

Invasive Alien Species

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Expert Advisory Group

NBDC Total species	17326 (01.11.22)
Non-native	1208 (7% total)
Invasive alien species	124 (10.3% Non-native)

Thanks to Micheal O'Cinneide and
National Biodiversity Data Centre



What you need to know

- **NBDC lists 61 high and 63 medium impact invasive species in Ireland**
- Invasive species are often cited as second only to climate change amongst factors impacting global biodiversity
- Impacts are often substantial but anecdotal or inadequately documented
- A list of **40 potential IAS** species has been drawn up for Ireland (Lucy et al. 2020).
- **National Biodiversity Data Centre** and **Northern Ireland Environmental Agency** support designated staff and issue advice and alerts, but a more coordinated and resourced approach is needed in Ireland
- Stokes et al. (2006) draw attention to the need to engage stakeholders and the additional complications of cross jurisdictional issues in addressing the threats inherent in IAS

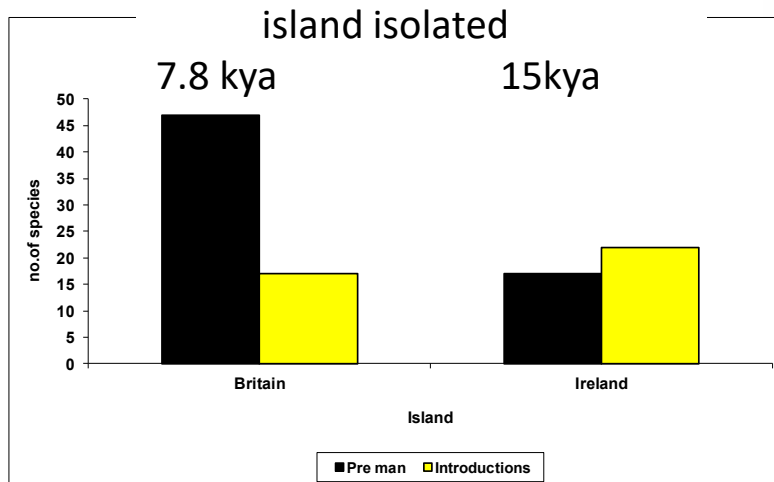


And.....

- Ireland contributes significantly to European and global biodiversity not by virtue of total number of species but by its unique ecology and history
- Ecosystems with fewer species are more vulnerable to the impacts of invasive species which can elbow their way into relatively 'vacant' ecological space or niche
- IAS often cause economic as well as environmental damage
- Recent rise in IAS arrivals reflects global trade, lack of biosecurity and climate change

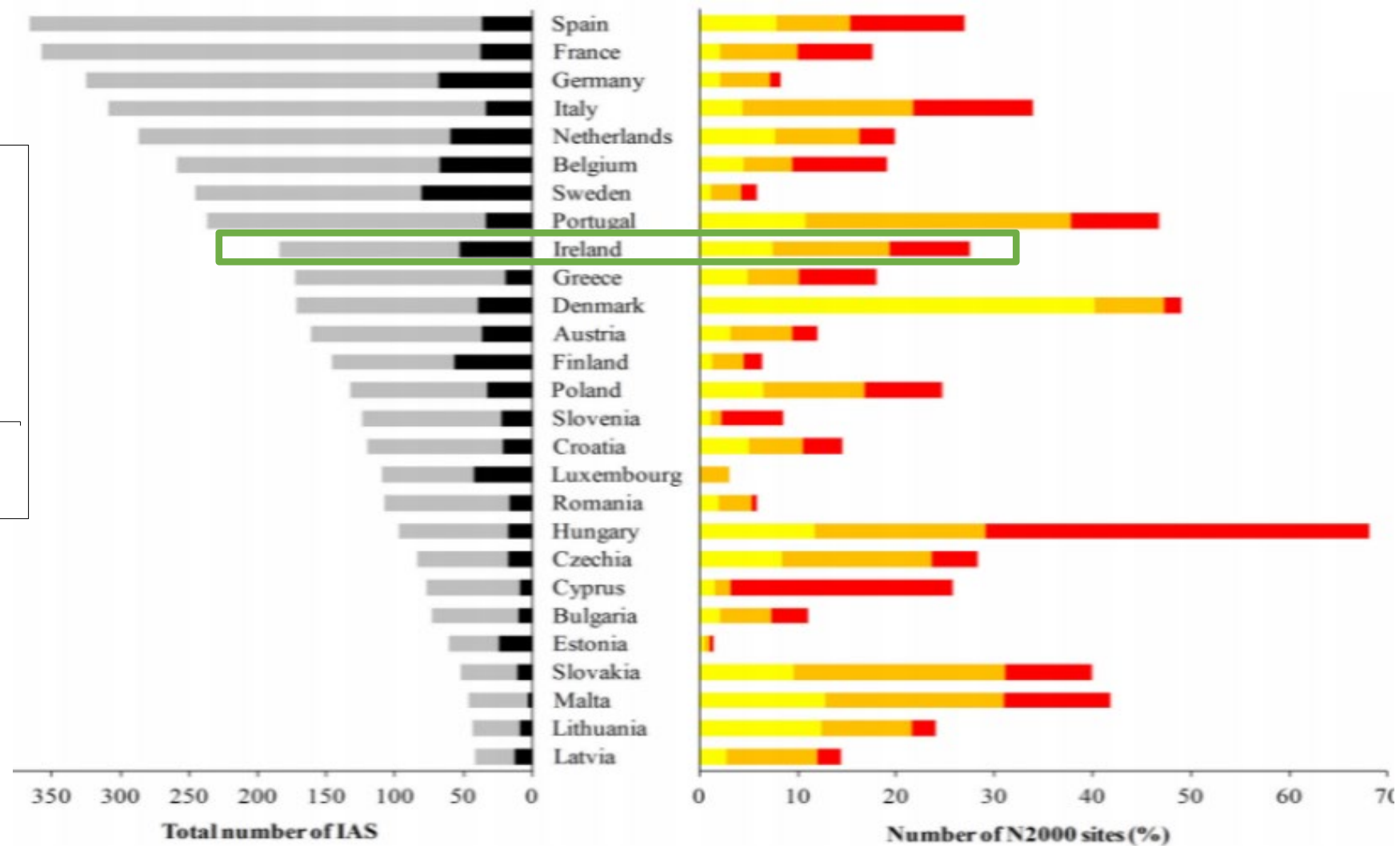


IAS in Ireland



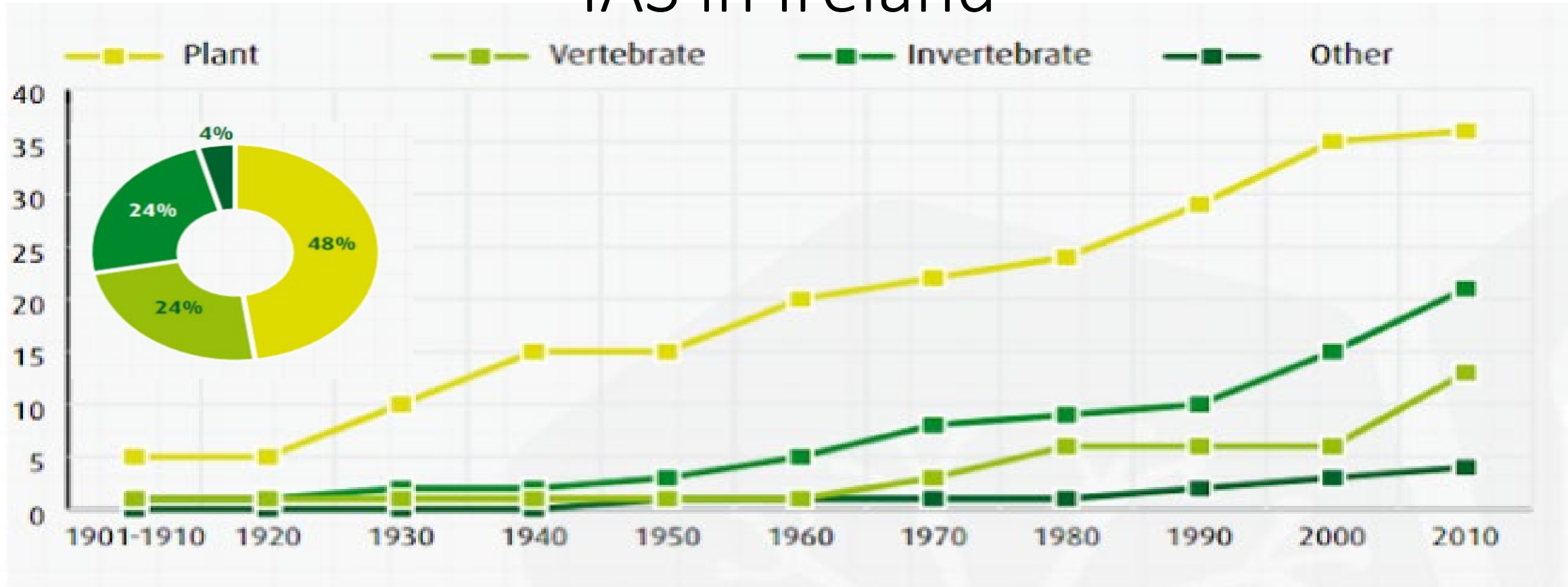
Pre-human arrivals and introductions of mammals in Britain and Ireland

Montgomery, W.I., Provan, J., McCabe, A.M. and Yalden, D.W., 2014. *Quaternary Science Reviews*, 98, pp.144-165.



Baquero et al., (2021) <https://t.co/R141qqhHdk?amp=1>

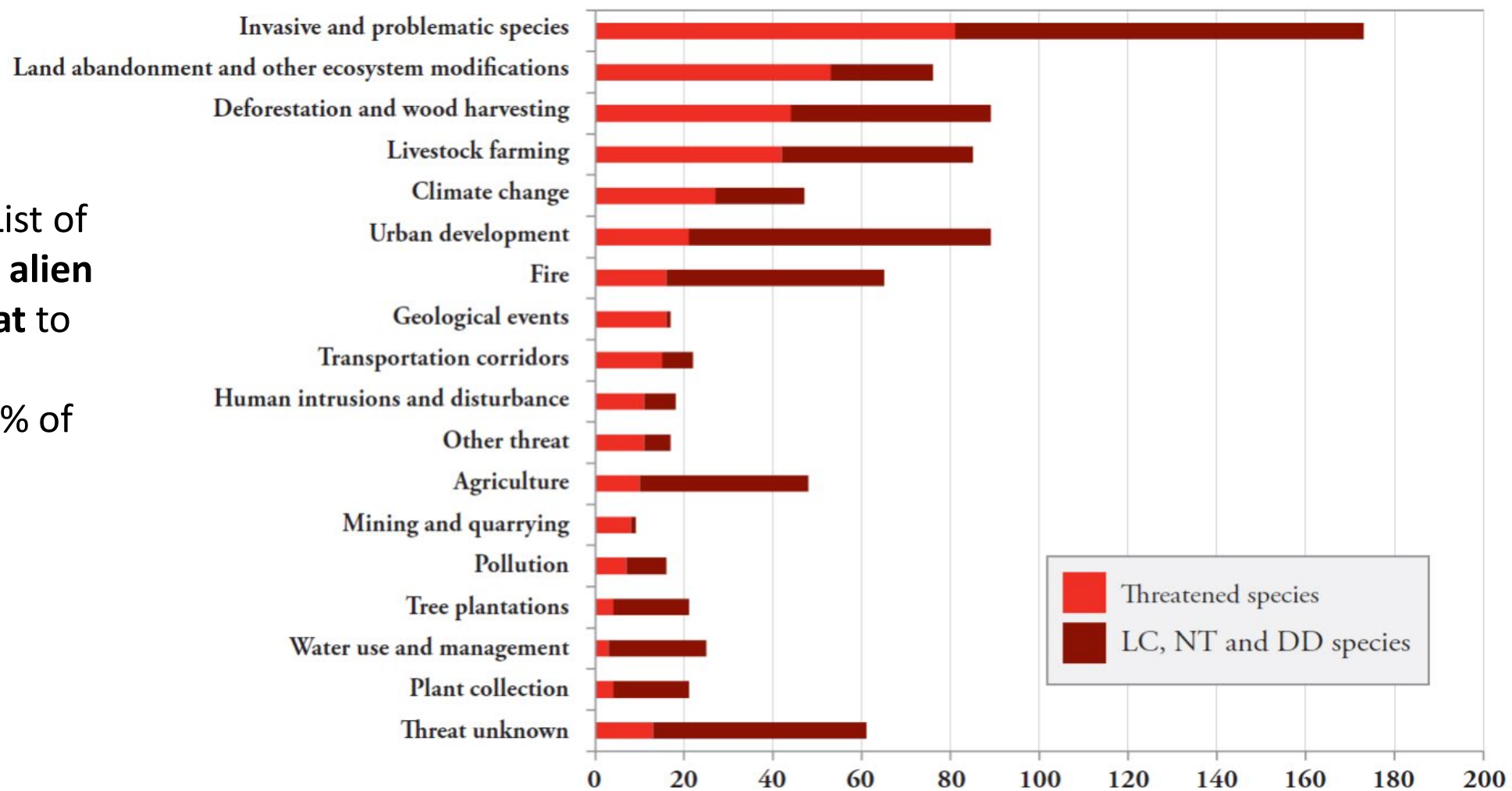
IAS in Ireland



Over the last 110 years there has been a gradual increasing trend in the number of plants and invertebrates introduced but with an unprecedented acceleration in the number of invertebrates recorded since 1990 and vertebrates since 2000 (Figure 10).

Case Study on European Trees

The 2019 “European Red List of Trees” found that **invasive alien species** are the **main threat** to European native **tree biodiversity**, impacting 38% of species.



IAS plants in Ireland



Image credits: Aoife Embleton, and Karen Bacon University of Galway

Snowberry



Japanese Knotweed



Winter Heliotrope



Giant Hogweed



Pacific Oysters (*Magallana gigas*)

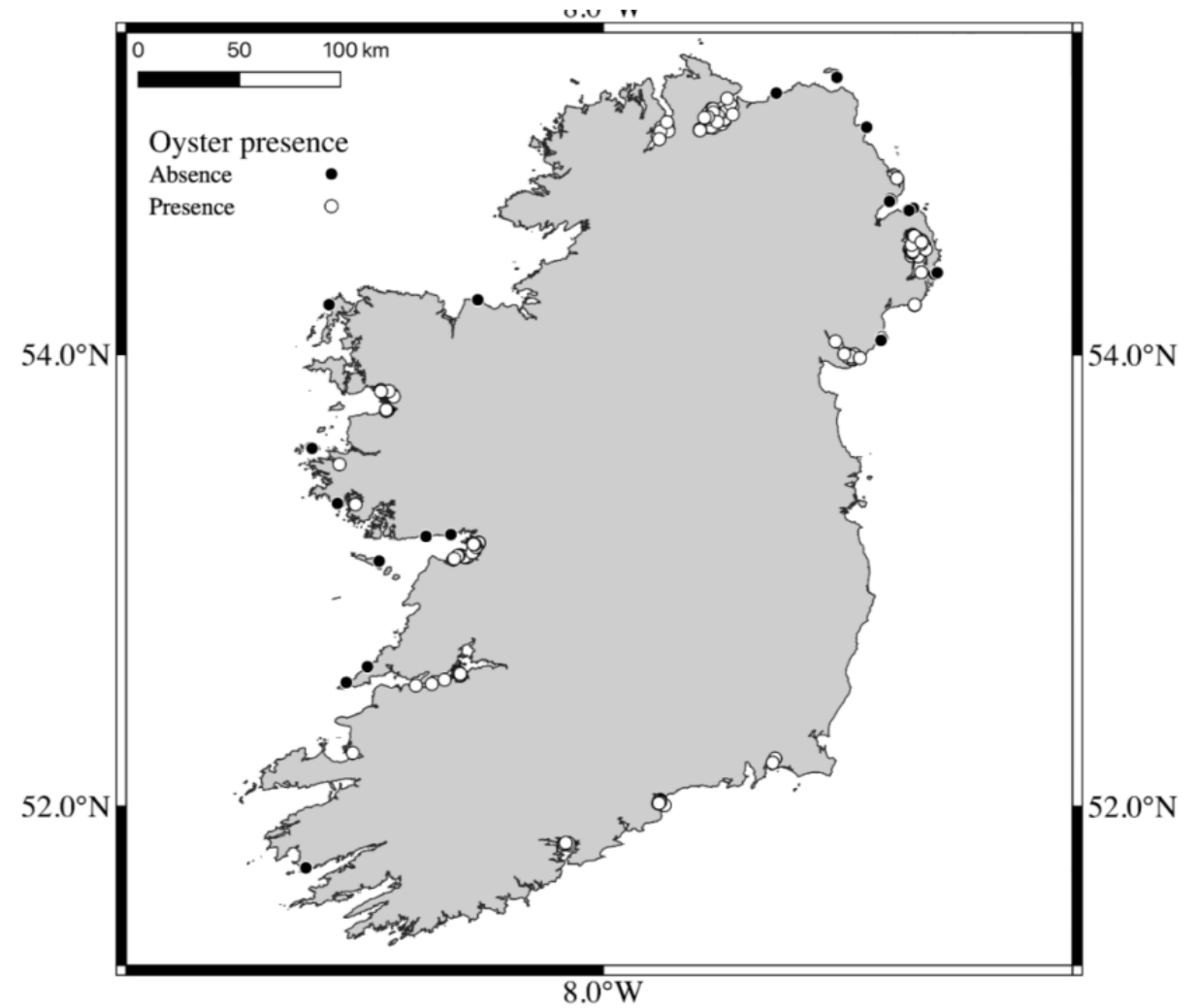
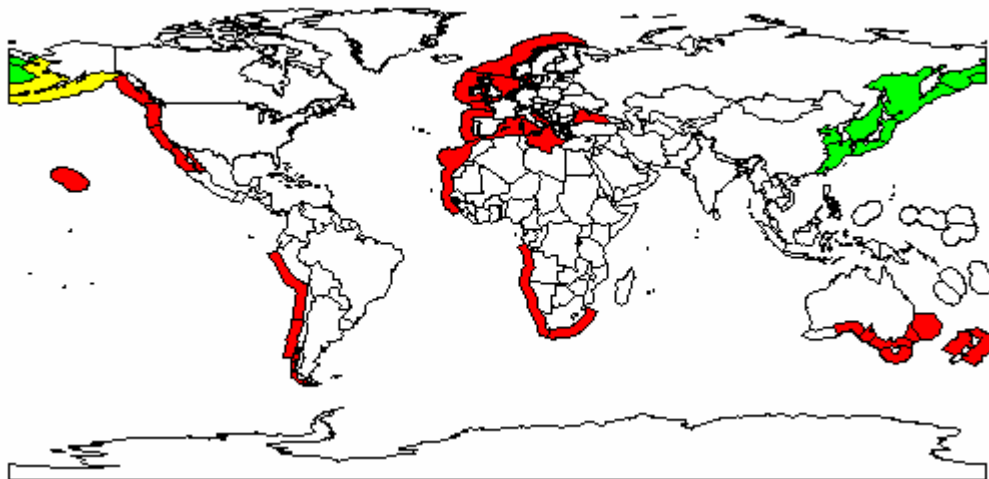


Figure 2.3 - The distribution of *Magallana gigas* in Ireland. Presence is indicated by white circles, absence by black circles, with records taken from GBIF, NBN Atlas, OBIS and Kochmann et al. (2013).

Impacts



Major change to habitat

Potential interaction with native oysters

Change to biodiversity – invertebrates, birds

Change to ecosystem processes

Reduced carrying capacity for aquaculture

Stabilise shores + increase carbon sequestration

Injury to beach users and change to aesthetics



Management

Surveillance and modelling to predict spread and identify priority areas for action

Regulation of aquaculture, e.g. triploids

Mechanical removal by hand

Promote commercial fisheries



Two IAS small mammals divide Ireland into four zones

1. Native only
2. Native + bank vole
3. Native + greater white-toothed shrew
4. Native + both IAS

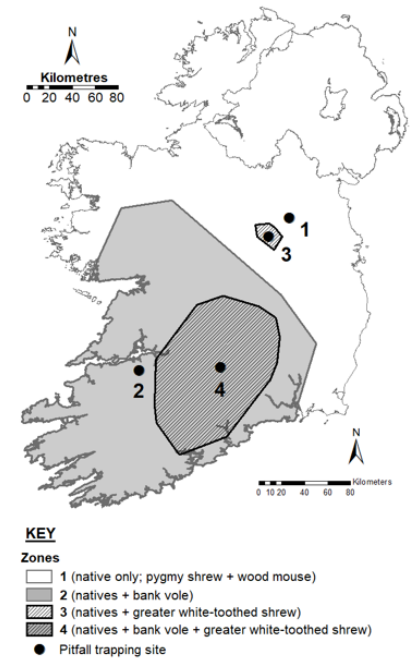
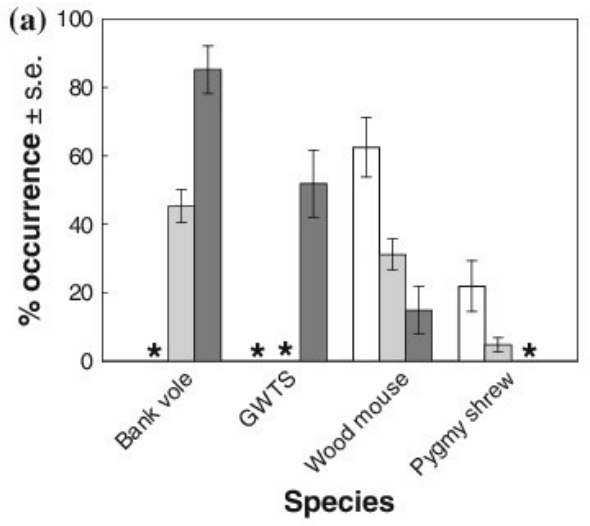
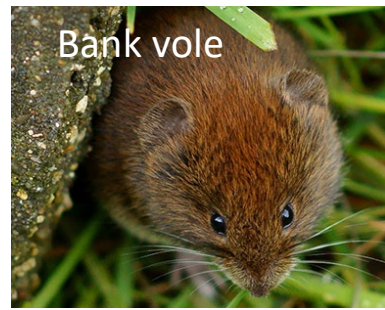
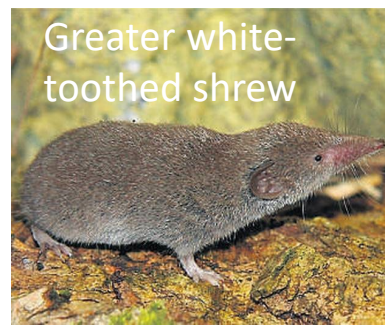
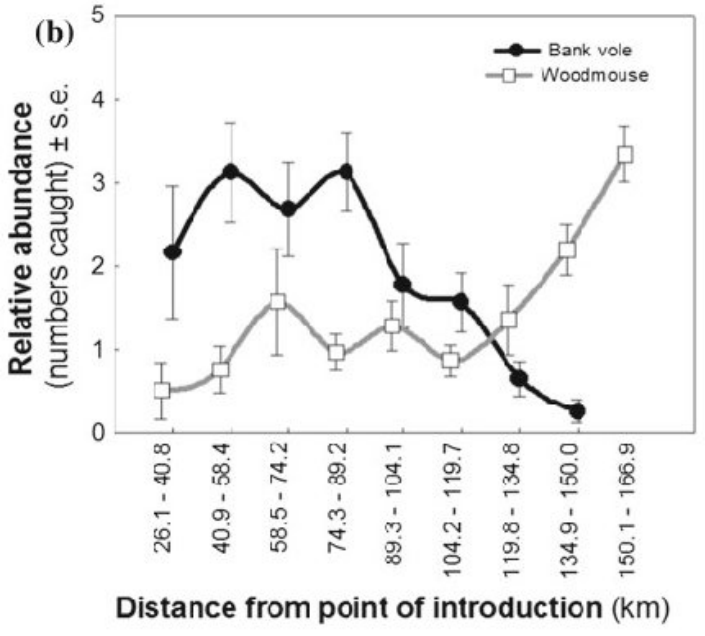
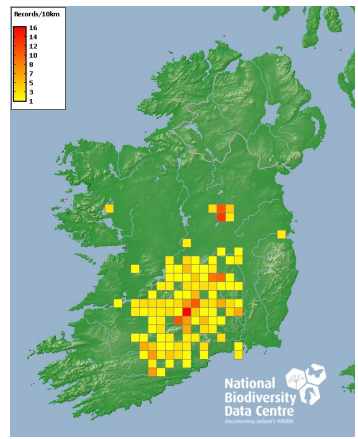


FIGURE 1 Ranges of four small mammal species in Ireland (two native, wood mouse and pygmy shrew; two invasive, bank vole and greater white-toothed shrew) categorised into four zones showing the location of invertebrate sampling (dots). Distributions based on Montgomery et al. (2012, 2015) and unpublished data (WI Montgomery).

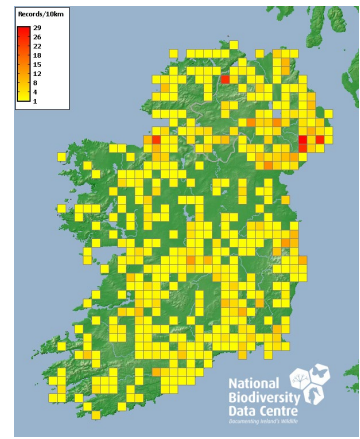


IAS

Native



GWTS

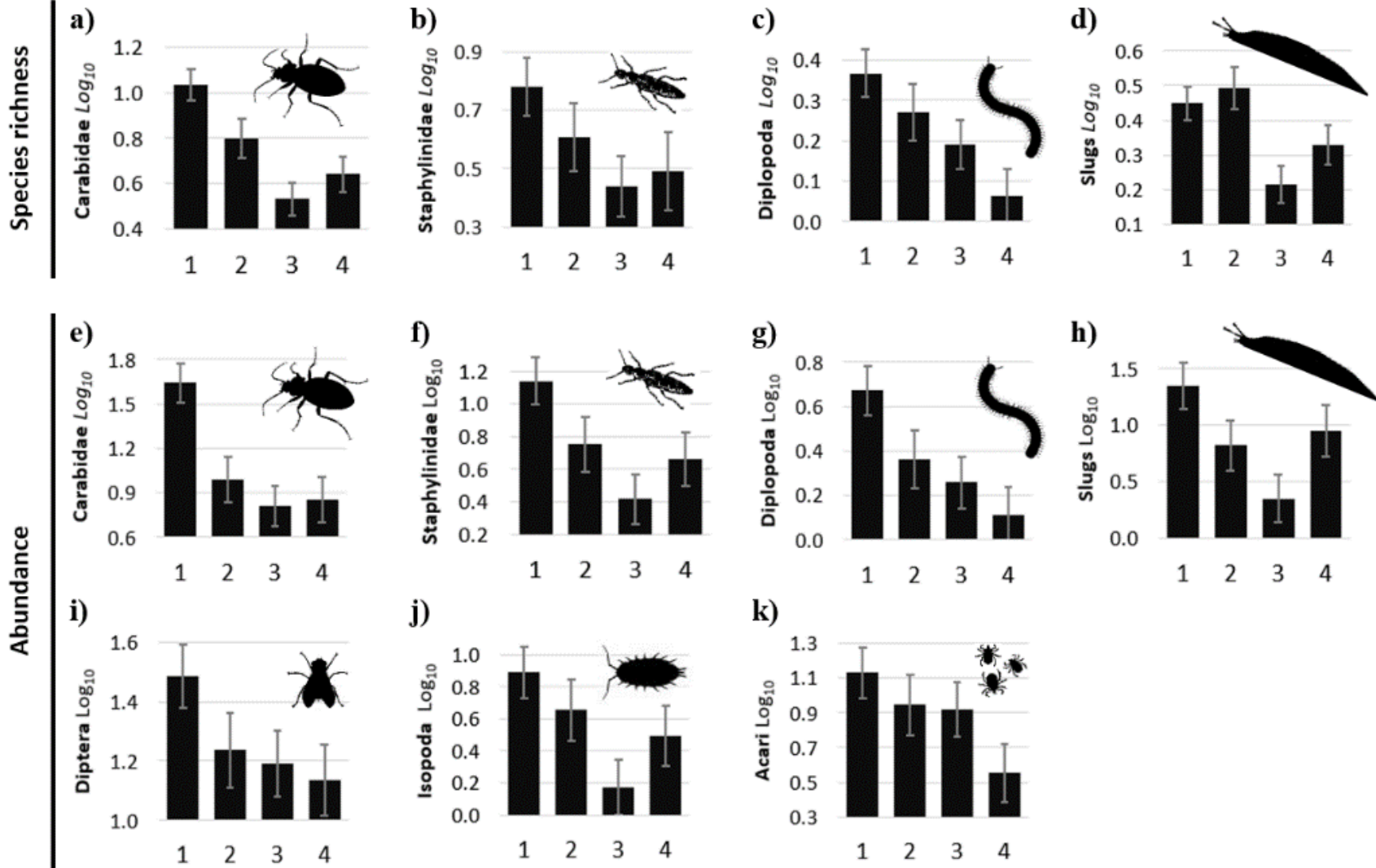


Pygmy shrew

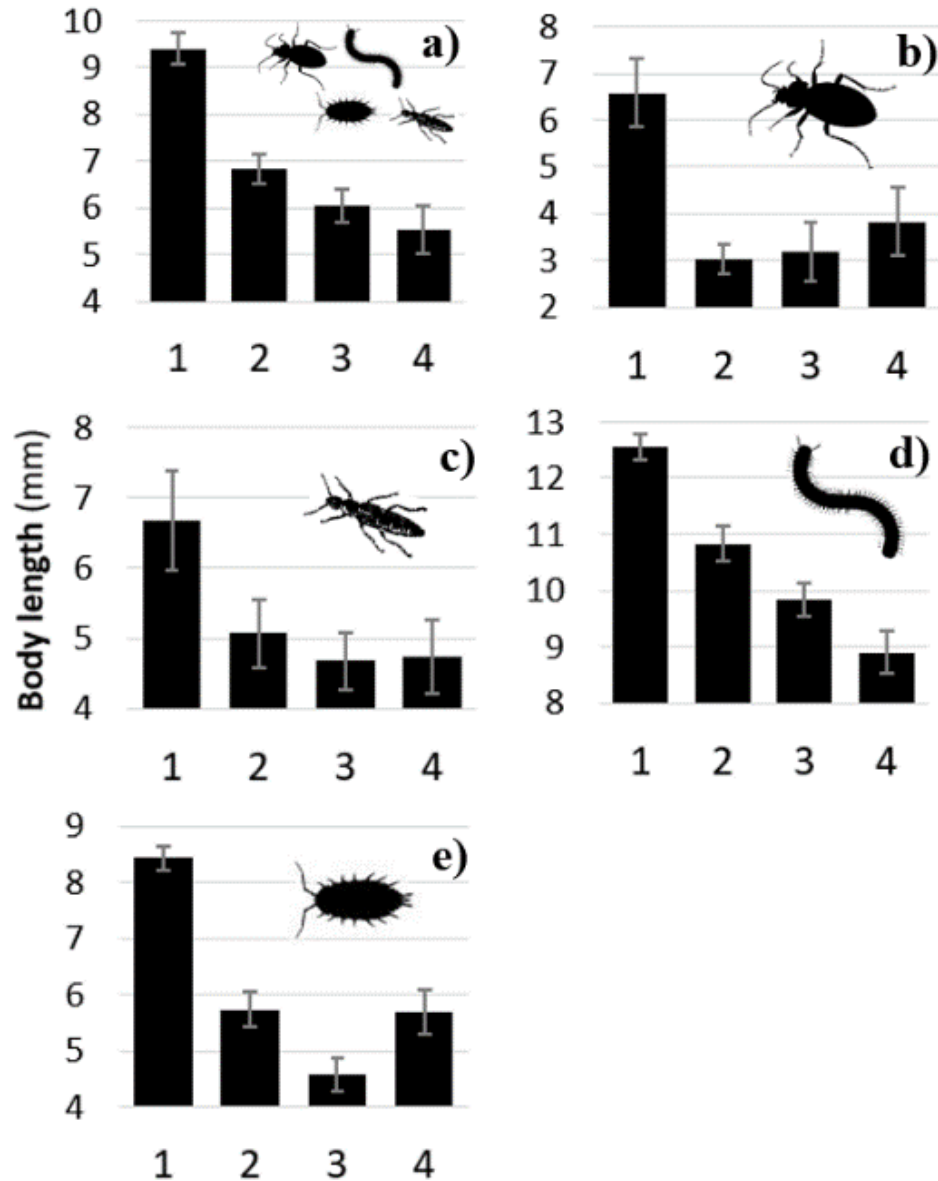
IAS small mammal impact on invertebrate community structure

1. Native only
2. Native + bank vole
3. Native + greater white-toothed shrew
4. Native + both IAS

- Taxa less rich and less abundant in Zones 2-4
- Impacted taxa account for 178 species (29%) and 10,003 individuals (65%)



Invertebrate 'downsizing' by IAS small mammals



- Mean invertebrate body length decreased by **41%** from **9.4 to 5.5mm** between Zones 1 and 4

Key taxa affected:

- Carabidae
- Staphylinidae
- Diplopoda
- Isopoda

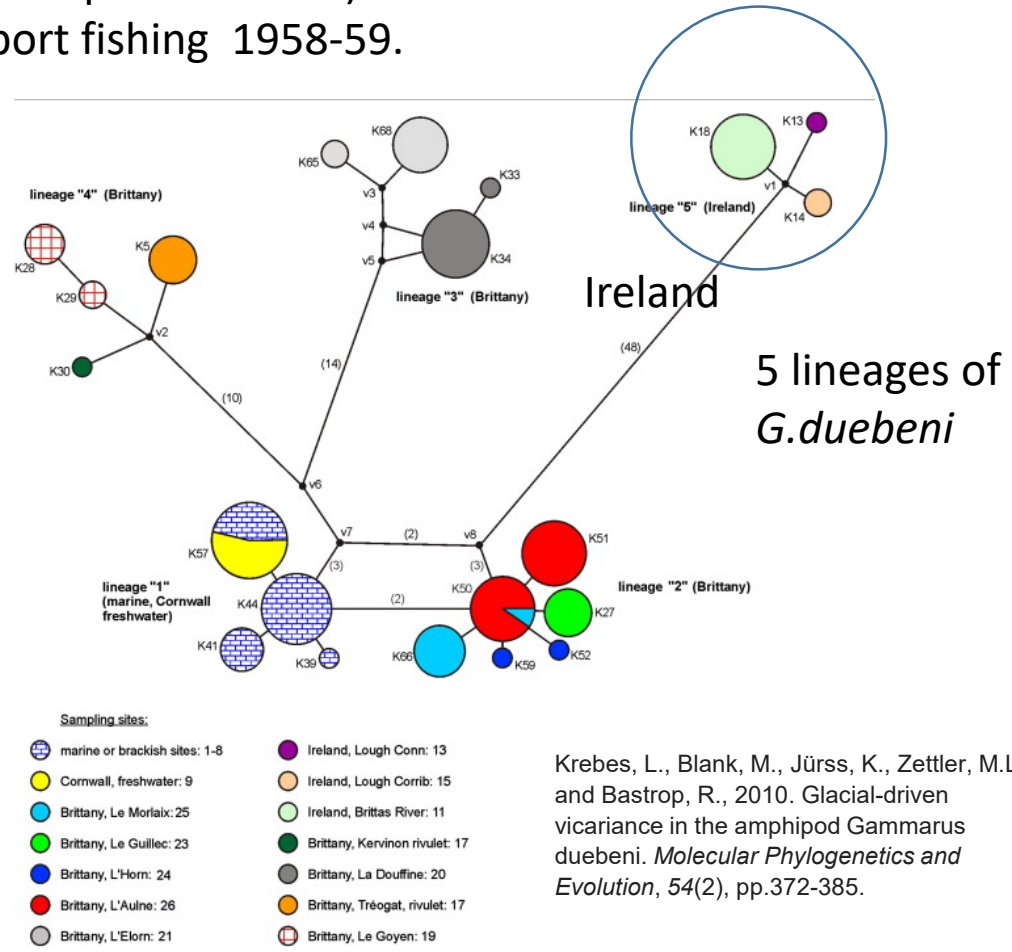


Gammarus pulex

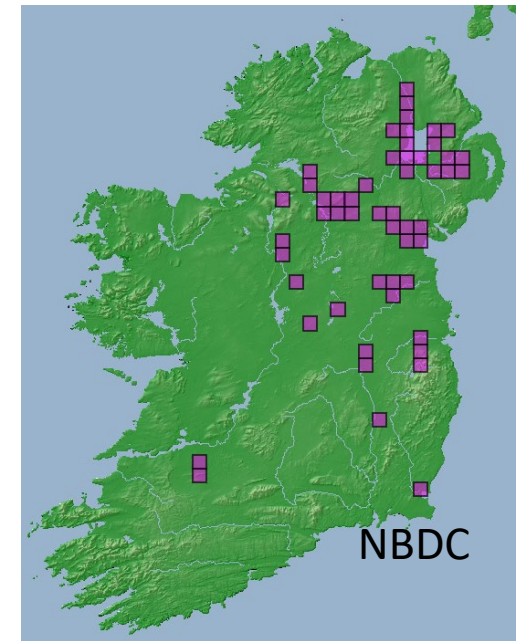
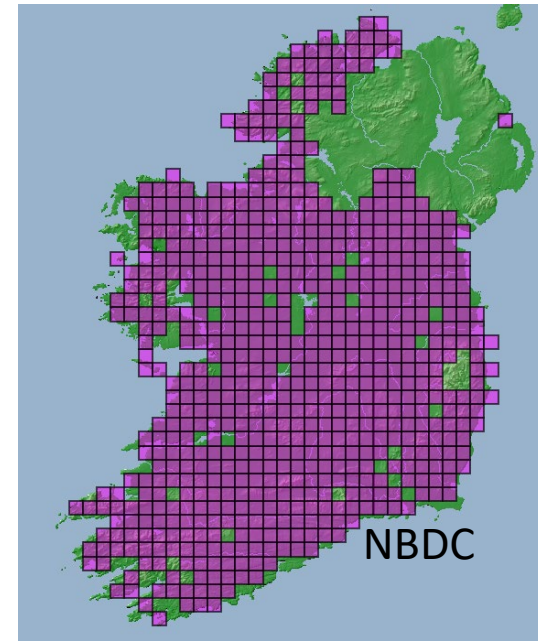
Gammarus duebeni has isolated populations in western Europe with a single lineage unique to Ireland where it dominates freshwater.

G.pulex originates in southern Europe. Introduced to Ireland (multiple sites in NI) from Yorkshire to enhance food for sport fishing 1958-59.

G. Duebeni celticus has long, kidney- shaped eyes, more long setae on legs and tends to be bigger and darker than *G. pulex* which has short, oval eyes.



Krebes, L., Blank, M., Jürss, K., Zettler, M.L. and Bastrop, R., 2010. Glacial-driven vicariance in the amphipod *Gammarus duebeni*. *Molecular Phylogenetics and Evolution*, 54(2), pp.372-385.



NI distribution of *G. duebeni* and *G. pulex* in NI

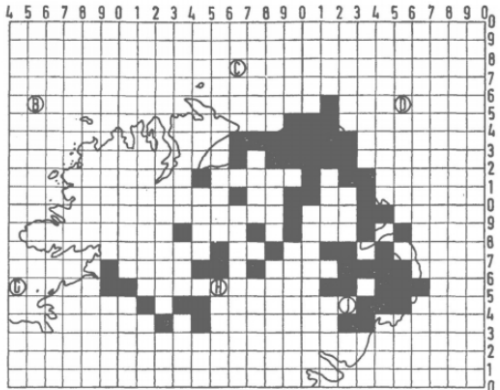


FIG. 1.—The known distribution of *Gammarus duebeni* (Liljeborg) in Northern Ireland on the 10km grid system.

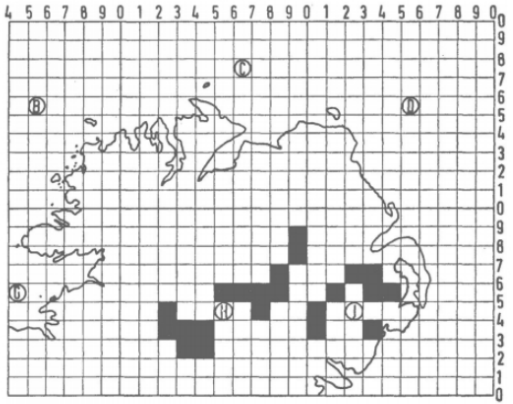
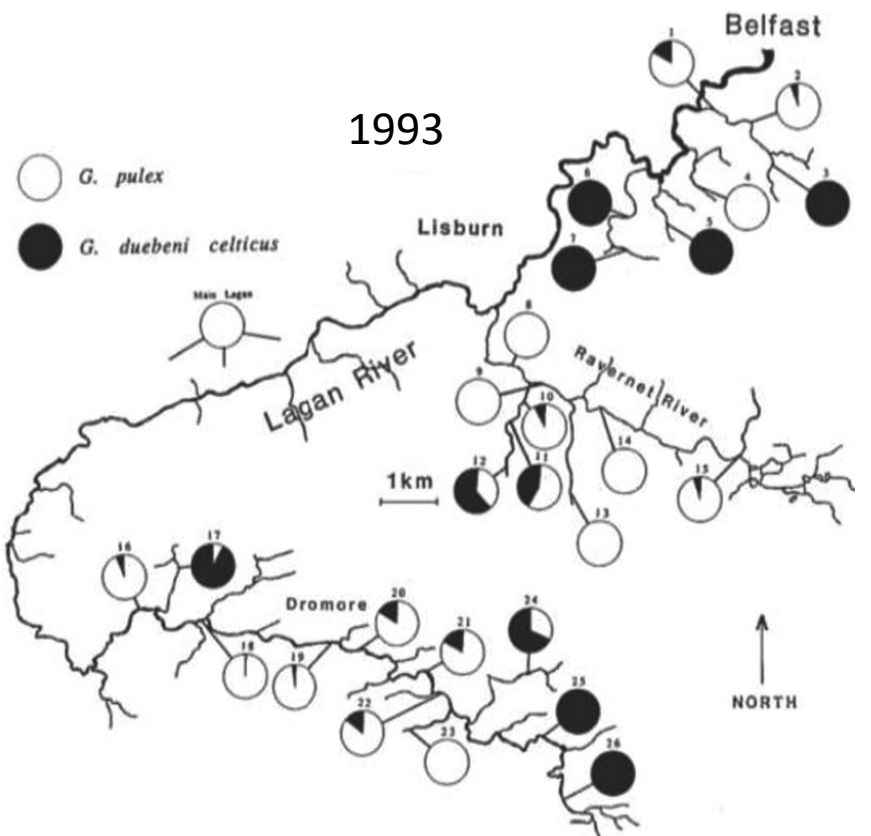
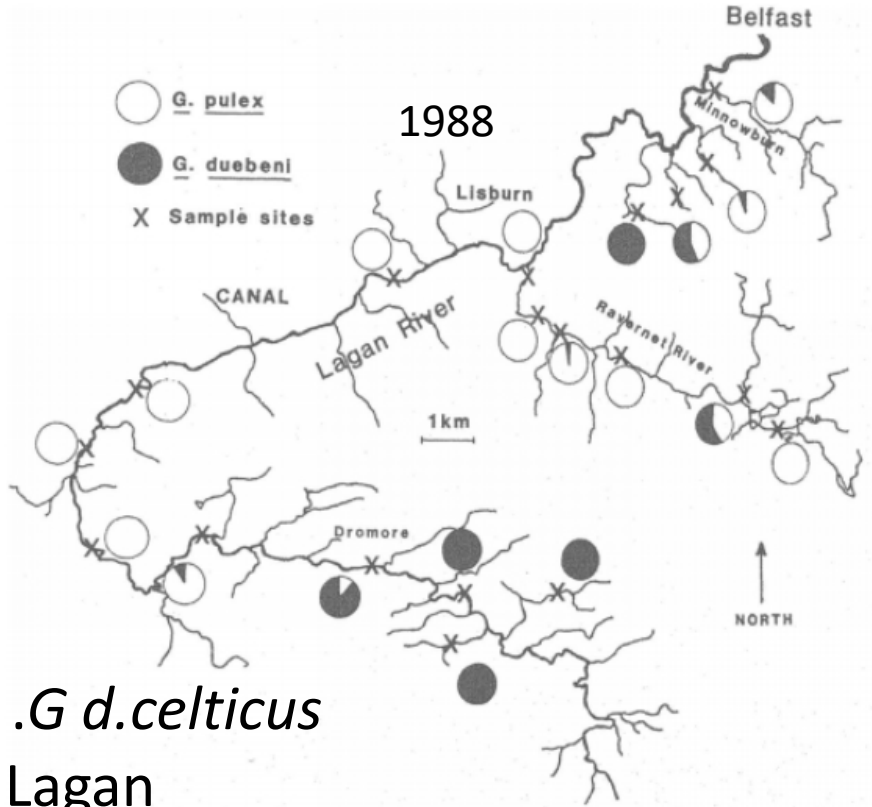


FIG. 2.—The known distribution of *Gammarus pulex* (L) in Northern Ireland on the 10km grid system.

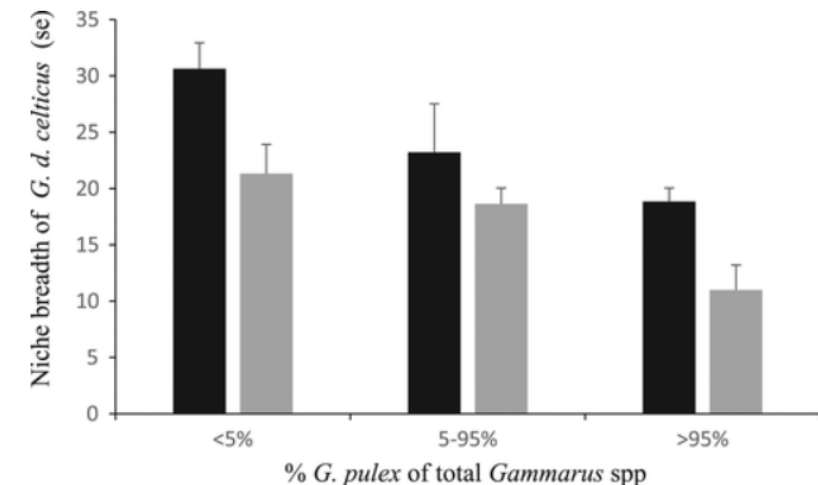
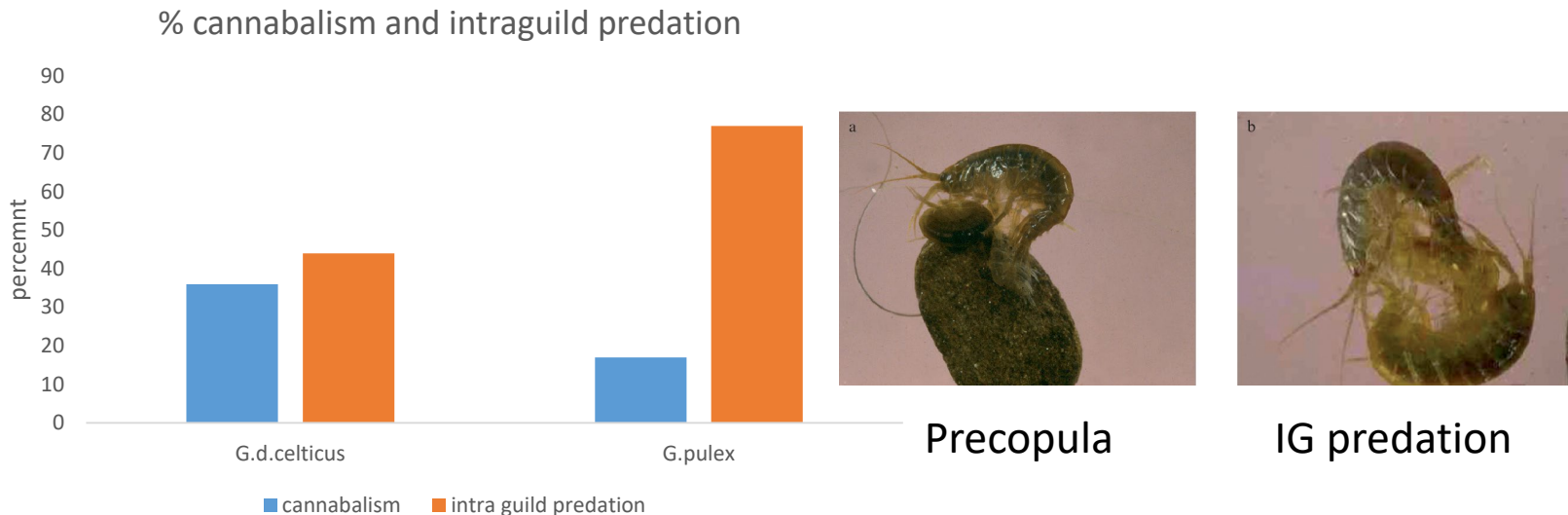


Distribution of *G. d.celticus* and *G. pulex* in Lagan catchment in 1988 and 1993

G.duebeni replaced by *G.pulex*: mechanisms

- Gammarids are predators of invertebrates
- Intraguild predation: *G.pulex* predaes *G.duebeni* more than *vice versa*
- Cannibalism greater in *G.duebeni* than *G.pulex*
- Spatial niche breadth of *G.duebeni* decreases with increasing abundance of *G.pulex*
- *G.pulex* more voracious predator than *G.duebeni*
- Parasites play a role in interactions between *Gammarus* species
- Environmental conditions affect outcome

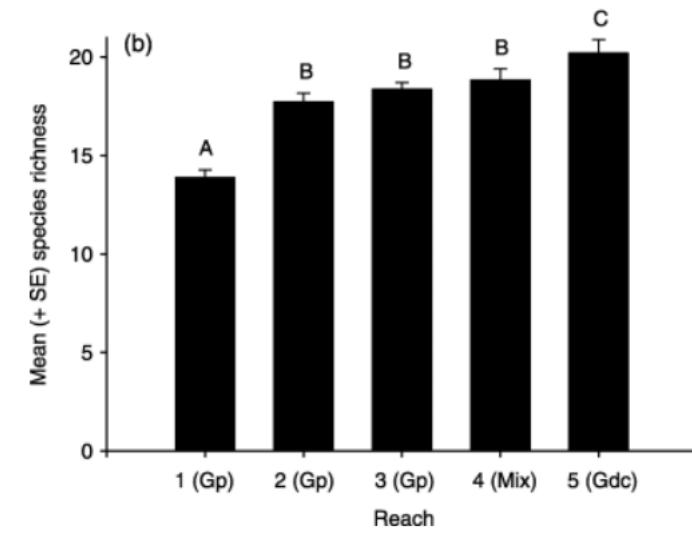
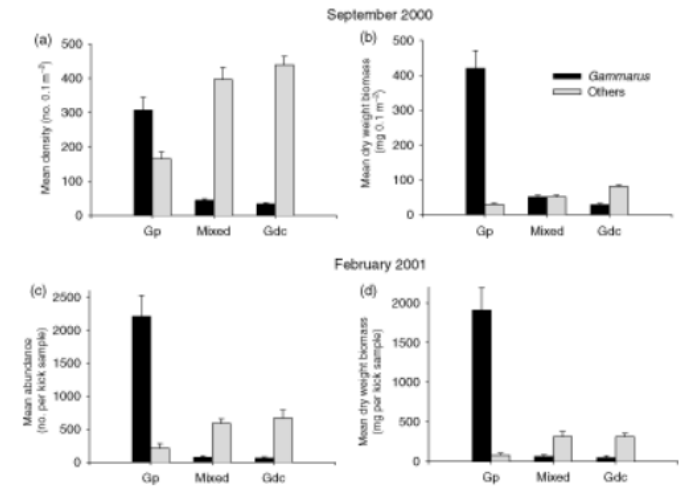
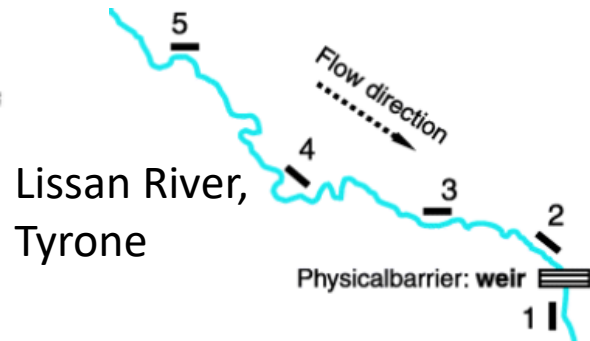
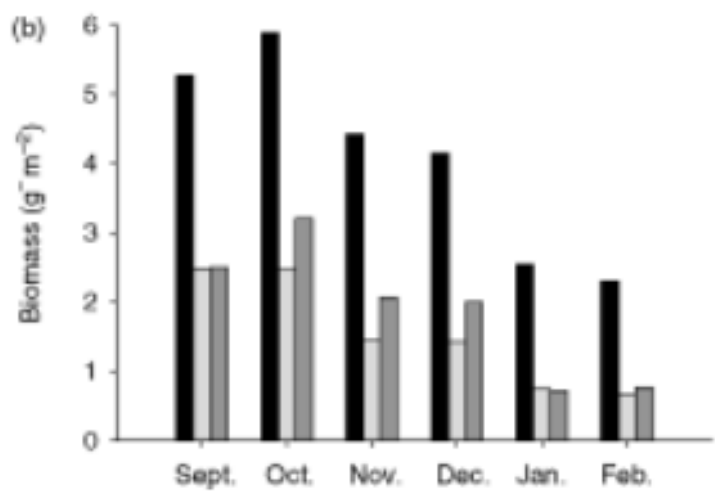
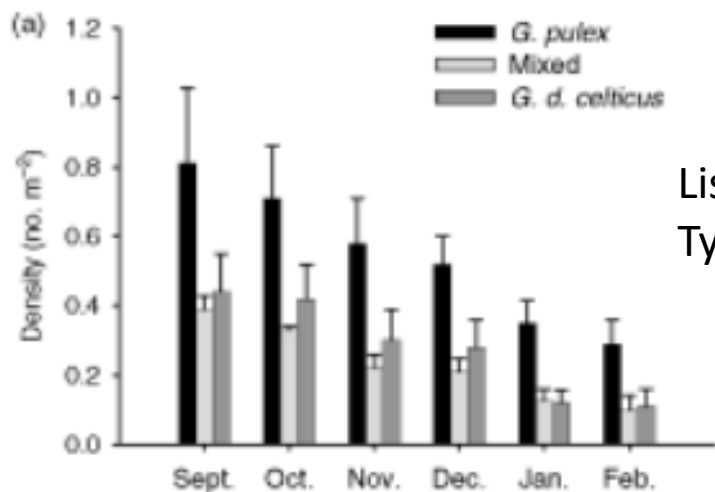
Dick, J.T., Montgomery, I. and Elwood, R.W., 1993. *Journal of Animal Ecology*, pp.79-88.
 Montgomery, W.I., Elwood, R.W. and Dick, J.T., 2022. *Ecology and Evolution*, 12(3), p.e8500.





Community impact of *G.pulex*

G.pulex reduces non-gammarid invertebrate species richness, density and biomass but enhances trout density and biomass



Kelly, D.W. and Dick, J.T., 2005. *Freshwater Biology*, 50(1), pp.127-140.

Kelly, D.W., Bailey, R.J., MacNeil, C., Dick, J.T. and McDonald, R.A., 2006. *Diversity and Distributions*, 12(5), pp.525-534.

In conclusion.....

- IAS may be established long before they are apparent
- Many processes may be involved in the process of species replacement
- Impacts of IAS may be readily apparent but require documentation
- Some impacts require systematic and detailed research
- IAS undermine biodiversity supporting many Ecological Services from food and water provision to human health and well-being

