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Ecosystem Services of Bivalve Shellfish

The Shellfish Association of Great Britain 54th Annual Conference

28 May 2024



Bivalve Ecosystem Services project collaboration



Aquatic Ecosystem Services

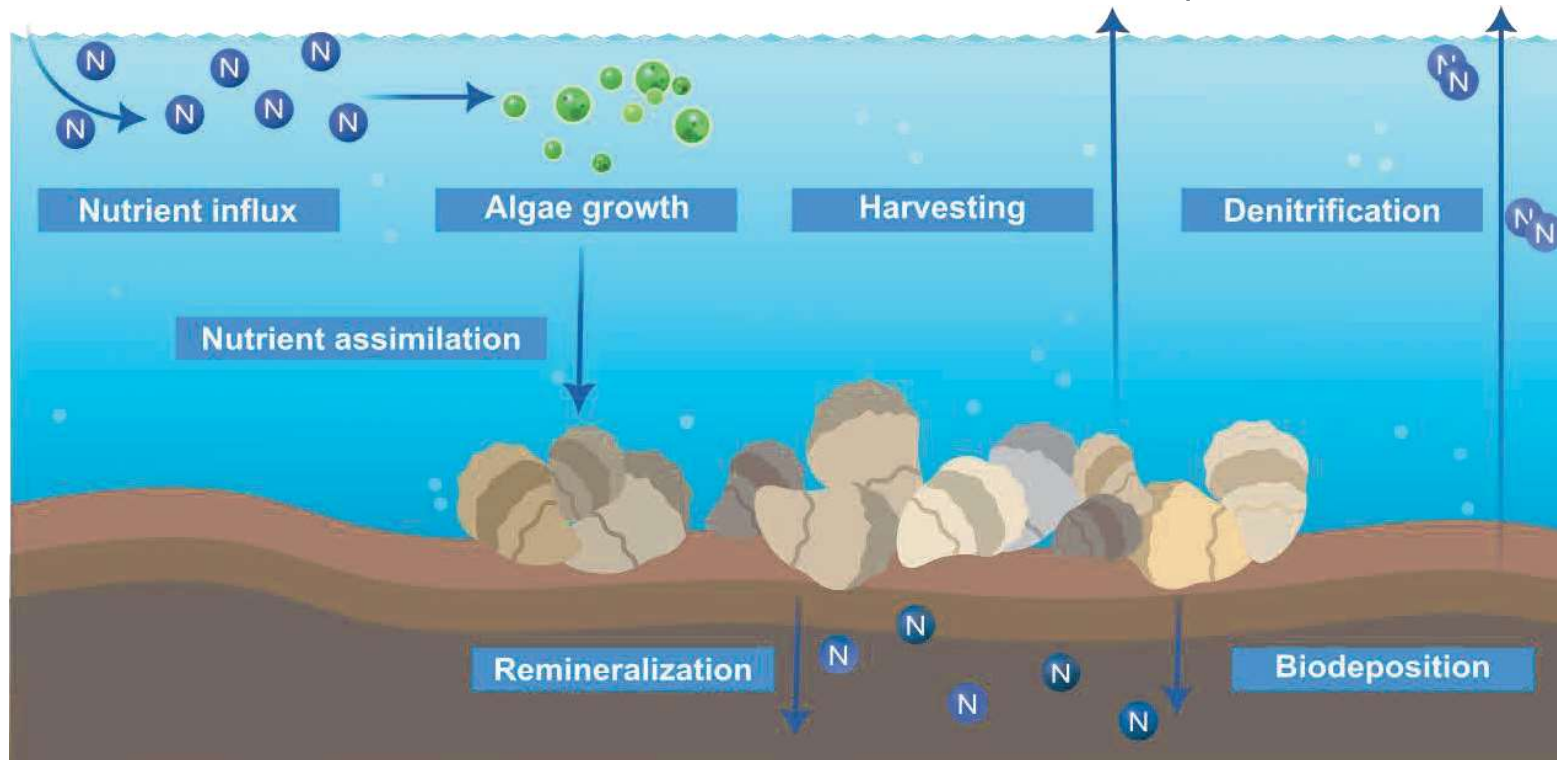
Any positive benefit that ecosystems provide to people

£ **211 billion** – value of UK marine ecosystem services and the societal benefits



Supporting & maintaining bivalve ecosystem services:

- Water quality maintenance and improvement
- Carbon sequestration



What did we do?

- **Question 1:** How much Nitrogen can bivalves remove from their environment?

- **Bonus:** How much Carbon can they remove?

- Commercially important bivalves:



Blue mussels
(*Mytilus edulis*)



European flat oysters
(*Ostrea edulis*)



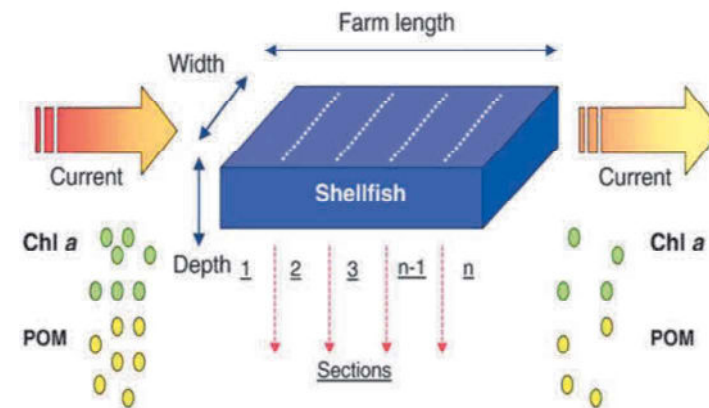
Manila clams
(*Ruditapes philippinarum*)



Pacific oysters
(*Magallana gigas*)

- Two analyses:

- Proximate analysis (PA)
- Modelling using FARM population model



The Farm Aquaculture Resource Management Model (FARM, Ferreira et al. 2007)

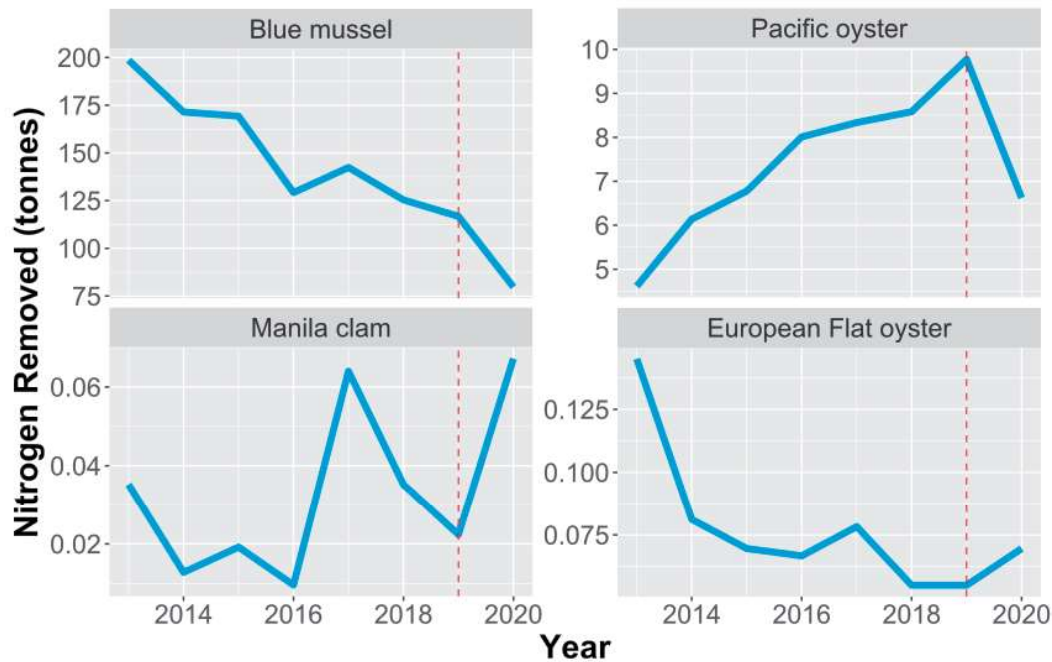
Previous evaluation (for UK region):

- Shellfish in nutrient management at Dundrum Bay |  2021



Nitrogen Removal

- Total Nitrogen Removed (2019) – **126.57 t (PA)** – **285/362 t (FARM)**
- Total Carbon Removed (2019) – **1762.5 t (PA)**



Proximate analysis 2013-2020

Based on shellfish production data 2015 -2020 data from Cefas

2020 data – interpret with caution (COVID)

NTB – Different Y scales

Nitrogen loadings (tonnes; 2014) and nitrogen removal (tonnes) based on 2019 bivalve production data.

Country	N-Total input	N-removal	
		Proximate analysis	FARM
England	266 088.31	30.47	~68.6 - 88.1
Northern Ireland	9 206.83	10.01	~22.2 - 29.9
Scotland	72 305.60	60.27	~136.4 - 171.3
Wales	21 561.33	25.82	~58.5 - 73.20
Total	369 162.10	126.57	~285.7 - 362.5

Value of bivalve water bioremediation

- **Question 2:** What is the potential economic value of the water quality improvement services provided by bivalves?
- Value estimated based on the cost of alternative Nitrogen removal strategies (avoided cost)
(not the compensation paid to growers)
- **Nitrogen removal through sand filters and Methanol dosing:**
 - Wessex Water data
 - £58,300 / tonne of Nitrogen removed annually
 - Estimated saving – **£7 to £16/ £21 million annually**
- **Replacement and Abatement:**
 - Solent Case study (Watson et al., 2020)
 - £295,000 /tonne of Nitrogen removed annually (average)
 - Estimated saving – **£37 - £84/ £100 million annually**

Total N Removed by shellfish (2019)
126 - 285/362 tonnes

Stage 2 – Case Studies

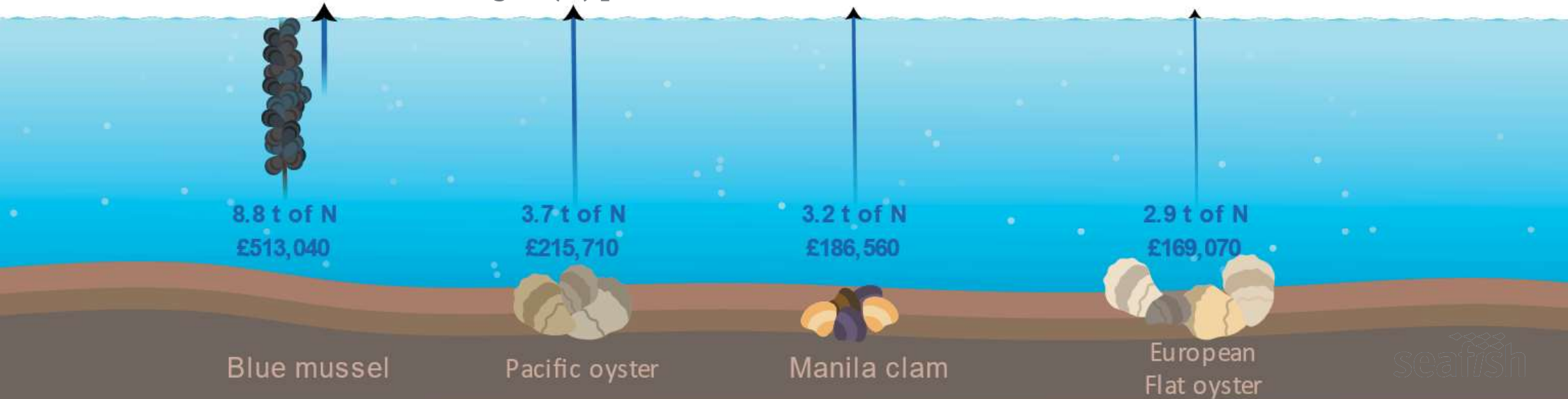
- **Aims:**
 - Offer **more detailed estimates for case studies** around UK (nutrient removal, value).
 - Elemental analysis, FARM model
 - Investigation of Nitrogen, Carbon and Phosphorus
 - Help inform the **development of best practice guidance** for bivalve-related nutrient removal management programmes.
 - Based on case studies results
 - Supported by research and interviews with experts involved in other bivalve bioremediation projects.



Key Facts

- **126-285/362 tonnes of nitrogen** removed by the UK bivalves aquaculture (estimated for 2019).
- **£7 to £21 million** annually of potential cost savings.
- Nitrogen uptake does not affect the safety of consumption.
- **The greater the future bivalve production, the higher the nitrogen removal.**

Removal of nitrogen (N) per 1000 tonnes of bivalve harvested (Proximate analysis)



Thank you

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