

Invasive Species

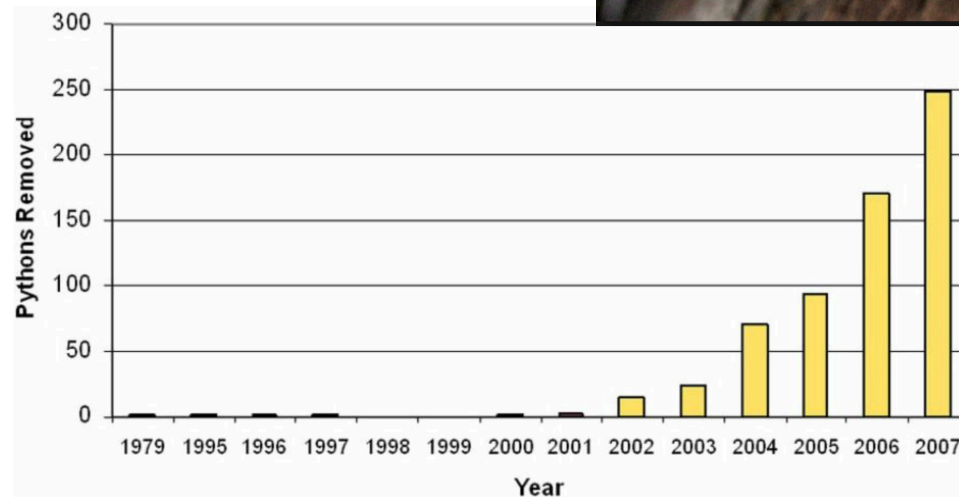
Terms

- Introduced: species that originate in one location and are brought to another
 - Alien
 - Non-native Native: Species not introduced to that area
- Invasive: A non-native species in an ecosystem that causes or is likely to cause economic or environmental harm

Methods of introduction

- Deliberate

- Comfort
- Biological control
- Ecological remediation
- Ornaments
- Agriculture
- Domestic
- Sport



Methods of introduction

- Deliberate

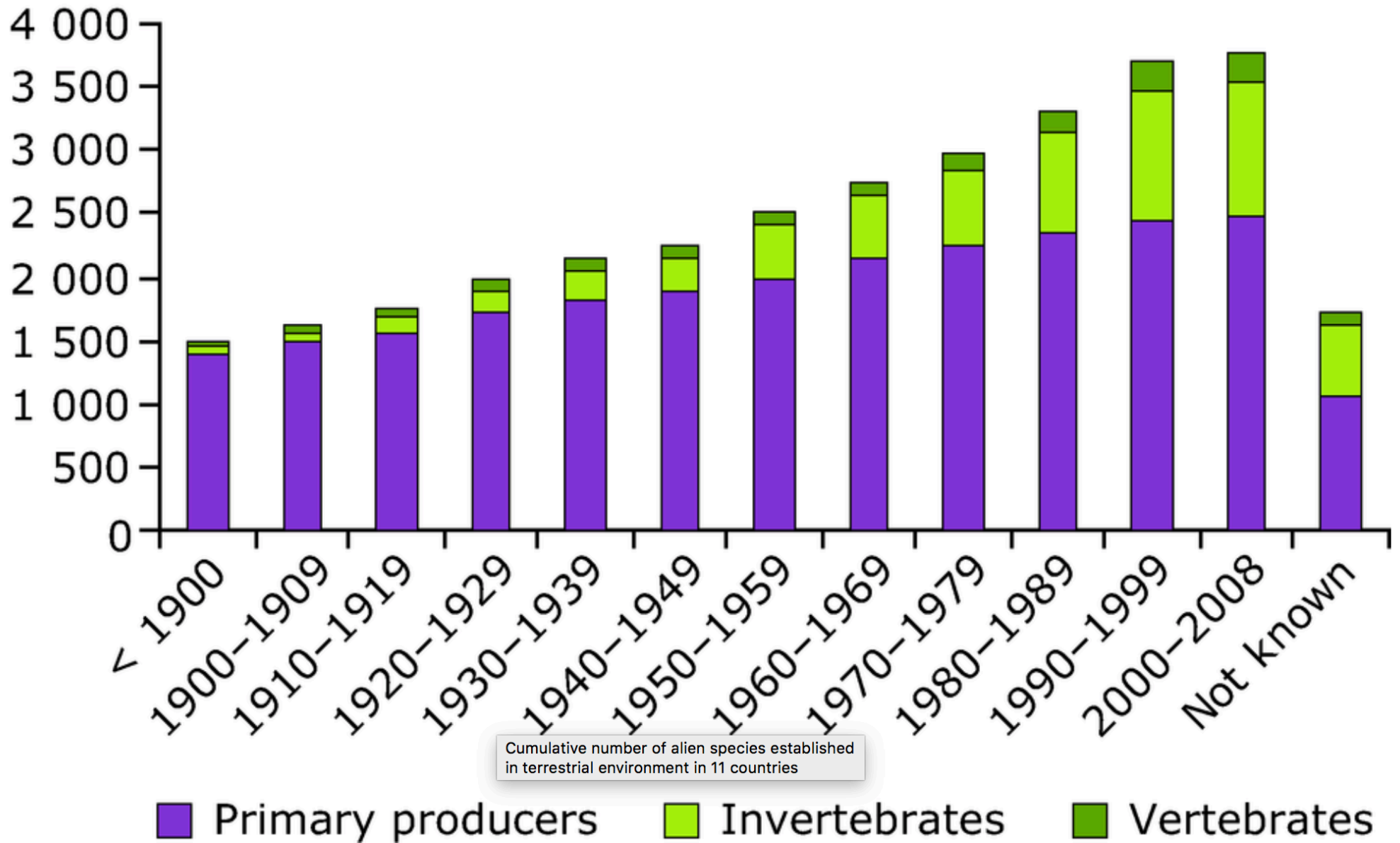
- Comfort
- Biological control
- Ecological remediation
- Ornaments
- Agriculture
- Domestic
- Sport

- Accidental

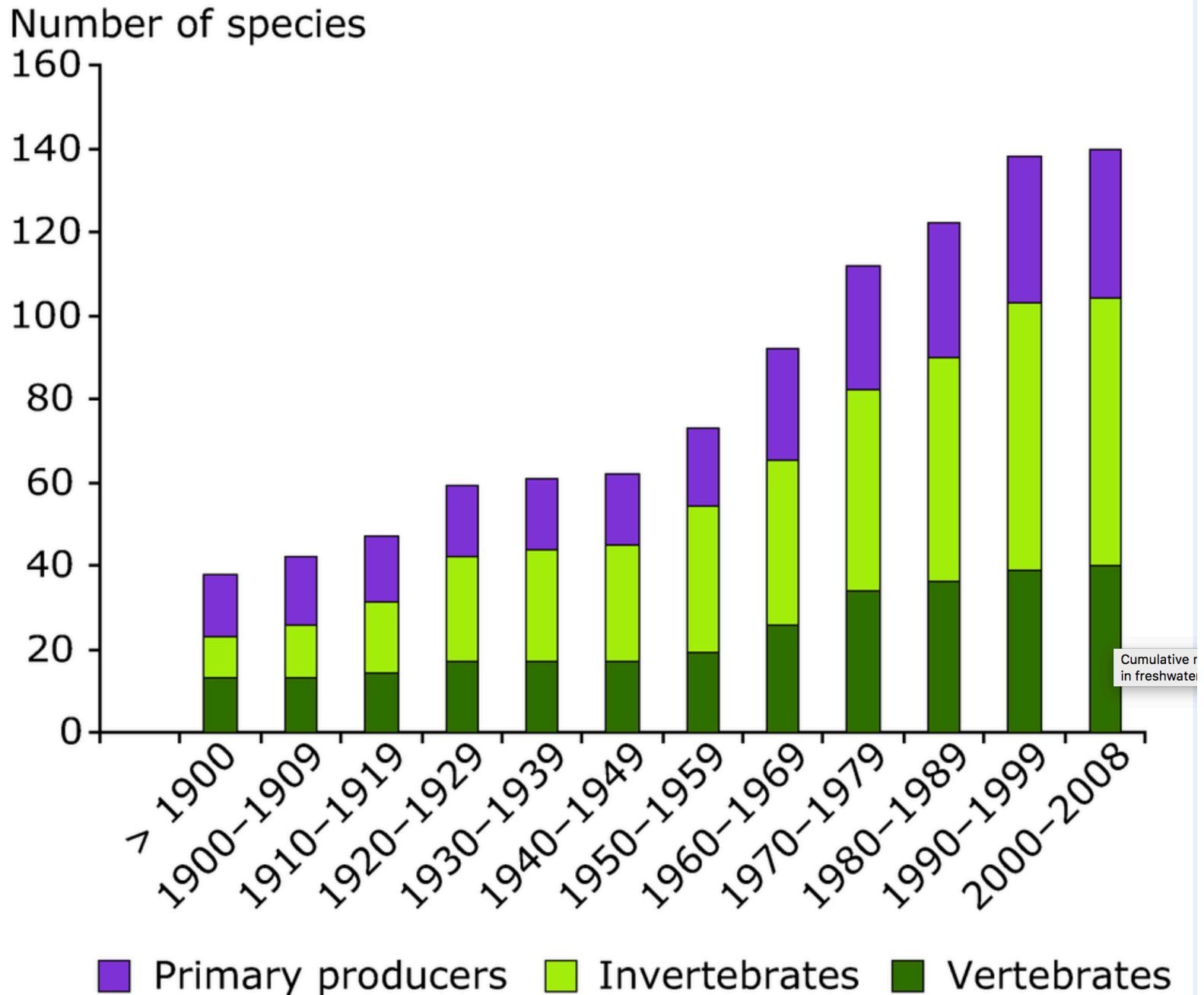
- Travel (air, sea, land)
- Shakespeare



How common?

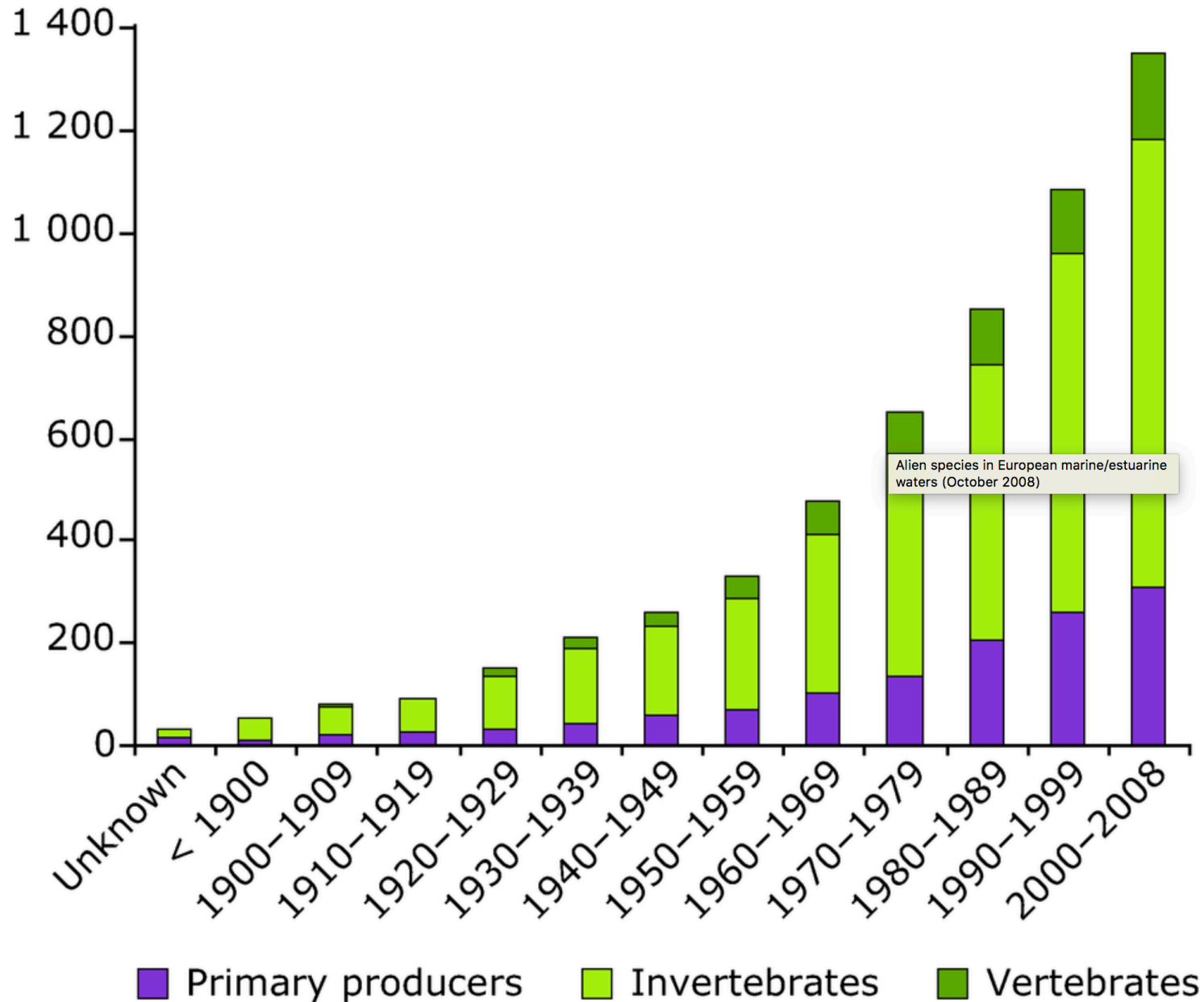


How common?

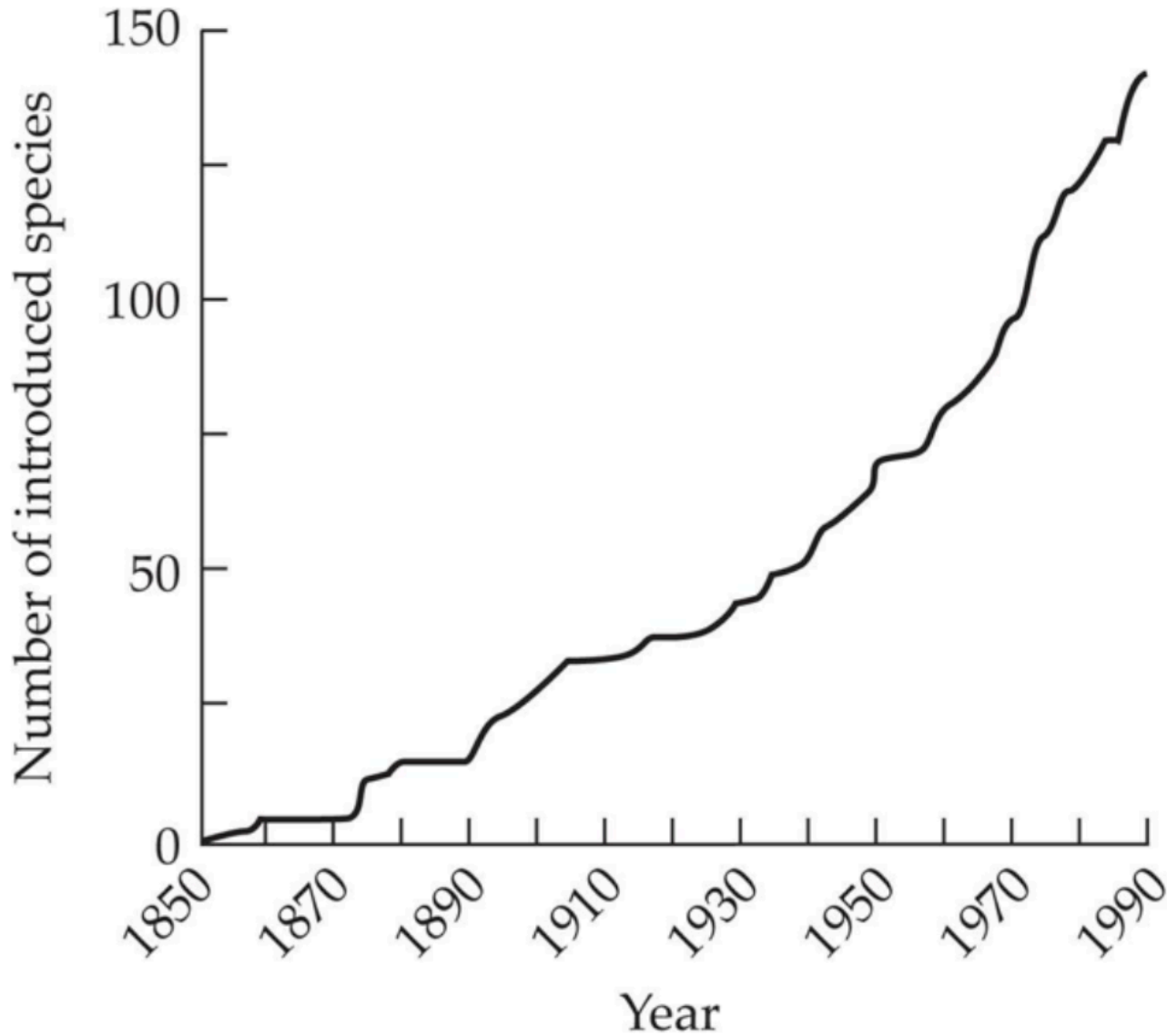


How common?

Cumulative number of species



How common?



Economic cost of invasives

Type of organism	Annual cost of damage + control (\$ billions)
Plants (e.g. weeds)	34.7
Mammals (e.g. rats, cats, feral pigs)	37.5
Birds (e.g. pigeons, starlings)	1.9
Fish	5.4
Arthropods (e.g. insects, crustaceans)	20.1
Mollusks (e.g. mussels, clams)	22.1
Microbes (e.g. pathogens, diseases)	25.7

Ecosystem costs

- Habitat loss
- Habitat alteration
- Predation
- Resource competition



Invasions and conservation

- Invasives are the a leading cause of population decline and extinction in animals
- Invasives are a leading factor in freshwater fish endangerments and extinctions
- Brown tree snakes have been implicated in the extinction of 10 species in Guam
- More than 400 of the 1300 species currently protected under ESA are at risk at least partly because of the threat of invasive species

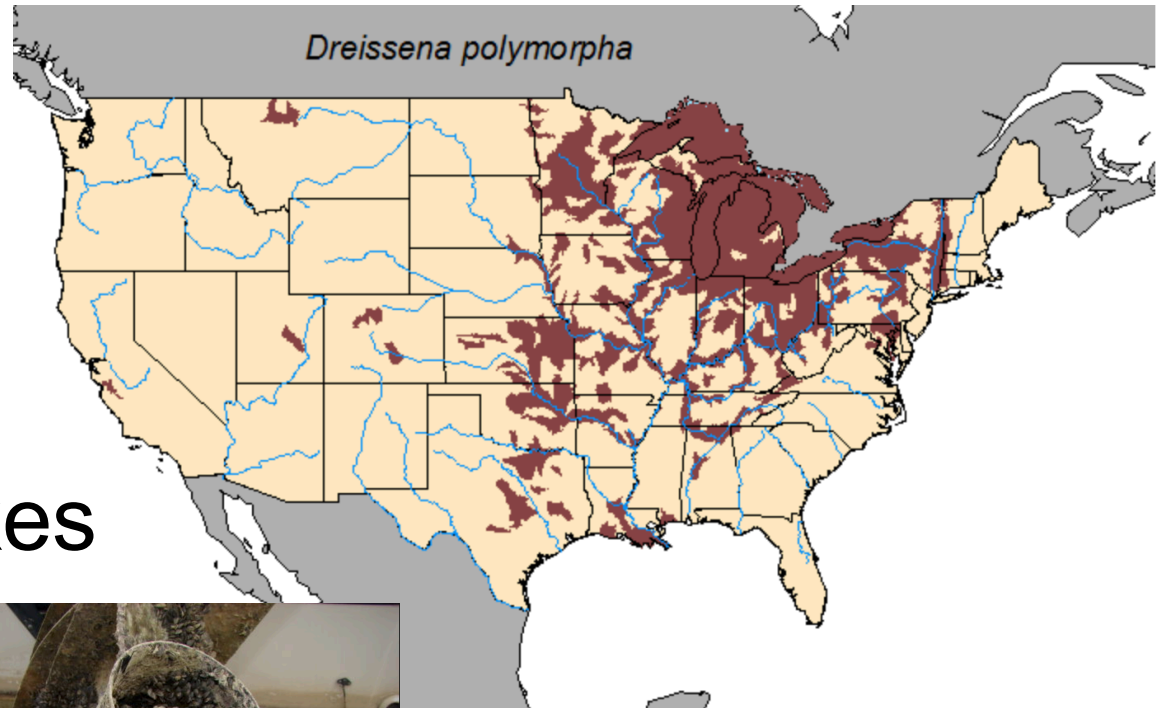
European Starling

- American Acclimatization Society for European Settlers
- Eugene Scheiffelin (1890)
- 60 birds into Central Park



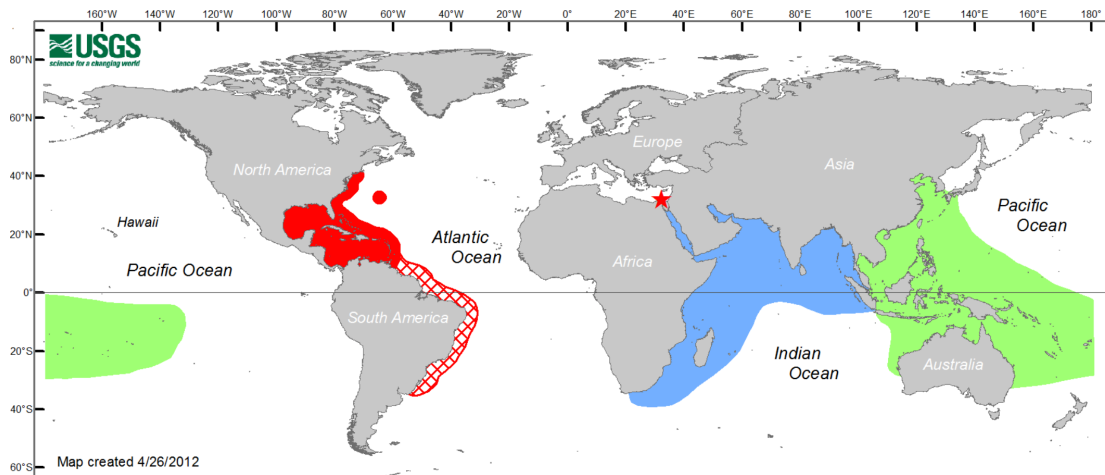
Zebra mussel

- Native to Eastern Europe/Western Russia
- Introduced accidentally to Great Lakes via ballast
- 1988 first detected
- Outcompete Native
- Attach to boats
- Clog irrigation intakes



Lionfish

- Two closely related species invasive in US waters
- Native to Indo-Pacific
- First detected in Florida coasts in 1980s
- Aquarium release-mediated introduction



Map of native range of *Pterois volitans* (green) and *P. miles* (blue) adapted from Schultz (1986) and Randall (2005). Star in Mediterranean Sea denotes Lessepsian migration of *P. miles* via the Suez Canal (Golani and Sonin 1992). Non-native range of *P. volitans* and *P. miles* in the Americas is shown in red (from Schofield et al. 2012). Predicted future distribution of lionfish along coastal South America is shown in red hatching (Morris and Whitfield 2009).

