

# Gary Caldwell

Newcastle University

 @SAGB



Shellfish  
Association of Great Britain

THE CROWN  
ESTATE



Llywodraeth Cymru  
Welsh Government



Department  
for Environment  
Food & Rural Affairs



The FISHMONGERS'  
Company's  
FISHERIES CHARITABLE TRUST

SEPAmatic



Infrastructure  
and Environment



Crown Estate  
Scotland  
Oighreachd a' Chrùin Alba

seafish



Marine  
Management  
Organisation

# Crustacean Mortalities in Northeast England

## Dr Gary Caldwell





Images: Sharon Bell



© Sharon Bell NCJ MEDIA



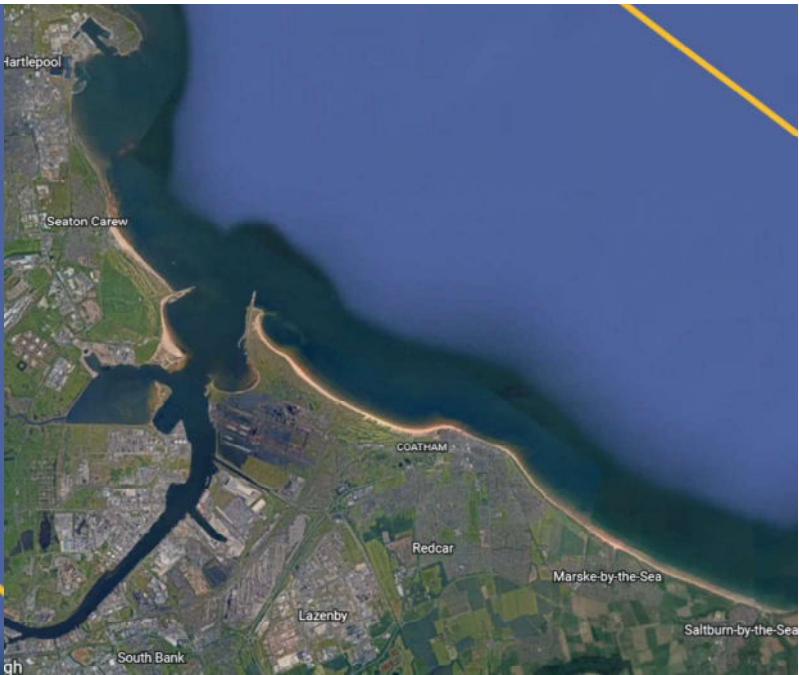
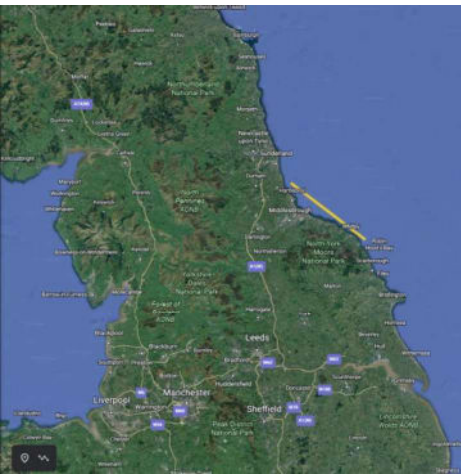
News > UK News > In The News

## 'Something is very wrong here' - Residents' shock after thousands of dying sea creatures wash up on North East beaches

An investigation has been launched after thousands of dead and dying crabs and lobsters were washed up on the shoreline

**Mail**Online

What is causing THOUSANDS of sea creatures to wash up dead in 'mountains waste deep' in the North East? Mystery over mass deaths amid fear pollution is to blame





Vilton

Lazenby

Grangetown

Teesville

South Bank

Motor Sports Park

River Tees

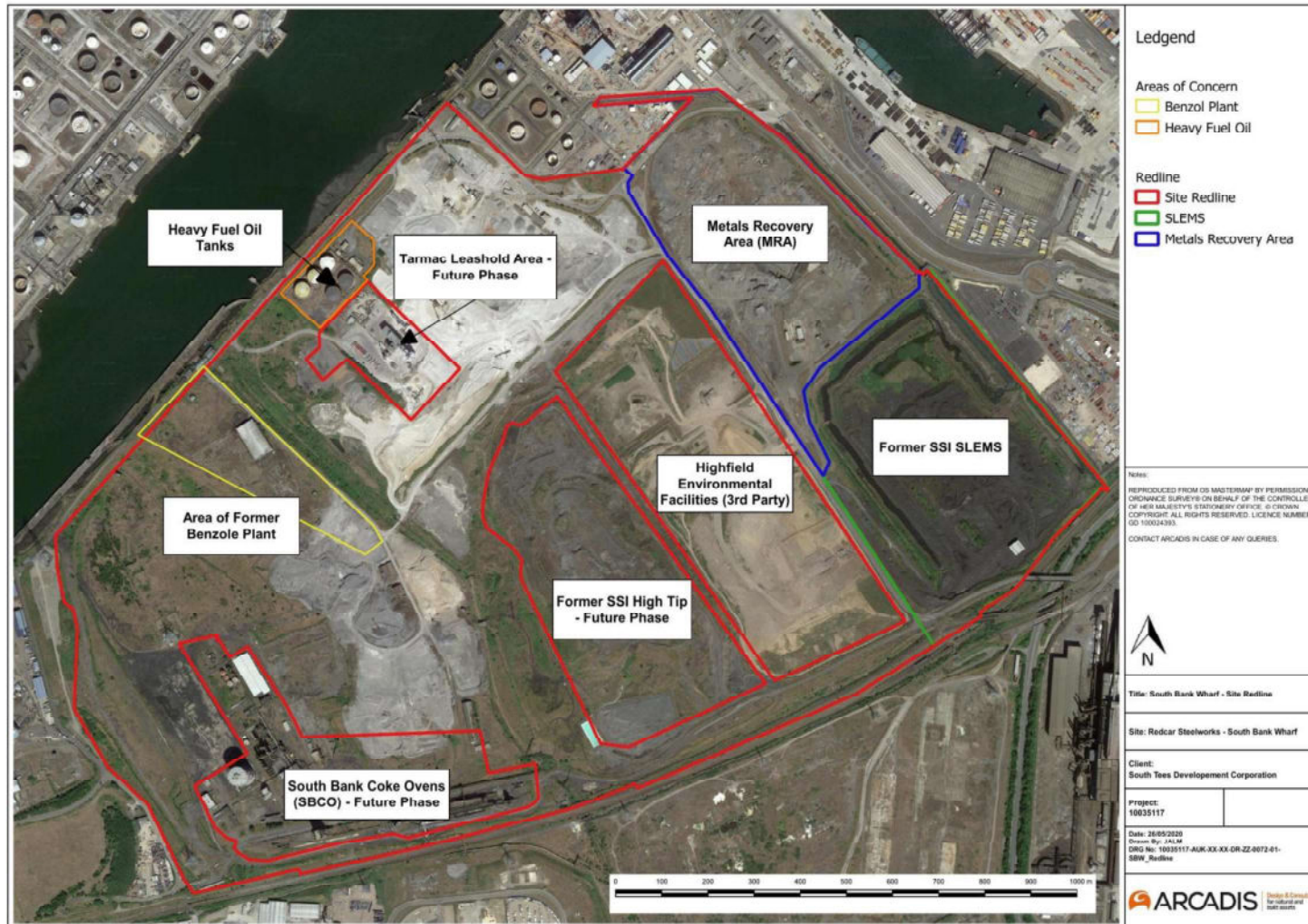
River Tees

South Gare And Coatham Dunes

South Gare

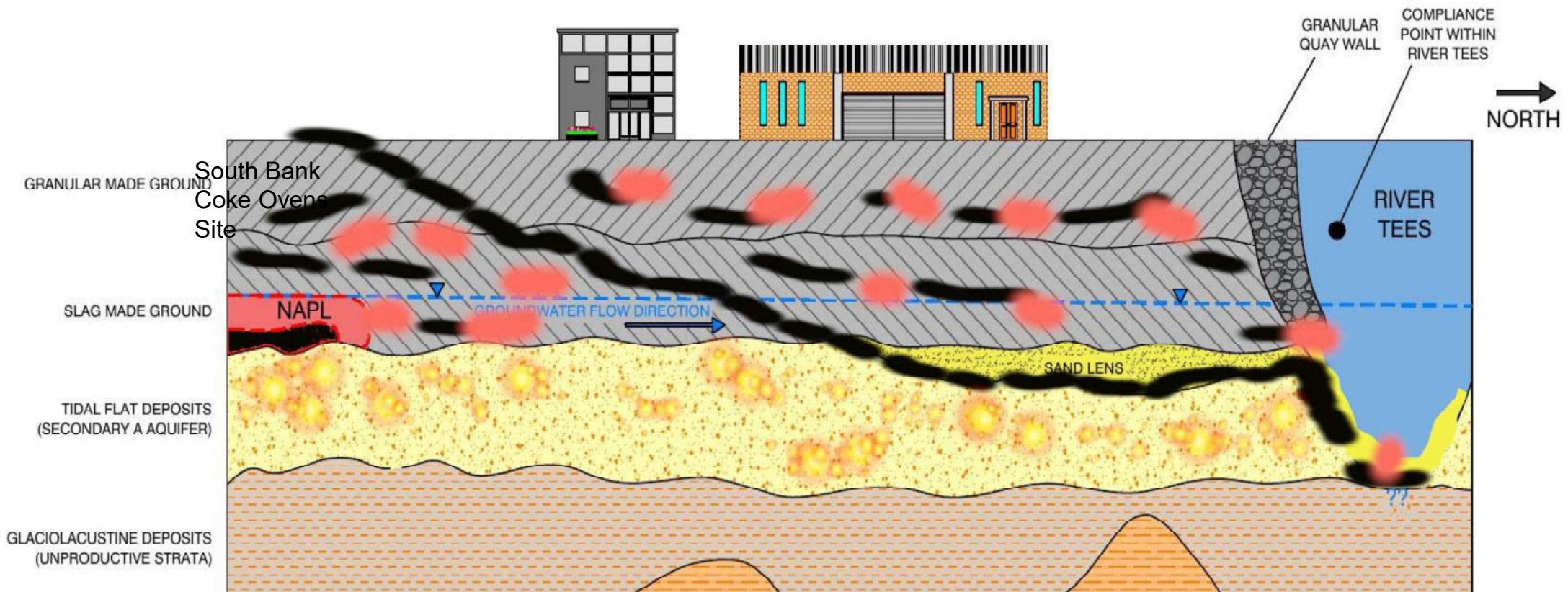
2D

# South Bank sources of contamination 2020



- Reclaimed land
- Historical site of:
  - **Steelworks & coke ovens**
  - **Metal recovery**
  - **Landfill**
  - Contaminants need to be considered – metals, PAHs, phenols, chromium, petroleum hydrocarbons, PCBs, VOCs, dioxins, furans, pyridine, novel contaminants from industrial legacy
  - Plus vanadium and rare earths (offsite sources)

# Revised Conceptual Model showing risks to river/marine receptors



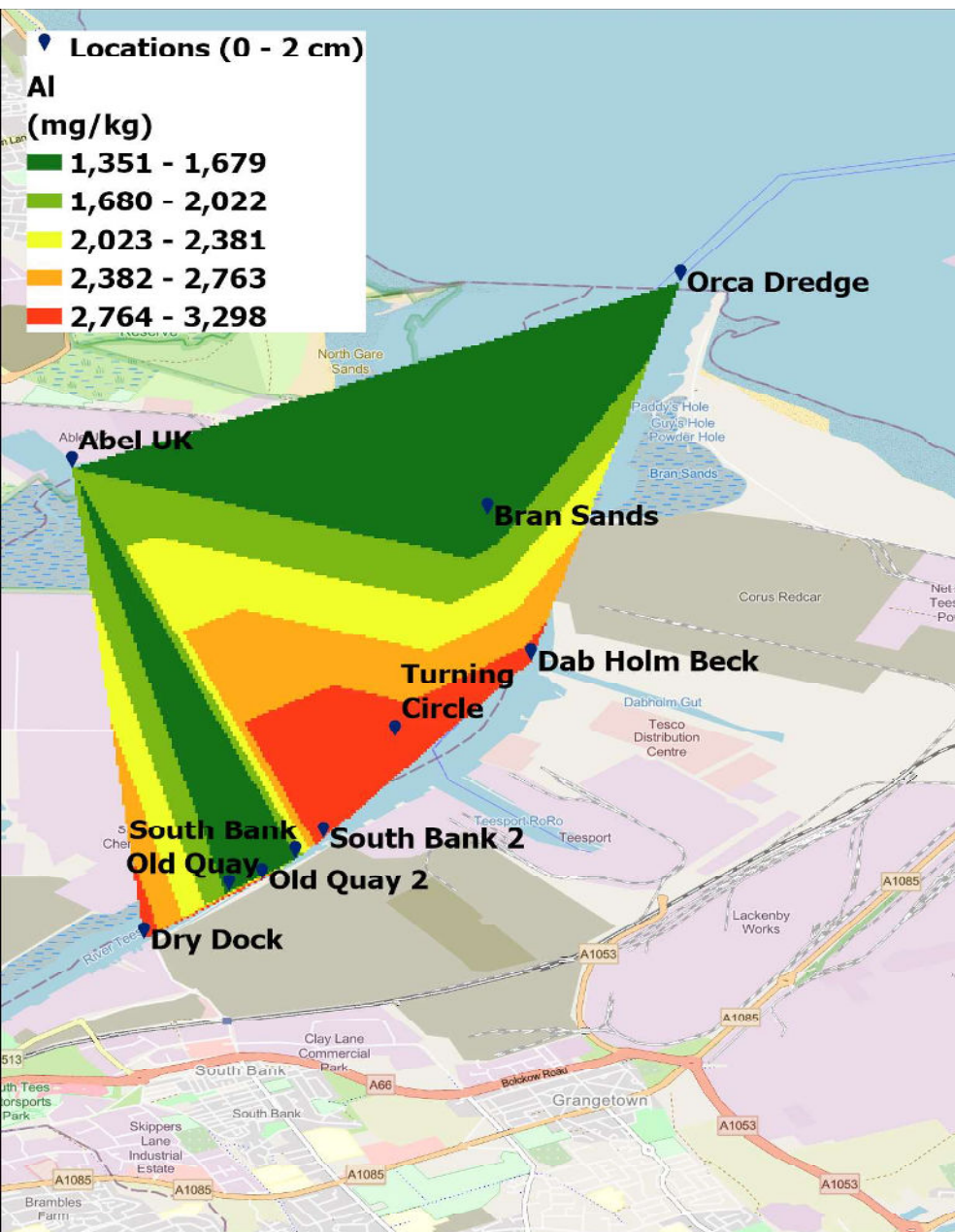
South Bank, Teesworks, Redcar - Detailed Quantitative Risk Assessment - South Tees Development Corporation - Document Ref: 10035117-AUK-XX-XX-RP-ZZ-0331-02-SB\_DQRA - Revision: 02 - SEPTEMBER 2021 - Arcadis

[https://www.northeastfc.uk/Teesworks/Planning/R-2022-0096-CD/R-2022-0096-CD-10035117-AUK-XX-XX-RP-ZZ-0331-02-SB\\_DQRA.pdf](https://www.northeastfc.uk/Teesworks/Planning/R-2022-0096-CD/R-2022-0096-CD-10035117-AUK-XX-XX-RP-ZZ-0331-02-SB_DQRA.pdf)

Environment Agency 2003 – R&D Publication 133 – An illustrated handbook of DNAPL transport and fate in the subsurface

[https://www.clu-in.org/conf/itrc/dnaplpa/dnapl\\_handbook\\_final.pdf](https://www.clu-in.org/conf/itrc/dnaplpa/dnapl_handbook_final.pdf)

# Aluminium



Max conc. = 45,145 mg/kg

= >4.5% by weight of aluminium.

Note that aluminium ore (bauxite) typically contains concentrations of 15-25%.



A Machine Learning approach:

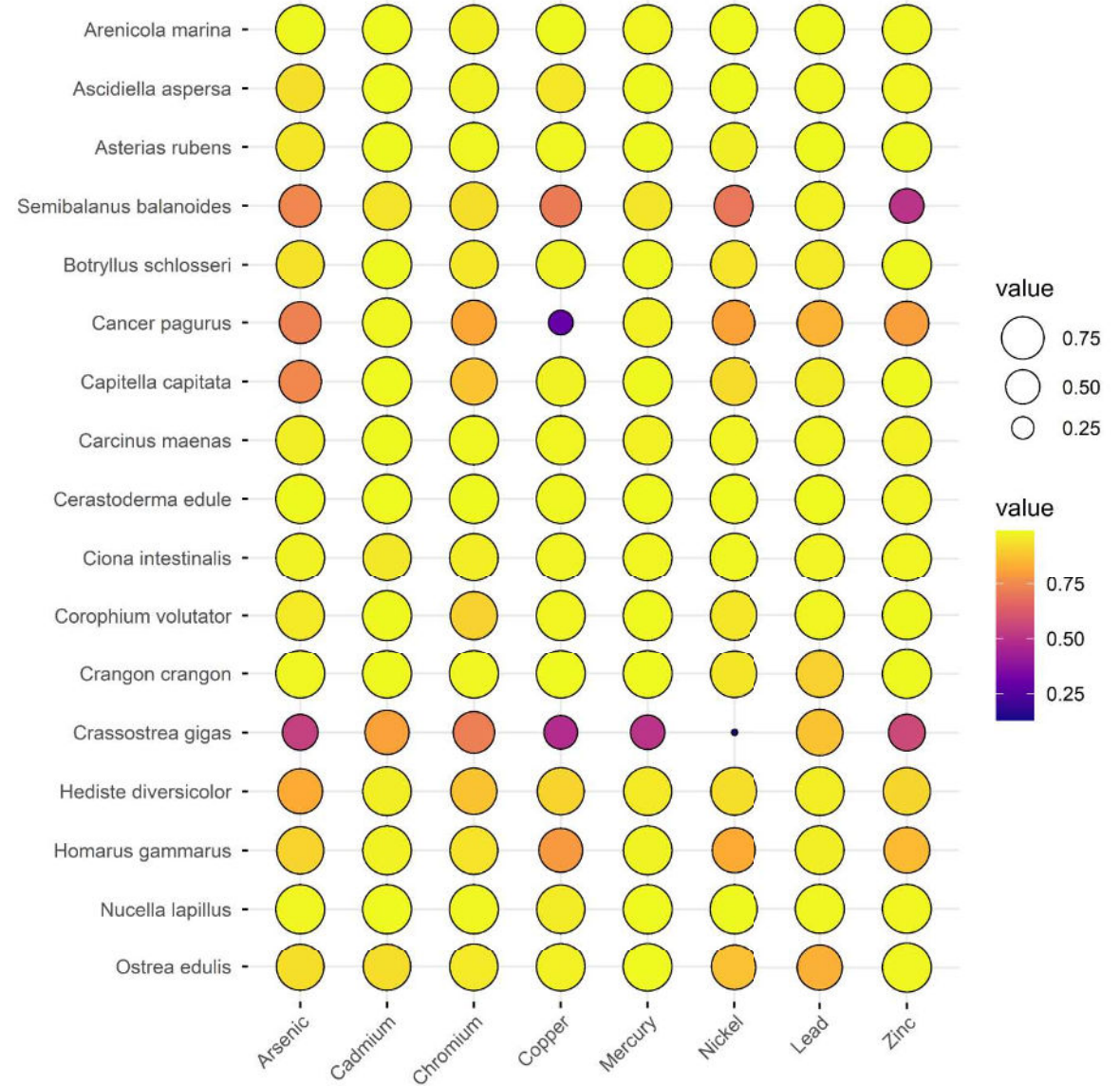
PubChem

US EPA ECOTOX knowledgebase

National Centre for Biotechnology  
Information Taxonomy Database



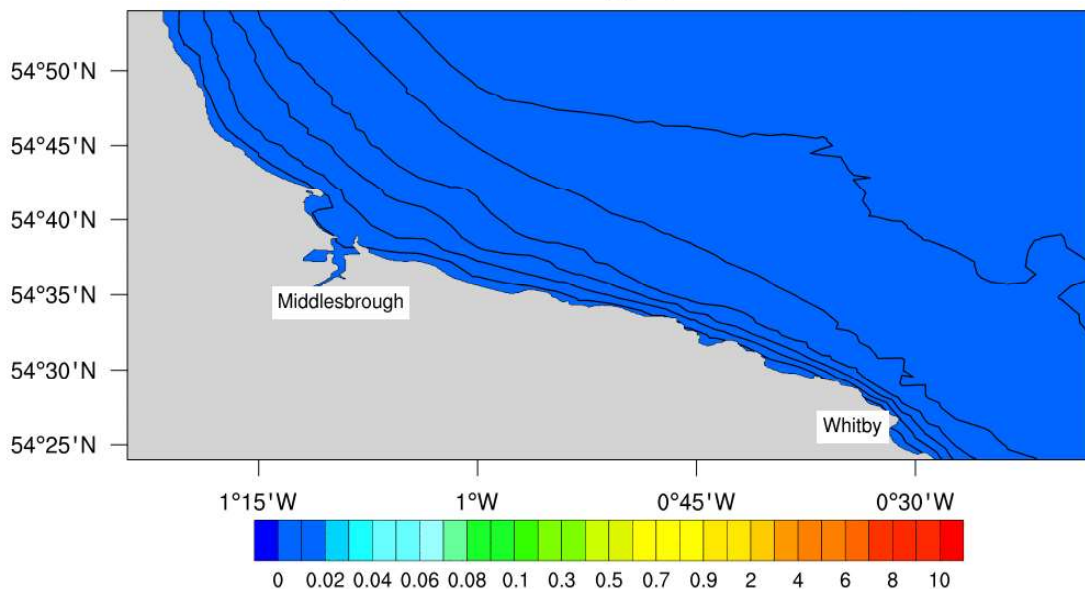
Neural networks and  
Knowledge Graph Embedding



# Model predicting the transport and dispersal of pyridine from the September and October dredges by UKD Orca.

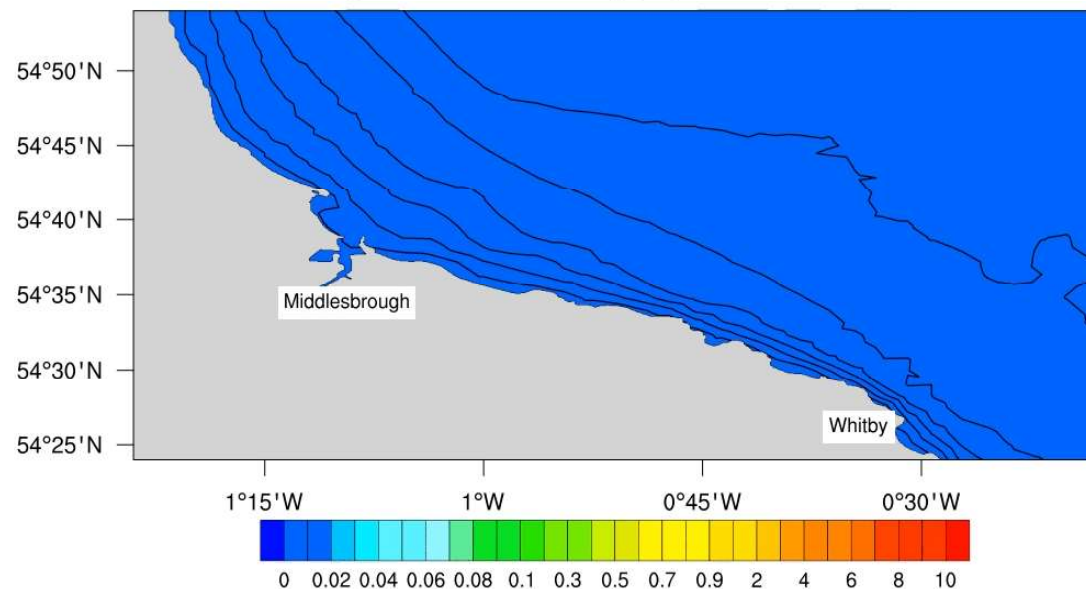
Dissolved

Pyridine concentration ( $\mu\text{g l}^{-1}$ ) 25 SEP 2021 1200



Sediment bound

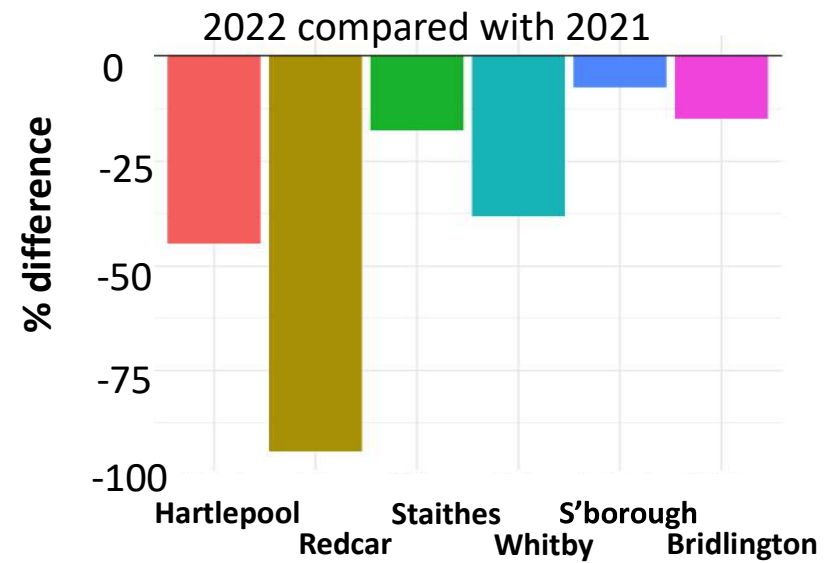
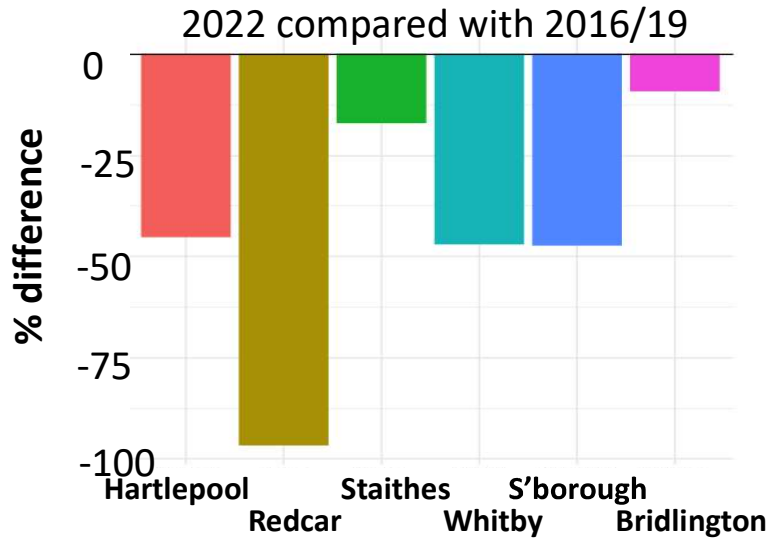
Pyridine concentration ( $\mu\text{g l}^{-1}$ ) 25 SEP 2021 1200



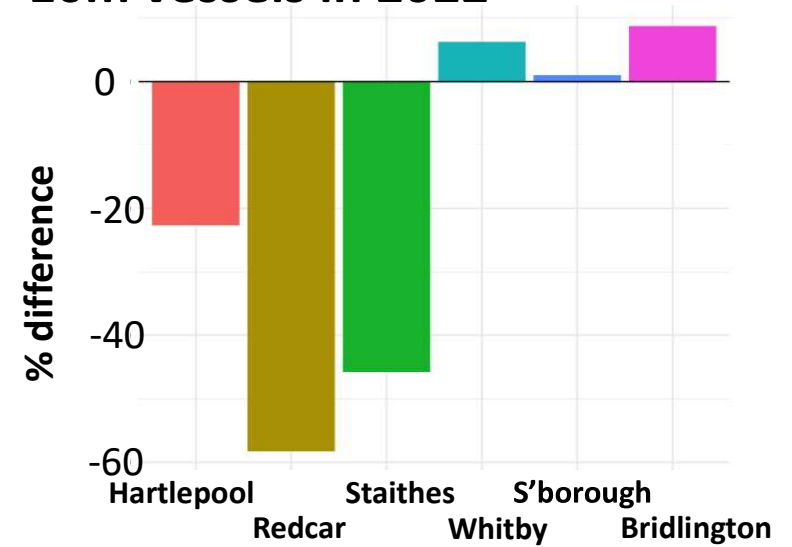
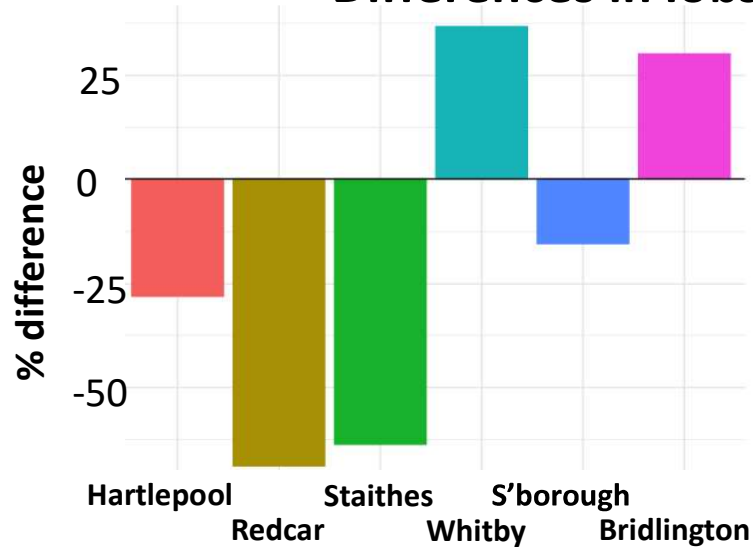
Model based on:

- 1000 L pyridine released at dredge and disposal sites per dredge event.
- 90% of pyridine assumed to have decayed after 8 days
- Disposal site is less impacted due to greater water depth

## Differences in edible crab landings for <10m vessels in 2022



## Differences in lobster landings for <10m vessels in 2022



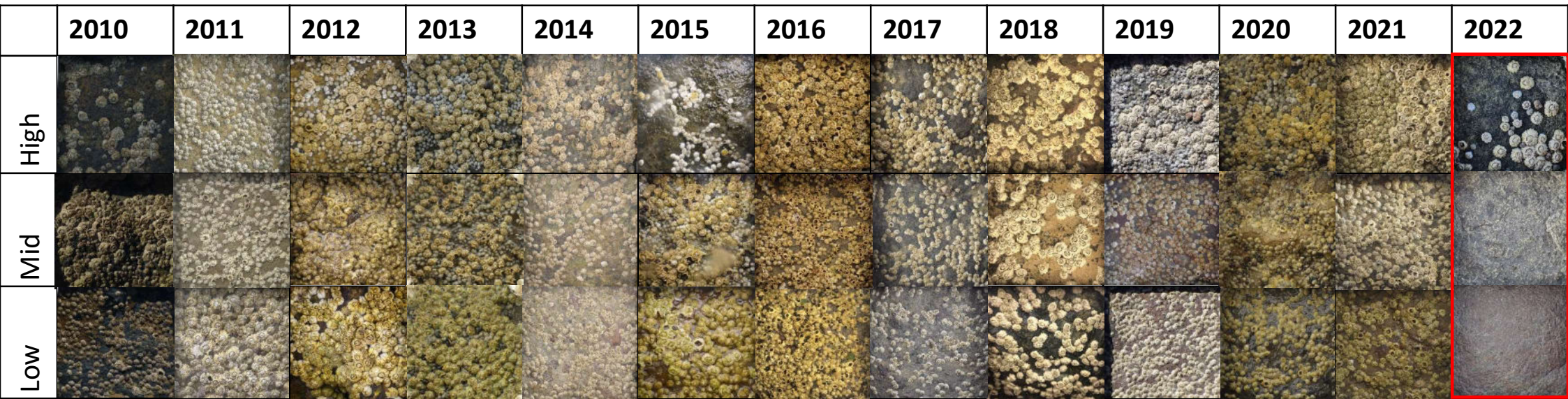
**Brittle star  
infestation**



**Tube worm  
infestation**

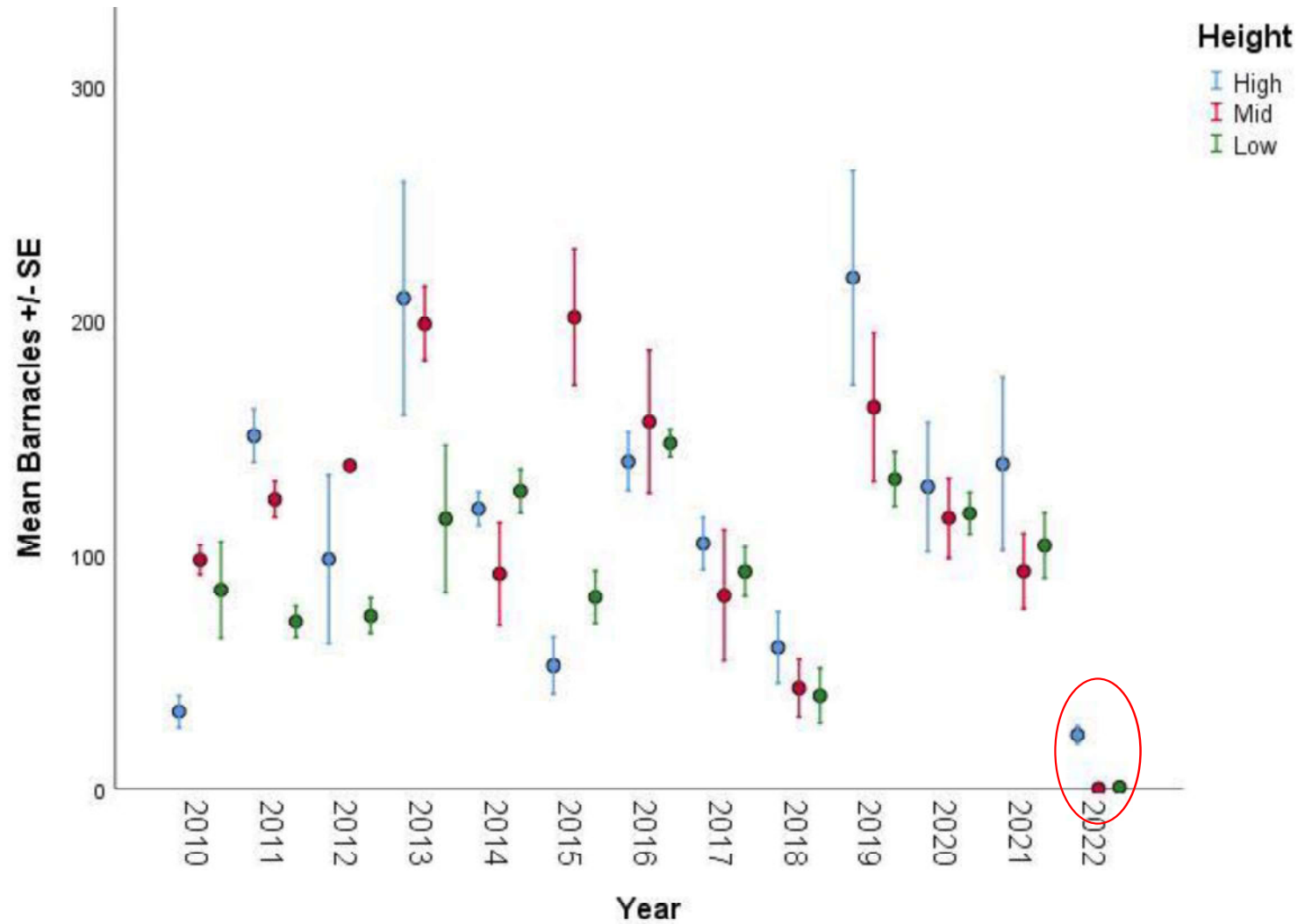




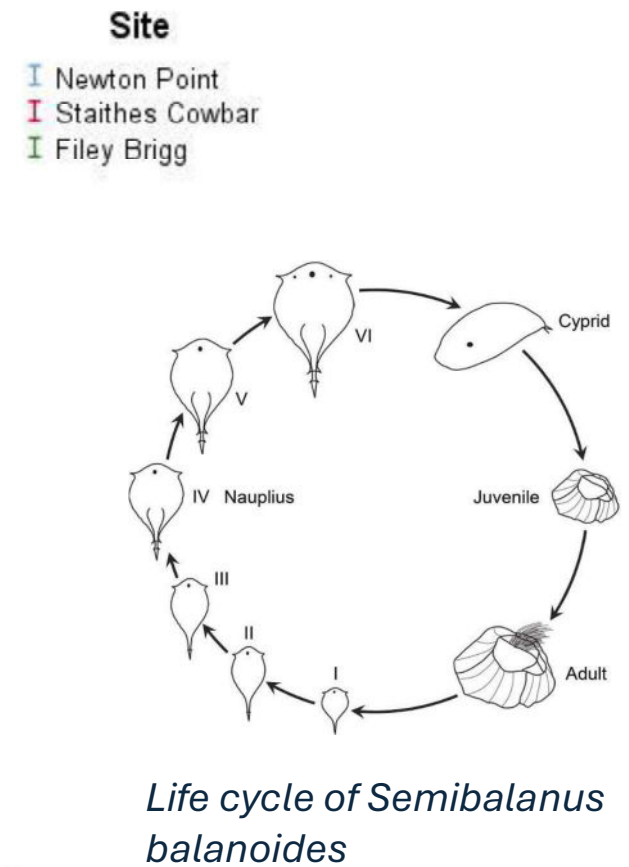
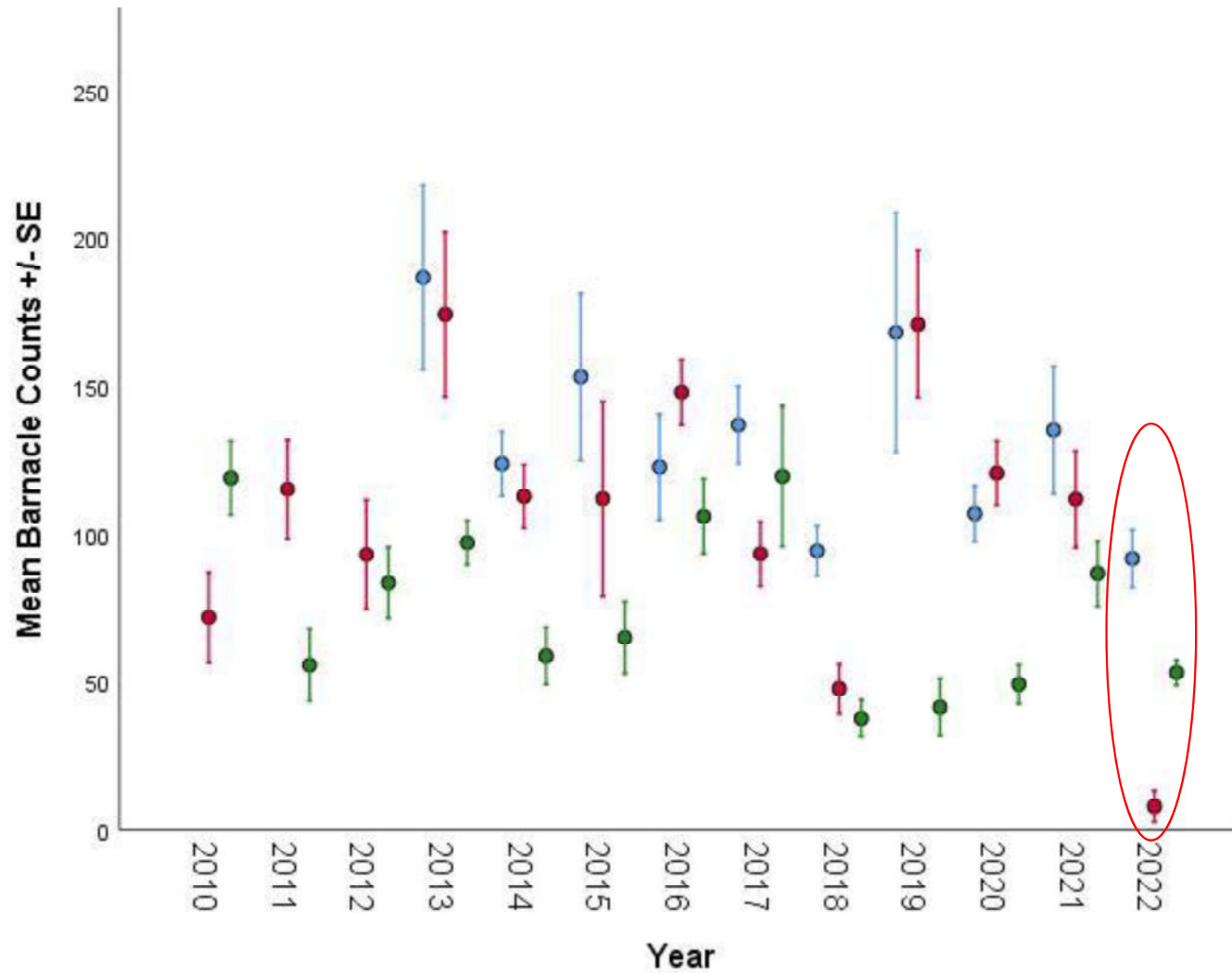


Visual representation of the barnacle communities on each of the shore heights at Staithes.

Data collected as part of the MarClim Project (Marine Biodiversity and Climate Change) Mieszkowska & Sugden 2022. Data collected annually in August.

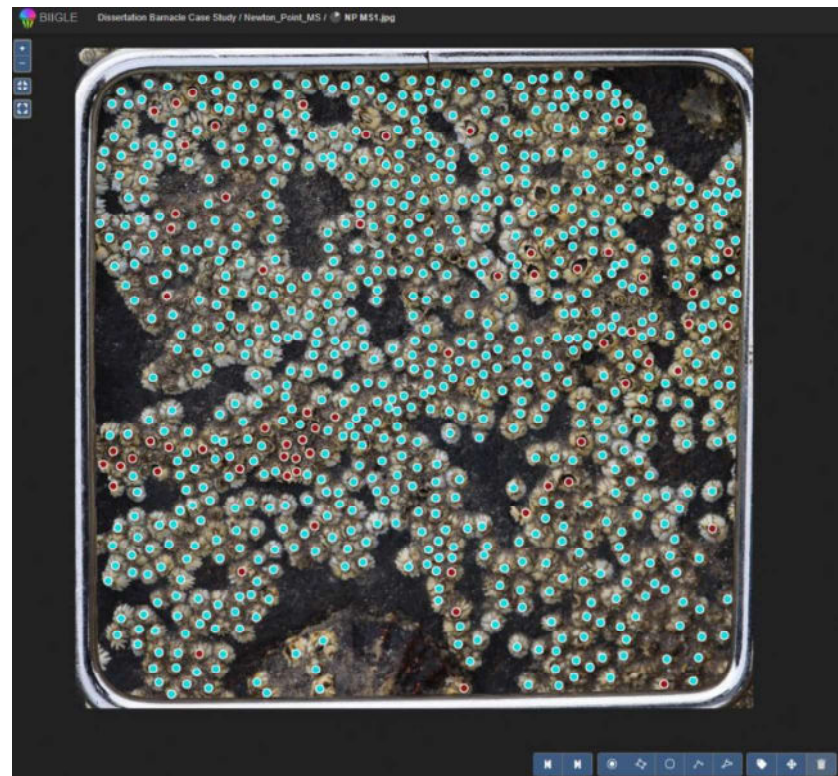
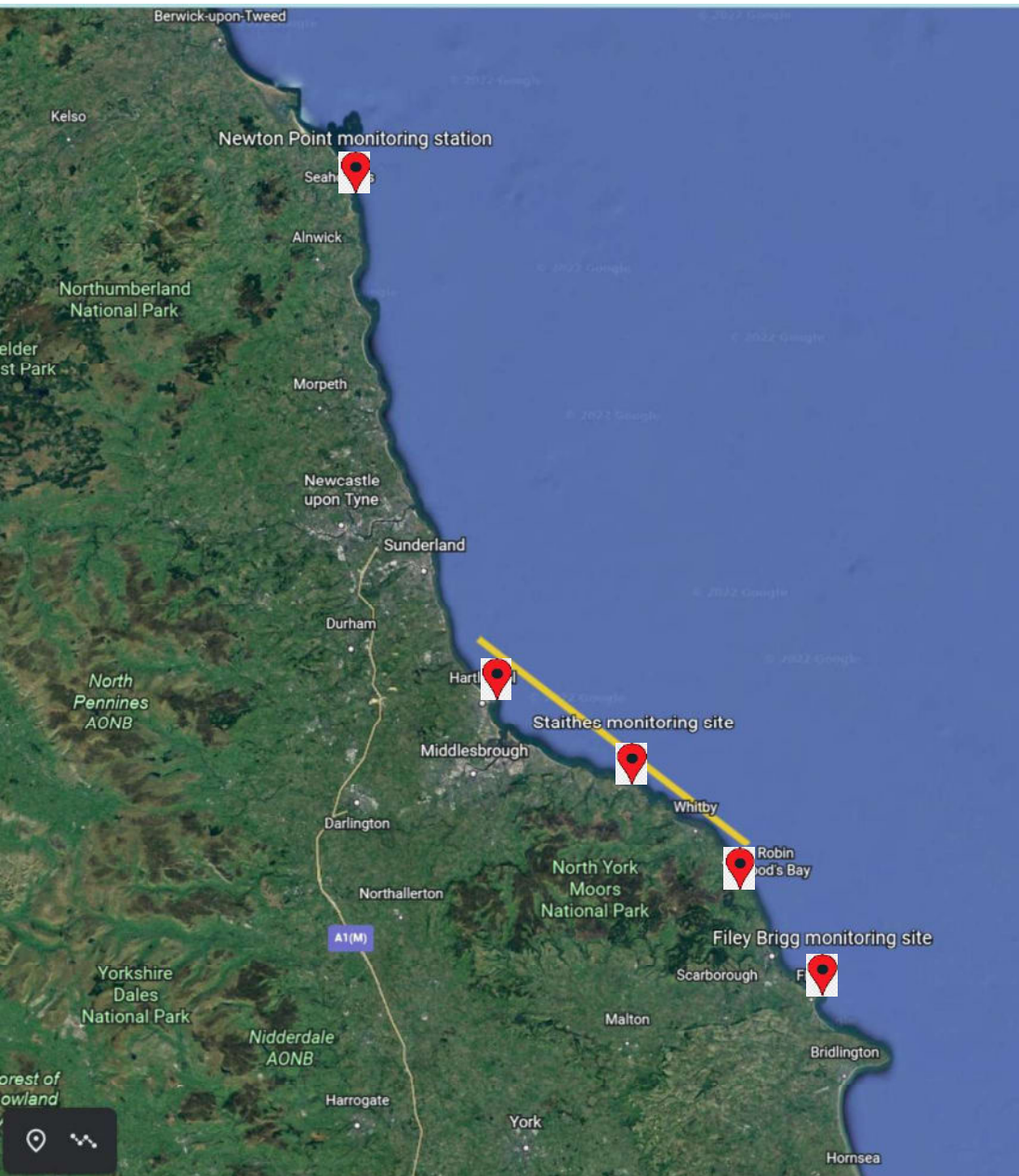


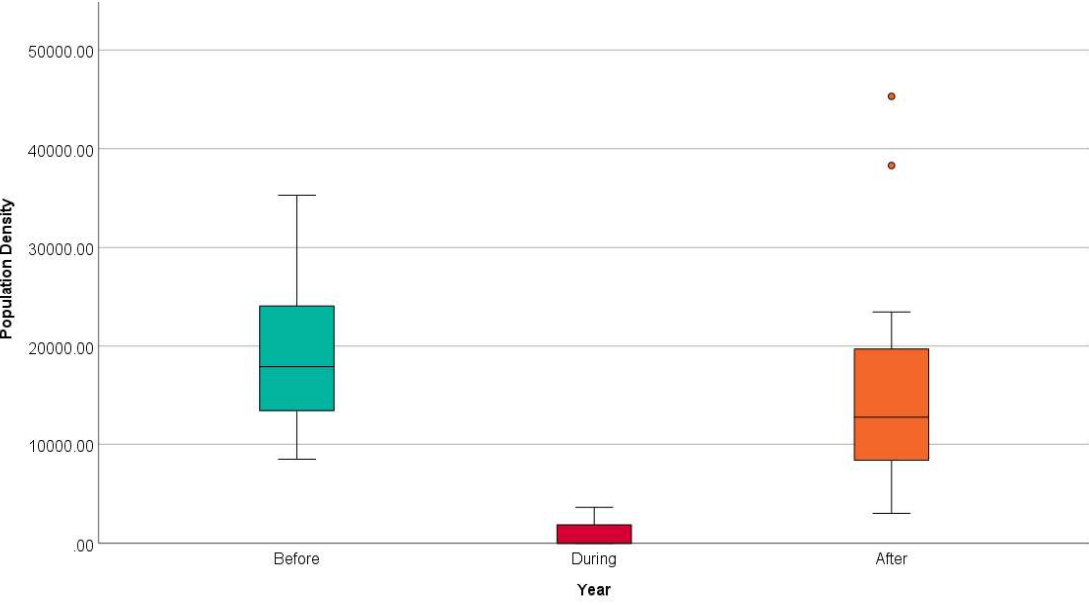
Mean barnacle community over time at Staithes, stratified by shore height (high shore, mid shore, low shore), n= 6 per shore height with each sample covering 10 cm<sup>2</sup>.



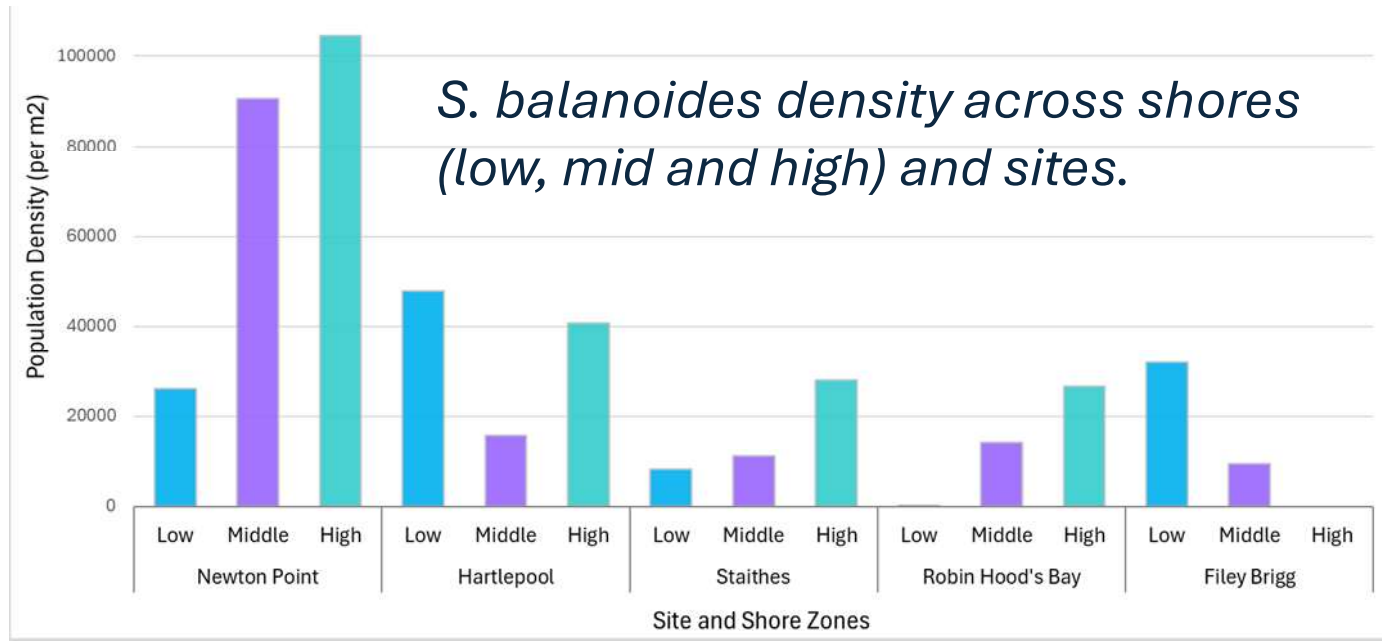
Mean barnacle community counts over time at Newton Point (Northern), Staithes (Central) and Filey Brigg (Southern), n= 6 per shore height with each sample covering 10cm<sup>2</sup>.



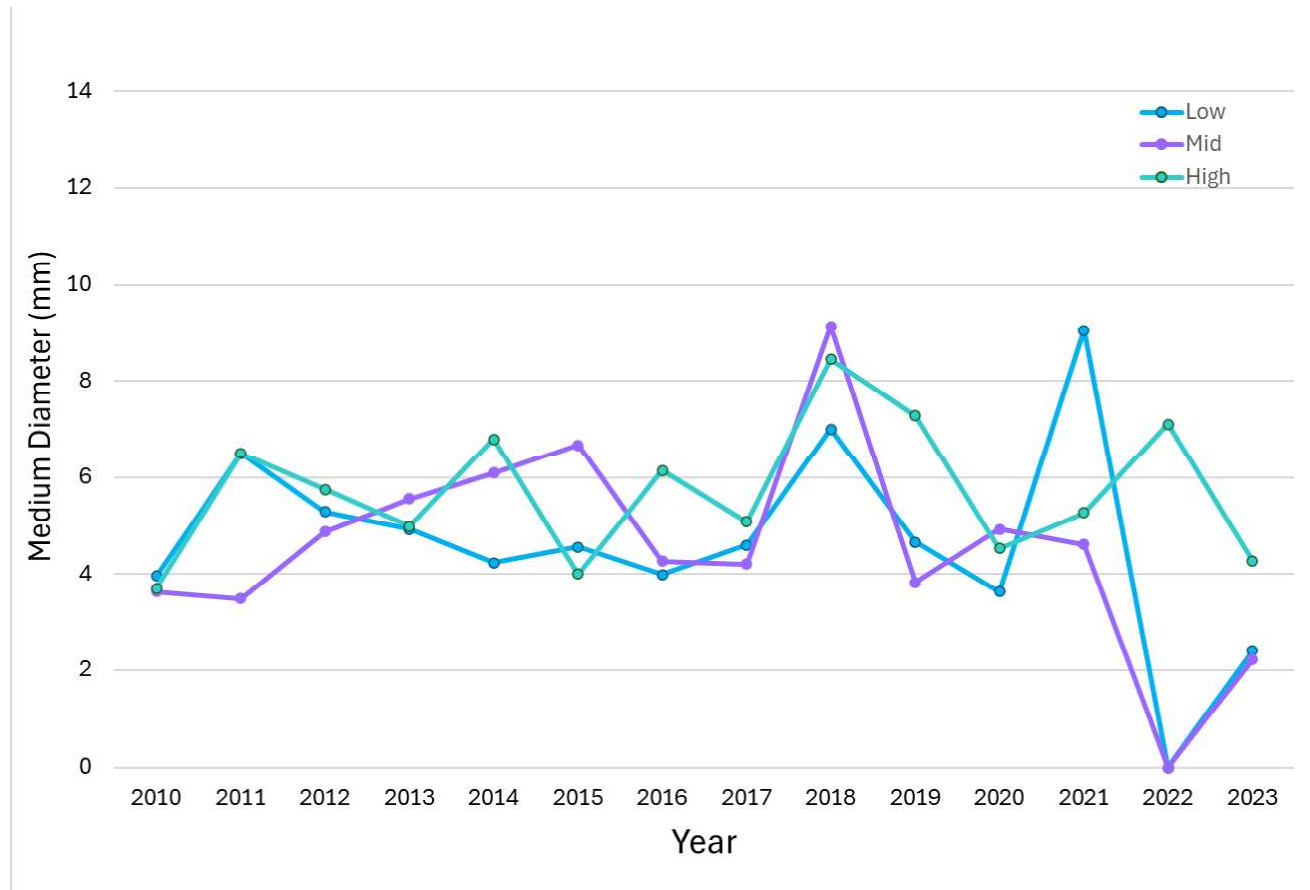
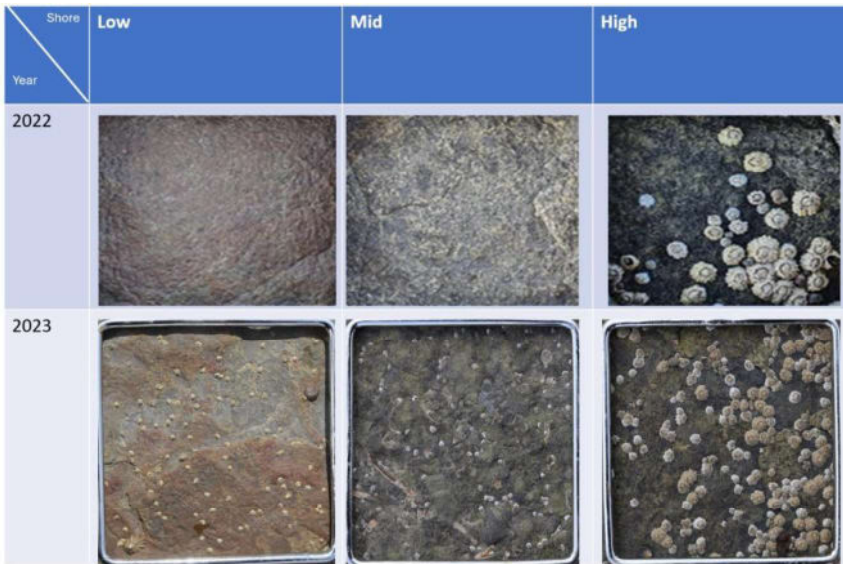




*S. balanoides* density ( $m^2$ ) at Staithes before (2010-2021), during (2022) and after (2023) the die-offs.



*S. balanoides* density across shores (low, mid and high) and sites.



*Diameter of S. balanoides through time at Staithes.*

# Future of the NE inshore fishing fleet?



Images: WikiCommons, The Times, Tessa Bunney

# A huge team effort on a shoe-string budget

- Simon Gibbon
- Dawn Love
- Robin Yardley
- Richard Randle
- Chloe Eastabrook
- Miguel-Angel Morales Maqueda
- Heather Sugden
- Joyce Idomeh
- Charlotte Vagg
- Poppy Lawrence
- Taz Nasif-Whitestone
- Brett Sallach
- Rodney Forster
- Tim Deere-Jones
- John Bothwell
- Joe Redfern
- Darren Grocke
- Dave Roberts
- James Smith
- Wasim Iqbal
- Jon Pitchford
- Bryce Stewart
- Sarah Coulthard
- Shara Ahmed
- Rebecca Braund
- Abbie Tunncliffe
- Kyah Thompson
- Sophie Lane
- **The fishers and coastal communities of the northeast and north Yorkshire, especially Sally Bunce, the Rennie family, the Widdowfield family & James Cole**



Everyone who has contributed to the public fundraising efforts



# 54th Annual Conference

Shellfish Association of Great Britain

#SAGB54