Revitalising our Estuaries: Tales from the River Tees

Judy Power – Tees Rivers Trust
Henry Short – Tees Rivers Trust

Tees Rivers Trust – who?

- We are……small but mighty!
- Independent charity established in 2009
- Source to sea approach
- Our ambitions:
  - Making habitat improvements, increasing biodiversity and adapting to the impact of climate change.
  - Creating opportunities using the river and water environment to encourage local businesses, facilitating job creation and supporting tourism.
  - Engaging with people to improve, value and enjoy the water environment.

A river of contrasts

A river under pressure

- Legacy of human activity shaping the river and reducing its ability to adapt to climate change.
- Freshwater systems are amongst the most directly impacted by climate change.
- Pressure from plans to increase industrial and residential development
- The most recent WFD assessments (2020) have identified that only 13 out of 87 water bodies are achieving “good” ecological status.

Estuarine restoration – WHY?

- Reconnecting habitats and species
- Building resilience to effects of climate change
- Restoring eco system engineers
- Improving water quality & biodiversity
- Carbon sequestration

The Leven at its confluence with the Tees after heavy rain

Estuarine restoration is not just at one end of the river

Catchment wide solutions to relieve pressure downstream

- Reducing sediment loading
- Innovative solutions for soil health
- Minimising contamination from septic tanks and agriculture
- Controlling invasive species
- Flow control = flood risk alleviation

Improving connectivity and minimising flood risk

The Tees Estuary

A place of unique challenges

- Globally significant for bird species and internationally designated
- 93% loss of estuary habitat between 1861-1993

- Heavily modified river banks
- Reclaimed land for industry
- Legacy of contamination in river
- Entrenched perceptions of the estuary
- Politics! Economy v ecology
- Current water quality:
  - Out of the 19 waterbodies in the estuary, 10 are classified below moderate and none are good or above for water quality
  - All waterbodies fail for chemical content

Intertidal habitat creation – our first steps in estuarine restoration....

Intertidal habitat – why?

- Softens estuary edges
- Absorption of boat wake wave action
- Refuge and feeding for marine species

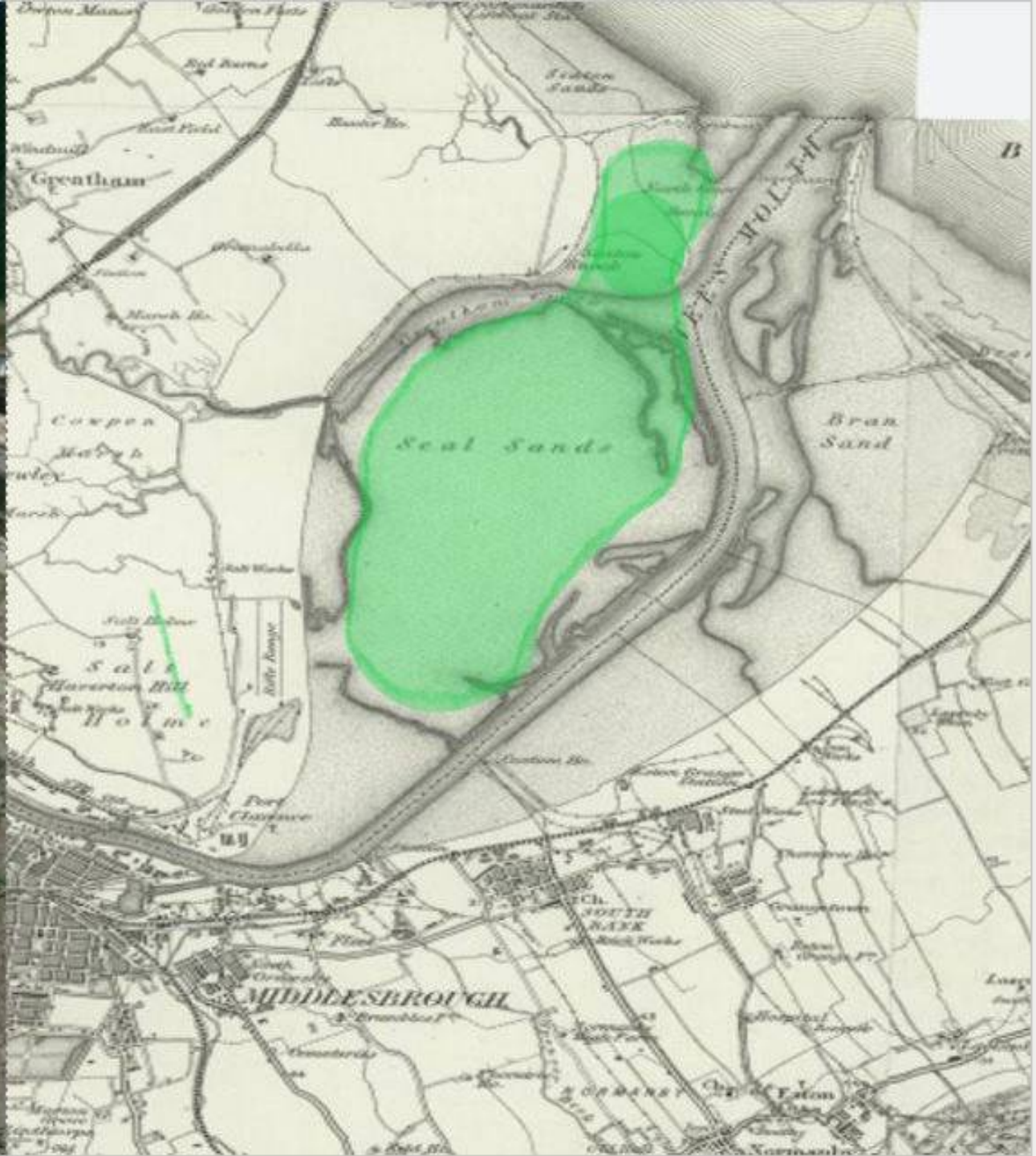
Intertidal habitat – how?

- Brash bundles for sediment accretion
- Industrialised coir bundles for planting
- Naturalised effect over several cycles

Intertidal habitat – tackling the obstacles

- Hard to access sites – for both materials and machinery
- Marine licencing
- Anti social behaviour
- Tide!
- Capital cost = £198, 483.00 for 500m

Seagrass and Oyster On the TEES?


Grantham
Seal Sands
Bran Sand
MIDDLESBROUGH

Oysters on the Tees – Redcar Beach

From a film about Redcar beach in the Ironstone Museum - Cleveland

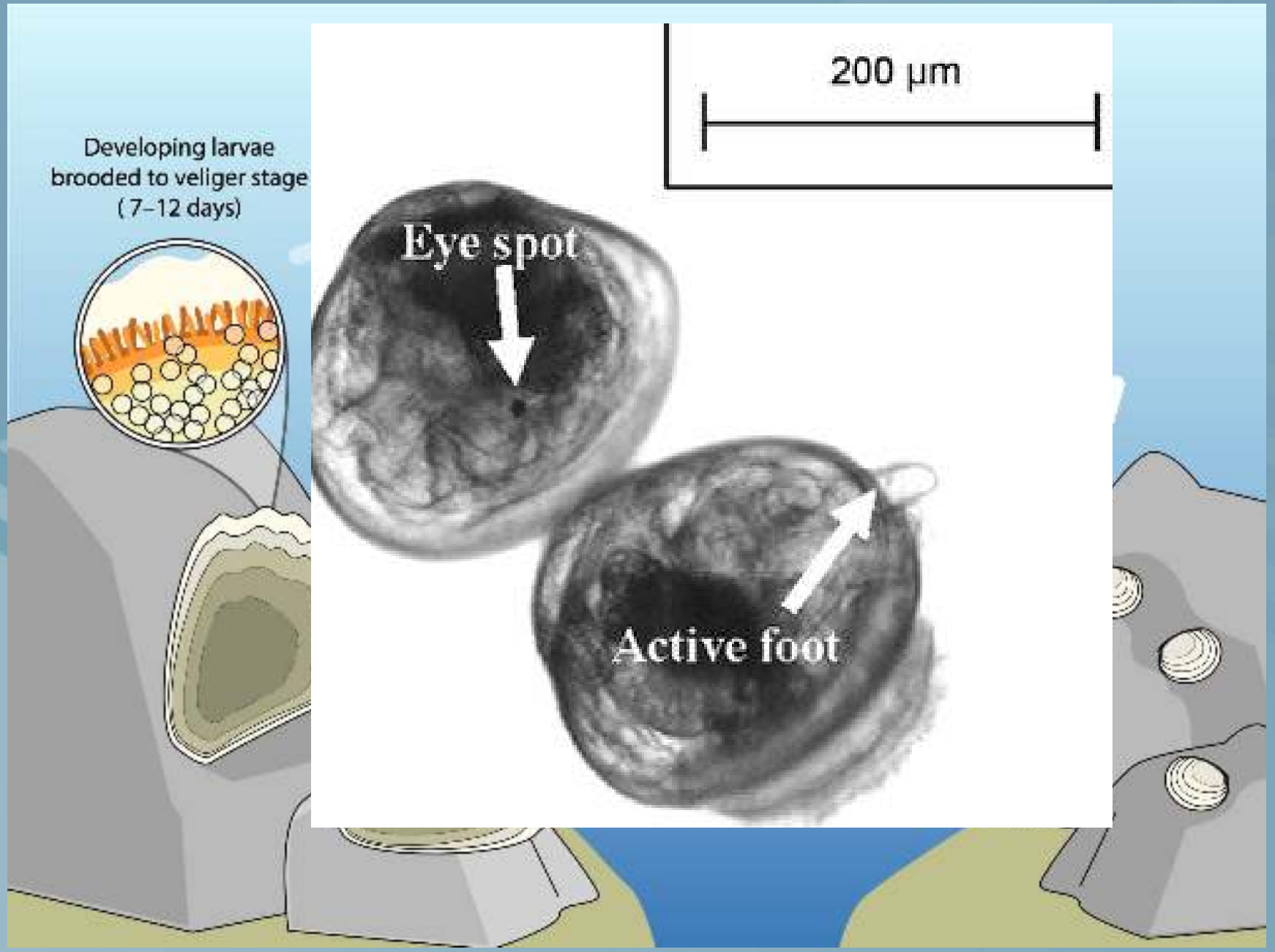
Our Aims

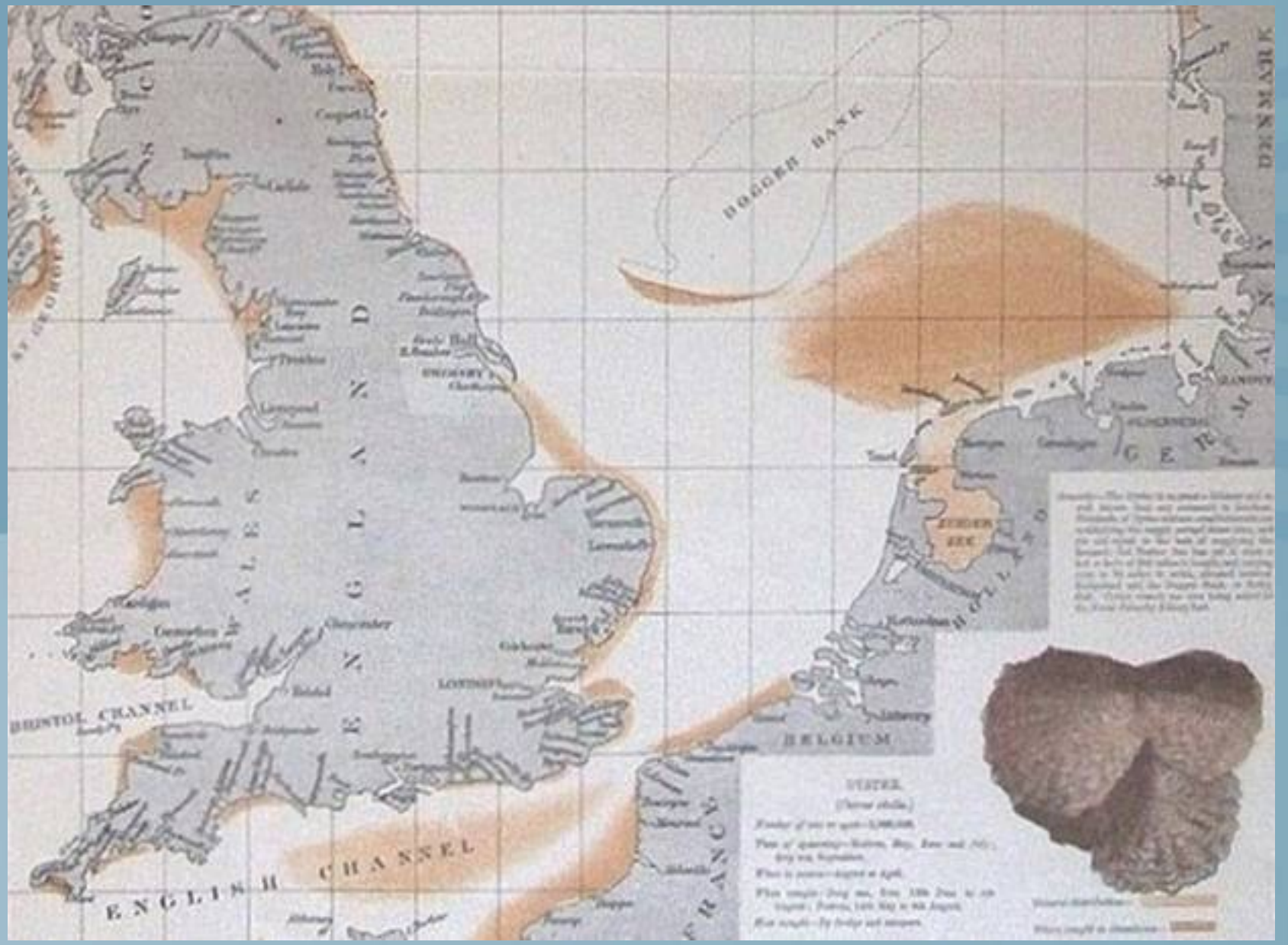
- Reintroduce locally extinct species
- Improve water quality
- Improve biodiversity
- Protect the coastline

What are oysters?

- Marine Bivalve
- Inhabits coastal waters and estuaries
- Filter feeders
- Gregarious

Oyster Lifecycle





Olsen's 1883 Piscatorial Atlas of the former distribution of the native oyster (Olsen, 1883)

Where did they go?

- Overfishing
  - 700 million oysters eaten in 1 year in London
- Reduced water quality
- Invasive species

2 Species found in the UK

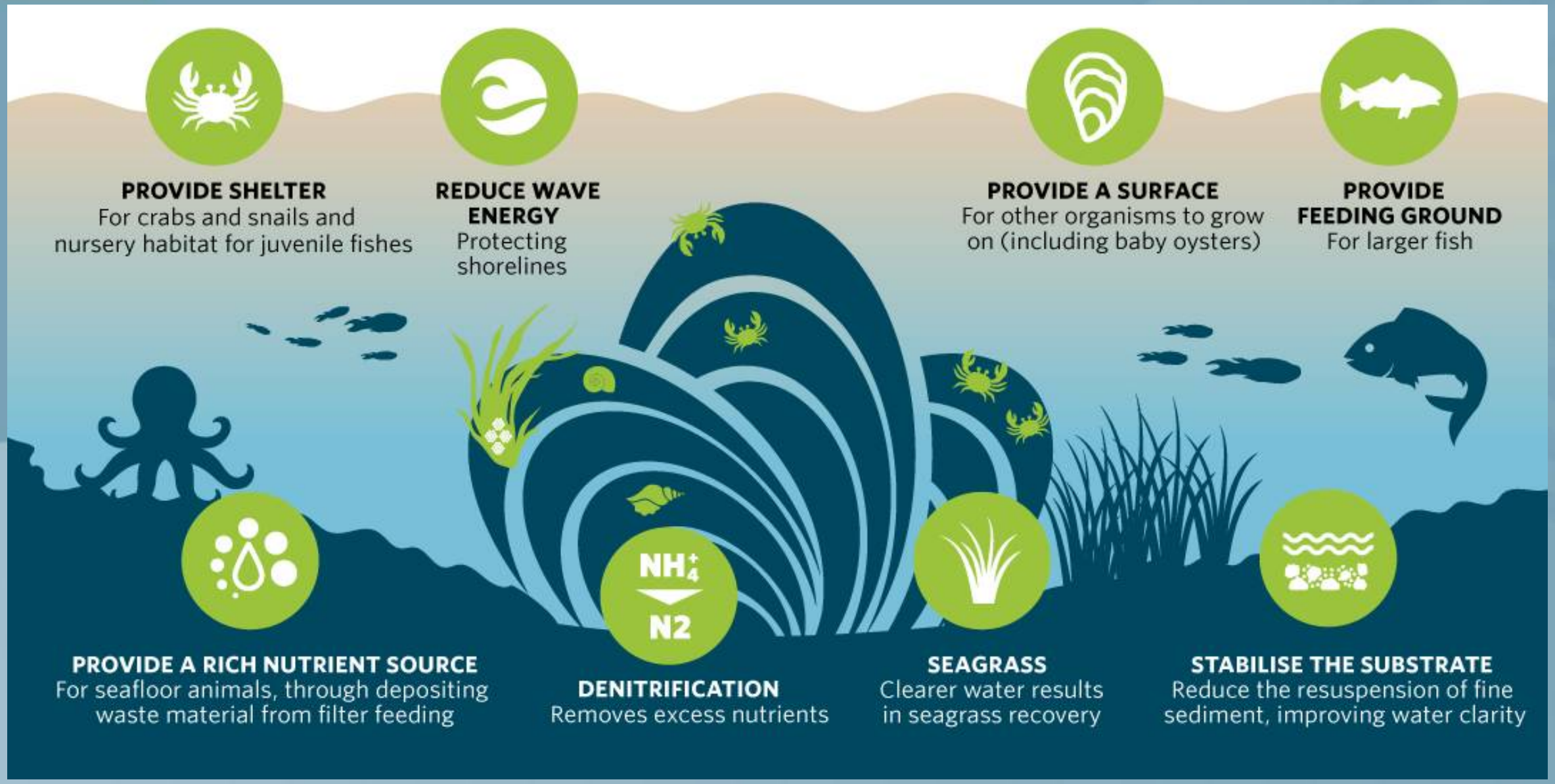
Native Oyster *(Ostrea edulis)*

Pacific Oyster *(Crassostrea gigas)*

Why Restore Oysters?

- Ocean Vacuum Cleaners
  - A Single Oyster can filter 200L of water per day
- Can remove nitrate and other pollutants
- Coastal protection

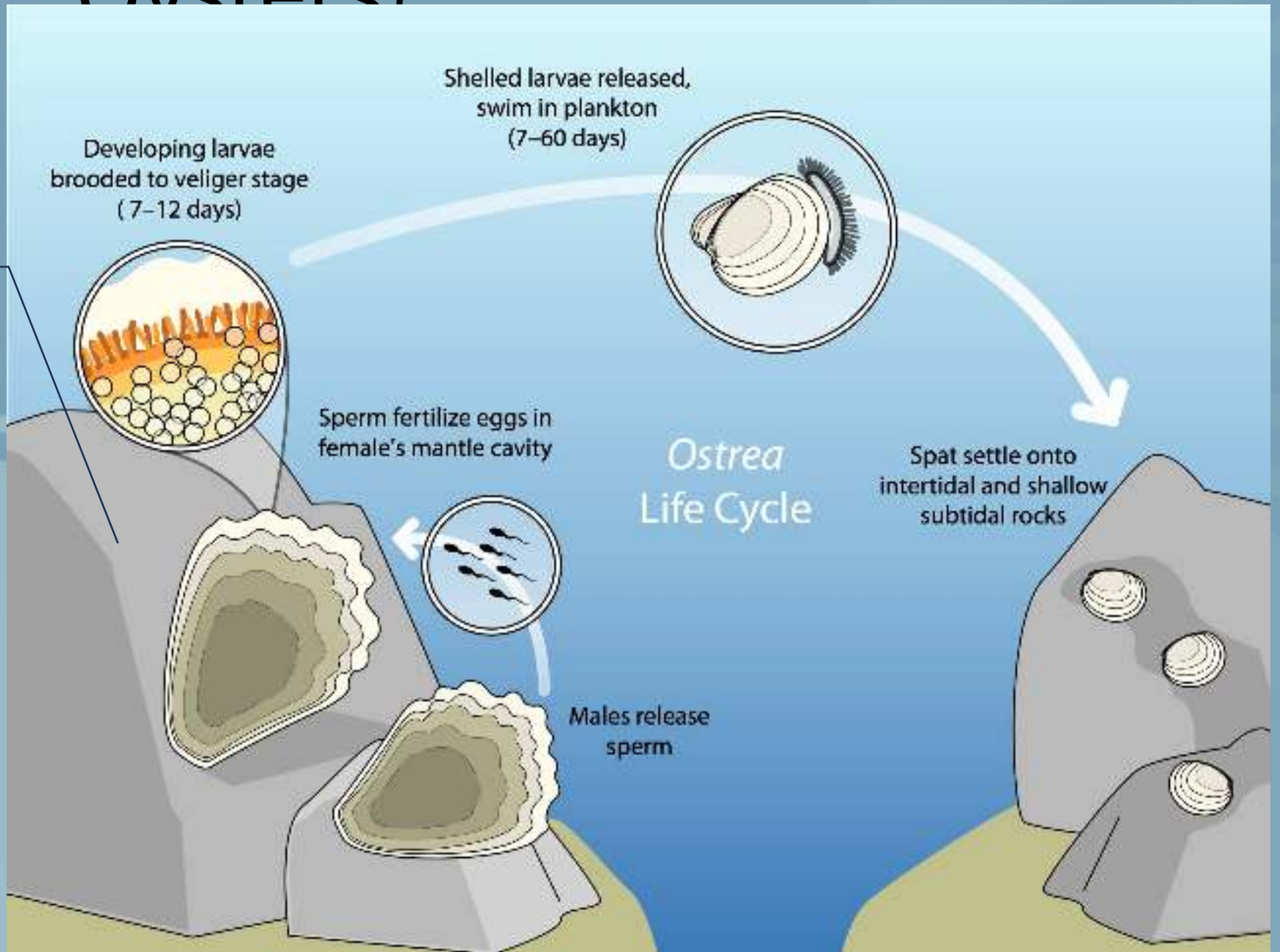
Oyster Reefs


PROVIDE SHELTER
For crabs and snails and nursery habitat for juvenile fishes
REDUCE WAVE ENERGY
Protecting shorelines
PROVIDE A SURFACE
For other organisms to grow on (including baby oysters)
PROVIDE FEEDING GROUND
For larger fish
NH4+
N2
PROVIDE A RICH NUTRIENT SOURCE
For seafloor animals, through depositing waste material from filter feeding
DENITRIFICATION
Removes excess nutrients
SEAGRASS
Clearer water results in seagrass recovery
STABILISE THE SUBSTRATE
Reduce the resuspension of fine sediment, improving water clarity

Great Idea – But how?

How to restore Oysters?

Reproductive adults



Larvae Production

- Oyster nurseries
- Hold adult oysters
- A single oyster can produce 20 million larvae a year



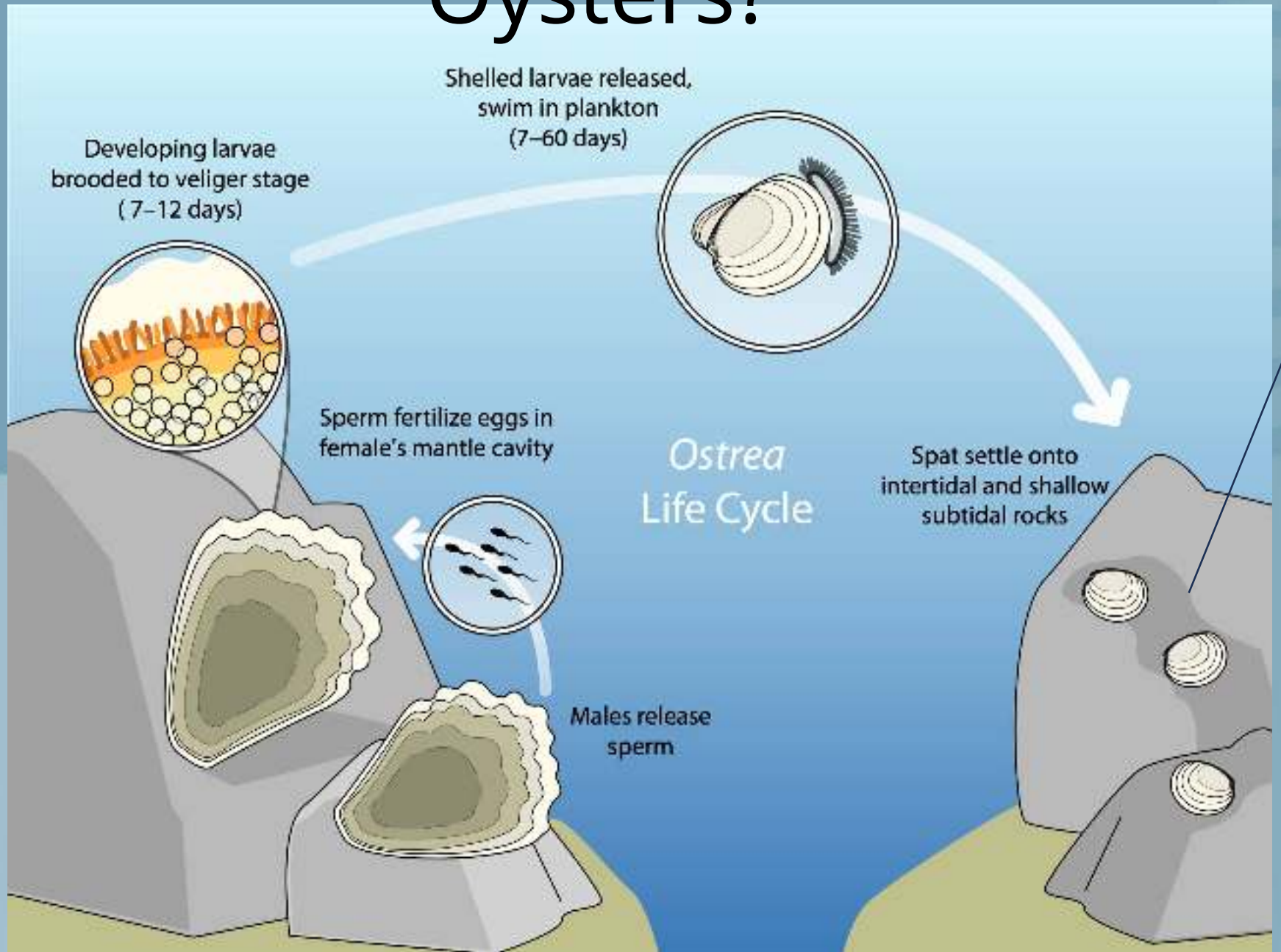

- Oyster nurseries in Hartlepool Dock
- 25 Cages
- Over 1000 Oysters
- Over 100 million larvae released into Tees Bay

Monthly Volunteer Sessions

Monthly Monitoring

- Over 95% survival
- Over 45 species associated with the nurseries

How to restore Oysters?

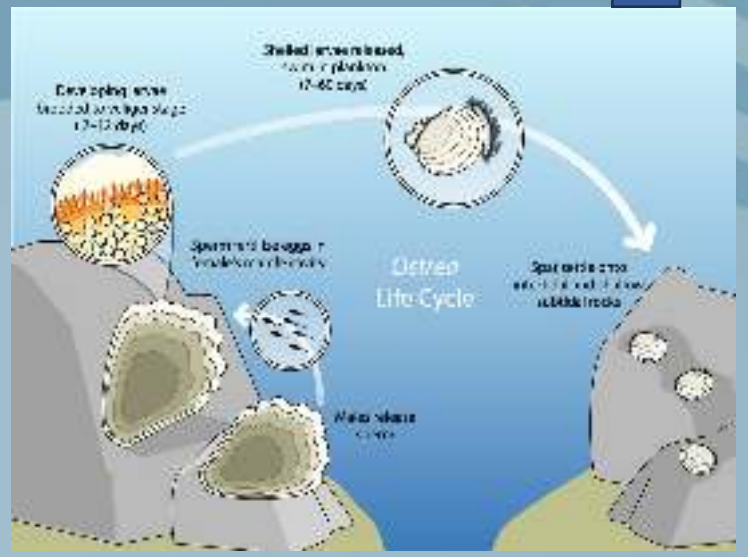


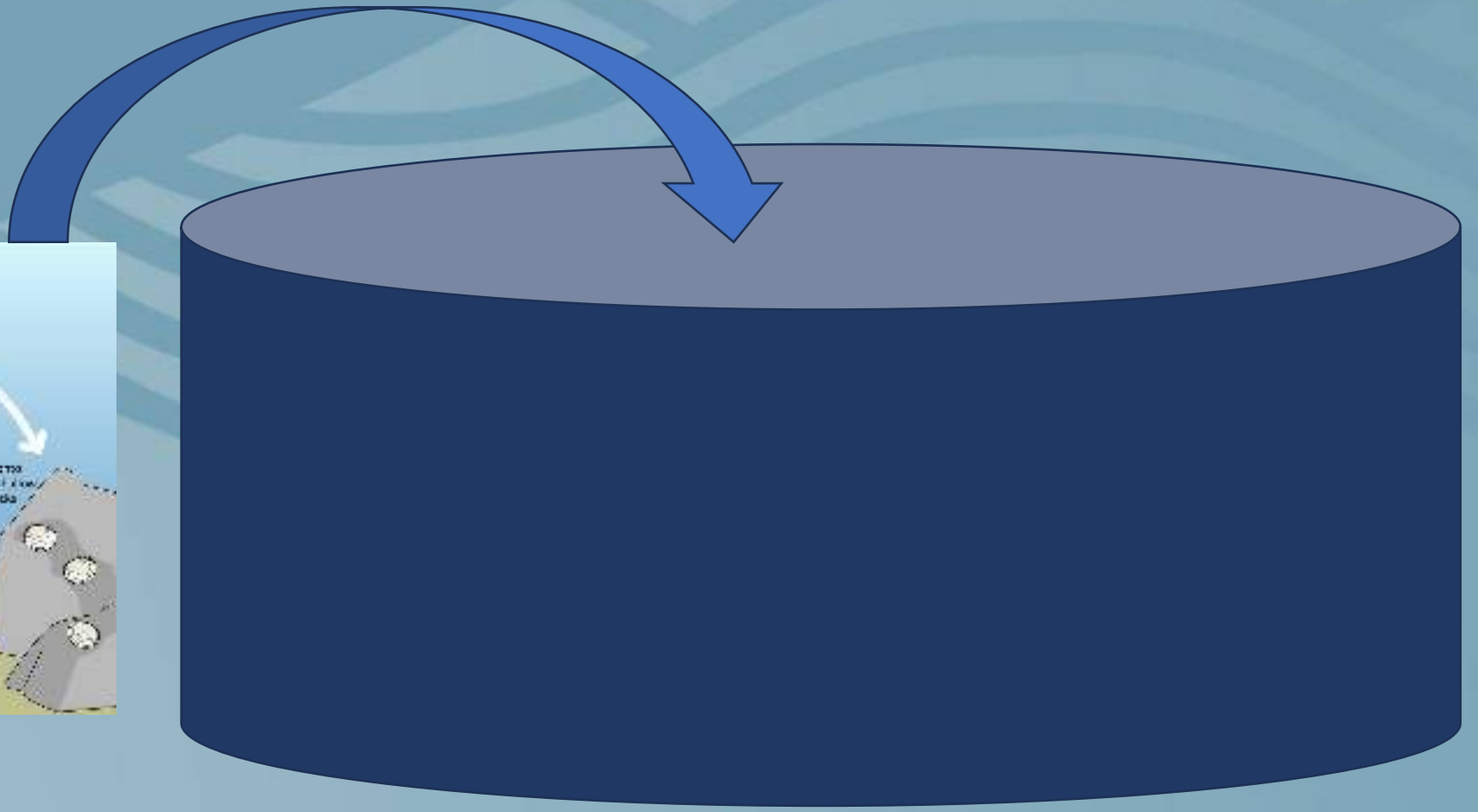
Provide Suitable Substrate

Seabed Restoration

- Hard substrate
- Sand or gravel
- Mix of shell and gravel known as cultch

Spatting Pond





Spatting Tank

- 500 Oysters
- 123000L Tank
- 0.3t of Scallop shell
- 2000 Spat produced

Improvements

- Add Aeration
- Manually Feed

Seagrass

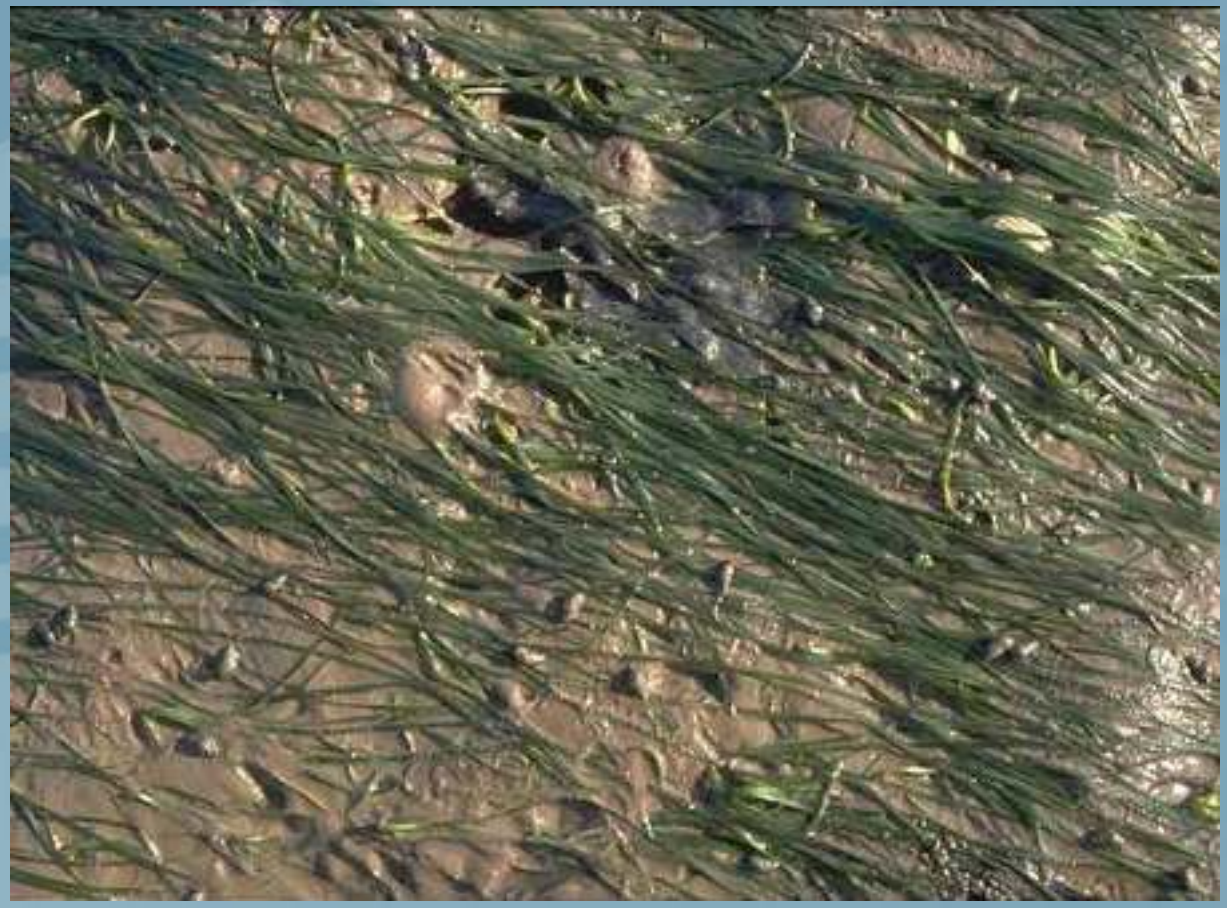
What Is seagrass?

- Seagrass is a marine plant
- The only fully marine flowering plant
- It is found in shallow coastal waters as it needs sunlight to survive
- Grows meadows that look like grass

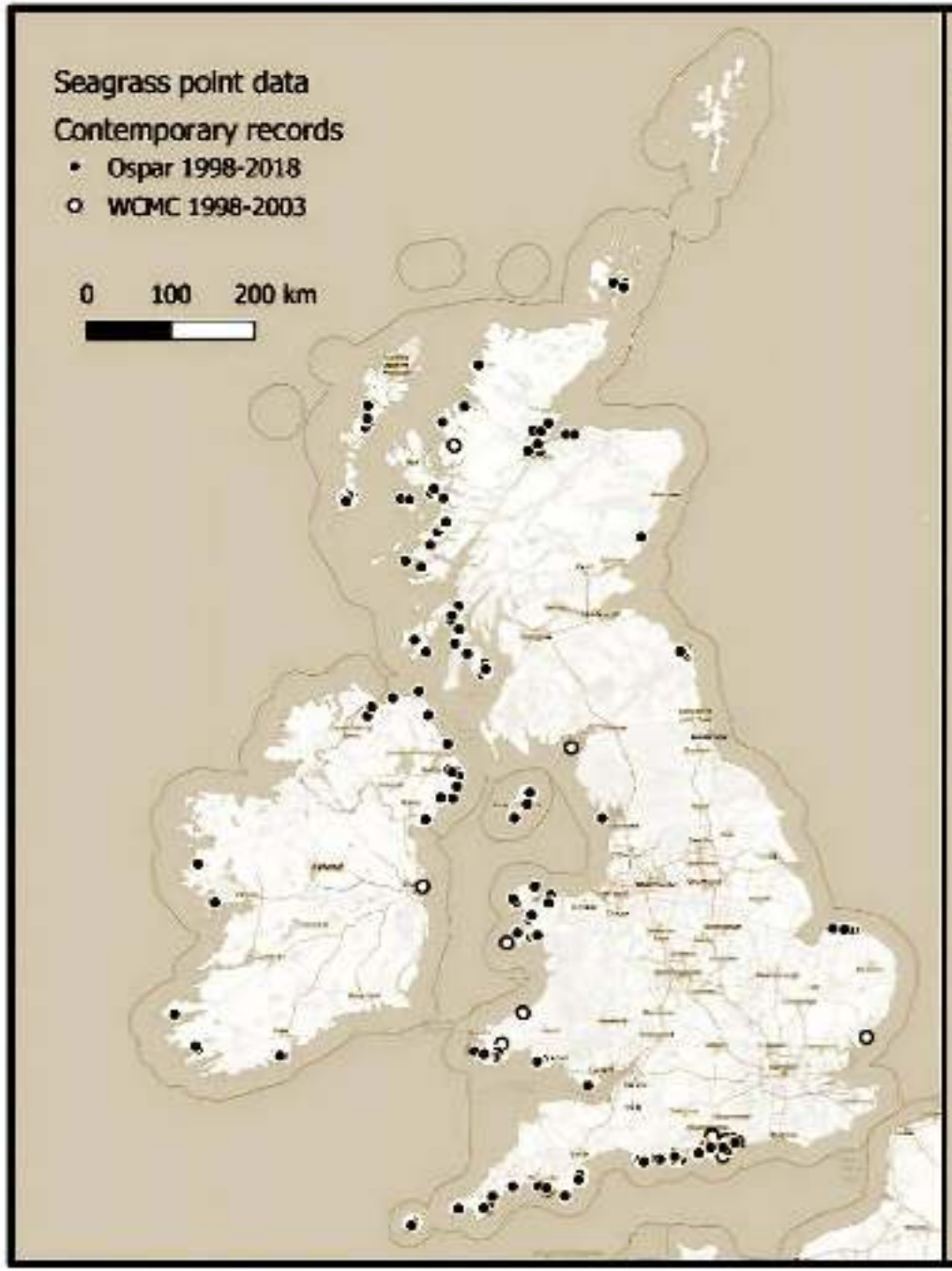
Flowers?

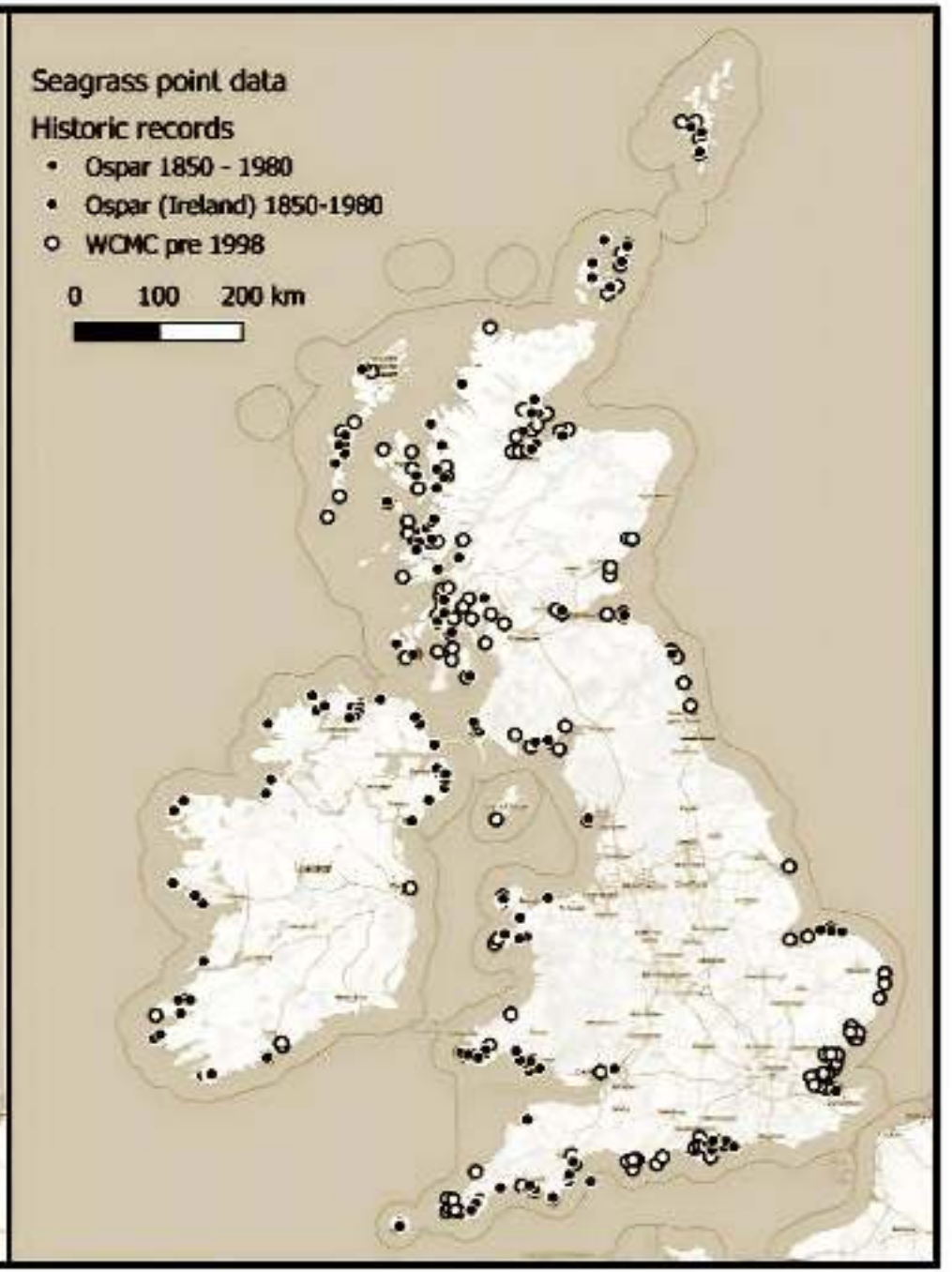
The Two Species of UK seagrass

Common eelgrass -Zostera Marina



Dwarf eelgrass -Zostera Nolteii


Seagrass point data
Contemporary records
Ospar 1998-2018
WCMC 1998-2003
0 100 200 km


Seagrass point data
Historic records
Ospar 1850 - 1980
Ospar (Ireland) 1850-1980
WCMC pre 1998
0 100 200 km

Where did it go?

- Land reclamation
- Wasting disease
- Reduced water quality

Why Restore Seagrass?

- Large carbon storage
  - 30x better than rainforests?
- High Biodiversity
- Coastal protection

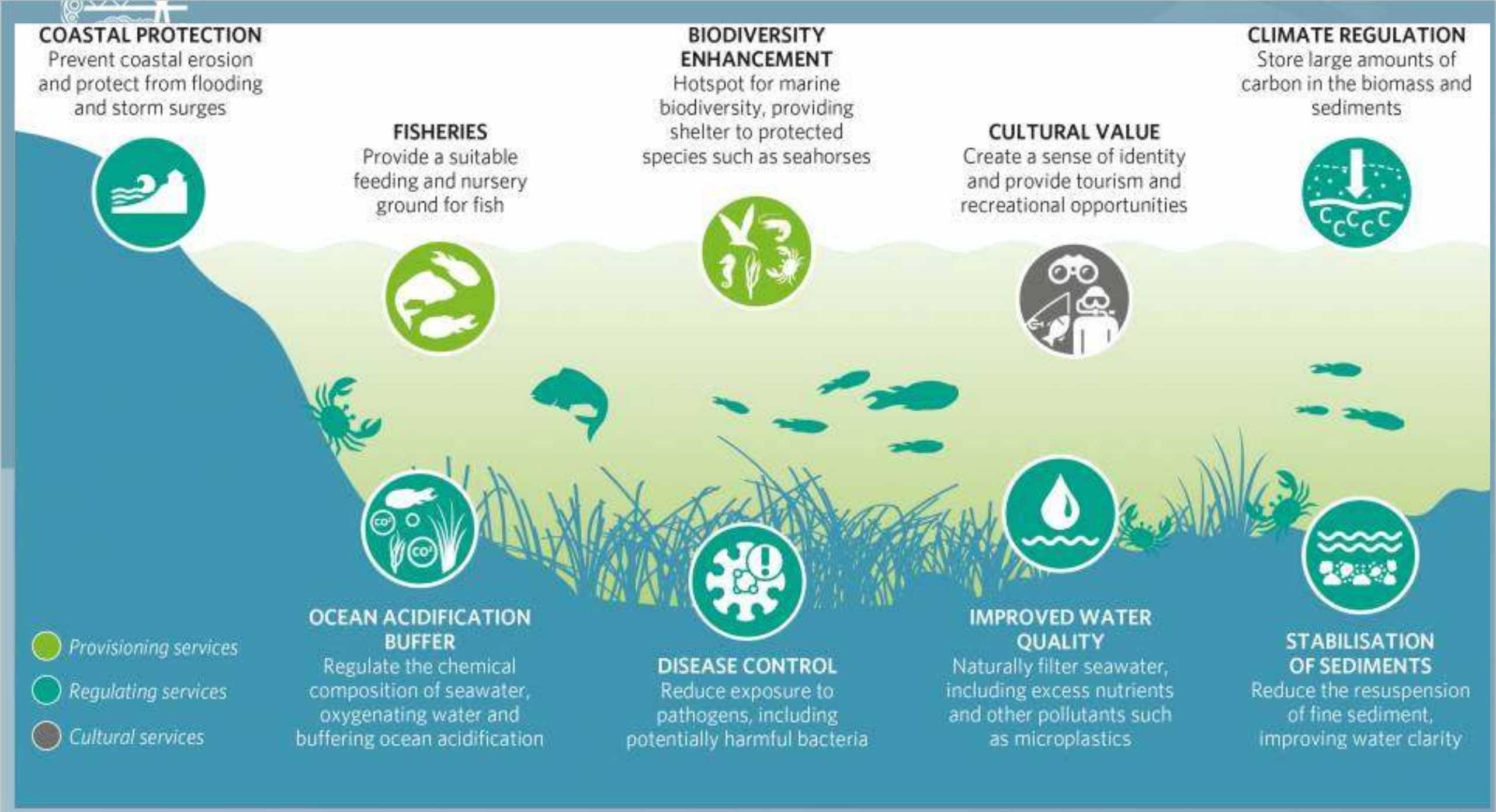
COASTAL PROTECTION
Prevent coastal erosion and protect from flooding and storm surges

FISHERIES
Provide a suitable feeding and nursery ground for fish

BIODIVERSITY ENHANCEMENT
Hotspot for marine biodiversity, providing shelter to protected species such as seahorses

CULTURAL VALUE
Create a sense of identity and provide tourism and recreational opportunities

CLIMATE REGULATION
Store large amounts of carbon in the biomass and sediments



OCEAN ACIDIFICATION BUFFER
Regulate the chemical composition of seawater, oxygenating water and buffering ocean acidification

DISEASE CONTROL
Reduce exposure to pathogens, including potentially harmful bacteria

IMPROVED WATER QUALITY
Naturally filter seawater, including excess nutrients and other pollutants such as microplastics

STABILISATION OF SEDIMENTS
Reduce the resuspension of fine sediment, improving water clarity

Provisioning services
Regulating services
Cultural services

How to restore Seagrass?

- Source some Seagrass Seeds
- Put them in the Estuary
- Protect them

Failure!!

Estuary Planting At North Gare

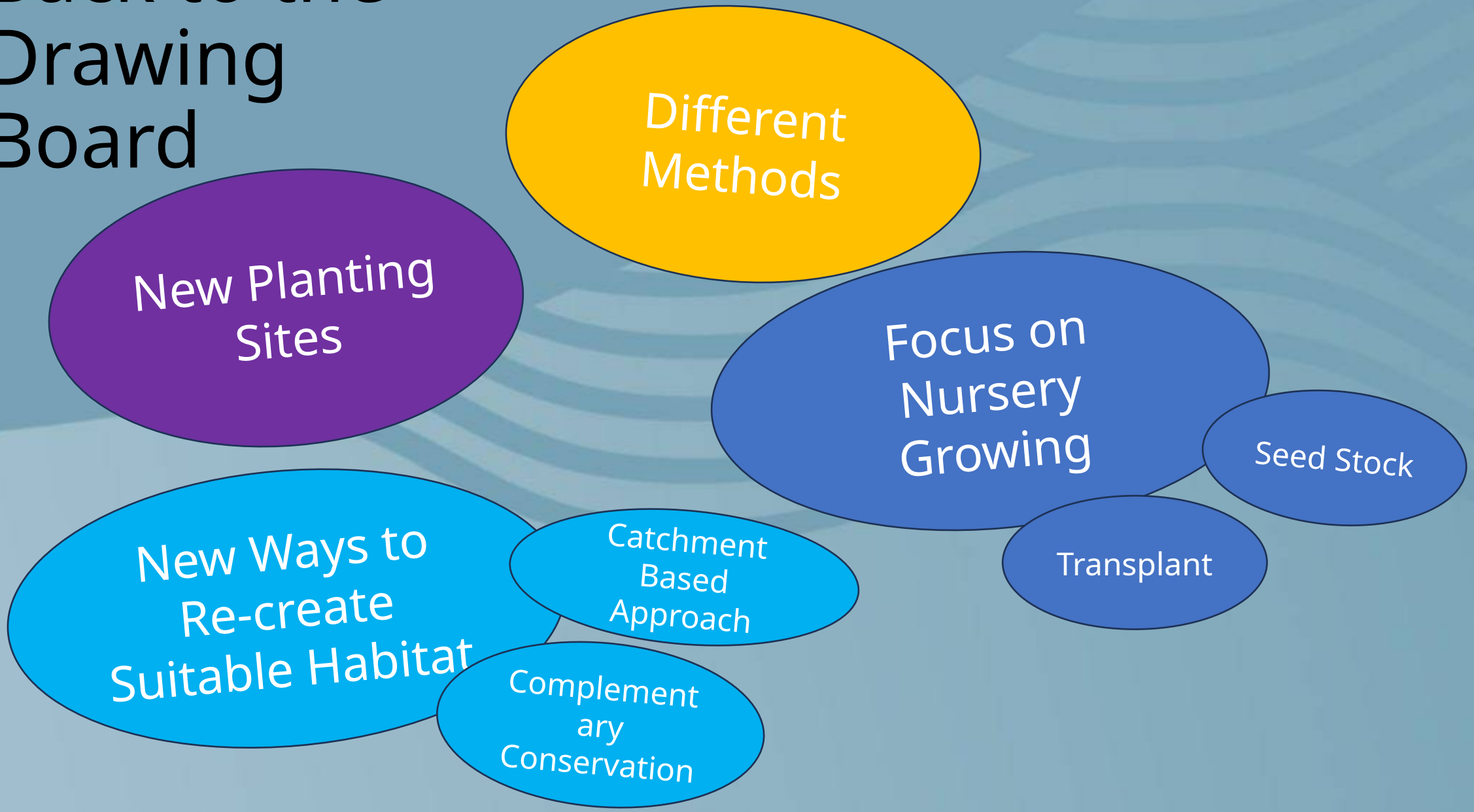
- 2023
- Trial Plot 4 x 10m
- Seed bag planting

Source: Google Earth Pro (2023)

Planting Attempt 2

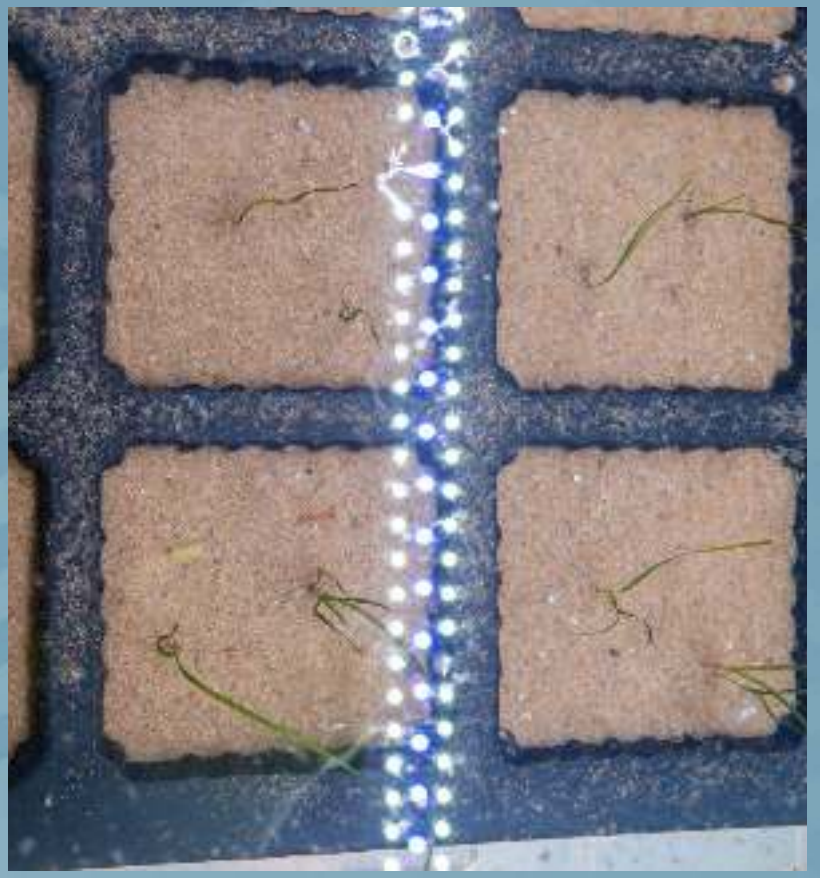
- New Site
- New Methods
- New learnings

Back to the Drawing Board



(Tees Estuary Restoration Initiative) TERI

- The North East's first and only terrestrial seagrass nursery
- Acting as a mentor to other projects
- Working with Stronger Shores and Newcastle University
- Facility expansion to try new plant husbandry techniques
- Seed bank for restoration across the UK
- Trialling new techniques for increasing plant growth
- Native oyster breeding pond created
- New oyster breeding techniques to increase brood stock
- Mussel reef tanks for substrate seeding trials



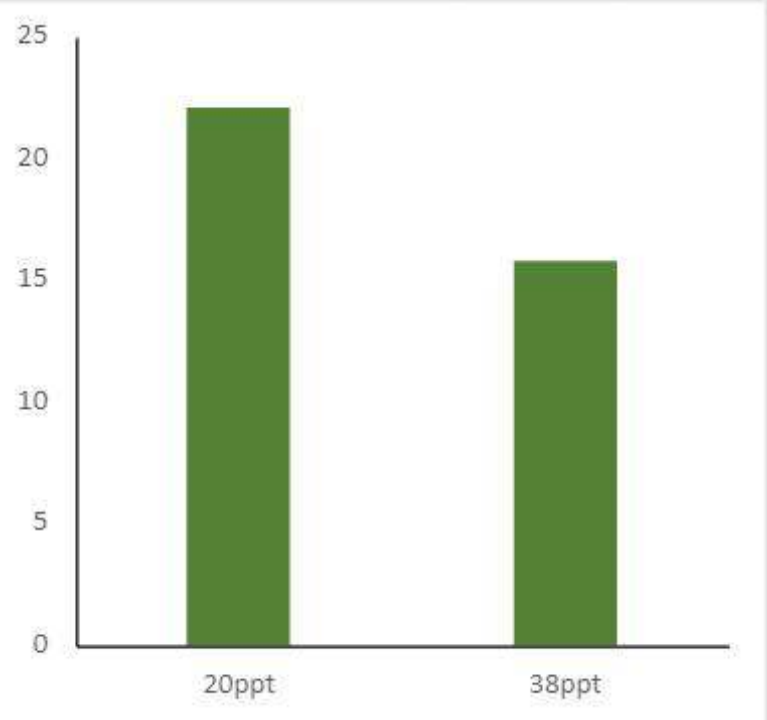
Container Based System

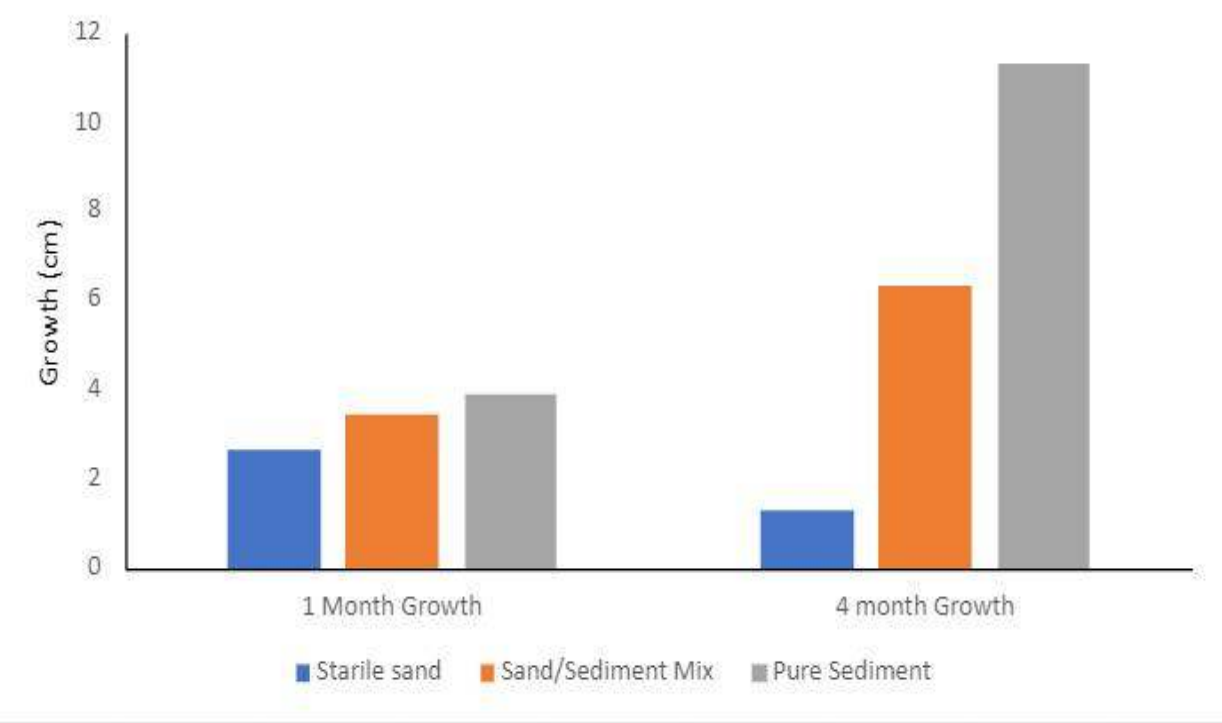
Seagrass Polytunnel

Seagrass Trials

- Testing Sediments
  - Sterile sand + fertiliser
  - Sand/Estuary Sediment Mix
  - Pure Estuary Sediment
- Testing Salinity
  - 38ppt
  - 20ppt

Results





Germination

- No significant effect of salinity on germination
- Highest germination success in Tees sediment

Growth

- No change at first
- Sand with added fertiliser quickly died off
- By far the best growth seen in sediment from the estuary

The Future?

MIXING IT UP

- A healthy ecosystem should have lots of life, and a variety of this life.

- Ecosystem based Restoration
  - Mussels
  - Kelp
  - Intertidal habitat

Re-creating Suitable Habitat

- Tackling the root of some seagrass stressors throughout the whole catchment
- Aim to increase the area available, within the estuary, suitable habitat for seagrass restoration.

Restoring Mussels to the Tees – what we thought we would do

- Species decline around UK estuarine and coastal waters
- Pressure from habitat loss and pathogens
- Vital for healthy eco systems
- Provide eco system service – filter feeding to remove toxins from water
- Carbon sequestration

Restoring Mussels to the Tees – what we now think we will be doing….

- Initial surveys show mussels may not be in a decline on the Tees
- Mussel spat forming in tanks
- Using captured spat to trial growth methods for wider restoration
- Pathogen testing to take place as part of UK wide research
- First meeting of the UK Mussel Network

Providing refuge for fish

- Graduate Trainee project – new recruit appointed to start in April
  - 78 candidates applied, many local to the Tees area
- Initial prototypes created and tested September 2024.
- Installed alongside oyster nursery
- Fortnightly monitoring
- 10 species recorded using cages so far including:
  - Pollack
  - Sticklebacks
  - Shrimp
  - Scorpion Fish
  - Juvenile Herring
  - Shore Crab

Thank You!!

Follow Our Journey

The Tees Rivers Trust

@teesriverstrust

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Henry Short – henry@teesriverstrust.org
Judy Power – judy@teesriverstrust.org