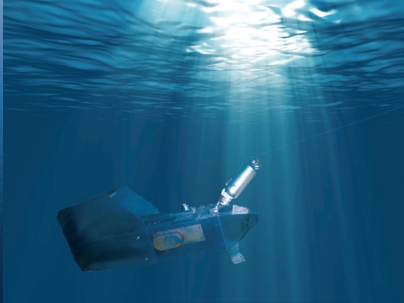




The Continuous Plankton Recorder Survey



The longest running and most geographically extensive marine ecological survey in the world



Our network of ships and tow routes

Pacific routes

The CPR Survey would not be physically or economically possible without the generous support of ships, owners, charterers, managers, port operatives and agents. We are incredibly grateful to all those involved, helping in our operational activities - we could not do it without your continuing support.

---- Routes seeking funding

Routes deploying Planktag Instrument: A-, C-, IN, LG, LR, M-, PR, R-, V-

Routes deploying Minilog Instrument: A-, BA, C-, IB, LG, R-, SA

Routes deploying RBR Instrument: AT, VJ

See page 6-7 for instrument details



SWL CCGS:
Sir Wilfrid Laurier



AT Matson Shipping:
Matson Kodiak



VJ APL Shipping:
APL Qingdao

North Atlantic routes



NWP CCGS:
Amundsen



EB ACL: Atlantic Sea



Zs & MD Eimskip:
Selfoss



LR & V- Eimskip: Lagarfoss



R- DFDS: Selandia
Seaways



Zs, LR, V- and MD Eimskip:
Skogafoss



DJ & DI Smyril Line:
Norrona



PR Brittany Ferries:
Armorique



Bs Geest Line: Royal
Klipper



M- Sea Cargo: SC Express



A- SERCO NorthLink
Ferries: Hildasay



IB & SA Containerships:
Kristin Schepers



ST Marine Supply
AS: Norbjorn



IN P&O Ferries: Norbay



Plymouth Sound:
MBA RV Sepia



C- DFDS: Ficara Seaways



LG DFDS: Primula
Seaways

Continuous Plankton Recorder Survey

“The CPR is one of the most reliable, robust samplers that can be used over large spatial scales – and remains the method-of-choice for new plankton surveys”



- Towing our oceans since **1931**
- **Seven million** miles of ocean surveyed
- Plankton used as indicator species to **monitor** ocean health
- **Experienced** Plankton Taxonomists
- Data **freely** available for download and collaborations encouraged
- 60-year **global archive** of towed silks for use in new projects
- World-class **scientists**
- High impact scientific **research**
- Research used to inform national and international management **policy**

The Continuous Plankton Recorder (CPR) Survey is operated by the Marine Biological Association (MBA). Established in 1884, it is one of the world's longest-running Learned Societies, dedicated to promoting research into our oceans and the life they support. It has a leading marine biological research laboratory where many eminent scientists- including twelve Nobel prize winners- have carried out their research.

Her Majesty The Queen approved the grant of a Royal Charter to the Marine Biological Association in 2013 in recognition of the MBA's long and eminent history and its status within the field of marine biology.

Patron: HRH The Duke of Edinburgh

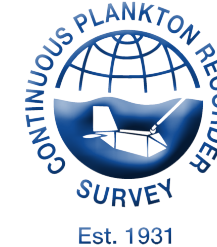
Honorary Fellows

HSH Prince Albert of Monaco

Dr Sylvia Earle

Prof James Lovelock

Sir Tim Hunt



Head of CPR Survey:

David Johns djoh@mba.ac.uk

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Reg. Charity Number 1155893

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The Continuous Plankton Recorder

A platform for integrated ocean observing

In addition to the traditional biological sampling undertaken by the CPR the towed body can be equipped with a range of sensing capabilities to extend its utility for integrated observing

Seawater enters via the aperture. Plankton are captured on a filter silk band then covered by a further silk band. The continuously moving band is wound through the CPR on rollers turned by gears, which are powered by a propeller allowing for up to 500nm per internal to be towed

Star Oddi CTD

Conductivity, Temperature and Pressure (Depth)

Vemco Minilog

Temperature sensor

DST P&R

CPR Internal

Phytoplankton, Zooplankton, Planktonic Bacteria, Viruses and Microplastics

Planktag

Conductivity, Temperature, Chlorophyll-a, Fluorescence and ambient Light.

Data telemetry enables observations to be streamed back within minutes of the CPR surfacing

WaMS

Water and Molecular Sampler

UFE Multispectral Fluorometers

Rapid optical detection of phytoplankton forms, Pressure (Depth) and Temperature

RBR CTD

Conductivity, Temperature, Pressure (Depth) and Fluorescence

Key Statistics

Length x width x height :
100 x 36 x 42 cm

Weight: 85kg

Tow depth: 5 - 10 metres

Tow speed: 8 - 25 knots

Aperture size: 1.27 cm²

Collects: Phyto- and Zooplankton, Planktonic Bacteria and Viruses.

Instruments record:
Conductivity, Temperature, Depth, Chlorophyll-a, Fluorescence, ambient Light, and three-axis accelerations.

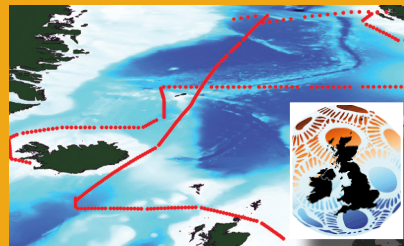
Cost Effective, Proven and Reliable. Since 1931

Application of the CPR



- Ideally suited as a premium long-term ocean monitoring tool
- Cost effective, proven and reliable
- 500nm tow-leg transits
- Optimum > 9 knots
- Seven million miles of ocean surveyed
- > 17,500 tows
- Successfully used since 1931
- Platform for instrumentation

Adaptations of the CPR



UK Ocean Acidification cruise

Developed the 'short multi tow' methodology, allowing a CPR to be deployed on short transits, using a single filtering silk. Produced almost 400 Arctic samples



Tara polar circumnavigation

Double-tow rope methodology to overcome no powered winches. Propeller modified to compensate for the low hull speed of the vessel, increasing the mechanical efficiency



Macroecology of *vibrio cholerae* in Lake Tanganyika

Ship had no winches aft and low hull speed with a multi-national but not lingual crew. Successful scientific expedition incorporating several sampling stops across 481nm lake

Working with the shipping community

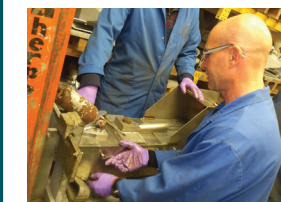


With the CPR Survey and database growing in scientific importance with every mile towed, it is crucial to stop and reflect on the fact that we are very much a collaborative organisation and that the Survey is very much a joint endeavour with the shipping industry.

We are forever in the debt of our friends in the shipping community. We have volunteers from every section of the industry supporting our Survey and we simply could not achieve what we have over nine decades of surveying the oceans without their support.

We wish to thank wholeheartedly the owners, operators, charterers, captains and crew of all the vessels that tow and support our global Survey and extend a warm invitation to visit us any time at our laboratory in Plymouth.

Our Services



Courses and training

We offer IMA REST approved CPR Technical Training Course as well as bespoke maritime courses



Supply

Our plankton filter silks are custom designed, handmade, quality controlled and supplied to the global CPR Survey community



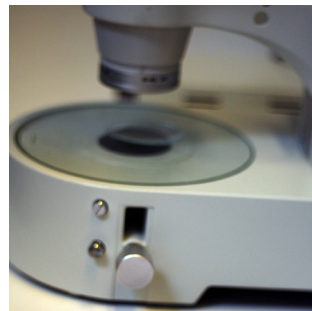
Logistics and support

For your CPR Survey: including supply, training, help in setting up new routes, securing volunteer ships and ongoing support

Want further information? Contact Operations Manager Lance Gregory
ppr@mba.ac.uk

Plankton Analysis

"The CPR Survey operates in many of the world's oceans, this gives our Analysts the expertise to identify many different types of plankton. We analyse microbes up to fish larvae, using traditional light microscopy and molecular techniques"



Plankton Skills

Considered an International Centre of Excellence for planktonic taxa identification, we offer a range of services including all aspects of plankton identification, enumeration, sampling and other related subjects: we regularly run training events, ranging from bespoke one-to-one tuition up to international workshops.



Specialist Outreach

We frequently provide lectures for higher education and wildlife groups, sit on expert panels and engage with the media. Our expert team are able to speak on a wide range of topics from ocean plastics and marine taxonomy, to global warming and our changing planet.

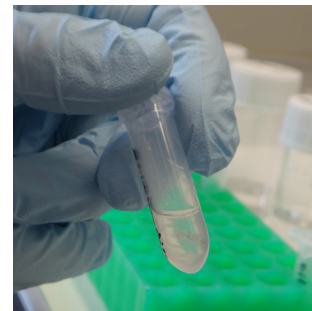


"Our Analysts record over 800 phytoplankton and zooplankton taxonomic entities"



Plankton Archive

Housing the world's largest catalogued plankton archive, with samples dating back to the late 1950s, we hold thousands of samples from around the world. These are available for various types of retrospective analysis (such as microscopic/ taxonomic, molecular and isotopic).



Quality and Excellence

As an International Centre of Excellence our skills are routinely assessed by participating in external programmes such as the International Phytoplankton Intercomparison exercise and members of our team write and organise the International Zooplankton Ringtest, on behalf of the North East Atlantic Marine Biological Analytical Quality Control (NMBAQC) Scheme.



Want further information? Contact
Senior Analyst Marianne Wootton
mawo@mba.ac.uk

Our Data

The CPR Survey is of global importance and our data are used by scientists, policy makers and environmental managers across the world.

Our data are used to examine strategically important science topics such as climate change, human health, fisheries, biodiversity, pathogens, invasive species and ocean acidification.

The results have included the globally first documented studies of large-scale ecological regime shifts, biogeographic, phenological and trans-arctic migrations in the marine environment in response to climate change.

>250,000
Sample Records

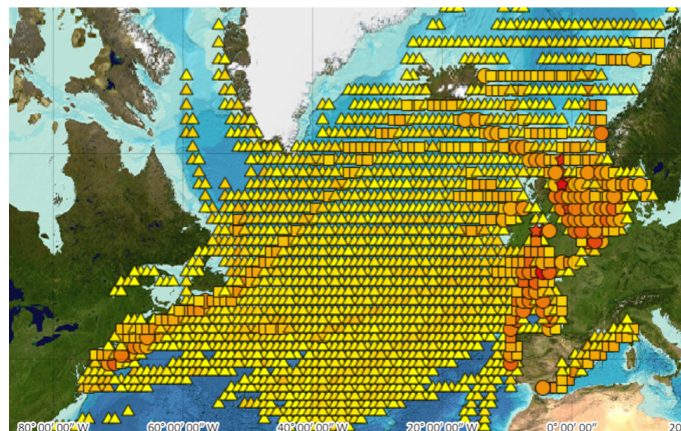
>175 million
Biological Records

>800
Plankton Taxa

**Bacteria &
Viruses**

**Ocean Conductivity,
Temperature, Depth,
Chlorophyll-a
fluorescence**

Our Data are available for **FREE**



<https://data.cprsurvey.org/datacatalog/>

*“Our Data are used by
scientists, policy makers and
environmental managers
across the world”*

*“Our open data policy
will help produce the
best quality science”*

Tracking pathogenic marine bacteria



“Increasing reports of food poisoning from seafood are leading us to investigate plankton-borne marine pathogens to develop better early warning systems”

A form of cholera was contracted from people eating contaminated fish eggs on the west coast of Canada. They recovered but the eggs were found to harbour pathogenic *Vibrio* bacteria. This is the first report of fish eggs causing food poisoning.

Vibrio bacteria are known to adhere to the surface of some planktonic organisms such as fish eggs or plankton eaten by shellfish. The bacteria can release a toxin that causes enteric disease.

CPR Survey scientists have been funded by NERC to track the source of these pathogens using CPR samples taken in this region. This will build a picture of the environmental conditions that *Vibrio* pathogens prefer.

We are working with UK and Canadian government scientists to link these marine pathogens to human cases to develop better early warning systems and advise public health bodies of the risks.

Predators' effects pass down the food chain

Pink Salmon, a species that represents nearly 70% of all Pacific salmon, are especially abundant in alternate years in the Southern Bering Sea.

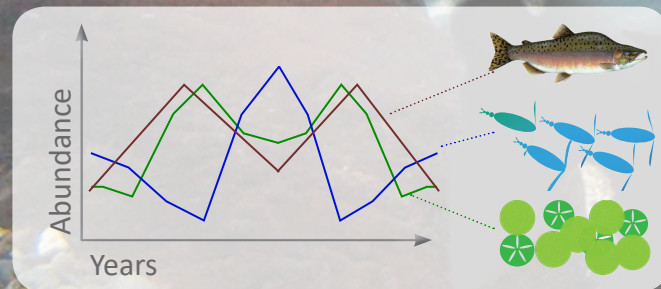
Our research shows that when numbers of Pink Salmon were high the numbers of copepods were low because they were being eaten by the salmon. The reduction in copepods meant that the copepod's phytoplankton food, the diatoms, could grow unchecked and so numbers of diatoms were high.

We saw the reverse pattern in alternative years; fewer salmon leading to more copepods and so fewer diatoms.

This finding is highly unusual because most of the time the changes we see in plankton numbers are caused by changes in ocean climate (temperature, currents and so on) which pass UP the food chain. Instead we see here a "trophic cascade" where effects pass DOWN the food chain from predator to prey.

"The CPR was originally designed in the 1930's to support fisheries"

"Almost a century later we are still using CPR data to explore the links between important fish stocks and their prey"



Using our global experience to spot non-natives



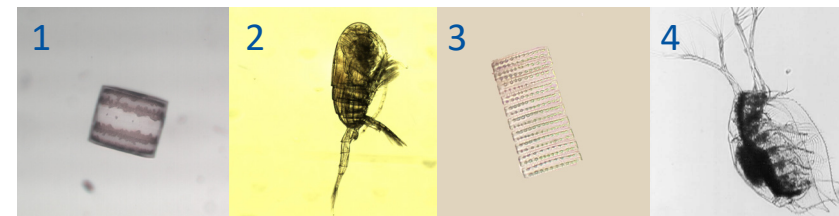
There has been growing concern regarding the spread of marine organisms throughout the world's oceans. With extensive marine traffic, and the effects of climate change, new areas are now accessible and suitable for species that are potentially more competitive than native species. We need to monitor our seas so that we can set management plans and prevent economic or environmental harm from these 'non-natives'.

The CPR Survey operates in many of the world's oceans meaning our experienced team are ideally placed to spot not only new species, but plankton new to a region.

The CPR Survey is acting as an early-warning system on the lookout for both invasive plankton, and the planktonic larval stages of other organisms.

We work closely with Marine Climate Change Impacts Partnership (MCCIP) and watch out for species on the UK's non-native watch-list for the EU Marine Strategy Framework Directive.

CPR Survey discovered invasives



"The CPR Survey acts as an early-warning system on the lookout for invasives which could cause environmental or economic harm"

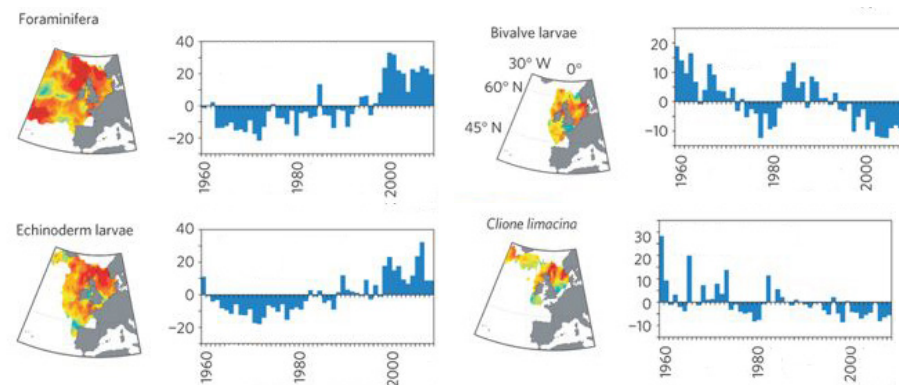
Species and likely causes of invasion 1. The diatom *Coscinodiscus wailesii* and 2. The small copepod, *Pseudodiaptomus marinus*; anthropogenic causes such as ballast waters. 3. The Pacific Ocean diatom, *Neodenticula seminae*; reduction in ice cover and 4. The cladocera, or water flea, *Penilia avirostris*; increasing sea surface temperatures and potentially ballast water.

Winners and losers?

Ocean acidification is the ongoing decrease in the pH of the Earth's oceans, caused by the uptake of carbon dioxide from the atmosphere.

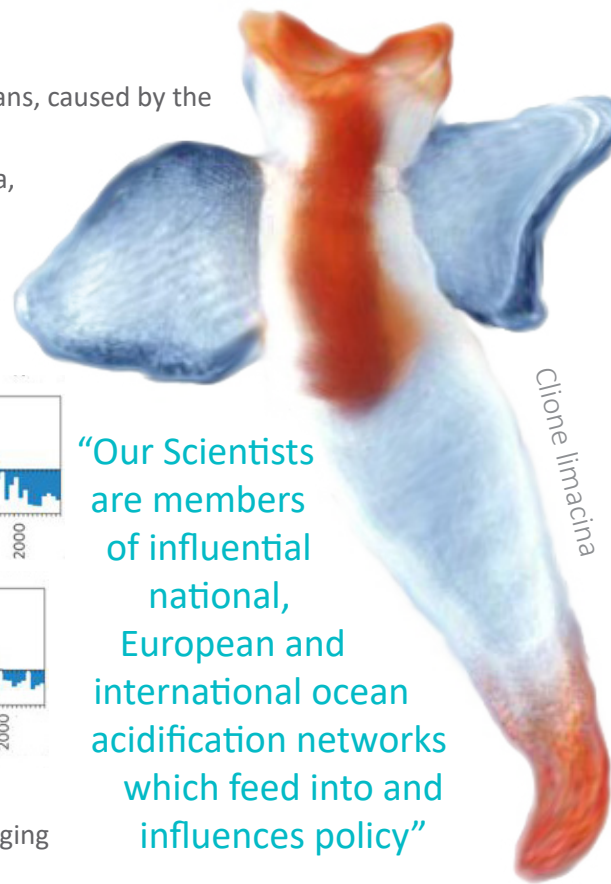
The CPR Survey routinely identifies key ocean acidification indicator taxa, those with calcified structures are likely to be the most susceptible to a change in pH, such as molluscs and echinoderm larvae.

Consistent monitoring of such species is key to determining change, as multiple stressors impact their environment.



Some species have increased in their abundances (or frequency of occurrence) whilst some have decreased. The shifts are due to the changing chemistry and warming of the oceans.

“Our Scientists are members of influential national, European and international ocean acidification networks which feed into and influences policy”



The trickle before the flood

The Arctic sea regions are experiencing the strongest warming on the planet (twice as fast as the planetary average) and the loss of sea ice in recent decades has been unprecedented.

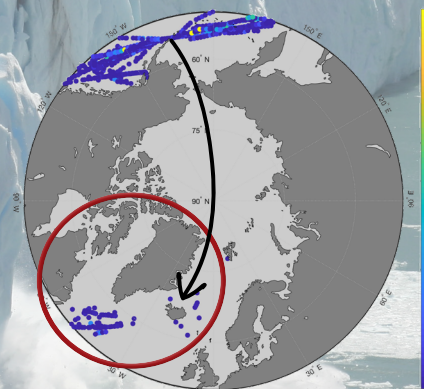
These changes are having huge consequences on the biodiversity and populations of plankton, fish, marine mammals and seabirds of these northern Seas.

Following an unusually extended ice free period large numbers of a Pacific diatom were found by the CPR survey in the North Atlantic after an absence of over 800,000 years.

The diatom species may be the first evidence of a trans-Arctic migration in modern times which, could be an indicator of the scale and speed of changes that are taking place in the Arctic as a consequence of climate warming.

The future consequences of such a change to the biodiversity, productivity and health of Arctic systems caused by these trans-Arctic migrations, as well as the encroachment and establishment of more southerly distributed species are at present unknown but are being closely monitored by the CPR Survey in both the Atlantic and Pacific Oceans.

“The Arctic sea regions are experiencing the strongest warming on the planet; twice as fast as the planetary average”



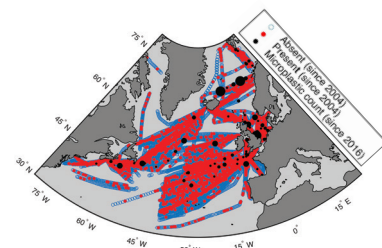
A result of ice melt; migration of a diatom from the Pacific Ocean to the Atlantic after an absence of over 800,000 years.

Plastics and marine litter

Marine litter consists predominantly of plastics and is an increasing global concern because of its worldwide distribution and potential impact on the environment and human health.

Microplastics

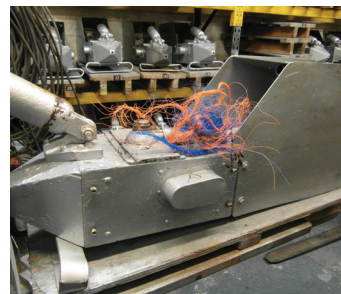
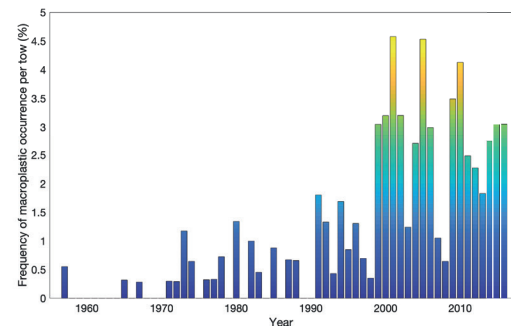
The Survey has been routinely recording microplastics since 2004. The term 'microplastic' was first coined in a pioneering study that used our dataset to demonstrate the increase in marine microplastics in the North Atlantic.



Macroplastics

Entanglements of marine litter have been recorded on the CPR, demonstrating the increase and composition of plastics as well as hot spots most likely to impact wildlife.

One of the earliest ever record of plastics within the ocean was recorded by a CPR in 1957.



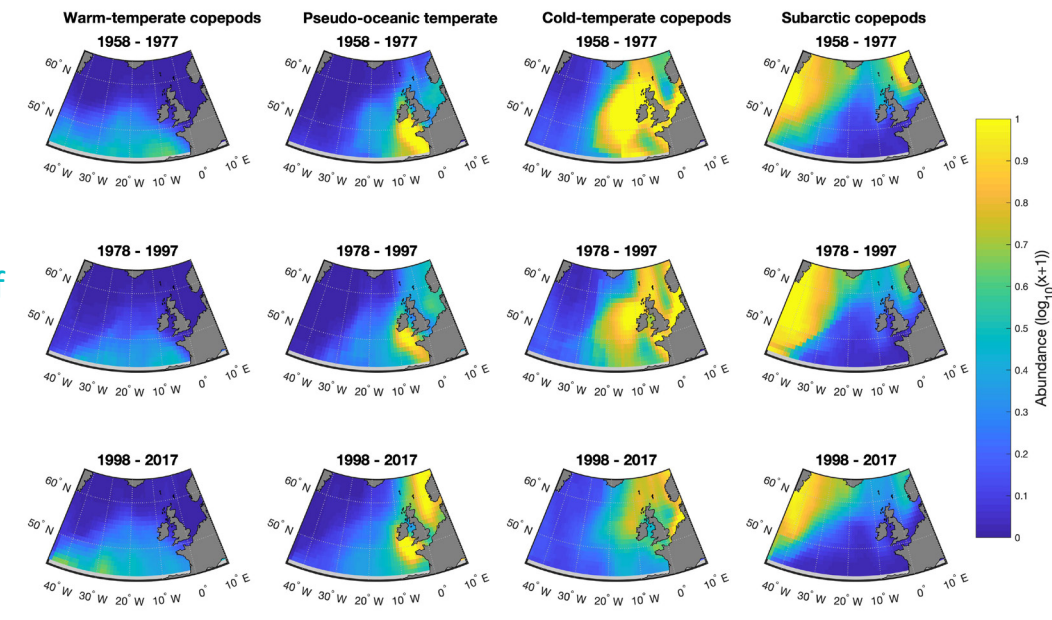
“The CPR Survey is unique in that it can look back historically to track the presence, and increase, of plastics in our ocean”

Ocean warming and implications for biodiversity

In the last 60 years there has been a progressive shift northwards in the plankton community, with an increase in the presence of warm-water, and a decline in cold-water species in temperate areas.

The changes are related to increases in sea surface temperature, and will impact throughout the food web, having consequences for other marine life, from fish larvae, to whales and seabirds.

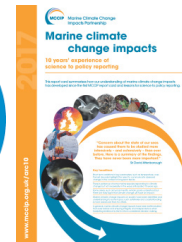
“Warm-water plankton are moving north and cold-water plankton are moving northwards out of the area”



Policy

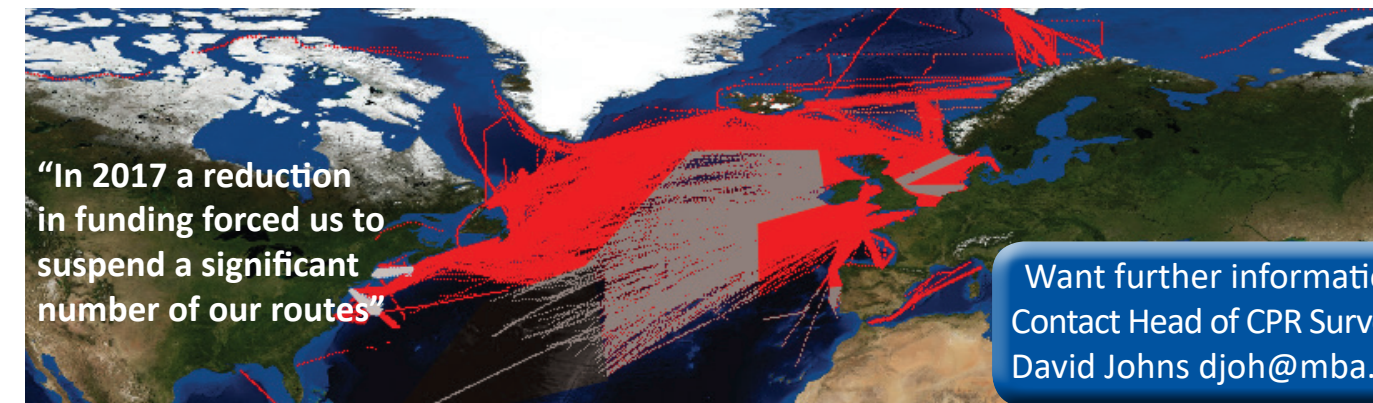
“The extensive spatial scale, transboundary coverage, multi-decadal time series, combined with the taxonomic richness of the dataset, has placed CPR Survey science at the forefront of evidence provision for high-level policy and management advice”

The CPR Survey has co-evolved with policy playing an integral part in providing relevant, targeted evidence for United Kingdom, European and International decision-makers. Data and research from the Survey have informed high profile and strategic global marine assessments such as:



- **United Kingdom Marine Monitoring, and Assessment Strategy**
- **European Union’s Marine Strategy Framework Directive (MSFD)**
- **Intergovernmental Panel on Climate Change (IPCC) Reports**
- **United Nations World Ocean Assessment**
- **MCCIP (large-scale assessments are based on CPR Data)**

Challenges facing the CPR Survey



“In 2017 a reduction in funding forced us to suspend a significant number of our routes”

Want further information?
Contact Head of CPR Survey
David Johns djoh@mba.ac.uk

In 2017, a reduction in our funding forced the review of our sampling regime, and with a reduced capability we had to make the decision to cease towing a significant number of routes, to consolidate our efforts. Most of these routes were in oceanic waters, outside of national jurisdiction and therefore problematic to fund. However these oceanic waters are of vital importance in our understanding of global processes, and can offer an early-warning system to our oceans health.

The CPR Survey (which shares its data freely) has provided a global early-warning system to help ensure the protection of our ocean. Without this coverage the health of our oceans will suffer.

We view the reinstatement of these routes one of our top priorities and welcome any support you can give.

The background of the entire slide is a dense, artistic collage of various marine plankton species. These include diatoms with their characteristic silica shells, radiolarians, forams, and other microscopic organisms. The illustrations are rendered in a style that combines scientific accuracy with artistic flair, using a color palette of deep blues, purples, and greens. The organisms are scattered across the frame, creating a rich, textured backdrop for the text.

Established in 1931, the Continuous Plankton Recorder (CPR) Survey is the longest running, most geographically extensive marine ecological survey in the world. It collects plankton coupled with ocean physical, chemical and biological observations with the resulting data providing information on the biogeography and ecology of the planktonic community. The Survey is a globally recognised leader on the impacts of environmental change on the health of our oceans. It provides the scientific and policy communities with a basin-wide and long-term measure of the ecological health of marine plankton.

Follow us
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