, Francesca Gherardi<sup>k</sup>, Martin Hejda<sup>a</sup>, Salit Kark<sup>l</sup>, Philip W. Lambdon<sup>m</sup>, Marie-Laure Desprez-Loustau<sup>n</sup>, Wolfgang Nentwig<sup>o</sup>, Jan Pergl<sup>1</sup>, Katja Pöhlisch<sup>p</sup>, Wolfgang Rabitsch<sup>q</sup>, Alain Roques<sup>r</sup>, David B. Roy<sup>s</sup>, Susan Shirley<sup>t</sup>, Wojciech Solarz<sup>u</sup>, Montserrat Vilà<sup>v</sup>, and Marten Winter<sup>d,f</sup>

S

## Socioeconomic legacy yields an invasion debt

Franz Essl<sup>a,b,1</sup>, Stefan Dullinger<sup>c,d,1,2</sup>, Wolfgang Rabitsch<sup>a</sup>, Philip E. Hulme<sup>b</sup>, Karl Hülber<sup>c,d</sup>, Vojtěch Jarošík<sup>e,f</sup>, Ingrid Kleinbauer<sup>c</sup>, Fridolin Krausmann<sup>g</sup>, Ingolf Kühn<sup>h</sup>, Wolfgang Nentwig<sup>i</sup>, Montserrat Vilà<sup>j</sup>, Piero Genovesi<sup>k</sup>, Francesca Gherardi<sup>l</sup>, Marie-Laure Desprez-Loustau<sup>m</sup>, Alain Roques<sup>n</sup>, and Petr Pyšek<sup>e,f</sup>

## ECOLOGY LETTERS

Ecology Letters, (2011) 14: 702–708

doi: 10.1111/j.1461-0248.2011.01628.x

### REVIEW AND SYNTHESIS

Ecological impacts of invasive alien plants: a meta-analysis of their effects on species, communities and ecosystems

#### Abstract

Montserrat Vilà<sup>1,\*</sup>, José L. Espinar<sup>1</sup>, Martin Hejda<sup>2</sup>, Philip E. Hulme<sup>3</sup>, Vojtěch Jarošík<sup>2,4</sup>, John L. Maron<sup>5</sup>, Jan Pergl<sup>2,6</sup>, Urs Schaffner<sup>7</sup>, Yan Sun<sup>7</sup> and Petr Pyšek<sup>2,4</sup>

Biological invasions cause ecological and economic impacts across the globe. However, it is unclear whether there are strong patterns in terms of their major effects, how the vulnerability of different ecosystems varies and which ecosystem services are at greatest risk. We present a global meta-analysis of 199 articles reporting 1041 field studies that in total describe the impacts of 135 alien plant taxa on resident species, communities and ecosystems. Across studies, alien plants had a significant effect in 11 of 24 different types of impact assessed. The magnitude and direction of the impact varied both within and between different types of impact.

## Global Change Biology

Global Change Biology (2012) 18, 1725–1737, doi: 10.1111/j.1365-2486.2011.02636.x

## A global assessment of invasive plant impacts on resident species, communities and ecosystems: the interaction of impact measures, invading species' traits and environment

PETR PYŠEK<sup>\*†‡</sup>, VOJTĚCH JAROŠÍK<sup>\*†‡</sup>, PHILIP E. HULME<sup>‡</sup>, JAN PERGL<sup>\*§</sup>, MARTIN HEJDA<sup>\*</sup>, URS SCHAFFNER<sup>¶</sup> and MONTSERRAT VILÀ<sup>||</sup>

### RESEARCH PAPER



## Contrasting patterns in the invasions of European terrestrial and freshwater habitats by alien plants, insects and vertebrates

Petr Pyšek<sup>1,2\*</sup>, Sven Bacher<sup>3</sup>, Milan Chytrý<sup>4</sup>, Vojtěch Jarošík<sup>1,2</sup>, Jan Wild<sup>1</sup>, Laura Celesti-Grapo<sup>5</sup>, Núria Gassó<sup>6</sup>, Marc Kenis<sup>7</sup>, Philip W. Lambdon<sup>4</sup>, Wolfgang Nentwig<sup>8</sup>, Jan Pergl<sup>1</sup>, Alain Roques<sup>10</sup>, Jiří Šádlo<sup>1</sup>, Wojciech Solarz<sup>11</sup>, Montserrat Vilà<sup>12</sup> and Philip E. Hulme<sup>13</sup>

### REVIEWS REVIEWS REVIEWS

## How well do we understand the impacts of alien species on ecosystem services? A pan-European, cross-taxa assessment

Montserrat Vilà<sup>1\*</sup>, Corina Basnou<sup>2</sup>, Petr Pyšek<sup>3</sup>, Melanie Josefsson<sup>4</sup>, Piero Genovesi<sup>5</sup>, Stephan Gollasch<sup>6</sup>, Wolfgang Nentwig<sup>7</sup>, Sergej Olenin<sup>8</sup>, Alain Roques<sup>9</sup>, David Roy<sup>10</sup>, Philip E. Hulme<sup>11</sup>, and DAISIE partners<sup>12</sup>

INAS

## Plant extinctions and introductions lead to phylogenetic and taxonomic homogenization of the European flora

Marten Winter<sup>a,b,1</sup>, Oliver Schweiger<sup>a</sup>, Stefan Klotz<sup>a</sup>, Wolfgang Nentwig<sup>c</sup>, Pavlos Andriopoulos<sup>d</sup>, Margarita Arianoutsou<sup>d</sup>, Corina Basnou<sup>e</sup>, Pinelopi Delipetrou<sup>f</sup>, Viktoras Didžiulis<sup>g</sup>, Martin Hejda<sup>a</sup>, Philip E. Hulme<sup>h</sup>, Philip W. Lambdon<sup>i</sup>, Jan Pergl<sup>h</sup>, Petr Pyšek<sup>h,k</sup>, David B. Roy<sup>l</sup>, and Ingolf Kühn<sup>a</sup>

Preslia 80: 101–149, 2008

101

## Alien flora of Europe: species diversity, temporal trends, geographical patterns and research needs

Zavlečená flóra Evropy: druhová diverzita, časové trendy, zákonitosti geografického rozšíření a oblasti budoucího výzkumu

Philip W. Lambdon<sup>1,2\*</sup>, Petr Pyšek<sup>3,4\*</sup>, Corina Basnou<sup>5</sup>, Martin Hejda<sup>3,4</sup>, Margarita Arianoutsou<sup>6</sup>, Franz Essl<sup>7</sup>, Vojtěch Jarošík<sup>4,3</sup>, Jan Pergl<sup>13</sup>, Marten Winter<sup>8</sup>, Paulina Anastasiu<sup>9</sup>, Pavlos Andriopoulos<sup>6</sup>, Ioannis Bazos<sup>6</sup>, Giuseppe Brundu<sup>10</sup>, Laura Celesti-Grapo<sup>11</sup>, Philippe Chassot<sup>12</sup>, Pinelopi Delipetrou<sup>13</sup>, Melanie Josefsson<sup>14</sup>, Salit Kark<sup>15</sup>, Stefan Klotz<sup>8</sup>, Yannis Kokkoris<sup>6</sup>, Ingolf Kühn<sup>8</sup>, Hélia Marchante<sup>16</sup>, Irena Perglova<sup>3</sup>, Joan Pino<sup>5</sup>, Montserrat Vilà<sup>17</sup>, Andreas Zikos<sup>6</sup>, David Roy<sup>1</sup> & Philip E. Hulme<sup>18</sup>



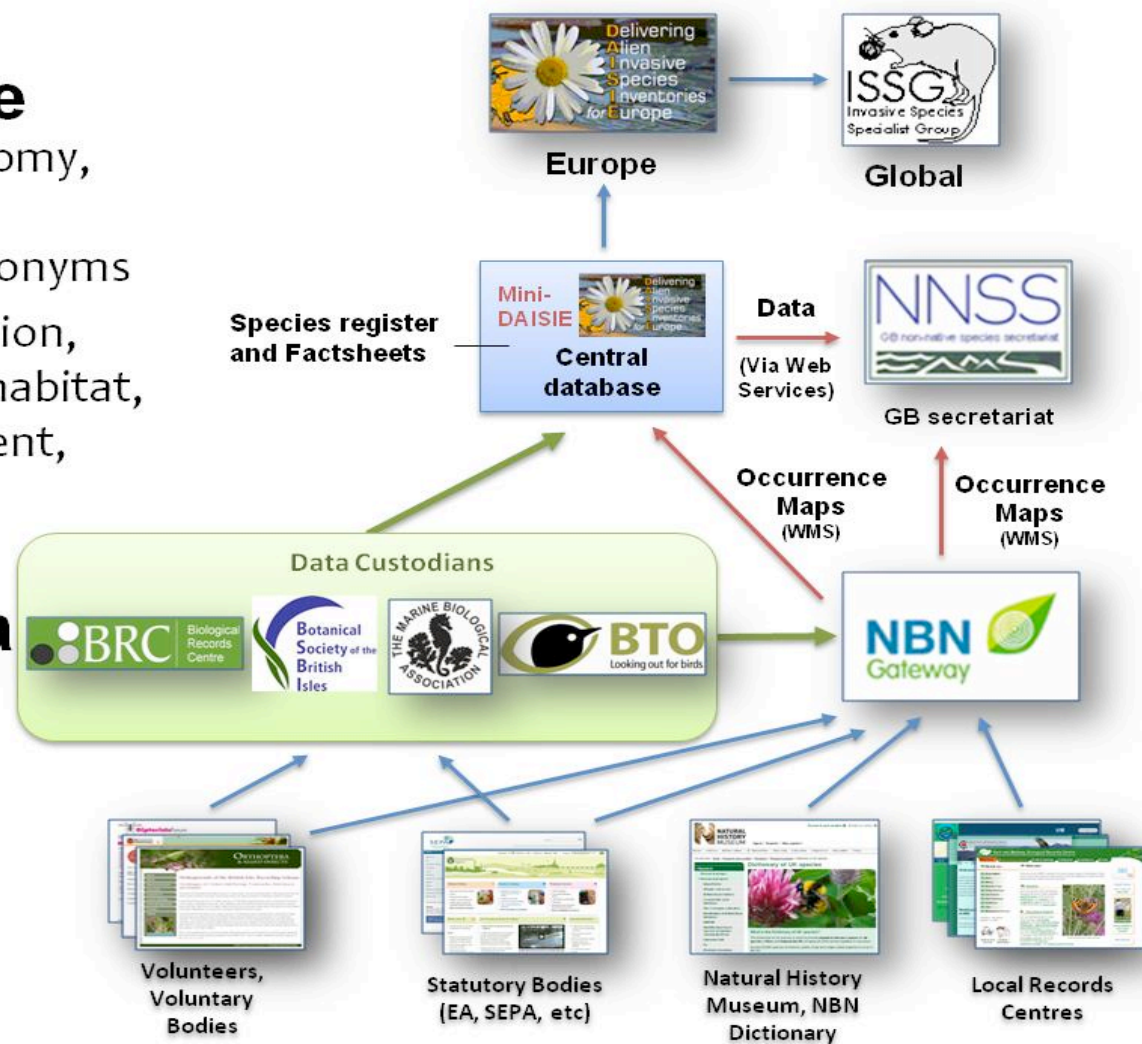
# GB Non-Native Species Information Portal

## Central Database

- **Species register** – taxonomy, dates and pathways of introduction, habitat, synonyms
- **297 factsheets** – description, photo, biology, ecology, habitat, range, impact, management, bibliography

## Occurrence data

- **NBN Gateway**





# 1919 established alien species in GB



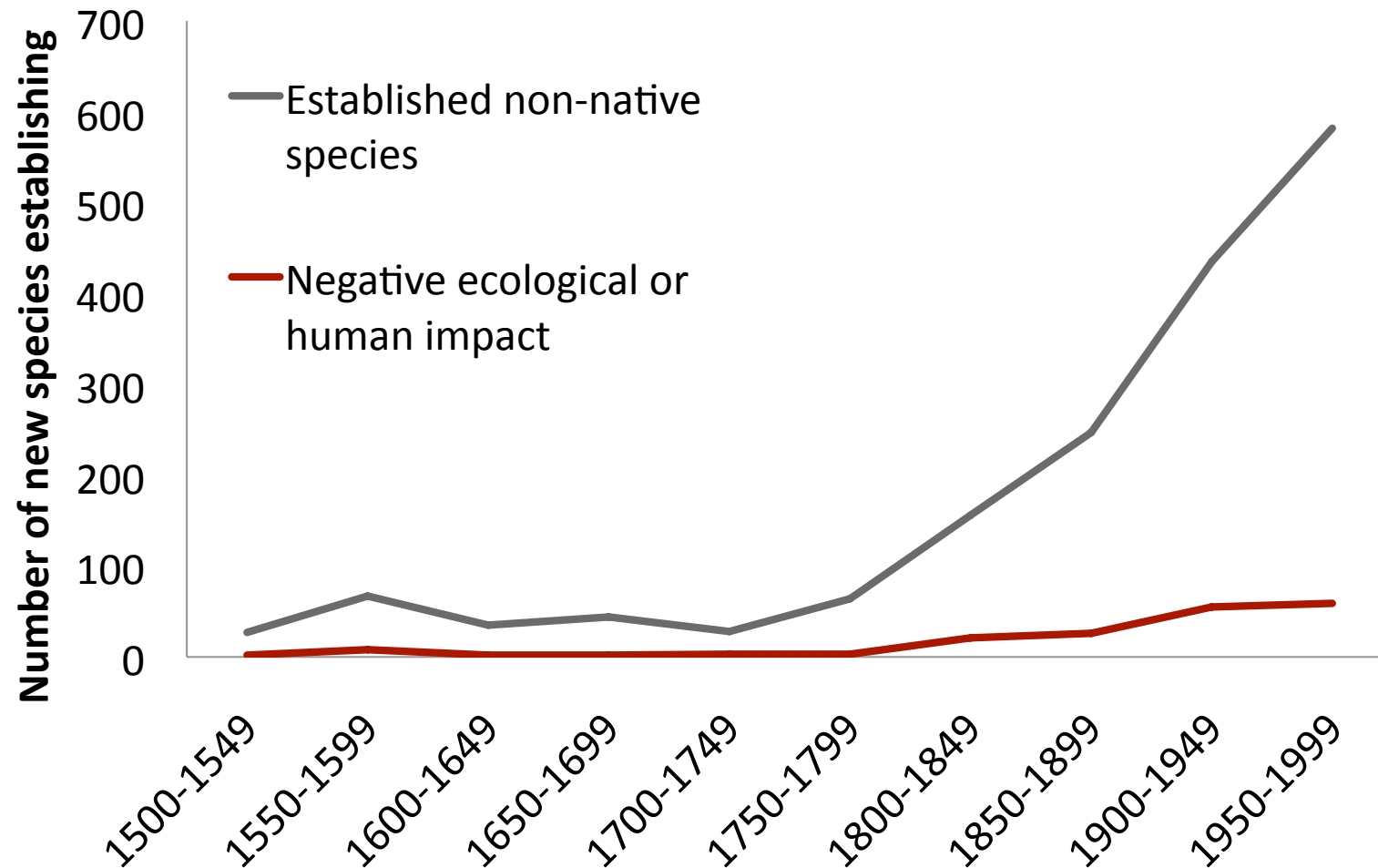


# Scorecard 2014 for Great Britain

- 1494 established non-native plants
- 420 established non-native animals
- 234 established non-native species designated as having negative ecological or human impact:
  - 96 (6.4%) established non-native plants
  - 136 (32.4%) established non-native animals

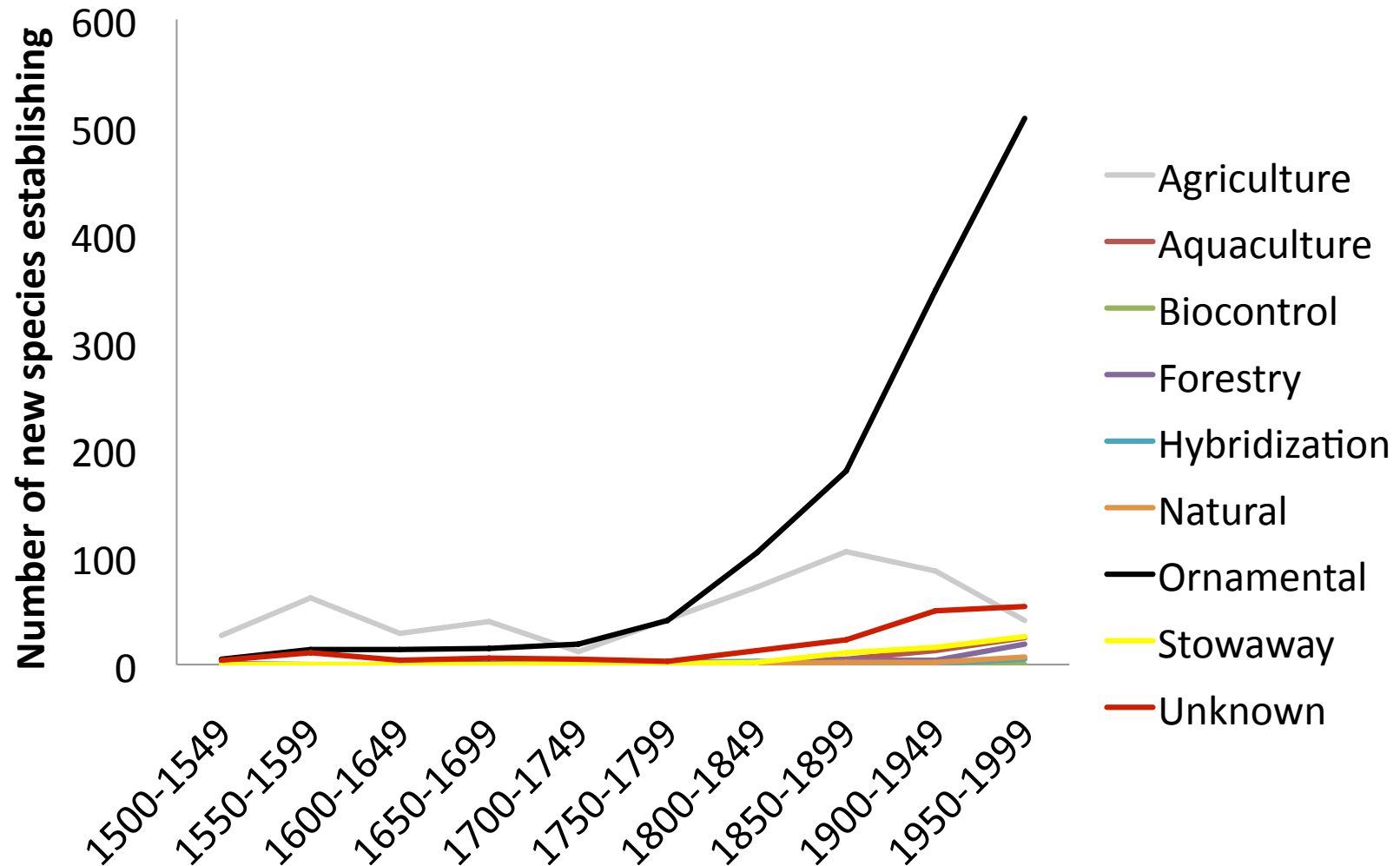
Roy et al. (2014) *Biological Invasions*

# GB Non-Native Species Information Portal

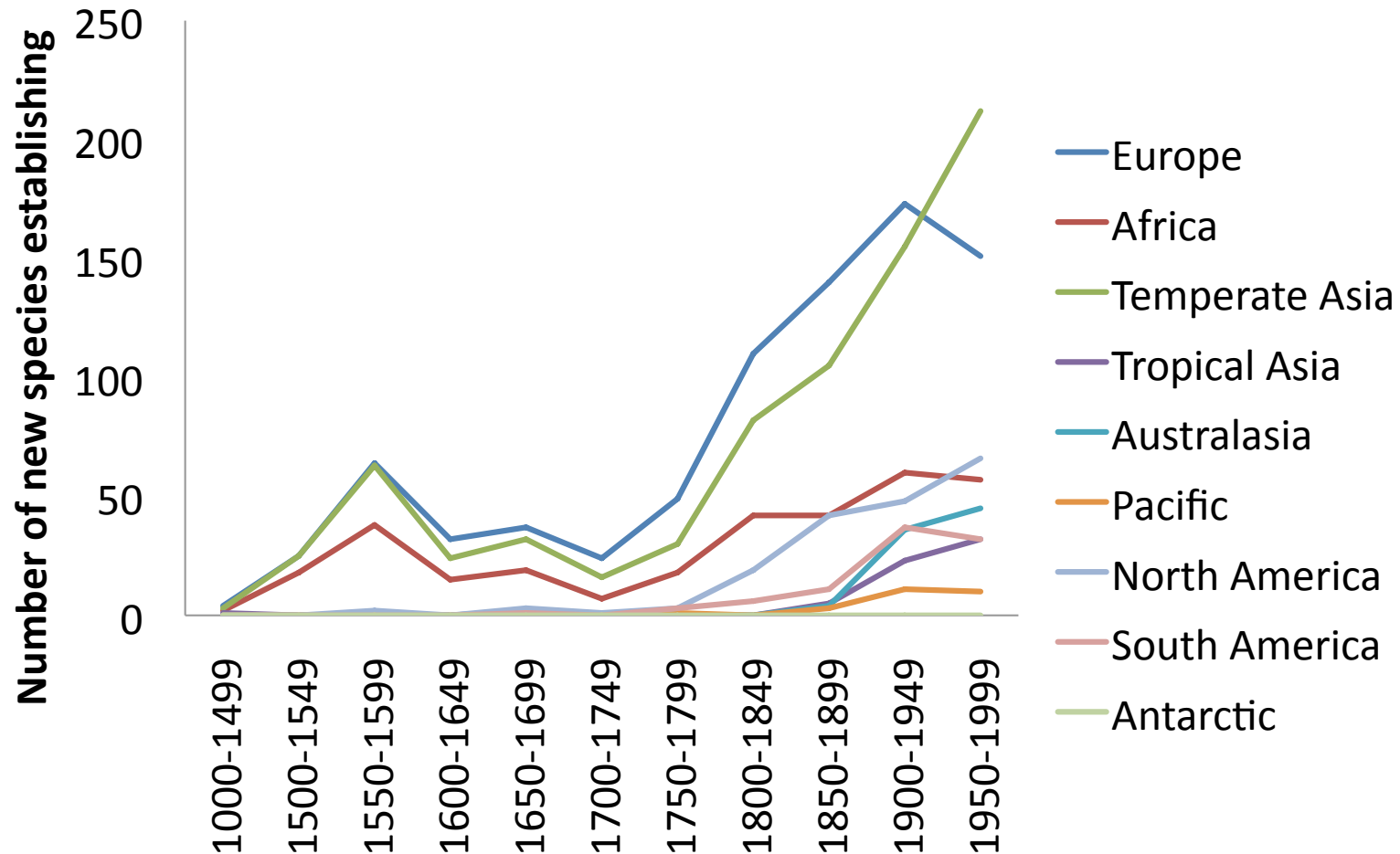




# Many along ornamental pathway

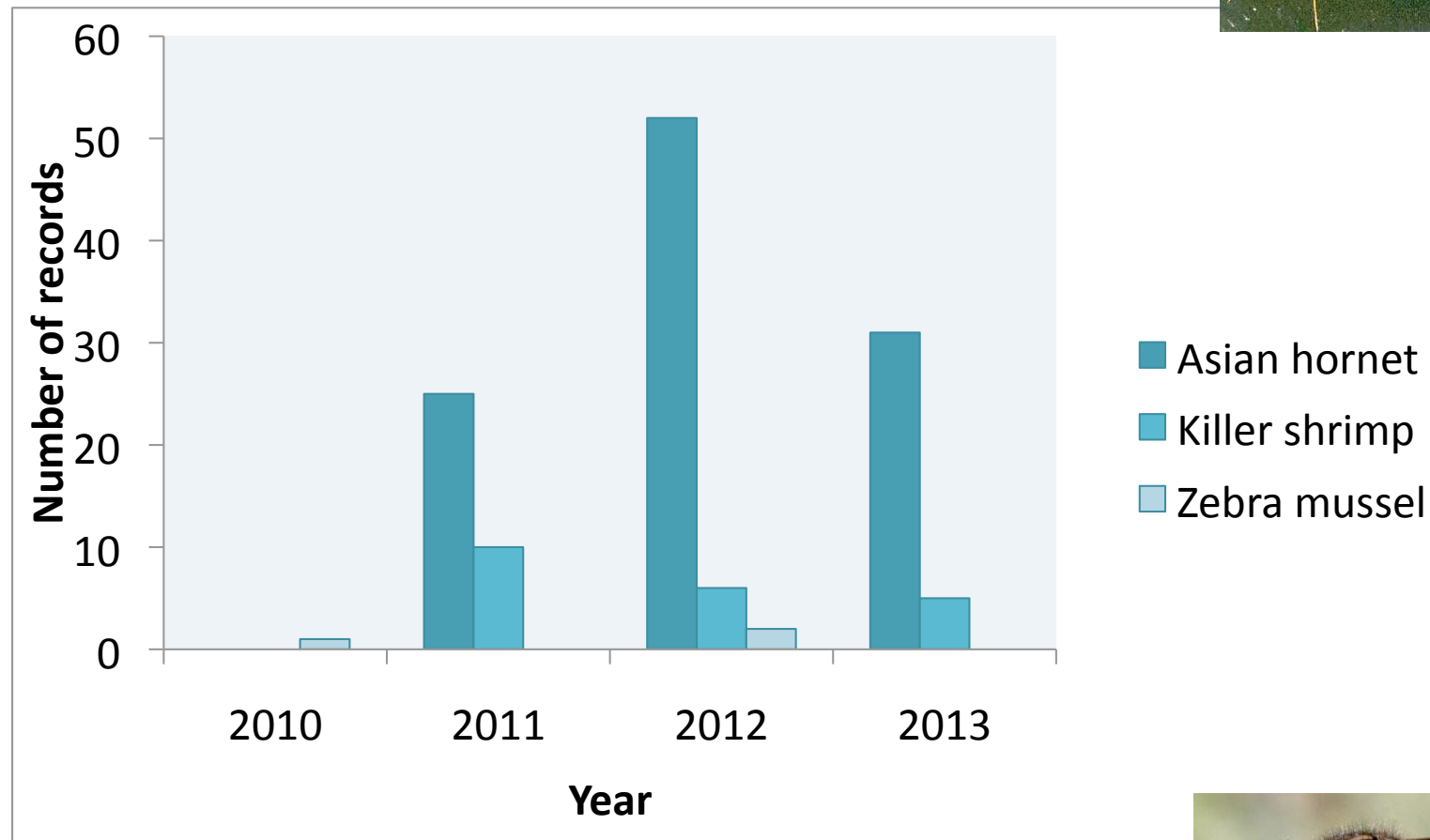


# Increasing number from temperate Asia

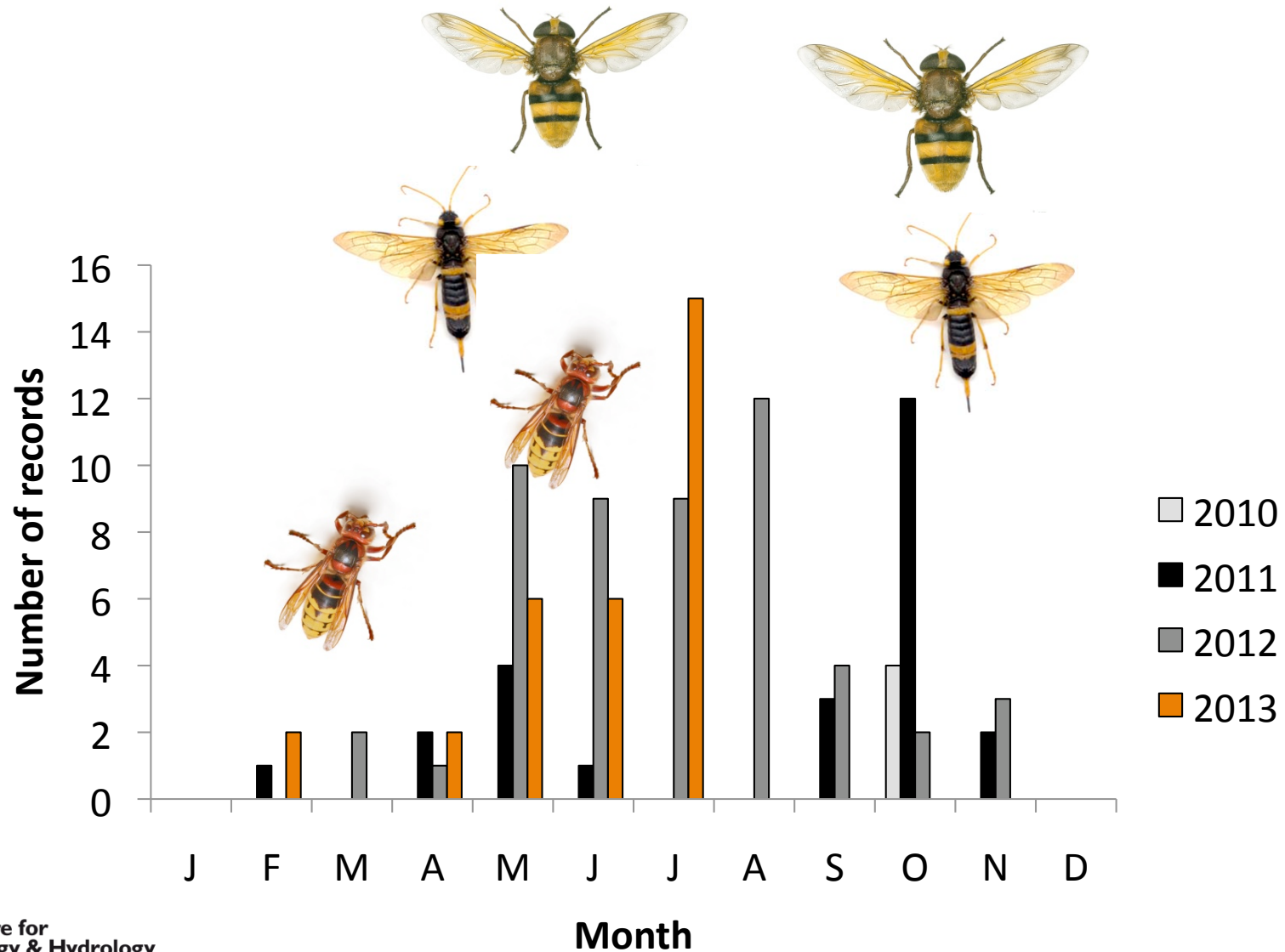




# Alert\_nonnative@ceh.ac.uk

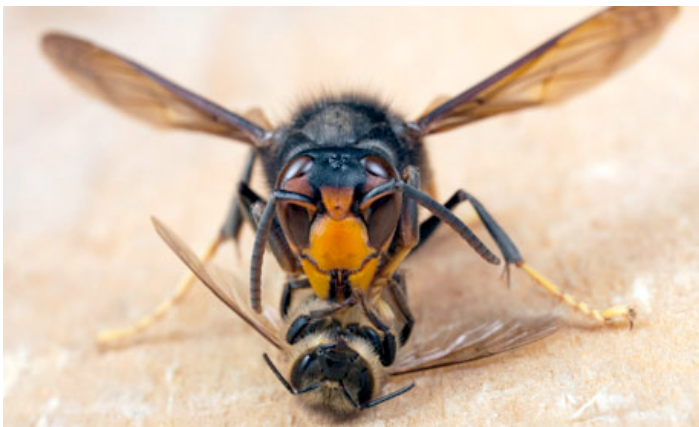


# Asian hornets...not what they seem



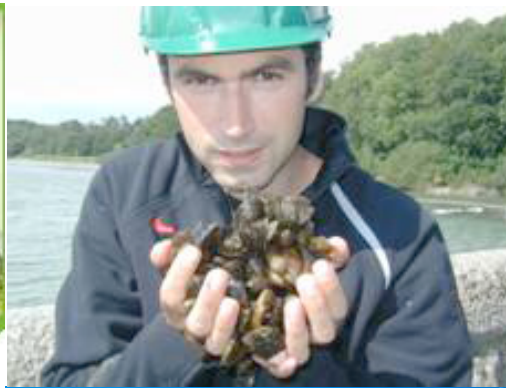


# Can we predict invasions?



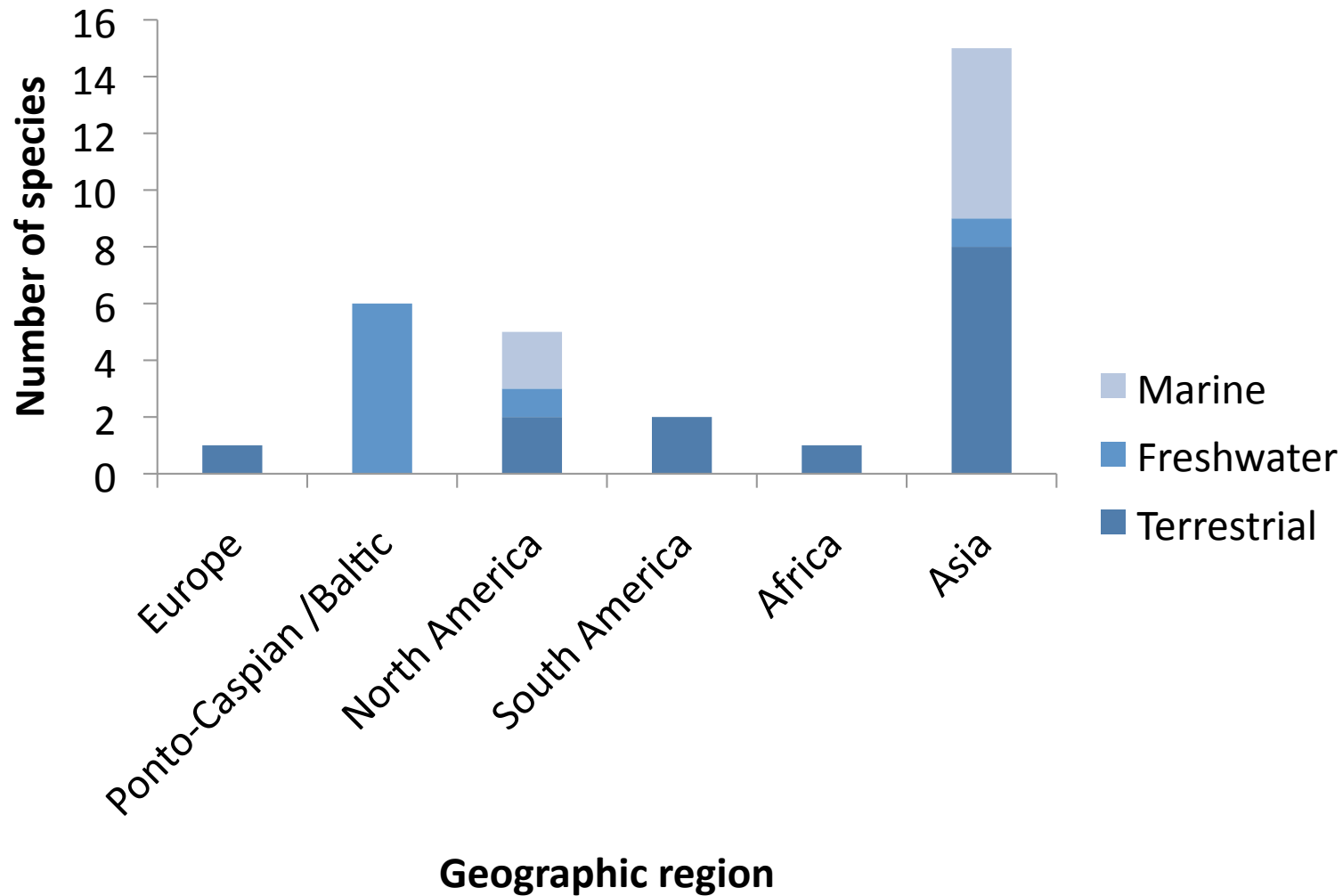


# The experts...

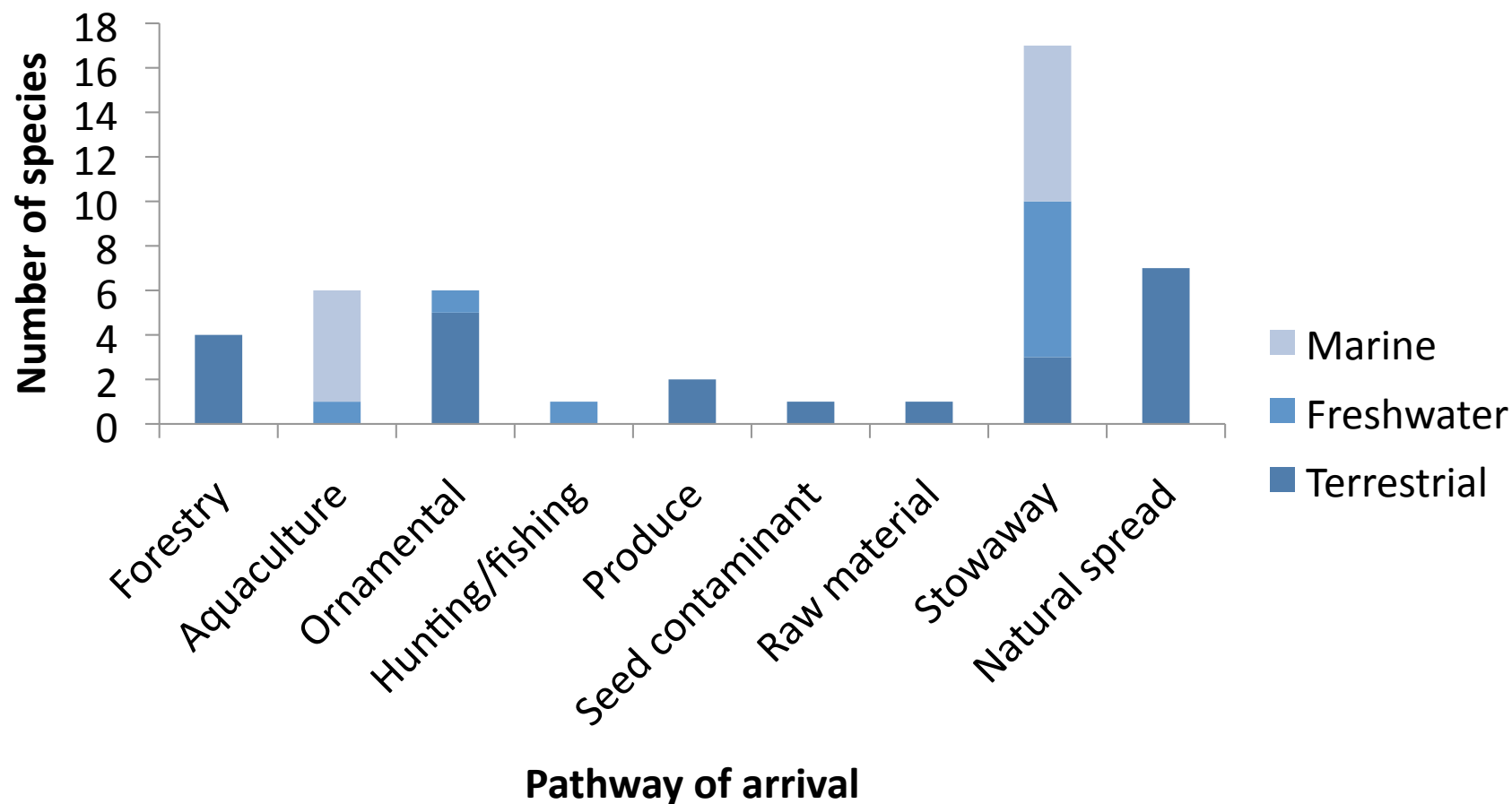




# IAS originating from across the globe



# Stowaway pathway dominating





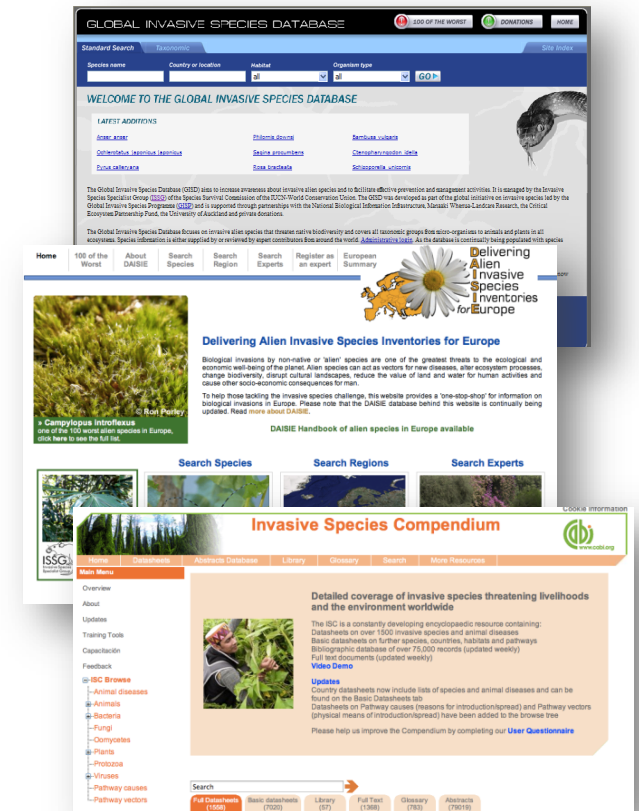
# Prioritising pathways



Aesculapian snake *Zamenis longissimus*

# Exploring pathways by linking information sources

ISSG Global Invasive Species Database, DAISIE Europe, and CABI Invasive Species Compendium agreed to undertake a preliminary assessment of pathways of introduction of IAS for Europe, supported by Council of Europe and CBD







## **Convention on Biological Diversity**

Distr.  
GENERAL

UNEP/CBD/SBSTTA/18/9/Add.1  
1 May 2014

ORIGINAL: ENGLISH

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SUBSIDIARY BODY ON SCIENTIFIC,  
TECHNICAL AND TECHNOLOGICAL ADVICE  
Eighteenth meeting  
Montreal, 23-28 June 2014  
Item 5.2 of the provisional agenda\*

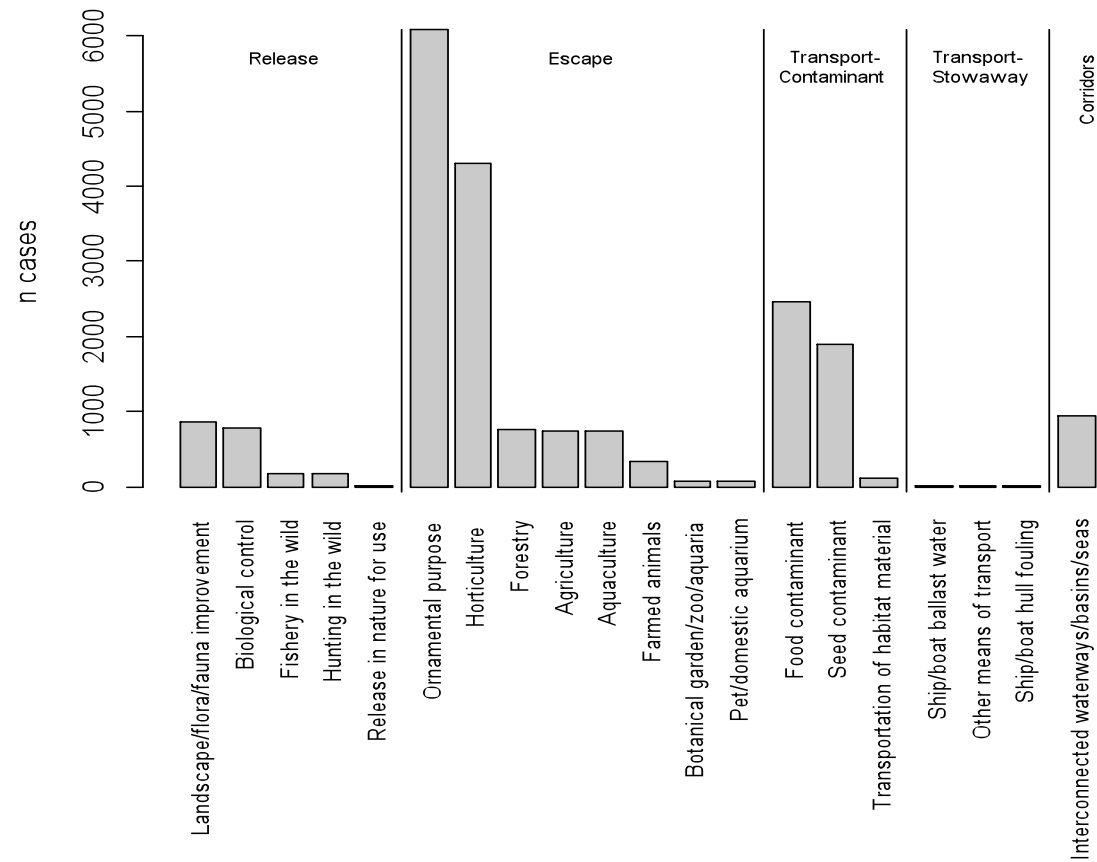
### **PATHWAYS OF INTRODUCTION OF INVASIVE SPECIES, THEIR PRIORITIZATION AND MANAGEMENT**

*Note by the Executive Secretary*

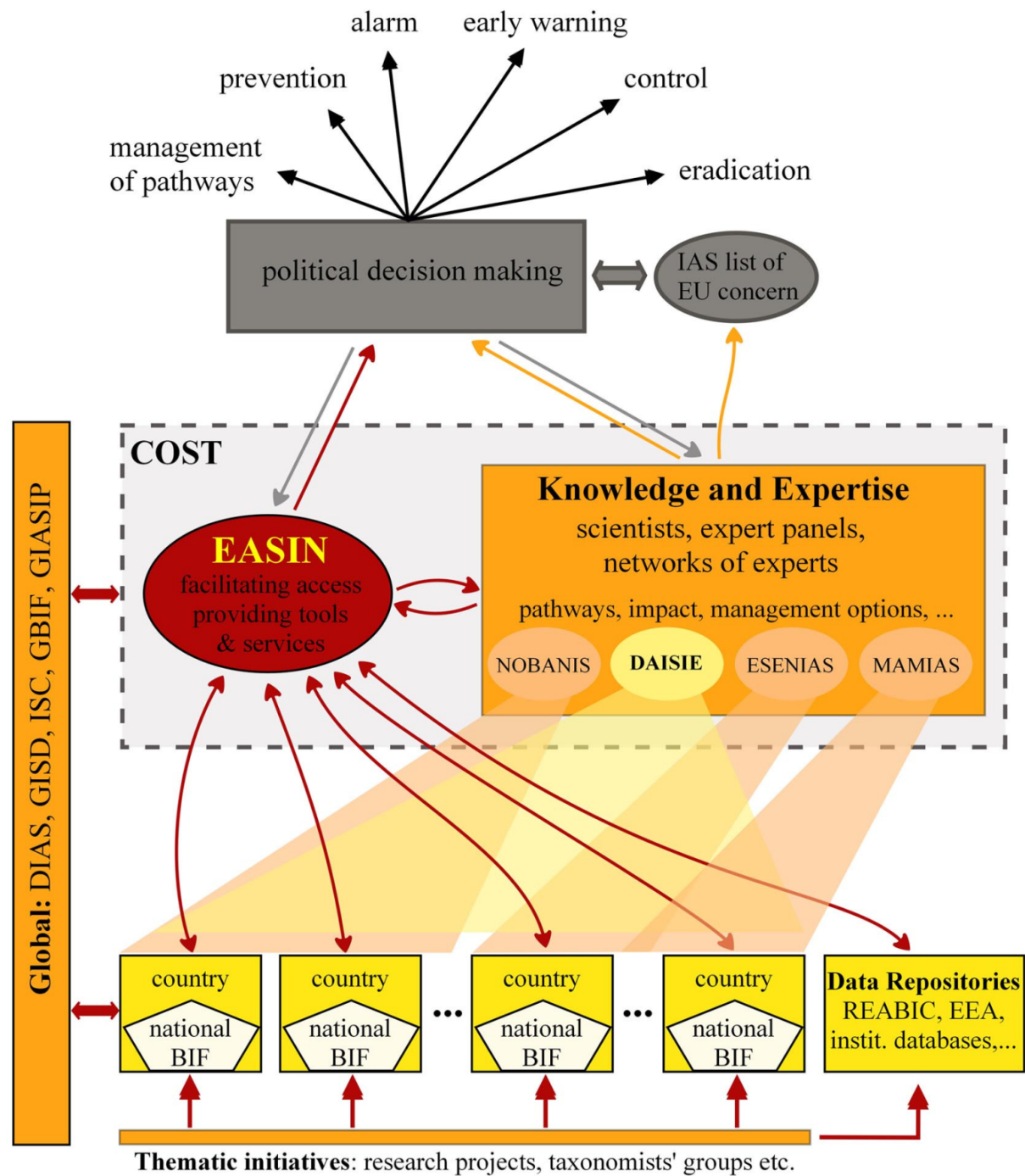
#### **I. INTRODUCTION**

1. The Guiding Principles for the Prevention, Introduction and Mitigation of Impacts of Alien Species that threaten Ecosystems, Habitats and Species (the Guiding Principles) annexed to decision VI/23\*\* provide all Governments and organizations with guidance for developing effective strategies to minimize the spread and impact of invasive alien species. In particular, the Guiding Principles highlight the importance of identifying pathways of introduction of invasive species in order to minimize such introductions, and call to assess the risks associated with such pathways.

# Harmonising pathway information







# Importance of collaboration



COST TD1209



COST is supported by the EU  
RTD Framework Programme



ESF provides the COST Office  
through an EC contract

COST Action TD1209

[Log in](#) [Help](#)

Act ...to facilitate enhanced knowledge gathering and sharing through a network of experts, providing support to a European IAS information system which will enable effective and informed decision-making in relation to IAS

[WG1](#)

[WG2](#)

[WG3](#)

[WG4](#)

[STSM](#)

[Comm](#)

[Meet](#)

[Work](#)

[Follo](#)

[Face](#)

- Networking
- Workshops
- Short Term Scientific Missions





# ALIEN Challenge Working Groups

- Four working Groups
  - WG1 - Early Warning & Rapid Response
  - WG2 - Analysis of pathways
  - WG3 - Analysis of impacts
  - WG4 - Harmonisation and integration
- If you are interested in getting involved check the website details:

<http://www.brc.ac.uk/alien-challenge/home>



COST is supported by the EU  
RTD Framework Programme



ESF provides the COST Office  
through an EC contract

# Informing the EU Regulation on IAS

(10) As invasive alien species are numerous, it is important to ensure that **priority is afforded to addressing the subset of invasive alien species considered to be of Union concern**. A list of such invasive alien species considered to be of Union concern should therefore be drawn up and regularly updated .

(11) The **criteria to list invasive alien species considered to be of Union concern are the core instrument to apply this Regulation**. In order to ensure an effective use of resources, the criteria should also make sure that the invasive alien species having the most significant adverse impact among the potential invasive alien species currently known are those that will be listed.

# Informing the CBD



**CBD**



**Convention on  
Biological Diversity**

Distr.  
GENERAL

UNEP/CBD/SBSTTA/18/9/Add.1  
1 May 2014

ORIGINAL: ENGLISH

SUBSIDIARY BODY ON SCIENTIFIC,  
TECHNICAL AND TECHNOLOGICAL ADVICE  
Eighteenth meeting  
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## **PATHWAYS OF INTRODUCTION OF INVASIVE SPECIES, THEIR PRIORITIZATION AND MANAGEMENT**

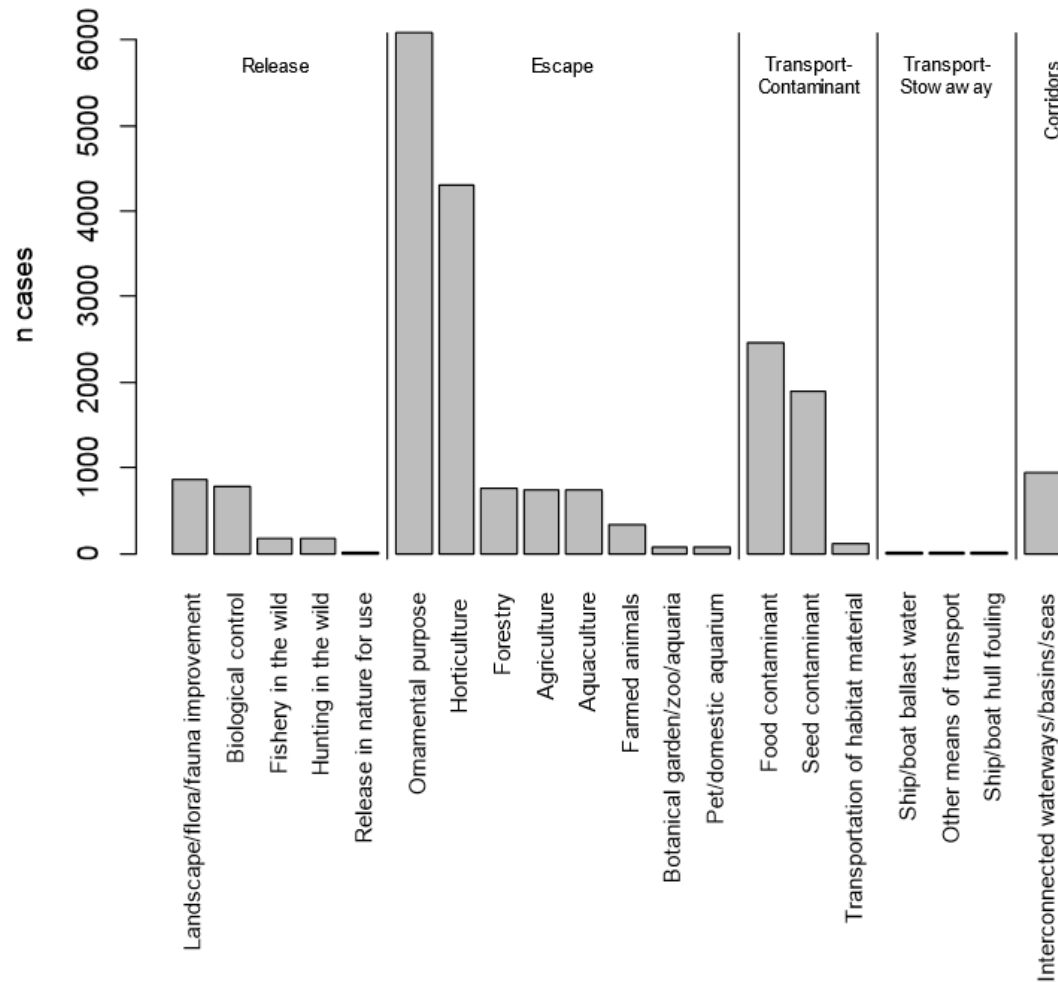
*Note by the Executive Secretary*

### **I. INTRODUCTION**

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# Linking information across the world



# Inspiring the next generation of invasion biologists





# Establishing collaborations





# Addressing gaps in understanding

- Socio-economic impacts workshop in Cyprus, September 2014
- Horizon scanning for non-native pathogens in UK, February 2014



# Establishment of scientific excellence and cooperation worldwide



## ALIEN Challenge

 **cost**  
EUROPEAN COOPERATION  
IN SCIENCE AND TECHNOLOGY



COST is supported by the EU  
RTD Framework Programme



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# Thank you



COST is supported by the EU  
RTD Framework Programme



ESF provides the COST Office  
through an EC contract



Department  
for Environment  
Food & Rural Affairs



UK  
Ladybird Survey

