

COCKLES

Co-Operation for Restoring Cockle Shellfisheries
and its Ecosystem-Services in the Atlantic Area

Invasive species: major threats and opportunities

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FINAL VIRTUAL CONFERENCE

March 2021



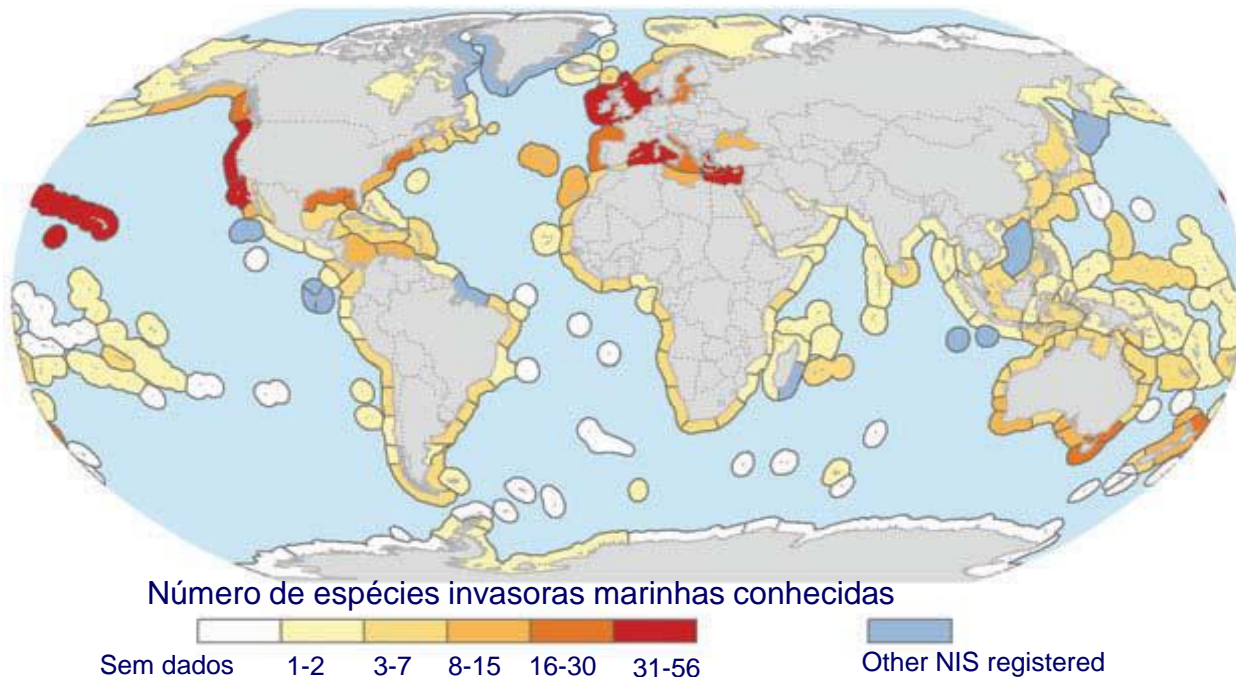
Invasive species: why do we care?

- Exotic, non-native or non-indigenous species introduced by humans, intentionally or unintentionally, outside of their natural range and outside of their natural dispersal potential
- Invasive species are likely to cause impacts on Environment, Economy and Human Health



Invasive species: why do we care?

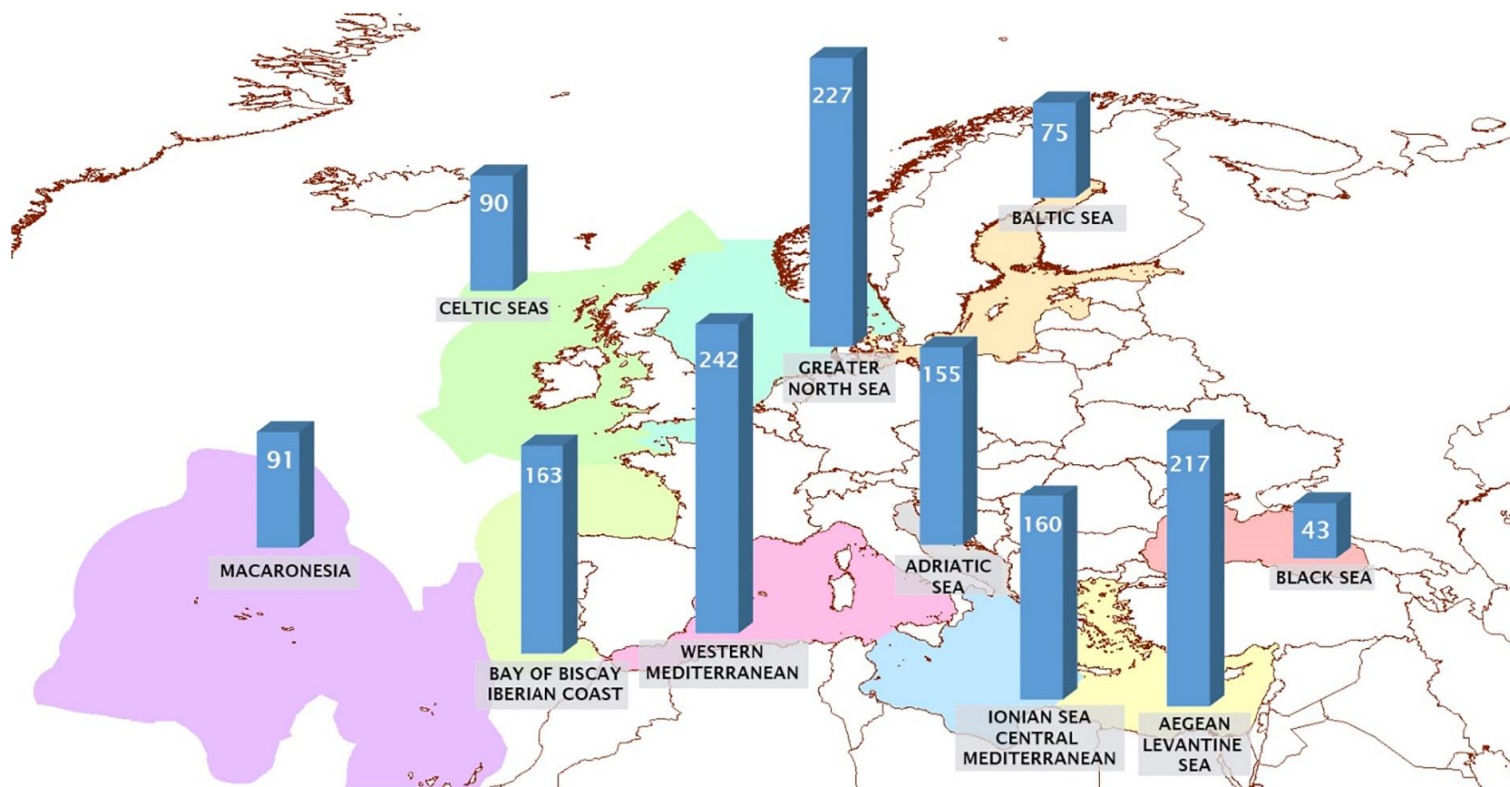
- Second cause of global marine biodiversity loss
- Worldwide problem



Adapted from Molnar et al., 2008

Invasive species: why do we care?

- 787 exotic species in estuaries and coastal waters of the EU countries



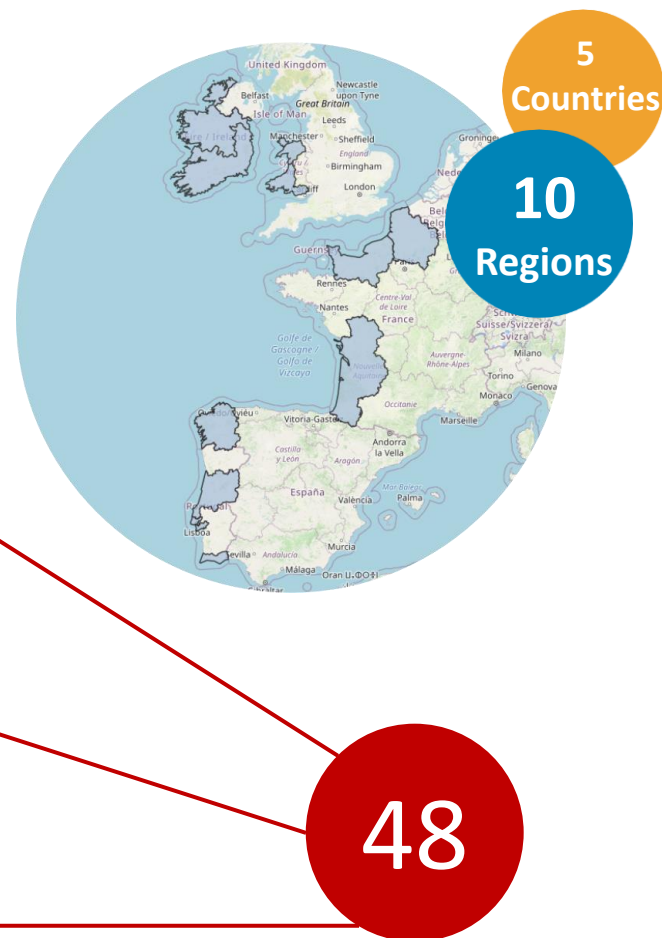
Tsiamis et al., 2019, Marine Pollution Bulletin

Invasive species: do the cockles care?

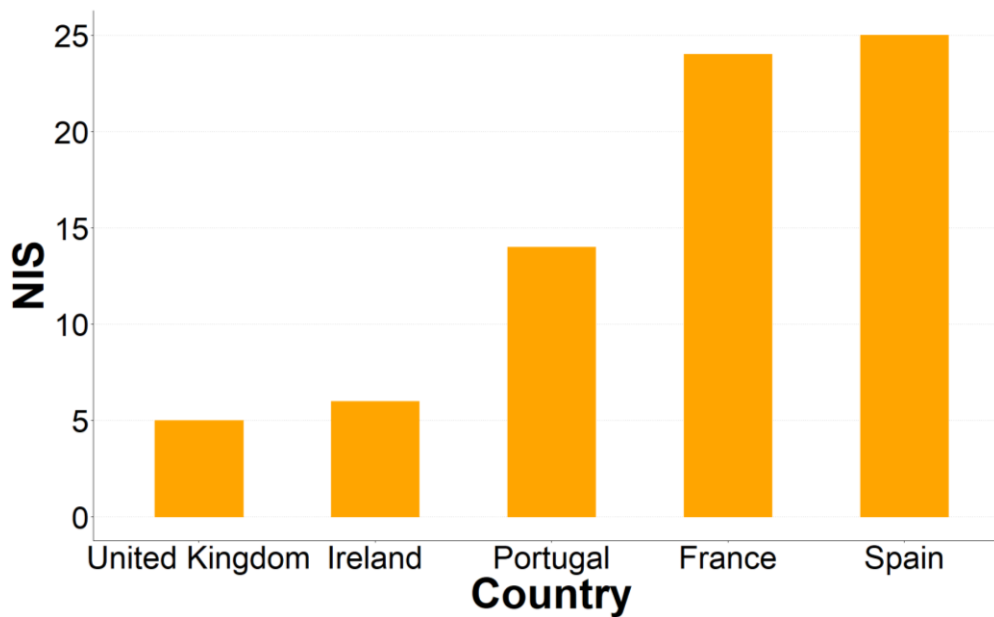
1. What is the overlap between areas occupied by cockles and other bivalve exotic species?
2. Invasive species compete with cockles for the same food sources?
3. Are there other characteristics which might enhance competition with cockles?



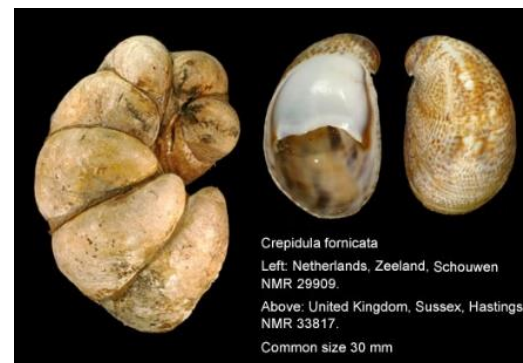
Exotic species in the AA



Exotic species in the AA



Most frequent *Crepidula fornicata*



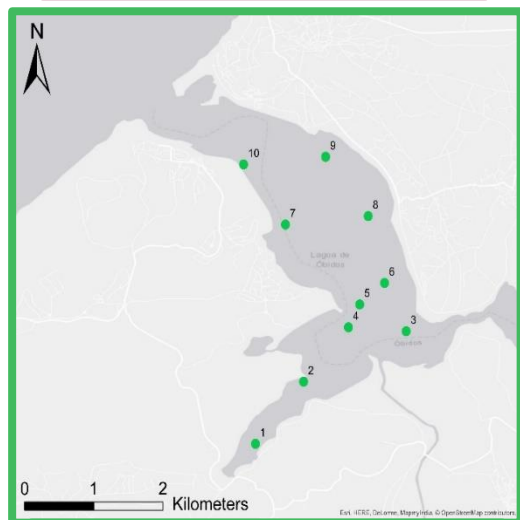
Most abundant *Ruditapes philippinarum*



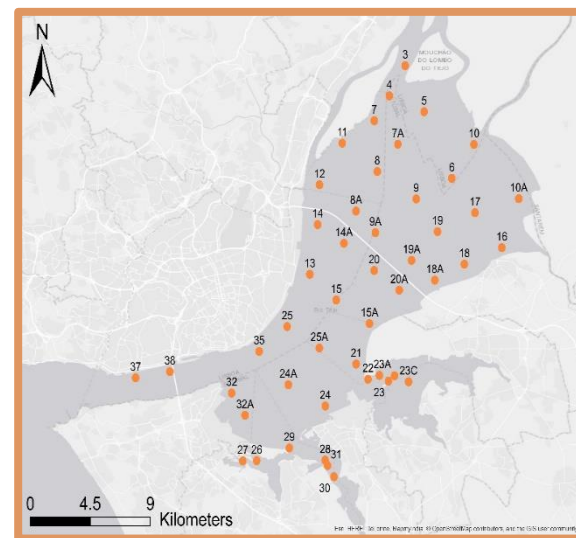
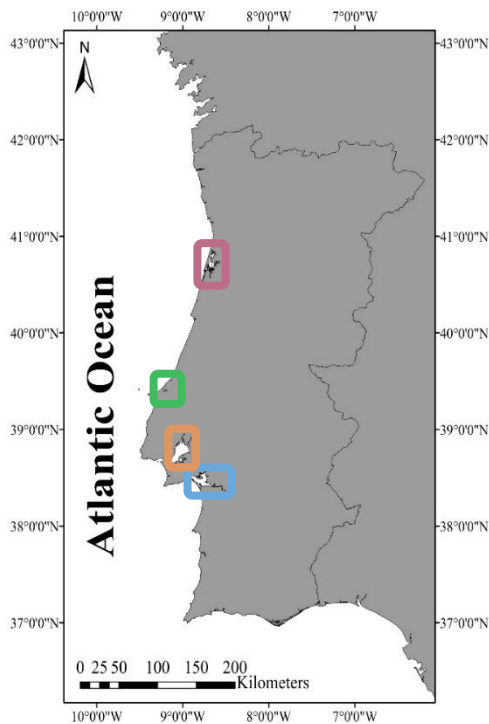
Overlap cockles/exotic species



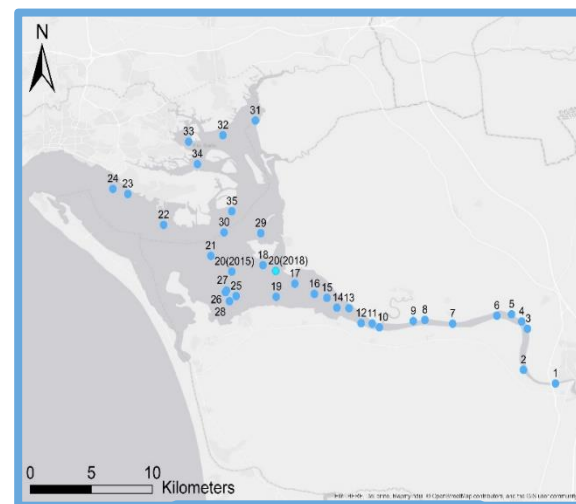
Aveiro coastal lagoon



Óbidos coastal lagoon



Tagus estuary



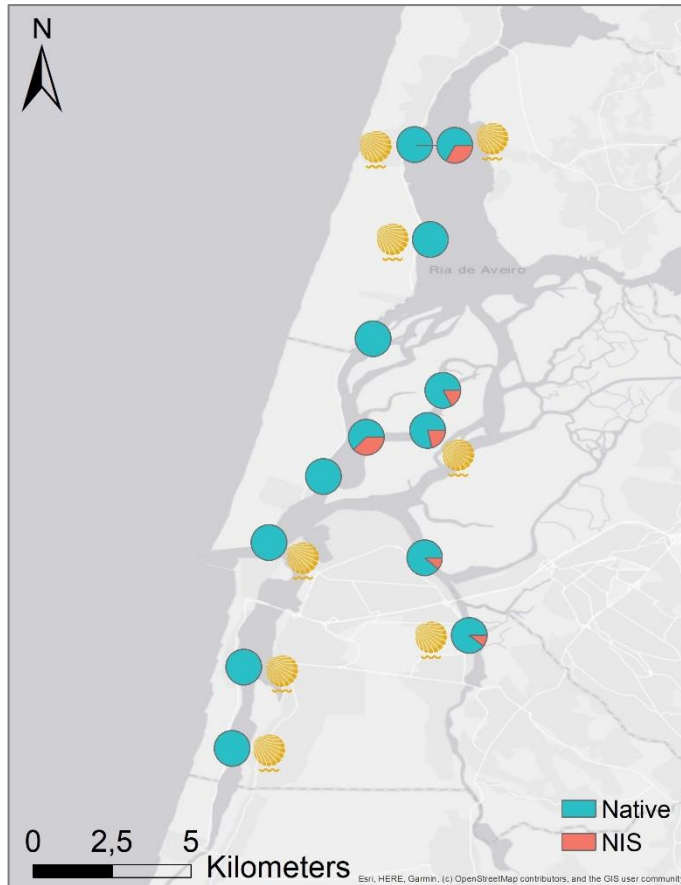
Sado estuary

Overlap cockles/exotic species

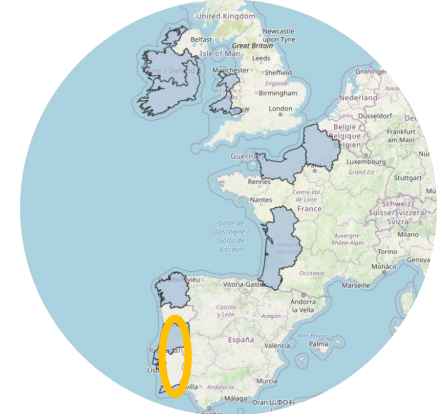
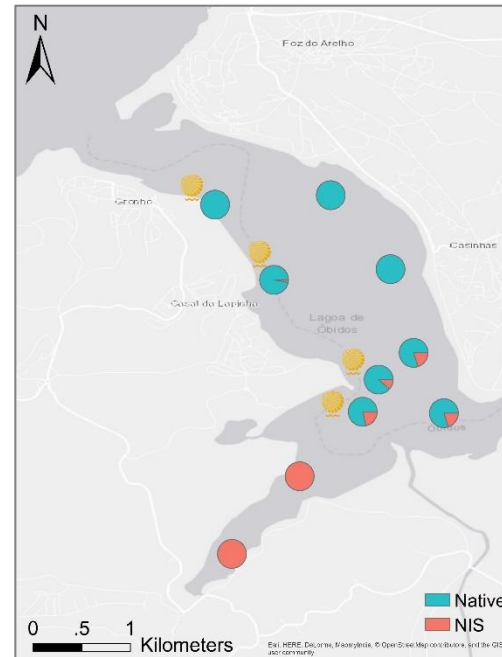


Overlap cockles/exotic species

Ria de Aveiro



Óbidos coastal lagoon



Crepidula fornicata

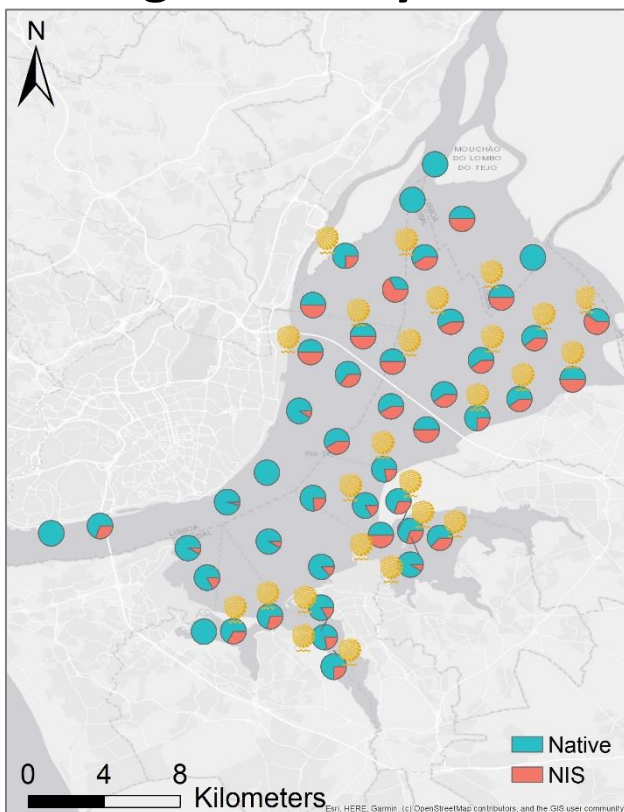


Ruditapes philippinarum

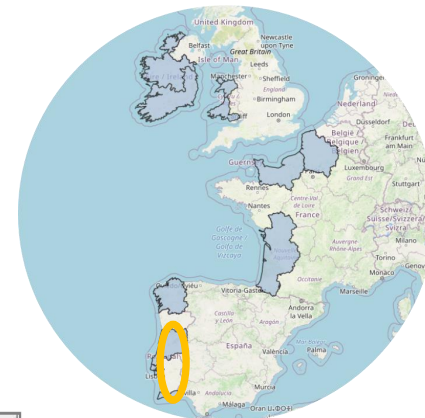
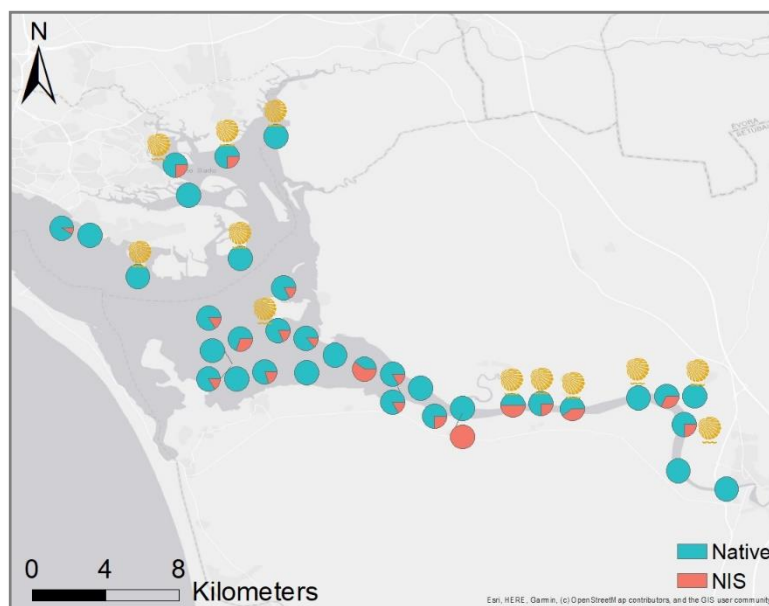
- Co-occurrence of cockles and exotic species in some locations

Overlap cockles/exotic species

Tagus estuary



Sado estuary



Ruditapes philippinarum

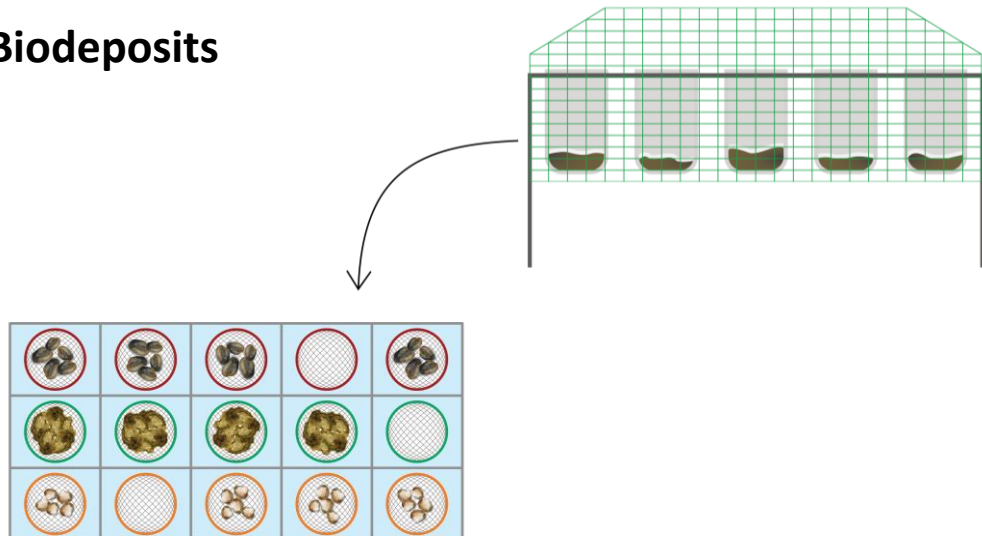
- Co-occurrence of cockles and exotic species in some locations
- The Manila clam is the dominant bivalve species at the Tagus estuary

Competition for food?

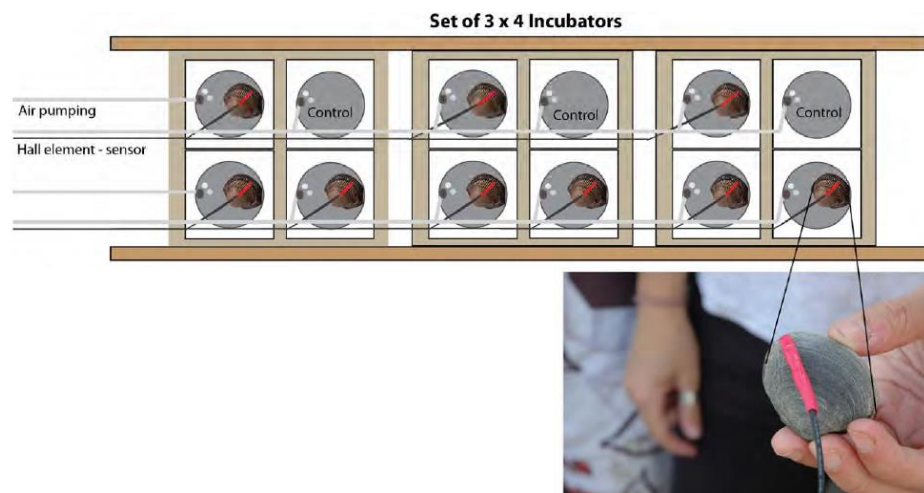
- Identifying the Diet of Cockles, Oysters and the Manila clam
- Measuring Clearance Rates (CR) – L/h/individual
 - ✓ Direct Methods – Particle removal
 - ✓ Indirect Methods – Biodeposition



- **Biodeposits**



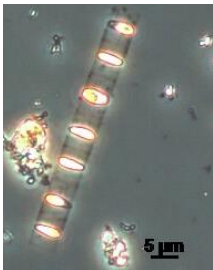
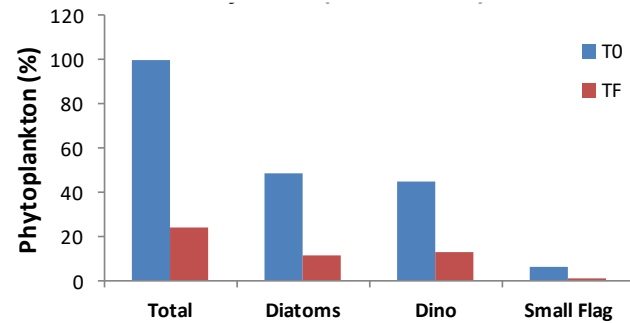
- **In situ experiments with incubators**



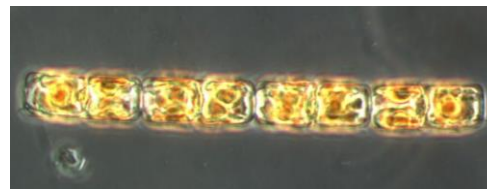
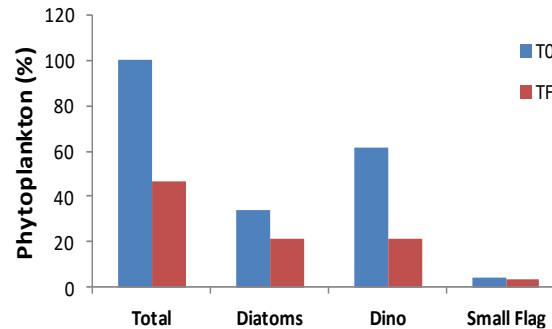
Competition for food?

Diet preference

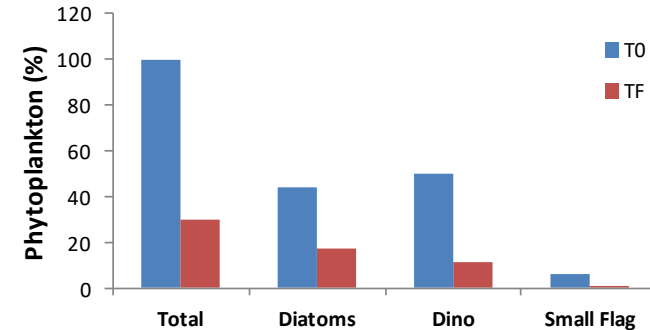
Clam



Cockle

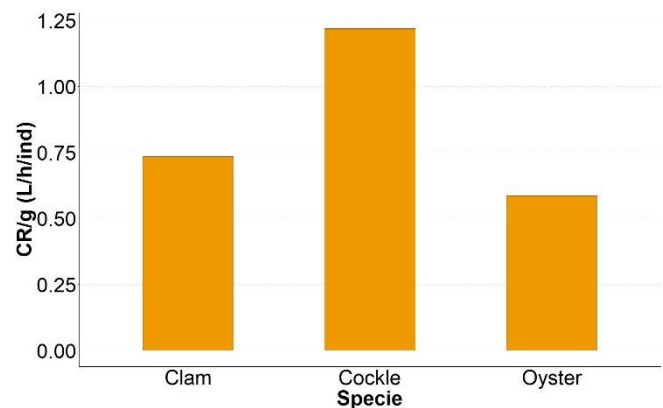
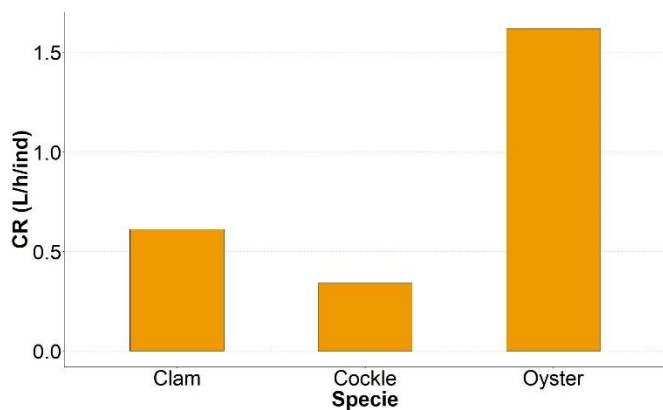


Oyster

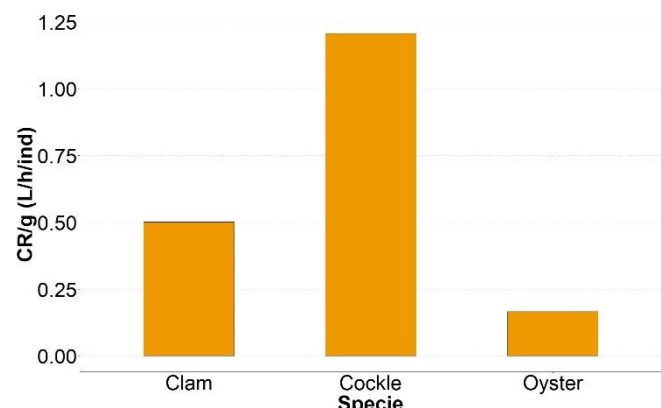
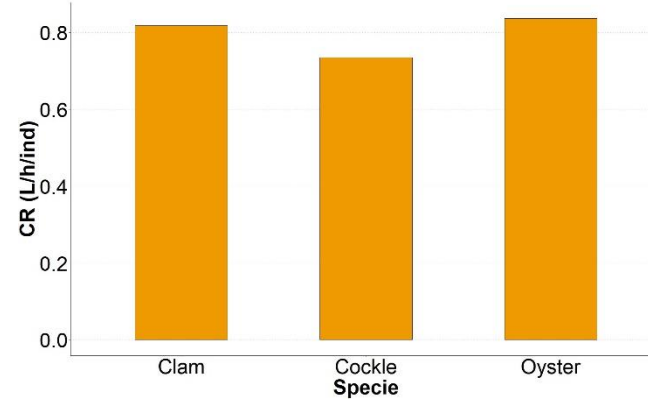


- All species showed no clear preferences
- Dinoflagellate and diatoms species are significantly consumed

Biodeposits

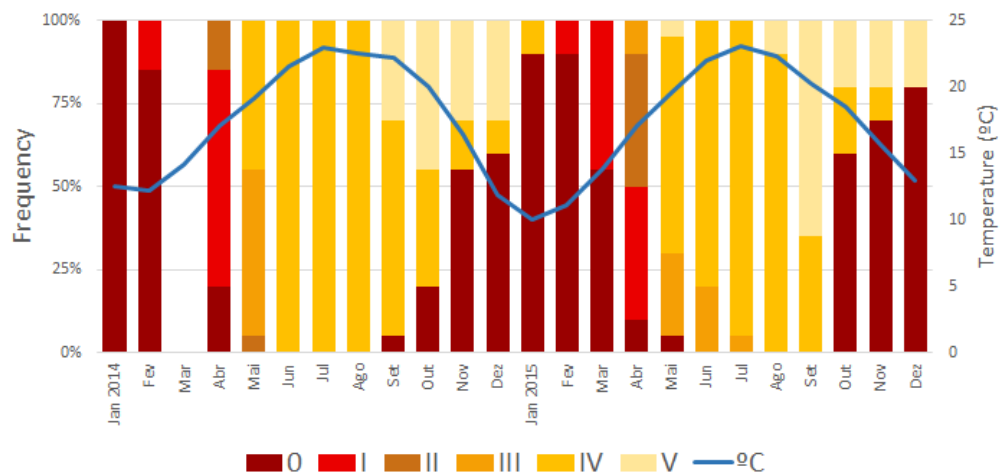


In situ experiments

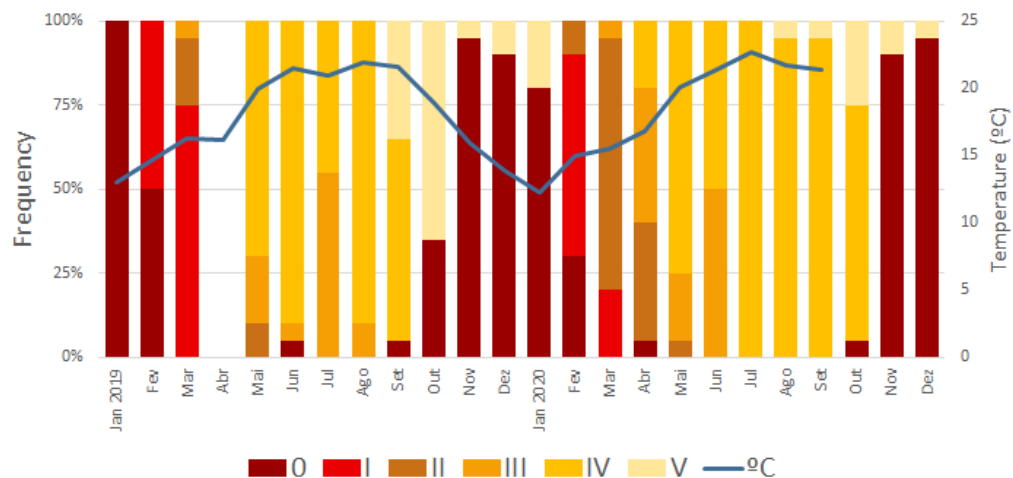


- Cockle is the most efficient species, with higher rates of ingestion/g

Reproductive success?



- Spawning from April to November



- Spawning from April to October



Cockles



Clams



- Both species have a broad distribution in estuaries and coastal areas
- Overlapping spatial distribution
- Opportunistic diet
- Cockles are highly efficient filter feeders
- Both species have a high reproductive success

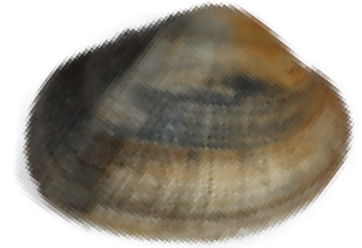
There are no apparent threats for cockles but...



Grooved
carpet
shell



Manila
clam



- There was a strong decrease in the abundance of the grooved carpet shells in some systems invaded by the Manila clam
- There is evidence of hybridization
- The grooved carpet shell has a higher commercial value but the Manila clam has a higher productivity

This evidence recommends ...

Management of threats and opportunities

- Sustainable fisheries management for well established and productive populations
- Monitoring of population parasites and pathogens and prohibit the translocation of specimens between different systems
- Certification of origin to value genuine and high-quality bivalves
- Population control of recent introductions to promote

“Bivalve Sanctuaries”

Happy COCKLES Sanctuary!!!!!!





COCKLES experiments with Happy Endings!