
Oceans

Dynamic Briefing

Generated 02 April 2019 for Douglas McCauley, University of California, Santa Barbara



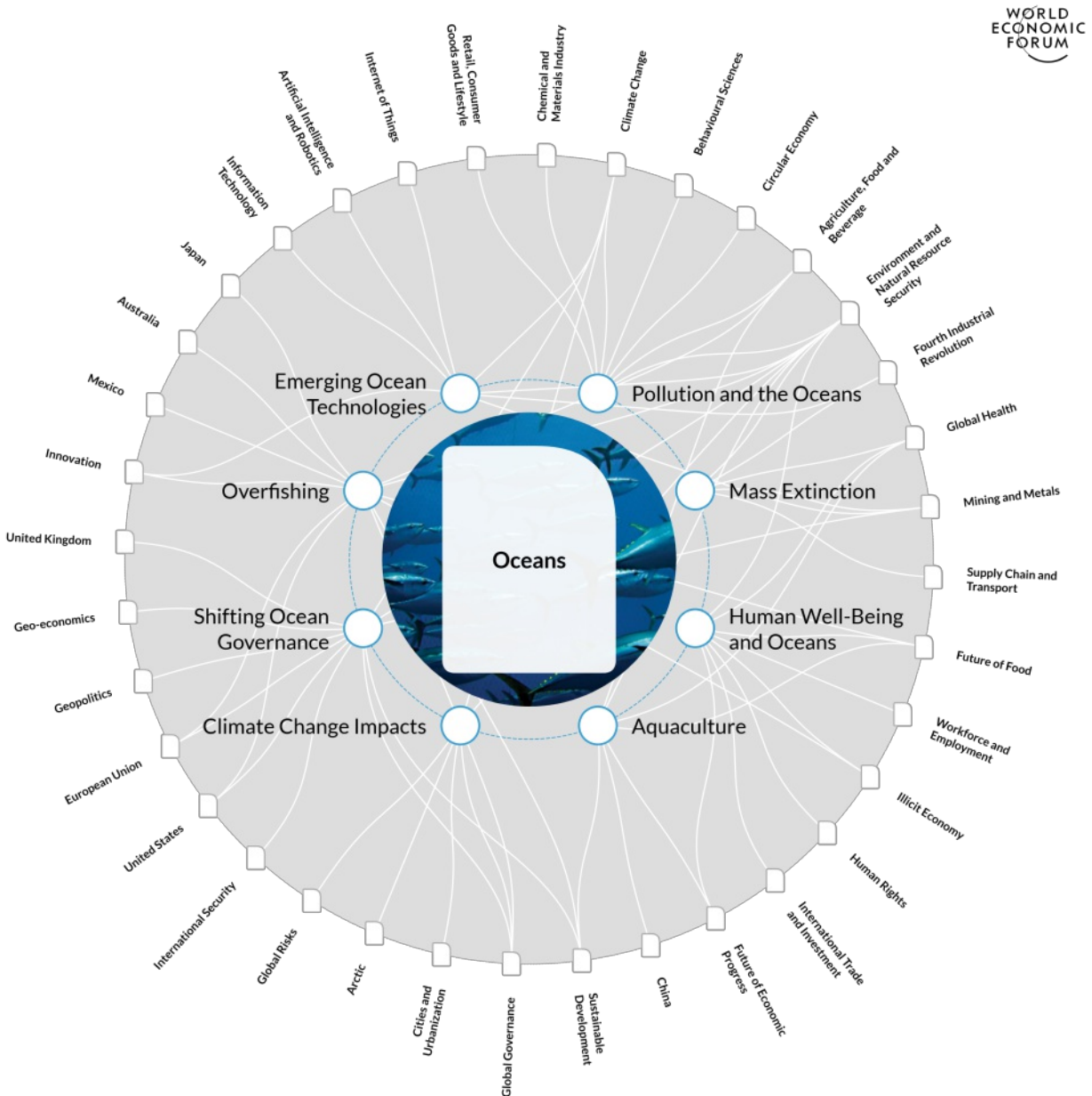
Oceans

Co-curated with [University of California, Santa Barbara](#)

Last review on Tue 04 December 2018

About

This dynamic briefing draws on the collective intelligence of the Forum network to explore the key trends, interconnections and interdependencies between industry, regional and global issues. In the briefing, you will find a visual representation of this topic (Transformation Map – interactive version available online via TopLink), an overview and the key trends affecting it, along with summaries and links to the latest research and analysis on each of the trends. Briefings for countries also include the relevant data from the Forum’s benchmarking indices. The content is continuously updated with the latest thinking of leaders and experts from across the Forum network, and with insights from Forum meetings, projects communities and activities.



Executive summary

Oceans are a critically important source of nutritious food, income, inspiration, and stability. A 2017 estimate published by the consultancy BCG valued global “ocean assets” at more than \$24 trillion. However, marine ecosystems face dangers that put this value at risk, like climate change, ocean warming, increased acidification, oxygen depletion, pollution, overfishing, and illegal fishing. Innovative policies, strong business leadership, and disruptive technologies will all be essential to navigate towards a cleaner and safer future.

This briefing is based on the views of a wide range of experts from the World Economic Forum’s Expert Network and is curated in partnership with Professor Douglas McCauley, Marine Biologist and Assistant Professor, University of California, Santa Barbara.

1. Pollution and the Oceans

The most harmful ocean pollutant is - far and away - carbon pollution. In the last decade, the oceans have absorbed nearly a third of the carbon dioxide emitted by industrial activity. This has slowed climate change, but at great cost to ocean health.

2. Mass Extinction

As far as life on land is concerned, we are rapidly approaching what scientists have dubbed the “Sixth Mass Extinction” - as human-caused extinction rates approach levels last experienced during the era that saw the end of many dinosaur lineages. The situation in the oceans is a little brighter, for the moment.

3. Human Well-Being and Oceans

The oceans are more than a beautiful home to inspiring ocean wildlife; they are a critically important source of nutritious food, income, jobs, and global stability. The oceans yield \$2.5 trillion annually in goods and services, according to a “conservative” estimate published in 2017 by the consultancy BCG, making them equivalent to one of the largest single economies in the world.

4. Aquaculture

In 2014, for the first time in history, the global population ate more farmed fish than wild fish; this was a development as transformative as our forebears’ long ago shift from hunting and gathering on land to becoming able to rely on agriculture. Aquaculture in the ocean is a booming industry.

5. Climate Change Impacts

The oceans are being hit hard by climate change. Effects include ocean warming, ocean acidification, and oxygen depletion. A future ocean that is hotter, more acidic, and a more difficult place for ocean life to breathe presents serious challenges.

6. Shifting Ocean Governance

The oceans have always been difficult to govern; they cover 90% of the habitable space on the Earth, creating an immense, supranational domain with unique regulatory challenges. Unlike most natural assets on land, many ocean resources (such as the bluefin tuna that is prized for sushi) regularly swim across jurisdictional boundaries.

7. Overfishing

The scientific philosopher Thomas Henry Huxley assured everyone in 1883 that it would be impossible to deplete populations of prolific fish like cod, mackerel, and herring. Within a century, he was proven wrong.

8. Emerging Ocean Technologies

Emerging technologies are changing the way we harvest food, energy, minerals, and data from the ocean. Rapid innovation in marine robotics, artificial intelligence, low-cost sensors, satellite systems, and methods for collecting and analysing data may yet create a cleaner and safer future - though these developments also present potential challenges for ocean health.

Pollution and the Oceans

The oceans have become a receptacle for the world's pollution

The most harmful ocean pollutant is - far and away - carbon pollution. In the last decade, the oceans have absorbed nearly a third of the carbon dioxide emitted by industrial activity. This has slowed climate change, but at great cost to ocean health. When carbon dioxide is absorbed by seawater it increases acidity levels, and threatens ocean life ranging from the microscopic snails that feed salmon to the coral reefs that support tourism. Plastics are another particularly insidious form of ocean pollution; according to the non-profit Ocean Conservancy, coastal nations generate 275 million metric tons of plastic waste every year (and 8 million metric tons of plastic enters the oceans). The Ellen MacArthur Foundation predicts that there will be more plastic than fish (by weight) in the oceans by 2050, and the United Nations Environment Programme has recorded more than 817 species of ocean animal that have encountered plastic pollution. Plastic pollution has also been detected in seafood sold for human consumption; a 2015 study by a team of University of California, Davis and Hasanuddin University researchers flagged man-made debris in 25% of seafood market fish, and 67% of all species sampled in the US.

According to a report published in the journal *Science Advances* in 2018, only 9% of plastic waste has been recycled globally - highlighting a need to re-think design and regulation in a way that incentivizes re-use. Potential solutions include policies that curb the use of single-use plastics like bags or straws, or improving the capture of plastics that leak out of waste systems. Researchers have found that just 10 of the world's rivers are the source of 90% of the plastic pollution entering the oceans, pointing to a possible focus for efforts to curb plastic pollution as a matter of policy and industrial reform - by stopping pollution at its source. Another major source of ocean pollution is the runoff of fertilizers used in agriculture, which are carried down rivers into oceans where they create population explosions of algae and bacteria. This in turn depletes oxygen levels, killing fish and creating inhospitable conditions for marine life. As a result, more than 400 low-oxygen "dead zones" have been documented in the oceans worldwide. The spread of these areas could be limited, in a way that also saves money for the agriculture industry, by deploying a more strategic and responsible application of fertilizers.

Related insight areas: [Retail, Consumer Goods and Lifestyle](#), [Chemical and Materials Industry](#), [Climate Change](#), [Behavioural Sciences](#), [Circular Economy](#), [Agriculture, Food and Beverage](#), [Environment and Natural Resource Security](#)



[The Atlantic Citylab](#)
How American Recycling Is Changing After China's National Sword
01 April 2019

With China no longer accepting many recyclables, U.S. recycling programs hope consumers can change their habits to reduce contamination rates.



[World Economic Forum](#)
5 things you need to know about water
21 March 2019

Securing adequate supplies of clean water in a changing climate is one of the world's most urgent social, political, economic, and environmental challenges.



[World Resources Institute](#)
127 Countries Now Regulate Plastic Bags. Why Aren't We Seeing Less Pollution?
11 March 2019

Despite a surge of regulation, single-use plastics continue to make their way into the environment. Here are five reasons why.



[UN Environment](#)
Marine litter and microplastics in seas of the Northwest Pacific
07 March 2019

We have entered an 'Age of Plastic' where plastics may outweigh fish in the oceans by 2050. One of the most densely populated regions of the world, the Northwest Pacific, is the global hotspot of marine litter and microplastics pollution. Northwest Pacific Action Plan (or NOWPAP), one of the eighteen Regional Seas Programmes of the UN Environment, has been responding to the threat of marine litter in the region since 2005. Through a regional framework of cooperation - the NOWPAP Regional Action Plan on Marine Litter - China, Japan, Republic of Korea and Russia are working on the monitoring, reduction and removal of marine litter and microplastics along the coasts and in seas of the NW Pacific.



[World Economic Forum](#)
We can decide to live within the limits of our planet
22 February 2019

Does the Fourth Industrial Revolution offer new opportunities or pose new threats? The World Economic Forum's Global Future Council on Environmental and Natural Resource Security has spent the last two years trying to answer this question.



[World Economic Forum](#)
Ghost fishing is haunting our ocean
06 February 2019

<http://www.weforum.org/>



[World Economic Forum](#)
5 astonishing statistics that show how urgently we need to save our ocean
29 January 2019

<http://www.weforum.org/>

Mass Extinction

Ocean life is sitting on an extinction cliff

As far as life on land is concerned, we are rapidly approaching what scientists have dubbed the “Sixth Mass Extinction” - as human-caused extinction rates approach levels last experienced during the era that saw the end of many dinosaur lineages. The situation in the oceans is a little brighter, for the moment. According to the International Union for Conservation of Nature, about 17 ocean animal extinctions have occurred in the last 500 years (during the same period, more than 500 land animal extinctions have occurred due to human activity). A 2016 report in the journal *Science* projected that rates of extinction in the oceans could increase dramatically, however - particularly as climate change accelerates. Ocean animals that are under threat include Monk Seals (both the Hawaiian monk seal and the Mediterranean monk seal), Blue Whales (which were depleted in the early 1900s), and all six species of sea turtle found in US waters. Without a change to business as usual in ocean management, we could therefore soon initiate an additional Sixth Mass Extinction in the oceans.

An industrial revolution is beginning in the oceans, with parallels to the industrial revolutions that have taken place on land. This involves a rapid expansion of marine industries such as ocean farming, marine energy, and marine transport, and a nearly five-fold increase in the amount of ocean area being explored for deep sea mining. According to the International Union for Conservation of Nature, by May 2018 the International Seabed Authority had issued 29 contracts for the exploration of deep-sea mineral deposits, and more than 1.5 million square kilometres of international seabed (about the size of Mongolia) had been set aside for mineral exploration in the Pacific and Indian oceans and along the mid-Atlantic ridge. Mining in international water is expected to begin in 2025, according to the IUCN. On land, animal extinction rates began accelerating rapidly during the first two industrial revolutions, when there was much less awareness of the link between human health and the environment. Now, the oceans present an opportunity to intelligently move a marine industrial revolution forward without associated spikes in animal extinction that would compromise the oceans' nourishing resources.

Related insight areas: [Environment and Natural Resource Security](#), [Fourth Industrial Revolution](#), [Global Health](#), [Mining and Metals](#), [Supply Chain and Transport](#)



[World Economic Forum](#)
Tourism is damaging the ocean. Here's what we can do to protect it

26 March 2019

When properly planned and managed, sustainable tourism can contribute to improved livelihoods, inclusion, cultural heritage and natural resource protection.



[International Institute for Sustainable Development](#)
How the U.S. EPA is Changing its Mercury Policy

18 March 2019

Even before President Trump took office in January 2017, he pledged to jump-start the country's struggling coal industry and create more jobs. Since he has been in office, it is a promise that's led to substantial policy changes at the United States Environmental Protection Agency (EPA).



[The New York Times](#)
How the Internet Travels Across Oceans

11 March 2019

Hundreds of thousands of miles of cable connect continents to support our insatiable demand for communication and entertainment. Companies have typically pooled their resources. Now Google is going its own way.



[The New York Times](#)
Ocean Heat Waves Are Threatening Marine Life

05 March 2019

Scientists say the heat waves are becoming more common and longer, and are killing off the species that underpin many marine ecosystems.



[University College London](#)
Plastic pollution is distracting from bigger environmental threats

21 February 2019

Ocean plastic pollution is distracting from bigger environmental issues such as climate change and overfishing, according to scientists at UCL and Bournemouth University.



[International Institute for Sustainable Development](#)
How Will Cannabis Legalization Affect our Fresh Water?

04 February 2019

The world's freshwater laboratory is a very busy field station these days—with ongoing studies examining algal blooms, climate change, selenium toxicity,



[Imperial College London](#)
Vegetable and fish diet linked to lower high blood pressure risk in pregnancy

24 January 2019

A diet rich in vegetables and fish is associated with a lower risk of developing high blood pressure, and a related condition known as pre-eclampsia.

Human Well-Being and Oceans

The fates of the oceans and humanity are increasingly intertwined

The oceans are more than a beautiful home to inspiring ocean wildlife; they are a critically important source of nutritious food, income, jobs, and global stability. The oceans yield \$2.5 trillion annually in goods and services, according to a “conservative” estimate published in 2017 by the consultancy BCG, making them equivalent to one of the largest single economies in the world. The oceans provide millions of jobs in fishing, aquaculture, tourism, energy, transportation, and biotechnology. The value of ocean resources is particularly important for poor countries. Fishery net exports from developing countries alone have been valued at \$37 billion, or more than value of meat, tobacco, rice, and sugar exports combined, according to a report published in 2018 by the Food and Agriculture Organization (FAO). Wealthier nations are also dependent on ocean resources. The collapse of cod stocks along the east coast of Canada, for example, sparked the largest mass layoffs in the country’s history and prompted large-scale migration from affected provinces. Canada spent almost \$2 billion between 1994 and 1998 on aid and recovery programs aimed at coping with this social and ecological disaster.

The oceans act as a massive refrigerator of free-range, highly nutritious food fit for human consumption. According to the FAO, fish provide more than 3.1 billion people with at least 20% of their animal protein, and serve as a critically important source of nutrients essential to good health like iron, zinc, and omega-3 fatty acids. Researchers estimate that if current trajectories for fishery decline persist, 845 million people could become at risk of diseases associated with malnutrition. Ocean health and human health intersect in other important, but sometimes less obvious ways. Fishery declines have been linked to human trafficking when, for example, child and slave labour is used to capture increasingly rare fish. Another example: some analysts suggest that piracy in Somalia and West Africa can partially be explained by disenfranchised fishermen turning to violence in order to protect decreasing offshore fish stocks. In situations where overfishing has depleted potentially lucrative species, organized crime has also escalated. In Mexico’s Sea of Cortez, for example, it is believed that drug cartels may be involved in an illicit industry that is both depleting a critically-endangered fish and threatening to trigger the extinction of the Vaquita (a small porpoise).

Related insight areas: [Future of Food](#), [Workforce and Employment](#), [Global Health](#), [Illicit Economy](#), [Human Rights](#), [International Trade and Investment](#), [Future of Economic Progress](#), [Environment and Natural Resource Security](#)



World Economic Forum

Climate change is a security threat. We must act now

26 March 2019

We must rise above the politics of doubt and accept that climate change leads to a fragile economy and risks human security, writes the prime minister of Bangladesh.



Chemistry World

Combating food fraud

18 March 2019

Tackling the issue of food fraud in the industry requires equipping scientists with the right analytical tools and technologies



Mother Jones

Microplastic Pollution is absolutely everywhere.

10 March 2019

Microplastic pollution spans the world, according to new studies showing contamination in the UK's lake and rivers, in groundwater in the US and along the Yangtze river in China and the coast of Spain. The new analysis in the UK found microplastic pollution in all 10 lakes, rivers and reservoirs sampled. The River Thames in London was found to have about 80 microplastic particles per litre, as was the River Cegin in North Wales. He urged MPs to back legislation "to drastically reduce the flow of plastic pollution that's blighting our environment". Research by the National University of Singapore found more than 400 types of bacteria on 275 pieces of microplastic collected from local beaches.



The Economist

Why is the ocean in deep trouble?

04 March 2019

The ocean is essential for life's survival on this planet, but it is under threat. The impact of climate change, pollution and overfishing is immense—yet largely hidden from sight.



University College London

Darwin's finches don't tell the whole story of avian evolution

20 February 2019

The connection between bird diet and skull shape is surprisingly weak for most species according to a new study led by UCL and the Natural History Museum, rewriting our understanding of how ecosystems influence evolution.



London School of Economics and Political Science

The deep roots of the trust crisis

02 February 2019

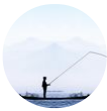
Sigmund Freud, the public affairs industry, and the internet may all have played a part, write Isabelle Stanley and Rod Dowler. We all depend in our social, business, financial, and political affairs, on a shared currency of trust. But we have somehow devalued this currency and breaches of public trust have recently grown to epidemic proportions. Donald Trump, the President [...]

We are shifting from being ocean hunters to ocean farmers

In 2014, for the first time in history, the global population ate more farmed fish than wild fish; this was a development as transformative as our forebears' long ago shift from hunting and gathering on land to becoming able to rely on agriculture. Aquaculture in the ocean is a booming industry. According to a report published in 2018 by the Food and Agriculture Organization of the United Nations, global aquaculture production excluding plants increased by roughly 30% between 2011 and 2016, to 80 million tonnes. Production of finfish alone during 2016 was valued at \$138.5 billion, according to the FAO report. While growth has been geographically diverse, the vast majority is currently centred in Asia. China alone represents more than 60% of global aquaculture production. The industry's expansion could help meet a growing global demand for food from animal sources that may increase by 80% by 2050 - fuelled by global population growth, and by increasing amounts of wealth in developing countries.

Aquaculture could play an important role in promoting global food security. But there are challenges involved in keeping the nutritious products produced in lower-income nations within domestic markets, where they can help fight malnutrition and undernutrition; that's because farmed seafood like shrimp is now often exported from developing to developed nations. In addition, just like farming on land, farming in the ocean can be environmentally destructive. While proponents of aquaculture note that it can take pressure off of frequently-overfished wild stocks, the negative effects of aquaculture include pollution, the harvesting of at-risk wild fish to feed farmed fish, and the destruction of wild fish nursery grounds (like mangrove forests) in order to build fish farms. Innovation could better enable more responsible fish farming, particularly as an increasingly crowded and protein-hungry world looks to the oceans for nourishment. The challenge will be to make ocean aquaculture something that can successfully meet food shortfalls - without also inflicting damage on ecosystems.

Related insight areas: [Environment and Natural Resource Security](#), [Agriculture](#), [Food and Beverage](#), [Future of Economic Progress](#), [China](#), [Future of Food](#), [Global Health](#), [Sustainable Development](#)



[The Science Breaker](#)

Staying ahead of the wave: predicting fishing efforts in a changing world to save biodiversity

25 March 2019

Recent advancements in fishing technologies are unbalancing global marine ecosystems. Our spatio-temporal model to predict global fishing efforts may allow fishers to prevent detrimental overlap of fleets, which eventually helps to save biodiversity.



[London School of Economics and Political Science](#)

Dismantling the EU's environmental policy will not be easy – though some will try

14 March 2019

After 40 years of shared environmental policy, disentangling the UK's *acquis* will be difficult – though some will want to try. Charlotte Burns (University of Sheffield) says a number of obstacles stand in their way: devolution, pressure from the public and NGOs and a lack of capacity in the civil service. The environment, which was largely ignored during the referendum [...]



[World Economic Forum](#)

In an era of global uncertainty, the SDGs can be our guide

08 March 2019

Growing unrest doesn't just threaten the 1%, or even the top 10%. It puts everyone's wellbeing in jeopardy. The UN's groundbreaking goals can be key to a new era of international cooperation.



[World Resources Institute](#)

In World That Says It's Cutting Nutrient Pollution, Progress Is Lacking

04 March 2019

More than 700 coastal areas are affected by algal growth and dead zones, despite a growing number of global agreements to reduce water pollution.



[Circle of Blue](#)

Permian Oil Boom Uncorks Multibillion-Dollar Water Play - Circle of Blue

15 February 2019

Producing oil produces even more water. Getting rid of it is a large and expanding business.



[The Conversation](#)

The world's shellfish are under threat as our oceans become more acidic

28 January 2019

Acidic seawater conditions are interfering with the ability of shellfish to produce strong, resilient shells, and it's happening all over the world.



[World Economic Forum](#)

In 2020, we need a new deal for nature

21 January 2019

In the race to solve the challenges facing our planet, we can't afford to ignore the threat to biodiversity. This should be the year that sees real momentum behind a biodiversity action agenda - we need a 'New Deal for Nature' to emerge.

Climate Change Impacts

Oceans are extremely vulnerable in the face of climate change

The oceans are being hit hard by climate change. Effects include ocean warming, ocean acidification, and oxygen depletion. A future ocean that is hotter, more acidic, and a more difficult place for ocean life to breathe presents serious challenges. The oceans have absorbed more than 90% of the heat produced via greenhouse gas-associated warming since the 1970s - and according to the National Oceanic and Atmospheric Administration, the five warmest years on record have all occurred since 2010. Ocean life is largely accustomed to stable temperatures, and is vulnerable to related changes. Coral reefs, for example, which can house millions of species, are being bleached from overheating. Back-to-back extreme ocean heat waves in 2016 and 2017 caused massive bleaching of the Great Barrier Reef off the coast of Australia, killing half of its coral. Potential related economic impacts, not to mention environmental impacts, are significant - a 2013 Deloitte study found that the Great Barrier Reef was generating about \$7 billion in revenue for Australia, largely via tourism.

As an ocean warms, its oxygen levels drop. Oxygen content in the oceans declined by an estimated 2% between 1960 and 2010, according to a study published in the journal *Nature* in 2017. In addition, since the First Industrial Revolution, the acidity of the oceans has increased by roughly 30% as a result of carbon dioxide dissolving in marine waters; this makes it more difficult for many organisms to form healthy skeletons and shells. Scientists from the University of British Columbia's Institute for the Oceans and Fisheries have predicted that if climate change continues unchecked, global fisheries may suffer \$10 billion in annual revenue loss by 2050. Global warming-driven sea level rise may be the most impactful form of ocean-related climate change - scientists predict that half of the population in 25 megacities (cities with more than 10 million inhabitants) will be affected by sea level rise if climate change is not slowed; Miami, Shanghai and dozens of other cities have already suffered related effects. Climate change must be aggressively checked in order to enable natural adaptation and evolution, and scientists typically agree that the best way to do this is to confront the difficult task of directly reducing global carbon emissions.

Related insight areas: [Global Governance](#), [Cities and Urbanization](#), [Environment and Natural Resource Security](#), [Arctic](#), [Global Risks](#), [Climate Change](#)



[The New Yorker](#)
Louisiana’s Disappearing Coast
 25 March 2019

Can engineers save Louisiana’s disappearing coast?



[World Resources Institute](#)
Estimating and Reporting the Comparative Emissions Impacts of Products
 12 March 2019

This paper provides recommendations for companies to improve the credibility and consistency of claims they make about the comparative greenhouse gas impacts of their products, frequently called “avoided emissions”.



[Yale Environment 360](#)
Piling Up: How China’s Ban on Importing Waste Has Stalled Global Recycling
 07 March 2019

China’s decision to no longer be the dumping ground for the world’s recycled waste has left municipalities and waste companies from Australia to the U.S. scrambling for alternatives. But experts say it offers an opportunity to develop better solutions for a growing throwaway culture.



[The Science Breaker](#)
Salmon are shrinking and you can see it in their genes
 04 March 2019

Atlantic salmon age at maturity has globally declined over the last four decades. This trait is strongly associated to survival and reproductive success. By monitoring temporal changes in the gene (vgll3) controlling age at maturity, we showed that Atlantic salmon have quickly evolved to mature earlier, at a smaller size, in the Teno river.



[The Conversation](#)
Melting Himalayan glaciers: a big drop in a bucket that’s already full
 10 February 2019

A new report predicts that one-third of the ice in the Himalayas will melt, even if we contain global warming to 1.5C. So what does that mean for the flood-prone valleys below?



[The Science Breaker](#)
Marine mammals may suffer dire consequences of ancient gene loss
 08 February 2019

Genes encode proteins that perform functions in our bodies, so when we lose genes, we lose the ability to perform their associated tasks. For marine mammals, loss of one gene may leave them especially vulnerable to exposure to widely-used chemicals.



[The New York Times](#)
Oceans Are Getting Louder, Posing Potential Threats to Marine Life
 22 January 2019

Increasing ship traffic, sonar and seismic air gun blasts now planned for offshore drilling may be disrupting migration, reproduction and even the chatter of the seas’ creatures.

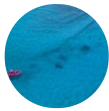
Shifting Ocean Governance

Current regulation does not adequately address the changes now impacting oceans

The oceans have always been difficult to govern; they cover 90% of the habitable space on the Earth, creating an immense, supranational domain with unique regulatory challenges. Unlike most natural assets on land, many ocean resources (such as the bluefin tuna that is prized for sushi) regularly swim across jurisdictional boundaries. In addition, damage incurred within one nation's jurisdiction (like plastic pollution) can impact nations many thousands of kilometres away. Meanwhile climate change is driving seafood stocks towards the planet's poles, to escape warming waters. This can create worrisome volatility in less-developed regions - as fish travel out of the reach of countries that need them most. Unfortunately, policies that can properly address these issues have been deferred. Two thirds of the oceans are on the high seas, or outside of the jurisdiction of any single country. The United Nations has committed to developing a first-of-its-kind, legally-binding treaty to better manage biodiversity and resources on the high seas by 2020. If it is successfully implemented, this could be a significant boon for ocean biodiversity.

The cross-border migration of valuable seafood has the potential to not only deprive developing economies of resources, but also spur regional conflict. Research published in the journal *Science* in 2018 suggested that as many as 70 countries will see new fish stocks in their national waters by the year 2100, as a result of climate change. New international agreements are needed to govern the sharing of fishery resources, and to prevent countries from overharvesting stocks when they realize their assets are migrating beyond their borders. One positive development in the world of ocean governance has been the establishment of marine protected areas. These can buy time for at-risk ecosystems to better adapt to climate change. However, based on a review of 144 studies, researchers at the University of York have concluded that about 30% of the oceans would need to be placed within protected areas in order to meet ocean health management goals - though just over 7% is currently protected. The United Kingdom has protected an area of ocean larger than the country's own land mass, and Chile, the US, and Kiribati have established protected areas that are collectively larger than Italy - now, other countries need to catch up.

Related insight areas: [Environment and Natural Resource Security](#), [Mining and Metals](#), [International Security](#), [United States](#), [European Union](#), [Sustainable Development](#), [Geopolitics](#), [Climate Change](#), [Global Governance](#), [Geo-economics](#), [United Kingdom](#)

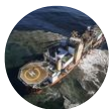


Yale Environment 360

Will Large Protected Areas Save the Oceans or Politicize Them?

25 March 2019

In the last decade, governments have been pushing to create vast Marine Protected Areas large enough to protect species from overfishing and other threats. But critics are questioning whether the creation of these large protected areas is driven more by geopolitics than conservation.



Nature

Scientists track damage from controversial deep-sea mining method

16 March 2019

Researchers will monitor the environmental effects of industrial effort to extract valuable metals from the Pacific sea floor.



Project Syndicate

A New Paradigm for Plastics

06 March 2019

By focusing environmental and public-health debates on the issue of waste-management, plastics producers have managed to conceal the elephant in the room. But governments and consumers can no longer ignore the fact that plastic is a problem at all stages of its life cycle – not just after it ends up in the ocean.



Grantham Institute - Imperial College of London

The 400-year-old shark – what will a Greenland shark born today experience as the climate changes?

01 March 2019

Nicholas Dunn, Research Postgraduate on the Science and Solutions for a Changing Planet DTP and based at the ZSL Institute of Zoology, is developing environmental DNA methods to assess the distribution of sharks and rays. In this blog, he considers climate change from the perspective of a Greenland Shark, an ancient species where individuals can live for up to 400 years. Did you know that one ...



World Economic Forum

Davos 2019 - Promise and Peril: Mining Underwater

10 February 2019

Seabed and river mining is touted as a new source of precious metals, such as manganese, nickel, copper and cobalt. What are the geopolitical and ecological ...



Woodrow Wilson International Center for Scholars

Are Sulu Sea Trilateral Patrols Actually Working?

29 January 2019

One of the minilateral security initiatives emerging out of Southeast Asia over the past few years has been the new trilateral cooperation mechanism for managing a range of transnational challenges in the Sulu Sea between Indonesia, Malaysia, and the Philippines. With the mechanism expected to continue to take shape into 2019 as well, it is worth asking where it stands as well as the opportunities and challenges that lie ahead for it.

Overfishing

Fish are being removed from the sea faster than they can be replaced

The scientific philosopher Thomas Henry Huxley assured everyone in 1883 that it would be impossible to deplete populations of prolific fish like cod, mackerel, and herring. Within a century, he was proven wrong. The Food and Agriculture Organization of the United Nations reported in 2018 that about a third of global fish stocks are overfished - not least because fishing laws promote the philosophy that anything fishermen fail to harvest themselves will just be taken by others. Research published in 2016 in the Proceedings of the National Academy of Sciences suggested that replacing antiquated fishery governance systems with rights-based fishery management tools could increase fisheries' collective annual profit by \$53 billion. These tools can be used to allocate individual fishing rights to local fishermen and fishing communities, and their successful adoption has been documented in Australia, Iceland, and Mexico. Another issue is wasteful inefficiency; many fisheries capture, kill, and potentially discard marine species like sharks, dolphins, and sea turtles regardless of their suitability as potential food, and the damage that this causes imperils broader ecosystem health.

Illegal and unreported fishing exacerbates overfishing, and is a growing problem. According to a study published in 2014 in Marine Policy, up to a third of all wild seafood imported in the US is believed to be illegally caught. In the case of long-living, slow-growing marine species, a single incident of illegal fishing can set an ocean ecosystem back by decades. New surveillance technologies and platforms for data sharing are needed in order to rein in illegal fishing; one promising related development is the Agreement on Port State Measures, a global treaty that went into force in 2016 and can curb illegal fishing vessels' access to ports. However, more countries are needed to back the agreement. There are a variety of other ways to combat overfishing, including a more strategic review of the billions of dollars spent globally on harmful fishery subsidies that, in many instances, promote economically-irrational overfishing (an effort is now underway at the World Trade Organization to pursue related reform). Replicating the European Union's yellow/red card program for combating illegal fishing, which blocks market access to non-compliant foreign supply nations, is another potential option. Better controlling overfishing and illegal fishing is an increasingly critical element of safeguarding global food security, and of ensuring the health and prosperity of coastal economies.

Related insight areas: [Agriculture](#), [Food and Beverage](#), [Global Governance](#), [Innovation](#), [Mexico](#), [Australia](#), [Environment and Natural Resource Security](#), [European Union](#), [United States](#), [Japan](#), [Future of Food](#), [Sustainable Development](#), [Illicit Economy](#)



[The Conversation](#)

Bleaching has struck the southernmost coral reef in the world

31 March 2019

Marine heatwaves have caused coral bleaching in one of the most isolated ecosystems in the world.



[The Conversation](#)

Underwater mudslides are the biggest threat to offshore drilling, and energy companies aren't ready for them

11 March 2019

In 2004 an underwater avalanche destroyed an oil platform off Louisiana, causing a 14-year spill. An expert on oil and gas seeps in the Gulf of Mexico warns that this could happen in other places.



[The Economist](#)

What sharks reveal about the state of the ocean

05 March 2019

Tagging killer sharks is a daunting prospect. But some pioneering scientists believe it's a vital part of the urgent struggle to protect the ocean and marine life from the devastating environmental impact of humanity.



[World Economic Forum](#)

What is Earth? How we answer could define our future

28 February 2019

The astronomical body we call home is becoming increasingly difficult to define.



[International Institute for Sustainable Development](#)

Weighing up the Environmental Cooperation Agreement under the Canada-United States-Mexico Agreement

08 February 2019

Trade agreements can have important environmental effects. We take a look at what's old, what's new and what's noteworthy in the Canada-United States-Mexico Agreement when it comes to the environment.



[Grantham Institute - Imperial College of London](#)

Indigenous wisdom: Leaders of Arctic tribes visit Imperial

24 January 2019

The Imperial College Environmental Society and Pacific Environment recently hosted an event with four Arctic indigenous leaders, who discussed climate change and its effects on indigenous communities in the Arctic. Richard Knight, Research Postgraduate at Imperial's Centre for Environmental Policy, reflects on the fragility of the environment Arctic communities depend upon, and how it can be protected. "It is like we do not exist, and ...



[MIT Technology Review](#)

Let's keep the Green New Deal grounded in science

18 January 2019

Advocates hope the proposal will inspire voters, but that's no reason it has to ignore the latest research.

Emerging Ocean Technologies

New opportunities for ocean-based industries are emerging, and so are challenges

Emerging technologies are changing the way we harvest food, energy, minerals, and data from the ocean. Rapid innovation in marine robotics, artificial intelligence, low-cost sensors, satellite systems, and methods for collecting and analysing data may yet create a cleaner and safer future - though these developments also present potential challenges for ocean health. Ocean mining is one example; portions of the seafloor are rich in gold, platinum, cobalt, and rare-earth elements, though these resources have up until now been out of reach. New, 300-ton mining machines have been developed that can harvest minerals in some of the deepest parts of the sea. Japan has completed its first large-scale mineral extraction from the seabed, and plans to begin commercial mining in its waters within the next decade. Meanwhile on the high seas, the Jamaica-based International Seabed Authority has issued more than 1 million square kilometres of mining exploration claims to 20 different countries. However, much of the seabed within these claims remains unexplored, and new species are frequently being discovered in the vicinity. It remains unclear if and how sediment plumes from seabed mining will affect the health of oceans generally, and fisheries specifically. Finding a way to properly balance mining interests against potential impacts on ocean ecosystems and marine industries remains a challenge.

A revolution in our ability to collect and process ocean data has now enabled the detection of illegal fishing from space, empowered sustainability-focused companies to more efficiently connect with people, and helped build intelligent zoning plans that better balance the needs of fishermen, marine transportation, and ocean conservation. In addition, new technologies are being developed to plug into the ocean's enormous stores of green energy (possibilities include wave energy, tidal energy, thermal energy, and offshore wind). A record 4,331 megawatts of new offshore wind power was installed around the world during 2017, according to the Global Wind Energy Council, which increased the size of the market by 95%. While remaining hurdles to harvesting ocean energy include cost efficiency and the potential impact of new ocean power plants on ocean life, other exciting innovations are on the way: a robot that swims like a tuna, underwater data centres, autonomous self-driving ships, and geodesic spheres that can serve as offshore fish farms, for example. Properly embraced, disruptive technologies can help us take more from the oceans while damaging them less.

Related insight areas: [Fourth Industrial Revolution](#), [Information Technology, Innovation, Artificial Intelligence and Robotics](#), [Environment and Natural Resource Security](#), [Climate Change](#), [Mining and Metals](#), [Internet of Things](#)



International Institute for Sustainable Development
Undertreated Sewage Contributes to Harmful Algal Blooms
 22 March 2019

In this short brochure, the Lake Winnipeg Foundation and the International Institute for Sustainable Development, present their plans for an interim solution to Winnipeg's phosphorus woes.



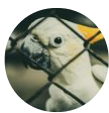
UNESCO
The Plastic Initiative: Inspiration for Youth
 11 March 2019

At UNESCO, we take this issue very seriously. With its World Network of Biosphere Reserves, as well as its capacities in the Natural Sciences, Education and ...



The Conversation
Somali piracy and countering other organised crimes at sea
 05 March 2019

With the exception of Somali piracy, counter-measures have failed to stop transnational criminal networks from taking to the seas.



Global Initiative against Transnational Crime
Do we need a global agreement on wildlife crime?
 28 February 2019

In an article published on 18 February, 'Do we need a wildlife crime convention', Scanlon has opened up once again an important debate that we need to have: what should be the response to organized wildlife crime and do we need an internationally binding convention to address IWT? His article provides an objective assessment of the shortcomings of our current responses to wildlife crime. Among these, as Scanlon notes, CITES is not a crime-related convention; does not oblige countries to criminalize illegal wildlife trade; and is not a natural forum for the enforcement or wider criminal-justice community.



World Economic Forum
Climate change is disrupting this major ocean food source
 08 February 2019

<http://www.weforum.org/>



The Science Breaker
Steady decline of coral reefs in the Anthropocene
 28 January 2019

Coral reefs are in a steady decline worldwide due to a range of anthropogenic (man-made) stressors. For this study, we focused on the effect of the two main drivers of change on the reefs: ocean warming and increasing storm intensity. Both of these stressors result in changes in the composition of coral communities, and a decrease in coral cover.



The Science Breaker
Fish and ships
 18 January 2019

How far has your dinner travelled to get to your plate? If it's a piece of fish, then the answer might surprise you.

References

1. Pollution and the Oceans

- How American Recycling Is Changing After China's National Sword, The Atlantic Citylab, www.citylab.com
- 5 things you need to know about water, World Economic Forum, www.weforum.org
- 127 Countries Now Regulate Plastic Bags. Why Aren't We Seeing Less Pollution?, World Resources Institute, www.wri.org
- Marine litter and microplastics in seas of the Northwest Pacific, UN Environment, www.youtube.com
- We can decide to live within the limits of our planet, World Economic Forum, www.weforum.org
- Ghost fishing is haunting our ocean, World Economic Forum, www.youtube.com
- 5 astonishing statistics that show how urgently we need to save our ocean, World Economic Forum, www.youtube.com

2. Mass Extinction

- Tourism is damaging the ocean. Here's what we can do to protect it, World Economic Forum, www.weforum.org
- How the U.S. EPA is Changing its Mercury Policy, International Institute for Sustainable Development, iisd.org
- How the Internet Travels Across Oceans, The New York Times, www.nytimes.com
- Ocean Heat Waves Are Threatening Marine Life, The New York Times, www.nytimes.com
- Plastic pollution is distracting from bigger environmental threats, University College London, www.ucl.ac.uk
- How Will Cannabis Legalization Affect our Fresh Water?, International Institute for Sustainable Development, iisd.org
- Vegetable and fish diet linked to lower high blood pressure risk in pregnancy, Imperial College London, www.imperial.ac.uk

3. Human Well-Being and Oceans

- Climate change is a security threat. We must act now, World Economic Forum, www.weforum.org
- Combating food fraud, Chemistry World, www.chemistryworld.com
- Microplastic Pollution is absolutely everywhere., Mother Jones, www.motherjones.com
- Why is the ocean in deep trouble? , The Economist, www.youtube.com
- Darwin's finches don't tell the whole story of avian evolution, University College London, www.ucl.ac.uk
- The deep roots of the trust crisis, London School of Economics and Political Science, blogs.lse.ac.uk

4. Aquaculture

- Staying ahead of the wave: predicting fishing efforts in a changing world to save biodiversity, The Science Breaker, www.thesciencebreaker.com
- Dismantling the EU's environmental policy will not be easy – though some will try, London School of Economics and Political Science, blogs.lse.ac.uk
- In an era of global uncertainty, the SDGs can be our guide, World Economic Forum, www.weforum.org
- In World That Says It's Cutting Nutrient Pollution, Progress Is Lacking, World Resources Institute, www.wri.org
- Permian Oil Boom Uncorks Multibillion-Dollar Water Play - Circle of Blue, Circle of Blue, www.circleofblue.org
- The world's shellfish are under threat as our oceans become more acidic, The Conversation, theconversation.com
- In 2020, we need a new deal for nature, World Economic Forum, www.weforum.org

5. Climate Change Impacts

- Louisiana's Disappearing Coast, The New Yorker, www.newyorker.com
- Estimating and Reporting the Comparative Emissions Impacts of Products, World Resources Institute, www.wri.org
- Piling Up: How China's Ban on Importing Waste Has Stalled Global Recycling, Yale Environment 360, e360.yale.edu
- Salmon are shrinking and you can see it in their genes, The Science Breaker, www.thesciencebreaker.com
- Melting Himalayan glaciers: a big drop in a bucket that's already full, The Conversation, theconversation.com
- Marine mammals may suffer dire consequences of ancient gene loss, The Science Breaker, www.thesciencebreaker.com
- Oceans Are Getting Louder, Posing Potential Threats to Marine Life, The New York Times, www.nytimes.com

Acknowledgements

- Cover and selected images throughout supplied by Reuters.
- Some URLs have been shortened for readability. Please follow the URL given to visit the source of the article. A full URL can be provided on request.

Continue the experience online

Explore the collective intelligence of the World Economic Forum

Our digital platform enables you to understand more about the key issues that are driving transformational changes across different economies, industries and global issues. Exclusive to Forum members and constituents, these enable you to:

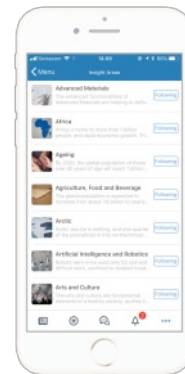
- Browse curated knowledge across 120 different economies, industries and global issues
- Visualise relationships and linkages between insight areas using the Forum's exclusive Transformation Maps framework
- Express your opinion on knowledge and understand how your peers are responding
- Search for knowledge and experts

Connect to our digital platform

Visit **Toplink** on the web or download the app on your mobile device to learn more.



toplink.weforum.org/knowledge



toplink.weforum.org/page/apps





COMMITTED TO
IMPROVING THE STATE
OF THE WORLD

The World Economic Forum, committed to improving the state of the world, is the International Organization for Public-Private Cooperation.

The Forum engages the foremost political, business and other leaders of society to shape global, regional and industry agendas.

World Economic Forum
91-93 route de la Capite
CH-1223 Cologny/Geneva
Switzerland
Tel.: +41 (0) 22 869 1212
Fax: +41 (0) 22 786 2744
contact@weforum.org
www.weforum.org