



OCEAN & CLIMATE REPORT

JANUARY 2021

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FOREWORD

The ocean has represented home for the past 25 years. As an avid surfer, a daily routine includes assessing conditions, selecting the best local location and spending an hour or two paddling around and riding waves.

This simple repetitive act connects us with the natural world in ways that are difficult to explain. When in the sea you're completely vulnerable yet feel a sense of protection over a beach or reef. You care for her shores as you would a best friend and share intimate moments of joy, sorrow and success. The line-up is a sacred zone where we connect with friends from all backgrounds and share heritage with family. A place to learn and encounter what it's like to swim with dolphins, watch turtles glide and obtain a primal fear instinct and utmost respect for the top of the food chain. Not many other experiences in life offer such an affinity.

It's this relationship with the ocean that places us at the forefront of a changing climate. We are already experiencing the impacts below our boards and along the shores. Over the last few years, the Amazon then Australia's East Coast burnt in unprecedented bushfires chocking our line ups, incinerating coastal towns, native wildlife and dune vegetation. Local marine ecosystems are changing before our eyes, with every ocean heatwave bleaching the world's coral reefs. Acidification is eating away at the exoskeletons of our favourite tropical tubing waves. Coastal erosion is evident across the globe and our island neighbours are being swamped by sea level rise.

Whilst warmer waters may sound inviting the impacts are extreme and terrifying. 93% of the excess heat is trapped in the world's oceans with the potential to drastically affect ocean currents - the regulator of our global weather systems upon which all life depends.

Floating around in the crystal blue waters under the warm spring sun it's difficult to grasp the urgency of the situation; it seems fine here, until you paddle around the next bay and notice any one of the impacts above impeding the environment. Luckily, there is a solution. With the opportunity to rewild our planet and to develop a successful sustainable economy, we are now in the perfect position to do something about it. Together we must work to mitigate CO₂ emissions and strive for a Net Zero future. As ocean lovers, we all have an individual and united responsibility to act mindfully with our own choices and demand better of big business and governing policies.

After reading this report, I feel empowered as a wave rider and a mother to do everything I can. I see my number one role as a parent to provide my child with a safe and flourishing future.

To ensure the legacy of riding waves and a healthy planet ocean will be something he gets to enjoy with his children. I ask you all to take immediate action in whatever way you can. Join me in making a positive change; start with the small things, easily changeable options in our own home; transport choices, where our money is invested or the food we choose to eat. Then move onto the fun stuff of joining a peaceful protest or paddle out, reaching out to your MP or write letters to big businesses. It's going to take us all to turn this around, but together across the UK and outstretched to the other side of the world, we can. We must take a note from our experience in the sea and learn that to succeed we must thrive as part of nature.



Belinda Baggs

Patagonia GSA, Co-founder Surfers For Climate,
Proud member Surfers Against Sewage.



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**“TOGETHER WE MUST
WORK TO MITIGATE
CO₂ EMISSIONS
AND STRIVE FOR A
NET ZERO FUTURE.”**



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CASE STUDY **SURFERS FOR CLIMATE**

Surfers For Climate is an Australian-based charity with a mission to empower and mobilise a sea-roots movement for positive climate action. The charity champions the political power of surfing communities and uses this to make representative MPs take action on climate. They also aim to empower the global community of surfers to work together

to stop coastal and off-shore fossil fuel developments and to take-action on implementing climate solutions. You can find out how to 'Wipeout Your Emissions' with their top climate actions including how to start climate conversations and advice on sustainable banking. Find out more:

www.surfersforclimate.org.au

Photo of Belinda Baggs / Photo credit: Jarrah Lynch



EXECUTIVE SUMMARY

Climate change is the most unprecedented environmental crisis our blue planet faces; affecting communities, ecosystems and species worldwide and ultimately threatening all life on Earth. Taking up over 70% of the Earth's surface, the ocean plays a key role within the climate emergency.

From ocean warming and acidification to biodiversity loss and mass migration, the impacts of climate change on the ocean are extreme and far reaching; as a global climate regulator, the deterioration of ocean health will only heighten the effects of climate change. However, through restoration and rewilding, the marine environment can thrive again and provide the natural mechanisms to help mitigate climate change and ensure protection against the climatic changes we can no longer prevent. Although they are among the fastest disappearing ecosystems in the world, blue carbon habitats, such as kelp forests and seagrass, have the potential to extract and store a vast amount of carbon dioxide and therefore, play a pivotal role in addressing the climate crisis.

96% OF PEOPLE BELIEVE THE GOVERNMENT MUST TAKE ACTION URGENTLY

It is vital that we understand and acknowledge the symbiotic relationship between the ocean and climate. The findings from The Ocean and Climate Survey reveal that 89% of the public are extremely concerned about the climate emergency and around 97% are aware of the impact it is having on our blue planet.

89% OF THE PUBLIC ARE EXTREMELY CONCERNED ABOUT THE CLIMATE EMERGENCY AND AROUND 97% ARE AWARE OF THE IMPACT IT IS HAVING ON OUR BLUE PLANET

The results point, overwhelmingly, to the fact that the public does not think enough is being done to tackle the climate crisis; 99% of respondents agreed more action needs to be taken and 96% of people believe the government must take action urgently.

The scientific evidence, public call for action, and numerous ocean recovery initiatives highlight an indisputable need for the ocean to be at the centre of the climate movement. As much as we depend on all blue spaces for our mental and physical wellbeing, the ocean now depends on us for its survival; and as we step into the UN Decade of Ocean Science for Sustainable Development, we must come together to shout for the ocean, before it is too late.



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CLIMATE CHANGE IS THE MOST
**UNPRECEDENTED
ENVIRONMENTAL CRISIS**
OUR BLUE PLANET FACES; AFFECTING
COMMUNITIES, ECOSYSTEMS AND
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INTRO- DUCTION

Rainforests are often referred to as the lungs of our planet, but all life also depends on the ocean. Alongside providing food, habitat, energy and water for people and wildlife, the ocean also regulates our global climate, generates the oxygen we breathe and stores the excess carbon we produce.

The ocean plays a fundamental role in mitigating human-induced climate change, whilst also bearing the brunt of its impact. However, as carbon emissions and atmospheric temperature continue to rise, the ocean has almost reached capacity. The impacts of warming waters, increased ocean acidity and sea level rise already reach from deep ocean ecosystems to coastal communities and will only intensify unless we act now. The inextricable link between the ocean and climate highlights that the voice of the ocean must be heard, if we are to tackle this environmental emergency.

Human-induced climate change is caused by the increase in greenhouse gas (GHG) concentrations in our atmosphere, which amplifies the Earth's natural greenhouse gas effect (see page 17).

CARBON DIOXIDE LEVELS ARE AT THE HIGHEST THEY HAVE BEEN FOR AT LEAST THE PAST 800,000 YEARS.

As greenhouse gas concentrations increase, more heat from the sun is retained, causing the average atmospheric temperature to rise and the global climate to change.

Greenhouse gas emissions, such as carbon dioxide, are emitted when fossil fuels are burnt to produce the energy we use. Today, carbon dioxide levels are at the highest they have been for at least the past 800,000 years and they are still rising.¹

CLIMATE CHANGE IS ARGUABLY THE MOST PRESSING CRISIS THIS, AND FUTURE GENERATIONS WILL HAVE TO FACE

In this report, we outline the impacts of the climate crisis in relation to the ocean and how this will affect marine ecosystems and human populations across the world. We illustrate how climate change is already affecting you, and how important a complex and thriving wild ocean is to us all. Lastly, we highlight the main causes of climate change and discuss the solutions to what is arguably the most pressing crisis this, and future generations will have to face.



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¹ IPCC, 2019: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. In press.



**THE IMPACTS OF
WARMING WATERS,
INCREASED OCEAN ACIDITY
& SEA LEVEL RISE
ALREADY REACH FROM
DEEP OCEAN ECOSYSTEMS
TO COASTAL COMMUNITIES**

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THE IMPACTS

The impacts of human-induced climate change are extreme and far reaching. Countries are on fire; sea ice is melting at an alarming rate and species are being driven to extinction right before our eyes. But how exactly is the ocean being impacted by the climate crisis and what effect is this having on the rest of the world?

OCEAN WARMING

Global atmospheric temperatures have risen dramatically since the 1970s due to human-induced climate change. Yet, only 1% of the trapped heat actually remains in the atmosphere.² As the largest heat sink on the planet, the ocean has absorbed around 93% of the excess heat trapped by the rising concentration of greenhouse gases.³ This has caused significant ocean warming, which has occurred persistently since 2005.⁴

The ocean provides the clearest measure of global warming and is the most certain indicator that climate change is happening. Over the past five years, the ocean has reached its hottest temperatures on record, meaning the rate of ocean warming has more than doubled since 1993.⁵

Alongside the average increase in ocean temperatures, underwater heatwaves are becoming more frequent, prolonged and severe, with the number of heatwave⁶ days increasing by 50% over the last 30 years.⁷

To put this into perspective, human-induced climate change has heated the ocean by the equivalent of one atomic bomb explosion per second for the past 150 years.⁸ As a consequence, ocean systems and composition are significantly changing.

Higher ocean temperatures have led to global sea level rise, which is one of the most significant impacts of climate change.



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Sea level has risen 8 inches on average since 1880, 3 inches of which were in the last 25 years.⁹ Primarily, sea level rise is caused by thermal expansion, which is the process of water molecules expanding when they heat up. However, sea level rise has accelerated in recent decades due to the increasing rates of ice loss from glaciers and the Greenland and Antarctica ice sheets.

As the ocean continues to warm, glacial melting is likely to become the primary contributor to global-sea level rise.¹⁰ Rising sea levels are already having devastating effects on low-lying coastal habitats, significantly impacting both environmental ecosystems and human livelihoods. The impacts associated with sea level rise are also exacerbated by more regular and more intense extreme weather events such as hurricanes, storm surges, flooding and heavy rainfall, which are a further consequence of ocean warming.¹¹

Rising temperatures and subsequent sea ice melt will also significantly disrupt the ocean currents that regulate the Earth's climate. As the ice sheets are lost at a faster rate, the ocean currents will slow and could eventually stop, which means regional temperatures will be more extreme and large areas of land could become uninhabitable.¹²

2 Borunda, A. (2019) Ocean Temperature Rise, National Geographic

3 IPCC, 2019: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. In press.

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5 Carrington, D. (2020) Ocean temperatures hit record high as rate of heating accelerates, The Guardian

6 A marine heatwave is when seawater temperatures exceed a seasonally-varying threshold for at least 5 consecutive days: <http://www.marineheatwaves.org/all-about-mhws.html>

7 Carrington, D. (2019) Heatwaves sweeping oceans 'like wildfires', scientists reveal, The Guardian

8 Carrington, D. (2019) Global warming of oceans equivalent to an atomic bomb per second, The Guardian

9 IPCC, 2019: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M.

HUMAN-INDUCED CLIMATE CHANGE HAS HEATED THE OCEANS BY THE EQUIVALENT OF ONE ATOMIC BOMB EXPLOSION PER SECOND FOR THE PAST 150 YEARS

This is particularly significant for countries in North West Europe, such as the United Kingdom (UK), which is dependent on the Gulf Stream (Atlantic Current) for a relatively mild climate. If this was disrupted, there would be freezing winters in Europe, faster sea level rise in the USA¹³ and increasing drought in the Sahel, Africa.¹⁴

Ocean warming is also having an effect on the level of oxygen sea water is able to hold, causing deoxygenation to occur.¹⁵ Despite being one of the most under reported effects of climate change, even the smallest fall in ocean oxygen levels can create significant issues with far-reaching and complex implications. Magnified by the impact of sewage pollution and agricultural runoff, ocean deoxygenation creates uninhabitable marine areas called 'dead zones' where fish and other species struggle to 'breathe' (see page 10).

Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. In press.

10 Nunez, C. (2019) Sea level rise, explained, National Geographic

11 IPCC, 2019: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. In press.

12 IUCN (2017) Ocean warming, accessed 4 August 2020, <https://www.iucn.org/resources/issues-briefs/ocean-warming>

13 Jackson, L.C., Kahana, R., Graham, T., Ringer, M.A., Woollings, T., Mecking, J.V., and Wood, R.A. (2015) Global and European climate impacts of a slowdown of the AMOC in a high resolution GCM, Climate Dynamics, Vol.45, No.11, pp.3299–3316

14 Carrington, D. (2018) Avoid Gulf stream disruption at all costs, scientists warn, The Guardian

15 IPCC, 2019: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. In press.



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DID YOU KNOW?

SEWAGE POLLUTION AND AGRICULTURAL RUNOFF ARE PRIMARY CAUSES OF OCEAN DEOXYGENATION, RESPONSIBLE FOR CREATING UNINHABITABLE MARINE AREAS.¹⁶

These so-called “**dead zones**” are caused by a rise in bacteria and nutrients in the water that boosts the growth of ‘algae blooms’. This organism growth eventually reduces the volume of oxygen in the water meaning other species struggle to survive. As rainfall intensity increases due to climate change and more sewage enters the ocean as a result, ocean deoxygenation will become more prominent, causing a decline in ocean health.¹⁷

¹⁶ Davis, N. (2018) Baltic Sea oxygen levels at ‘1,500-year low due to human activity’, The Guardian

¹⁷ Roberts, C. (2013) The Ocean of Life: The Fate of Man and The Sea, Penguin Books

¹⁸ Borunda, A. (2019) Ocean acidification facts and information, National Geographic

¹⁹ IPCC, 2019: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. In press.

OCEAN ACIDIFICATION

While the level of oxygen in the water decreases, the concentration of carbon dioxide is increasing, causing the ocean to become more acidic.

As part of the carbon cycle, there has always been a slow exchange of carbon between the atmosphere and ocean. However, this exchange has been significantly disturbed as atmospheric CO₂ levels have increased and more carbon has diffused into the ocean.¹⁸

OCEAN ACIDIFICATION IS OCCURRING AT A RATE APPROXIMATELY TEN TIMES FASTER THAN ANYTHING EXPERIENCED DURING THE LAST 300 MILLION YEARS

Since the start of the industrial revolution, human activity has added almost 400 billion tonnes of carbon into the atmosphere. Although the majority of this has remained in the atmosphere, the ocean has absorbed over 30% of CO₂ emitted.¹⁹ Above the surface, this seems to be a good thing – if the excess carbon had not been absorbed into the ocean, global temperatures would have risen even higher than they already have. However, under the surface, the intensity of carbon uptake is drastically altering the composition of marine water.

Current ocean acidification is unprecedented in magnitude, occurring at a rate approximately ten times faster than anything experienced during the last 300 million years.²⁰ As the ocean reaches its capacity, not only will the acidification adversely affect a range of marine organisms, but the rate at which CO₂ is absorbed from the atmosphere will slow, aggravating the impacts of climate change even further.

²⁰ IPCC, 2019: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. In press.



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BIODIVERSITY AND ECOSYSTEMS

The changes in the ocean, such as rising temperatures, sea level change, slowing ocean currents, deoxygenation and acidification, are having detrimental impacts on marine wildlife and ecosystems.

The rate at which these changes are happening mean that species are unable to adapt in time and are consequently forced to migrate to new regions or are driven to extinction.

Specifically, in the UK, there have been large changes in species abundance²¹ and distribution²², from seabirds and marine mammals at the top of the marine food web to vital plankton at the bottom. Keystone species, such as zooplankton, are struggling to survive in the warmer waters and their demise has decreased the food available for larger marine mammals. As a consequence of this and more frequent storms, British seabird numbers, including arctic skuas, kittiwakes and guillemots, have declined by almost 70% over the last 20 years.²³

Other vital species are also under threat from warming waters. The atlantic salmon, for example, usually returns from the Atlantic to Scotland to breed each year, however, increased water temperatures will mean reproduction is less successful.²⁴ Over time, this will cause a decrease in overall salmon population, impacting the other species reliant on them for survival.

At a more global scale, ocean acidification is affecting marine crustaceans, such as urchins, sea snails and clams, causing their shells to dissolve or form irregularly.²⁵ As a response, these species are forced to put more energy into repairing their shells, rather than focusing on reproduction, which will eventually cause a decline in numbers.

21 Species abundance is the number of individuals per species, and relative abundance refers to the evenness of distribution of individuals among species in a community.

22 Species distribution is the geographical distribution of occurrence of animal and plant species in relation to a grid, region, administrative unit or other analytical unit.

23 WWF. (2019). 9 UK species affected by climate change, accessed 4 August 2020, <https://www.wwf.org.uk/updates/9-uk-species-affected-climate-change>

24 WWF. (2019). 9 UK species affected by climate change, accessed 4 August 2020, <https://www.wwf.org.uk/updates/9-uk-species-affected-climate-change>

Similarly, delicate marine ecosystems are struggling to survive in the warmer and more acidic conditions. These ecosystems provide food, habitats and protection for almost all sea life and drastically affect all marine biodiversity levels. One of the most commonly known and visually dramatic effects of climate change is the destruction of coral reefs, which is caused by rising sea temperatures and acidification.

DELICATE MARINE ECOSYSTEMS ARE STRUGGLING TO SURVIVE IN THE WARMER AND MORE ACIDIC CONDITIONS

Recent years have seen widespread and severe coral bleaching around the world, with a loss of 70% of coral reefs in some regions.²⁶ Less documented, but just as significant, is the destruction of habitats such as kelp forests, mangroves, seagrass meadows and tidal marshes. These ecosystems are some of the most productive and biodiverse in the world. Although these coastal systems cover only a fraction of the Earth's surface, they take in carbon at much faster rate and can store it for much longer than their terrestrial counterpart, giving them the name 'blue carbon habitats'.

Despite their importance, blue carbon habitats are among the fastest disappearing ecosystems in the world, with almost 30% of their global coverage already lost.²⁷ In the UK alone, it is predicted that the majority of its 26,000 square miles of kelp forests are likely to completely disappear by 2100, unless we work to protect and restore them.²⁸

These examples provide just a tiny snapshot of the impact climate change is having on marine wildlife and ecosystems. In reality, the extent of marine biodiversity loss is extremely far-reaching and occurring at an alarming rate.

25 Hayhow DB, Eaton MA, Stanbury AJ, Burns F, Kirby WB, Bailey N, Beckmann B, Bedford J, Boersch-Supan PH, Coomber F, Dennis EB, Dolman SJ, Dunn E, Hall J, Harrower C, Hatfield JH, Hawley J, Haysom K, Hughes J, Johns DG, Mathews F, McQuatters-Gollop A, Noble DG, Outhwaite CL, Pearce-Higgins JW, Pescott OL, Powney GD and Symes N (2019) The State of Nature 2019. The State of Nature partnership.

26 IUCN (2017) Coral reefs and climate change, accessed 4 August 2020, <https://www.iucn.org/resources/issues-briefs/coral-reefs-and-climate-change>

27 The Blue Carbon Initiative. 2019. The Blue Carbon Initiative. Conservation International. Accessed 4 August 2020, <https://www.thebluecarboninitiative.org>

28 Simpson, J. (2014) Britain's kelp forests could be destroyed within next 100 years, The Independent



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MARINE ECOSYSTEM SERVICES

The ocean is a life-support system for the entire global population, so the impacts of climate change on marine ecosystems will influence every aspect of society.

In addition to its role within the climate system, services provided to people by the ocean include food and water supply, renewable energy, tourism, trade and transport as well as the benefits for our health and well-being.²⁹

Many coastal communities are already experiencing the impacts of sea level rise, such as the riverine nation of Bangladesh. Over the last decade, nearly 700,000 Bangladeshis have been displaced on average each year due to sea level rise, extreme rainfall and flooding.³⁰

The impacts of sea level rise and subsequent flooding are also being experienced closer to home. The 2007 summer floods, which occurred across England, were titled a 'national catastrophe', causing widespread destruction and an economic loss of around £4 billion.³¹ More recently, it was publicised that the Welsh coastal village of Fairbourne will be the first community in the UK to be forced to leave their homes due to the threat of sea level rise and coastal erosion.³²

Overall, alongside the global economic impacts caused by flooding, projected sea level rise and extreme weather events could displace almost 200 million people worldwide by 2100, disproportionately affecting those in less-economically developed countries (LEDCs).³³

The destruction of coastal habitats and decline in marine species is also predicted to significantly impact the global food supply and the economy. A large proportion of LEDCs depend on the ocean for their main form of income, either through fishing, trade or tourism. Small scale fisheries account for around half of the fish harvested from the ocean and provide jobs for more than 47 million people in developing countries.³⁴

The decline in fish stocks, driven by human-induced climate change and other human activities, could therefore, limit economic development and indefinitely contribute to growing global inequalities, as developed countries are more able to adapt to the biodiversity loss. For example, the oyster industry in the Pacific has lost nearly 110 million USD in annual revenue due to ocean acidification, a direct impact of climate change.³⁵

THREE MAJOR STORMS IN 2017 COST THE CARIBBEAN ISLAND TOURISM INDUSTRIES ALMOST \$3 BILLION



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30 McDonnell, T. (2019) Climate change creates a new migration crisis for Bangladesh, National Geographic

31 Chatterton, J.B., Viavattene, C., Morris, J. Pennining-Rowell, E., Tapsell, S. The costs of the summer 2007 floods in England, Report for Bristol. (2010). Environment Agency.

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34 Hoegh-Guldberg, O., R. Cai, E.S. Poloczanska, P.G. Brewer, S. Sundby, K. Hilmi, V.J. Fabry, and S. Jung, 2014: The Ocean. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1655-173

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CASE STUDY FAIRBOURNE VILLAGE

**FAIRBOURNE IS A SMALL COMMUNITY
VILLAGE ON THE COAST OF NORTH WALES,
WITH A POPULATION OF AROUND 1200.**

Originally built in the 20th century on reclaimed land, Fairbourne has always battled against high tides and river flooding.³⁶

Whilst the village is currently defended from the sea on both its estuarine and coastal front at a cost of almost £7m, rising sea levels mean that the area would be below normal high tide levels within the next 50 years.

Due to the scale of the problem, the council decided it could no longer afford to defend the village. As a result, over the next 26 years, the entire community, including all businesses will be relocated, making Fairbourne villagers the first of Britain's climate refugees.³⁷

Although sea level rise in the UK is not yet at the same extent as other countries, Fairbourne has provided a warning that the climate change impacts are happening now and they will only get worse. A report by the Committee on Climate Change in 2018 found nearly 530,000 homes are at risk along the English coast.³⁸ As an island nation, sea level rise and extreme weather will pose numerous threats to coastal communities unless we act now to mitigate climate change.

³⁶ Wall, T. (2019) 'This is a wake-up call': the villagers who could be Britain's first climate refugees, The Guardian

³⁷ Wall, T. (2019) 'This is a wake-up call': the villagers who could be Britain's first climate refugees, The Guardian

³⁸ The Committee on Climate Change (2018) Managing the coast in a changing climate, October 2018, London.



RISING SEA LEVELS, STORM SURGES, INCREASED PRECIPITATION & SUBSEQUENT FLOODING COULD ALSO PUT INCREASED PRESSURE ON SEWER SYSTEMS RESULTING IN THE DECLINE OF WATER QUALITY

Local and global economies will similarly be affected by the direct impact climate change has on coastal and marine tourism.³⁹

Through the impacts on ecosystems, such as coral bleaching, more extreme weather and sea level rise, climate change can reduce the appeal of coastal destinations, increase operating costs and ultimately decrease income. For example, three major storms in 2017 cost the Caribbean island tourism industries almost 3 billion USD in loss, damage and environmental recovery costs.⁴⁰ Again, this disproportionately affects coastal communities in developing countries as they have less economic opportunities to allow them to adapt.

However, the decline in marine tourism could also create possibilities for ocean conservation, allowing ecosystems to replenish.

Rising sea levels, storm surges, increased precipitation and subsequent flooding could also put increased pressure on sewer systems resulting in the decline of water quality.⁴¹

The inadequate sewer system in the UK, for example, is already unable to cope with the level of water entering the system during the winter months.

The Met Office has shown that extended periods of extreme winter rainfall are seven times more likely due to human-induced climate change, meaning more sewage will be entering the rivers and ocean through Combined Sewer Overflows (CSOs).⁴² This will increase the risk of illness for water users and limit the possibilities for recreational activity, such as surfing which may be further disrupted by changing wave conditions and storm surges.⁴³



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DID YOU KNOW?

CLIMATE CHANGE HAS THE POTENTIAL TO HAVE A SIGNIFICANT IMPACT ON SURFING AND OTHER WATER SPORT ACTIVITIES IN THE UK AND ACROSS THE WORLD

Primarily, increased rainfall is expected to lead to more CSO discharges and more diffuse pollution from urban and agricultural runoff. This will undoubtedly lead to an increase in the chances of contracting a sewage related illness while in the water.⁴⁴

9% OF SURFERS WERE COLONISED BY RESISTANT BACTERIA, COMPARED TO JUST 3% OF NON-SURFERS

Already, regular bathers are exposing themselves to bacteria which has become resistant to even the most clinically effective antibiotics.

Research by the European Centre for Environment and Human Health (ECEHH), found 9% of surfers were colonised by resistant bacteria, compared to just 3% of non-surfers. Antibiotic resistant bacteria can cause failures in the treatment of infections meaning swimmers, surfers, kayakers and other water users are being put at an ever-increasing risk.⁴⁵

The growing risk of entering the water is particularly prominent as the ocean, and all blue spaces, are now recognised as valuable health services which maintain and improve mental well-being.^{46,47}

Blue carbon habitats, such as reefs and kelp forests, are central to some recreational experiences such as surfing, so their decline will undoubtedly influence the ability to enjoy ocean activities. Sea level rise will also result in some reef breaks working less often or possibly disappearing altogether and the necessary implementation of coastal protection schemes to combat sea level rise will result in a loss of surf breaks. Whilst the winter period may see more storm activity and larger waves, the summer months could become even more inconsistent with longer, flat periods.⁴⁸

Overall, it is clear climate change is likely to have a significant negative impact on many water-based recreational activities in the UK.



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The Earth's climate has always fluctuated from periods of global warming to global freezing. These natural climate changes have altered the Earth's surface and are responsible for global mass extinctions; a similar story to what is happening today. The only difference is, this time, the climate is changing far quicker and it is a direct result of human activity.

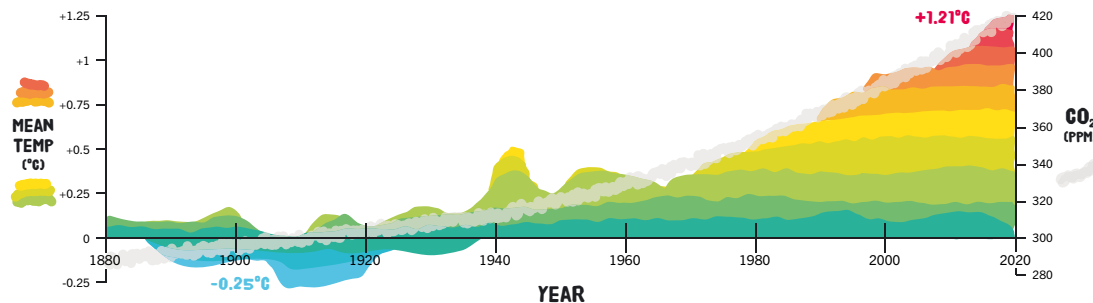
FOSSIL FUELS

The overwhelming cause of human-induced climate change is the increased concentration of greenhouse gases in our atmosphere. This has primarily been driven by the burning of fossil fuels such as coal, oil and gas to produce energy for human activities.⁴⁹

When fossil fuels are burnt they emit a large volume of gas, such as carbon dioxide, which remains in the atmosphere for millions of years, exacerbating the greenhouse gas effect and consequently driving global warming.⁵⁰

FIGURE 1: SHORT TERM GLOBAL TEMPERATURE RISE AND CO₂ EMISSIONS

Figure 1 shows the global mean temperature and average short term atmospheric CO₂ concentrations from 1880-2020. Met Office and Our World in Data Source: originally sourced from NOAA.



⁴⁹ IPCC, 2014: Summary for Policymakers. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

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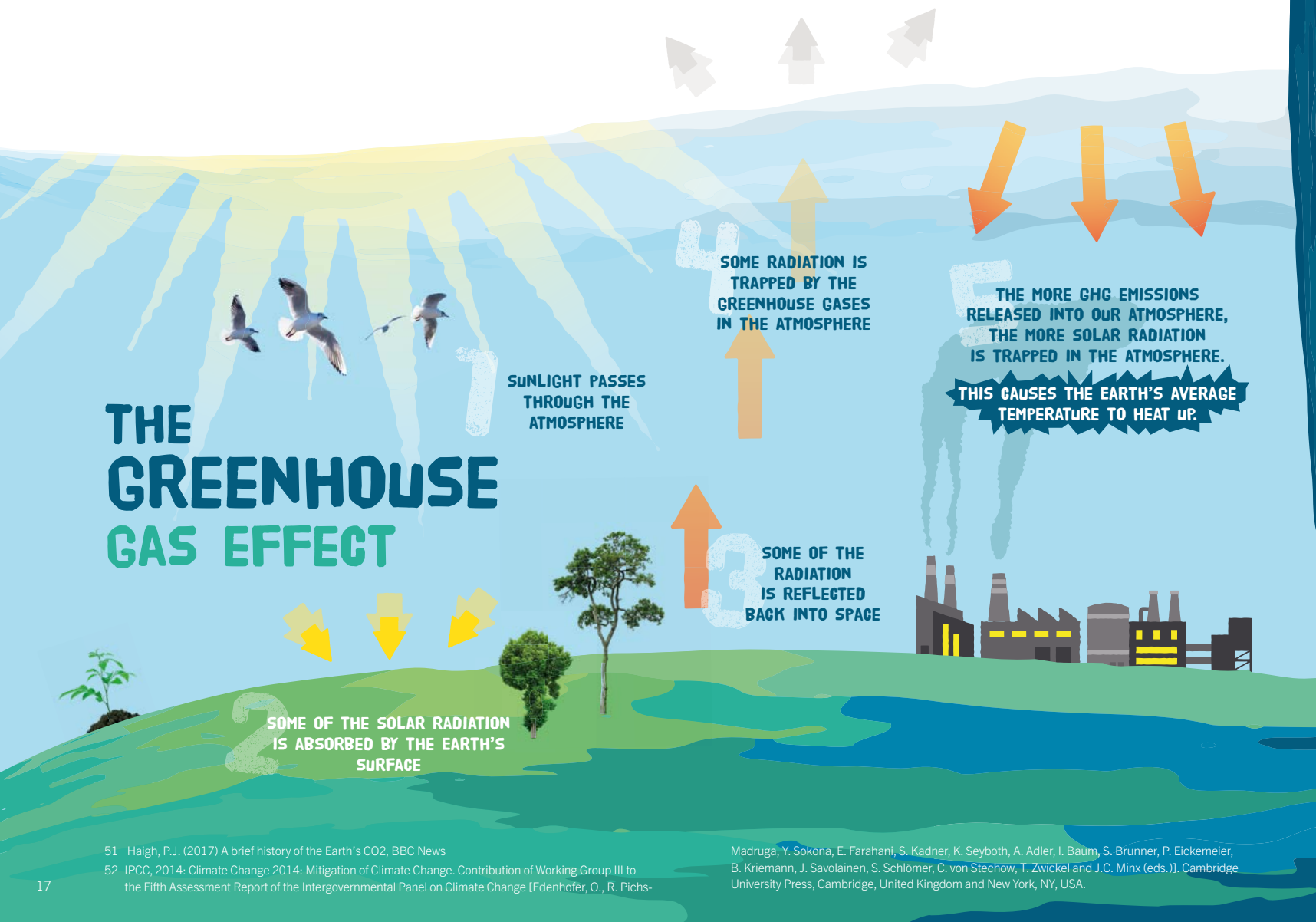
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Over the last 800,000 years, the concentration of CO₂ in our atmosphere has risen and fallen in a continuous pattern, yet never increasing beyond a maximum level of 300 parts per million (ppm).⁵¹ However, since the industrial revolution, CO₂ levels have risen exponentially and are almost 50% higher than pre-industrial levels.⁵²

Global atmospheric temperatures have risen to record levels in correlation with CO₂ emissions, creating an environment that is disrupting the natural balance of life on Earth.

THE GREENHOUSE GAS EFFECT



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**64% OF
GREENHOUSE
GAS EMISSIONS
COME FROM JUST
10 COUNTRIES**

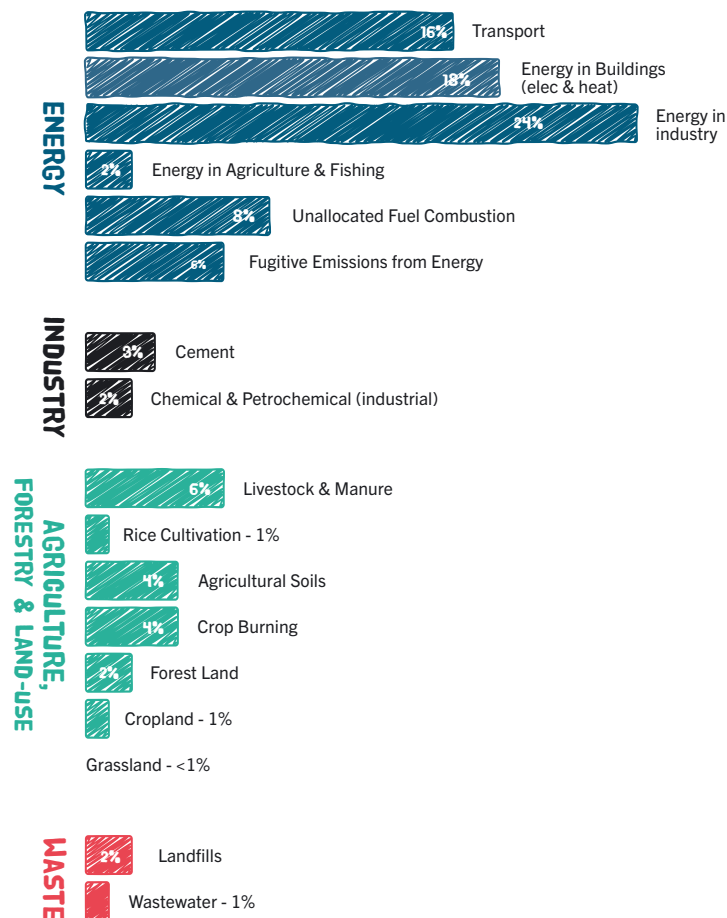
**THE 100 LEAST-
EMITTING COUNTRIES
CONTRIBUTE LESS
THAN 3%**

As shown in Figure 2, carbon emissions are driven by various sectors across the world⁵³ and each country, business and person contributes a different amount, dependent on their carbon footprint.

A carbon footprint refers to the amount of carbon dioxide released into the atmosphere as a result of the activities of a particular individual, organisation, or community, so there is a significant difference for each country.

FIGURE 2: GLOBAL GHG EMISSIONS BY SECTOR

Source: 'Our World in Data' 2016, original published by Climate Watch'.



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⁵³ International Energy Agency. 2020. Global CO2 emissions in 2019 – Analysis, IEA.

FIGURE 3: COUNTRIES WITH THE HIGHEST CO₂ EMISSIONS

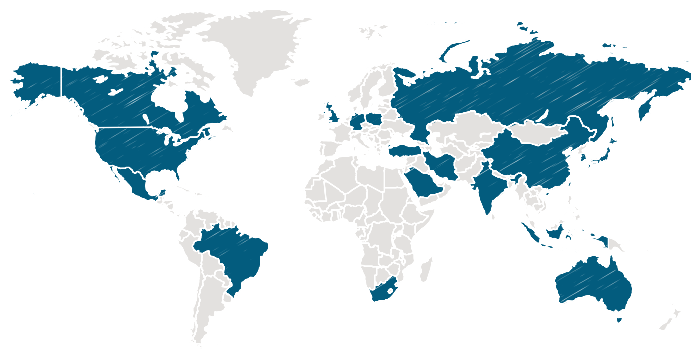
Source: Union of Concerned Scientists 2018, originally published by the International Energy Agency.

Rank		Country	CO ₂ Emissions (Gigatonnes)
1		China	10.06
2		United States	5.41
3		India	2.65
4		Russian Federation	1.71
5		Japan	1.16
6		Germany	0.75
7		Islamic Republic of Iran	0.72
8		South Korea	0.65
9		Saudi Arabia	0.62
10		Indonesia	0.61
11		Canada	0.56
12		Mexico	0.47
13		South Africa	0.46
14		Brazil	0.45
15		Turkey	0.42
16		Australia	0.42
17		United Kingdom	0.37
18		Poland	0.34

As shown in Figure 3, developed and rapidly developing countries, such as USA, China and India have the highest carbon footprint.⁵⁴ Around 64% of greenhouse gas emissions come from just 10 countries, while the 100 least-emitting countries contribute less than 3%.⁵⁵

COUNTRIES THAT HAVE CONTRIBUTED THE LEAST TO CLIMATE CHANGE WILL BE GREATLY AFFECTED BY OCEAN WARMING

Consequently, developed countries, such as the USA, have contributed the most to global greenhouse gas emissions but due to the wealth and ability to adapt to climate change impacts, will be least affected. Yet, countries that have contributed the least to climate change, such as the Pacific Islands, will be greatly affected by ocean warming and are less able to adapt to the changes. Inequalities such as this, play a key role in the causes and impacts of the ocean and climate crisis.⁵⁶



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⁵⁶ Mejean, A., Taconet, N., and Celine Guivarch (2020) Climate change could reverse falling inequality between countries. 17 March 2020. Carbon Brief



ENVIRONMENTAL DEGRADATION

Alongside the burning of fossil fuels, the destruction and removal of vital carbon sinks, such as rainforests and kelp forests, is also driving climate change.⁵⁷

Terrestrial and marine vegetation play a vital role in regulating CO₂ levels through photosynthesis, trapping carbon for millions of years.⁵⁸

Intensive agriculture, overfishing, dredging and oil and gas extraction, has removed or destroyed a large proportion of these environments, meaning less CO₂ is being absorbed from the atmosphere.⁵⁹ Unsustainable industries exploit these natural habitats in order to reduce costs, increase outputs and maximise profits.

UNSUSTAINABLE INDUSTRIES EXPLOIT THESE NATURAL HABITATS IN ORDER TO REDUCE COSTS, INCREASE OUTPUTS AND MAXIMISE PROFITS

As a result, in less than fifty years, more than half of the world's tropical rainforests have been destroyed, and blue carbon habitats, such as seagrass meadows, mangroves and tidal marshes, are being lost at a rate of 2% per year.⁶⁰ When these carbon sinks are removed or damaged, they also release stored carbon back into the atmosphere. For example, between 2015 – 2017, global loss of tropical forests contributed about 4.8 billion tonnes of carbon dioxide per year, equating to approximately 10% of global CO₂ emissions.⁶¹

CLIMATE CHANGE IS THEREFORE A WAKE-UP CALL, NOT ANOTHER ISSUE TO ADD TO THE LIST OF THINGS WE MUST WORRY ABOUT

The declining health of the ocean plays a significant role in amplifying the impacts of climate change. The increased water temperature and acidity levels means the ocean is less able to regulate atmospheric CO₂ and the carbon cycle is consequently disrupted.⁶² The health of the ocean is influenced by a range of factors such as chemical pollution, oil spills, overfishing, unsustainable tourism and development, sewage pollution and a significant volume of plastic pollution. All of these polluting activities contribute to the destruction and decline of delicate ecosystems and marine wildlife that would otherwise help to regulate the global climate and mitigate climate change.

Ultimately, the two primary causes of climate change, the burning of fossil fuels and environmental degradation, are driven by our current global economic model that is encapsulated by infinite growth. An infinite growth that is dependent on a completely finite planet. Unless we recognise the impossible nature of our economic system we will not be able to address this environmental crisis. Climate change is therefore a wake-up call, not another issue to add to the list of things we must worry about. It is telling us that we need to completely change how we function as a global community, otherwise we will not survive and we will take a large proportion of life on earth with us.⁶³



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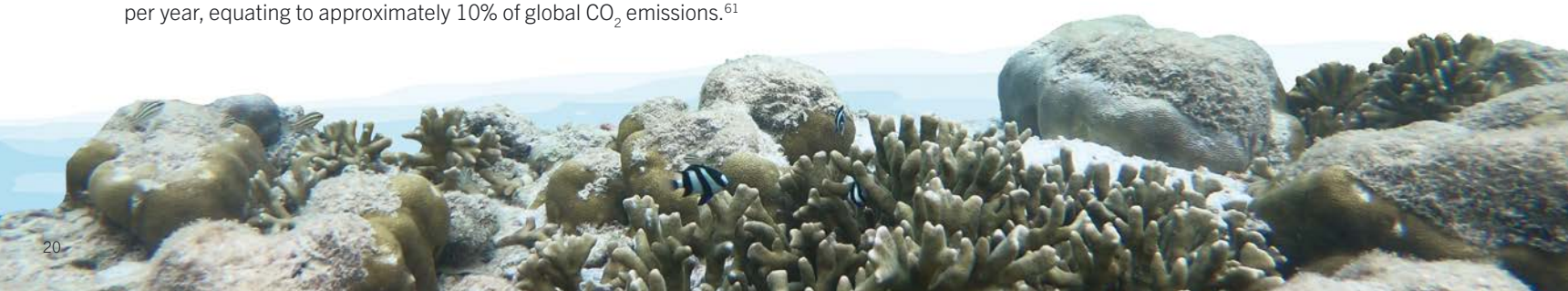
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DID YOU KNOW?

PLASTIC POLLUTION & CLIMATE CHANGE ARE INEXTRICABLY LINKED.



Almost all plastic is derived from fossil fuels such as oil and gas.

The process of extracting and transporting those fuels and manufacturing the plastic also creates billions of tonnes of greenhouse gases. On top of this, the single-use plastic culture and poorly regulated management means that the majority of plastic is either incinerated, adding to carbon emissions, or ends up in landfill site where it can leak back into the environment, particularly where landfills are not well managed.⁶⁴

It is estimated that the production and incineration of plastic has pumped more than 850 million tonnes of greenhouse gases into the atmosphere. By 2050, those emissions could rise to 2.8 billion tonnes. Without addressing the plastic crisis, we cannot mitigate climate change.⁶⁵

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The coronavirus pandemic has proven that drastic policy change can successfully and quickly alter how we work as a global community. If we are to ensure the average global temperature increase stays below 1.5°C, the same urgency needs to be adopted when addressing climate change. As we reach environmental tipping points⁶⁶, it is vital that we work to mitigate CO₂ emissions at the source, but also introduce nature-based solutions to remove the CO₂ we have already emitted.⁶⁷

NET ZERO

To reverse the ocean and climate crisis, we need an urgent and drastic reduction in greenhouse gas emissions, especially carbon dioxide.

Primarily, we must stop burning fossil fuels at source, which means ending new fossil fuel extraction and phasing out existing production.²⁸ We need to move away from an economy driven by a dependency on fossil fuels and focus on rebuilding our society on green infrastructure.

The global community must become net zero by 2030, through the widespread introduction of renewable energy, such as wind and solar, as well as reducing our dependency on unsustainable and destructive materials, such as plastics.⁶⁹

Despite the introduction of legally binding targets to cut emissions, current progress by world governments has been far too slow.⁷⁰ At a national level, countries must adopt ambitious targets to reach net zero by 2030, with a clear overarching plan that outlines how they will get there. Net zero action plans should include changes to the transport system, building insulation, agricultural methods, alongside removing subsidies for polluting industries. The most recent attempt to establish international cooperation over climate change is the 2015 Paris Agreement. The Paris Agreement, which has since been ratified by 189 governments across the world, aims to 'hold the increase in global average temperature to well below 2.0°C from pre-industrial levels and pursue efforts to limit temperature increase to 1.5°C from preindustrial levels'.

⁶⁶ Environmental tipping point are thresholds where a tiny change could push the whole environmental system into a completely new state

⁶⁷ Mcsweeney, R. (2020) Explainer: Nine 'tipping points' that could be triggered by climate change. February 2020. Carbon Brief

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DID YOU KNOW?

IF WE FAIL TO SIGNIFICANTLY REDUCE OUR GLOBAL GREENHOUSE GAS EMISSIONS AND AVERAGE TEMPERATURE RISES BY 2°C, COMPARED TO 1.5°C, THE CONSEQUENCES WILL BE DEVASTATING FOR ALL LIFE ON EARTH.

For example, 10 million more people would have to migrate due to sea level rise, 50% more of the global population would experience water scarcity and 2 million km² of permafrost would disappear.⁷¹

Starting in 2020, global emissions would need to be reduced by 14% every year until 2040 to limit warming to 1.5°C. It is still achievable if action is taken now and our carbon emissions fall dramatically by 2030.⁷²

**WE NEED AN URGENT AND
DRASTIC REDUCTION
IN GREENHOUSE GAS EMISSIONS,
ESPECIALLY CARBON DIOXIDE**



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⁷¹ Hoegh-Guldberg, O., Jacob, D., Taylor, M., et al. (2019) The human imperative of stabilizing global climate change at 1.5°C, Science, Vol.365, No.6459

⁷² United Nations Environment Programme (2018) UN Environment Annual Report 2018, United Nations



Each ratified government produced a set of Nationally Determined Contributions (NDCs) which outlined long-term efforts to reduce national emissions and adapt to the impacts of climate change. In November 2021, the UK will host the 26th Conference of Parties (COP26). This is the first opportunity, since the Paris agreement, to review climate commitments and strengthen ambition through the re-submission of each countries NDCs.

THE UK HAS CUT CO₂ EMISSIONS BY 44% SINCE 1990 AND HAS DECLARED A CLIMATE EMERGENCY WITH A GOAL TO REACH NET ZERO BY 2050

So far, the UK has cut CO₂ emissions by 44% since 1990 and has declared a climate emergency with a goal to reach net zero by 2050. However, this date is too far away to ensure the impacts of climate change are minimised, and the government is already failing to meet required targets.⁷⁴

Up until November 2020, there was no government-wide action plan in the UK, but rather a series of piecemeal policies owned by individual departments.

The newly announced 'Ten Point Plan' represents an important step forward on the UK's path to net zero.⁷⁵ Some pledges, such as the promise to ban all combustion engine sales and to ensure the protection and restoration of the natural environment, are a positive starting point.

However, the action plan has been criticised for the minimal amount of funding it has received in comparison to carbon intensive industries and its overall lack of urgency.⁷⁶

IT IS PREDICTED THAT OCEAN ENERGY COULD PROVIDE A MINIMUM OF 10% OF THE UK'S ELECTRICITY

DID YOU KNOW?

NET ZERO REFERS TO THE BALANCE BETWEEN THE AMOUNT OF GREENHOUSE GAS PRODUCED AND THE AMOUNT REMOVED FROM THE ATMOSPHERE.

Net zero is reached when the amount of greenhouse gas produced is no more than the amount taken away.⁷³

In order for a net zero target to be meaningful or credible it is essential that emissions are first reduced at source to the greatest possible extent before any residual emissions are compensated with greenhouse gas removal. Unfortunately, net zero can be seen as a form of 'green washing' as big businesses invest in greenhouse gas removal, such as carbon offsetting or carbon capture and storage, rather than actually cutting their emissions at source.



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⁷⁵ GOV.UK. 2020. PM outlines his Ten Point Plan for a Green Industrial Revolution for 250,000 jobs, November 2020. Accessed 18 November 2020, <https://www.gov.uk/government/news/pm-outlines-his-ten-point-plan-for-a-green-industrial-revolution-for-250000-jobs>

⁷⁶ Walker, P., and Elgot, J. (2020) Boris Johnson announces 10-point green plan with 250,000 jobs, The Guardian





As an island nation, the ocean offers a range of possibilities to help minimise our emissions through renewables such as wave and tidal energy. Europe holds 20-30% of global tidal resources and 80% of these are located around the coastlines of UK and France.

It is predicted that ocean energy could therefore provide a minimum of 10% of the UK's electricity.⁷⁷ In the first quarter of 2020, renewable energy made up almost half of the UK's electricity generation, highlighting that net zero is possible if a specific action plan is in place.⁷⁸

AT AN INDIVIDUAL LEVEL, WE MUST AIM TO MINIMISE OUR CARBON FOOTPRINT WHERE POSSIBLE, THROUGH BEHAVIOURAL AND LIFESTYLE CHANGES

Big businesses also need to take responsibility and cut their emissions to reach net zero by 2030, by eliminating carbon emissions altogether or if that is not possible, balancing their remaining carbon emissions with carbon removal. At an individual level, we must aim to minimise our carbon footprint where possible, through behavioural and lifestyle changes. We can all make small changes to help reduce global CO₂ emissions such as switching to a renewable energy supplier or choosing 'green' pension funds.

We can reduce our meat intake or switch to a plant based diet that will reduce the need for intensive livestock production that forms a large proportion of greenhouse gas emissions. Reducing our fish consumption will also reduce the reliance on industrial fishing practices that are a primary cause of marine ecosystem decline. These changes will play a key role in tackling the ocean and climate crisis.⁷⁹

⁷⁷ Scottish Renewables (2019) UK Marine Energy 2019 - A New Industry, Marine Energy Council

⁷⁸ Ambrose, J. (2020) Renewable energy breaks UK record in first quarter of 2020, The Guardian

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REWILD, RESTORE AND PROTECT

Reducing carbon emissions alone will not be enough to keep global heating below the required 1.5°C.⁸⁰

Large amounts of carbon must also be removed from the atmosphere. Rewilding, restoring and protecting natural carbon sinks is an effective way to increase the extraction of CO₂.⁸¹ Evidence suggests carbon sinks could provide over a third of the greenhouse gas mitigation required globally between now and 2030.

Yet, so far, rewilding initiatives attracted only 2.5% of funding for mitigation, and far too little political attention.⁸²

The ability of terrestrial vegetation, such as rainforests, to sequester carbon through photosynthesis is well known. However, there are emerging possibilities associated with blue carbon captured in ocean ecosystems. Blue carbon is the most effective, yet overlooked, method for long term carbon sequestration and refers to the carbon stored in marine biomass such as kelp forests, salt marshes, mangroves and seagrass meadows. Salt marshes, for example, are ten times more effective at capturing carbon than terrestrial ecosystems but numbers have decreased by 80% over the last 200 years.⁸³



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REWILDING IS THE LARGE-SCALE RESTORATION OF ECOSYSTEMS AND THE REINSTATEMENT OF NATURAL PROCESSES.

It enables nature to take care of itself and encourages a balance between people and the rest of nature, where each can thrive.⁸⁴

Through protection and restoration, rewilding can occur both on land and in the ocean. Although only 13% of the world's seas are now classed as wild, there are already many examples that highlight rewilding can allow the ocean to thrive once again.⁸⁵

80 IPCC, 2014: Summary for Policymakers. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

81 Rewilding Britain (2019) Rewilding and climate breakdown: How restoring nature can help decarbonise the UK. May 2019

82 Rewilding Britain (2019) Rewilding and climate breakdown: How restoring nature can help decarbonise the UK. May 2019

83 The Blue Carbon Initiative. The Blue Carbon Initiative, accessed 4 August 2020, <https://www.thebluecarboninitiative.org>



BLUE CARBON IS THE MOST EFFECTIVE, YET OVERLOOKED, METHOD FOR LONG TERM CARBON SEQUESTRATION

Fortunately, through protection and rewilding projects, these ecosystems can be restored to their pre-industrial state, forming a crucial aspect of climate change mitigation and adaptation.⁸⁶ Terrestrial, marine and freshwater environments must be managed with a holistic approach that encapsulates their connection and importance in mitigating climate change. To maximise their impact, 30% of the ocean and all UK Marine Protected Areas should be highly protected by 2030.⁸⁷

Whilst Marine Protected Areas (MPAs), fisheries management measures, and licences control the amount and type of activity at sea and alleviate some human impacts, they are both too lenient and too inadequately enforced to provide any real protection to allow blue carbon habitats to recover. For example, the UK's current network of MPAs are designated to protect discrete habitats, however they still allow extremely damaging extraction processes to take place including industrial fishing by supertrawlers.⁸⁸ The 'Benyon Review Into Highly Protected Marine Areas' (HPMAs), highlighted that HPMAs completely prohibit extractive, destructive and depositional uses and allow only non-damaging levels of other activities. The adoption of HPMAs, therefore, would allow the UK to remain at the forefront of combatting climate change and also help to meet national and international climate commitments.

CASE STUDY SEAGRASS OCEAN RESCUE

A seagrass species commonly referred to as eelgrass once formed extensive meadows around the coastal waters of the British Isles but are now categorised as being nationally scarce.

Alongside reduced water quality, seagrass habitats are threatened by coastal development and poor land use, including disturbance from marine activities.

Leading the way as the largest marine restoration project in the UK, Seagrass Ocean Rescue are restoring 20,000m² of seagrass meadow on the Pembrokeshire coastline.

As the first of its kind, the project aims to increase the uptake of nature-based solutions to climate change, while improving marine biodiversity and lessening the risk of coastal erosion.⁸⁹



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⁸⁴ Rewilding Britain. 2019. Defining rewilding, accessed 18 November 2020, <https://rewildingbritain.org.uk/explore-rewilding/what-is-rewilding/defining-rewilding>

⁸⁵ Rewilding Britain (2019) Rewilding and climate breakdown: How restoring nature can help decarbonise the UK. May 2019

⁸⁶ Benyon, R., Barham, P., Edwards, J., et al. (2020) Benyon Review Into Highly Protected Marine Areas, 2020. June 2020. Department of Environment, Food & Rural Affairs, UK Government.

⁸⁷ Benyon, R., Barham, P., Edwards, J., et al. (2020) Benyon Review Into Highly Protected Marine Areas, 2020. June 2020. Department of Environment, Food & Rural Affairs, UK Government

⁸⁸ Benyon, R., Barham, P., Edwards, J., et al. (2020) Benyon Review Into Highly Protected Marine Areas, 2020. Department of Environment, Food & Rural Affairs, UK Government

⁸⁹ Carrington, D. (2020) UK's lost sea meadows to be resurrected in climate fight, The Guardian



BLUE CARBON HABITATS

TIDAL MARSHES NATURALLY FILTER POLLUTED WATER

TIDAL MARSHES

Tidal marshes are made up of mineral sediment, organic material and salty water. They store carbon in the soil, several meters deep, at a speed 2 to 4 times greater than a mature tropical forest.

Tidal marshes also filter the water and minimize the impact of sewage and agricultural pollution⁹⁰

MANGROVES

Usually found in floodplains, mangroves are the most carbon-rich forests in the tropics.

But, emissions from the degradation of mangroves can be as high as 10% of the total emissions from global deforestation, despite only accounting for 0.7% of the tropical forest area⁹²

**50% OF THE
EARTH'S
MANGROVES
HAVE NOW
DISAPPEARED**

**KELP FORESTS CAN
ABSORB 200 MILLION
TONNES OF CO₂**

SEAGRASS MEADOWS

Underwater flowering plants that grow in mass along the majority of the world's coastlines.

Seagrass has incredibly long roots which mean carbon is drawn deep into the sea bed and trapped for millions of years.⁹¹

**SEAGRASS
MEADOWS
TRAP OVER 10%
OF BLUE CARBON**

KELP FORESTS

It is estimated that around 200 million tonnes of carbon dioxide are being sequestered by kelp every year – which is around the same annual emissions as the state of New York!⁹³

^{90, 91, 92, 93} The Blue Carbon Initiative. The Blue Carbon Initiative, accessed 4 August 2020, <https://www.thebluecarboninitiative.org>

CASE STUDY 'NO-TAKE ZONE' ISLE OF ARRAN

In 1984, the government allowed trawlers and dredgers to come closer to the shores surround the Isle of Arran in Scotland. As a result, the marine ecosystems and biodiversity of the island collapsed.⁹⁴

In response, a community-based campaign relentlessly lobbied the Scottish government to implement a 'no-take zone', otherwise known as a HPMA. In 2008, the 2.67km HPMA was finally implemented, and since then there has been a dramatic revival of various marine species in the island's waters.

Lobsters are now four times more abundant, king scallop density is four times higher, and blue carbon habitats have returned in mass to the sea floor, providing habitats for juvenile fish and protection for the coastal community.

There are only three other 'no-take zones' in the UK including the Medway estuary, Flamborough Head and Lundy Island, all of which have seen the incredible bounce back of nature.

Although there are about 350 MPAs across the country, as they still allow fishing and have minimal monitoring, their positive impact on degraded ecosystems is almost non-existent.

The Isle of Arran is an incredible example of what happens when nature is allowed to thrive. If this is embraced at a national, and global scale, we will see a drastic improvement in the health of our ocean and in our ability to mitigate climate change.⁹⁵

Photo of the Isle of Arran in Scotland

THE ISLE OF ARRAN IS AN INCREDIBLE EXAMPLE OF WHAT HAPPENS WHEN NATURE IS ALLOWED TO THRIVE...



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⁹⁴ Busby, M. (2020). How a no-take zone revived a Scottish fishery devastated by dredgers. *The Guardian*

⁹⁵ Stewart, B.D., Howarth, L.M., Wood, H., et al. (2020) Marine Conservation Begins at Home: How a Local Community and Protection of a Small Bay Sent Waves of Change Around the UK and Beyond. *Frontiers in Marine Science*, Vol.7



EDUCATION AND MOVEMENT BUILDING

Education and awareness building are some of the most important tools to initiate the changes we want to see in our future.

Increasing each other's understanding of climate change encourages a change in attitudes and behaviour and empowers individuals to demand the government take environmental action.⁹⁶

Over the past few years, as climate change impacts worsen and the government has failed to significantly address the crisis, the climate and environmental movement has grown in size and influence.⁹⁷ The rise of movements such as Extinction Rebellion and the Fridays For Future youth protests, have built momentum and provided a platform for the public to join together and demand positive change.⁹⁸ This is particularly important when addressing an issue such as the ocean and climate crisis, which can sometimes seem, overwhelmingly, out of our control. Environmental movements highlight that we are not alone in our fight to protect and restore the natural world and remind us that our voices are louder when we shout together. In order to tackle the ocean and climate crisis, it is vital that the momentum of the climate movement continues to grow, at an individual, community and national level.

ENVIRONMENTAL MOVEMENTS HIGHLIGHT THAT WE ARE NOT ALONE IN OUR FIGHT TO PROTECT AND RESTORE THE NATURAL WORLD

As the generation who will have to live with the consequences of climate breakdown and ecological disaster, young people have led the way in climate action and protests, sending the message that we are currently losing in the race for our lives.

In March 2019, more than 1.4 million youth activists went on strike for the climate, with one of their key demands highlighting the need for climate crisis to be a core part of the national school curriculum.⁹⁹

While students are fighting for climate action outside the classroom, their education should provide them with the tools and knowledge to enable them to utilise their powerful voice and drive positive change.¹⁰⁰ Supporting this, a review undertaken by the Welsh Youth Parliament, revealed that 71% of young people rank school lessons as one of the top three ways to receive information about environmental issues, such as the need to reduce plastic consumption.¹⁰¹ The students of today are the decision-makers of the future so the inclusion of the ocean and climate crisis in their education plays a pivotal role in tackling this global emergency.

71% OF YOUNG PEOPLE RANK SCHOOL LESSONS AS ONE OF THE TOP THREE WAYS TO RECEIVE INFORMATION ABOUT ENVIRONMENTAL ISSUES

Currently, the topic of climate change, controversially labelled 'environmental change', is included in the English curriculum from primary years to GCSE level with a focus on scientific processes and the debate around climate evidence.¹⁰² With over 97% of published scientists agreeing that climate change is caused by human activity, it is clear there is no 'debate' around climate evidence; this should be reflected in our education system.¹⁰³ Plus, climate change is not just a question of science and relates to economic, political and social studies as much as it is linked to geography and physics.¹⁰⁴ Campaigners, such as Teach The Future¹⁰⁵, have therefore argued that climate education should fit into subject areas across the curriculum, including vocational courses.¹⁰⁶

As a response to the current inaction of England's Department of Education, climate education programmes, such as Thought Box, have developed educational resources to empower the climate strike generation and help teachers around the world invite climate conversations into the classroom.¹⁰⁷



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CASE STUDY THOUGHT BOX

Thought Box is an educational organisation that develops programmes and resources to help pupils think more critically about the world around them.

The organisation works in 54 countries, engaging with over 100,000 students. Overall, they want to increase understanding of the social, cultural and environmental influences which shape personal, local and global actions and futures.¹⁰⁸

Thought Box developed a free 'Changing Climates' curriculum that offers lesson plans and resources for every school child aged 5-18 years old.

The curriculum focuses on the causes and effects of climate change and addresses some of the controversy behind climate inaction. The impact of climate change on mental health is also explored, alongside positive and empowering actions that can be taken to address the crisis. All of the lessons and resources build on key ideas and guidance from climate scientists, educators and psychologists.

The climate curriculum is one of the free resources available to all Thought Box members!



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101 Littering and Plastic Waste Committee (2020) Reduce, Reuse, Recycle. Welsh Youth Parliament. November 2020

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103 NASA. Global Climate Change: Scientific Consensus: Earth's Climate is Warming, accessed 18 November 2020, <https://climate.nasa.gov/scientific-consensus>

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PUBLIC AWARENESS

To gain an insight into public understanding of the ocean and climate crisis we launched the Ocean and Climate Survey in October 2020. The national survey provided an opportunity for the public to voice their opinions on the impacts, causes and solutions relating to the environmental crisis.

To ensure all age groups participated, the survey was accessible and available to everyone (see Figure 4). It is especially key that we listen to the voices of the younger generations as they are the people who will be most affected by the impacts of climate change. Advertised across all SAS platforms for five weeks, the survey attracted 5,920 responses.

Are you worried about climate change?

Figure 5 reveals that almost 89% of the public are very worried about climate change, with less than 1% of respondents showing no concern at all.

89% OF THE PUBLIC ARE VERY WORRIED ABOUT CLIMATE CHANGE

Although unsurprising, the results highlight that the public perceives the climate crisis to be an extremely urgent issue. This level of concern was matched at all ages and demonstrates that both the young and old are worried about climate change. However, in recent years, it has mainly been the younger generations driving the climate movement, why?

FIGURE 4: AGE OF RESPONDENTS

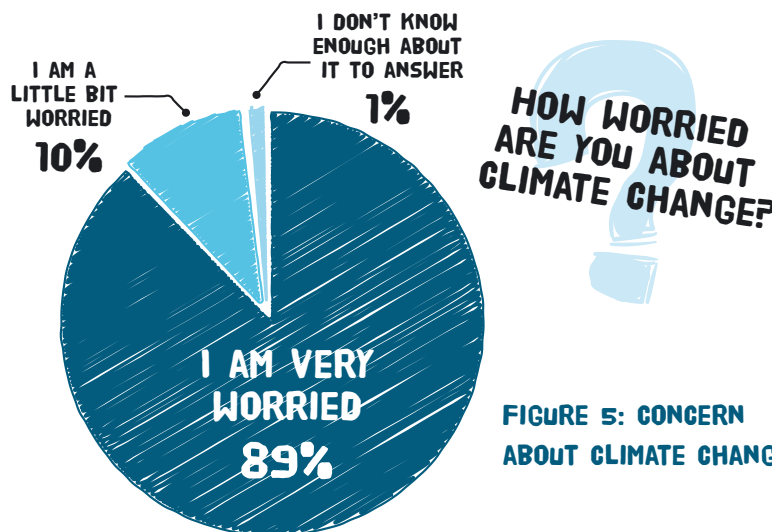
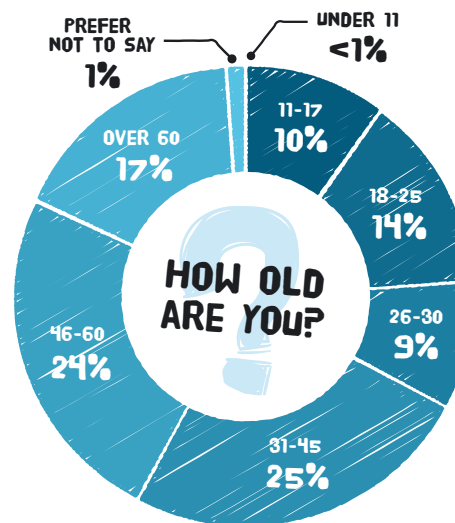


FIGURE 5: CONCERN ABOUT CLIMATE CHANGE



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What do you know about climate change?

It is clear the public are very concerned about climate change, but what is their level of understanding of the issue and how do they think it will affect them and other people across the world?

FIGURE 6: CAUSES OF CLIMATE CHANGE

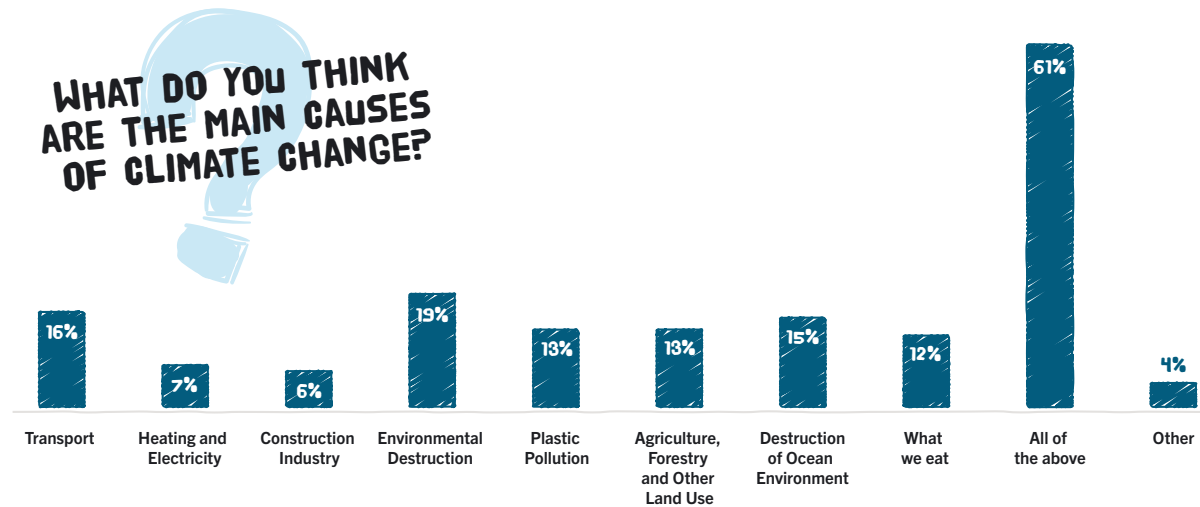


Figure 6 highlights 61% of the respondents agree that all of the proposed causes contribute to climate change, suggesting a high level of understanding. However, when the other responses were added, a hierarchy of 'causes' developed. More specifically, 80% of people agreed that environmental destruction is one of the main causes of climate change whereas only 68% of people believed heating and electricity is causing climate change. However, interestingly, Figure 2 shows that the heating and electricity plus energy in industry, such as construction, actually contribute the highest amount of greenhouse gas emissions globally.

As we have already explored, there are many different causes of climate change. The answers to this question were categorised into the broad areas of: transport, heating and electricity, environmental destruction, plastic pollution, agriculture forestry and other land use, destruction of the ocean environment and what we eat. Respondents were also given the opportunity to choose 'all of the above' or an 'other' option.

97% OF PUBLIC BELIEVE MORE ACTION NEEDS TO BE TAKEN TO TACKLE THE OCEAN AND CLIMATE CRISIS

In addition to the options provided, 213 respondents suggested alternative causes of climate change such as consumerism, inequality, overpopulation, lack of education and political inaction. All of these issues contribute to climate change to a varying degree.

It is positive to note that the public recognise the significant impact consumerism has on the environment since around 10% of global emissions come from the fashion industry alone.¹⁰⁹



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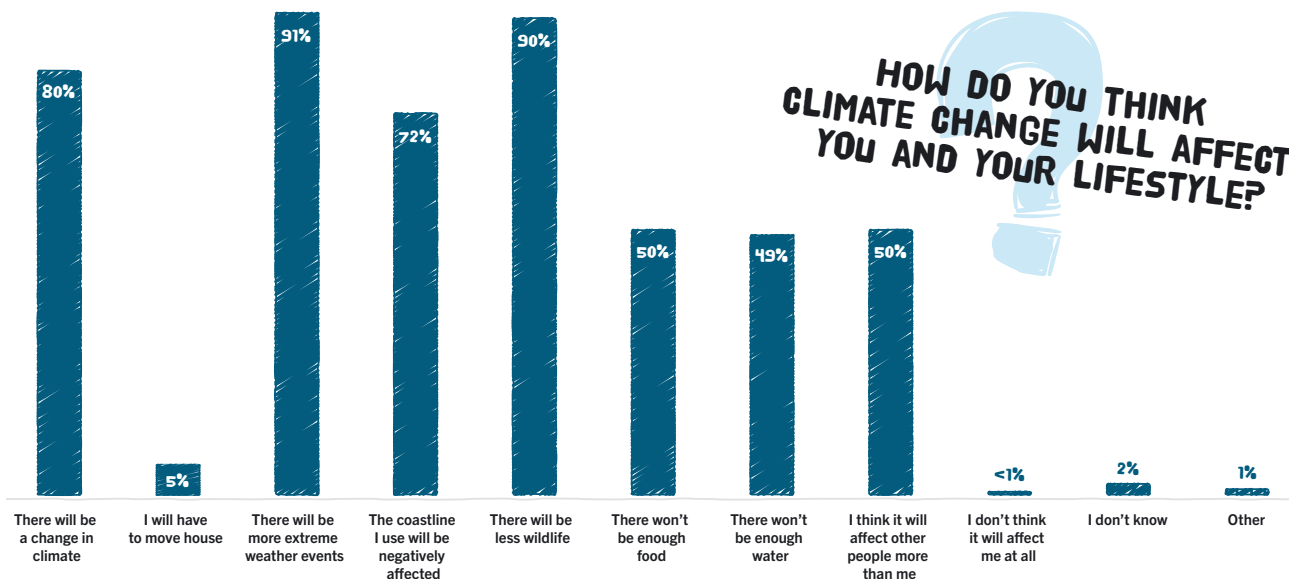


The argument that population growth is the cause of climate change assumes that everyone on the planet has equal access to resources and therefore must share the blame for the climate crisis we are experiencing. However, the poorest half of the population – 3.5 billion people – are responsible for just 10% of global emissions, whilst the richest 10% contribute 50% of global emissions.¹¹⁰ This suggests it is not population growth driving climate change, but unsustainable economic growth and inequality.

Interestingly, the majority of respondents who suggested 'overpopulation' was a cause of climate change were aged over 46 years old (73%).

The results also show the public understand the significant impact climate change has on the ocean. This shows a level of awareness of the ocean's role within the climate crisis. Almost 100% of people acknowledge that climate change is causing sea level rise, extreme weather, ocean warming, ocean acidification and biodiversity loss; none of the respondents thought that climate change did not impact the ocean.

FIGURE 7: IMPACTS OF CLIMATE CHANGE



¹¹⁰ Oxfam. (2015). Extreme Carbon Inequality: Why the Paris climate deal must put the poorest, lowest emitting and most vulnerable people first. December 2015. Oxfam



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96% OF THE PUBLIC BELIEVE THAT THE GOVERNMENT NEEDS TO TAKE URGENT ACTION

Figure 7 highlights that the public understands climate change will affect them and their lifestyle in some way. 92% of people think there will be more extreme weather events where they live and 91% agree that wildlife biodiversity will decrease. As the majority of respondents live in the UK or Europe, it is positive to note that, despite the often-misleading message that climate change will not significantly affect these areas, 80% of people still recognise there will be a change in climate where they live.

However, despite a third of respondents living near the coastline, only 5% of people think they will have to move house as a result of climate change, whereas 80% of respondents think that other people across the world will have to migrate.

As mentioned in the case study on page 12, the entire village of Fairbourne in North Wales will have to relocate due to climate-induced sea level rise, making them Britain's first climate refugees. The impact of sea level rise in the UK will only get worse, and it is predicted that nearly 530,000 homes are at risk along the English coast alone.¹¹¹

Similarly, almost half of the respondents do not think they will be affected by a lack of food and water but over 80% agree that other people across the world will suffer from these changes. Again, this highlights that climate change is often still perceived as an environmental issue that will affect other people more than us but in reality, it will have an impact on all our lives.

Alongside the options provided, the public also suggested 'other' ways climate change will affect them including ecoanxiety, lifestyle changes, migration and new diseases.

¹¹¹ Committee on Climate Change (2018) Managing the coast in a changing climate, October 2018

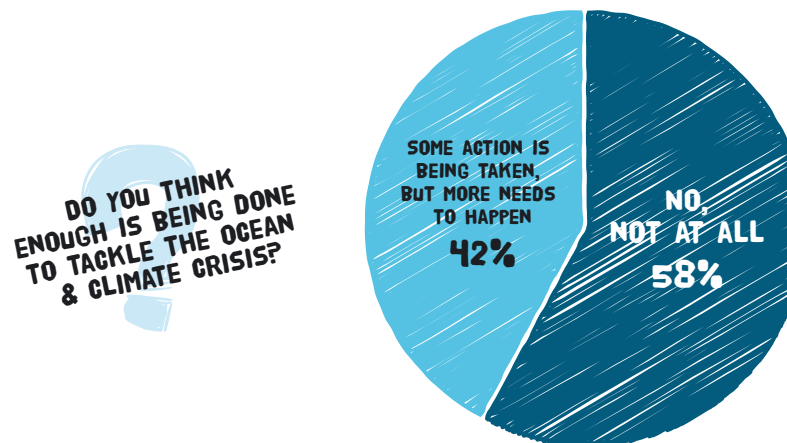
A 2017 report describes ecoanxiety as a source of stress caused by "watching the slow and seemingly irrevocable impacts of climate change unfold and worrying about the future for oneself, children and later generations".¹¹²

Often, action is seen as the solution to ecoanxiety and by working together we can overcome our fears and create positive change.

97% OF THE PUBLIC BELIEVE THAT WE NEED TO STOP POLLUTING THE OCEAN

As countries become more and more uninhabitable due to climate changes, climate migration is also inevitable. However, as the respondents noted, it will be those who have contributed the least to climate change that will have to move away from their homes. It is therefore essential that the developed countries, who are responsible for the majority of climate impacts, provide help and refuge to those in need.

FIGURE 8: ACTION TO TACKLE CLIMATE CHANGE



¹¹² Clayton, S., Manning, C., College, M., et al. (2017) Mental health and our changing climate: Impacts, Implications and Guidance, March 2017. American Psychological Association



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How should we tackle the ocean and climate crisis?

As governments, businesses and communities work to tackle the climate crisis with various degrees of urgency, it is important to hear the opinion of the public and understand how they think this environmental emergency should be addressed.

Unsurprisingly, 58% of the public said that nowhere near enough was being done to tackle the ocean and climate crisis; 42% agreed that some action is being taken but more needs to happen. Less than 0.2% thought that enough action was being taken. These results speak for themselves. This means that 97% of public think that more action needs to be taken to address the ocean and climate crisis.

As explained on page 22-23, there are a range of readily available solutions to tackle the climate crisis. The answers provided related to political action, reducing our dependency on fossil fuels, rewilding and the restoration of nature, lifestyle changes, plastic reduction and emissions reduction in businesses. Respondents were also given the opportunity to choose 'all of the above' or suggest an 'other' option.

Over 80% of respondents agreed that 'all of the above' solutions were needed to tackle the ocean and climate crisis, suggesting that the majority of the public understand that a range of approaches is required.

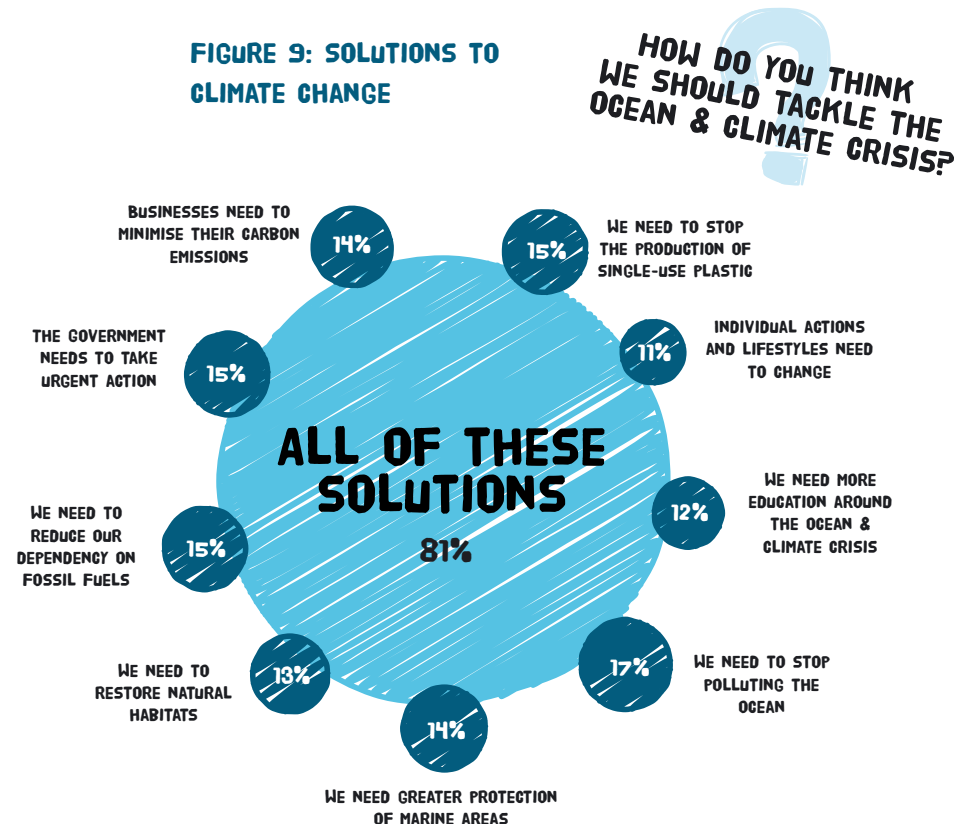
Overall, 96% of the public think the government needs to take urgent action to address climate change.

Almost all of the respondents (98%) agreed that ocean health plays a key role in tackling the ocean and climate crisis, stating we must 'stop polluting the ocean'.

76% OF PEOPLE BELIEVE THAT THE DESTRUCTION OF THE OCEAN ENVIRONMENT IS A CAUSE OF CLIMATE CHANGE

This highlights the need to also focus on issues such as water quality and plastic pollution. Sixty three respondents also suggested 'other' ways to address the climate crisis such as a circular economy, awareness raising, community action and equality.

FIGURE 9: SOLUTIONS TO CLIMATE CHANGE



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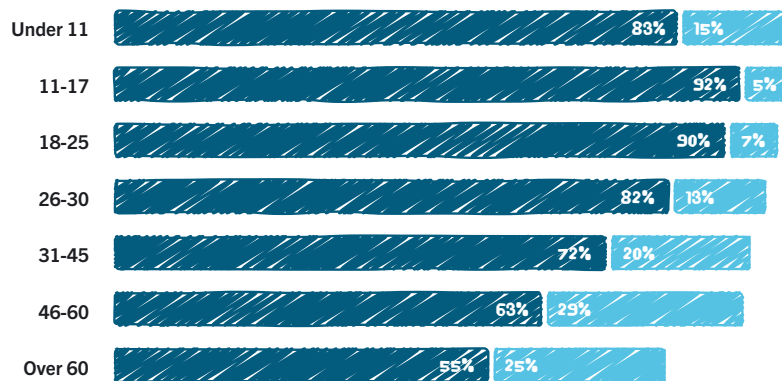
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Despite the apparent understanding and awareness of climate change, 94% of respondents are still interested to learn more about the ocean and climate crisis. 92% of 11-17 year olds said they would definitely want to learn more, whereas only 55% of 61+ year olds want to learn more. But what do the public want to learn about?

94% OF THE PUBLIC WANT TO LEARN MORE ABOUT THE OCEAN AND CLIMATE CRISIS

FIGURE 10: EDUCATION AND CLIMATE CHANGE



DO YOU WANT TO LEARN MORE ABOUT THE OCEAN & CLIMATE CRISIS?

Yes
Maybe

79% of those interested in learning more about the ocean and climate crisis want to learn what they can to help; this figure increased to 90% in the 26-30 age group.

Respondents were less interested to learn about how the climate crisis will affect them (39%), but over 70% are keen to learn more about the impacts and solutions of climate change in relation to the ocean. A small number of respondents also suggested other topics such as 'how to raise awareness' and learning about climate change policy.

Almost all respondents agree that not enough is being done to tackle the ocean and climate crisis. All ages of the public recognise that a range of solutions need to be put in place including the restoration and protection of the ocean, urgent government action and lifestyle

SURVEY SUMMARY

To conclude, the public, at all ages, are very concerned about the ocean and climate crisis. Overall, there is a good understanding of the extent and scale of the crisis we face as a global community and the public recognise the inequalities related to the causes and impacts. The ocean is not only perceived as a victim of climate change but also as a vital mechanism to tackle the crisis.

It is clear the public want the government and businesses to address the crisis immediately and there is a strong desire to engage in climate issues through education, awareness raising and direct action. Now it is time to put our collective voices together and shout for the ocean.



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As business continues as normal, the ocean is sending us a direct warning – through extreme weather, rising seas, melting ice caps and species extinction – our blue planet is on fire.

Even if we act now and cut our emissions immediately, the impacts of climate change will continue but they will be unimaginably worse if we sit back and do nothing.

WE MUST LOOK TOWARDS THE NATURAL SOLUTIONS WHICH ARE READILY AVAILABLE

It is important, now more than ever, that we come together to put pressure on governments and businesses to address the ocean and climate crisis.

Alongside the immediate and necessary policy change required to create a shift in how we work as a global community, we must look towards the natural solutions which are readily available.

If we work together to allow the natural world to recover and the marine and land-based environments to thrive, the destruction of our planet could be, in part, reversed.

The link between the ocean and climate change is undeniable, so it is vital that the ocean's voice is heard amongst all climate action. It is important that we continue to raise awareness of the effect climate change is having on the ocean but also champion the oceans role as a key tool in tackling the climate crisis.

THE DESTRUCTION OF OUR PLANET COULD BE, IN PART, REVERSED



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A BLUE BOUNCE BACK FROM COVID-19, WHICH PUTS THE OCEAN AND ALL-NATURAL ENVIRONMENTS, AT THE CENTRE OF RECOVERY

We need economic stimulus packages that support sustainable industries with a focus on investing in renewable energies and projects which store blue carbon.

We need to prevent bail-outs that maintain and perpetuate polluting industries.

LEGISLATION AND GOVERNMENT POLICY THAT ACHIEVES NET ZERO BY 2030

We need ambitious targets to reach net zero carbon by 2030.

We need a clear overarching and ambitious action plan to reach net zero.



OCEAN REWILDING TO REMOVE CARBON FROM THE ATMOSPHERE

We need to recognise the intrinsic link between the ecological and climate crisis and invest in ocean rewilding to allow natural ecosystems to actively remove CO2 from the atmosphere.



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