Overview on Introduced Aquatic Species in Europe with focus on ICES Member Countries

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Content

- Invaders per Region
- Invasion Status
- Marine vs. Freshwater Invaders
- Invasion Rate
- Changes in Introduction Vectors
- Biological Invasions and Global Warming
- Summary

Regions considered

- Seas of all EU Member states plus Norway, non-EU Mediterranean Sea, Black Sea (approx. >160,000 km coastline)
- Adjacent water bodies (lakes, estauries etc.)
- Temperature range from arctic to warm-temparate conditions
- Salinity range from freshwater to marine conditions
- Various habitats including rocky shores, sandy beaches, mud flats

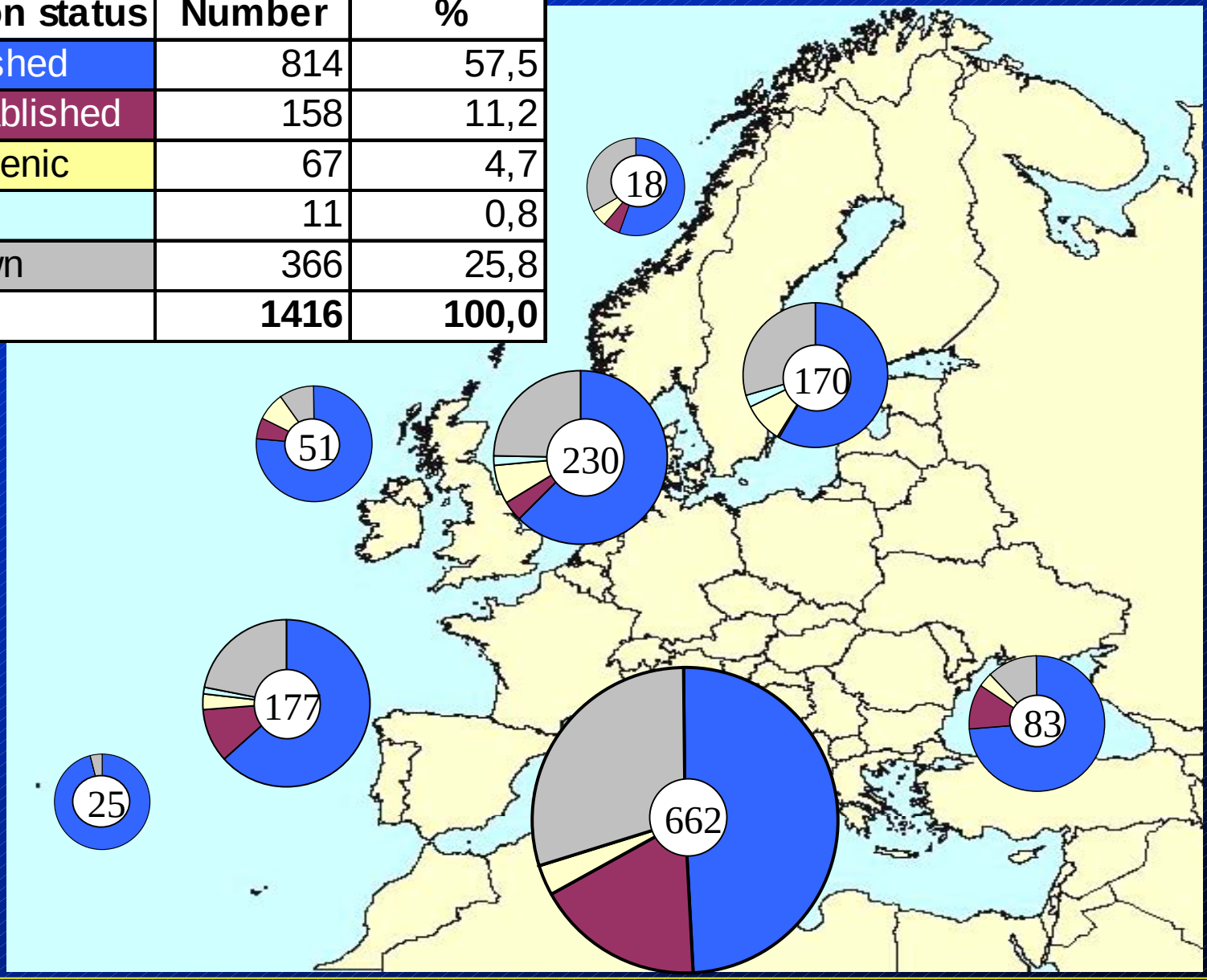
Overview

- 1,032 non-indigenous species are known to occur in the regions considered
- The region with the highest number of first records of invaders is the Mediterranean Sea

Region	Total	
	number	%
Mediterranean Sea	662	46,8
North Sea	230	16,2
Atlantic coast	177	12,5
Baltic Sea	170	12,0
Black Sea	83	5,9
Azores	25	1,8
Irish waters & NW UK	51	3,6
Arctic waters	18	1,3
Total	**1416**	**100,0**

Invaders per Region

Invasion status	Number	%
Established	814	57,5
Un-established	158	11,2
Cryptogenic	67	4,7
Extinct	11	0,8
Unknown	366	25,8
Total	**1416**	**100,0**



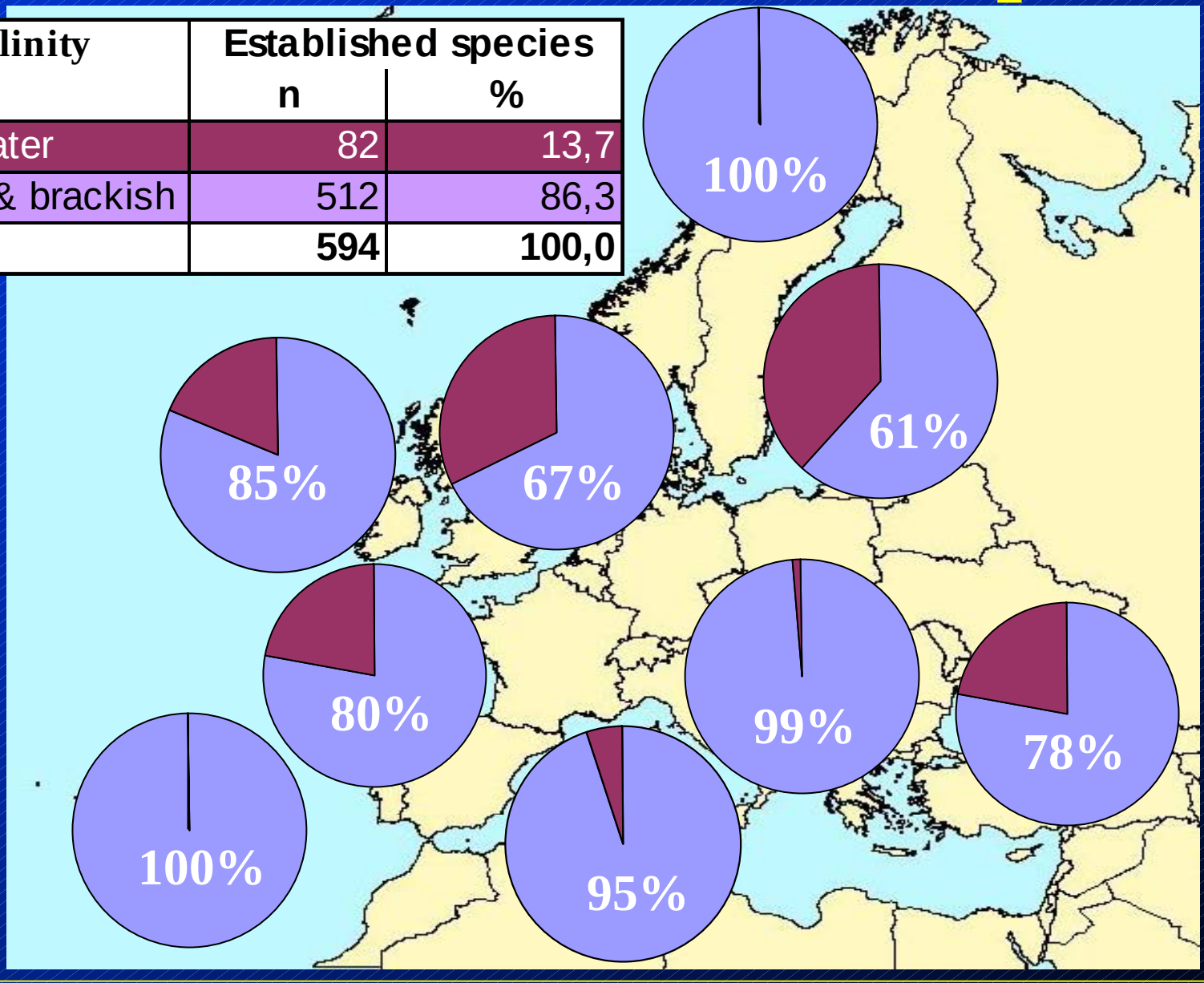
Invaders in Europe

- Most invaders (75,3 %) occur in one region (so far)
- 15 invaders in 6 regions:
  - *Eriocheir sinensis*
  - *Elodea canadensis*
  - *Colpomenia peregrina*
  - *Bannemaisonia hamifera*
  - *Azolla fuliculoides*
- 4 species in 7 regions:
  - *Teredo navalis, Ficopomatus enigmaticus, Balanus improvisus and Crassostrea gigas*
- 3 species in 8 regions:
  - *Mya arenaria, Crassostrea gigas and Bonnemaisonia hamifera*

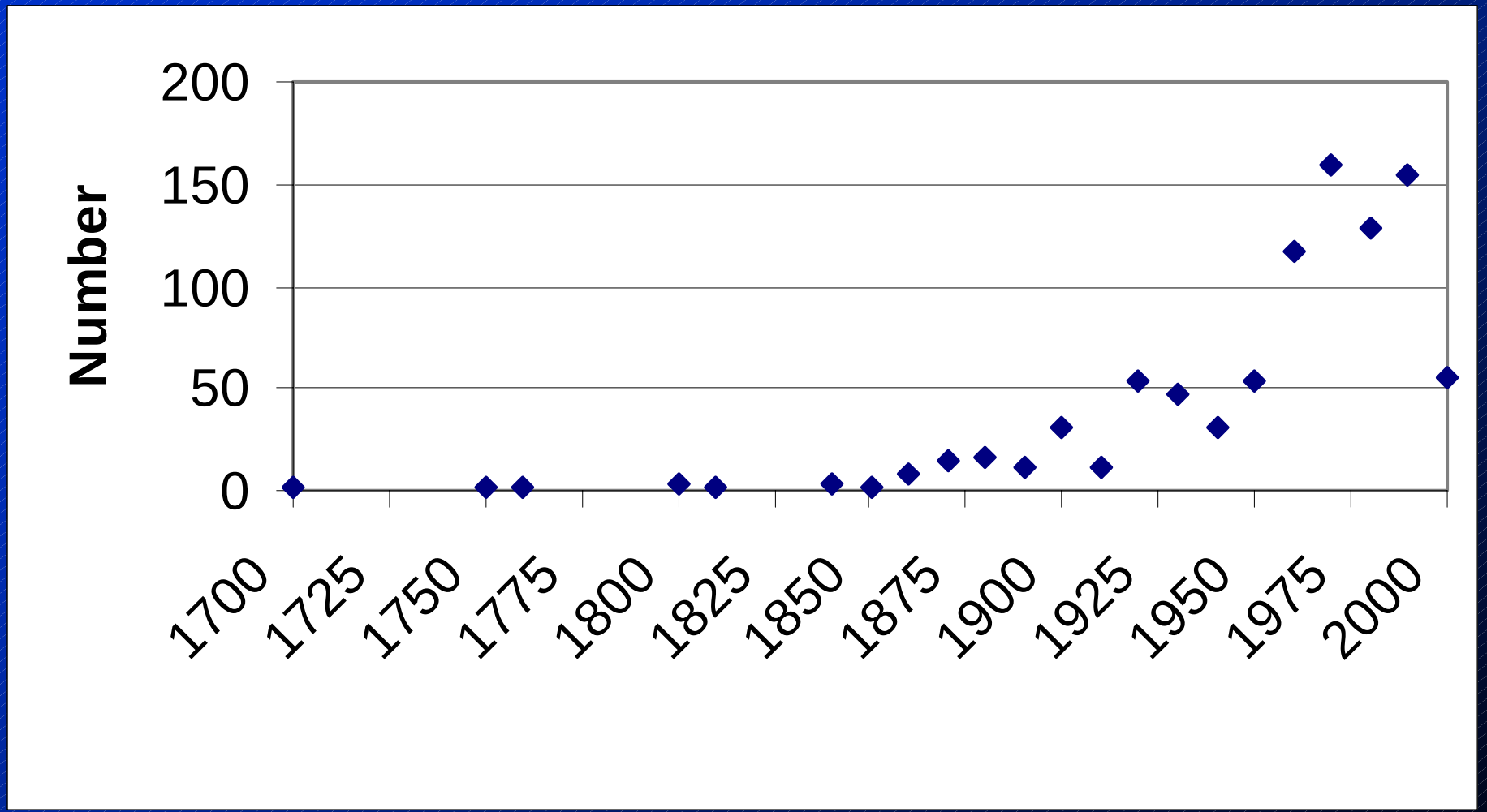
Number of regions invaded	Number of invaders	%
1	777	75,3
2	142	13,8
3	57	5,5
4	22	2,1
6	15	1,5
5	12	1,2
7	4	0,4
8	3	0,3
Total	**1032**	**100,0**

Freshwater vs. Marine Species

Salinity	Established species	
	n	%
Freshwater	82	13,7
Marine & brackish	512	86,3
Total	**594**	**100,0**

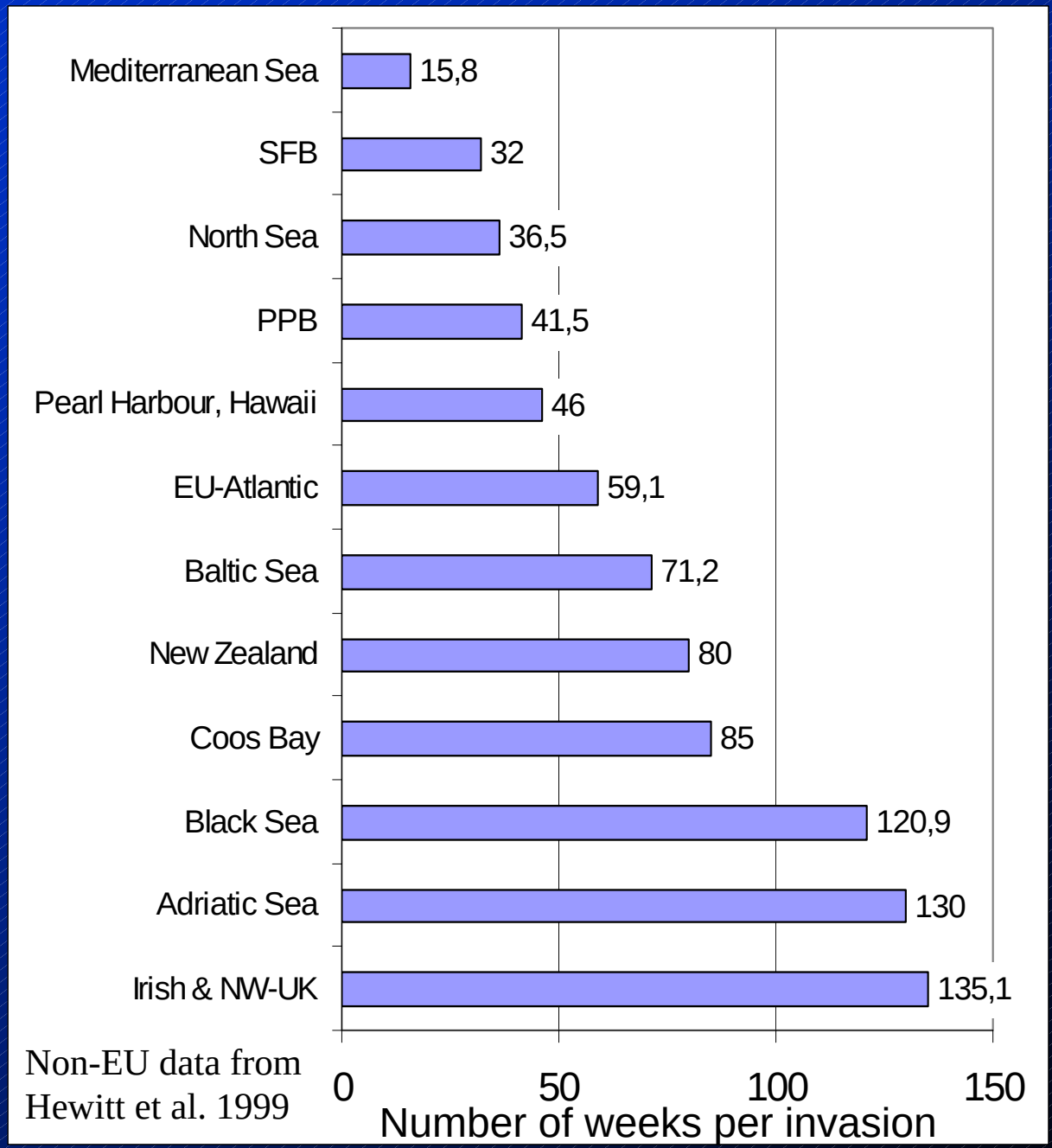


Timeline of Invasions in Europe



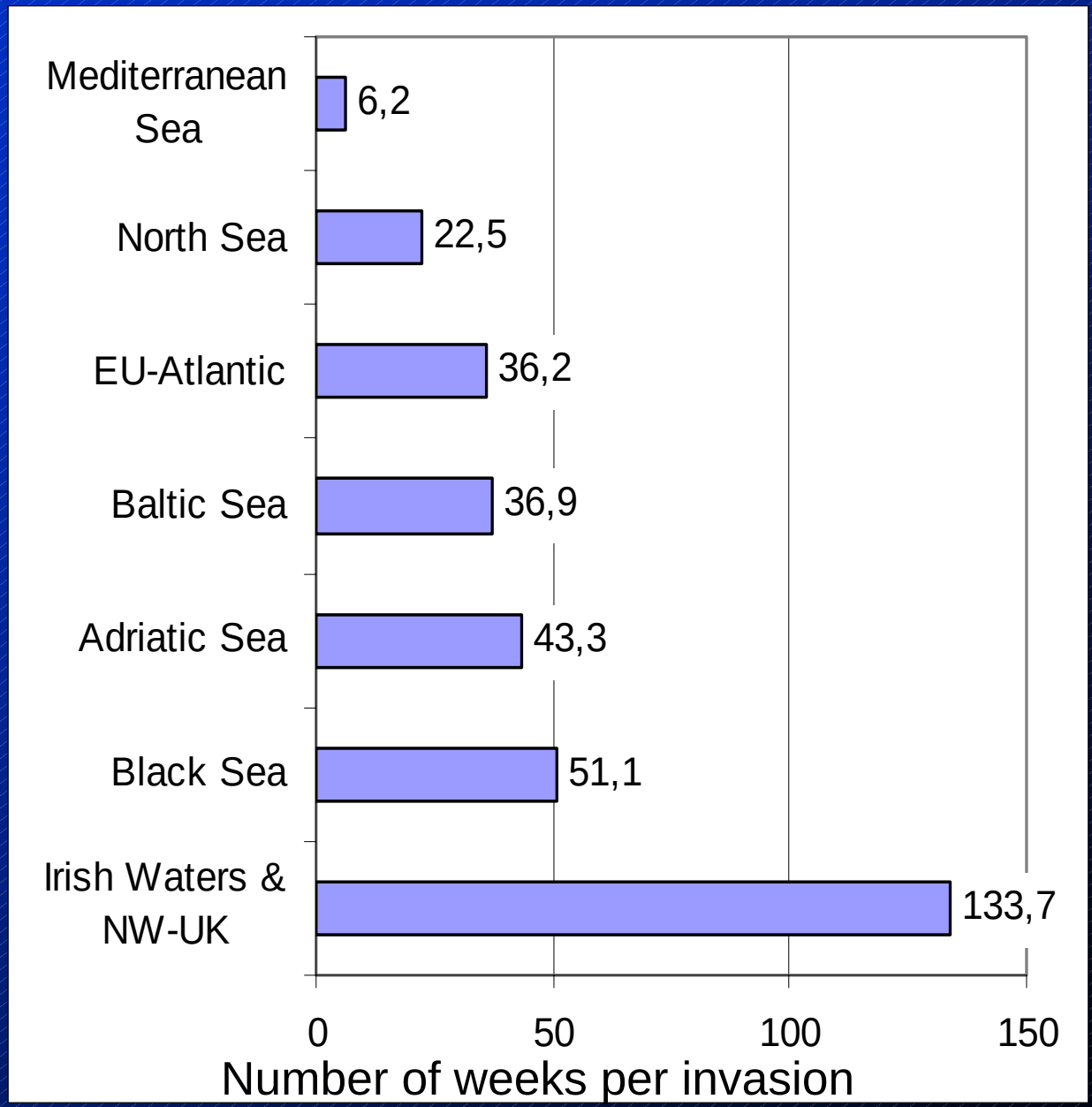
Invasion rate

- Data since 1800
- Max: every 4 **months** a new species in Med.
- Min: every 2.6 **years** in Irish&NW UK
- Mean: 1,5 years



Invasion rate

- Data since 1950
- Max: every 6,2 **weeks** a new species in Med.
- Min: every 2.5 **years** in Irish&NW UK
- Mean: 0,9 years

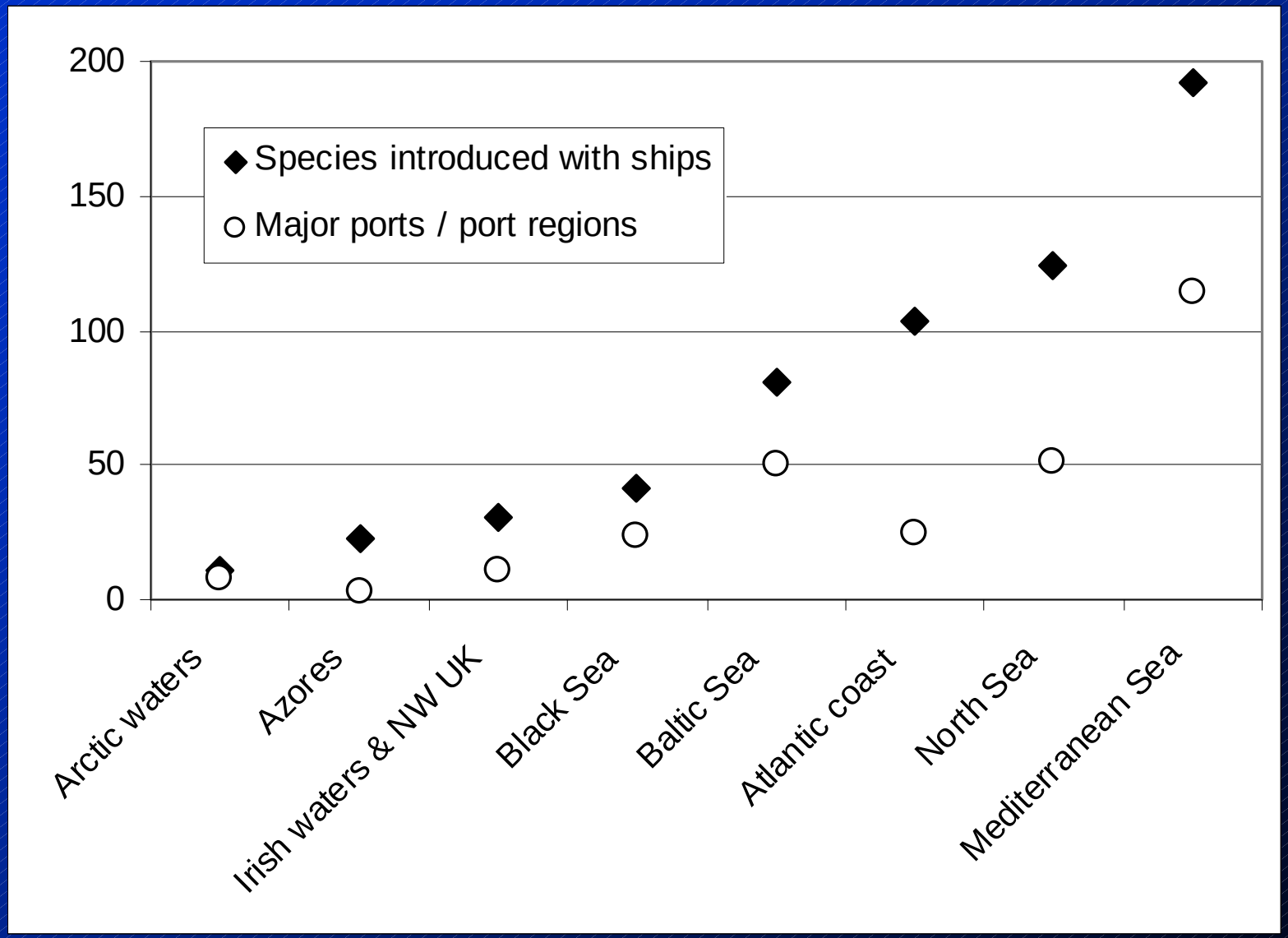


Vector Importance

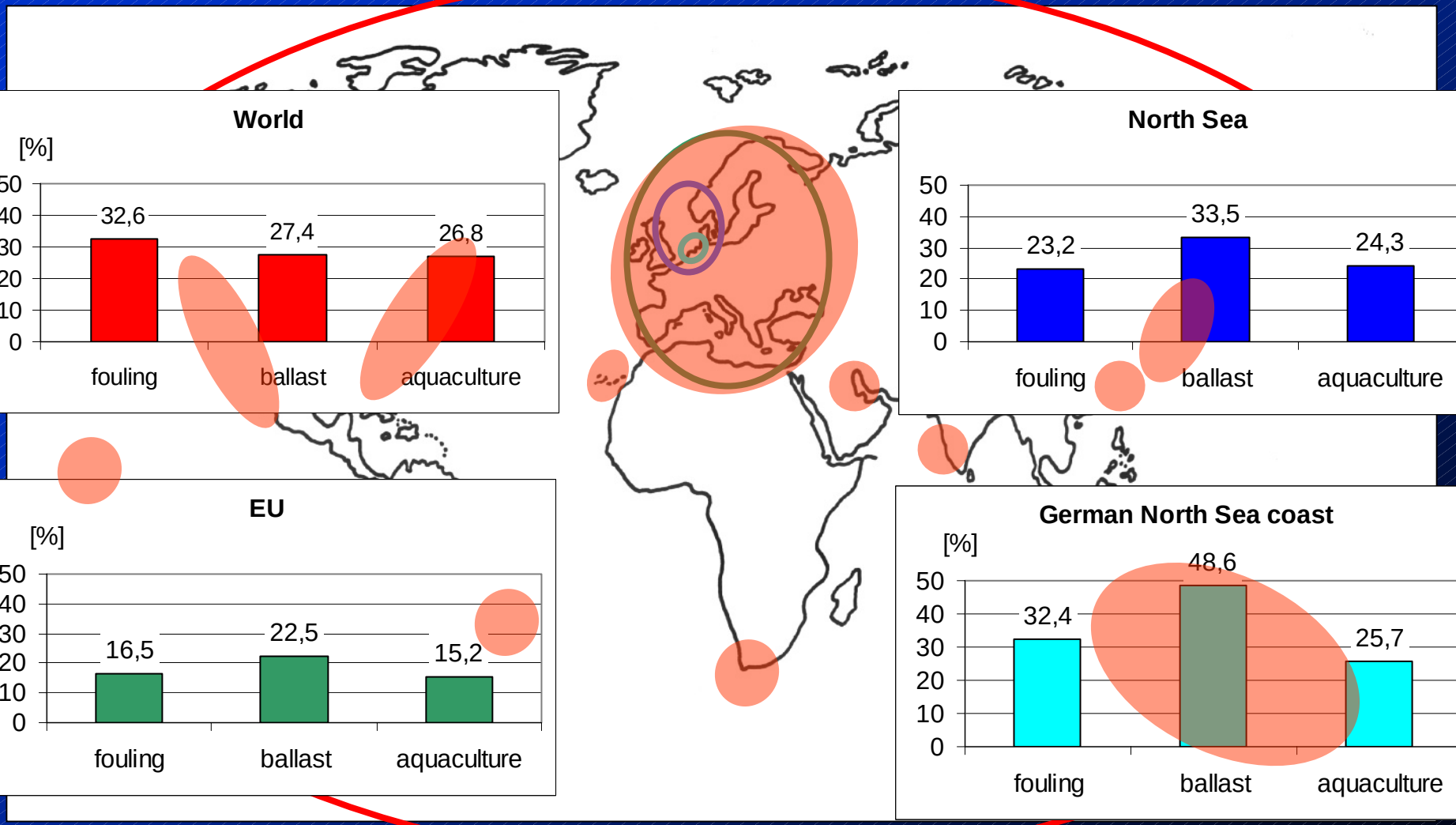
- Dominating "vectors" are Suez Canal migrations, ballast water, hullfouling and aquaculture

Vector	Total number	Freshwater number	Brackish & marine number
Lessepsian	253	0	253
Ballast	230	48	182
Fouling	170	42	128
Aquaculture	161	36	125
Stocking	90	63	27
Range	65	19	46
Canal	20	18	2
Ornamental	20	13	7
Science	8	1	7
Bait	6	1	5
Unknown	9		
Total	**1032**		

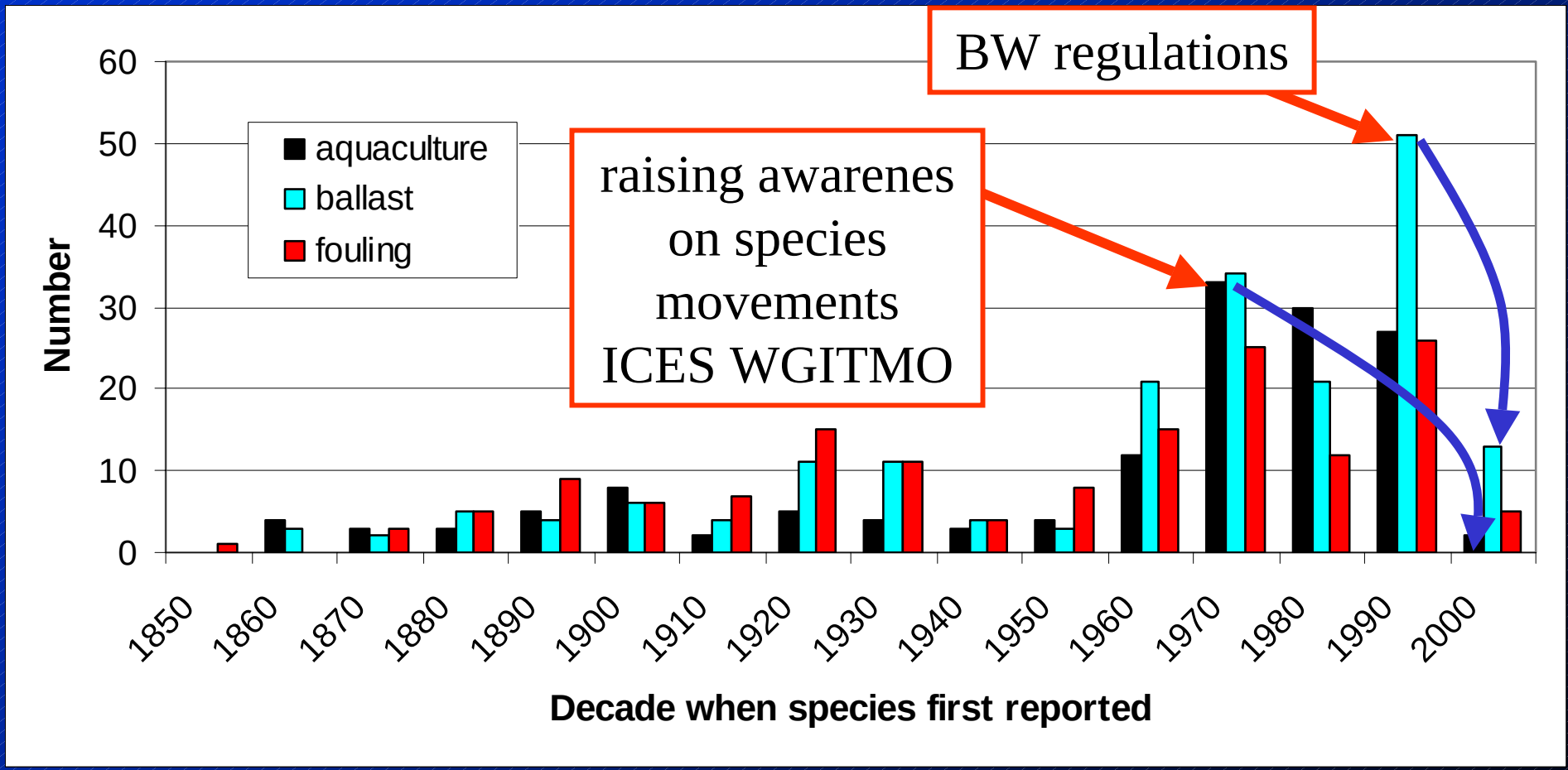
Bioinvaders and Ports



Relative Vector Importance

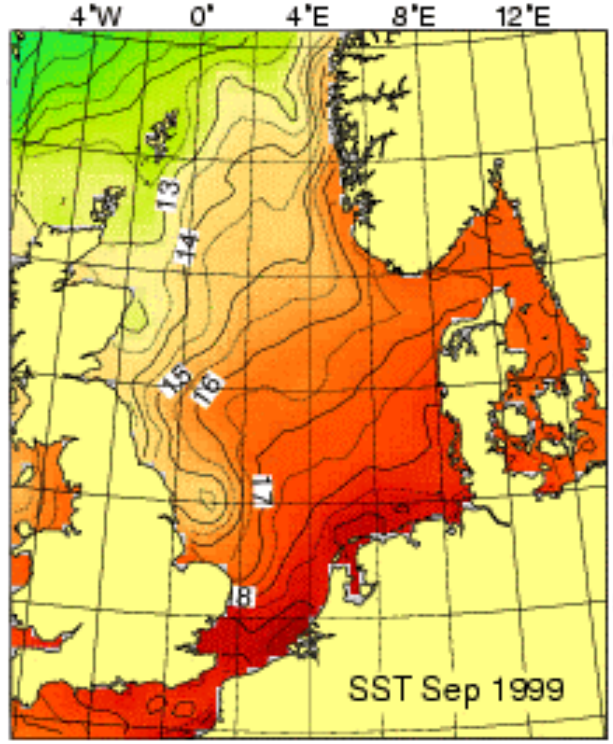


Changes in Introduction Vectors

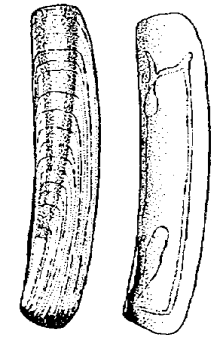


Global Warming

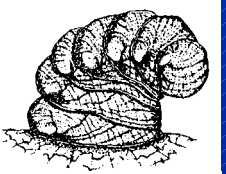
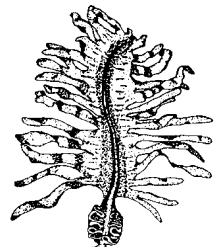
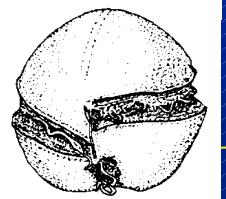
- 1990s was the warmest decade ever measured in the North Sea
- Temperature increase of 1.13 °C since 1962 (Helgoland)
- Europe: 65 species colonized new regions by range expansion
- Many colonized colder waters
- Native biota migrate northwards to colder waters
- Further SST increase predicted



ICES Ocean Climate Status Summary
www.ices.dk





Summary

- 1,032 aquatic invaders have been found in European Seas - predominantly zoobenthos species
  - 814 (57,5 %) established, 158 un-established and 366 species with unknown population status
- Region with the highest number of invaders is the Mediterranean Sea (662 species)
- The invasion rate is increasing towards the end of the last century
- Ballast water, hull fouling and aquaculture are the most important invasion vectors

Acknowledgements

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Delivering
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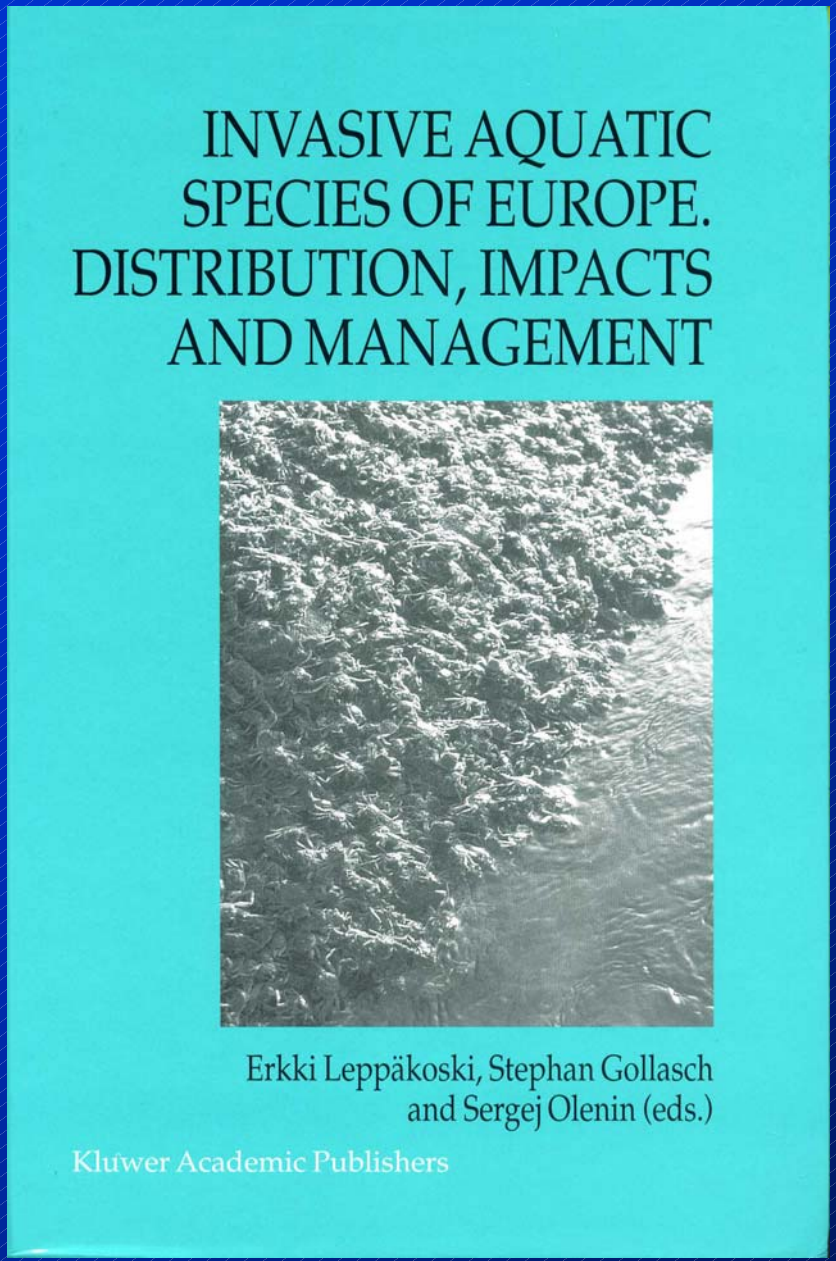

Thank you very much for your attention !

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