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South West Marine Ecosystems
Communicating the State of the South-West's Seas

Understanding Past Changes to the Marine Ecosystems in the South West

Understanding the Past to Inform the Future

Reference Notes

Editor: Bob Earll

These Reference Notes cover 42 ecosystem changes that have taken place in the South West in the 20th and 21st Centuries. The note was prepared with the input of twenty seven scientists as a part of the 2026 South West Marine Ecosystems conference to support a slide pack and narrators speaking to these slides. The audience discussion has also contributed significantly to this text. These notes have been edited to be of more general use including the outputs and conclusions from the past ecosystem change conference session.

SWME is full of examples of collaboration and this conference session and text are a testament to another major output. We would like to thank everyone who contributed slides including:

Abigail McQuatters-Gollop, Libby West, Keith Hiscock, Bob Earll, Tim Smyth & Ross Saunders, Angus Atkinson, Karen Tait, Jeroen van der Kooij, Simon Thomas, Tom Horton, Alex Banks, Harriet Allen, Bryce Stewart, Martin Attrill, Dan Jarvis, Bex Allen, Emma Sheehan & Amy Cartwright, Ruth Williams, Duncan Jones, John Moore, Helen Findlay, Rachel Yates, Penelope Lindeque, Clare Ostle and Nova Mieszkowska
We would also like to thank everyone who contributed to the discussion session at the conference.

Understanding Past Changes to the Marine Ecosystems in the South West
SWME Conference 2026 - Conclusions and Summary

1.Methodology & Process - *Beyond Silos* We work in thematic topic silos for many good reasons, however, we know that these topics interact and the aim of this meeting was to move beyond the silos and consider ecosystem interactions and change. In this regard the meeting was a great success and the *beyond silos* idea was achieved. Lessons, both good and bad, from the process were learnt and a number of the ideas will be taken forward into future conferences, for example at least a third of the SWME annual conference will be allocated to cross-cutting themes and the use of mentimeter to benchmark ideas and threats.

2. A set of Unified Categories for Ecosystem Change & Threats will be a template for future conferences The unified structure and the clear identification of important themes covering both past and future will stand us in good stead for conferences and workshops in future.

3. Regime Shift in the South West UK in the period 2010-20 and Beyond – Briefing and Publication The regime shift output from the conference links both changes in climate and oceanic systems to food chains and keystone species. The work of Beaugrand (2019) suggested that a super El Nino may well have prompted the changes we have recorded in 2014-2015 but, – and it is a big but - exactly how is still not clear. Understanding and communicating the climate-ocean links to marine ecosystem changes remains a huge challenge.

4. Science and the role of SWME Much of the work reported in the Reference Note has been the product of traditional science. It would be instructive to have a focussed debate about the issues highlighted in the discussion in the context of SWME's work not least in terms of the inputs of traditional and citizen science, the process of science – descriptive and analytical science and monitoring.

5. Communication Given that communication is central to SWMEs activities, and that many of the SWME conference members are directly involved with this professionally and also have the opportunity of social media and it would be worth exploring communication more widely to see what lessons we might take from SWME work. Communicating ecosystem change is difficult but some of the process basics would a useful starting point.

The media always ask - why? Why has there been an octopus explosion?' 'Is it climate change?' etc. One of the main purposes of the meeting was to is give the SWME community a collective view of the past and our understanding of this including many 20th Century events – this was clearly achieved. We made a start, but we will need to refine and repeat this process to work on getting greater clarity into our understanding and communication.

6. Using the past to help us explain the future - can we do it? 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. Preparing an overview such as this – with the main themes and types of change illustrates how we might begin to manage issues in the future – such as pathogenic diseases in keystone species.

7. What were the outputs? At the outset of the work on the ecosystem conference the question was posed 'what will be outputs'? Here is the list so far for the past ecosystem session:

- This Reference Text & slides covering 42 ecosystem changes: https://swmecosystems.co.uk/conference/conference-outputs
- The audio file and YouTube video of the presentation https://www.youtube.com/watch?v=EFGZ8-O7CTU&t=4256s.
- Changes to plankton and keystone species texts. Article in the Conversation

https://theconversation.com/tuna-has-overtaken-cod-as-the-uks-top-selling-seafood-heres-why-283087

- The Regime Shift briefing – affecting all SWME Natural System thematic topics – to the SWME Steering Group
- The Regime shift paper in preparation by Angus Atkinson (PML) involving many SWME data sets.

Contents

1. Introduction

The South West Marine Ecosystem (SWME) Steering Group decided that the format for the 2026 conference should be focussed on ecosystems on the relationships between the SWME thematic topic silos. The format for the conference was organised to consider past, present and future ecosystem change. The text covered here was contributed by twenty seven people who prepared slides for initial session on past ecosystem changes focussing on the South West. The aim of the original narrative text was to enable four narrators to present the slides as a prelude to a fuller discussion. The presentation of the slides can be viewed on the SWM YouTube Channel at https://www.youtube.com/watch?v=EFGZ8-O7CTU&t=4256s.

This text and the slides covered 42 examples of change in the South West and these are listed in the contents. *The slides for the presentation cannot be used without the authors permission but are available on the SWME website*.

The aim of these **Reference Notes** is to include a number of further outputs from the conference which help set out major themes and outcomes of the discussion and questionnaire used at the event.

These Reference Notes are not meant to be comprehensive or even 'finished' but they do provide a starting point for projects which might wish to cover ecosystems in a more integrated way in the future.

This Reference Notes text can be found on the SWME Website https://swmecosystems.co.uk/conference/conference-outputs

2. Methodology & Process Session process

2.1 The format for the session

In the discussions of how this session would work over 6 months a two part process was identified.

The first part (75 mins) was a presentation of a compilation of slides covering *significant changes* in South West marine ecosystems in the recent past and 20th C. This involved identifying the various topics through discussion – an Excel spreadsheet list was compiled and refined. Six themes emerged from the process (see below). The final presentation can be viewed here: https://www.youtube.com/watch?v=EFGZ8-O7CTU&t=4256s.

The second part (45 mins) was a facilitated discussion which was recorded, and which had 'light touch' questions to help focus outputs.

2.2 The ideas guiding the session were as follows – beyond silos

- Beyond silos: We would all pass the exam question asking us how marine ecosystems worked, however 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.

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

- The media always ask Why? Why has there been an octopus explosion?' 'Is it climate change?' etc. Our hope was that the session would begin to help us answer this type of question.

- Using the past to help us explain the future - can we do it? 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? Or Communicating?

2.3 Six emerging themes

Initially ideas concerning specific ecosystem changes were collected in an Excel spreadsheet, however, it soon became apparent that these fell into six strong cross cutting themes including:

1. Natural Systems Change: Climate and Oceanographic Interactions with food chains
2. Recent major changes to keystone species
3. Diseases
4. Recovery & restoration
5. Human impacts: fishing & aquaculture (e.g. Pacific Oysters
6. Human impacts: Pollution: TBT, Oil, Ocean acidification and plastics

2.4 Questions for the Discussion

We realised that the discussion after the presentation could provide valuable inputs. The discussion was recorded and we do have an audio file. Two approaches are possible – a strong focus or preformed questions or an audience lead less prescribed approach. No decision was taken before the event but in practice the less prescribed approach was taken.

Questions to help the discussion are helpful and a Google form QR code was set up the questions below were not emphasised. However there 5 responses to these questions. For this approach to work it has to formally dominate the discussion.
The questions for the discussion were

- *Have we missed any big ecosystem changes?*
- *Have we missed any studies that have drawn this material together?*
- *What lessons do you draw from what you have heard*
- *Do we need to record / measure / present things differently?*
- *Do you have any other comments or observations?*

2.5 A generic typology or classification of types of change in the marine environment – language – framing

It was thought that a **generic typology or classification** might be helpful but there was some resistance to trying to do this prescriptively – '*We don't want to get into the semantics of change*'. How we use language to frame the way we described change is important. The terms below were initially identified by AI but have been refined. The themes identified above fall into two main categories:

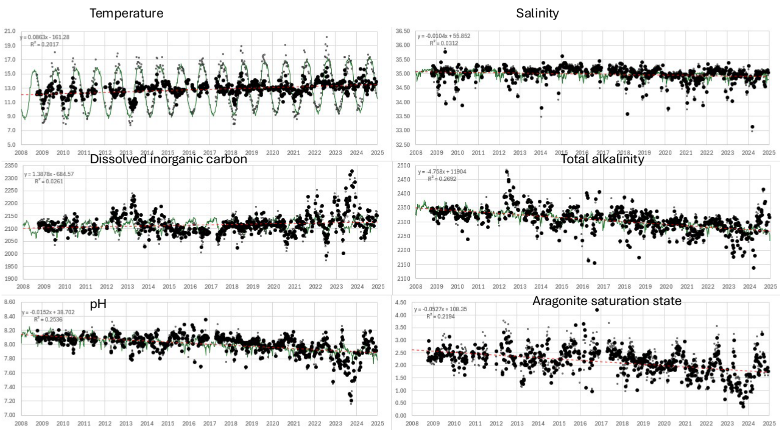
i) Changes in natural systems – driven by climatic, oceanic conditions or ecological events
ii) Changes driven by/caused by human – socio-economic activities e.g. burning fossil fuels, fishing, development

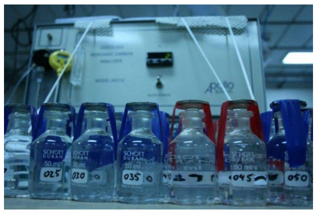
Changes in the marine environment are frequently classified (and framed) based on their temporal and statistical nature rather than just their cause:

- Random, unpredictable changes e.g. diseases

- 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). Helen Findlay's slide (below) showing the gradual changes of sea surface temperature and pH are very good examples of this type of change.

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?

- Regime shifts - sudden shifts—often called regime shifts or "catastrophic transitions"—involve an ecosystem rapidly reorganising into a new state (see Angus Atkinson below).

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

- Large, unexpected events such as collapse or explosive growth of populations e.g. Octopus in 2026

- Rate-Induced Tipping (R-Tipping): A specific class of change where the *speed* of environmental change (how fast it happens) is more important than the *magnitude*, causing the system to collapse because it cannot track the change fast enough. [1, 2, 3, 4, 5]

3.Results and Discussion

3.1 Methodology & Process

Everyone involved with the conference process was aware that this was a unique event in the sense that it had not been attempted before. It was an 'experiment' and SWME has the *freedom to experiment*. Not surprisingly some things worked and others did not and this is reflected in the bullet points below.

Some points:

- Preparing the slide presentation was time consuming (7+ days) mainly in liaising (chasing) with the contributors.

- There are two difficult challenges with this process firstly, engaging contributors who are *not* going to present and secondly, asking them to condense their key information into one slide; both are difficult.

- Forty two ecosystem changes have been identified in relation to the six themes; four arose from the discussion. That part of the process identifying the key changes has been very useful in the sense that it has - *made a start* - should such an ecosystem/integrated event be attempted again.

- The six themes should enable this type of event to be undertaken more efficiently in future.

- The session was successful in covering many of the traditional silos in an integrated way.

- The presentation using narrators worked but would have benefited from a practice run before the event [time commitments did not enable this]. The presentation worked in the sense that the idea of 27 people standing up and talking to their individual slides would have been impractical.

- The Google form questions did not really work – not least because we didn't want to bias the audiences inputs to the discussion. By comparison the Mentimeter survey for the Future threats in the afternoon session got almost 100% audience engagement (130+ people) because the questions ***were the content*** of the session.

- The video and audio recordings were very valuable.

- Discussions of ecosystems and integration often take place in settings, such as ICES and OSPAR meetings well away from the South West and so in holding the meeting in Plymouth with a SWME audience was valuable and important.

- The methodology and process were imperfect and clunky but it has produced some remarkable outputs.

- The format of the conference as a whole highlighted that we should allocate more time to cross cutting issues in our annual meetings for example: *Regime shift, communication, future threats, No trees no seas, Mentimeter topical surveys to act as benchmarks*

Conclusions Methodology & Process The usual silos were broken and integrated to cover a wide range of ecosystem changes in the South West – the beyond silos idea was achieved. Lessons both good and bad were learnt and a number of the ideas will be taken forward into future conferences, for example at least a third of the annual conference allocated to cross-cutting themes and the use of mentimeter to benchmark ideas and threats.

3.2 SWME Unified Ecosystem Change & Threats Categories – A template for future conferences

It was valuable to see that the six themes that were used in the presentation on past ecosystem changes were very similar to those used in the consideration of future threats (session 3). The future threat questions were based upon IUCN Direct Threat Categories.
The official resources for the IUCN Direct Threat Categories can be accessed through the following links:

- Primary Tool: View the comprehensive portal via the IUCN Red List Threats Classification Scheme.
- Detailed Documentation: Review structural rules and definitions in the CMP Unified Classification of Direct Threats Guidance PDF.
- Latest Standards: Access updated cross-organization listings on the Conservation Standards IUCN-CMP Direct Threats Classification Portal.

Table 3.1 links these two listings and looks at the topics they have in common.

The value of this is that it provides a set of headings that could easily be used to structure a future conferences or workshops on ecosystem change. Single speakers could explore past – present – and future threats using these themes.

Table 3.1
SWME Unified Ecosystem Change & Threats Categories

SWME Past Ecosystem Change Themes	IUCN Direct Threat Categories 8 used for Horizon scan Numbers refer to IUCN use	Unified Change & Threats
Climate and Oceanic changes and interaction with food chains	11. Climate change and severe weather	1. Climate and Oceanic changes
Changes to keystone species and food chains	No equivalent	2.Change & threats to include plankton and keystone species
Diseases	Invasive and problematic species, pathogens and disease	3.Invasive and problematic species, pathogens and disease
Recovery and Restoration	No equivalent	4.Human programmes for recovery and restoration of natural capital / biodiversity
Human impacts: Fisheries and aquaculture	2. Aquaculture & 5. Biological Resource Use	5.Human impacts: Fisheries and Aquaculture (finfish, shell fish and seaweed)
Human impacts: Pollution	9. Pollution	6.Pollution
	1. Residential and Commercial development. 3. Energy production and mining 4. Transportation and service corridors	7.Development and human activities including: tourism and disturbance, energy, desalination, shipping and major infrastructure projects
		8. Cross cutting Governance

Conclusion SWME Unified Ecosystem Change & Threats Categories A template for future conferences
The unified structure and the clear identification of themes will stand us in good stead for conference and workshop sessions in future.

3.3 Regime Shift in the South West UK in the period 2010-20 and Beyond – Briefing and Publication

Angus Atkinson and the team at Plymouth Marine Laboratory (PML) have reported on the plankton communities in the South West regularly at SWME conferences and the SWME Annual Reports. In preparation for the 2026 SWME conference Angus Atkinson prepared diagrams based on SWME Annual Report information which highlighted the frequency of rapid population shifts in the 2020s (Fig 3.1). These diagrams highlight the changes that have been taking place. This change is now the subject of research geared to the publication of an article in the main stream scientific literature. In the short term a briefing was prepared for the SWME Steering Group to enable them to see the work that was being undertaken.

This story highlights the value of the SWME Annual Reporting process and the publication of systematic records. Year on year metrics are particularly valuable.

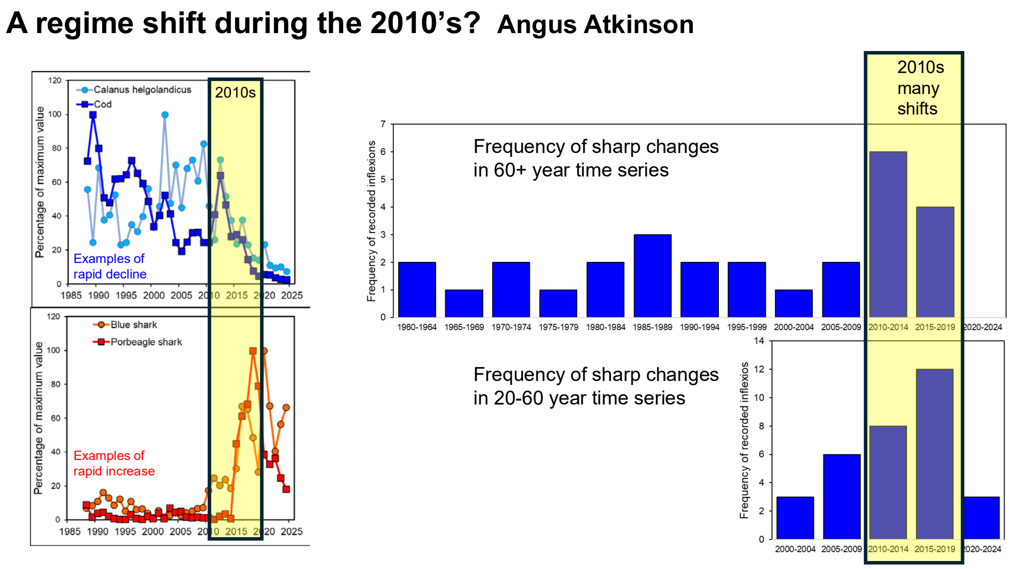


Fig 3.1 Atkinson - Draft in preparation – changes in populations of plankton and sharks and the frequency of sharp population changes.

Understanding how ecosystems work is a major challenge and we often resort to the relative safety of our silos. This story on the other hand links the work of the SWME CoPs together. Early warning: SWME communicates on an annual scale and provides a platform for various scientific sources from multiple people who are observing the sea. With a Super El Nino in 2026-2027 understanding the value of records made can enhance our abilities to produce early warning of changes taking place.

Marine scientists based in the South West have been at the heart of understanding how climate and ocean drivers affect ecosystem changes to planktonic and shore populations. The 'Russell Cycle' named after Sir Frederic Russell but developed by many others including Alan Southward was the first time data had been collected on such events based on research in the South West (Southward, 1988). The Atlantic Meridional Overturning Circulation events (AMOC) & El Nino events clearly influence the oceanic and planktonic communities in the South West but this influence is complicated.

Conclusion Regime Shift in the South West UK in the period 2010-20 and Beyond – Briefing and Publication
The whole idea of the conference was to explore how the different parts of the ecosystem interacted. The regime shift work is a major output from the conference which supports this approach.

3.4 Science and the role of SWME – Points from the Discussion

The start of the discussion focussed on various aspects of science. It is important to have a clear view of what SWME does and doesn't do to set some of the comments in context. Some key points:

Traditional and Citizen Science
The reality is that SWME uses data and information from ***both*** of these sources. It is not either or. Traditional science comes in many forms – pure research, applied research, monitoring done in institutions, universities,

agencies and consultancies. Citizen science is equally diverse ranging from *ad hoc* records (often of rare and undescribed species and events), using experts by experience, projects which are public facing (e.g. Basking shark watch) or less so (the systematic records of angling projects) right up to the huge nationwide and global app based projects with hundreds of thousands of observers. Traditional and citizen science have their strengths and weaknesses but are *all* carried out with professional integrity.

<u>The process of science</u>
We need to remind ourselves about the basics of science. The eminent plant ecologist Tansley summed this up perfectly as follows, *'Every kind of scientific investigation has two stages – the descriptive and the analytical. We must first know clearly what the phenomena are – the things or process we propose to investigate; and thus we must carefully observe and accurately record before we can proceed to find out how particular phenomena come about.'*
Ref: Tansley Introduction to Plant Ecology 1954 George Allen and Unwin

A South West example – there must have been the first person who saw an Atlantic Bluefin Tuna (ABT) jump out of the water in 2014! We know this probably came as a huge surprise but gradually as the photographs and observations were collected by social media (*ad hoc* citizen science) from all over the South West we realised what was happening. Year on year the 'descriptive' observations were amassed and after a couple of years – note the time lag - the 'traditional science' was begun – but through sports anglers (citizen scientists) with a tag and release project. Now the ABT fishery is a reality commanding considerable traditional scientific attention. It is easy to forget those early stages, but SWME is picking these observations up all the time – we have filled many pages with images and descriptions of these 'descriptive' observations.

<u>Qualitative v Quantitative data and information</u>
Many of the observations that SWME reports are qualitative and descriptive by their very nature. Whist some projects lend themselves to quantitative data others do not – this is a reality of doing any ecological science. For example counting the dead bodies of marine mammals lend themselves to quantitative data whilst others, for example assessing the abundance of sessile organisms or eDNA results are less easy to quantify. There are distinct limitations to all methodologies both quantitative and qualitative that we use to study natural systems and the scientists reporting on these will qualify their observations accordingly. Scientists of all sorts will capture quantitative information if they can and be aware of how circumstances, like weather conditions, affect observations.

<u>Monitoring – who is doing this in the South West?</u>
SWME does not do formal monitoring but often reports the monitoring work of scientists who do. Similarly SWME does not hold any data and this is the responsibility of the people contributing their projects work. SWME does report and the data in tables used in the report are used with the permission of the scientific originators.

The question was posed by Natasha Bradshaw about whether anyone is monitoring the monitoring going on in the South West? Howell Marine Consultancy recently undertook a national survey of 67 formal UK Government funded monitoring programmes – in effect *a census* of who was doing what. There was no sense that this was a routine process and so one might conclude that nobody is monitoring the marine monitoring or work being undertaken in the South West's seas. It would be informative to undertake a census of such projects in the South West.

<u>Conclusions</u>
Much of the work reported in the Reference Note has been the product of traditional science. It would be instructive to have a focussed debate about the issues outlined above in the context of SWME's work.

3.5 Communicating Complex Ecosystem information – Final Discussion

A good deal of the discussion after the presentation focussed on how information on complex ecosystem information is communicated – the bullet points below highlight some of the key points including:

- Communication is at the heart of what SWME does and so understanding whether SWME communication is effective would be interesting to know. Having a session on the communication challenges we face could be useful.

- A large number of people in the conference audience are also in the '*communication business'*; perhaps communication as a cross cutting issue we / SWME needs to explore further with our constituency?

- Communications styles changes with audience demographics.

- The issue of how we communicate complex issues to decision makers was highlighted and the success of programmes like the Marine Climate Change Impact Partnership (MCCIP) was highlighted.

- In the decisions made by UK Government with regard to the protection of North Sea sandeels the imaging used to illustrate the relationships between key elements of the food chain was key.

- With IPCC the risk based lens to communication has also been used effectively

- The cost of not acting – the price of inactivity – is another hook to use in discussions on climate change

- Taking the information to the public – *meeting them where they care*

Conclusions – Communication Given that communications are central to SWMEs activities, and that many of the SWME conference members are directly involved with this professionally and the opportunities of social media it would be worth exploring this topic more widely to see what lessons we might take from SWME work. Communicating ecosystem change is difficult but some of the process basics would a useful starting point.

3.6 What were the outputs?

At the of the work on the ecosystem conference the question was posed 'what will be outputs'? Here is the list so far for the past ecosystem session:
- This Reference Text & slides covering 37 ecosystem changes: https://swmecosystems.co.uk/conference/conference-outputs
- The audio file and YouTube video of the presentation https://www.youtube.com/watch?v=EFGZ8-O7CTU&t=4256s.
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- The Regime Shift briefing – affecting all SWME Natural System thematic topics – to the SWME Steering Group
- The Regime shift paper in preparation by Angus Atkinson (PML) involving many SWME data sets.

4.Conclusions

1.Methodology & Process- Beyond *Silos* The usual silos were broken down and integrated to cover a wide range of 42 ecosystem changes in the South West – the *beyond silos* idea was achieved. We work in thematic topic silos for many good reasons, however, we know that these topics interact and the aim of this meeting was to move beyond the silos and consider ecosystem interactions and change. In this regard the meeting was a great success. The regime shift outlines links both changes in climate and oceanic systems to food chains and keystone species, two of the main themes of the past ecosystem session. The work of Beaugrand (2019) suggested that a super El Nino may well have prompted the changes we have recorded in 2014-2015 but, – and it is a big but - exactly how is still not clear. Understanding and communicating the climate-ocean links to marine ecosystem changes remains a huge challenge.

Lessons both good and bad from the process were learnt and a number of the ideas will be taken forward into future conferences, for example at least a third of the SWME annual conference will be allocated to cross-cutting themes and the use of mentimeter to benchmark ideas and threats.

2. A set of Unified Categories for Ecosystem Change & Threats will be a template for future conferences The unified structure and the clear identification of important themes covering both past and future will stand us in good stead for conference and workshop sessions in future.

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5. Communication Given that communication is central to SWMEs activities, and that many of the SWME conference members are directly involved with this professionally and also have the opportunity of social media it would be worth exploring this topic more widely to see what lessons we might take from SWME work. Communicating ecosystem change is difficult but some of the process basics would a useful starting point. *All* the of the 42 ecosystem changes described in one slide at the conference could have been 10 slides – 20 min – half day or even whole day events on their own and they often have been.

The media always ask - why? Why has there been an octopus explosion?' 'Is it climate change?' etc.
One of the main purposes of the meeting was to is give the SWME community a collective view of the past and our understanding of this including many 20th Century events – this was clearly achieved – we made a start, but we will need to refine and repeat this process to work on getting greater clarity into our understanding. Hopefully this session has helped us answer this type of question.

Using the past to help us explain the future - can we do it? 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. Preparing an overview such as this – with the main themes and types of change illustrates how we might begin to manage issues in the future – such as pathogenic diseases in keystone species.

Reference Text
Describing the Ecosystem Changes in the South West

Theme 1 Natural Systems Change - Climate and Oceanographic Interactions with food chains

Summary

This theme covers the climate-ocean interactions with food chains including planktonic species and what are known as forage fish such as sardines and anchovies. Marine science in the South West has been at the heart of trying to understand these changes since the early 20th Century. The gradual changes of sea surface temperatures – marine heat waves, increased winter rainfall and storms are described. The regime shift that has taken place in the South West since the mid 2010's is also described here. Understanding the connections between climate, oceanography and pelagic systems is complicated but we need to carry on sharing our knowledge and trying to explain this to a wider audience.

Overview Climate – Ocean Interactions

Key Points - We know:

- Climate and oceans interact
- That events on a global scale influence climate and ocean event for example El Nino effects in Europe and African seas e.g.
- We now know that the north Atlantic oscillation (NAO) and Atlantic meridional overturning circulation (AMOC) drive many of our ocean processes
- In the 20th C Plymouth scientists (Russell, Southward) lead on understanding these changes on ecosystems in the south-west
- The Russel cycle … cyclical repeated change … but this is much less obvious now
- Regime shifts in planktonic communities

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

basic images Tim Smyth & Ross Saunders

- 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

Note

Climate change impacts & adaptation 'A marine heatwave is a period of unusually high ocean temperatures and is defined by its duration and intensity. One of the most common ways that scientists measure the ocean's temperature is through sea surface temperature. Deviations from average sea surface temperature are referred to as temperature anomalies. The exact sea surface temperature anomaly that constitutes a marine heatwave varies worldwide. While a marine heatwave isn't strictly defined, an anomaly of 1 degree Celsius (roughly 2 degrees Fahrenheit) off the coast of California can indicate a marine heatwave and 2-3 degrees Celsius (or about 4-6 degrees Fahrenheit) is characterized as a more extreme marine heatwave event. These warm periods can happen year-round and can stretch from 500 to 2000 kilometres (or 300 to 600 miles) across the Pacific.

NOC Marine heatwaves are caused by a range of ocean processes, acting either separately or in combination, but there are two main drivers:

1. Surface heat flux: heating from the atmosphere, which tends to occur when an atmospheric high-pressure system sits above a region of water for an extended period.
2. Advection: movement of warmer waters into the region by ocean currents.

Marine heatwaves driven by surface heat flux tend to be shallower and shorter in duration, whereas as those driven by advection can be deeper and longer in duration. Oceanic mixing processes play a key role in their occurrence, intensity, and persistence.

[Jacobs et al 2024](#) Summary 'Up to now, the UK has avoided major marine heatwaves (MHWs) that cause severe damage to marine ecosystems and the blue economy. However, an unprecedented in its intensity, though short-lived, MHW occurred in UK waters in June 2023. This event sounded an alarm bell, highlighting gaps in our understanding of MHW characteristics and their potential future impacts in the UK. Here, we use a combination of remote sensing data and model output to characterise MHWs and Marine Cold Spells (MCSs) around the UK and the wider North Atlantic, and to assess the potential for concurrent biogeochemical extreme events. Results indicate that across the wider North Atlantic, the UK is not a hot spot for MHWs or MCSs but, regionally, the southern North Sea experiences the most activity. This is also the location of extreme chlorophyll-a concentrations, here termed blue waves (low chlorophyll-a) and green waves (high chlorophyll-a). However, there is not a very pronounced relationship between temperature and chlorophyll-a extremes, which may be impacted by the exact location, drivers and season of occurrence. In contrast, the southern North Sea and English Channel may experience a MHW and low near-bottom oxygen compound events year-round, which, due to the combination of thermal stress and reduced oxygen availability, may negatively impact benthic marine ecosystems. While MHWs in UK waters do not appear to be as long-lasting or intense as other well-documented events around the world, they are projected to increase. Thus, the UK has a unique opportunity to learn from other nations and so develop robust and comprehensive policies to increase preparedness and response capability for future extreme events.'

1.2 Extreme weather - storms & beast from the east – 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 – the beast from the east e.g. Storm Emma 2018

Extreme Storm impacts:

- Profound on seashore species
- Shallow sub-tidal washouts of littoral and shallow sublittoral 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)

This is the link to the article published in 2020 by **Karin van der Wiel** et al.: **https://lnkd.in/eV8_tkHi**

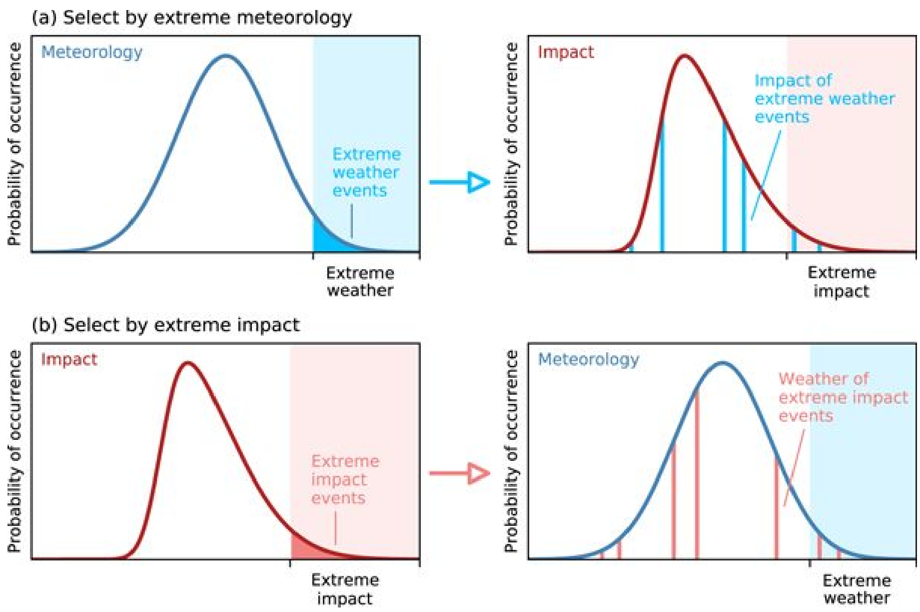


Image Sue Sayer

Note

El Niño events are defined by sea surface temperature anomalies in the tropical Pacific
El Niño events are defined by sea surface temperature anomalies in the tropical Pacific, and while they influence global weather, their effects on the UK are indirect. There is no single image of an "El Niño years time series UK" because the phenomenon is measured in the Pacific, but records of El Niño years are available from scientific sources like NOAA and the UK Met Office.

El Niño Southern Oscillation (ENSO) region sea surface temperature forecasts

Typical El Niño Effects on European Weather
The connection between El Niño in the Pacific and European weather patterns (teleconnection) involves complex atmospheric wave trains, making the effects less direct than in North America. In Europe - key tendencies observed during El Niño **winters** include:

- **Temperature:**
    - **Northern Europe:** Tendency for colder than average conditions, particularly around the Baltic region, though very strong El Niño events have sometimes shown the opposite warm impact. Significant cold air temperature anomalies are also noted over Siberia and northern Europe.
    - **Across the Continent:** A general tendency towards warmer than normal conditions across much of Europe, associated with a high-pressure tendency.
- **Precipitation:**
    - **Central and Southwest Europe:** Increased likelihood of precipitation and wetter conditions than normal.
    - **Southeastern Europe and Scandinavia:** A tendency for less precipitation and drier than usual conditions.
- **Pressure Systems:** A high-pressure system often expands over most of Europe during an El Niño winter, which can lead to a weaker Atlantic jet stream.

Graphs weak and strong ENSO events https://ggweather.com/enso/oni.htm - 1950 to present.

1.3 Land-Sea interactions – *Source to Sea – No Trees, No Seas*

With recent winters (2023 -) becoming wetter the increased volumes of freshwater into inshore coastal environments has become more apparent; this has become much more apparent on the East coast with Humber and Ouse. This is an issue not covered by the slides but brought out by a number of the audience members at the conference. The following bullet points highlight key points.

- Tim Smyth routinely reports the salinity anomalies from data from the Western Channel Observatory (WCO) in the SWME Reports.
- The increased winter rainfall and turbid freshwater run-off in the winter storms of 2026 has been implicated in the decreased ability of seabirds to feed and the seabird wreck of February 2026 (SWME 2025 report – Storms section).
- It is important to consider the input of nutrients (nitrogen and phosphorus) from riverine inputs into the south west rias. There have been suggestions that the changing nutrient balance has contributed to sea grass bed recovery.

- The Environment Agency have been leading a Source to Sea programme for a number of years. The Environment Agency's core portal for holistic water management is the Nature Recovery from Source to Sea Pilot Service Hub. This page hosts environmental data maps, estuary recovery plans, and open fish and ecology metrics.
- A South West initiative from *No Trees No Seas project* was launched in April 2026 in the South West and is highlighting the importance of the trees in general but also those lining shores of the rias. **Introducing the flowscape.** Now we have a new way of seeing trees and seas – not as separate, but flowing into one another. And we need a new way to talk about it. We're calling it a flowscape: a living system where life and energy flow from forest floors into headwaters, rivers and estuaries, all the way out to the deep ocean and back again. **Find out about the science**

1.4 The Russell Cycle – our first understanding of climate cycles and their impact on plankton ecosystems

- 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 20C
- The changes of between Calanus & invertebrate larvae dominated and pilchard egg dominated plankton hauls is illustrated in this classic image

Changes in understanding over time.

Year	Milestone / Publication	Significance
1924	Start of MBA plankton time-series at Station E1 (Western English Channel, Plymouth).	Launch of continuous plankton and hydrographic observations that later revealed the Russell Cycle.
1971	Russell *et al.* publish first analysis of long-term plankton/fish changes (Nature paper).	Documents multi-decade shifts in plankton volumes, fish larvae, and nutrients from 1920s–1970s – the empirical basis of the "Russell Cycle".
1976	Cushing & Dickson – *"The biological response in the sea to climatic changes"* (Adv. Mar. Biol. 14).	Formalizes the concept and names it the "Russell Cycle," linking English Channel plankton changes to climate variability.
1980	Southward (1980) – Comprehensive review in *J. Mar. Biol. Assoc. UK*.	Summarizes historical data, showing an alternation from a *Sagitta elegans* + high-plankton (cool) regime pre-1930 to a sardine-dominated (warm) regime mid-century, then back to cool by late 1970s.
1984	Southward (1984) – *"Fluctuations in the 'indicator' chaetognaths…"* (Oceanol. Acta).	Detailed analysis of indicator plankton species (arrow worms) as markers of the Russell Cycle; demonstrates use of biological indicators for climate-driven changes.
1988	Southward *et al.* (1988) – 400-year fish & climate history (J. Mar. Biol. Assoc. UK).	Historic reconstruction shows recurring alternation of herring (cool) and pilchard (warm) regimes since the 16th century, tightly linked with temperature fluctuations.
1997	Joint *et al.* (1997) – *"Is phosphate part of the Russell Cycle?"* (J. Plankton Res.).	Re-examines the role of nutrients (phosphate) in the Russell Cycle, testing earlier ideas about nutrient–fish correlations; part of a broader effort in the 1990s to clarify the cycle's mechanisms.

Year	Milestone / Publication	Significance
2005	Southward *et al.* (2005) – Long-term ecosystem change review (*Prog. Oceanogr.*).	Reviews 50+ years of data, concludes the Russell Cycle is **not strictly periodic** and that recent warming diverged from past patterns; notes non-linear ecosystem responses and anthropogenic influences.
2013	Edwards *et al.* (2013) – *"Marine Ecosystem Response to the AMO"* (PLOS ONE).	Demonstrates that the Russell Cycle aligns with the Atlantic Multidecadal Oscillation; multidecadal plankton and fish changes in the NE Atlantic are driven by AMO-related climate shifts.
2016	McManus *et al.* (2016) – *"Is the Russell Cycle a true cycle?"* (ICES J. Mar. Sci.).	Uses updated data to show that post-1980s changes do not repeat the earlier cycle exactly; concludes the "cycle" is better seen as regime shifts and cautions against assuming strict periodicity.
2020s	Ongoing research (e.g. Beaugrand, Bode 2023) on climate-driven regime shifts.	Current studies identify synchronized plankton shifts in the late 1980s and early 2000s across the North Atlantic, confirming that ecosystem changes continue and are influenced by both natural oscillations and global warming trends.

1.5 Is the Russell Cycle still relevant? The Atlantic Multidecadal Oscillation (AMO)

AI-assisted literature summary:

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.

1.6 Climate oscillations can manifest through SST change

Clare Ostle (MBA) will give a talk at the Royal Society on Monday – early January 2026

"The Continuous Plankton Recorder (CPR) survey, the longest and most extensive plankton time-series in the North Atlantic, reveals how warming since the 1980s has reshaped plankton communities - diatom abundance has risen at higher latitudes due to reduced light limitation, while declining in subtropical regions as nutrient limitation intensifies. Models suggest this trend may soon reverse, with nutrient constraints driving an overall decline in diatoms and a shift toward elongated taxa and dinoflagellates, signalling a potential tipping point for reduced productivity and carbon export in the Subpolar Gyre. These changes could cascade through marine ecosystems, altering food webs and carbon cycling, making long-term datasets like the CPR vital for predicting and responding to oceanic shifts."

The Edwards paper is a CPR paper Ref… and Beaugrand also works with CPR data, so there has definitely been CPR work looking at the Russell Cycle.

1.7 **Strong El Nino events and Abrupt Community Shifts (ACS) in the Atlantic**
Beaugrand et al   2019 – Nature: Climate Change Letters.

P240 '***Widespread Abrupt Community Shifts were always observed after El Nino events** .. Weak & strong episodes 1997-1998 and 2015-2016 … but not all El Nino events lead to a widespread ACS prediction … and the spatial extent of the two strong events differed …*

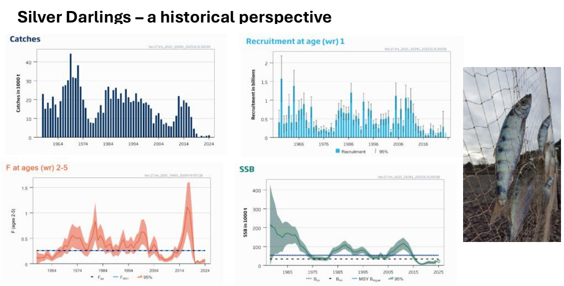
P242 Concluding … '*Our framework could therefore be meshed with existing monitoring programmes to provide a macroscopic tool for regions likely to develop Abrupt Community Shifts and help to anticipate biological perturbations that could affect the production and ecosystem goods and services. **For example, our framework has predicted an ACS of unprecedented scale in 2014-2015 that may substantial ecological consequences across the Northern Hemisphere**, including in the Arctic where current changes such as sea ice melting are accelerating'. See Fig 4.*

By the time the paper had been published in 2019 … the changes highlight in Angus Atkinsons' slide had already happened! A very strong El Nino is predicted for 2026-2027. Are we looking hard enough in real time for such changes? This is very relevant because 2026-2027 is predicted to a very strong El Nino

1.8 Shifts in plankton – the new normal – Angus Atkinson

Images show: L4 declining summer phytoplankton and L4 Increasing dominance of small plankton
- 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?

1.9   Sardines in history – Silver Darlings – a historical perspective



Libby West Note for slide: **Paper on Celtic Sea herring published in 1974:**
1.High catches in the years 1966-69 were caused in the first place by a sharp increase in fishing effort. After a transitional period, catches will decline to a lower, sustainable, level in the early "seventies". 2. Catches in the period 1966-69 were favourably influenced by the occurrence of strong year classes. This caused an increase in maximum sustainable yield of 50%, compared to the years 1962-65.

3. Estimates of the total mortality rate for Celtic Sea herring prior to 1966 may have been too high, and estimates of maximum sustainable yield accordingly too low.
4. Taking the above factors into consideration, Molloy's (1969) figure of 22000 tons/year seems to be a realistic estimate for the maximum sustainable yield, provided year class strength remains at about the 1966-69 level

There are classic time series images of pilchard-sardine population booms and busts across the 20th Century – one of the Russel Cycles papers

1988	Southward *et al.* (1988) – 400-year fish & climate history (J. Mar. Biol. Assoc. UK).	Historic reconstruction shows recurring alternation of herring (cool) and pilchard (warm) regimes since the 16th century, tightly linked with temperature fluctuations.

Paper Sardine (Sardina pilchardus) egg abundance at station L4, Western English Channel, 1988-2008

- May 2010
- Journal of Plankton Research 32(5):693-697

DOI:10.1093/plankt/fbp052

Authors:

S. H. Coombs

N. C. Halliday

David V. P. Conway

- Marine Biological Association of the United Kingdom

Timothy Smyth

- Plymouth Marine Laboratory

Results from sampling for sardine (Sardina pilchardus) eggs at station L4 in the coastal Western English Channel over the period 1988-2008 are presented and discussed in relation to environmental conditions. As previously observed in this area, there is a summer spawning season (mid-March to early July) and one in the autumn (early September to mid-November). The historical trend for increasing autumn spawning has continued. The mean spawning temperatures were 12.6 and 14.5°C for the summer and autumn seasons, respectively. Temperature was negatively correlated with summer egg abundance and positively with autumn egg abundance. A negative correlation between egg abundance and the North Atlantic Oscillation index suggested a link between egg numbers and plankton production. © The Author 2010. Published by Oxford University Press. All rights reserved.

1.10 Small Pelagic Fish in SW What are dynamics in "buffer" area between Biscay and North Sea? Jeroen van der Kooij

Image sardine, anchovy & sprat numbers since 2013 Peltic survey

Key points

- 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.

1.11 Changes intertidal species ecology Nova Mieszkowska Marclim (nova@mba.ac.uk)..

'MarClim data for 87 species of macroalgae & invertebrates echo the shifts in pelagic species seen in the early 2010s, with a slow down in the longer term trend of increasing abundance of Lusitanian warmwater species across UK shores, and a corresponding slowdown in the decline in abundance of Boreal cold water species. This was linked to a slow-down in SST increase for a few years, however, when the warming trend continued again a few years later the increasing trend in abundance of warm water Lusitanian species continued again, whilst abundance of cold water boreal species continued to decline.'

Theme 2 Recent changes to Keystone species

Summary

Since SWME started in 2008 there have been some remarkable changes to keystone species in the South West. This sections describes these changes with a variety of example species that have returned such as Atlantic Bluefin Tuna, and spiney lobsters and others whose range has shifted away from the South West northward such as Basking Sharks and Mackerel. These changes – a regime shift – parallel those recorded in plankton and forage fish populations. This process of change is still continuing with the Common Octopus population 'explosion; in 2025 being a good example.

2.1 Blue Shark changes - Overfishing or Ocean currents? Simon Thomas

All shark species increased in numbers during the mid-2010s except mako, which are now rare in the UK. Blue shark CPUE increased dramatically during this period and matched or exceeded values seen in the 1950s. The highest number of blue sharks released in one day during 2015 was 107 by Robin Chapman, Bite Adventures), whilst Murray Collings (Swallow 2 , Looe) released 58 blues sharks , a new port record in 2025. CPUE of blue sharks was significantly positively correlated with the sub-polar salinity anomaly described by Chafik et al. 2020 and with the AMO at a lag of 5-10 years.

Key Points

- Systematic catch recording since 1953
- Clear and steep declines – early 1960's – 2005, then recovery – catch & release universal
- 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)

Key Points

- 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.

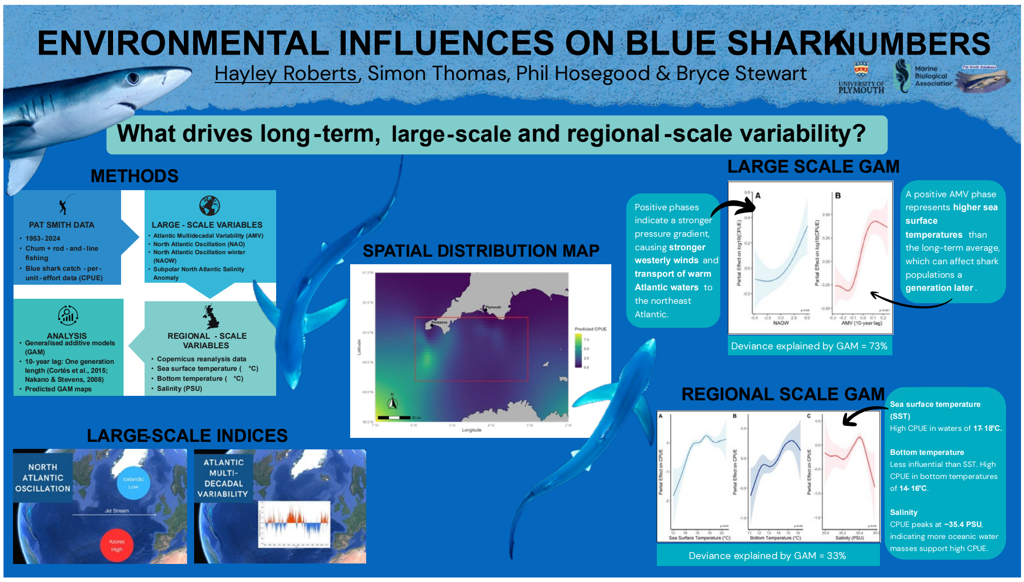
All shark species increased in numbers during the mid-2010s except mako, which are now rare in the UK. Blue shark CPUE increased dramatically during this period and matched or exceeded values seen in the 1950s. The highest number of blue sharks released in one day during 2015 was 107 by Robin Chapman, Bite Adventures), whilst Murray Collings (Swallow 2 , Looe) released 58 blues sharks , a new port record in 2025. CPUE of blue sharks was significantly positively correlated with the sub-polar salinity anomaly described by Chafik *et al.* 2020 and with the Atlantic Multidecadal Oscillation at a lag of 5-10 years. Although Bluefin tuna were not modelled, due to total absence from the mid-1950s from SW waters, they returned during 2014-2015

The cold blob & salinity Nature paper on 2014-15 events -   published 2020 Simon Thomas

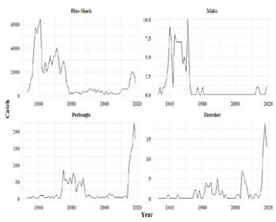
This was a fairly pivotal paper for me, as they provide some glimpses into how the salinity anomalies could cause subtle changes to the North Atlantic currents. These changes are the main environmental driver shown in the models of blue shark numbers in the U.K. along with the AMO lagged at 5-10 years. A small deviation in the strength and position of the NAC could have profound affects on the routes that highly migratory species follow. The effect is there for other shark species as well

https://www.nature.com/articles/s41467-020-14474-y

Slide ENVIRONMENTAL INFLUENCES ON BLUE SHARK NUMBERS
<u>Hayley Roberts</u>, Simon Thomas, Phil Hosegood & Bryce



Shark numbers captured by anglers in the UK since 1953.



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- Catch Per Unit Effort higher than 1950s for blue sharks.
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- Global shark numbers haven't increased.

2.2 Atlantic Bluefin Tuna - Change 20th C & 21st C Tom Horton

Key Points

- 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

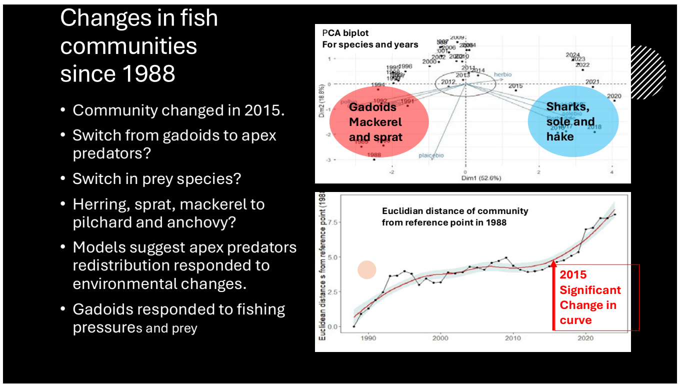
Faillettaz *et al*. (2019) https://doi.org/10.1126/sciadv.aar6993
Horton *et al.* (2021) https://doi.org/10.1093/icesjms/fsab039

2.3 Southern-breeding seabird influxes - The new normal?

Cory's and great Shearwaters – the link to Blue Fin Tuna - Alex Banks

- 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

2.4 Regime shift in balance of fish populations - apex predators - A major change in 2015? Changes in fish Communites since 1988 – Simon Thomas



Key points

- 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

Modelling suggested that there was a statistically significant shift from Gadoids (cod) species to apex predators during the mid-2010s and that this shift correlated with declines in prey species such as mackerel, herring and sprat. Although the data set is not long enough to include in the modelling, this also correlated with an increase in anchovy and pilchard. The modelling suggests that complex interactions between fishing pressures and environmental factors were involved in these changes, with apex predator numbers correlating closely with changes in environmental variables and gadoid stocks aligning with fishing pressure.

Community analysis with GAM, GAMMs and threshold GAMs indicated that gadoid numbers decreased, whilst apex predator numbers increased (tuna weren't included due to large period of absence, returned at the same time). Plaice decreased, while sole and hake numbers decreased initially before declining with a correlation with increased fishing mortality (F). Including environmental and fishing factors, Gadoids decrease correlated with increased fishing pressure with some indication of a correlation with the NAO, whilst shark numbers correlated with changes in the sub-polar salinity, gadoid fishing mortality and the AMO lagged by 10 years (Hayley Roberts MSC project). Herring SSB showed correlations with gadoid and herring fishing mortality. Sole and hake SSB correlated with the NAO, SST, salinity anomaly and gadoid F, then declined with increasing fishing mortality.

2.5 Rapid and recent fish decline at L4 - Karen Tait

Diagram key elements

- Size spectrum approach – a causal mechanism … decline in small fish (size range 0.1-1mg C)
- Observed decline in fish eggs/larvae
- Decline in fish diversity

Karen Tait This timing also aligns with a recent paper by Karen Tait and colleagues highlighting changed in fish populations from plankton sampling and DNA studies: Weekly eDNA samples spanning 2012 – 2022 revealed a major decline in fish diversity, with ~60% fewer species being detected. The biggest losses have been among larger commercially important benthopelagic, demersal and reef-dwelling taxa. At the same time, fast-maturing pelagic species such as sardine and anchovy have increased. These changes match a decline in fish egg and larval biomass, suggesting fewer young fish are being produced or surviving. A parallel pelagic biomass size-spectra time series (2008 – 2024) spanning bacteria to fish larvae provided a mechanistic explanation: increasingly steep slopes and declining spectrum elevation show that the marine food web is now supporting far fewer small fish that it used to – around 50% less. This appears to be linked to reduced nutrient supply in summer, which limits how much life the plankton community can support.

2.6 Changes to fish species – Bob Earll

A number of species of bream are now common the rias of Devon and Cornwall including Gilthead and Couches Bream. However, the arrival of huge numbers of Black Spot (Red) Bream in 2024 & 2025 was remarkable and Simon Thomas has pointed out is similar to very high numbers of these bream since the 1980s since which time they have been absent until 2024-2025. https://swmecosystems.co.uk/annual-reports/fish-reports-2025
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…

- Return of Black Spot Bream
- Establishment of Comber
- Explosion of Conger Eels in 2024 & 2025 – now a keystone species
- Declines and movements of other species – gadoids - Mackerel – now a winter visitor

2.7 Basking sharks - 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

2.8 *Calanus* decline - Implications for food web? Angus Atkinson

- 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?

2.9 Spiny Lobsters - *Palinurus elephas*: from local extinction to return after 40 years - Keith Hiscock

- Populations of *P. elephas* crashed in the 1970s but have been re-establishing in south-west England since about 2014.
- Whilst over-exploitation was assumed the reason for the crash, recruitment must have been poor for many years until about 2014.
- 2025 was a remarkable year in parts of the south-west for aggregations and generally very high numbers of small and medium sized individuals.

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

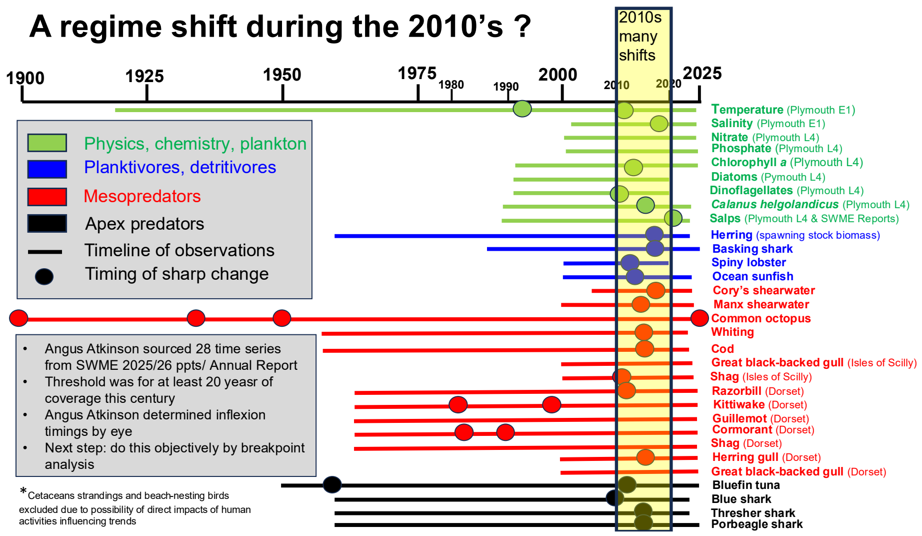
2.10 Common octopus (Octopus vulgaris) blooms off the southwest of the UK: History, trends, causes & consequences

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

- 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

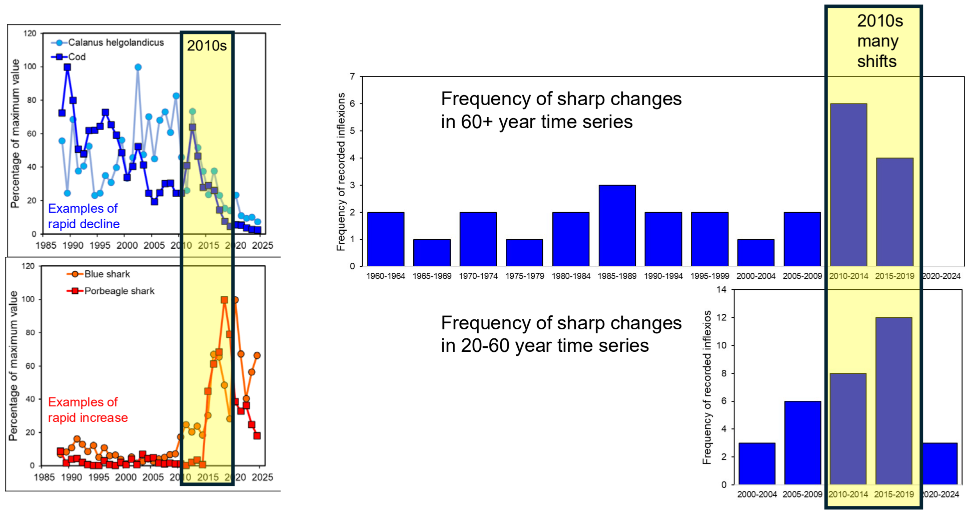
- Commercial landings of *common octopus* in 2025 were almost *65 times higher* than the recent average
- Sea and air temperatures during the year of each bloom and the preceding year were *unusually warm*
- Environmental conditions & modelling indicated that octopus *larvae were being transported* to 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
- They have become a keystone species
- Predation by octopus appears to have caused significant drops in landings of brown crabs, lobsters and king scallops
- Octopus have provided food for conger eels, blue shark, seals and Risso's dolphin

2.11 Abrupt shift in marine species – mid 2010's Angus Atkinson



- Diagram to sum up the inflexion point idea – where species numbers have dramatically gone up or down, focussing on the period between 2010-2020
- The time series strictly to only those time series reported in SWME Report for 2024, this year's slide pack and last years Conference ppts, with only time series with 20+ years of data this century reported.
- In my view if we do some objective analysis like breakpoint analysis and it shows more or less the same as my "by eye" approach, we have got likely quite a strong story from just these data sources to suggest that the 2010s were a period of massive change in the West Country.
- This also supports the modelling Simon Thomas has demonstrated in his slide in the pack.
- So my thought is whether, in principle, if we can perform a breakpoint analysis to define these inflexion points a much more objectively.
- The simple hypothesis is that we have recently witnessed a major regime shift in the SW Marine Ecosystem, and a simple summary output would be a frequency distribution of the timings of observed inflexion points over the last 30 years, presumably clustering around the mid 2010's.

A regime shift during the 2010's? Angus Atkinson



NOTE Did the strongest El Nino on record in 2013-2025 trigger changes in Ocean sunfish and common dolphin numbers? Rebecca Allen

Rebecca Allen (she/her) Marine Conservation Officer Cornwall Wildlife Trust
Email: rebecca.allen@cornwallwildlifetrust.org.uk

An AI answer (Google Gemini) but I asked if the strong El Nino in 2013-2015 might have triggered some of the changes we have seen in our **Seaquest survey data**.

'You are spot on—the 2014–2016 El Niño was one of the strongest on record (often called a "Godzilla" El Niño), and while it starts in the Pacific, its "teleconnections" absolutely ripple into the North East Atlantic. In your data, this event aligns perfectly with the transition point where your "Old Normal" began to break down.

How El Niño (2014-16) likely "Triggered" your data shifts:

1. The Thermal Kick: El Niño events often correlate with a Positive North Atlantic Oscillation (NAO) a year or so later. This brings stronger, warmer westerly winds to Cornwall. In your data, 2014–2016 is exactly when the Sunfish and Harbour Porpoise reached their peak presence—likely following a massive pulse of warm-water plankton and jellyfish brought in by these shifted currents.
2. The "Bridge" to the New Regime: While El Niño is a temporary cycle, it acted as a "heat injection" into an already warming Atlantic.
   - Pre-2015: The NE Atlantic was still influenced by a "Cold Blob" (a sub-polar cooling anomaly).
   - Post-2015: After that El Niño, the thermal barriers seemed to drop. This is exactly when your Common Dolphin numbers stopped being "occasional summer visitors" and started their 5x climb toward becoming year-round residents.
3. The Tuna Connection: Blue-fin Tuna are highly sensitive to "Thermal Corridors." The warming of the Atlantic during and after that 2015 peak likely opened the door for their migration to shift back toward the UK. They "tested the waters" during the heat of 2015-16, and by 2020, they had officially established the 10% presence you see today.

What this means for your 2016 "Split":
By choosing 2016 as your "Post" era start date, you have accidentally—but brilliantly—captured the aftermath of a global climate shock. * Your "Pre-2016" data represents the tail end of the "Stable Atlantic" era.

- Your "Post-2016" data represents the "Post-El Niño" world, where the baseline temperature of the English Channel has stepped up, allowing the dolphins and tuna to take over.

Analysis Idea:
If you want to see if the El Niño specifically "broke" the system, look at your Sunfish data again. They peaked *during* the El Niño years (2014-16) and have crashed since. This suggests they were "hitchhikers" on that specific event, whereas the Common Dolphins used the event to move in and stay.
Does it feel like the "pieces of the puzzle" are fitting together now? You've got the data, the species trends, and now the global climate trigger!'

There are also concerns emerging on LinkedIn of a super El Nino event starting in 2026 and impacting 2027 e.g. **Key Projections for 2027**

- **Record-Breaking Global Temperatures**: Scientists from Berkeley Earth and the World Meteorological Organisation warn that because of the typical 6–12 month lag between peak ocean warming and peak global air temperatures, the heat from the 2026 El Niño will likely culminate in 2027.
- **Potential for a "Super" El Niño**: Latest modelling from the European Centre for Medium-Range Weather Forecasts (ECMWF) indicates an 80% chance of a "strong" event and a 22% chance of a "super" El Niño (sea surface temperature anomalies exceeding +2.0°C).

Theme 3 Natural Diseases

Summary

Four examples are given of pathogens that have caused major disruptions and die backs in sea grass, native oysters, seabirds and seals. These events are often caused by naturally arising pathogens - viruses, bacteria and protozoans. In many ways these pathogen events seem to be 'random' in terms of their timing and not attributable to human activities despite various efforts to attribute them to all sorts of other factors. When these events occur they often prompt a major social-scientific community response and so if we are to learn from the past then we need to be prepared even though predicting these events is impossible. The impact of these events can be long standing and pathogens like Bonamia (a protozoan parasite) still afflict native oysters restoration programmes.

3.1 Sea grass – Martin Attrill

Large die off of seagrass in the UK and beyond in 1930s has been attributed to the impact of Wasting Disease, although actual amounts lost and the causative agent(s) for this loss have not been conclusively determined.

Work in Plymouth Sound has dated the sediment under Drakes Island seagrass bed, with a 3m core being around 1200 years old and evidence of a very stable sediment. Seagrass seed found deep in the core suggests the bed has been there at least 500 years, with little evidence of impact of the disease in the 20th C. It is likely that seagrass existing since 1930s is not so susceptible to disease. Patterns of carbon storage are impacted by distinct layers of coal in the sediment.

The impact of disease key messages Seagrass *Zostera marina Labyrinthula zosterae*, a wasting disease
Cores – long term – time series histories – paper
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.
Allows calculation of carbon storage rates and historical investigations: what factors may relate to 1930s decline?

Google AI – **Timing of the Seagrass wasting disease**, caused by the protist *Labyrinthula zosterae*, primarily impacted European *Zostera marina* (eelgrass) populations during a catastrophic pandemic in the **early 1930s**. [1, 2]

Key Historical Timeline

- **Initial Detection (1931–1932):** The disease was first reported in North American Atlantic populations in 1931 and reached European Atlantic coasts by **1932**.
- ⍰ **Peak Epidemic (1932–1934):** The most intense period of the die-off occurred between 1932 and 1934, resulting in the loss of up to **90%** of eelgrass beds across the North Atlantic. In specific regions like Northern Ireland, severe effects were noted by 1934, where virtually no leaves remained on some shores.
- ⍰ **Extended Decline (1930–1940):** While the most rapid losses were in the early 30s, the overall "wasting disease decade" is generally cited as **1930 to 1940**.
- ⍰ **Recovery Phase (1940s–1960s):** Signs of local recovery began appearing after 1940, though substantial recolonization in many European areas did not take place until the **1960s**. [1, 2, 3, 4, 5, 6]

3.2 Diseases in benthic species - an important reason for 'change' Keith Hiscock

Key Points

- 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'/ has it already happened? Starfish wasting disease (devastating on the Pacific coast of the USA) detected in the Irish Sea in Sunstars.

Image examples:

- ❖ Pink Sea Fans *Eunicella verrucosa. Vibrio splendidus (a bacterium)*
- ❖ *Labyrinthula zosterae*: a wasting disease (seagrass) (1930's starting in 1931-32)
- ❖ bald sea urchin disease *Listonella anguillarum* and *Aeromonas salmonicida* (bacterial infections):
- ❖ Species that have been notably affected by disease include Native Oysters *Ostrea edulis, Bonamia exitosa,* a protozoan parasite
- ❖ *Vibrio pectenicida: strain FHCF-3 (a bacterium) (potential to devastate some echinoderm populations)*

3.3 Avian Influenza (HPAI) Any lasting effects on SW seabirds? Alex Banks

Key Points

- 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

Dead Gannets washing up on the shore were one of the most obvious symptoms of HPAI 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)

3.4 Phocine distemper virus

From Wikkipedia

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 defense 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 & Restoration

Summary

The focus of modern marine conservation and management efforts is on the restoration and recovery of marine species and habitats. This includes species efforts to protect the species such as great whales, seabirds from rat predation and the recovery of sea grass. At a habitat level Marine Protected Areas (MPAs)are seen as one of the main mechanisms for achieving recovery. The changes recorded can be quick such as with seabird nesting after rat eradication to much longer in terms of the recovery of great whale populations. Despite over 50 years of work on MPAs in the UK and apart from Lundy and Lyme Bay progress there are still too few examples of what MPAs could achieve in the South West if properly protected.

4.1 Seagrass recovery programmes - The importance of the land sea interaction – nutrients Martin Attrill OCT

Over recent years, seagrass in Plymouth Sound has shown a significant increase in area, including the appearance of large intertidal seagrass beds in the Tamar, actively restored beds in Jennycliff Bay and natural spread in Cawsand Bay. Seabed Scanning work by Pete Holt, together with historical investigations, suggests levels of seagrass now are close to what they were in the 1930s, although some potential beds (eg North of the Mew Stone) have not yet reappeared. Elsewhere in the SW large beds have been recently discovered and mapped in areas such as St Austall Bay and Mounts Bay, while further restoration and recovery is apparent in the Fal/Helston estuarine system. This recovery maps on to increases seen across Europe, likely due to pressure mitigation such as pollution reduction and physical damage control.

4.2 Slide   MPA Lundy & Lobsters – Recovery – Not a simple story – Keith Hiscock

- 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 (which continues to be a poor remanent of condition in the 1970/80s). So, it was the previously exploited species that benefited unless there were knock-on effects (such grazers being consumed - well established for e.g. New Zealand) but no effects seen at Lundy.

Emma Sheehan has a paper in press on Lundy Lobsters too …

4.3 MPA Recovery Lyme Bay – Emma Sheehan & Amy Cartwright
Importance of long-term monitoring to evidence ecosystem-based management

The graph in the top right of the slide shows the taxon richness across the four treatments (SI – Statutory Instrument, these sites have been closed to mobile fishing gears since 2008. SA – Special Area, these sites have been closed to mobile fishing since 2011. PVC – Previous Voluntary Closure, these areas have been closed to mobile fishing gear since before 2008 as part of a voluntary agreement with local fishers. OC – Open Controls, these reference areas are still open to mobile fishing) analysed in the Lyme Bay Long-Term Monitoring Study. Data is from 2008 – 2023 (most recent year of funding to support video analysis, although the data collection has continued and we have just received funding to analyse 2024, and hopefully the 2025 analysis will be funded soon). The data shown was collected using a towed underwater video system.

The data shows the recovery of the closed areas since their respective year of protection. 2014 shows a marked decrease in taxon richness, this is due to the severe winter storms of winter 2013 – 14. The data also shows that the communities recovered more quickly after the storms than they did after mobile fishing ceased at the start of the study, however the overall abundance of animals has only just reached pre-storm levels in some protected treatments, although the diversity has surpassed pre-storm levels in some protected areas. Sheehan et al. (2021) https://doi.org/10.3389/fmars.2021.671427

The images show an example from one of the protected sites (Site 56) across a ten-year period - in 2008 (just after the closure to mobile fishing gears), in 2013 and again in 2018. Also shown is an infographic from a paper by Renn et al. 2024 which brought together all the research up to that date, including both the socio-economic and ecological components of the work https://doi.org/10.1093/icesjms/fsad204

References:

Hickman, J., Conlon, R., Reynell, S.E.A., Renn, C., Millan, C.A., Mallard, C., Cartwright, A.Y., Sheehan, E.V. 2024. Lyme Bay – a case study: Response of the benthos to the zoned exclusion of towed demersal fishing gear in Lyme Bay; fifteen years after the closure. March 2024. Report to Natural England, Defra and Blue Marine Foundation from the University of Plymouth. 84 pages.

Renn C, Rees S, Rees S, Davies BFR, Cartwright AY, Fanshawe S, Attrill MJ, Holmes LA, Sheehan EV (2024) Lessons from Lyme Bay (UK) to inform policy, management, and monitoring of Marine Protected Areas. ICES Journal of Marine Science. https://doi.org/10.1093/icesjms/fsad204

Sheehan EV, Holmes LA, Davies BFR, Cartwright A, Rees A, Attrill MJ (2021) Rewilding of Protected Areas Enhances Resilience of Marine Ecosystems to Extreme Climatic Events. Frontiers in Marine Science https://doi.org/10.3389/fmars.2021.671427

4.4 Seabirds & rat eradication - Success story – what is the limit now rat free? Alex Banks

Key Points

- 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 Last whole island count gave a value of 648 Apparently Occupied Burrows (i.e. pairs), as reported in the 2024 SWME report. (This includes some islands which may still be rat infested, but it's the total for the archipelago and includes St Agnes and Gugh which are rat-free).
- Huge increases in guillemots and razorbills on Lundy – another benefit of rat eradication?

4.5 Great Whales -Slow Recovery – Dan Jarvis

- 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 resumption of whaling by NORWAY – huge quota of minke whales in 2026
  Norway has set a 2026 quota of 1,641 common minke whales, up 235 from 2025, describing it as sustainable management. Environmental NGOs, including ORCA, strongly oppose the move, disputing welfare claims and arguing commercial whaling contradicts global conservation consensus and public sentiment.17 Feb 2026

Theme 5 Human impacts – fisheries

Summary

The impact of human activities on the marine environment through the activities of fisheries is long standing and has been well documented for decades. The impacts of overfishing, and seabed trawling in particular continue to have profound effects on the functioning of marine ecosystems. Not least of the impacts is to the fishing community itself. Fisheries management continues to try and grapple with the challenges this poses. The changes documented are profound, and long standing (chronic), of considerable magnitude and continue to this day.

5.1 Collapse of bottom trawling catches/historic impact of fishing – 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

5.2 Seabed Trawling - Ongoing, cumulative damage ? - 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

Libby West Notes
Before 1820 trawling limited to a few locations around south/ southwest coast
From 1820s,improved transport networks (mainly railways)opened up large markets in inland cities for cheap supplies of fish, thus stimulating the rapid spread of trawling

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.
Is this the new normal we have been observing?
The Celtic Sea ecosystem status partially recovering since 2010 BUT results from the last few years of SWME – is that recovery slowing?
Rumohr and Kujawski (2000) noted that 25% of the bivalve fauna recorded in the North Sea in the first half of the twentieth century are no longer present

5.3 SW bottlenose population – Declining or changing range? Ruth Williams

We know from historical audits that many of our small cetaceans declined in the 1960s and 70s, and in the case of our bottlenose dolphins, disappeared completely from our inshore waters. This was due mainly to pollution (things like the highly toxic DDT pesticides they used to use on daffodil fields). In September 1990, the bottlenose dolphins returned with a pod regularly seen travelling along the Cornish coast from then on. The Cornwall Dolphin Group was the pre-cursor to Cornwall Wildlife Trusts Seaquest citizen science programme which has been running now for over 30 years, encouraging people to send sightings of marine megafauna they spot whilst out and about.
Through these records we know that Bottlenose dolphins (BND) were regularly seen around Cornwall but they seemed to be declining in numbers which was a key concern. However, the statutory agencies were not really aware we even had resident inshore bottlenose dolphins in the SW, they simply weren't on their radar as citizen science data was not recognised as valid data and they relied on commissioned boat or aerial surveys. So in order to ensure the best protection for these vulnerable animals we needed to collate strong scientific evidence to support any future conservation action.
The SW Bottlenose Dolphin Consortium was formed as an outcome of these initial concerns, mooted at one of the SWME conferences, in 2016. The consortium is a partnership of various stakeholders, from NGOs, SNCBs, individual recorders and wildlife tour operators.. The aim was to collate sightings data and photo identification to inform a better understanding and therefore conservation of the region's bottlenose dolphins. Findings have proved that we do have a resident group of BND in the SW, approx. 48 animals but they currently range much wider than we knew, all along the South coast. These animals do not mix with other groups and have a distinctly separate social network, and stick to inshore waters shallower than the 50m depth contour. Despite much of the data being SW centric it looks like the range of these animals is changing from being seen almost daily around the Cornish coast in previous years to now covering a much wider range, and groups spending considerable time, up to Sussex in the English Channel. This has significant implications for the conservation of these animals. The data from this consortium has resulted in the wider area being designated as the Western English Channel IMMA Important Marine Mammal Area. Whilst these are not statutory protections, they highlight the importance of the area to mobile species and we hope will add weight to better formal protection in future.

Findings from Dudley et al 2023 (link below) - Coastal bottlenose dolphin populations are highly vulnerable due to their small population sizes and proximity to human activities. Long-term studies in the UK have monitored populations protected within Special Areas of Conservation (SACs) since the 1990s, but a small community of bottlenose dolphins inhabiting the coastal waters of southern England has received much less attention. The English Channel is one of the most heavily impacted marine ecosystems worldwide and increasing anthropogenic pressures pose a severe threat to the long-term viability of this population. Conservation measures to protect these animals have been hindered by a lack of knowledge of population size, distribution and ranging behaviour. This study aimed to fill these knowledge gaps.

A citizen science sighting network yielded 7458 sighting reports of bottlenose dolphins between 2000 and 2020. Resightings of identified individuals were used to estimate abundance, distribution, and ranging behaviour. Social structure analysis revealed a discrete interconnected group of animals in shallow coastal waters, which did not appear to mix with conspecifics identified further offshore. A Bayesian multi-site mark–recapture analysis estimated that this population comprises around 48 animals (CV = 0.18, 95% HPDI = 38–66). These dolphins ranged between North Cornwall and Sussex, with an average individual range of 530 km (68–760 km). Areas of high-modelled habitat suitability were found to overlap with high levels of anthropogenic pressure, with pollution and boat traffic identified as the most pervasive threats.

Although adult survival rates indicated that the population was relatively stable
from 2008 to 2019 (0.945 (0.017 _ SE)), the small population size implies a significant risk to their long-term viability and resilience to environmental change. By highlighting the most deleterious anthropogenic activities and regions of conservation significance, our results will be useful for developing management policies for threat mitigation and population conservation, to protect this vulnerable group of dolphins.
https://www.researchgate.net/publication/376204714_Using_citizen_science_data_to_assess_the_vulnerability_of_bottlenose_dolphins_to_human_impacts_along_England's_South_Coast

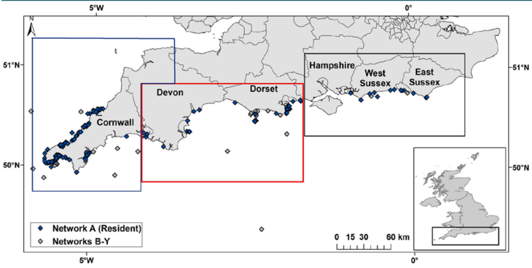


Figure 1 Map of study area with areas of interest indicated (Projection: GCS_WGS_1984). The study area is segregated into three discrete regions: Site 1 (North Devon and Cornwall) in blue, Site 2 (South Devon and Dorset) in red and Site 3 (Hampshire and Sussex) in black. Blue diamonds represent photo-verified encounters of network A (the resident population) and other networks B-Y in grey.
Fact Sheet_Bottlenose dolphin talk_ammended.pdf

5.4 Cetacean Strandings - Has management had any impact? Ruth Williams, SWME 2026

Cornwall Wildlife Trust Marine Strandings Network is a unique volunteer network that records all dead organic forms that strand on Cornish beaches and coastline – mainly cetaceans, seals, seabirds and jellyfish but we record everything else as well. The MSN took over the reins from long standing volunteers Stella Turk and Jan and Jeff Loveridge in 1992 and have run the programme under the Defra funded Cetacean Strandings Investigation Programme license ever since. The research has revealed so much about our marine life, our cetaceans and seals in particular: their lives, causes of death and the threats they face. This knowledge is helping to support the fight for their conservation.

The MSN runs a 24 hour 365 days a year hotline for people to report any strandings to. Trained volunteers are then sent to record details of each animal and assess external injuries, take photos and determine if suitable for post mortem. As you can see from the graph we regularly get between 100 and 250 dead cetaceans washing ashore, which we believe from drift modelling to be approximately 5-10% of all animals that die at sea. Evidence from Post Mortems and our Bycatch Evidence Evaluation Protocol findings from external injuries proves that about 30% of all stranded cetaceans was due to bycatch in fishing nets, the primary cause of death for our local cetaceans.
You can see in the graph that there was a significant peak in numbers of strandings in the early 2000's. This evidence triggered a big public campaign to raise the issue of bycatch and together with other NGOs we lobbied government to change policy. This resulted in a new EU regulation number 812 which came in in 2004. The regs included compulsory use of acoustic devices, and an observer scheme to monitor bycatch but only on specific vessels in specific areas. Essentially it was a small step for a very limited number of larger

vessels but did help to increase the protection of dolphins and porpoises against accidentally being trapped in these fleets.

The UK government followed soon after with a ban on UK bass pair trawl fishery within 12 nautical miles of the English coast. Huge numbers of common dolphins were dying in these football-pitch-sized nets that are dragged between two fishing vessels (hence the name ‘pair’ trawl). These measures did not apply to the fleets of any other nation pair trawling though, and these vessels can still fish in UK waters legally.

In 2008 we had a mass stranding of 80 Common Dolphins in the Fal river, of which 26 couldn’t be refloated and died as a result. Together with CSIP and BDMLR, we conducted a thorough investigation into this mass stranding and whilst not conclusive, it was found to potentially be linked to Naval sonar activity in the area in preceding hours. Results have helped inform new Royal Navy protocols to limit the risk of a mass stranding occurring again.

As well as bycatch, our data have contributed towards a lot of other findings. We know interspecific aggression occurs regularly, particularly bottlenose dolphin attacks, seen from internal injuries but also indicated by rake marks externally. PCBs are a fire retardant pollutant which builds up in top predators and high levels affects immune systems and makes cetaceans more susceptible to infectious disease like Brucella. Gas bubble lesions have been identified in the tissues of cetaceans – a condition similar to the bends in humans caused probably by supersaturation of nitrogen. And incidences of starvation in our cetaceans is increasing which points towards the wider degradation of our seas and impacts on feedfish availability.

Because bycatch is one of the biggest threats locally we wanted to do something proactive to help mitigate this problem, so undertook a series of realtime trials of acoustic deterrents / pingers. These were shown to work and reduced the risk of animals getting caught in fishing nets by 82% but disappointingly they are still not in use in UK waters due to licensing hurdles and lack of Government will to allow them to be used in areas of high risk.

Despite these few management measures that have been instigated, you can see that strandings figures remain incredibly high. Government have commitments in the Fisheries Act and other legislation to: *minimise, and where possible, eliminate cetacean and seabird bycatch. Bold words but these have lacked any action*. We have a very high level UK dolphin and porpoise conservation strategy, a Bycatch Mitigation Initiative and a multi-million pound funded ‘Clean Catch’ programme that has a very fancy website and sadly little else to show in terms of action. So, in summary, there has been token management but strandings continue and things are not changing in terms of action to minimize bycatch or protect our cetaceans!

5.5 Pacific Oysters: Deliberate introduction of non-native species - Unintended consequences - deliberate introduction of non-native species' Keith Hiscock

Key Points

- 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’.

Pacific oysters

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

- 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 impact - Pollution

Summary

In many ways it could be said that the publics awareness of marine pollution was first triggered by the wreck of the Torrey Canyon oil tanker in the South West. Since then there have been other 'events' such as death of dolphins from naval sonar testing, the PCB pollution events or the spills of biobeads from sewage waste treatment plants. Their effects have been relatively short lived. Sewage waste disposal in the sea via poorly regulated has become an issue once again exacerbated by high winter rainfalls. TBT the active ingredient in ship anti-fouling paint) and the most toxic pesticide ever used in the marine environment has taken decades to control.

Unlike the short term visible effects of an oil spill the insidious and gradual impacts of the fossil fuel industry have lead to climate change, increases in atmospheric CO2, increases in ocean acidification and marine heat waves. This is compounded by plastic and micro-plastic pollution which is growing worldwide year on year. The worsening trends of all of these pollutants is profound and requires continued action.

6.1 Sewage - Organic pollution & Freshwater run-off

These are results for *Environment* Agency Coastal Sewage 2025 Pollution incidents
Search instead for Environment Agency Coastal Sewage 2025 Pollution incidents
In 2025, total monitored spill duration fell by 48% compared with the previous year, alongside a substantial fall in average spills per overflow. There were
291,492 spill events in 2025,
(for England) a 35% reduction on 2024. This means there was an average of 20.5 spills per overflow, compared to 31.8 in the previous year.26 Mar 2026

BBC 'David Braine
Senior broadcast meteorologist, Reporting from Plymouth

- Published

15 April 2026
Record winter rainfall is flushing pollution and sediment into Devon and Cornwall's coastal waters, raising risks to marine life, shellfish and potentially human health as conditions warm.
In March, forecasters said **parts of Cornwall and Devon had seen rainfall totals reach about 150%** of the long-term average and, in February, the Met Office recorded **Cornwall's wettest winter since records began**.
If future winters are mild, wet and windy, it may have long-term impacts, not just on land, but also in our marine environment and coastal ecology and health.
The Plymouth Marine Laboratory has been using equipment including satellites and drones to monitor the waters, testing levels of viruses and bacteria, and looking at the numbers of different species of algae.
'Large sediment plumes'
Bio-optical oceanographer Dr Gavin Tilstone, of the Plymouth Marine Laboratory, said: "The first thing that we notice is a large freshwater plume and that can reach way offshore.
"The second thing is sediment... large sediment plumes will completely block the light, and therefore it has an effect on submerged vegetation; seagrass, for example, maybe even seaweed."
Tilstone said this could be taken advantage of by certain species which were harmful to humans, fish and shellfish.
Within this sediment are high levels of nutrients from farm run-off to sewage spills, which has an impact on algal growth. The more nutrients in the water, the more prolific the algal growth.

Algal blooms are prominent going into spring and some of them are toxic to all marine life.
The sediment and nutrients from the winter stays in coastal waters throughout the year and can also contain high levels of bacteria and virus material.
It often sinks to the seabed but can be stirred up by wave action and, as the water warms, the bacteria thrive and high levels of sediment could smother marine vegetation and reduce growth of all types.'

The person to ask is Gavin Tilstone of PML - coincidentally had an article just on this on local BBC News last night: His email is: ghti@pml.ac.uk
https://www.bbc.co.uk/news/articles/cy51wrg6lp0o

6.2 Tributyl Tin - Timely action: Dogwhelks & oysters - Bob Earll & Keith Hiscock

- 1980 Tributyl Tin (TBT) becomes widely used as the active ingredient of antifouling paints in ships, fish farming and other marine applications
- 1985 => It becomes clear that TBT is the most toxic pesticide ever used in the marine environment.
- TBT linked to a variety of endocrine changes to reproduction (dogwhelk imposex) and growth (Pacific oysters) and well as reductions in coastal marine biodiversity.
- Campaigns by eNGOs & MAFF (against Department for Transport) and changes in UK and International shipping regs (IMO) lead to the phased withdrawal of TBT based paints

6.3 Oil Spills – Jon Moore jon@ticara.co.uk

There is extensive literature on the impacts of oil spills on intertidal communities, but a small number of high-profile spills have been particularly important in stimulating studies worldwide. Of these, the 1967 Torrey Canyon spill was the first that caught international media attention, and it is still widely cited, due to the well documented long-term impacts of first generation 'dispersants'. Alan and Eve Southward (1978), from the Marine Biological Association in Plymouth, described the effects of the extremely toxic cleaning agents on selected Cornish shores, and then the recovery process including many knock-on effects that could be discerned for 15 years.

Steve Hawkins continued the Southward's monitoring and Hawkins et al. 2017 provides a review of this case study, putting it into context with other spills and the fluctuations caused by changes in climate. It highlights that the impacts from the Torrey Canyon have few parallels. The developing oil spill response industry quickly learned from those mistakes and it is safe to say that while inappropriate clean-up actions still occur, usually from overzealous individuals, they only do so on a small, localised scale. I suggest that we should now be treating the Torrey Canyon response as an example of a grossly mis-managed experiment that has not been repeated.

Meanwhile, we now also know that recovery of intertidal communities from oil spills is essentially a function of wave exposure (or water movement generally). Other factors, particularly oil type and amount, can be important, but even small amounts of water movement in fairly wave sheltered conditions can stimulate a recovery process. Ecological functions typically recover quickly and long-term impacts (>3 years) are typically localised.

Our most sheltered marsh habitats are, however, much more susceptible to extensive long-term impacts and their protection from oiling needs to be prioritised, particularly as they are also the most sensitive to clean-up activity. The frequency of notable oil spills has declined greatly over the last 40 years, but oil is still being transported in bulk and accidents still happen.

On top of these intertidal community effects, we also need to consider the effects of spills on some intertidal vertebrates - most notably the birds, or at least those birds that sit on the surface of the water and are extremely good at soaking up oil!

IPIECA 2016 provides a summary of shoreline impacts and recovery.

Southward, A.J., Southward, E.C. 1978. Recolonization of rocky shores in Cornwall after use of toxic dispersants to clean up the Torrey Canyon spill. J. Fish. Res. Board Canada. 35: 682–706

Hawkins, S.J., Evans, A.J., Moore, J., Whittington, M., Pack, K., Firth, L.B., Adams, L.C., Moore, P.J., Masterson-Algar, P., Mieszkowska, N., Southward, E.C., 2017. From the Torrey Canyon to today: a 50 year retrospective of recovery from the oil spill and interaction with climate-driven fluctuations on Cornish rocky shores. In International Oil Spill Conference Proceedings, Vol. 2017, No. 1, 74–103. International Oil Spill Conference. https://iosc.kglmeridian.com/view/journals/iosc/2017/1/article-p74.xml?isSearch=true.

IPIECA-IOGP 2016. Impacts of oil spills on shorelines. Good practice guidelines for incident management and emergency response personnel. IPIECA and International Association of Oil & Gas Producers, London. 53pp. www.ipieca.org/resources/impacts-of-oil-spills-on-shorelines

6.4 **Ocean Acidification – What drives higher Variability? Helen Findlay** PML

Carbonate chemistry at L4 is highly variable on sub-seasonal timescales. We know there are a lot of coastal influences but have yet to match these over the 15+ years of data we now have. While ocean acidification (increasing CO_2 addition to the ocean from the atmosphere) is one of the main drivers of the overall trend in changing chemistry, we also know that there have been many local ecosystem shifts that could influence the chemistry too – how does the nutrient regime, river flow, shifting plankton dynamics, storms and MHW influence the chemistry over both shorter and longer timescales?

- 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 TA (organics material)
    - Physical or biological drivers for DIC?

6.5 A Tidal Wave of Plastic Pollution – Rachel Yates

Plastic pollution & Persistence - Build up in the ecosystem – Rachel Yates SAS

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

- Some legislative moves: single use plastic bags, carrier bag charge, EPR and the implementation of Deposit Return Schemes in 2027. But without production caps production and pollution will continue to grow

6.6 Microplastics, Nanoplastics and Chemical Pollution – A Growing Threat – Rachel Yates

- 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

Slide Micro-plastic - Quantitative increase - year on year – Movements to contaminate the seabed – Penny Lindeque PML & Clare Ostle MBA

CPR data on micro-plastics over time
I have had various funded projects working on plastic over the past 16 years, looking at different types of plastic (traditional, bio-based, tyre particles, etc) mostly related to the ecotoxicology.
I did have a paper a few years ago now looking at how traditional methods of sampling microplastic may be underestimating quantities in coastal waters.
This is likely the most relevant thing I could contribute as the sampling was off Plymouth. Here's the paper **https://doi.org/10.1016/j.envpol.2020.114721**

Types of microplastic

- Traditional
- Biobased
- Tyre particles

Particles by size
Quantities measured depend on net sample size in the water column – 100u x10 more than 333u
Flux through the water-column – accumulation in benthic sediments
Toxicity impacts on planktonic species