

# 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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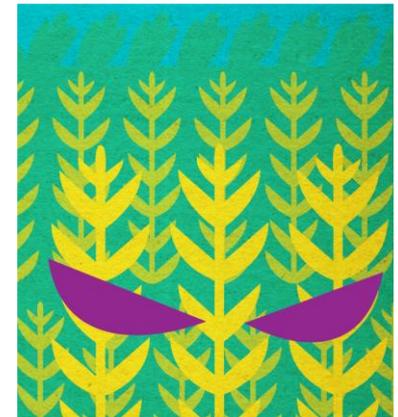
**FINAL VIRTUAL CONFERENCE**

**March 2021**



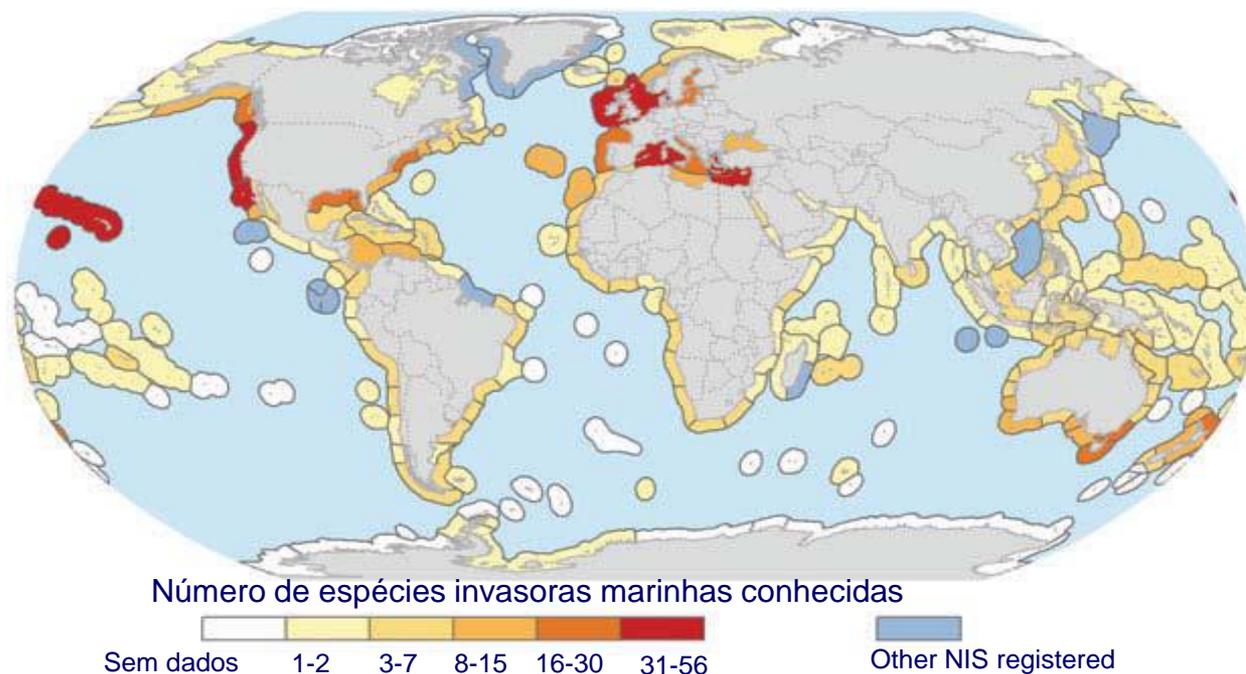
## Invasive species: why do we care?

- 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?

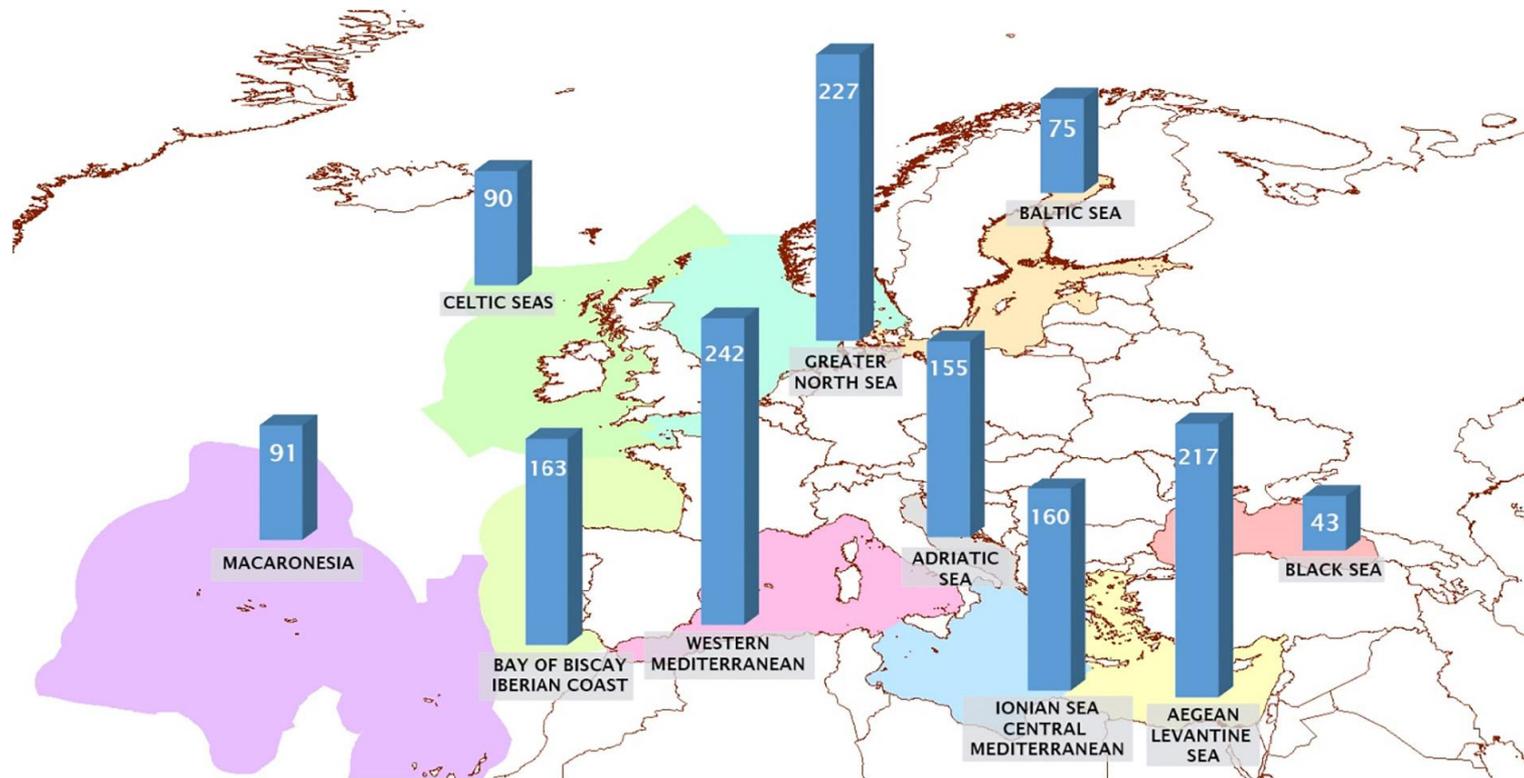
- Second cause of global marine biodiversity loss
- Worldwide problem



*Adapted from Molnar et al., 2008*

## Invasive species: why do we care?

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



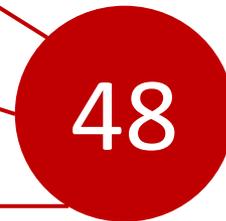
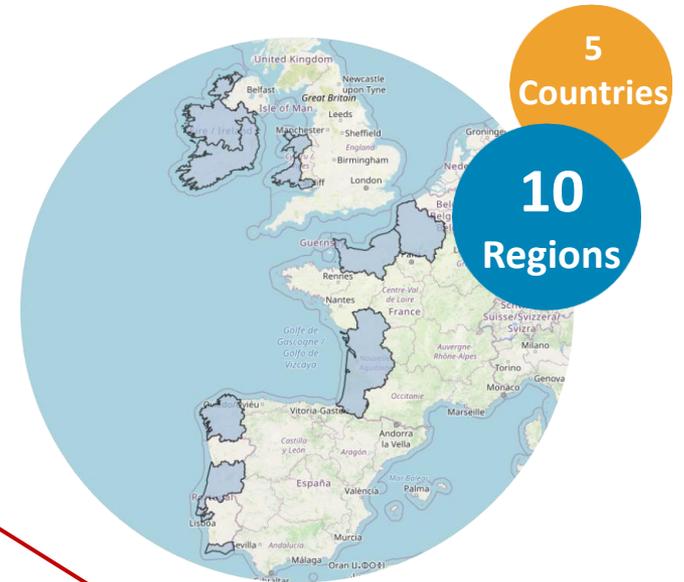
*Tsiamis et al., 2019, Marine Pollution Bulletin*

## Invasive species: do the cockles care?

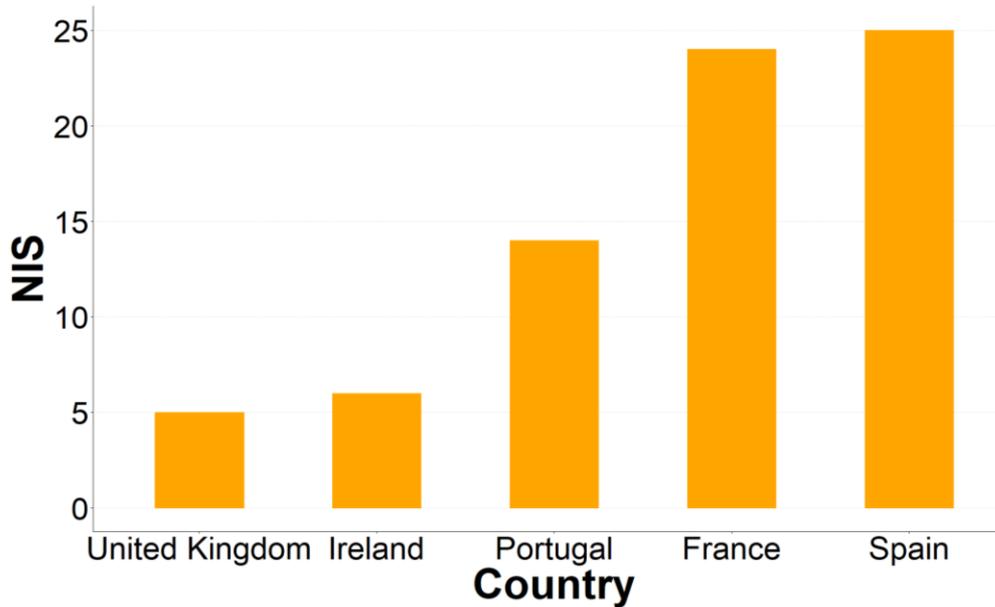
1. What is the overlap between areas occupied by cockles and other bivalve exotic species?
2. Invasive species compete with cockles for the same food sources?
3. Are there other characteristics which might enhance competition with cockles?



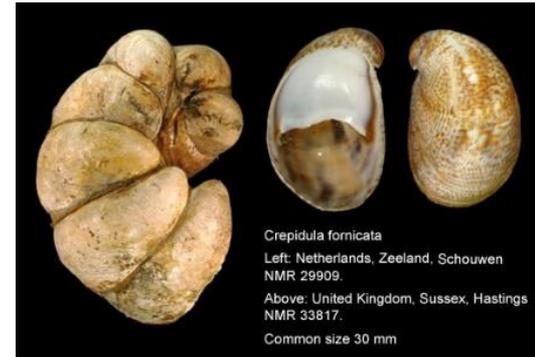
# Exotic species in the AA



## Exotic species in the AA



### Most frequent *Crepidula fornicata*



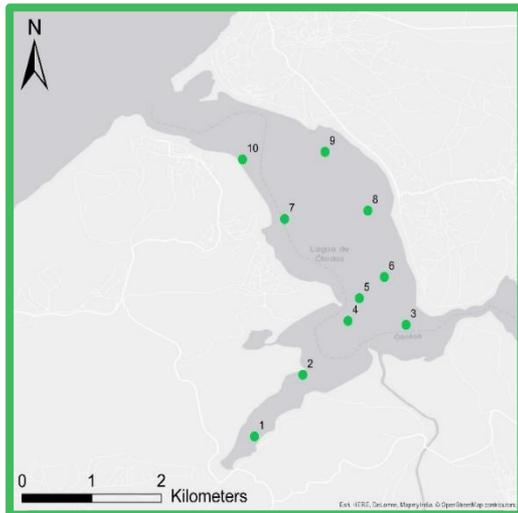
### Most abundant *Ruditapes philippinarum*



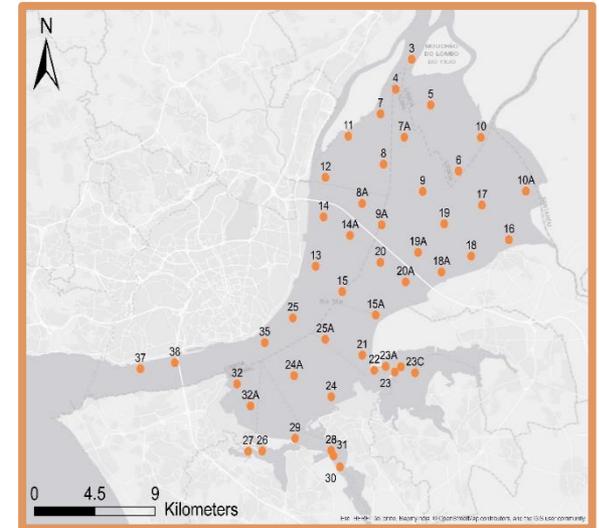
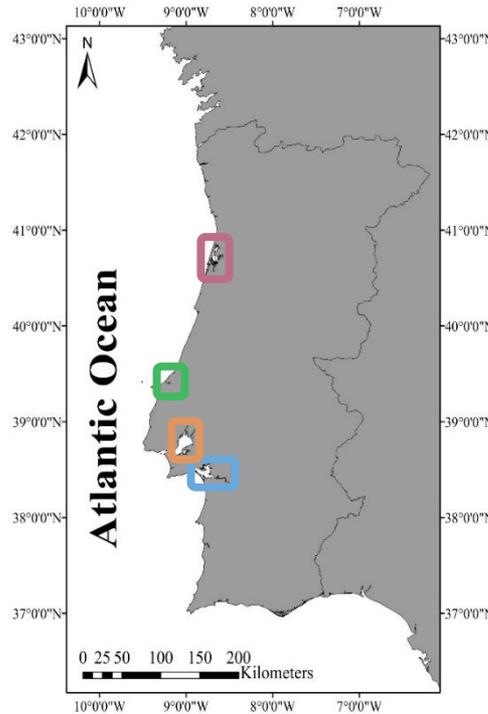
# Overlap cockles/exotic species



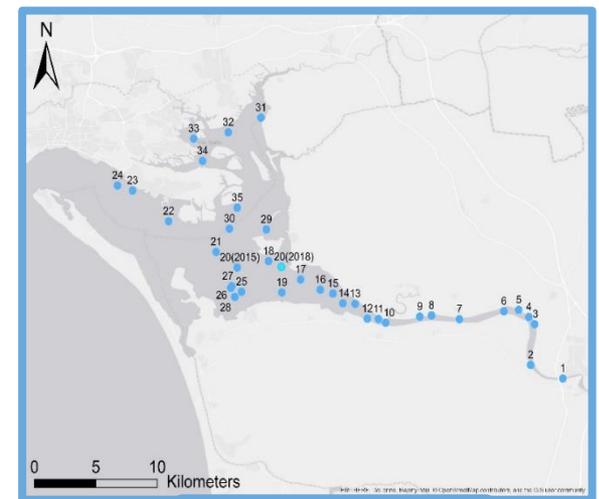
Aveiro coastal lagoon



Óbidos coastal lagoon



Tagus estuary



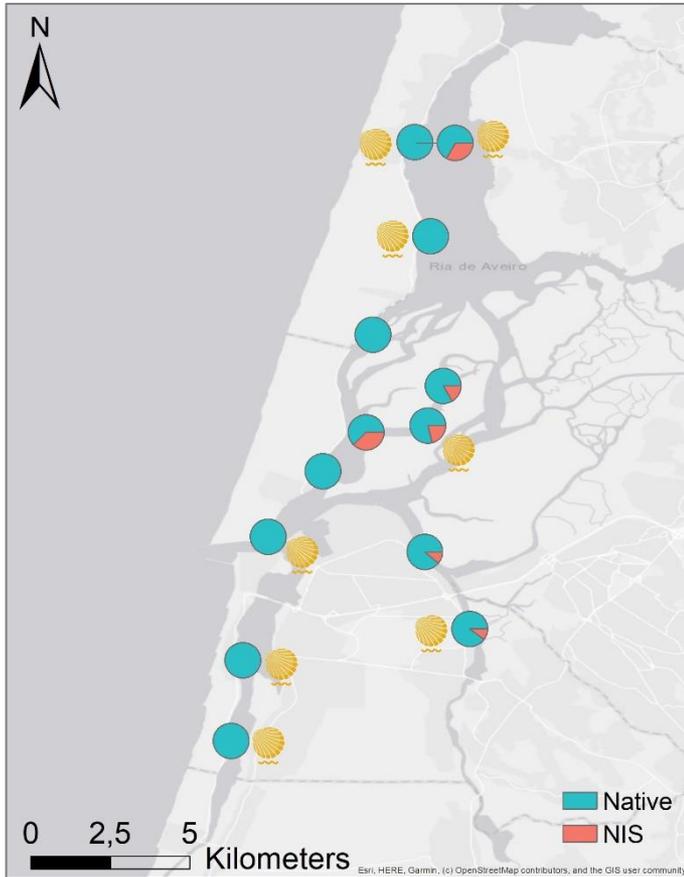
Sado estuary

## Overlap cockles/exotic species

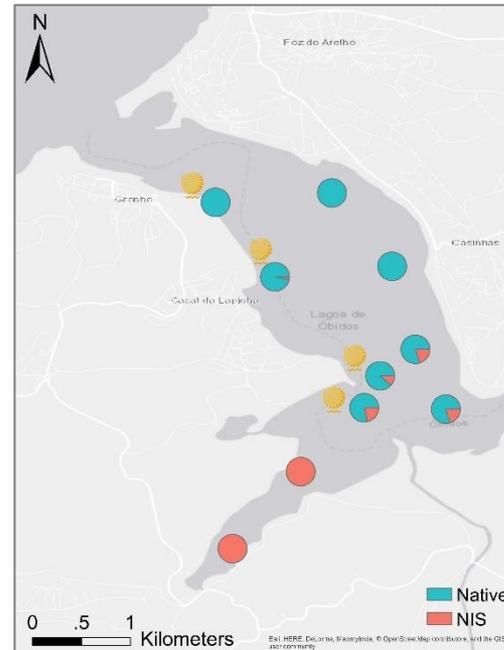


# Overlap cockles/exotic species

## Ria de Aveiro



## Óbidos coastal lagoon



*Crepidula fornicata*

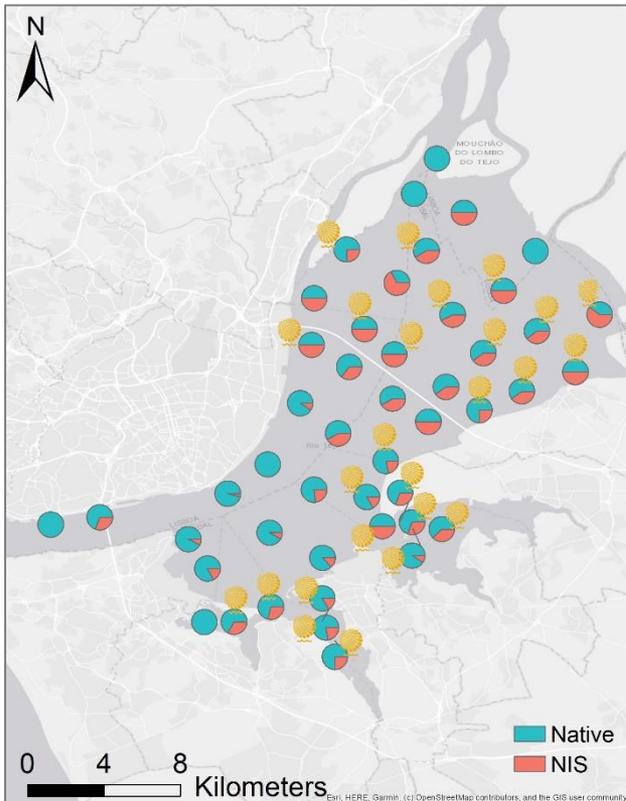


*Ruditapes philippinarum*

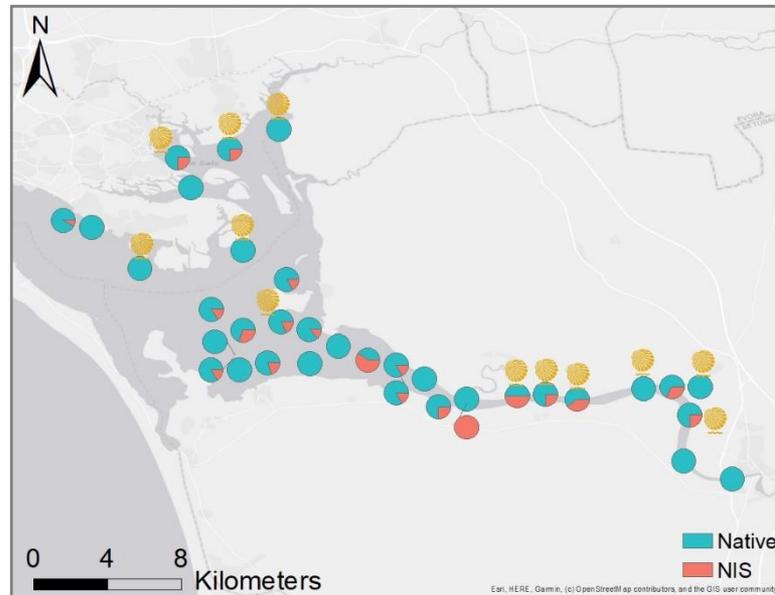
- Co-occurrence of cockles and exotic species in some locations

# Overlap cockles/exotic species

## Tagus estuary



## Sado estuary

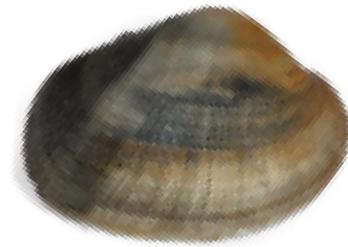


*Ruditapes philippinarum*

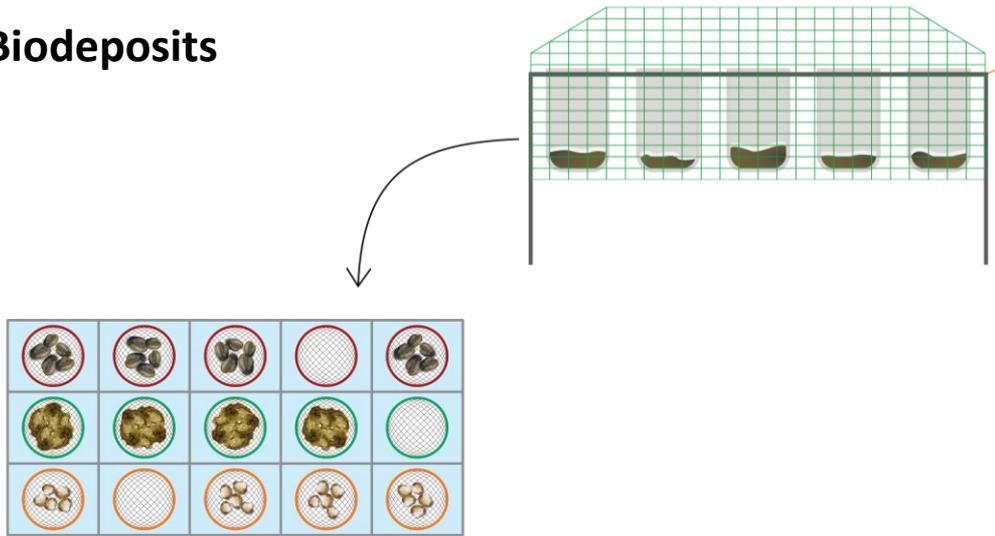
- Co-occurrence of cockles and exotic species in some locations
- The Manila clam is the dominant bivalve species at the Tagus estuary

## Competition for food?

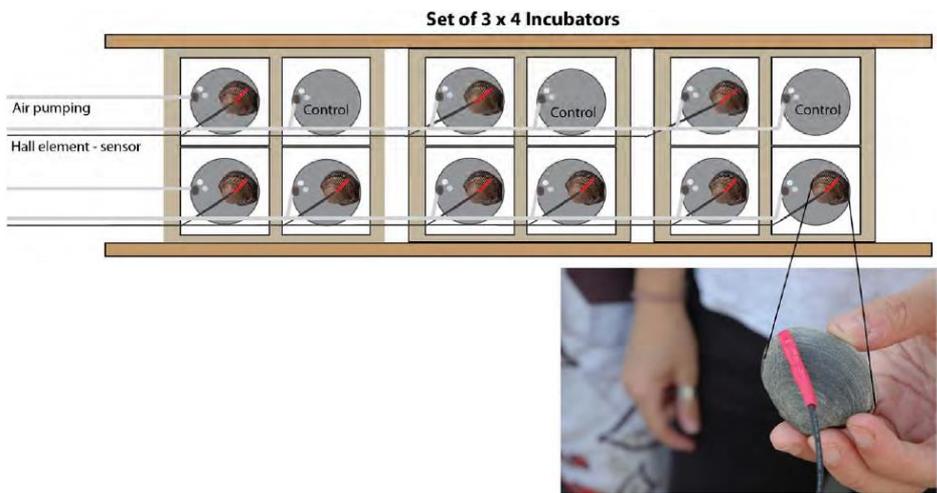
- Identifying the Diet of Cockles, Oysters and the Manila clam
- Measuring Clearance Rates (CR) – L/h/individual
  - ✓ Direct Methods – Particle removal
  - ✓ Indirect Methods – Biodeposition



• **Biodeposits**



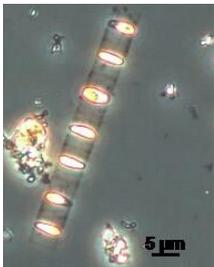
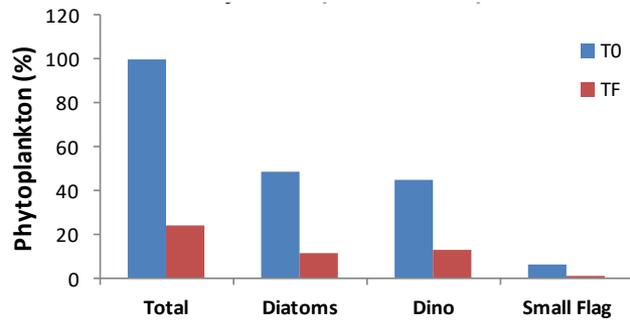
• **In situ experiments with incubators**



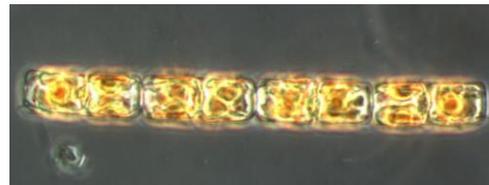
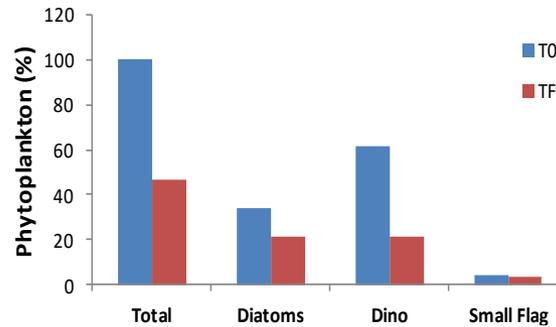
# Competition for food?

## Diet preference

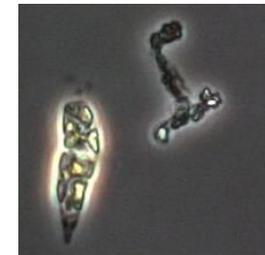
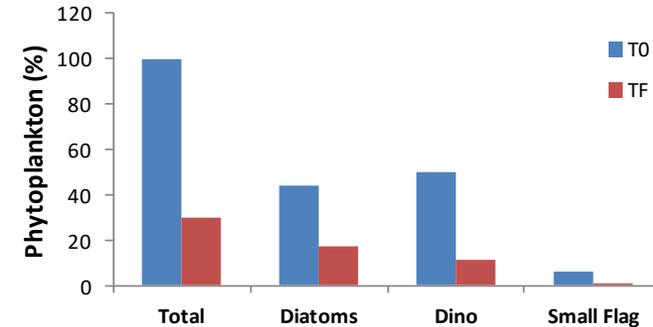
### Clam



### Cockle

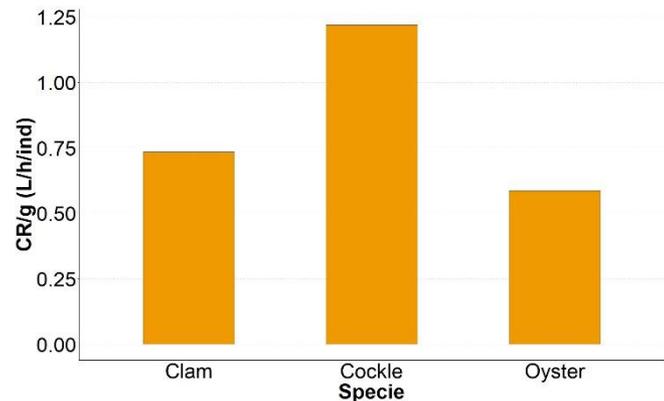
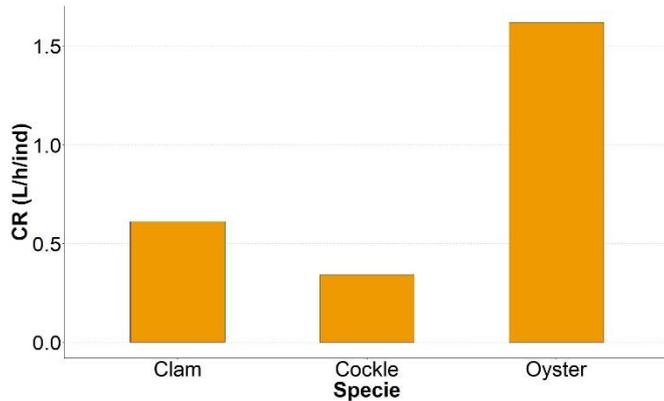


### Oyster

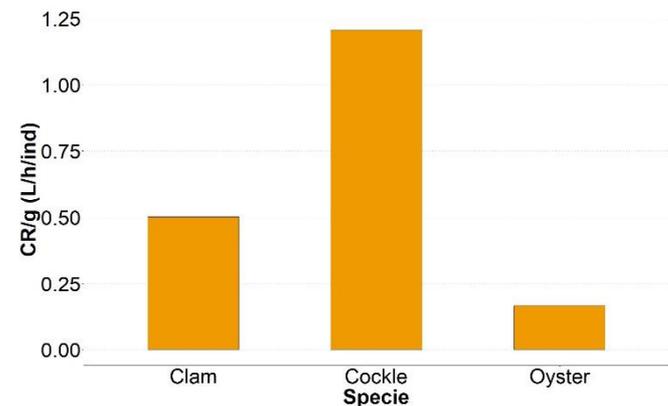
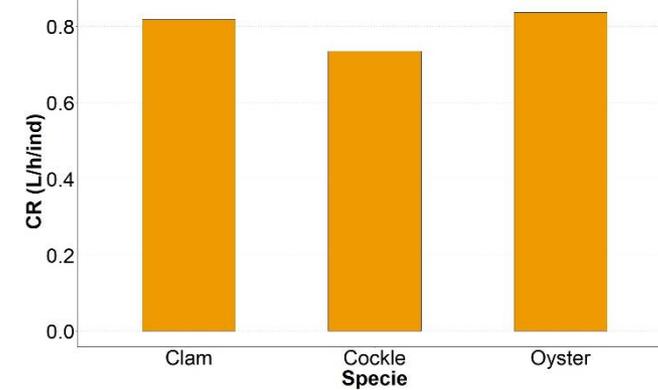


- All species showed no clear preferences
- Dinoflagellate and diatoms species are significantly consumed

## Biodeposits

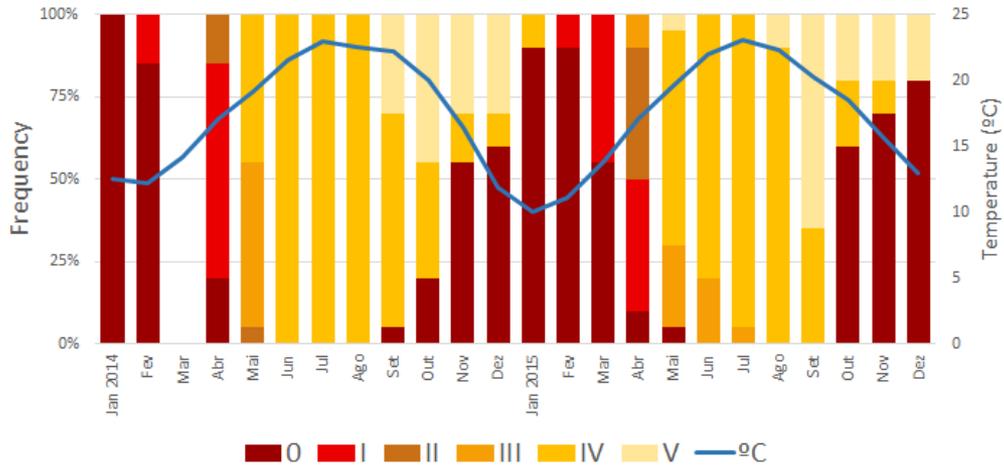


## In situ experiments

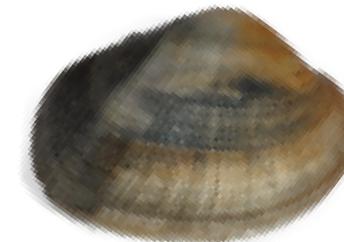
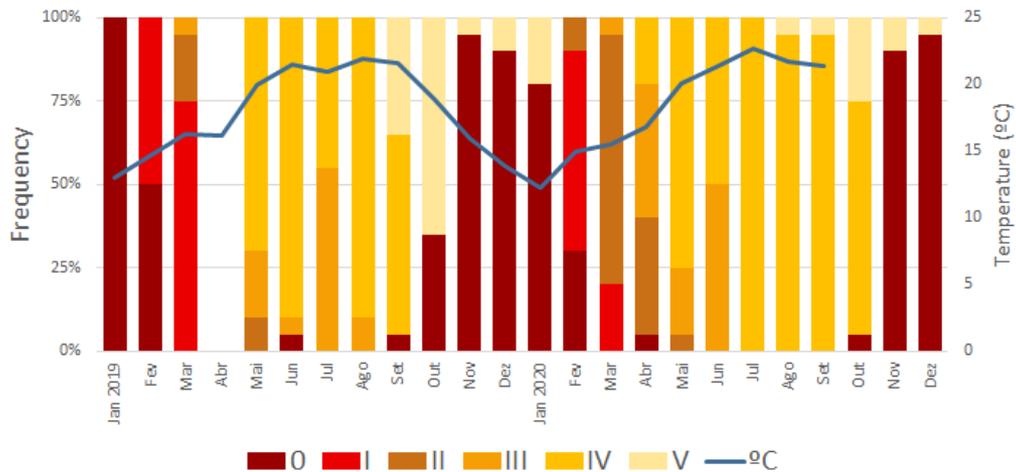


- Cockle is the most efficient species, with higher rates of ingestion/g

# 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

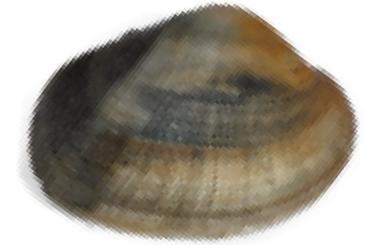
*There are no apparent threats for cockles but...*



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!**