

South-West Marine Ecosystems Conference

Understanding Past Ecosystem Changes in the South-West to inform the Future

Narrators:

**Abigail McQuatters-Gollop – Libby West – Keith Hiscock
& Bob Earll**

***Contributors:* Tim Smyth & Ross Saunders, Angus Atkinson, Karen Tait, Jeroen van der Kooij, Simon Thomas, Tom Horton, Alex Banks, Harriet Allen, Bryce Stewart, Haley Roberts, Martin Attrill, Dan Jarvis, Bex Allen, Emma Sheehan & Amy Cartwright, Ruth Williams, Duncan Jones, John Moore, Helen Findlay, Rachel Yates, Penelope Lindeque & Clare Ostle**

Session 1 Understanding Past Ecosystem Changes in the South-West to better inform the Future

Objectives of the Session

Beyond silos: We work in thematic topics silos – for many good reasons – BUT we know that these topics interact –

The aim of this meeting is to move beyond the silos and consider ecosystem interactions and change

Collective understanding One of the main purposes of this session is give the SWME community a collective view of the past and our understanding of this including many 20th Century events

Why has this happened? The media always ask Why?

‘Why has there been an octopus explosion?’ ‘Is it climate change?’ etc.

Hopefully this session will begin to help us answer this type of question.

Using the past to help us explain the future - Putting it more directly, and given the scale of science that takes place in the south-west, if we can’t explain the past what hope is there for the future? [Hindsight informs foresight.](#)

What lessons can we learn? Do we need to change what we are measuring?

South West Marine Ecosystems

Understanding the Past to inform the Future

Process

Part 1 – 50 mins Slide pack and narrative – (OUTPUTS)

34 examples of ecosystem change

Four narrators – Abigail McQuatters-Gollop – Libby West – Keith Hiscock – Bob Earll

Recorded & Videoed =>YouTube (OUTPUTS)

Part 2 – 70 mins Discussion –

- **Recorded discussion = AI processed = > OUTPUT**
- **Light touch questions – and Google Forms**

South-West Marine Ecosystems Conference

Session 1 Understanding Past Ecosystem Changes

Introduction

Structure of the Session: **SIX Themes**

1. **Climate and oceanographic interactions and their effects on plankton, foodwebs and forage fish** Abigail & Libby
2. **Recent major changes to keystone species** Libby
3. **Diseases** Keith
4. **Recovery & restoration** Keith
5. **Human impacts: fishing – non-native species -** Libby
6. **Human impacts: Pollution: Oil – TBT – Ocean acidification – plastics -** Bob

Types of change

How do we frame change? What language do we use?

Some useful terms defined by their temporal or statistical nature rather than cause.

Stochastic changes are random, unpredictable change - events

Gradual changes are long-term trends (e.g. ocean acidification) - **deterministic changes** follow a predictable trend (e.g., sea surface temperature rises linked to CO₂).

Sudden shifts—often called **regime shifts** or "catastrophic transitions"—involve an ecosystem rapidly reorganising into a new state.

Large unexpected events such as **collapse or explosive growth of populations** e.g. Octopus
Beaugrand et al 2019

Abrupt Community Shifts (ACS) – We define an ACS as a stepwise shift in community structure -
Beaugrand et al 2019

**Theme 1 Climate and
Oceanographic Interactions
with food chains and
natural systems**

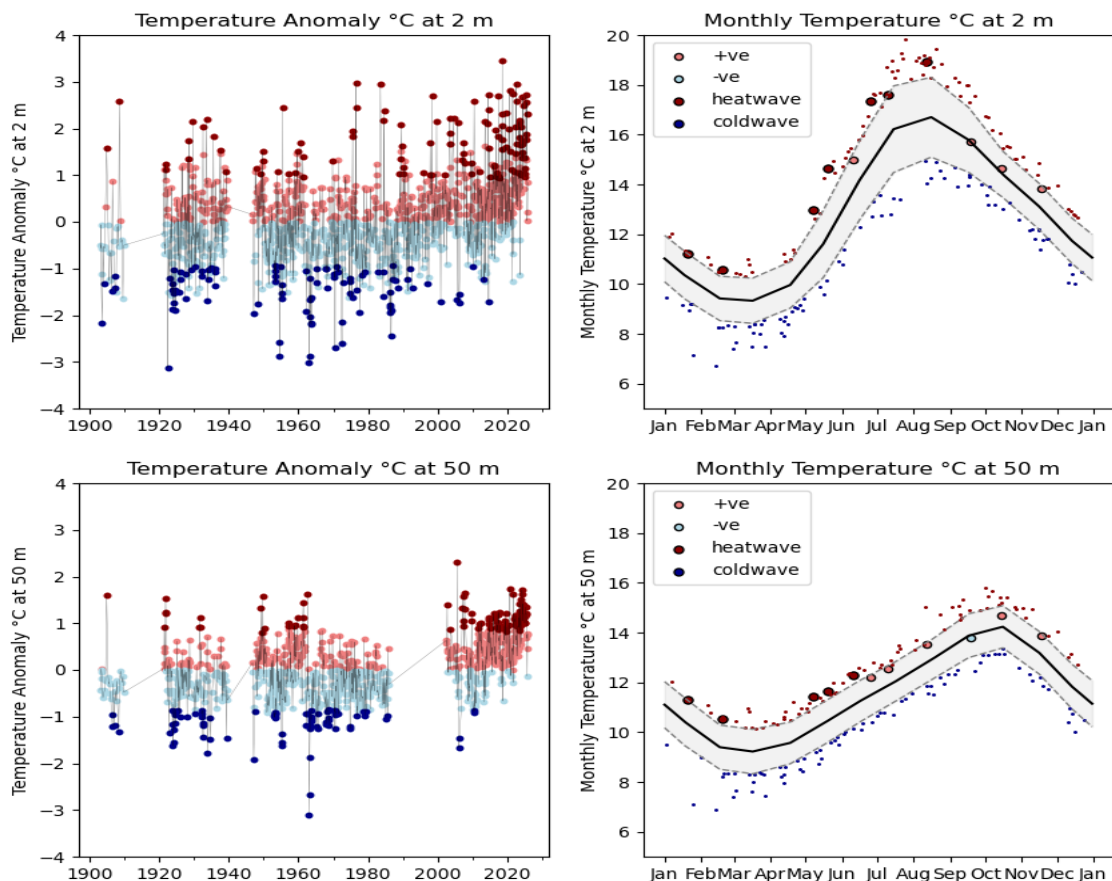


Marine Heatwaves

Marine Heatwave (MHW) until late August – then cooler autumn, MHW return Nov (Dec)

E1: 2025 Anomalies

Western Channel Observatory: Station E1
Year: 2025

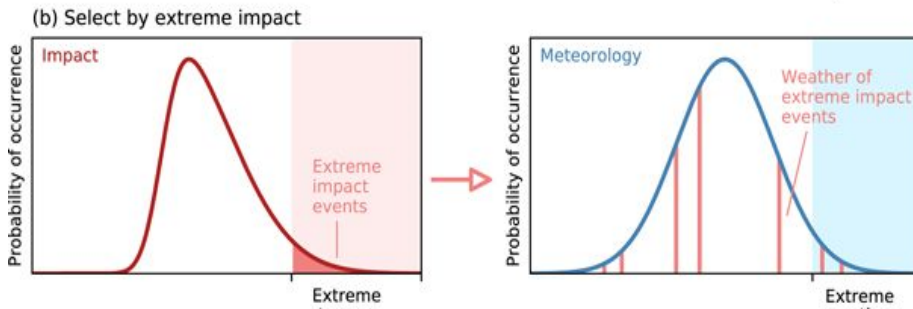
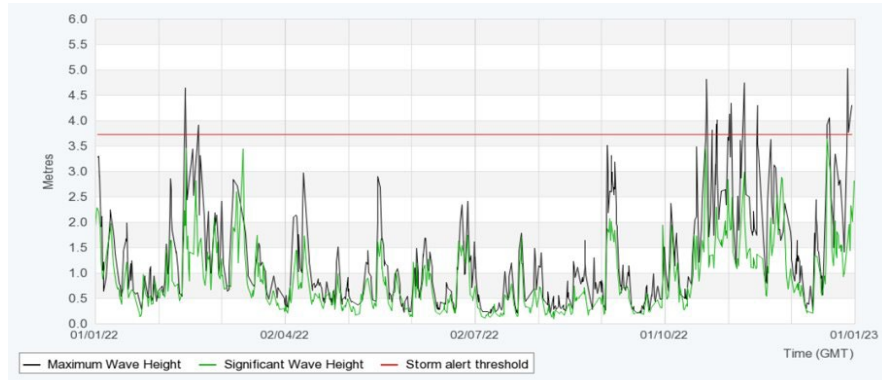


Key Points

- A marine heatwave is when temperatures exceed the 90th centile.
- South-west marine heatwaves: 2023, 2024, 2025
- Caused by long periods of strong sunshine and reduced windspeed (spring, summer); absence of cold weather (autumn, winter)
- Publications: [Berthou et al., \(2024\)](#)
- Vertical CTD profiles using RV Plymouth Quest
- Grey envelope: 10 – 90th centile
- Large dots – 2025
- Small points – records for individual given dates

Storms & Extreme Events – Climate & Impacts

Bob Earll



Key Points

Storms are a frequent and normal and frequent part of the climate of the south-west. [2022 – Met Office]

Extreme storm events are very high profile causing multiple impacts

- Storms from the East
- Multiple storms in close succession – 3 named storms in 7 days
- Combined with other meteorological drivers – low temperatures – e.g. the beast from the east & Storm Emma 2018

Extreme Storm impacts:

- Profound on seashore species
- Shallow sub-tidal washouts of sediment benthic species
- Mass mortalities of juvenile grey seals
- Orders of magnitude greater costs to coastal infrastructure e.g. Dawlish Railway (2018) and Slapton sands road (2014 & 2026)

Images: Keith Hiscock & BBC

The Russell Cycle – our first understanding of climate cycles

Abigail McQuatters-Gollop



- The ‘Russel Cycle named after Sir Frederic Russell but developed by many others including Alan Southward
- It was based on plankton studies in the south-west
- Was the ground-breaking in terms of oceanology
- It was the prevailing paradigm and way work was framed / for the main part of the 20th Century
- The changes of between *Calanus* & invertebrate larvae dominated and pilchard egg dominated plankton hauls is illustrated in this classic image

Image: Keith Hiscock

Is the Russell Cycle still relevant?

Abigail McQuatters-Gollop

The Atlantic Multidecadal Oscillation (AMO)

High AMO (Warm Phase) – Russell Cycle “Warm Regime”

Sea Conditions: Warmer SSTs, more stratification, weaker nutrient mixing.

Plankton: Lower biomass; dominance of warm-water species (e.g. *Sagitta setosa*).

Fish: Sardines/pilchards, anchovies, red mullet, seabream increase.

Biodiversity: Lusitanian species expand north; boreal species retreat.

Fisheries: Sardine fisheries dominate; herring declines.

Low AMO (Cool Phase) – Russell Cycle “Cool Regime”

Sea Conditions: Cooler SSTs, stronger vertical mixing, higher nutrients.

Plankton: Higher biomass; cold-water zooplankton (e.g. *Sagitta elegans*) return.

Fish: Herring, cod, haddock rebound; sardines retreat.

Biodiversity: Boreal species return; Lusitanian species contract.

Fisheries: Herring fisheries thrive; sardine catches decline.

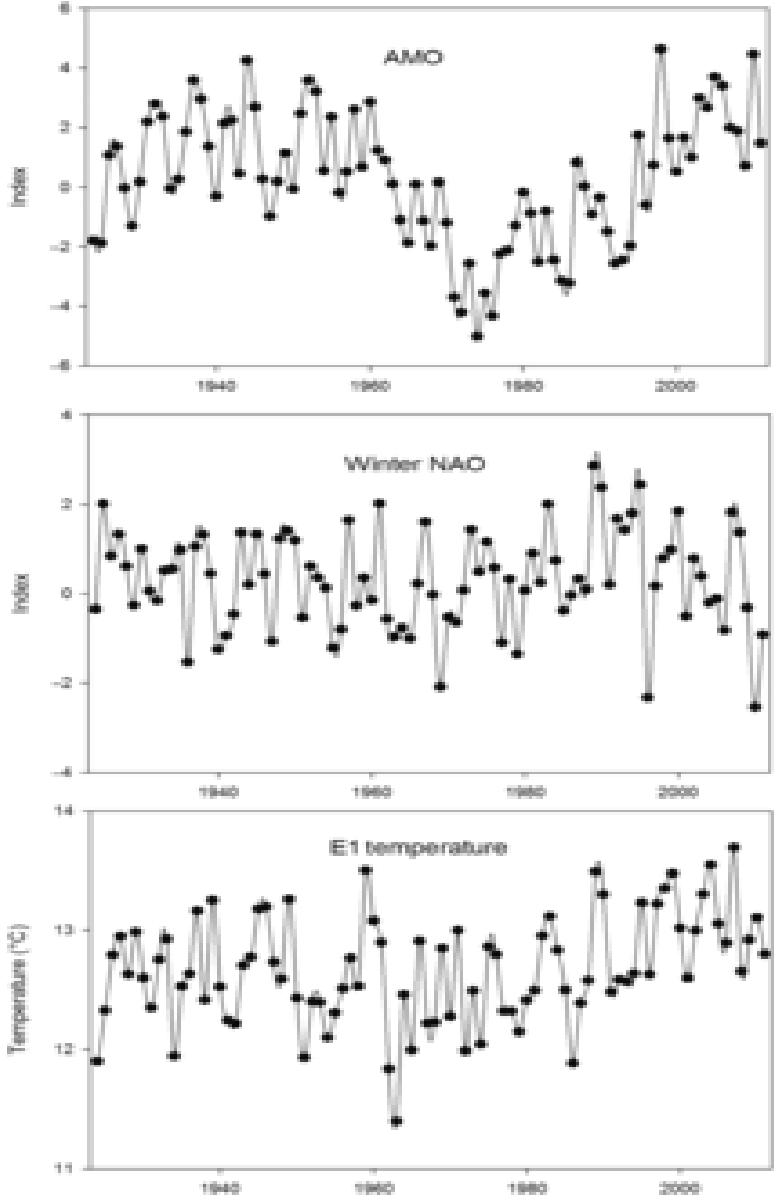
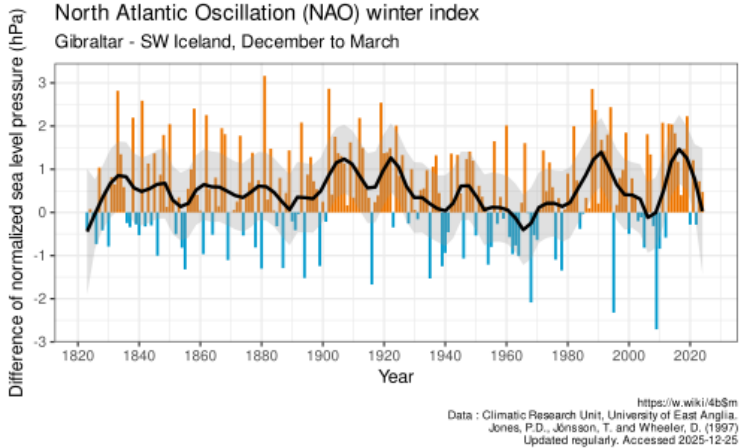
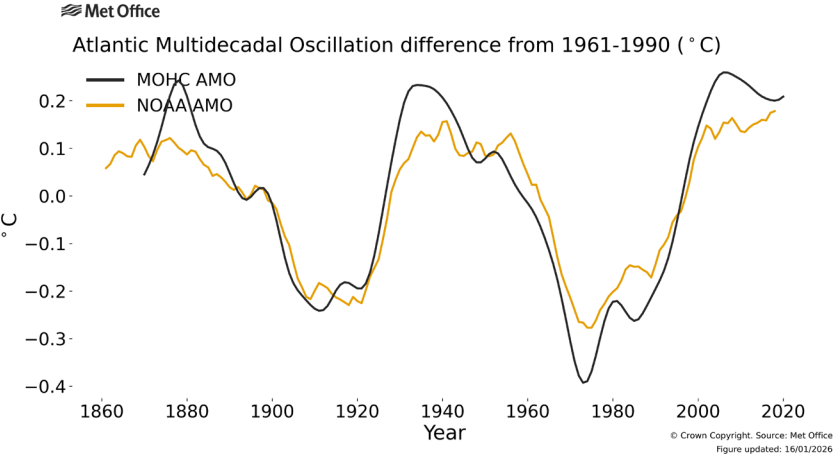
However... Licandro et al 2016 found:

- Some patterns in zooplankton suggest possible cycles.
- No strong evidence that the Russell Cycle still runs on a regular or climate-linked schedule.
- Ecosystem changes are likely irregular regime shifts, not true cycles.
- Human-driven warming may be disrupting any natural cycles.
- Current data is too limited to confirm long-term patterns confidently.

Climate cycles drive ocean dynamics

Abigail McQuatters-Gollop

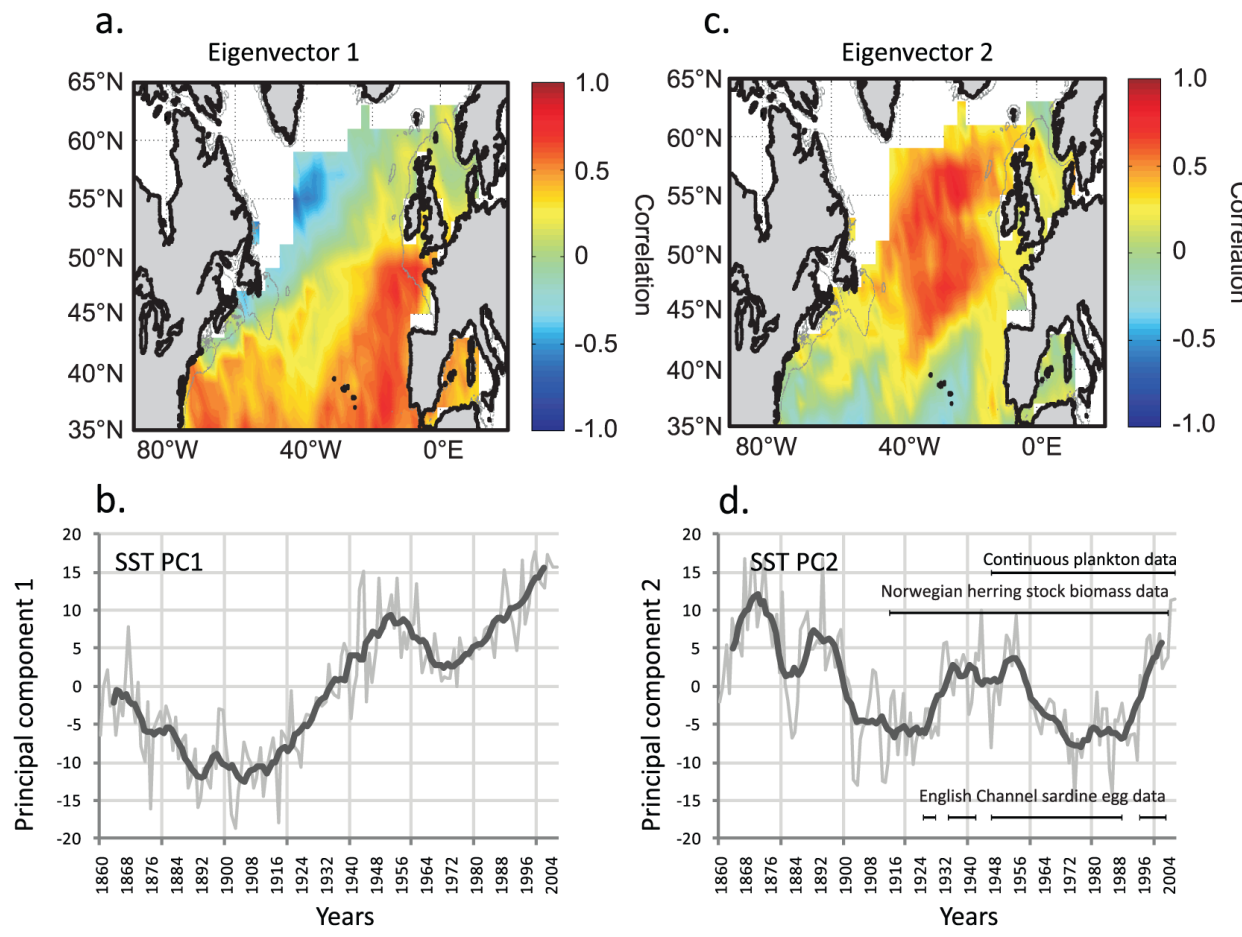
Atlantic Multidecadal Oscillation



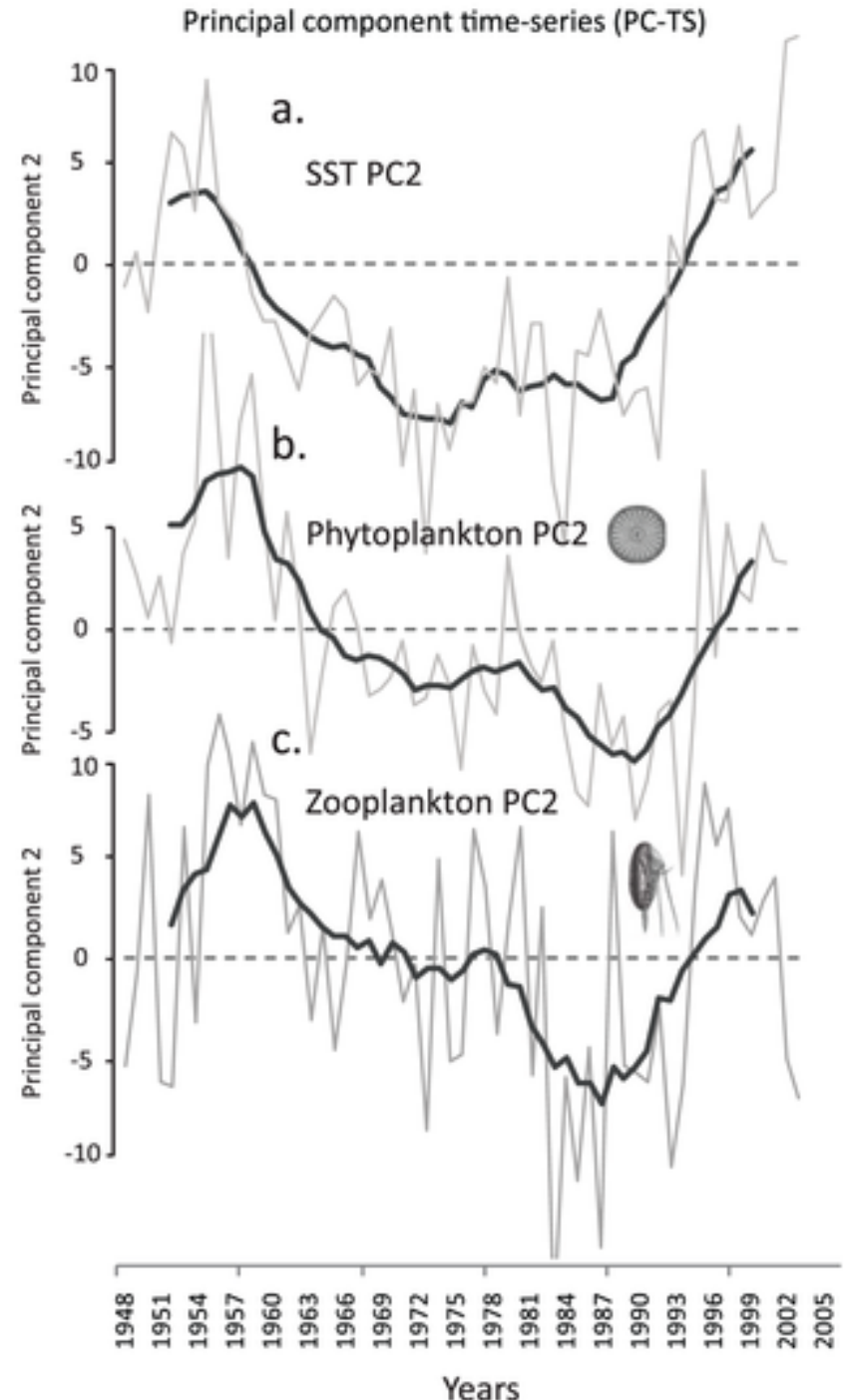
Licandro et al 2016

Climate oscillations can manifest through SST change

Abigail McQuatters-Gollop

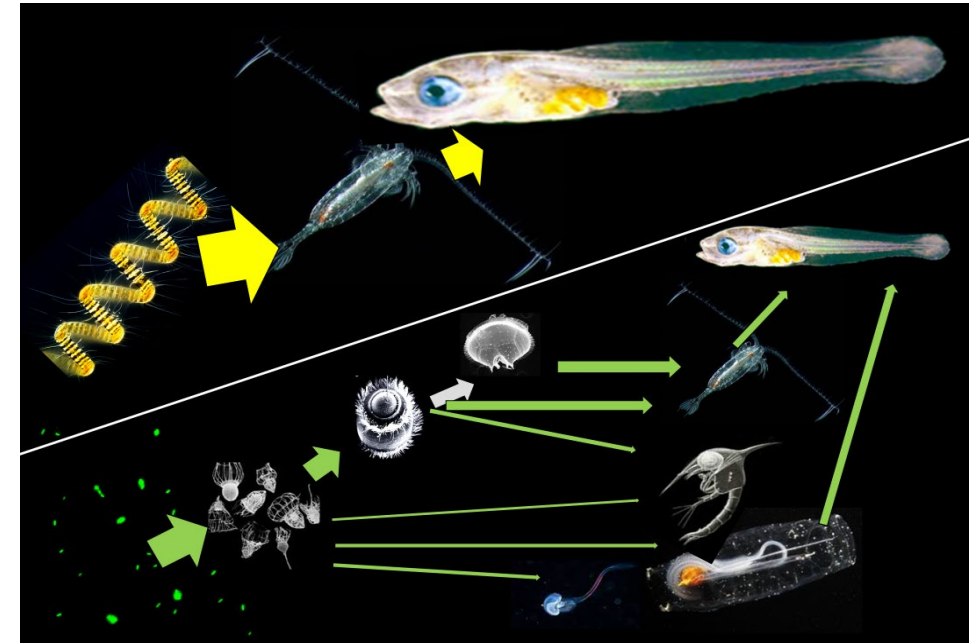
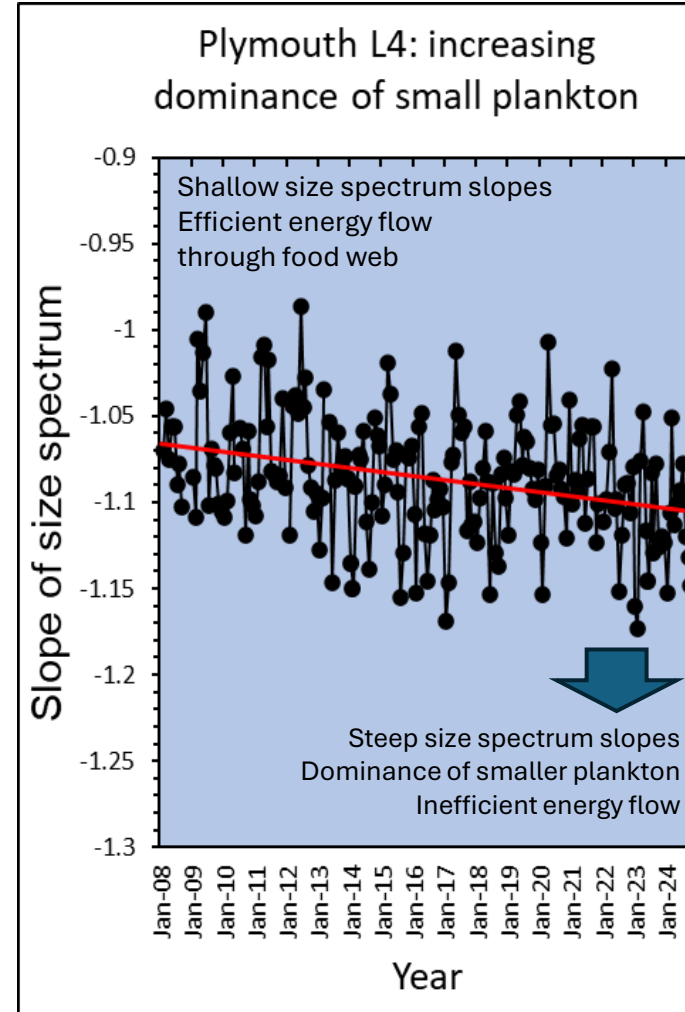
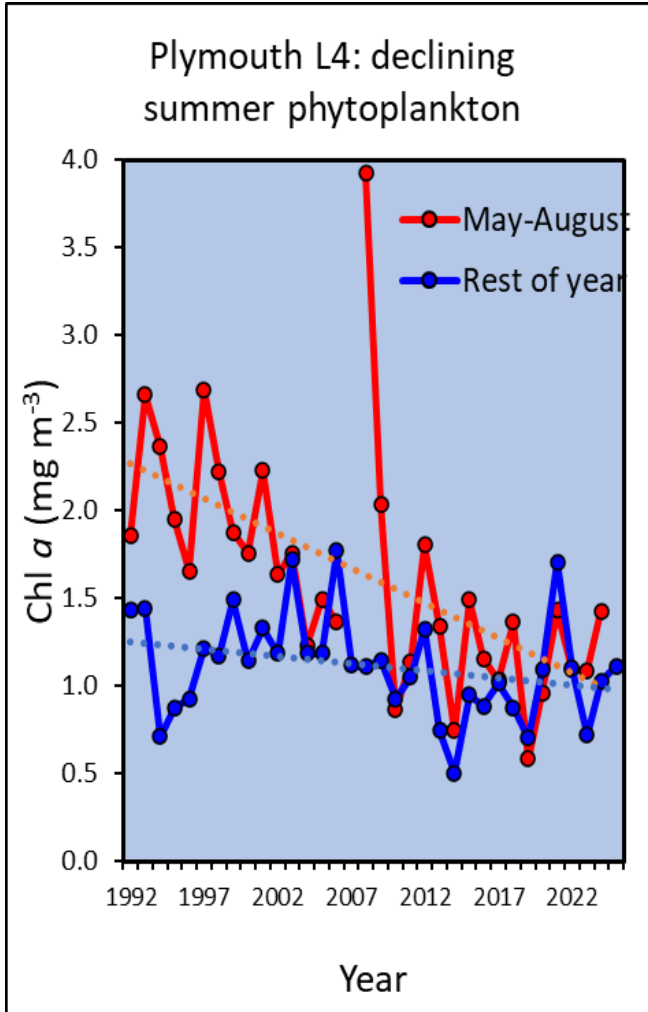


AMO signal reflected in SST change



Shifts in plankton - Angus Atkinson

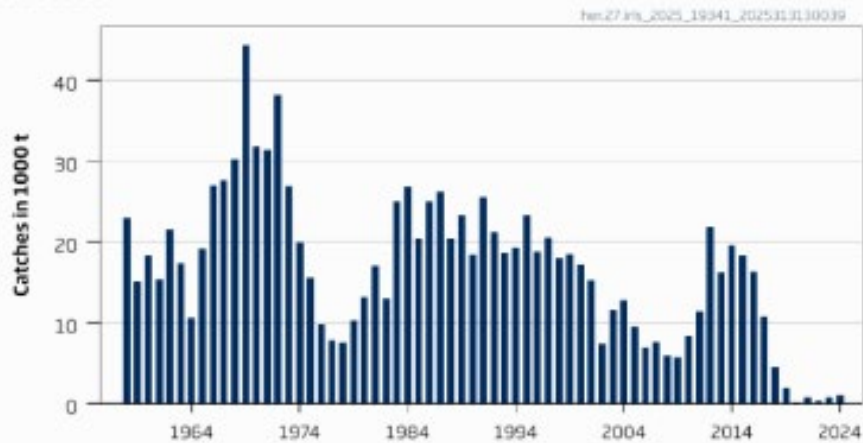
The new normal?



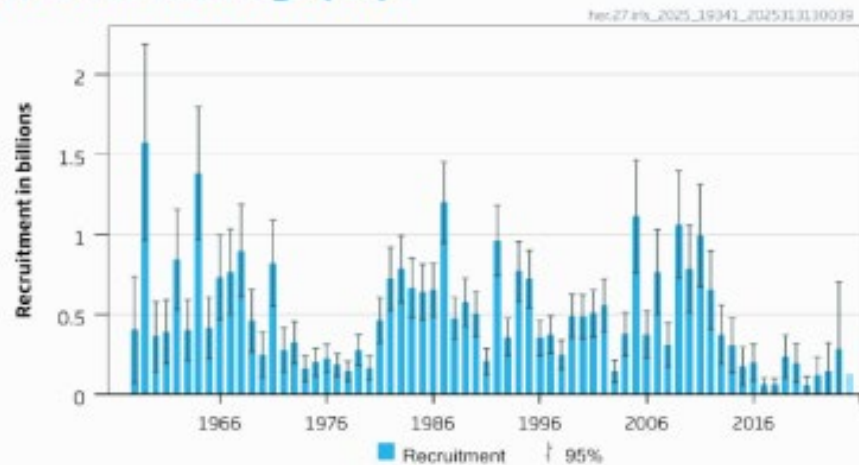
- Plymouth L4 site: long-term warming.
- Increasing summer Nitrate limitation
- Summer phytoplankton halved in 20 y
- Increasing dominance of small plankton, meroplankton, gelatinous filter feeders
- Inefficient food webs to fish
- Smooth decline or a regime shift?
- Changing top-down control?

Silver Darlings – a historical perspective - Libby West

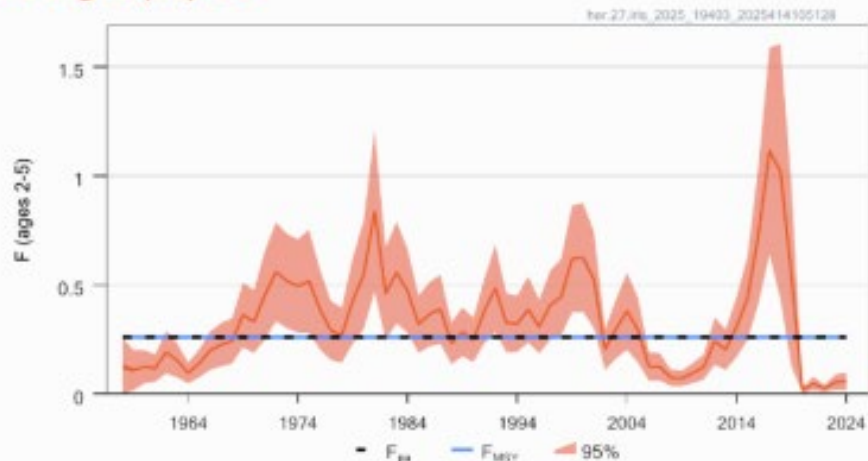
Catches



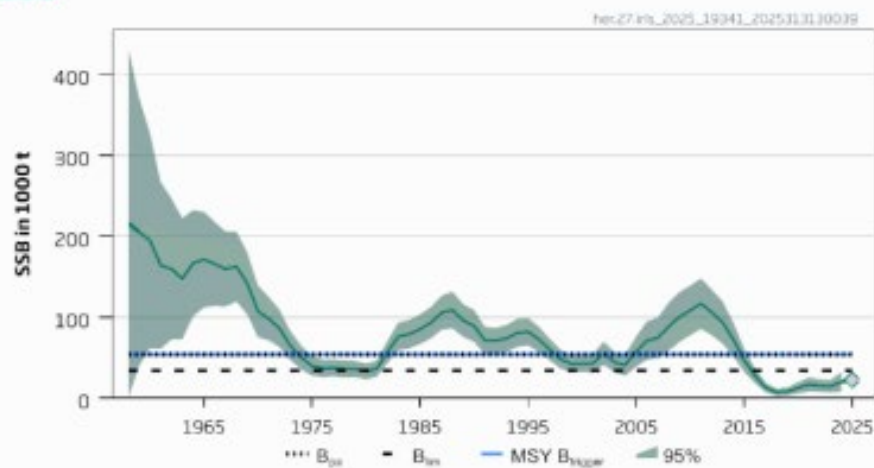
Recruitment at age (wr) 1



F at ages (wr) 2-5



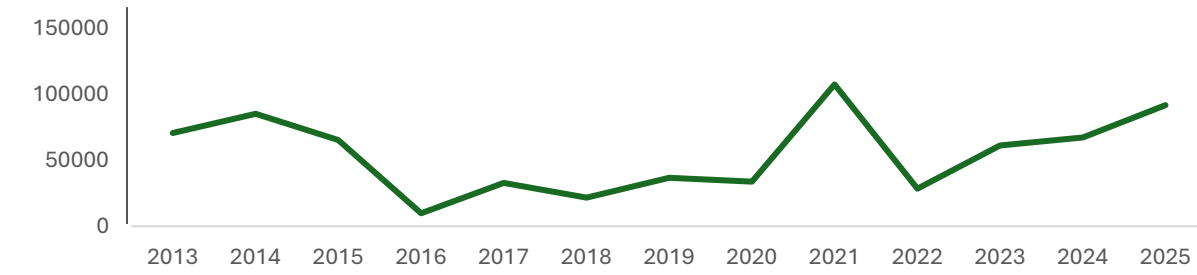
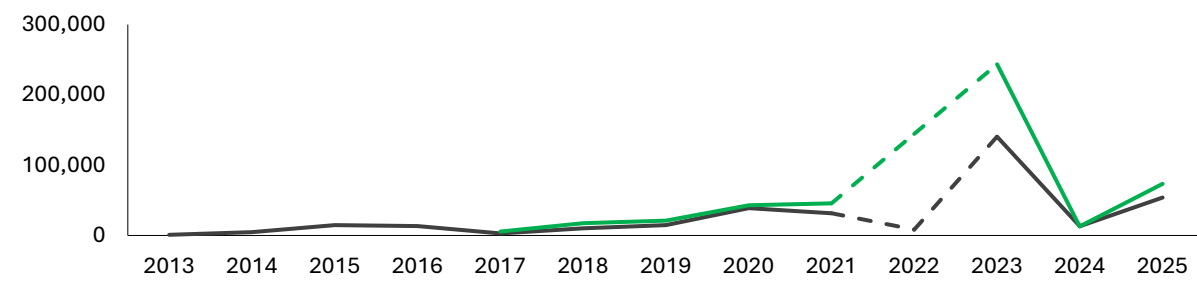
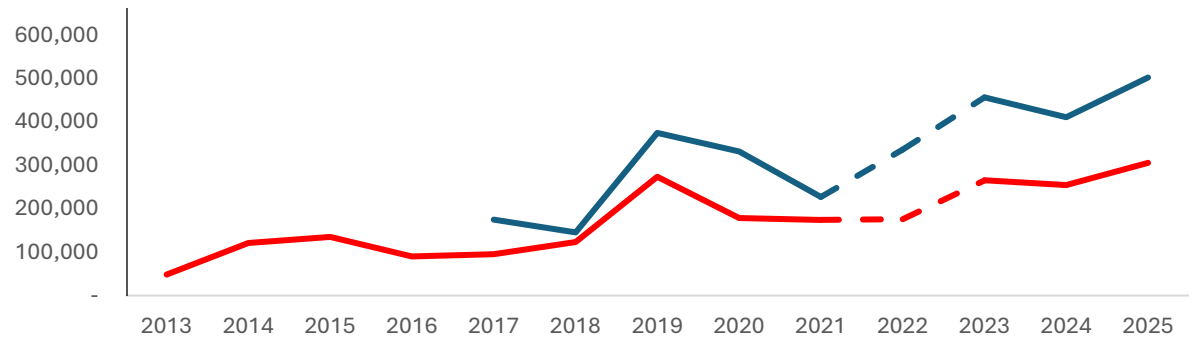
SSB



Small Pelagic Fish in SW

What are dynamics in “buffer” area between Biscay and North Sea?

Jeroen van der Kooij



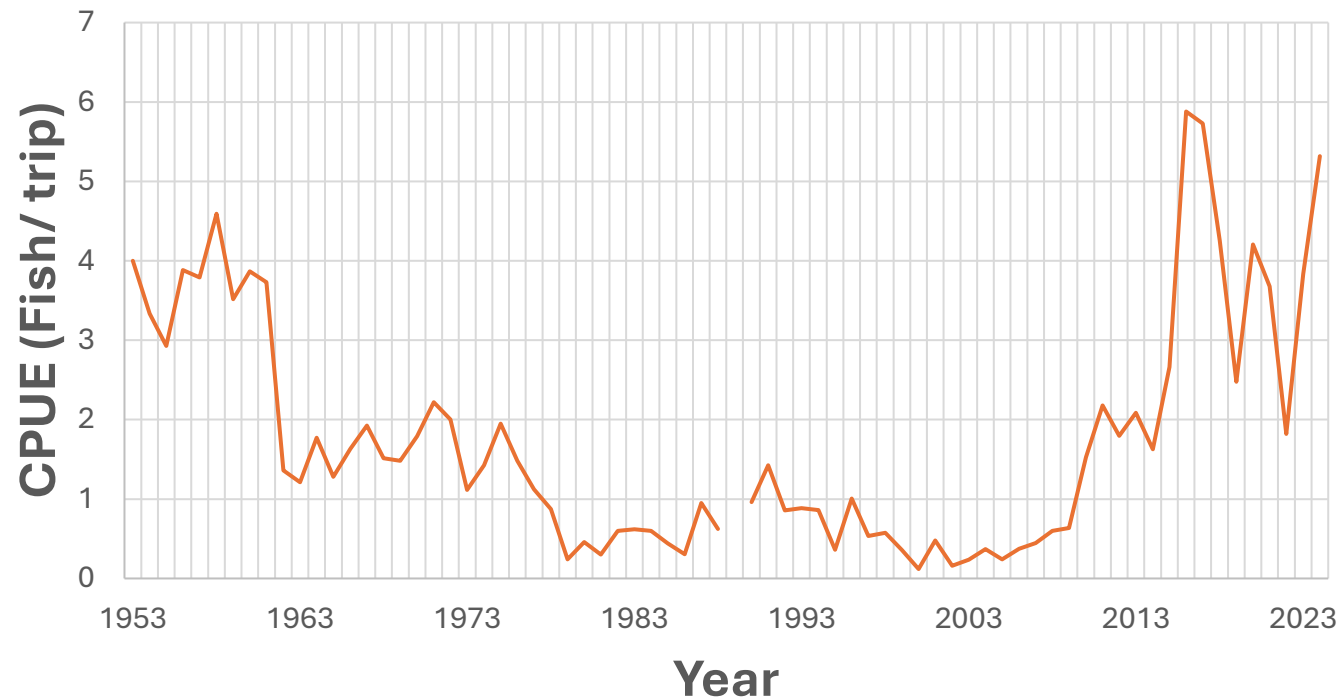
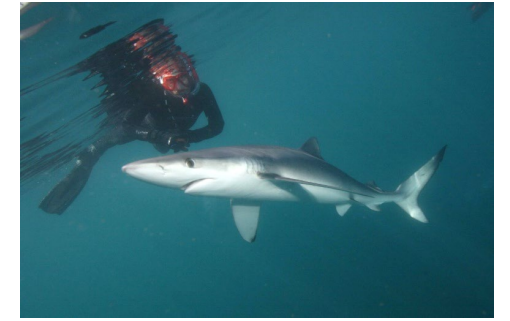
- Sardine, anchovy and sprat show overall increase in biomass over last decade.
- All three species show strong interannual biomass fluctuations with occasional ‘spike’ or drop
- Anchovy northward range expansion due to different processes (MEPS Vol. 741: 217–236, 2024)
- Sprat size in Lyme Bay has decreased, largely driven by an absence of fish older than 2 years.

Theme 2

Recent Major changes to KEYSTONE species

Blue Sharks – *Prionace glauca* Overfishing or Ocean currents?

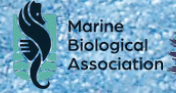
Simon Thomas



- Systematic catch recording since 1953
- Catch & release universal since when?
- Clear and steep declines – early 1960's – 2005, then recovery –
- Influence of ocean currents- pan Atlantic distribution?
- Influence of fronts in the SW?
- Mako – declined and not returned
- Porbeagle – bounce back (200 +/- fish / year +) same as Blue timeline
- Thresher – bounce back since 2015 (15 fish /Yr)

ENVIRONMENTAL INFLUENCES ON BLUE SHARK NUMBERS

Hayley Roberts, Simon Thomas, Phil Hosegood & Bryce Stewart



What drives long-term, large-scale and regional-scale variability?

METHODS

PAT SMITH DATA

- 1953–2024
- Chum + rod-and-line fishing
- Blue shark catch-per-unit-effort data (CPUE)

LARGE-SCALE VARIABLES

- Atlantic Multidecadal Variability (AMV)
- North Atlantic Oscillation (NAO)
- North Atlantic Oscillation winter (NAOW)
- Subpolar North Atlantic Salinity Anomaly



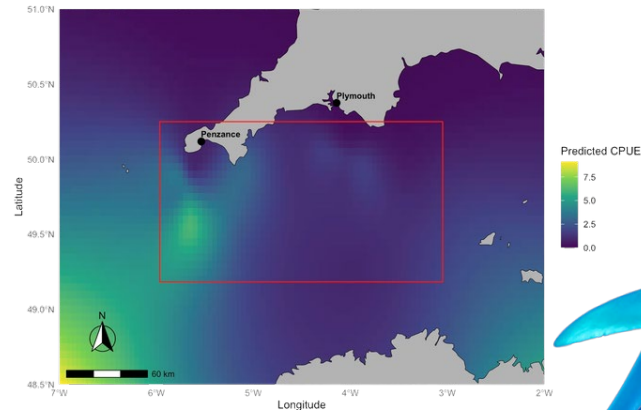
ANALYSIS

- Generalized additive models (GAM)
- 10-year lag: One generation length (Cortés et al., 2015; Nakano & Stevens, 2008)
- Predicted GAM maps

REGIONAL-SCALE VARIABLES

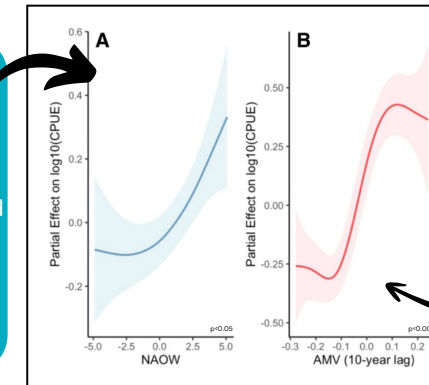
- Copernicus reanalysis data
- Sea surface temperature (°C)
- Bottom temperature (°C)
- Salinity (PSU)

SPATIAL DISTRIBUTION MAP



LARGE SCALE GAM

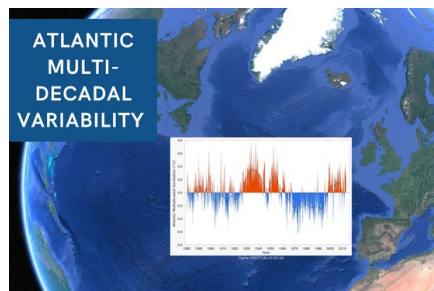
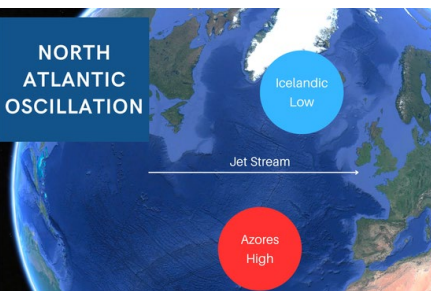
Positive phases indicate a stronger pressure gradient, causing stronger westerly winds and transport of warm Atlantic waters to the northeast Atlantic.



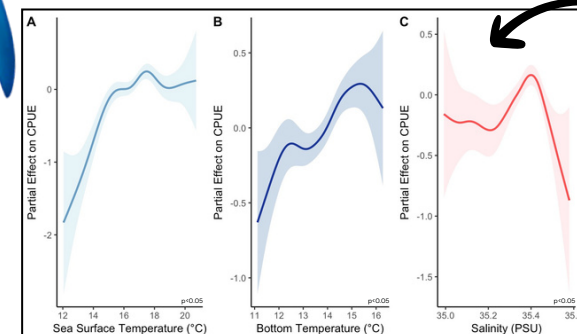
A positive AMV phase represents higher sea surface temperatures than the long-term average, which can affect shark populations a generation later.

Deviance explained by GAM = 73%

LARGE-SCALE INDICES



REGIONAL SCALE GAM



Sea surface temperature (SST)
High CPUE in waters of 17–18°C.

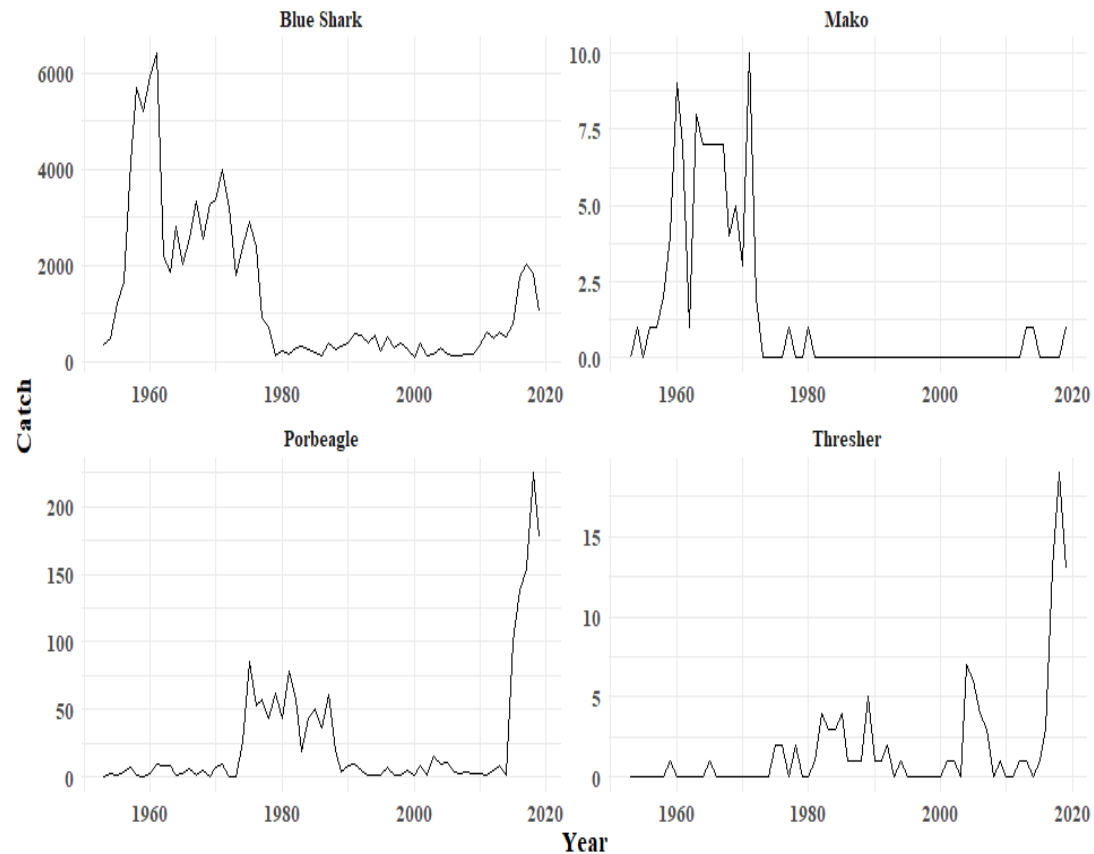
Bottom temperature
Less influential than SST. High CPUE in bottom temperatures of 14–16°C.

Salinity
CPUE peaks at ~35.4 PSU, indicating more oceanic water masses support high CPUE.

Deviance explained by GAM = 33%

Shark numbers captured by anglers in the UK since 1953.

Simon Thomas



- Shark numbers increased during mid 2010s.
- Catch Per Unit Effort higher than 1950s for blue sharks.
- Thresher and porbeagle returned to areas where they have been absent since late 1970s
- Global shark numbers haven't increased.

The return of Atlantic bluefin tuna (*Thunnus thynnus*) Tom Horton

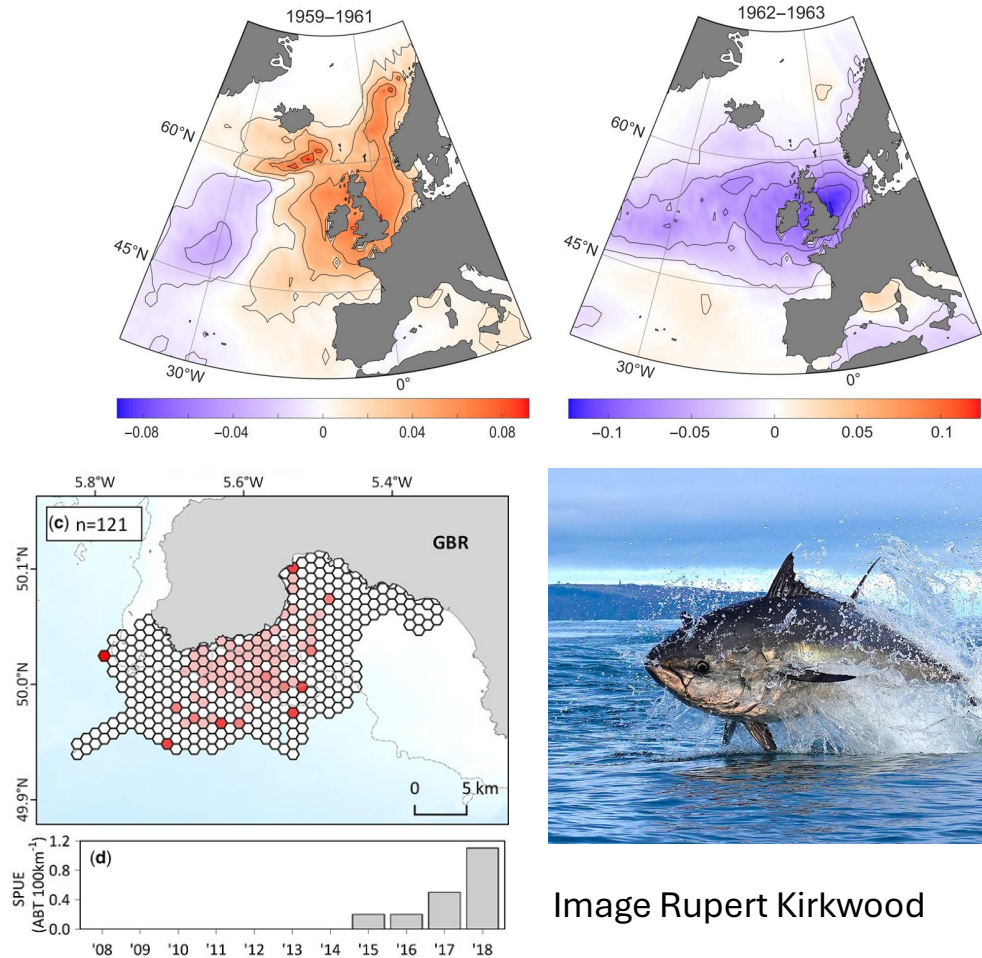


Image Rupert Kirkwood

- Remarkable return of Atlantic bluefin tuna from ~2014 to present and ongoing.
- Disappeared from the North Sea in the late 1960s.
- Science:
 - Thunnus UK & FishINTEL (2018 – 2023) – science on movement ecology
 - CHART Catch & Release Tag (2021-2023) – collaboration with sports anglers
- Recent quota has supported growing commercial (~15 licenses) and recreational fisheries (>100 licenses).
- Co-feeding with other species such as southern shearwaters

Faillettaz *et al.* (2019)

<https://doi.org/10.1126/sciadv.aar6993>

Horton *et al.* (2021)

<https://doi.org/10.1093/icesjms/fsab039>

Southern-breeding seabird influxes

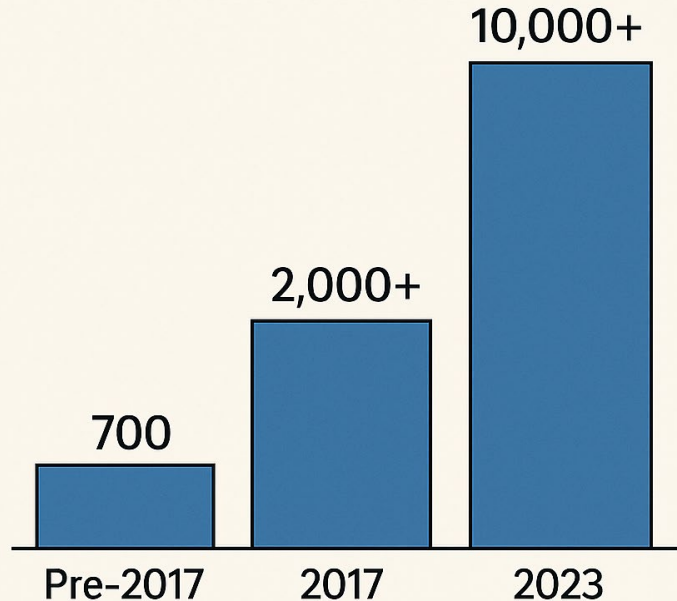
The new normal? The correspondence with AB Tuna return

Alex Banks

Photos: Scott Reid

Changes in Numbers of Cory's Shearwater

Calonectris borealis

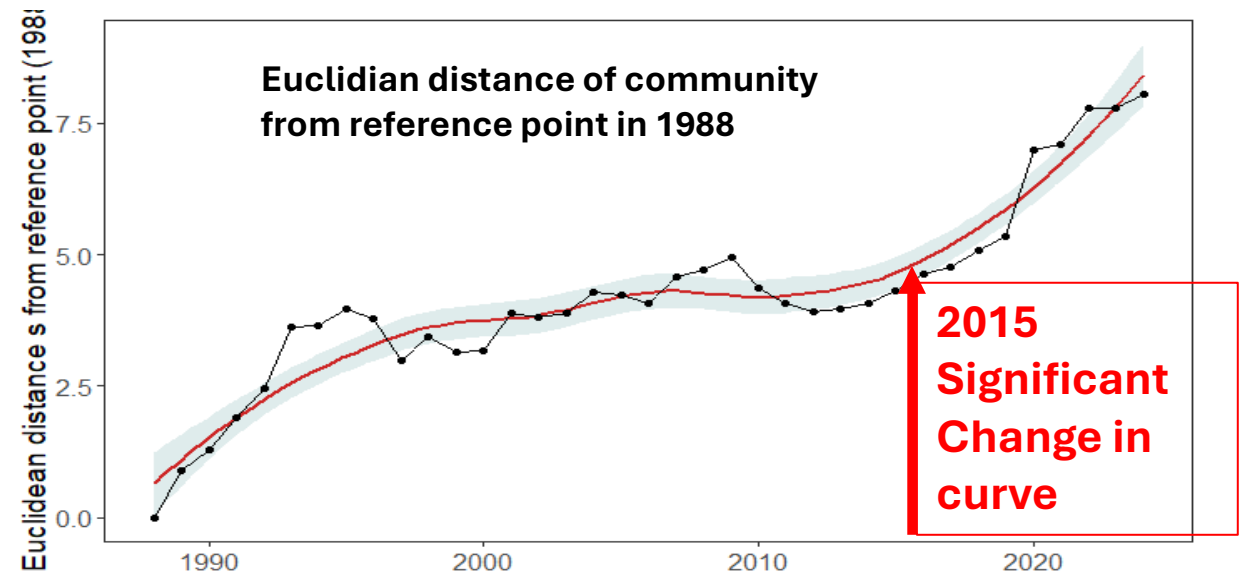
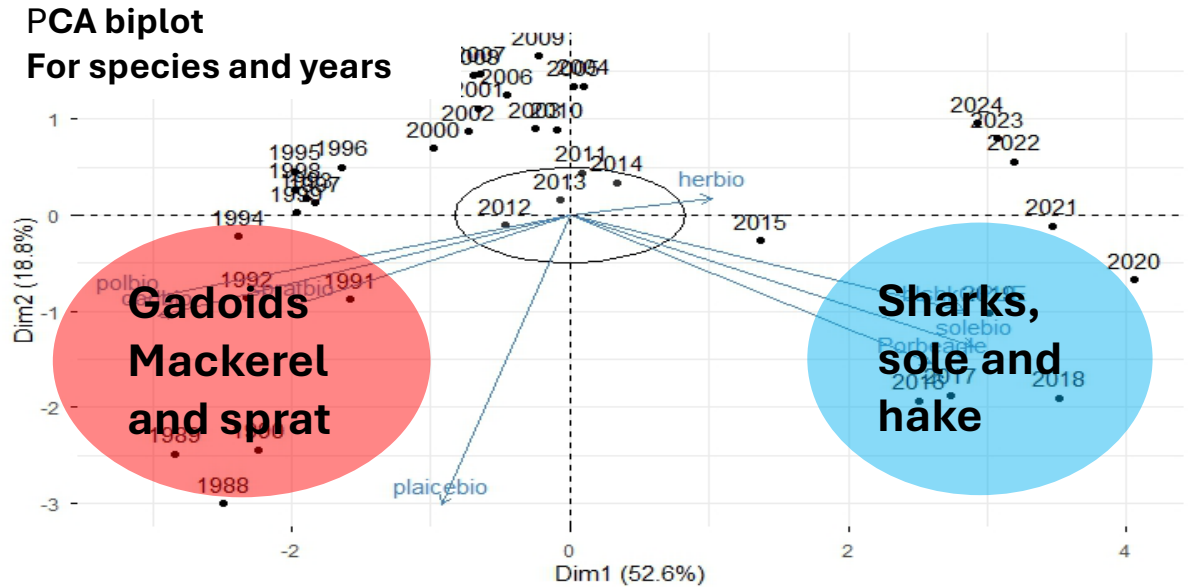


- Estimated **annual numbers of Cory's shearwater** have gone from 20 – 700 to 2,500 – 10,000 in less than 10 years
- Influxes of **Wilson's storm-petrel** and **great shearwater** over same time period
- Increasing number of rarities including **South Polar skua**, **Scopoli's shearwater**, **red-footed** and **brown boobies**

Changes in fish communities since 1988

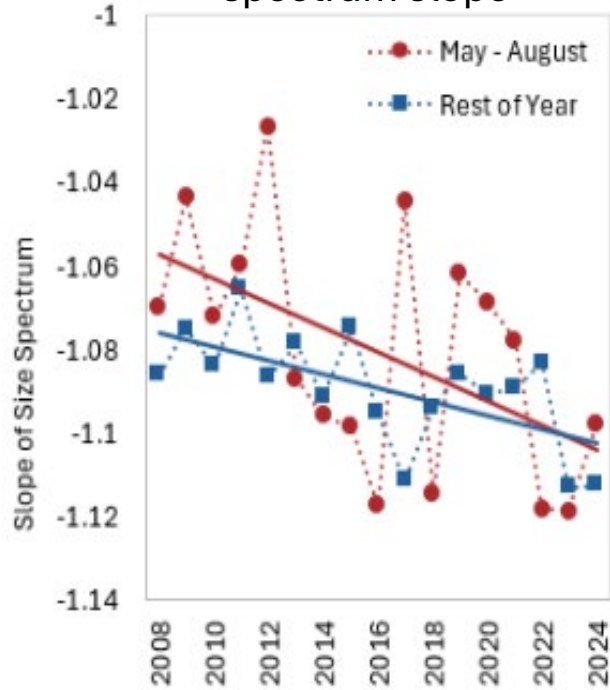
Simon Thomas

- Community changed in 2015.
- Switch from gadoids to apex predators?
- Switch in prey species?
- Herring, sprat, mackerel to pilchard and anchovy?
- Models suggest apex predators redistribution responded to environmental changes.
- Gadoids responded to fishing pressures and prey

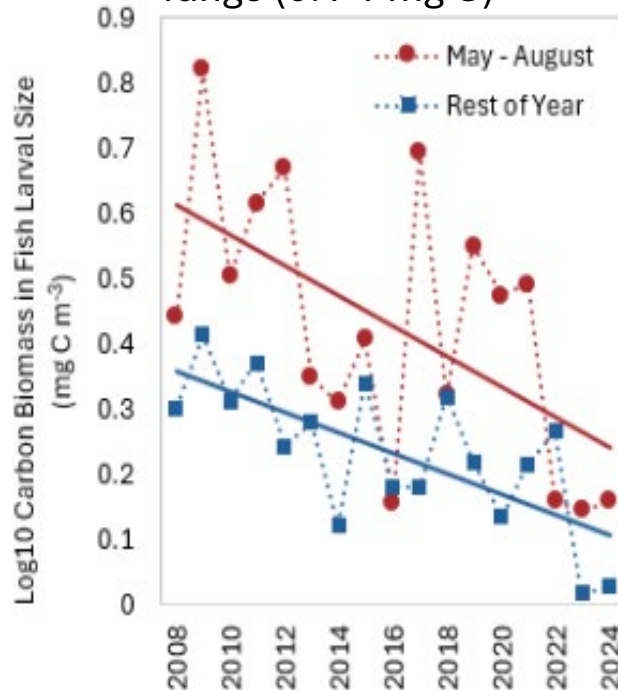


Rapid and recent fish decline at L4 Karen Tait and Angus Atkinson

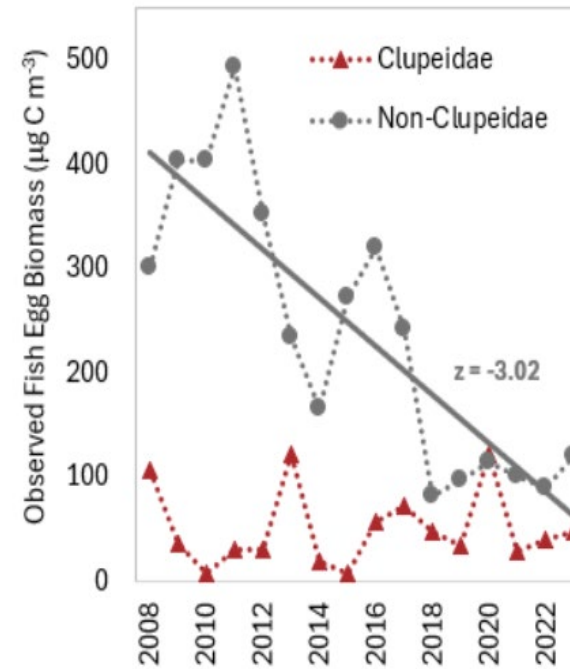
Steepening size spectrum slope



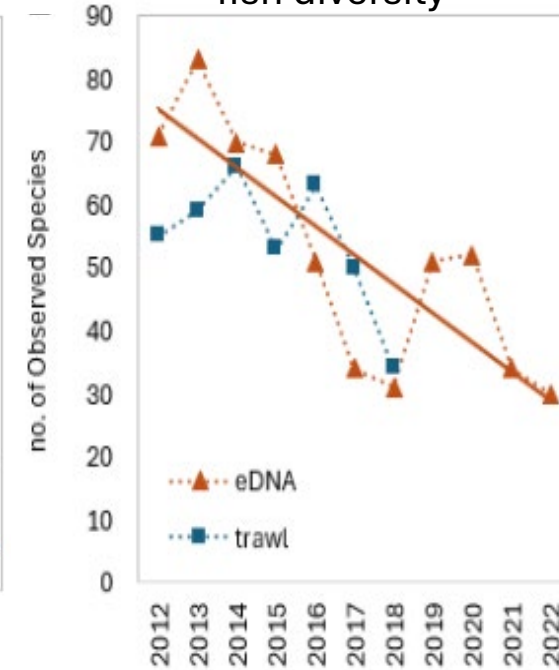
Decline in small fish size range (0.1-1 mg C)



Observed decline in fish eggs/larvae



Decline in fish diversity



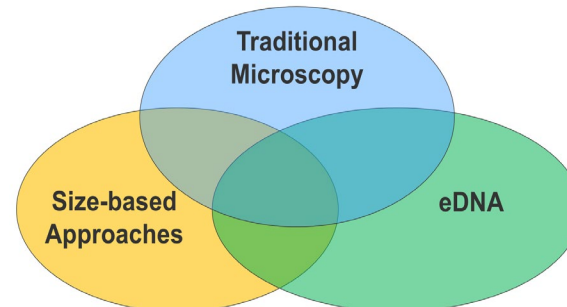
Size-spectrum approach
A CAUSAL MECHANISM?

Traditional microscopy
BROAD TAXA - EVIDENCE

eDNA
FULL TAXA-MECHANISM



Karen Tait, Angus Atkinson
unpublished data



Changes to fish species: returns - range extensions – changing balance of species - other species in decline.

SWME Fish CoP: Bob Earll, Paul Naylor, Matt Doggett, Josh Pickett, Matt Slater & Douglas Herdson



Images: Kirsty Andrews, Paul Naylor, Matt Slater & Josh Pickett

The changing mix of fish species has been a predicted outcome of climate change. We are seeing this in the South-West in a variety of ways...

Establishment of Comber Increase from 1 -5/year to very common since 2024, Range increase from Cornwall - Dorset

Returned Black spot (=red bream) since 2024 -> (since 1950s). Range expansions of black bream and Gilthead and Couches bream now well established => fisheries

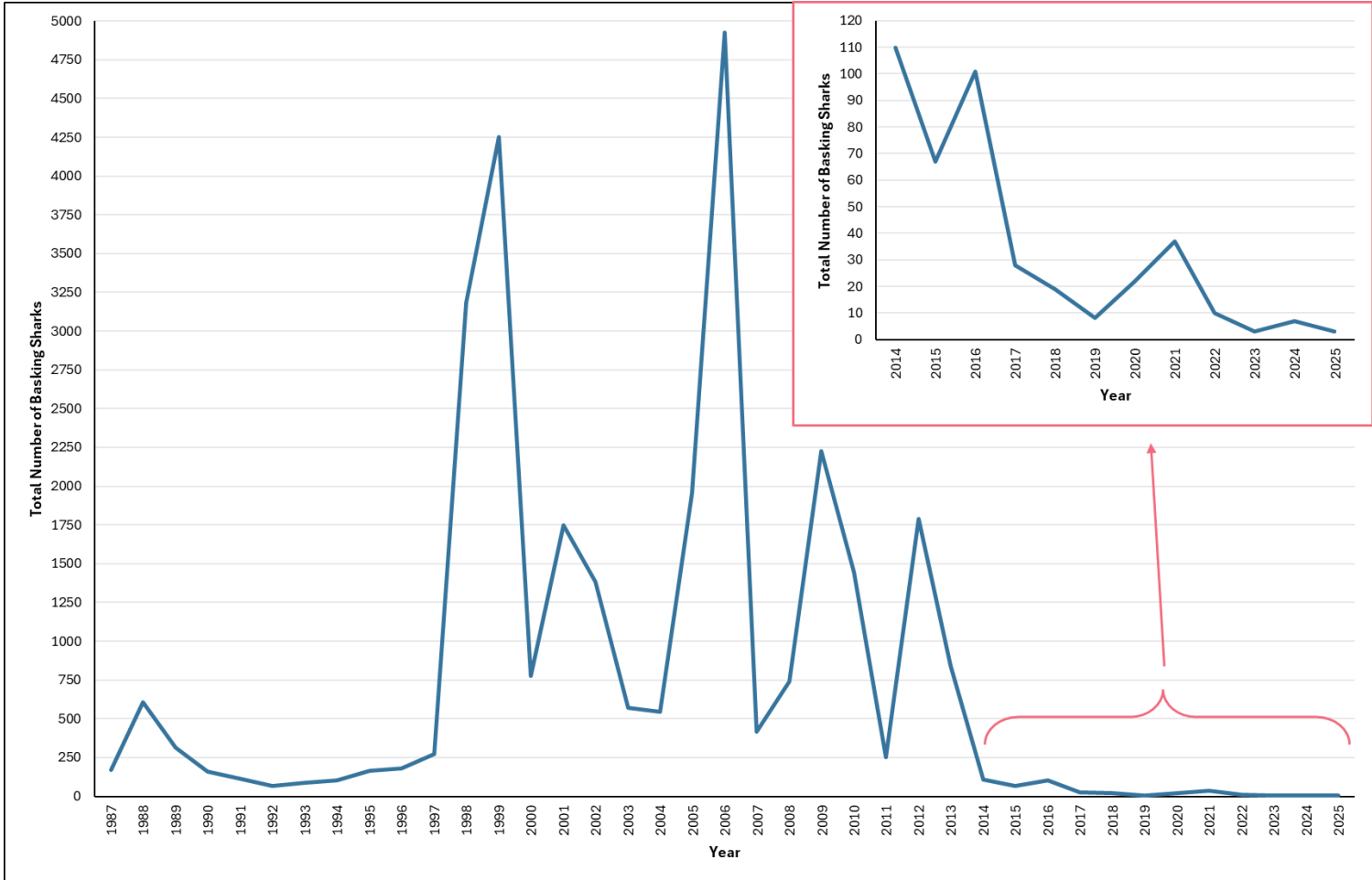
Explosion of Conger eels in 2024 & 2025 – huge numbers of small fish – now a keystone species

Declines and movements of other species
Mackerel – now a winter visitor & gadoids

Basking Sharks – *Cetorhinus maximus*

Why the move from the SW?

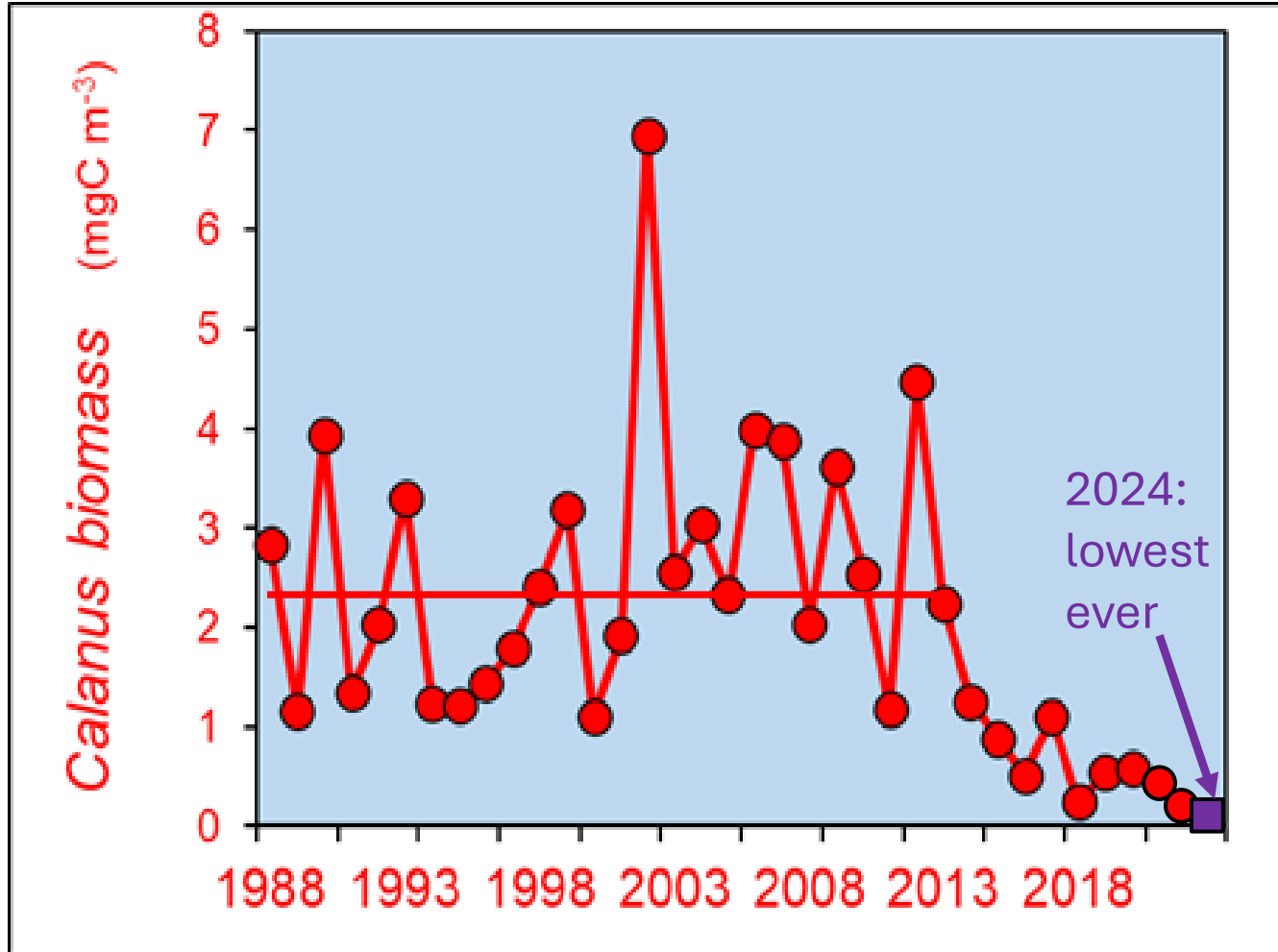
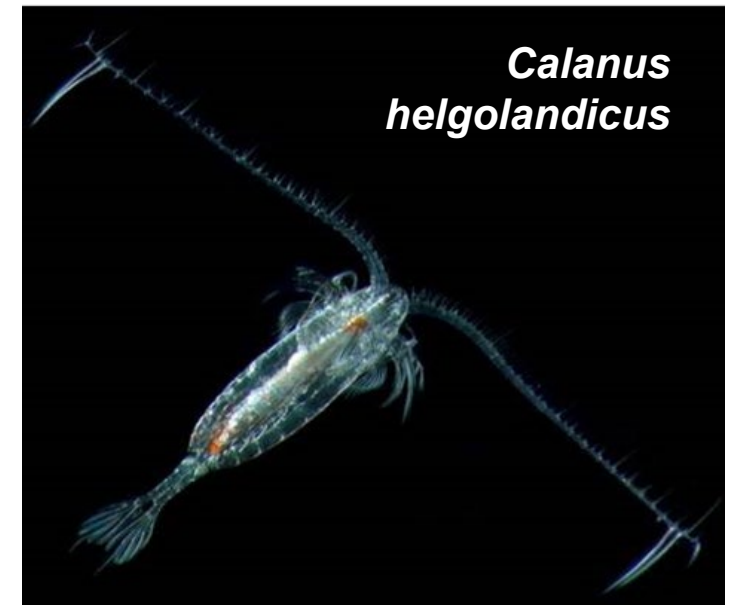
Harriet Allen | Shark Trust



- Citizen science observations: possible duplicate sightings, will miss sharks that are underwater or offshore
- Sharp decline in both sighting numbers and reports / engagement since 2014
- Increases in Irish observations over the last decade suggests range shift, likely following prey availability

Calanus decline - Angus Atkinson

Implications for food web?

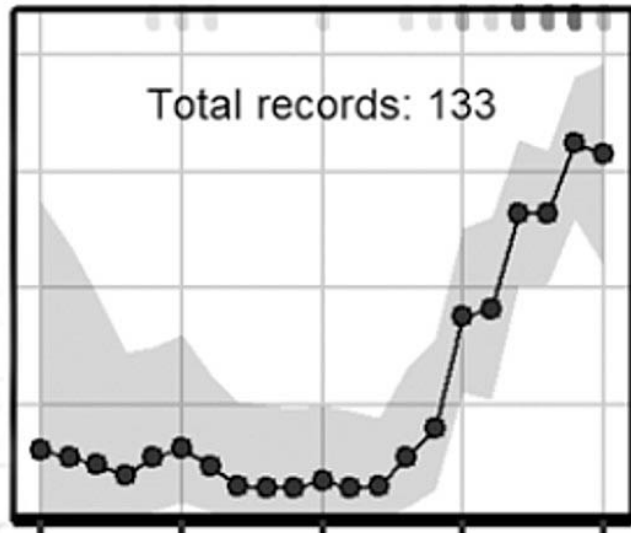


- Plymouth L4 site: abrupt mainly summer, decline in *Calanus* around 2015
- Does this timing relate to abrupt shifts of other components?
- What are the implications for species that rely on large and nutritious food?

Understanding past ecosystem change: recovery – Keith Hiscock

Spiny Lobsters: from local extinction to return after 40 years.

Seasearch



- Populations of *P. elephas* crashed in the 1960s and 70s.
- Whilst over-exploitation was assumed the reason for the crash, recruitment must have been poor for many years **until about 2014** when small individuals were observed in areas where they had been absent since the 1970s.
- Numbers continue to increase with large individuals generally in deeper water.

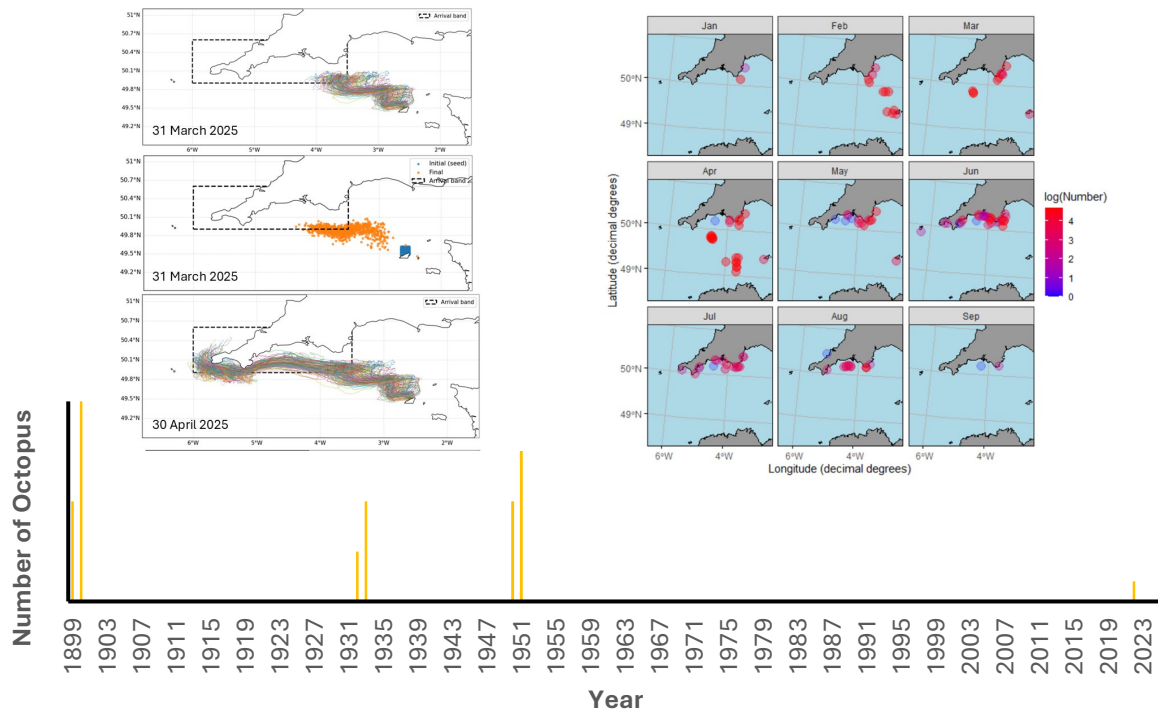
From: Jackson, A.C. 2021. *Journal of the Marine Biological Association of the United Kingdom*.101:1033-1046.

Common octopus (*Octopus vulgaris*) blooms off the southwest of the UK: History, trends, causes & consequences

Bryce D. Stewart, Simon Thomas, Tim Smyth, Molly James, Emma Sullivan, Alice E. Hall, Tully Osmond, Emma V. Sheehan

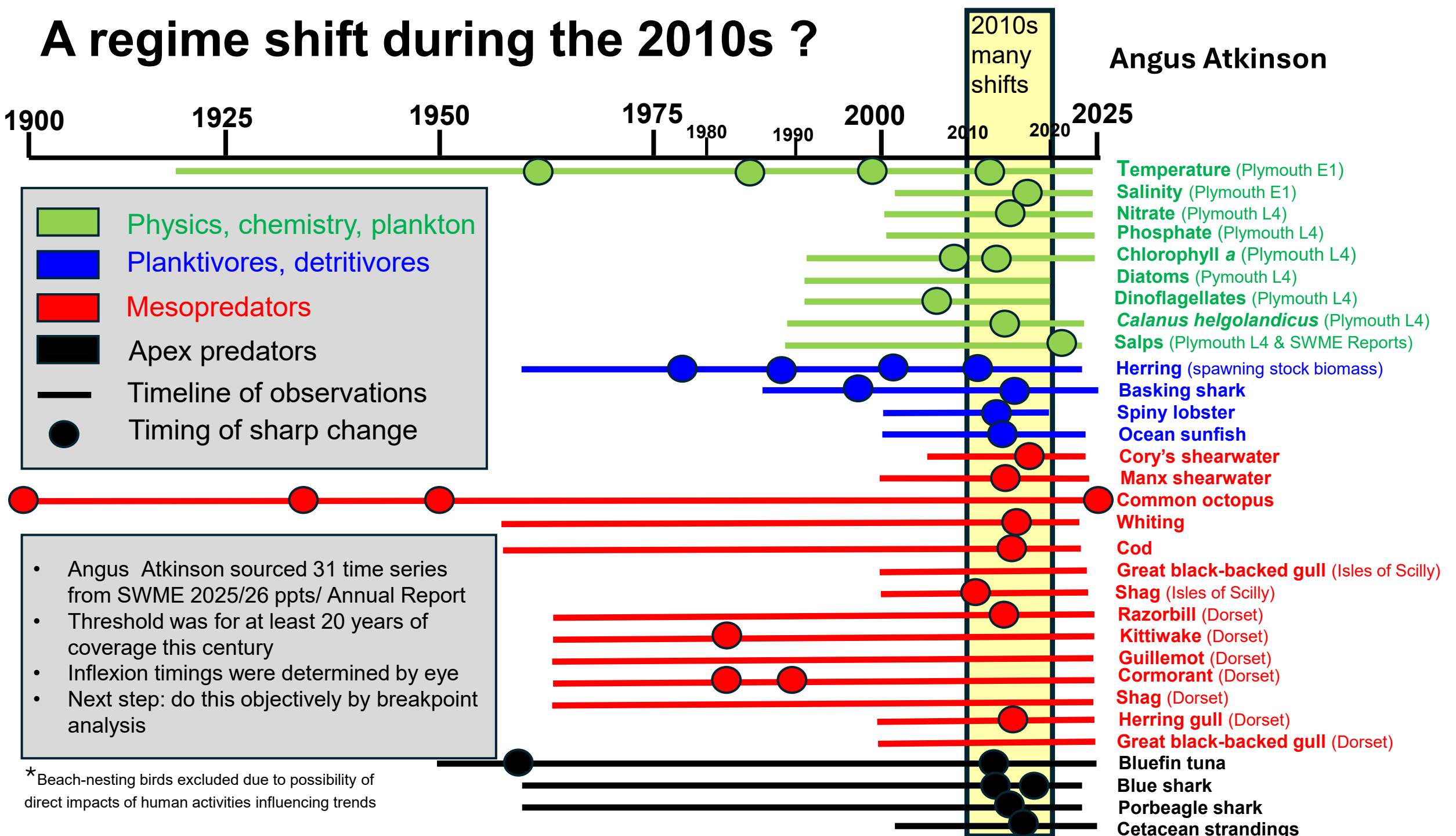


- 2025 saw the **largest bloom** of common octopus off SW UK for at least 75 years
- Previous major blooms occurred in 1899/1900, 1932/33 & 1950/51
- Commercial landings of **common octopus** in 2025 were almost **65 times higher** than the recent average
- Sea and air temperatures during the year of each bloom and the proceeding year were **unusually warm**
- Environmental conditions & modelling indicated that octopus **larvae were being transported** to the UK from the Channel Islands
- **Octopus breeding** in UK waters was widespread in 2025 – previously very rare
- **Some fishermen did well** by fishing for octopus, others did not
- **Keystone predator and prey** Predation by octopus appears to have caused **significant drops** in landings of **brown crabs, lobsters and king scallops** and **food for congers, blue sharks seals & Risso's dolphins**

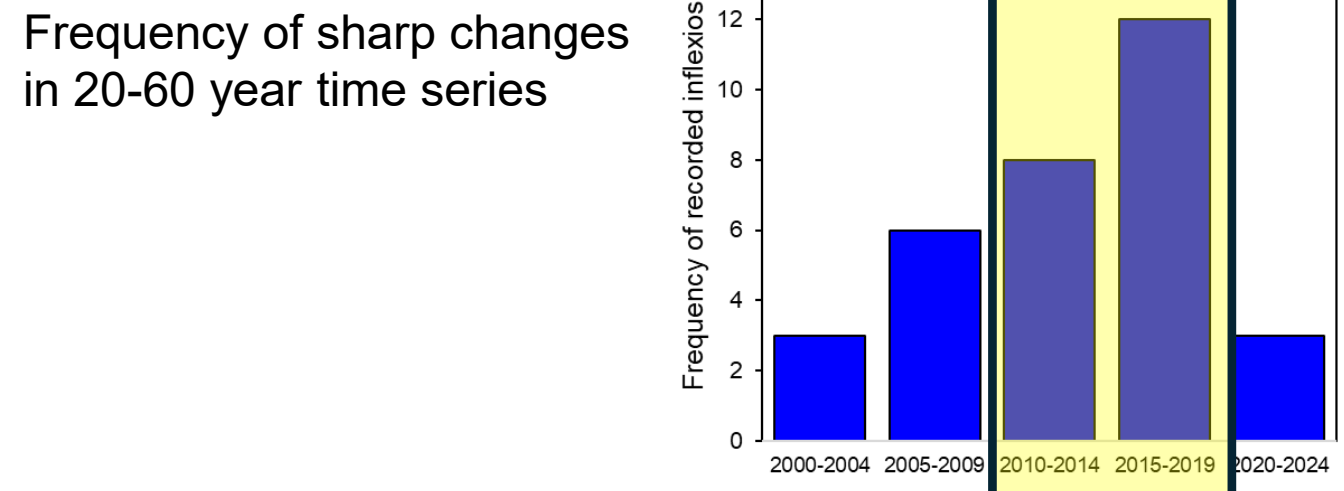
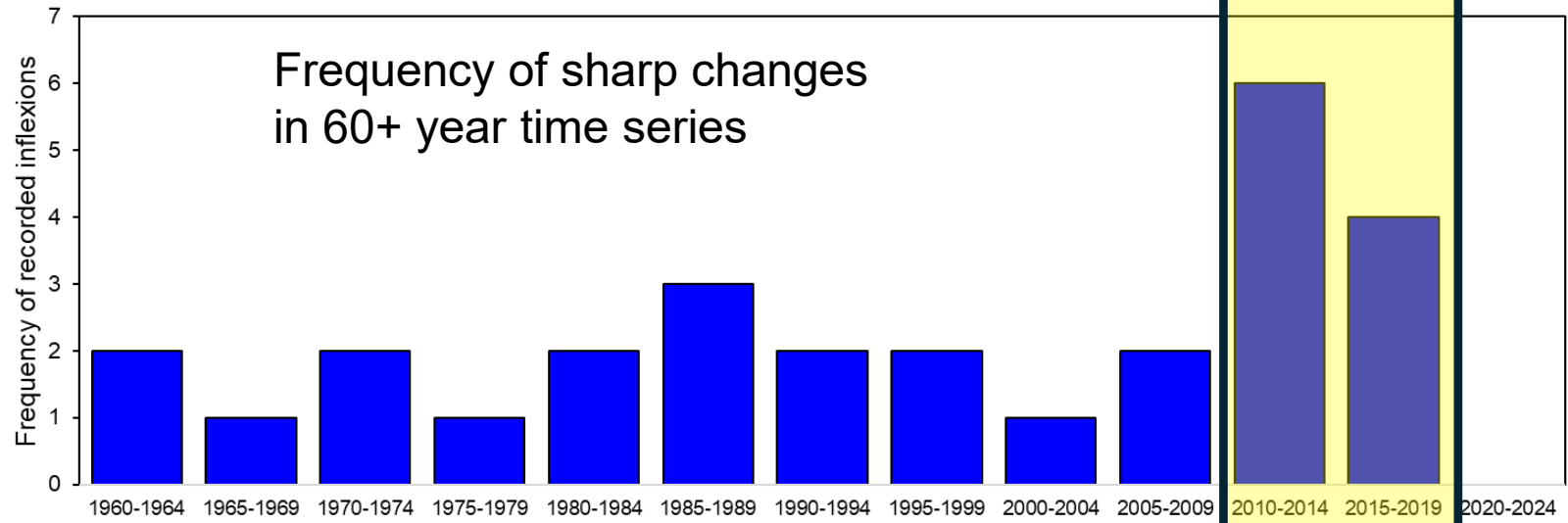
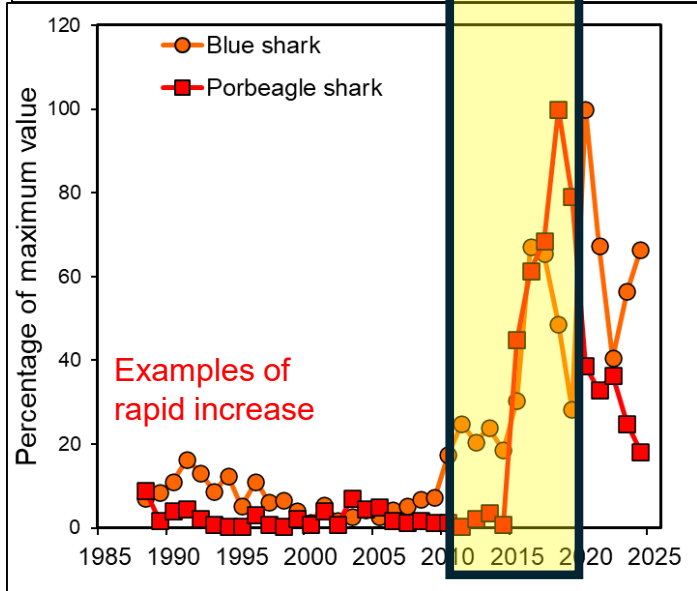
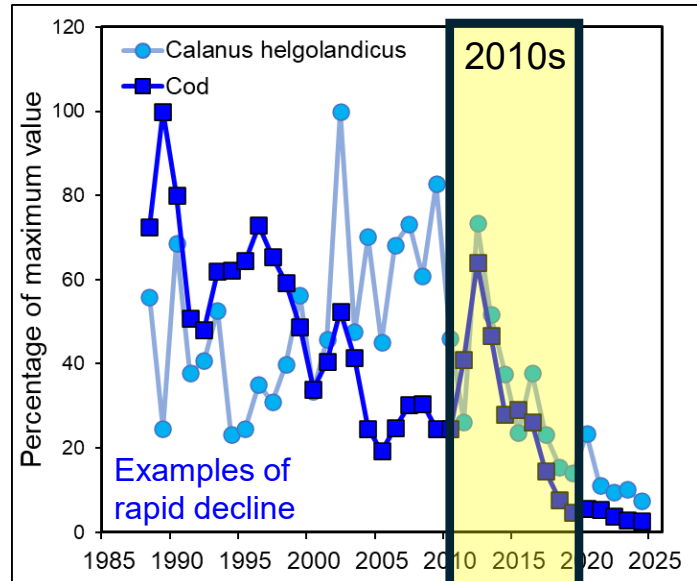


A regime shift during the 2010s ?

Angus Atkinson



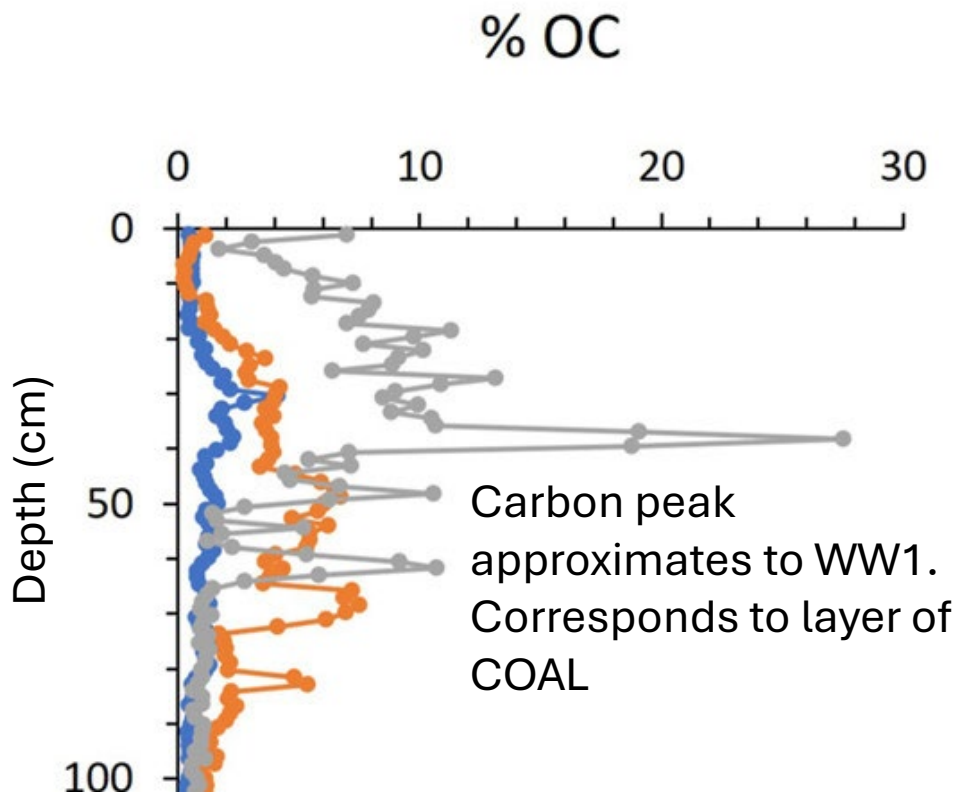
A regime shift during the 2010's? Angus Atkinson



Theme 3 Disease

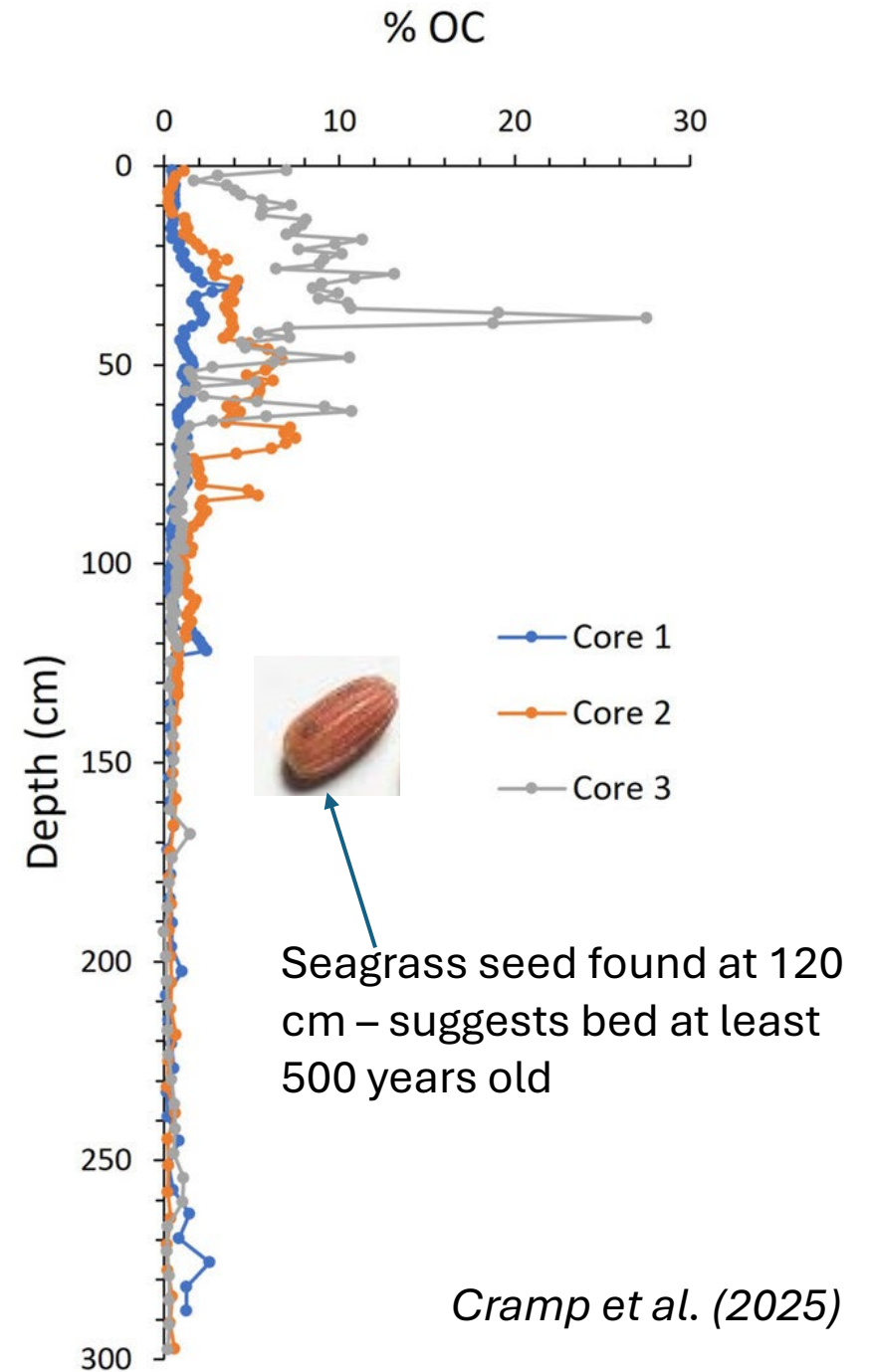
Seagrass Cores Martin Attrill & Jess Cramp

OCT/UoP taken 3m cores under seagrass beds to investigate Carbon levels. Radioisotope dating at **Drake's Island** estimate 3m core 900-1300 years old.



Jess Cramp

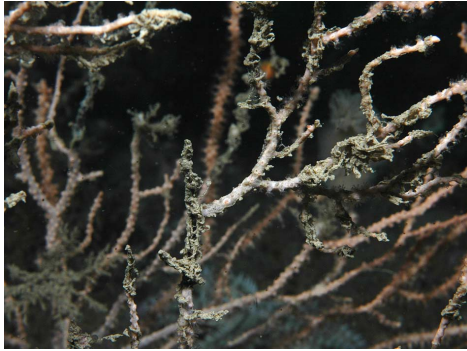
Allows calculation of carbon storage rates and historical investigations: what factors may relate to 1930s decline?



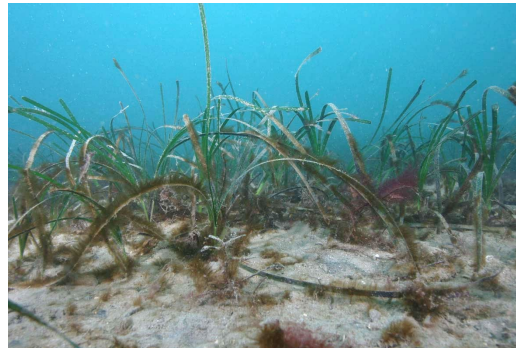
Cramp et al. (2025)

Understanding past ecosystem change: disease in benthic species

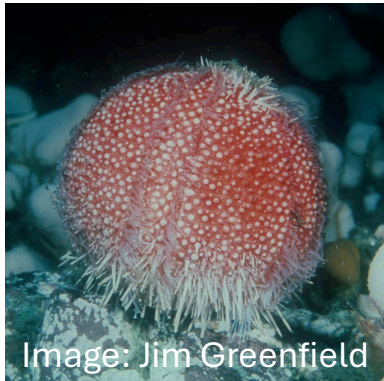
Keith Hiscock



Vibrio splendidus: a
bacterium (Pink Sea Fan)



Labyrinthula zosterae: a
wasting disease (seagrass)



Listonella
anguillarum and
Aeromonas salmonicida
(bacterial infections):
bald sea urchin disease:



Bonamia exitosa:
a protozoan parasite
(Native oysters)



Vibrio pectenicida:
strain FHCF-3
(a bacterium) (potential to
devastate some
echinoderm populations)

- Disease may be overlooked as a cause of change in benthic species abundance unless the species is commercially important, charismatic or keystone.
- Species that have been notably affected by disease include Pink Sea Fans *Eunicella verrucosa*, Seagrass *Zostera marina*, Sea Urchins *Echinus esculentus* and Native Oysters *Ostrea edulis*.
- Are starfish 'next'? Starfish wasting disease (devastating on the Pacific coast of the USA) detected in the Irish Sea in Sunstars.

Avian Influenza (HPAI)

Alex Banks

Any lasting effects on SW seabirds?

Chicks per pair, Dorset, 2023

	Common tern	Black-headed gull	Sandwich tern
Dorset			
Abbotsbury	0.17	0.07	
Lodmoor	0.02		
Brownsea Island	0.39	0.53	0.17

(Pre-HPAI: typically 0.5 – 2.0 chicks per pair)

SWME Report 2023 estimated 400 gannets washing up or detected dead at sea. 5,000 mortalities estimated at Grassholm but comparative counts between years suggested a 54% decline (2020 - 2023)(<https://www.rspb.org.uk/birds-and-wildlife/seabird-surveys-project-report>)



Photo: Isles of Scilly Wildlife Trust

- Colonies in the SW largely **affected less severely** than elsewhere in the major outbreaks of 2022 and 2023 – except for common and Sandwich terns
- **Productivity decreased** as many chicks died, but seemed to recover in 2024
- Main species **appearing to show any ongoing lag** in recovery of numbers is **common tern**

Phocine Distemper Virus

Timeline or Diagram,

From Wikipedia

Phocine distemper virus (PDV), is a [paramyxovirus](#) of the genus *Morbillivirus* that is pathogenic for [pinniped](#) species, particularly seals.^[2] Clinical signs include laboured breathing, fever and nervous symptoms.

PDV was first identified in 1988 as the cause of death of 18,000 [harbor seals](#) (*Phoca vitulina*) and 300 [grey seals](#) (*Halichoerus grypus*) along the northern European coast.^[3]

In 2002, an epizootic of PDV along the [North Sea](#) coast resulted in the deaths of 21,700 seals, estimated to be 51% of the population.

[Antibodies](#) to PDV have been found in a number of carnivorous mammal species in the Western North Atlantic, including [polar bears](#), and the [Atlantic walrus](#).^[3]

The suddenness of the emergence of PDV and related viruses in aquatic mammals has implicated environmental changes as the cause. Pollutants have been posited as contributors by interfering with the ability of animals to mount a defence against infection. Alternatively, [climate change](#) and [overfishing](#) may have forced aquatic species that naturally harbour the viruses into new areas, exposing immunologically susceptible populations.

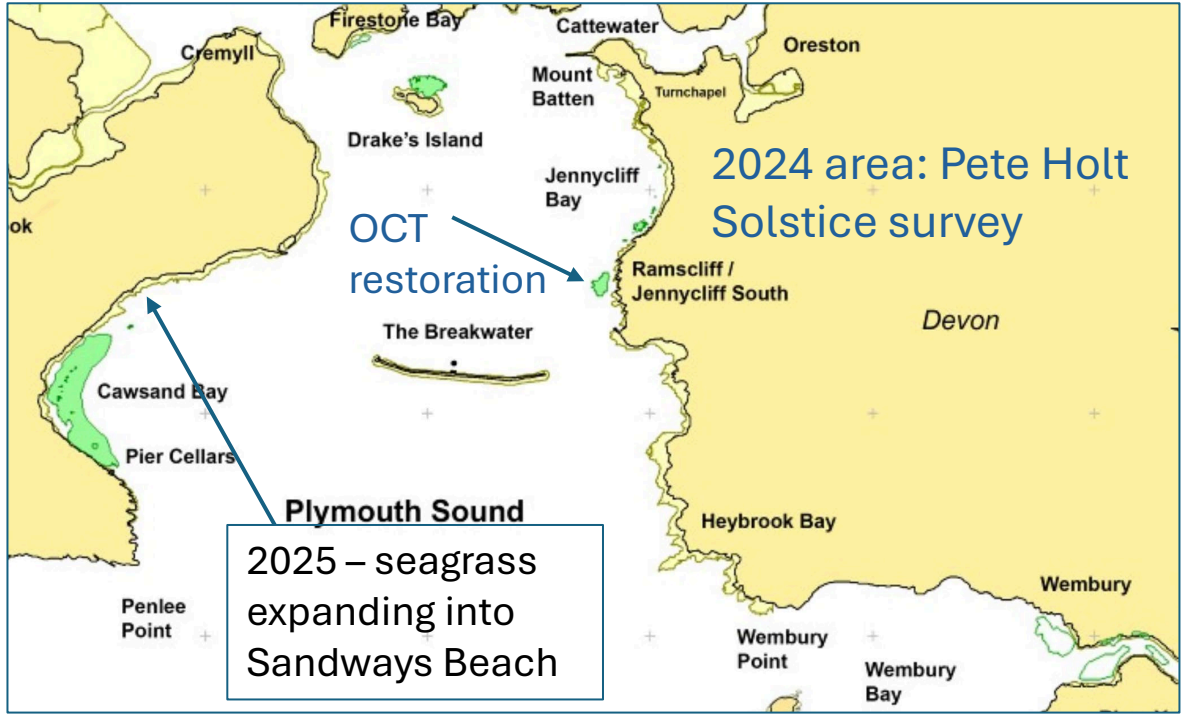
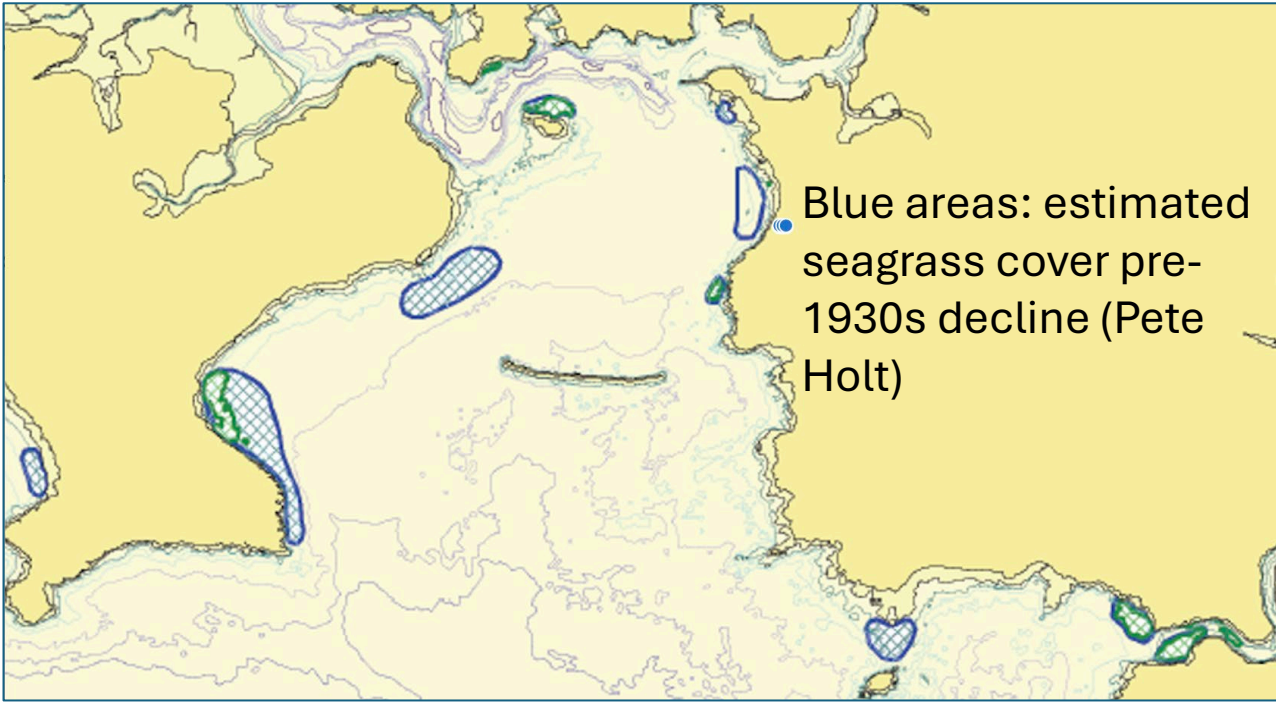
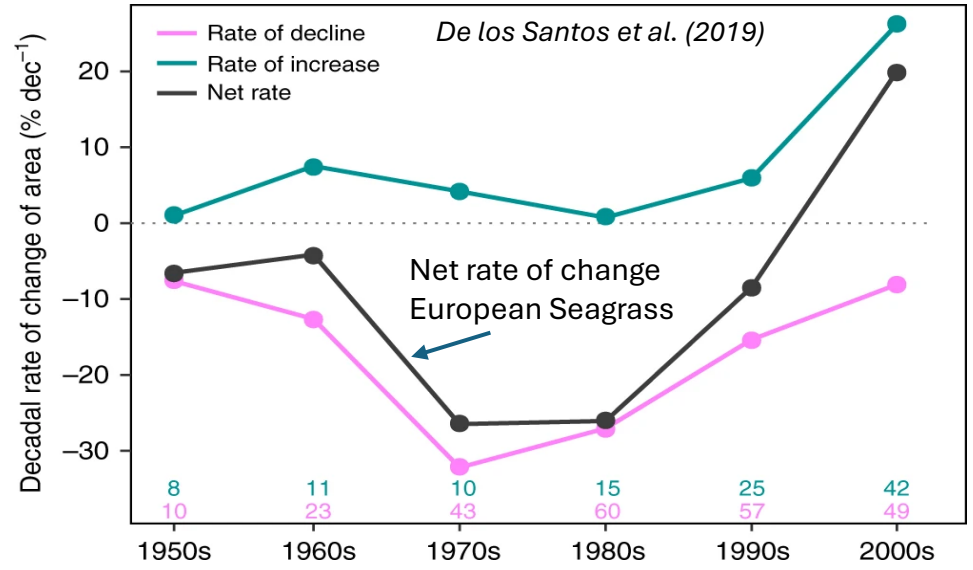
Theme 4

Recovery and restoration

Seagrass Recovery

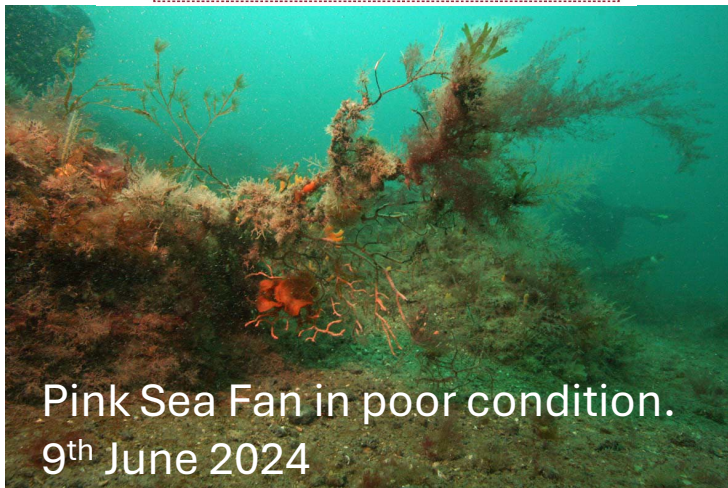
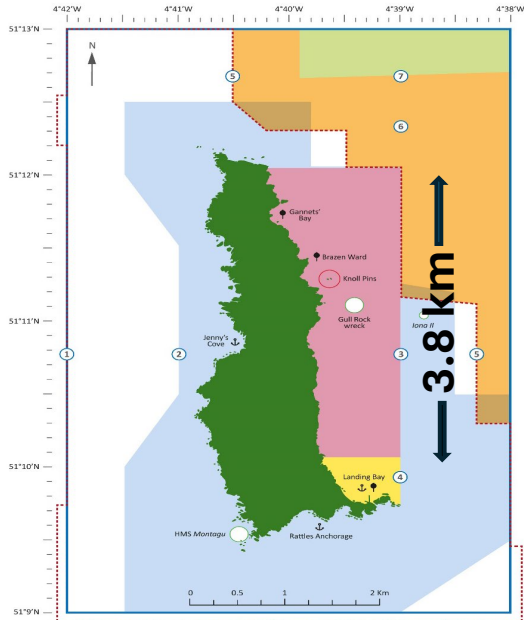
Martin Attrill

Natural spread, new discovery and habitat restoration increasing known SW seagrass area over recent decade



Understanding past ecosystem change: restoration

Lundy No Take Zone. Increased lobsters: but anything else? Keith Hiscock



Pink Sea Fan in poor condition.
9th June 2024

- In 2003, a No Take Zone of 3.3 sq km was established off the east coast of Lundy (Devon Sea Fisheries Committee byelaw).
- Surveys to monitor change revealed an approximately five-fold increase in numbers of commercial-sized lobsters between 2004 and 2022 in the NTZ compared to outside. (Paper submitted to MPB).
- The NTZ apparently had no impact on the attached seabed marine life (Coleman *et al.* 2013: JEMBE 44) (which continues to be a poor remanent of its condition in the 1970/80s: KH). It was the previously exploited species that benefited unless there were (hidden) knock-on effects (such grazers being consumed, e.g. New Zealand).
- Begs the question: what is adversely affecting marine life at Lundy?

MPA Recovery: Lyme Bay

Emma Sheehan

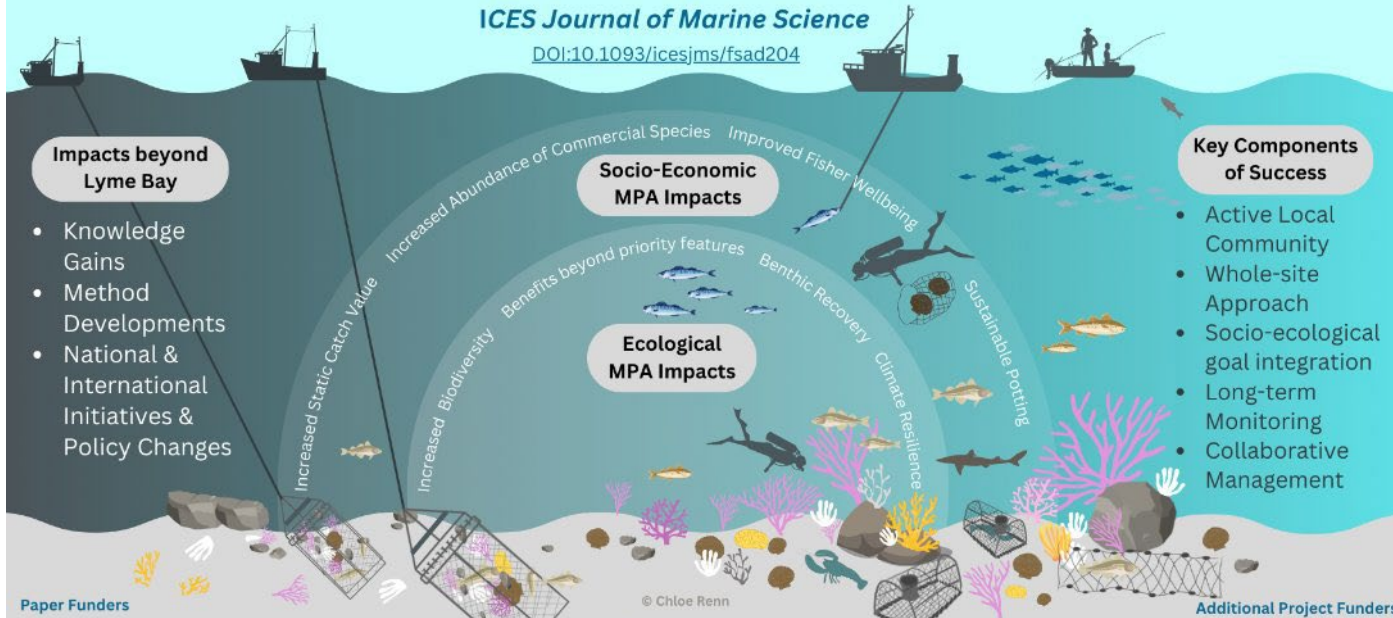
Importance of long-term monitoring to evidence ecosystem-based management

Lessons from Lyme Bay (UK) to inform policy, management, and monitoring of Marine Protected Areas

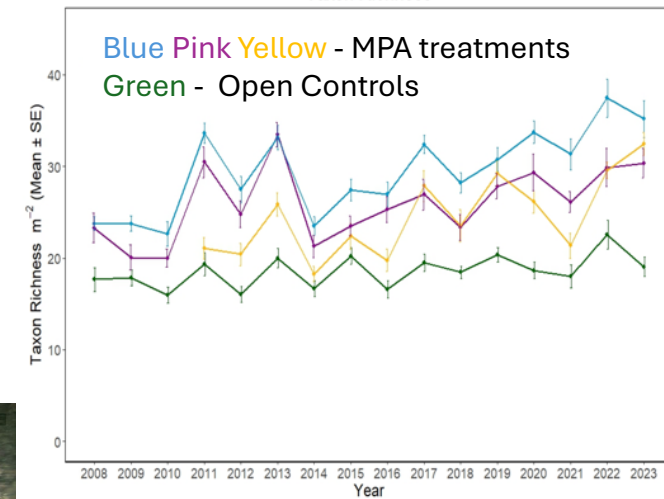
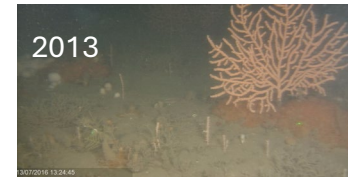
Renn, C., Rees, S., Rees, A., Davies, B.F.R., Cartwright, A., Fanshawe, S., Attrill, M.J., Holmes, L., Sheehan, E.V.

ICES Journal of Marine Science

DOI:10.1093/icesjms/fsad204



Recovery of Site 56



- Lyme Bay's continuous monitoring since 2008 has evidenced
 - Reef recovery
 - Climate resilience
 - Socio economic benefits
- The Whole Site model evidenced in Lyme Bay has been rolled out to other MPA sites in the UK and beyond.

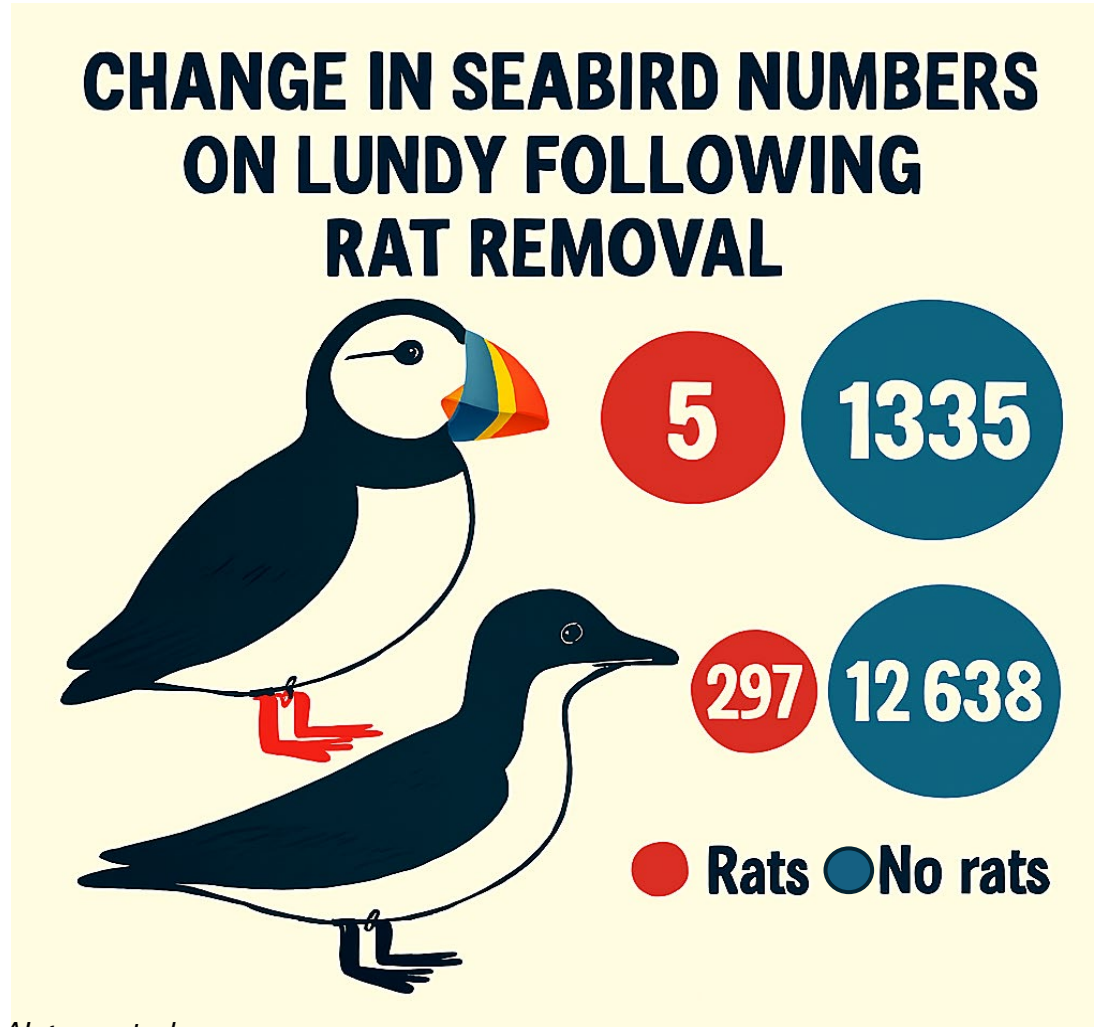


South West Inshore Fishermen's Association
 South Western Fish Producer's Organisation
 The European Maritime Fisheries Fund
 Interreg France (Channel) England

NERC
 Pig Shed Trust
 FLAG
 Devon wildlife Trust

Recovery on seabird islands

What's the limit once rat free?



AI generated.

Alex Banks



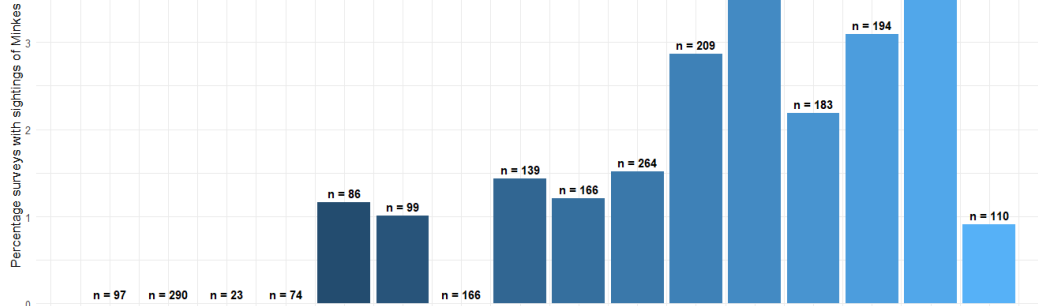
Photos: Paul St Pierre

- Huge increases in guillemots and razorbills on Lundy – another benefit of rat eradication?
- Storm petrels also now breeding on Lundy (161 pairs; absent in rat years)
- Burrow-nesters also recovering (5 x Manx shearwaters) on rat-free islands in the Isles of Scilly

Baleen whales in south west England

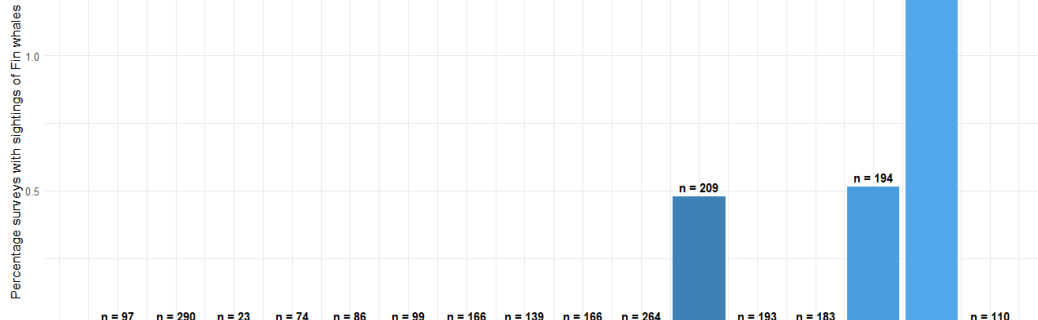
The great whale recovery?

Percentage Seaquest surveys with minke whales



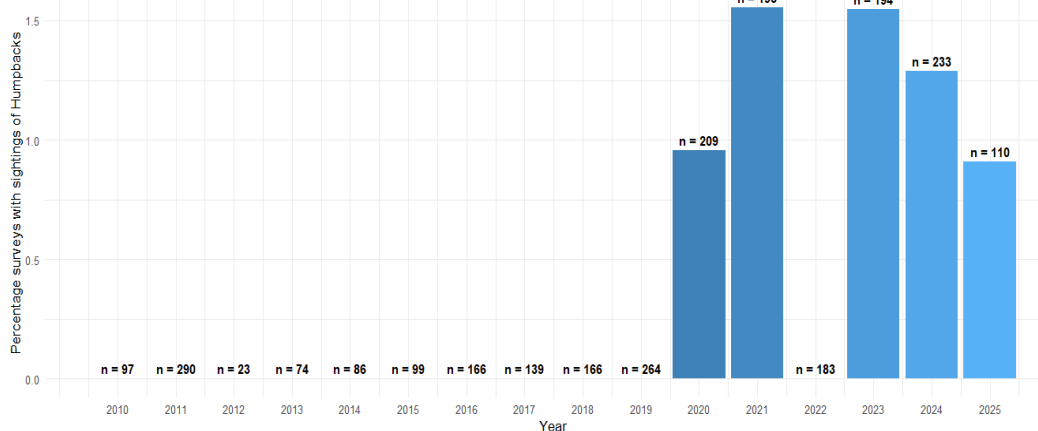
Minke whale, Nathaniel Barry

Percentage Seaquest surveys with fin whales



Fin whale, Marine Discovery Penzance

Percentage Seaquest surveys with humpback whales



Humpback whale, Rupert Kirkwood

Dan Jarvis and Bex Allen

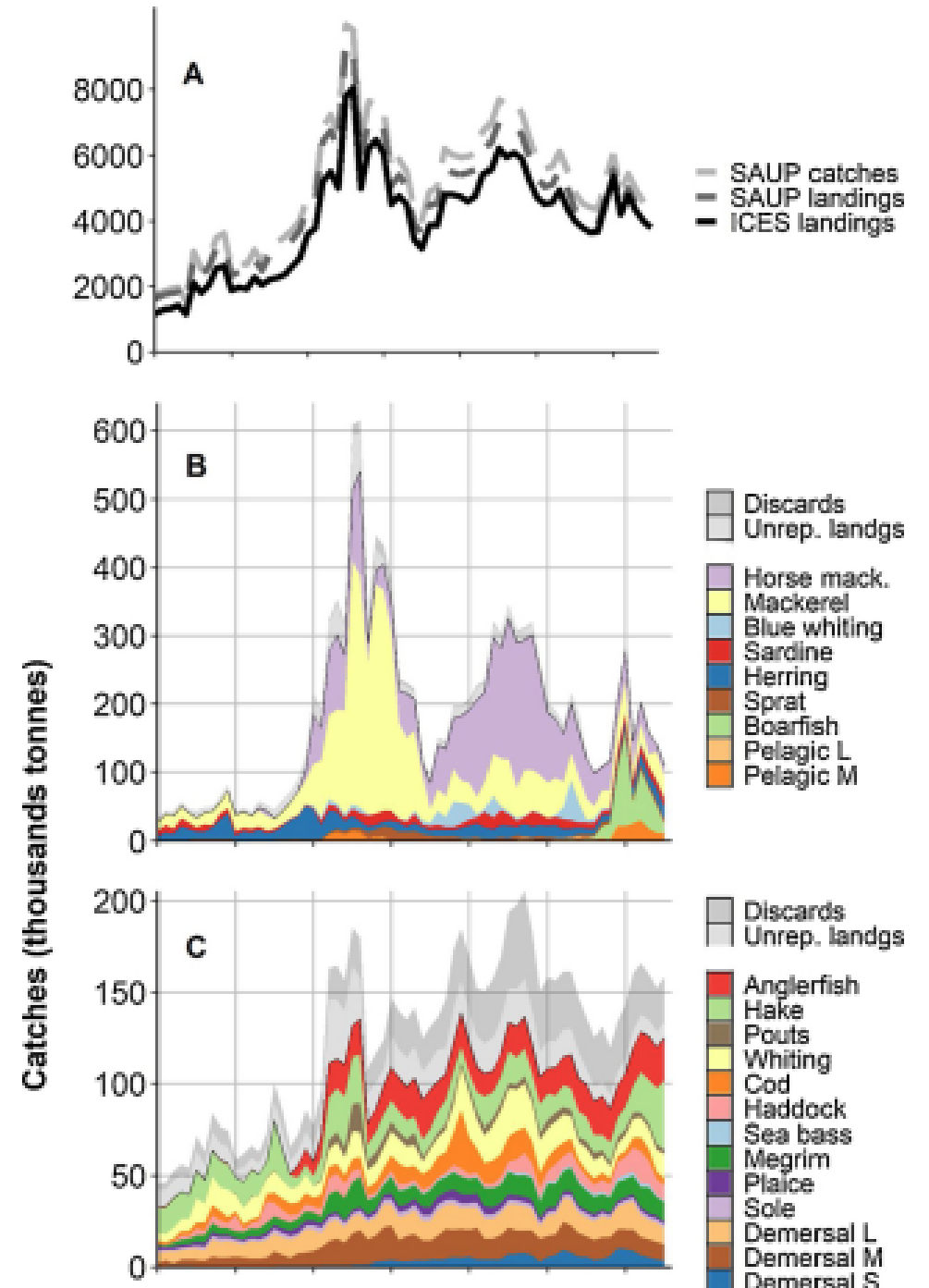
- Data taken from Cornwall Wildlife Trust Seaquest surveys 2010 - 2025
- Minke whales common and increasing in the region, with seasonal peaks in spring and summer
- Fin whales infrequently sighted but reports increasing in recent years, especially from Scilly. Seasonal peaks in summer and winter.
- Humpback whales only recently became prominent in the region, with peak during winter.
- Sightings data supports increasing baleen whale presence in the region, theorised to be due to climate change, prey shift and population recovery
- Need to be aware of Norway 1600 minke whale quota 2026 – ‘sustainable’

Theme 5 Human Impacts Fisheries and Aquaculture

Historical impacts of fisheries

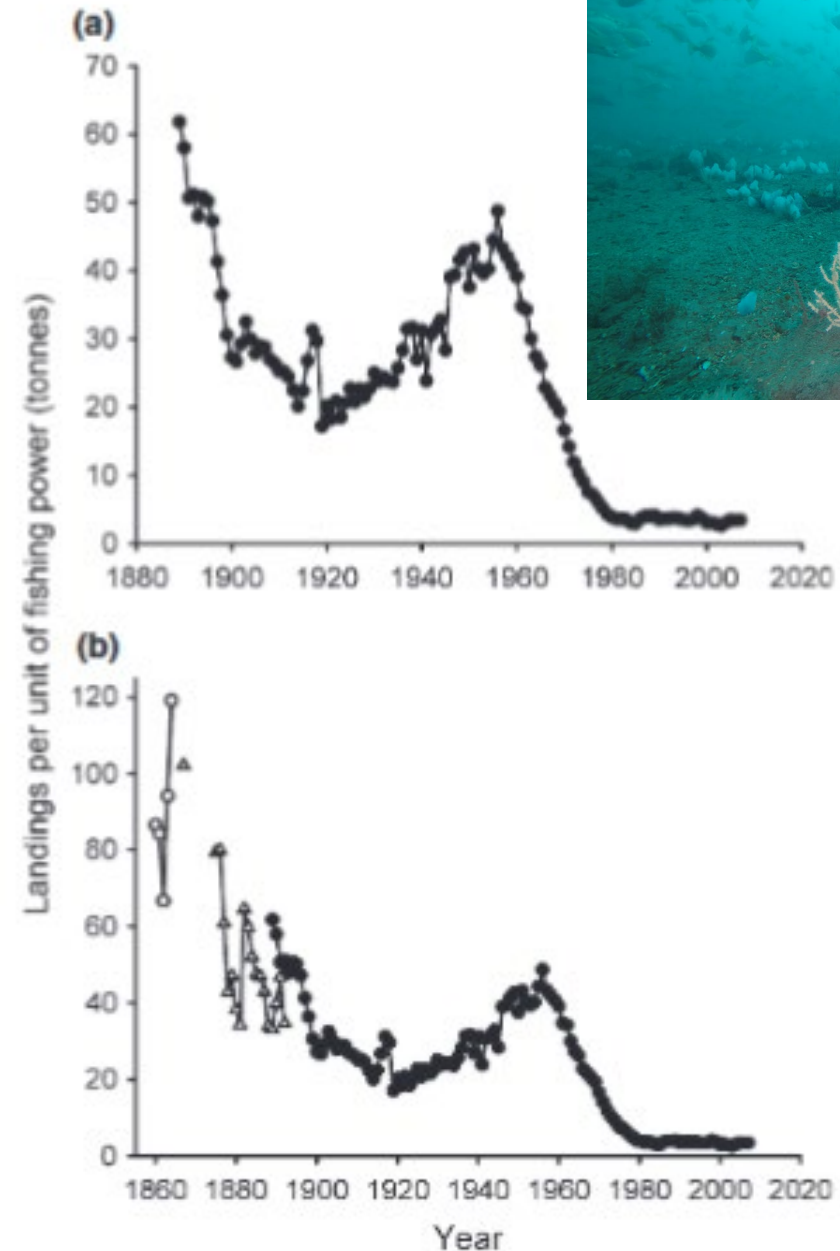
Libby West

- Hernvann and Gascuel - reconstructed catches in the Celtic Sea between 1950 and 2015: a) total catch, b) pelagic fish, c) demersal finfish
- **Celtics Sea large fishing-induced biomass decline occurred, mainly before 1970.**
- The early reduction in large demersal fish abundance may have initiated a trophic cascade.
- Species productivity changed
=hydroclimate-induced ecosystem shift.
- The drastic reduction in mackerel and horse mackerel abundance may also lead to a progressive rebalancing between demersal and pelagic compartments



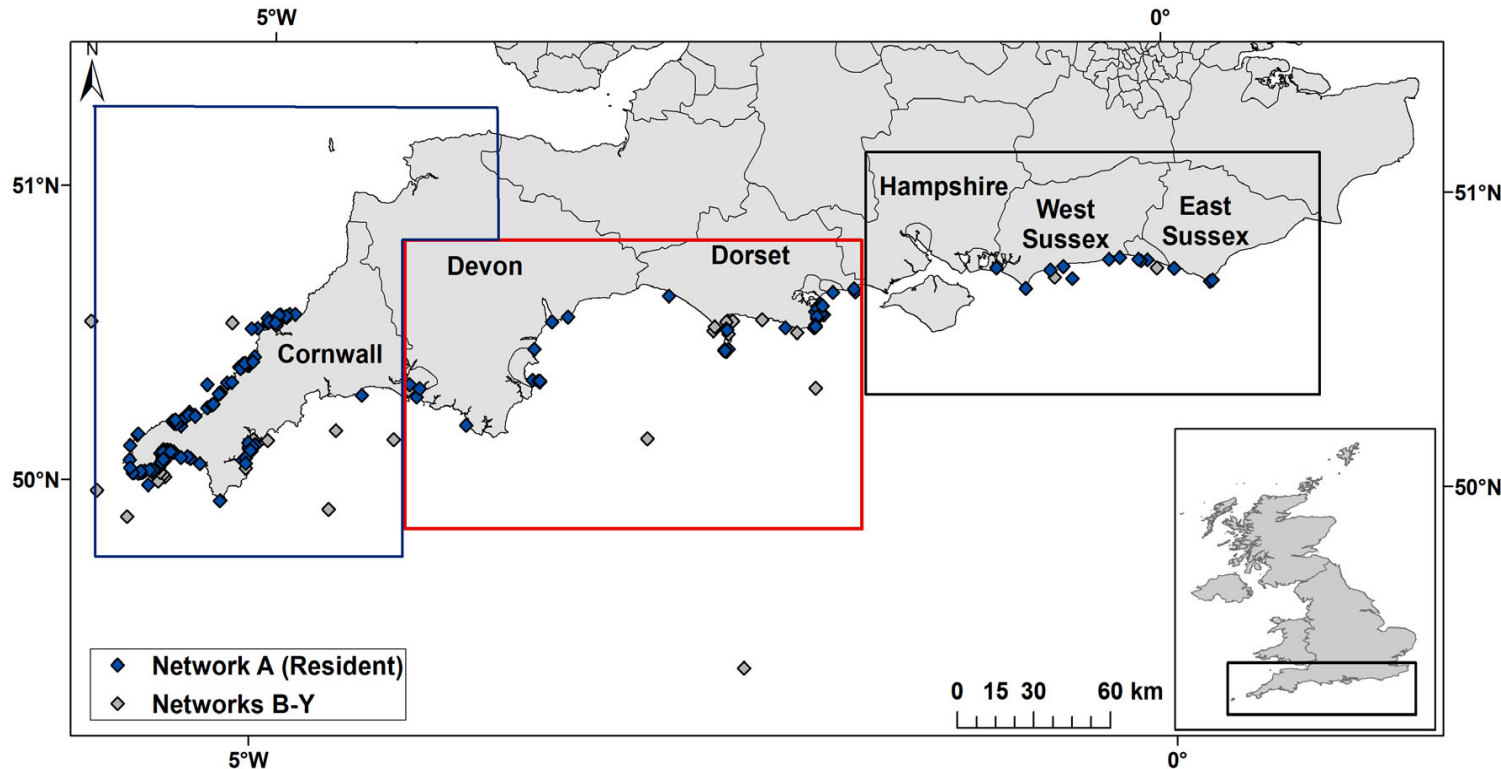
Shifting baselines – trawling - Libby West

- Bottom trawling in the British Isles as far back as the 14th century. Widespread after 1820. By sail, then steam.
- Official catch statistics started in 1880s. Big uncertainties in terms of catches before and even bigger questions about historical environment.
- Impacts of bottom trawling only seriously studied for ~40years
- Analyses of the few existing historical datasets suggest that larger bodied benthos were more prevalent prior to intensive bottom trawling
- Reduction in habitat complexity (architecture) that accompanies the removal of sessile epifauna

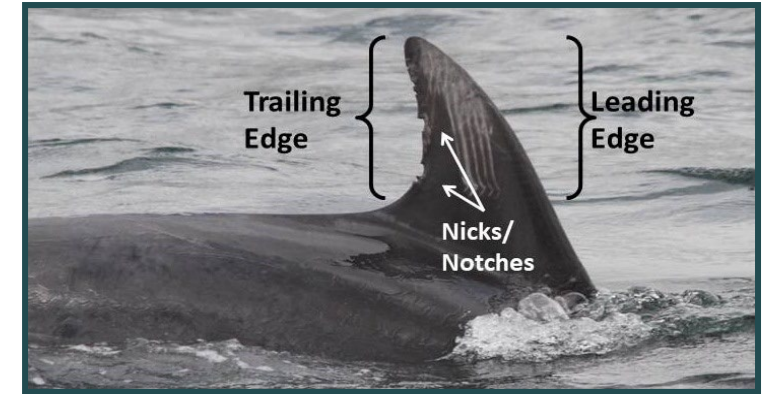


SW bottlenose population – Ruth Williams

Declining or changing range?



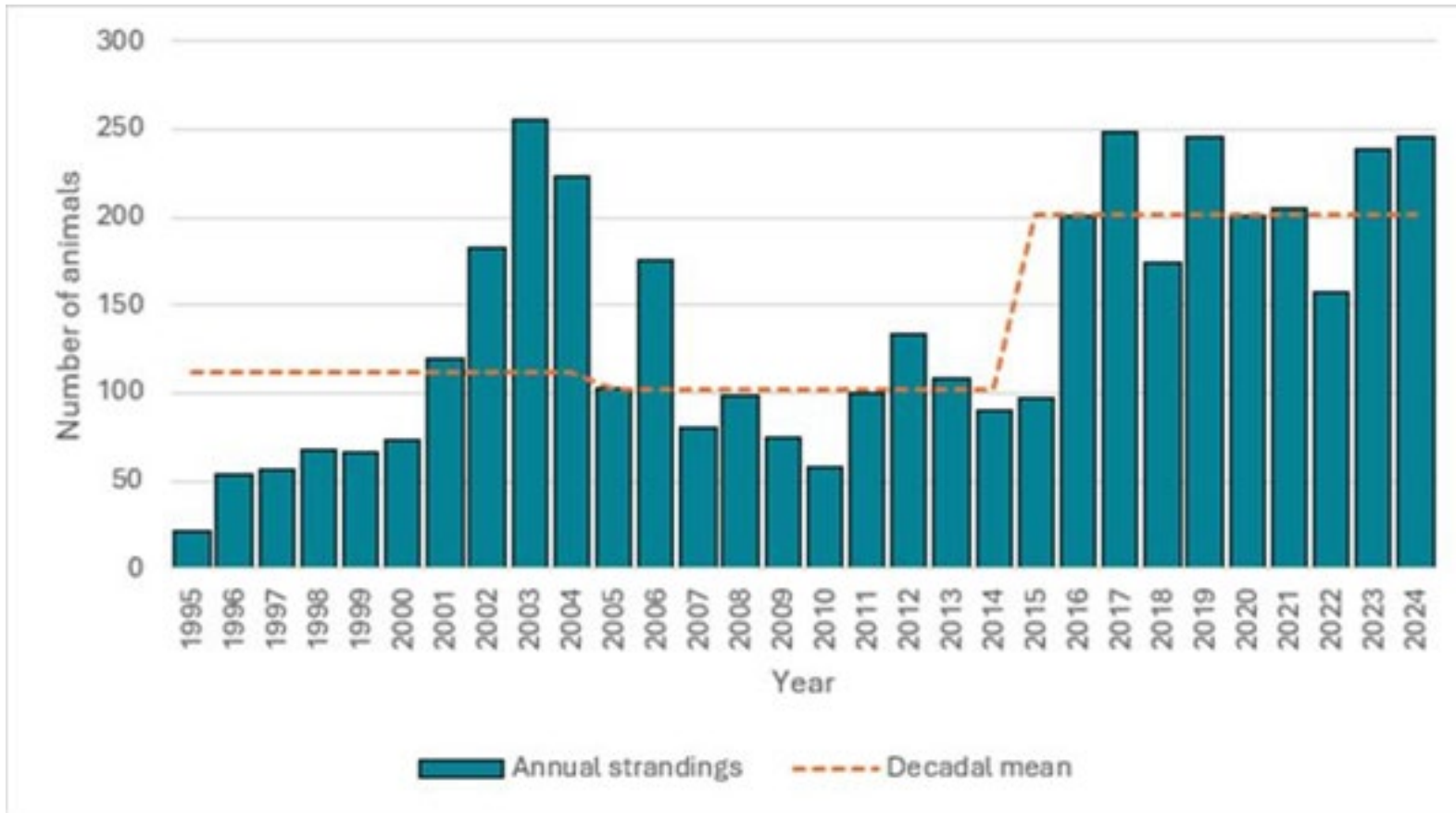
Blue diamonds represent photo-verified encounters of the resident population and other bottlenose social networks in grey.



- Decline seen from Seaquest SW records since 1990's – concern.
- Set up SW BND Consortium 2016
- Photo id proved 48 animals in resident pod that don't mix with offshore animals
- Stick to 50m depth contour
- Range changing since 2017 to whole south coast up to Sussex.
- No statutory protection – concerns this range overlaps with areas of high human activity and disturbance.

Cetacean Strandings – Ruth Williams

Has management had any impact?



- CWT MSN recording since 1992
- ~ 30% strandings due to bycatch
- 2004 EU Reg 812 and UK ban on pair trawling
- 2008 mass stranding of 80 CD's potentially from naval sonar
- Also PCBs, BND attacks, disease..
- 2013 – pingers reduce bycatch by 82%
- Continued high strandings and no further mitigation – action needed

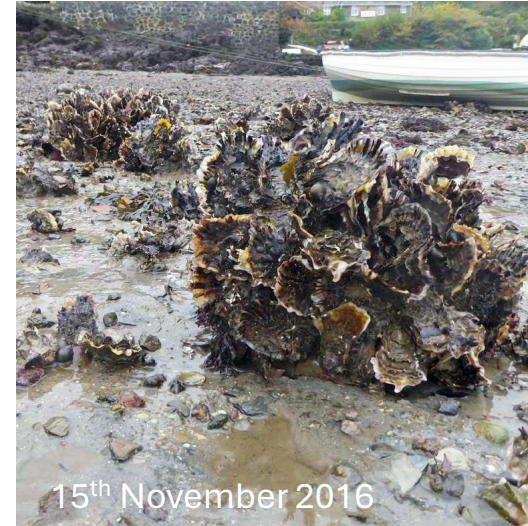
The dotted line is decadal mean, illustrating numbers doubled between, 2015-2024, ($\bar{x}=201$), compared to the preceding decade 2005-2014 ($\bar{x}=102$)

Understanding past ecosystem change: human impacts

Pacific Oysters (*Magallana gigas*): Deliberate introduction of non-native species.

Keith Hiscock

- There are about 100 non-native species known from benthic habitats in Britain.
- Many have arrived on shipping but some have been deliberately introduced for mariculture and may support non-native 'hitchhikers'.
- Impacts are not necessarily 'unexpected consequences' and experienced advice of dangers may have been ignored.
- The introduction of Giant Kelp to Brittany was a 'near miss'.



Native to Japan. Introduced into Britain in the 1960s (See: www.marlin.ac.uk).

In the 1950's and 60's government advice was that sea temperatures were not warm enough in the UK for Pacific oysters to successfully reproduce.

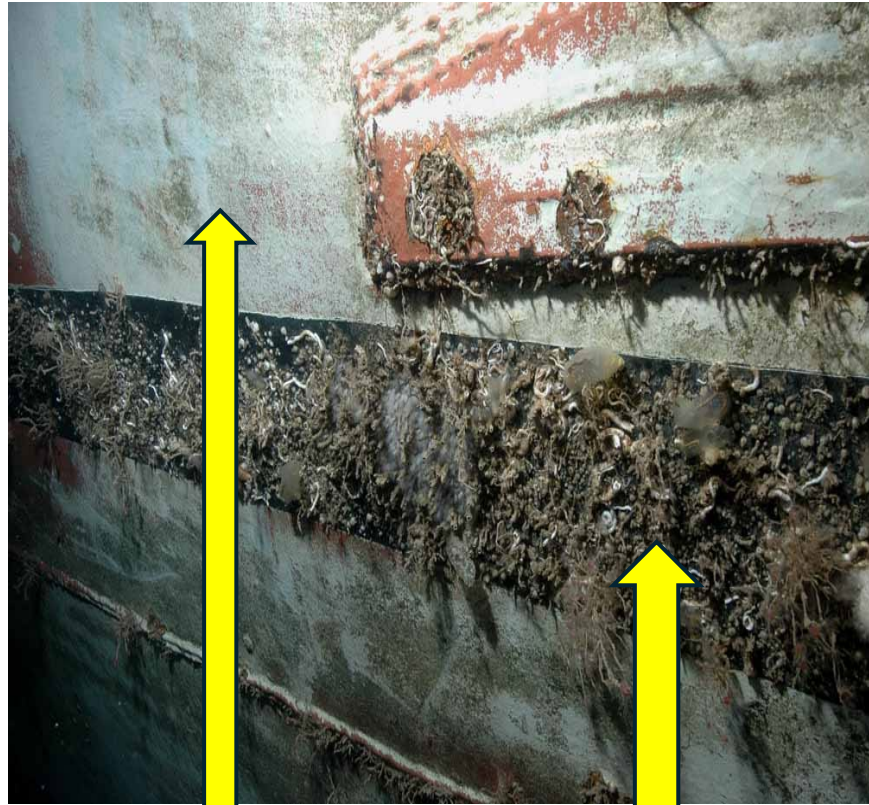
Likely that Wireweed *Sargassum muticum* entered Britain attached to Pacific Oysters.

Theme 6

Human Impacts: Pollution

Tributyl Tin – The Most Toxic Pesticide ever used - Timely action

Bob Earll & Keith Hiscock



TBT paint – grey and red - still
HMS Scylla.

working on

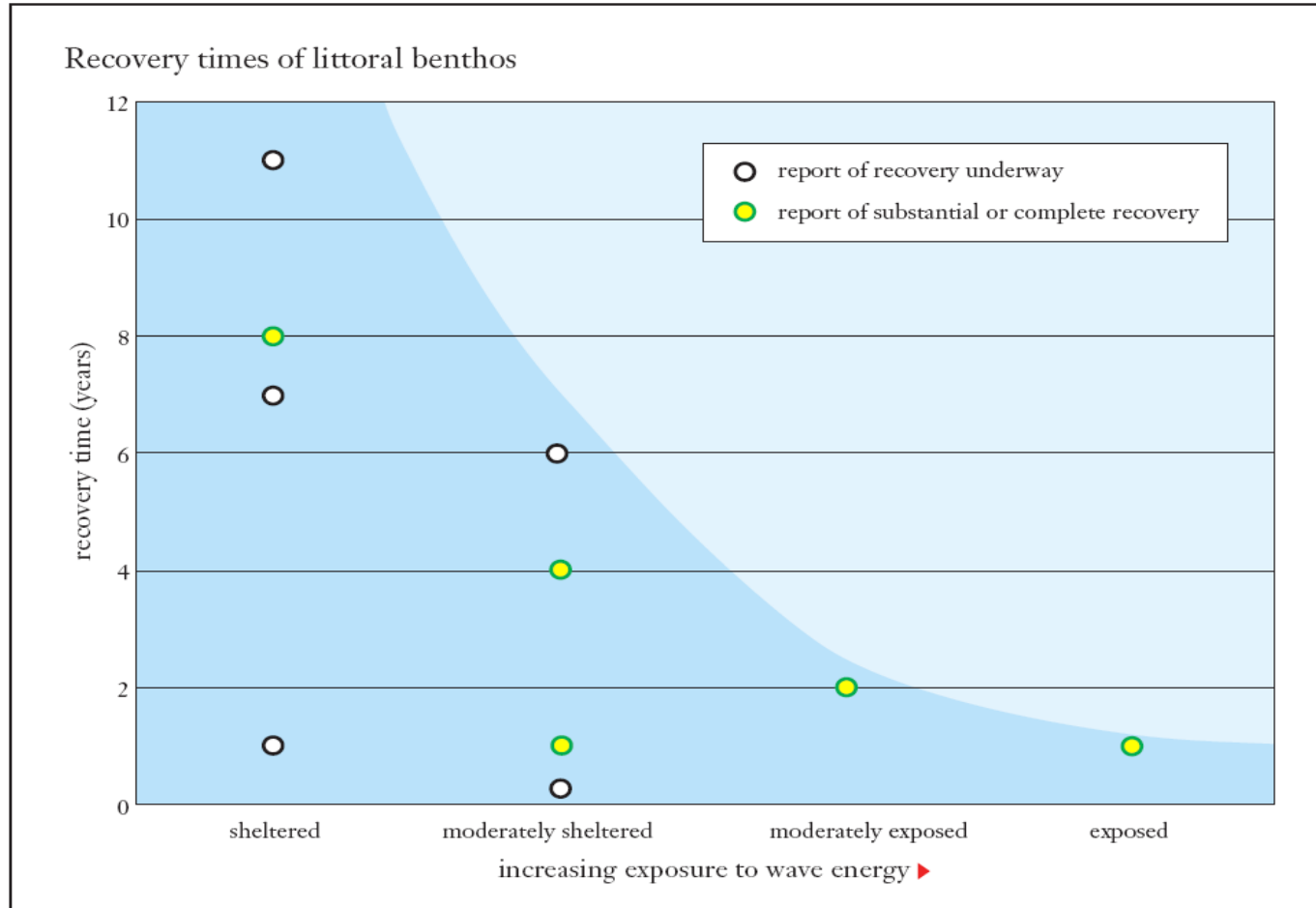
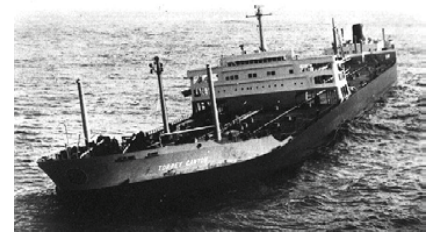
The black 'divers line' without TBT.

Image: Keith Hiscock.

- 1960s -> 1980s **Tributyl Tin (TBT)** becomes widely used as the active ingredient of antifouling paints on ships, fish farming and other marine applications
- 1980's => It becomes clear ***that TBT is the most toxic pesticide ever used in the marine environment***
- **Endocrine & growth disruption** TBT linked to a variety of endocrine changes to reproduction in molluscs (e.g. dogwhelk imposex) and stunting growth in Pacific oysters and well as reductions in coastal marine biodiversity.
- Campaigns by eNGOs & MAFF (against Department for Transport) and since the 1990s bans in UK and International shipping regs (IMO) lead to the phased withdrawal of TBT based paints worldwide

Shoreline recovery after oil spill Jon Moore

We should put Torrey Canyon 1967 behind us?

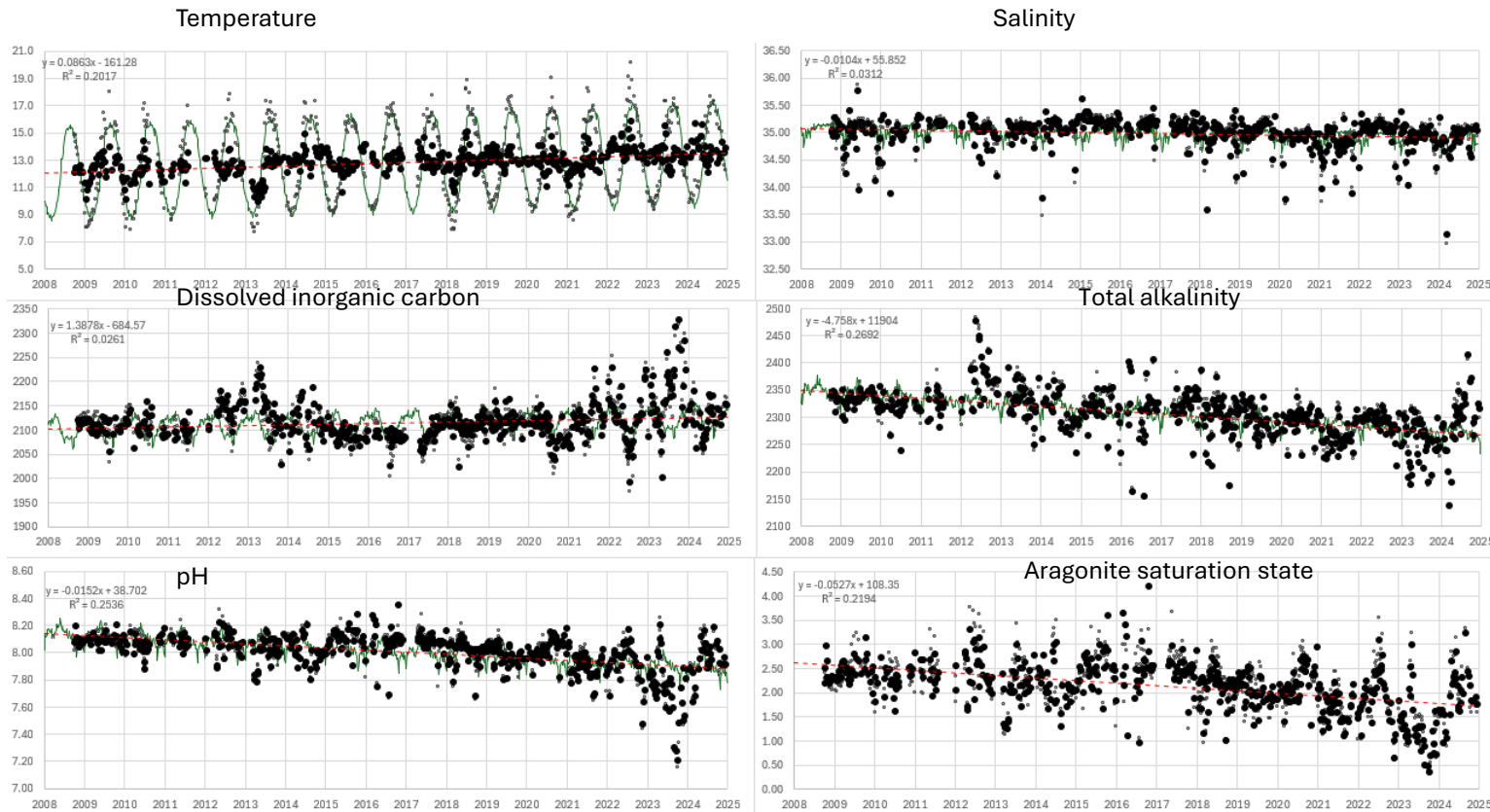
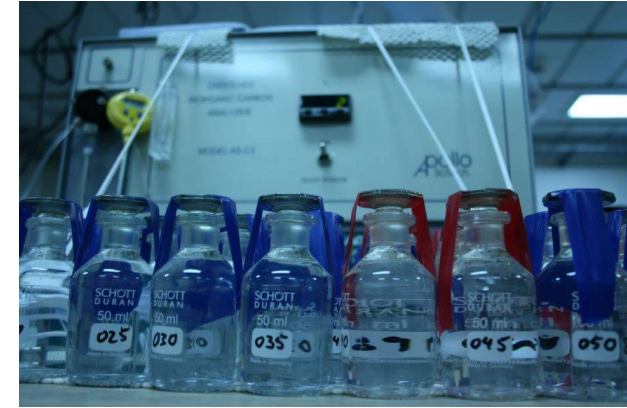


Jenny Baker (1991) IPIECA Guidelines on Biological Impacts of Oil Pollution. Vol 1.

- Recovery time is essentially a function of wave energy
- Marshes are **by far** the most sensitive habitats & birds on water are still at risk
- Elsewhere, long term impacts are typically localised
- Inappropriate clean-up can still happen, but the spill response industry has learnt the lessons of Torrey Canyon

Ocean Acidification Helen Findlay

What drives the high variability?

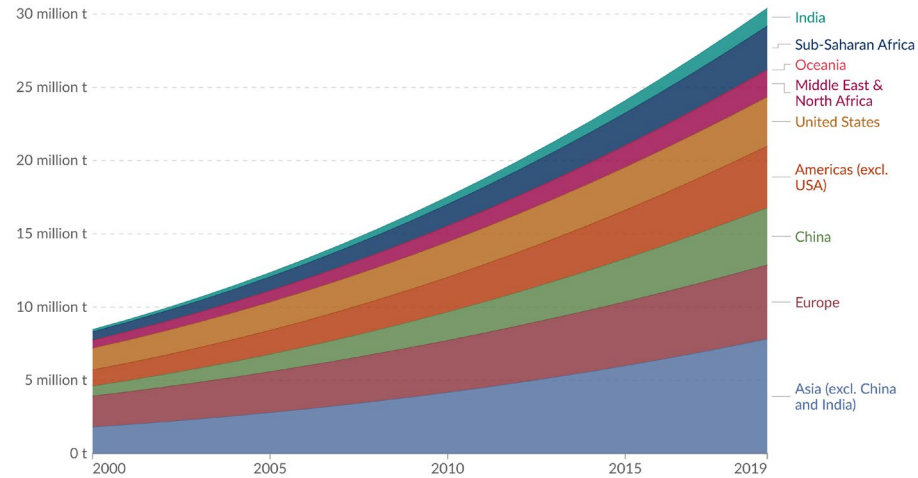


- Dissolved Inorganic Carbon (DIC) is increasing
- Total Alkalinity (TA) is declining
- pH is declining [H^+ increasing]
- Aragonite declining
- Large inter- and intra-annual variability:
 - River influence of Total Alkalinity (organics material)
 - Physical or biological drivers for DIC?

A Tidal Wave of Plastic Pollution – Rachel Yates

Plastic waste accumulated in the oceans, 2000 to 2019

The amount of plastic waste that has accumulated in the oceans since 1951. This is calculated as the running total of plastic flowing into the ocean each year.



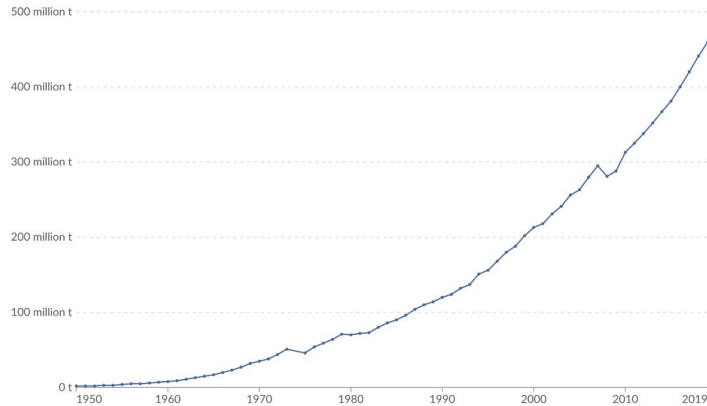
Data source: OECD (2022)

Note: Regional definitions adhere to those specified by the OECD¹.

OurWorldinData.org/plastic-pollution | CC BY

Global plastics production

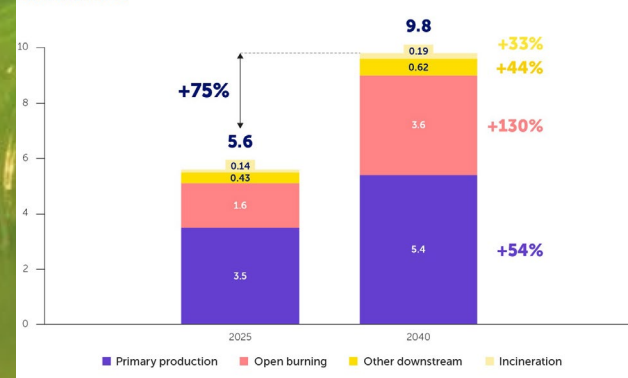
Annual production of polymer resin and fibers.



Data source: Geyer et al. (2017); OECD (2022)

OurWorldinData.org/plastic-pollution | CC BY

Figure 11: Human Health Effects of Plastic Will Rise by 75% Under BAU, Driven by Primary Production and Open Burning of Waste
Modelled impacts by plastic life-cycle stage in millions of years of healthy life lost, 2025 and 2040



KEY POINTS:

- Ocean plastic pollution predicted to almost triple from current 11 million Mt p/year to 29 Mt p/year by 2040
- Production has soared from 2 million tonnes (1950) to 450 Mt (2025)
- A 52% rise predicted by 2040 - to 680 Mt
- Plastic is absorbed in the planetary system. In air, soil, water, food and living things
- Emerging evidence on human health impacts, which is also set to increase (75% by 2040)
- This increase attributed to whole plastic lifecycle, in particular polymer production and waste management (open burning)
- Plastic production and inadequate waste management has been fuelling climate crisis
- Carbon emissions from production set to triple by 2050 – incineration a key issue
- Some legislative moves: single use plastic bans, carrier bag charge, EPR and the implementation of DRS in 2027. But without production caps production and pollution will continue to grow

Microplastics, Nanoplastics and Chemical Pollution – A Growing Threat

Rachel Yates SAS

Figure 18

Microplastic Pollution and How to Manage It

Impacts from 7 sources can be significantly reduced through action across the plastic life cycle. Microplastics are a particularly challenging form of plastic pollution because their small size makes them difficult to capture or clean up. In 2025, 17 million metric tons (Mt) of microplastic pollution annually comes from just seven sources – agriculture, paint, pellets, personal care products, recycling, textiles and tyres. This will grow to 25 Mt per year over the next 15 years if no new steps are taken. But with ambitious action and robust policies, existing solutions can reduce that figure by roughly 40% by 2040.

7 sources of microplastics make up 13% of plastic pollution globally

Tyres, paint, recycling and agriculture are the biggest sources of microplastic pollution, followed by pellets, textiles and personal care products.



Studies have found microplastics throughout people's bodies, raising concerns about their effects on human health.



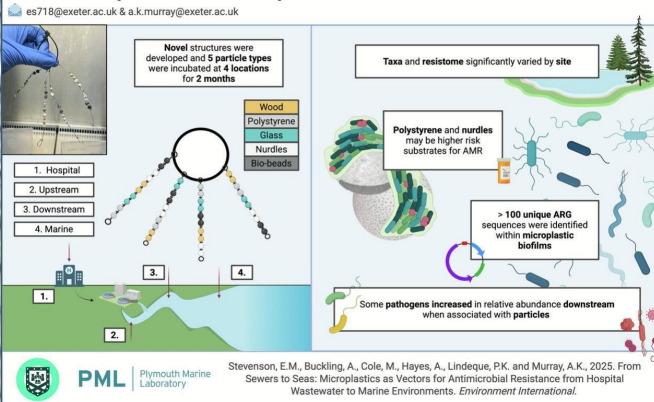
MP calls for ban on 'biobeads' at sewage works after devastating Camber Sands spillage

Exclusive: Use of toxic plastic beads in treatment works is unnecessary and outdated, say conservationists



Volunteers take part in a cleanup operation at Camber Sands in East Sussex. Photograph: Gareth Fuller/PA

Sewers to Seas: Exploring Pathogens and Antimicrobial Resistance on Microplastics from Hospital Wastewater to Marine Environments



- Plastic breaks down fastest in ocean conditions
- Increased plastic production leads to increased leakage at all stages including:
 - Oil and gas extraction
 - Spills from transportation of nurdles
- Micro/nano plastics pass easily into the whole eco-system – air, soil, water, all living things, including human bodies
- Other sources include tyres, agriculture, clothing, paint and recycling processes
- Pollution double whammy: evidence these plastics are carriers of chemicals, pathogens, toxins and bacteria
- 1400 chemicals used in plastic production are deemed hazardous to human health
- Emerging evidence of proliferation, impacts and mitigations
- Bio beads – case study example. Camber Sands Category 1 pollution incident

Microplastics - The growing threat

Pennie Lindeque (PML) & Clare Ostle (CPR, MBA)

Continuous Plankton Recorder
 "CPR samples showed an increase since the 1960s in Thompson et al 2004 Science, which coined the term microplastics"

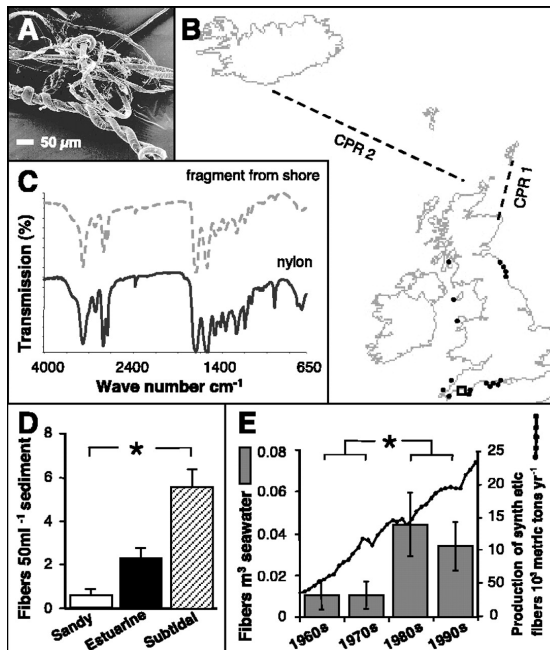


Fig. 6. Waterborne concentration of microplastics (items m^{-3}) in the western English Channel, as sampled using 100, 333 or 500 μm nets. (A) Box and whisker plots showing median concentrations across sites; *denotes significant difference (ANOVA, $p < 0.05$). (B) Bar chart displaying microplastic concentrations for each net found at each site

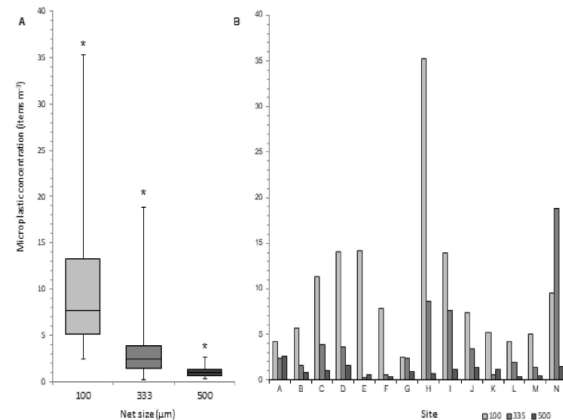


Fig. 6. Waterborne concentration of microplastics (Items m^{-3}) in the western English Channel, as sampled using 100, 333 or 500 μm nets. (A) Box and whisker plots showing median concentrations across sites; *denotes significant difference (ANOVA, $p < 0.05$). (B) Bar chart displaying microplastic concentrations for each net found at each site.

Micro-plastics – key points

1. Microplastics now found in every marine ecosystem: water column, benthos and species. Developing understanding of importance and interaction with marine species & processes
 2. Quantities of microplastic found in surveys growing.
 2. Growing understanding of types of microplastic – ‘designed’ and fragments & quantities
 4. Growing understanding physiological impact – toxicology
 5. Quantities found depend upon sampling methods – size distribution of MP particles varies
- <https://doi.org/10.1016/j.envpol.2020.114721>

Part 2 – 70 mins Discussion – Process

- 1. Recorded discussion = AI processed => OUTPUT**
- 2. Light touch questions**

Questions - Abigail

Google Forms – Outputs

1. *Have we missed any **big ecosystem changes**?*
2. *Have we missed any **studies** that have drawn this material together?*
3. ***What lessons** do you draw from what you have heard?*
4. *Do we need to **record / measure / present** things differently?*
5. *Do you have any **other points to make**?*

