POLITICS & SOCIETY

State of the oceans

The impact of climate change on the resilience and sustainability of the world's oceans

statista

Deutsche Meeresstiftung
German Ocean Foundation

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Scientific contributors

Prof. Dr. Stefan Rahmstorf

Professor of Marine Physics – University of Potsdam, Institute for physics and astronomy

Head of Department for Earth system analysis at Potsdam Institute for Climate Impact Research

Fellow of the American Geophysical Union

Honorary Fellow of the University of Wales/Bangor

Member of the Academia Europaea

Prof. Dr. Roberto Mayerle

Christian-Albrechts-University of Kiel, Director Research and Technology Center West Coast

Dr. Nikoleta Bellou

Marine biologist in the department Mass transport and ecosystem dynamics at the Institute for Coastal Systems Helmholtz-Center Hereon

Prof. Dr.-Ing. Kerstin Kuchta

Professor of Resource and Waste Management – Institute for Circular Resource Engineering and Management – CREM

Vice President Teaching – TU Hamburg

Dr. Moritz Mathis

Matter transport and ecosystem dynamics – Institute for Coastal Systems Helmholtz-Center Hereon

A sustainably managed ocean for all

Executive summary

Oceans are an essential component of the planet's ecosystem – for oxygen, food, and water – and it is impossible to sustain life on Earth without them. Oceans play a key role in providing services for climate regulation and are a rich resource for genetic pools, minerals, and, recently, renewable energy. Essentially, they are crucial to the global economy, supporting key industries such as fisheries, tourism, transport, and trade. While the oceans have supported humanity from the beginning, resource consumption in recent centuries has threatened their survival. Some of the major drivers that endanger their health are global warming, pollution, and habitat degradation.

- The oceans absorb excess heat and energy trapped in the atmosphere due to increasing greenhouse gas (GHG) emissions. This excess heat absorbed by the oceans leads to a plethora of cascading effects: extreme weather events, changing ocean currents, rising sea levels, and rapid melting of sea ice and ice sheets. These aggravate the negative impacts of overfishing, illegal fishing, pollution, and habitat degradation.
- Most of the waste, pollutants, and contaminants that end up in the oceans are mainly carried as runoffs by waterways such as rivers (page 32).
- Marine habitat degradation leads to biodiversity loss. Critical marine habitats such as seagrass, mangroves, and coral reefs are rapidly decreasing (page 25). One of the main reasons for marine habitat destruction is the lack of legislative measures for their protection.

In 2015, global leaders adopted the 2030 Agenda for Sustainable Development with a list of Sustainable Development Goals (SDGs). Of the 17 SDGs, number 14 – "Life below water" – was set to conserve and use the oceans, seas, and marine resources for sustainable development (see page 44). Besides, in December 2022, the initiative 30x30 was agreed upon at the COP15 to guide global action on nature. The initiative aims to ensure protection for at least 30 percent of global coastal and marine areas by 2030. Thus, conserving and sustainably using the ocean has gained international momentum in recent years.

01

Introduction

- Overview
- Fisheries
- Sea trade
- Ocean energy

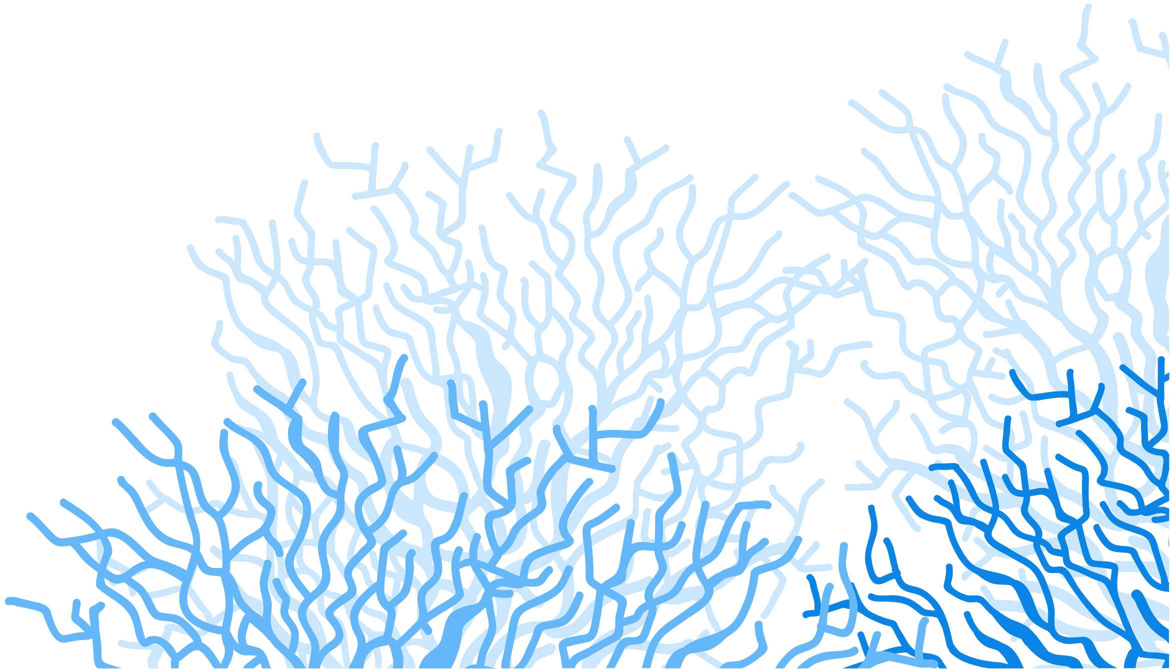
Oceans for an environmentally, economically, and socially sustainable future of the planet

Humanity’s dependence on ocean resources

The ocean plays a crucial part in maintaining life on Earth – the primary life support for all. However, human activities are threatening the health of the world's oceans; entire marine ecosystems are rapidly changing. Alterations in ocean chemistry and many oceanic processes have been recorded, from coral bleaching to sea level rise to higher temperatures, threatening many species of marine animals that cannot cope with these new conditions.

Accounting for the value of the oceans’ global economic contributions has proven to be a powerful instrument to enhance ecosystem protection or sustainable management. Realizing the implication of potentially losing these economic contributions has led the way toward incorporating the value of **ecosystem services** in policies, governance, and investments. Ecosystem services refer to the benefits people obtain from ecosystems. The publication of the Millennium Ecosystem Assessment (MEA) in 2005 portrayed a global picture of environmental degradation and biodiversity loss, with risks of severe impacts on society. Since then, ecosystem services have gained traction as a means of linking societal benefits to the ecology and functioning of ecosystems and are now frequently included in decision-making and legislation.

The MEA defined four types of ecosystem services to which marine and coastal ecosystems contribute, including **provisioning services**: fisheries and construction materials; **supporting services**: life-cycle maintenance for both fauna and local, element, and nutrient cycling; **regulating services**: carbon sequestration and storage, erosion prevention, waste-water treatment, and moderation of extreme events; **cultural services**: tourism, recreational, aesthetic, and spiritual benefits.



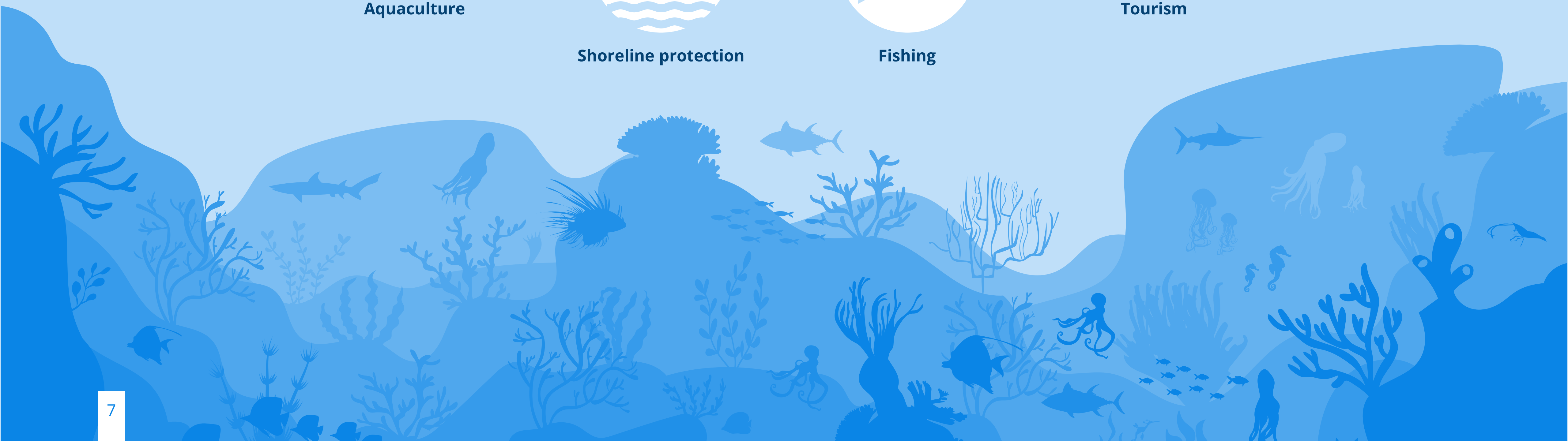
Source(s): Millennium Ecosystem Assessment; Ocean and climate platform

Oceans for an environmentally, economically, and socially sustainable future of the planet

Humanity’s dependence on ocean resources and marine ecosystems

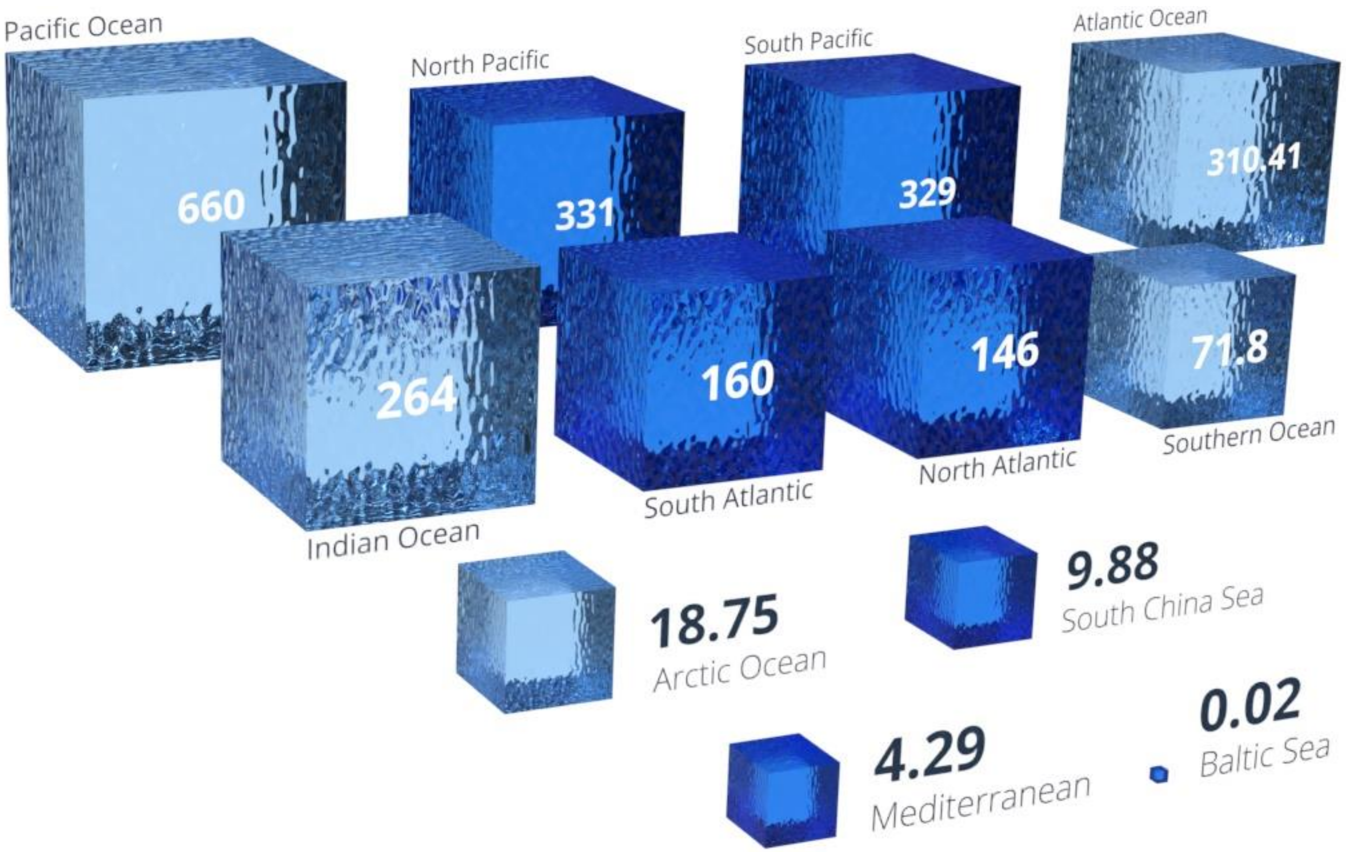
ECOSYSTEM SERVICES

- Subsistence harvest
- Aquaculture
- Shoreline protection
- Fishing
- Tourism
- Cultural identity



How many oceans are there?

Volume of global oceans (in million cubic kilometers)



Earth is aptly called the blue planet – about 71 percent of its surface is covered with water. An estimated volume of 1.4 billion cubic kilometers (km^3) of water resides on Earth.

While by definition, there is only one ocean that covers the majority of Earth's surface, due to geographical locations, there are five named oceans – the Atlantic, Pacific, Indian, and Arctic, and since 2000, the Southern (Antarctic).

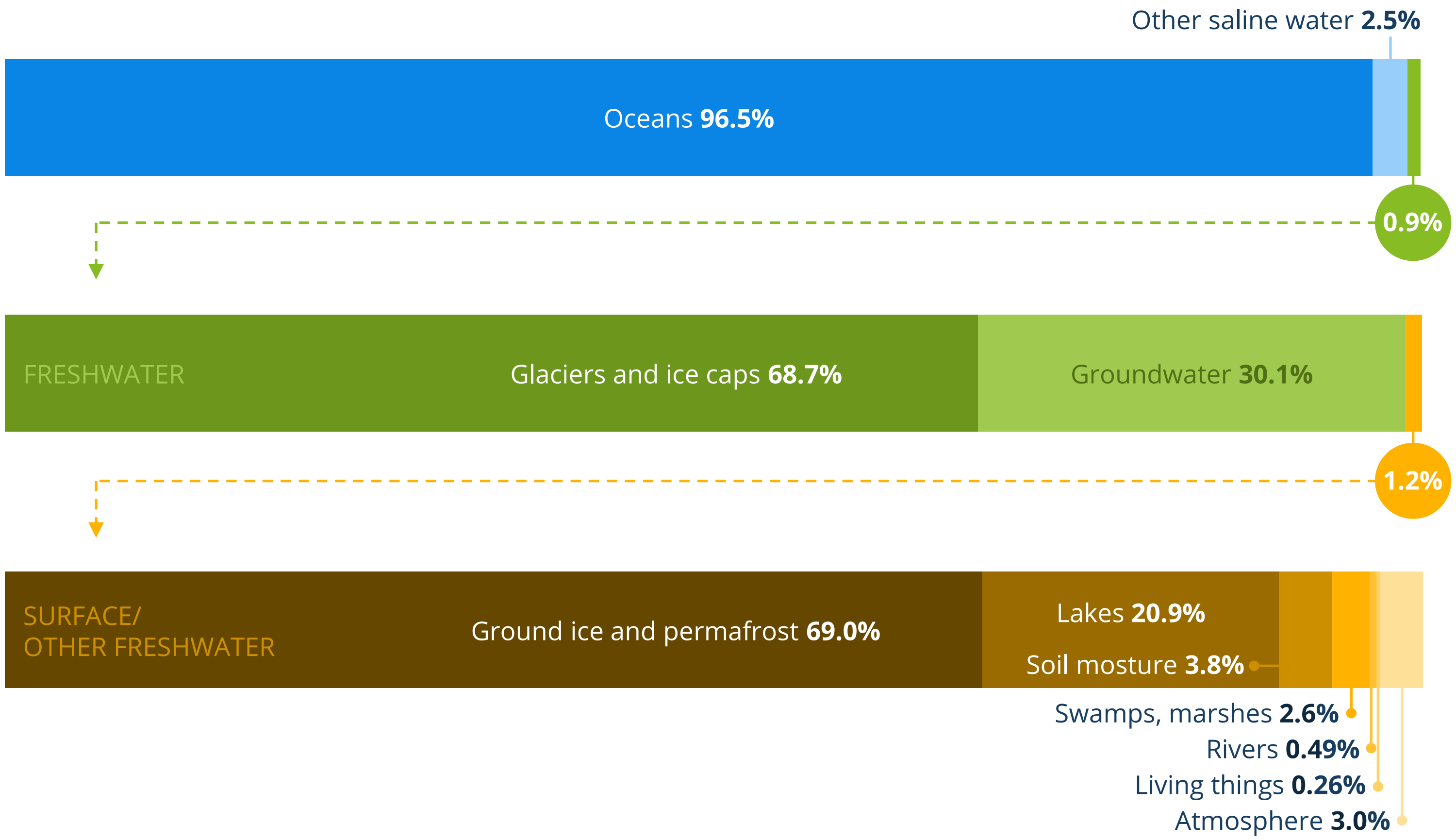
The largest of the oceans is the Pacific Ocean, which holds approximately 660 million km^3 of marine water.

Note(s): Worldwide; dark blue segments indicate a portion of a greater oceanic division.
Source(s): NOAA; ID 558451

Source(s): USGS

About 97 percent of Earth's water can be found in the oceans

Blue planet – how is Earth's water distributed?



The oceans account for the vast majority of the Earth's water, at 96.5 percent, and saline water, in total, accounts for some 99 percent of the water on Earth. The ocean's salinity level plays a vital role in ocean circulation and climate regulation.

One of the major concerns with global warming today is the rapid melting of glaciers and ice caps. As they hold about 69 percent of the world's freshwater, the fast pace of the melting and freshwater entering the ocean affects its salinity. This disrupts many intricate processes, which degrades ocean ecosystems.

Note(s): Worldwide; 1993
Source(s): Shiklomanov, Igor; US Geological Survey; ID 564724

Source(s): NASA; United States Geological Survey

Contributions of the ocean to socioeconomic development

Total direct global economic output of marine fisheries, coral reefs, seagrass, and mangroves was **6.9 trillion U.S. dollars** as of 2020

Revenue of the global cruise industry was **18.6 billion U.S. dollars** in 2022

CO_2

30 percent of annual global carbon emissions are absorbed by the oceans, amounting to an equivalent economic value of **4.3 trillion U.S. dollars** in 2020

Marine trade and transportation contributed **5.2 trillion U.S. dollars** worldwide in 2020

Global seafood market value was **250 billion U.S. dollars** in 2022

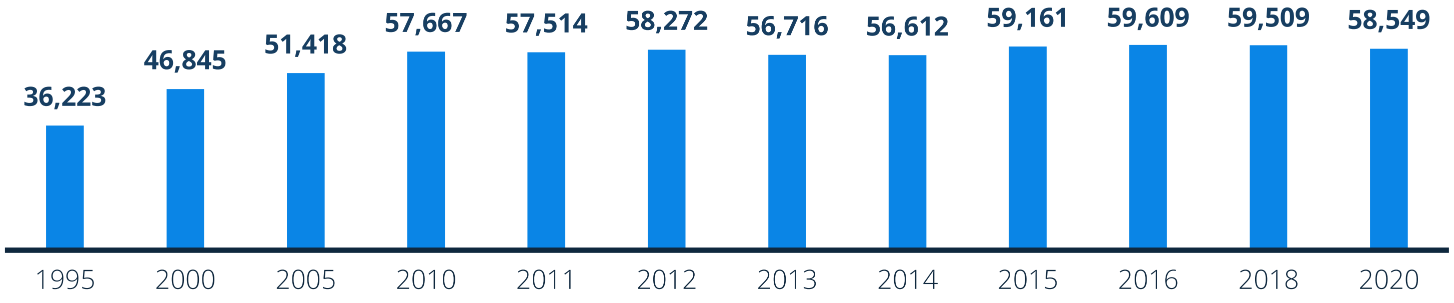
Productive coastlines worldwide contributed **7.8 trillion U.S. dollars** in 2020

Source(s): Allied Market Research; BRC; IMF; Ocean Panel Organization; Statista; Visual Capitalist; WWF; ID 821023; ID 1258061

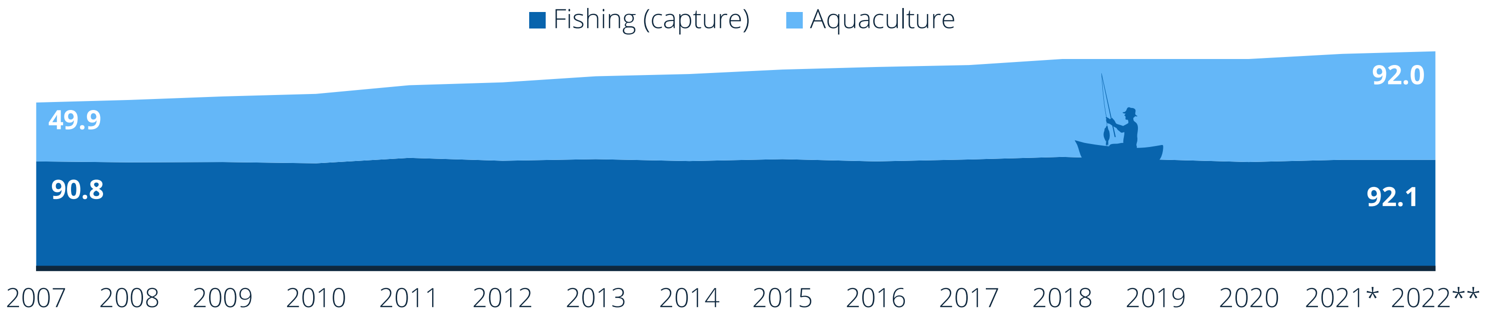
Reliance on fisheries and aquaculture for food and employment

Almost half of the global fish supply now comes from aquaculture

Total number of fishers and fish farmers worldwide from 1995 to 2020 (in 1,000s)



World fish production from 2007 to 2022, by fishing and aquaculture (in million metric tons)



Large populations worldwide rely on fishing as a primary food source, and it is also an important means of employment for many coastal communities. As of 2020, there were over 58 million fishers and fish farmers worldwide.

Increased global demand for fish and other seafood has led to overfishing. This has resulted in the depletion of naturally available stocks, giving rise to aquaculture to meet the growing global demand.

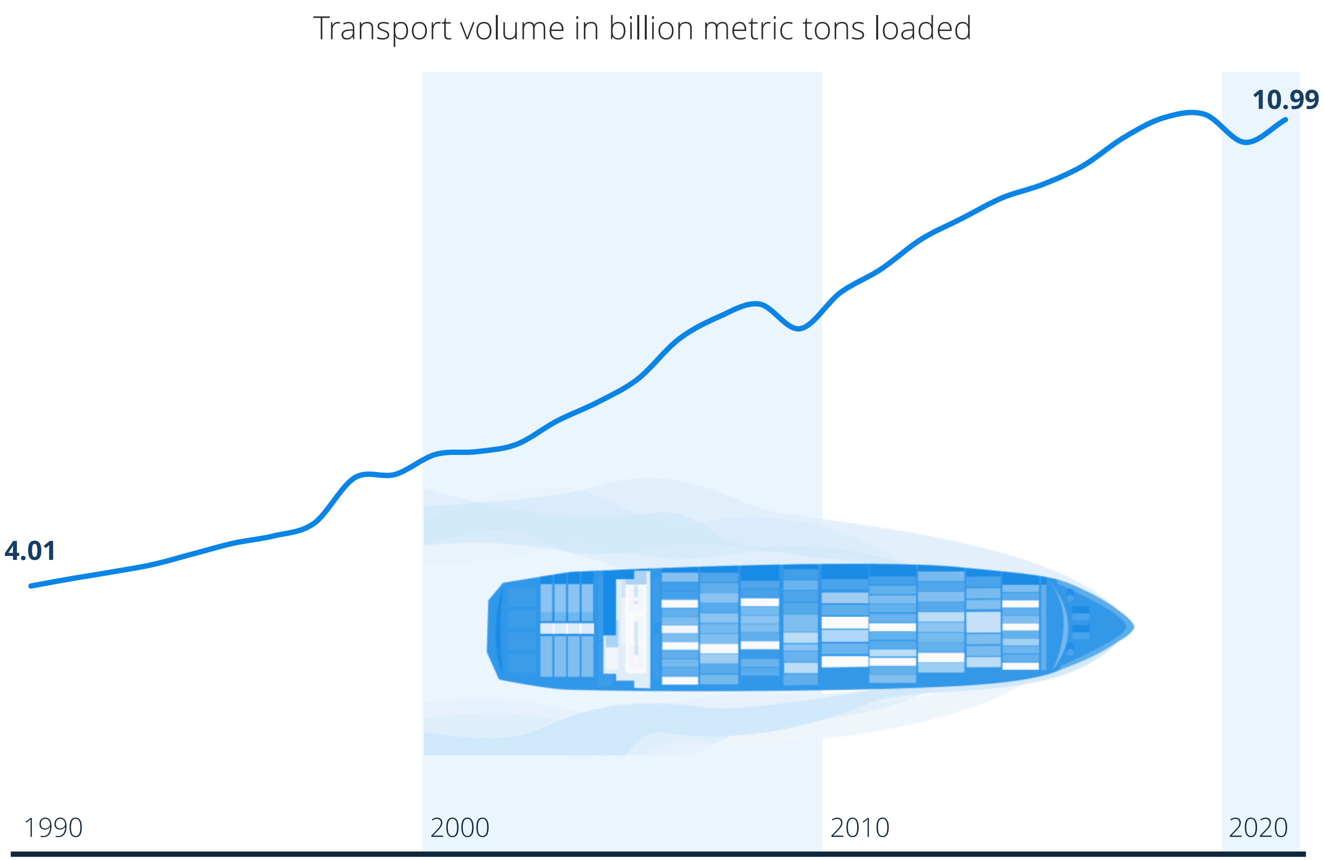
Over the past 15 years, the amount of fish produced through aquaculture has grown by roughly 80 percent, nearing 90 million metric tons in 2021.

(1) Note(s): Worldwide; 1995 to 2020; 2017 and 2019 were not provided by the source
Source(s): FAO; ID 248767

(2) Note(s): Worldwide; 2007 to 2022; *estimated; **projected
Source(s): FAO; ID 272311

Seaborne trade – increasing demand creates new sustainability challenges

Transport volume of worldwide maritime trade from 1990 to 2021



Oceans form a critical foundation for much of the world's economy, supporting several trade sectors through maritime logistics. Countless shipping lines span the globe creating a vital supply chain.

The amount of cargo transported via seaborne trade has been on a steep rise. The transport volume has more than doubled in the last three decades from a mere four billion tons in 1990 to almost 11 billion tons of loaded cargo in 2021.

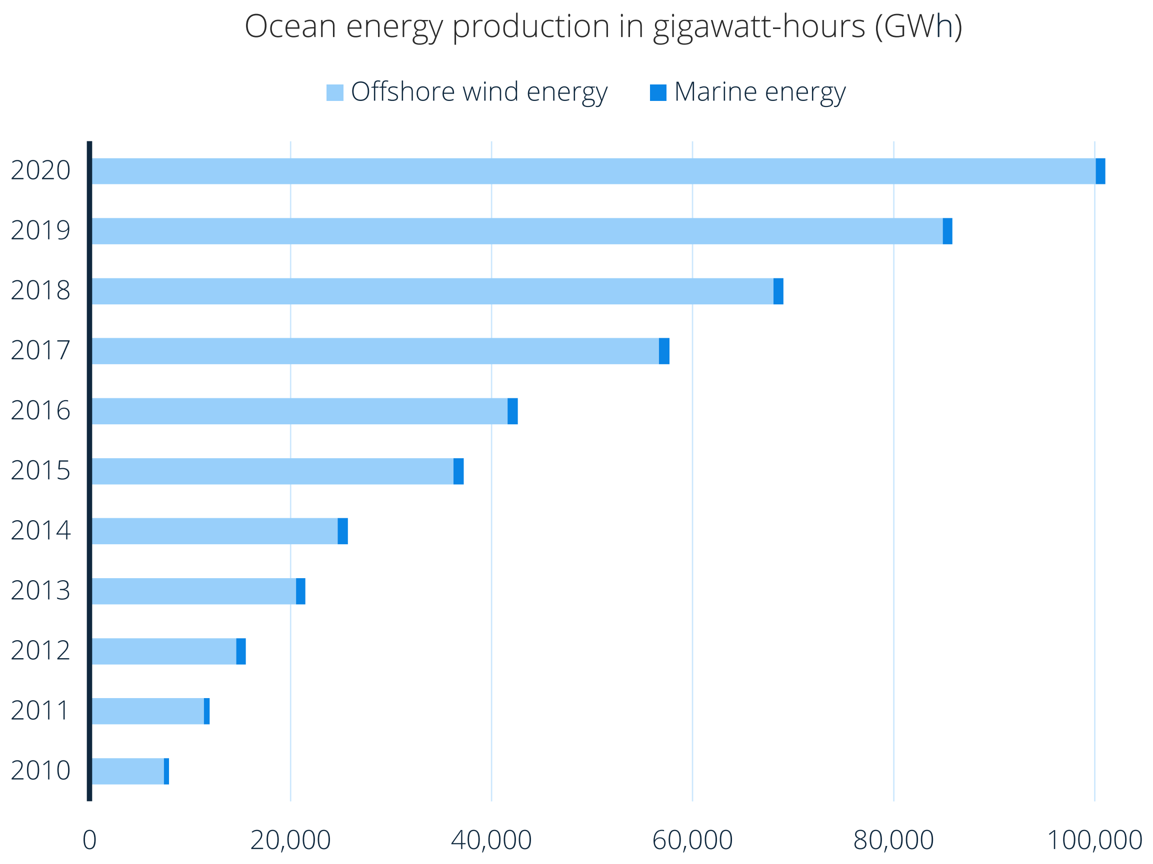
Nearly all these cargo ships are powered by fossil fuels. The pollution caused by this method of transport has been in the spotlight for several years. In 2021, international shipping emitted 700 million metric tons of carbon dioxide ($MtCO_2$) into the atmosphere, more than the total CO_2 emitted by Germany in the same year. Today, this sector must transition towards a sustainable future.

Note(s): Worldwide; 1990 to 2021
Source(s): Clarkson Research Services; UNCTAD; ID 264117

Source(s): Crippa et al.; EDGAR; European Commission; ID 1291468; ID 1171389

Harnessing energy from the ocean

The oceans are the world's largest untapped source of renewable energy



Note(s): Worldwide; 2010 to 2020
Source(s): IRENA; ID 1334849

Ocean energy, or marine energy, refers to all forms of renewable energy derived from the sea. Global marine energy capacity reached 524 megawatts in 2022 after nearly doubling at the beginning of the previous decade. South Korea and France currently have the highest installed marine power capacity, holding about 256 and 211 megawatts, respectively (see next page).

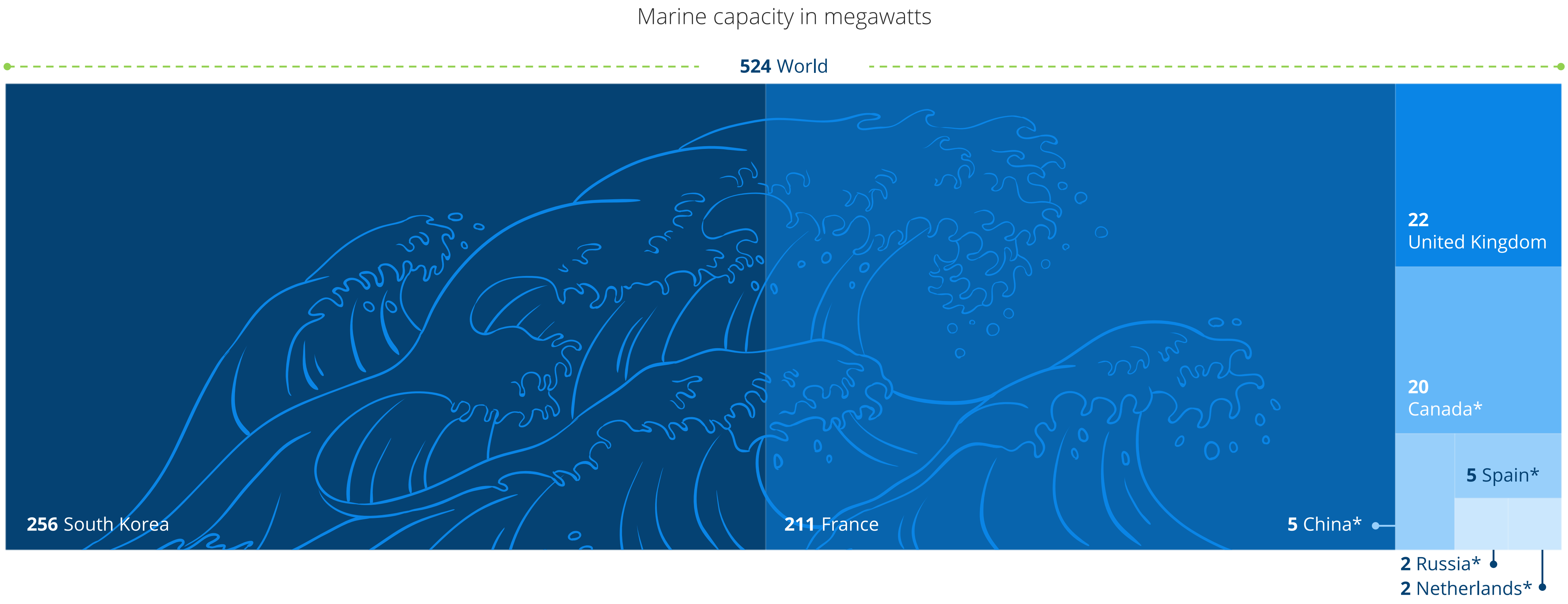
When also including offshore wind energy – whereby turbines are mostly located on the high seas – the global energy generation from the ocean amounted to some 101 terawatt-hours in 2020, a 12-fold increase compared to 2010.

Ocean power can not only help solve the energy crisis but also help in mitigating climate change. According to IRENA's 1.5 degrees Celsius scenario, offshore wind, ocean energy, and floating solar will all experience enormous expansion in the ensuing decades. For instance, offshore wind could grow from 34 gigawatt-hours in 2020 to 380 gigawatt-hours by 2030. By 2050, this could reach over 2,000 gigawatt-hours. Additionally, 350 gigawatt-hours more offshore renewable power capacity could come from ocean energy that same year.

Source(s): IRENA; ID 476267

Harnessing energy from the ocean

Leading countries in installed marine energy capacity in 2022



Note(s): Worldwide; 2022; *estimate
Source(s): IRENA; ID 1031127

02

Impacts of climate change

- Ocean warming
- Sea level rise
- Ocean acidification
- Loss of biodiversity

How is climate change impacting the world's oceans?

Anthropogenic climate change has already contributed about 1.1 degrees Celsius to global warming. The heat storage in the oceans significantly contributes to sea level rise through thermal expansion. Additionally, ocean warming affects ocean currents, impacts tropical cyclones, and is a major player in ocean deoxygenation processes and carbon sequestration into the ocean. These imbalances can lead to dramatic changes in ecosystems and biodiversity and can cause population extinctions, coral bleaching, the spread of infectious diseases, as well as redistribution of marine life (see pages 26 and 27).

According to the IPCC Sixth Assessment Report, climate change has already caused substantial damages and irreversible losses in coastal and open ocean ecosystems. In the future, a scenario of continued emissions will further disturb all major natural climate system components. For land and ocean carbon sinks, an increase in CO_2 emissions will mean a decrease in the proportion of emissions they can take up.

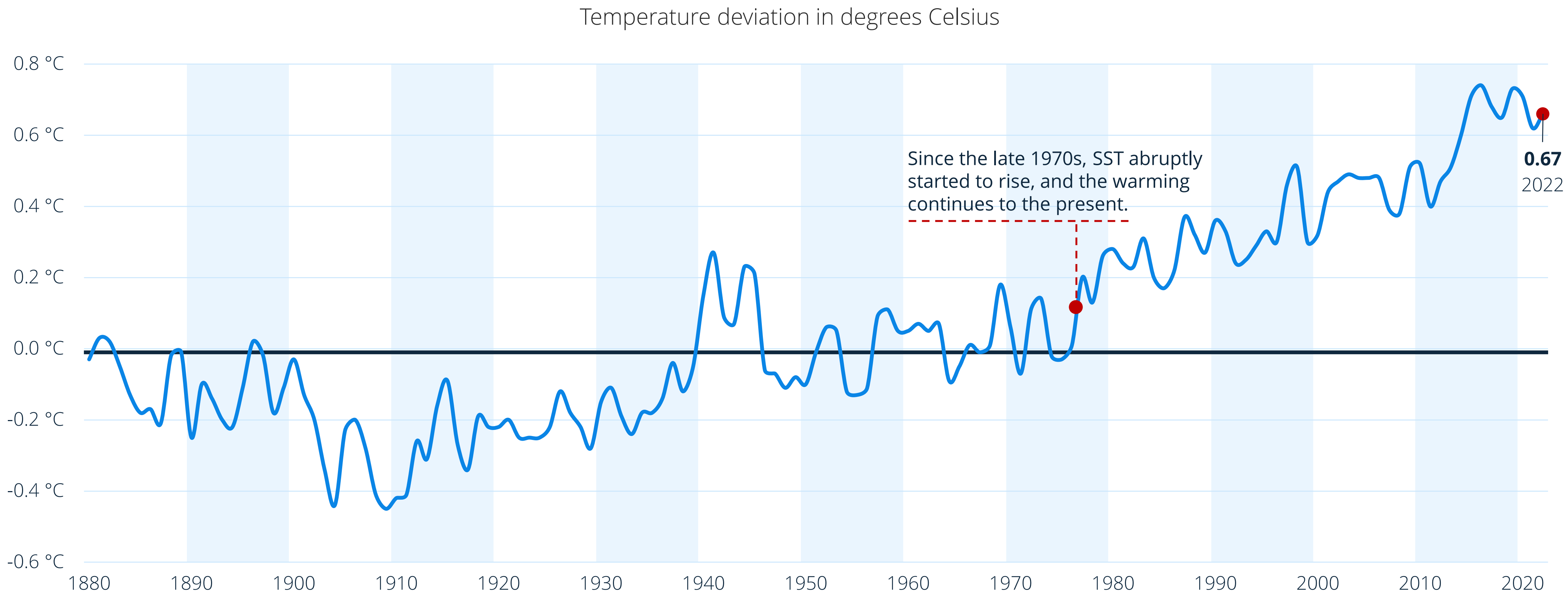
Among the various threats to coastal regions from rising global temperatures, coastal flooding caused by sea level rise is considered one of the most severe risks to human populations in and around these regions. The average yearly rate of mean sea level rise has been around 3.1 millimeters in the past three decades (page 21). Under a very low emissions scenario, the global sea level is estimated to increase by up to 38 centimeters by 2100 (page 23).

With the help of long-term observations of ocean parameters such as surface temperature, sea ice, sea level rise, and acidity, the effects of climate change on ocean environments can be monitored. This not only provides a deeper understanding of the processes in general but also provides information for developing mitigation strategies to better protect the oceans.

Source(s): IPCC; UN; WEF; ID 1296836

Global mean sea surface temperature (SST) has increased since the pre-industrial era

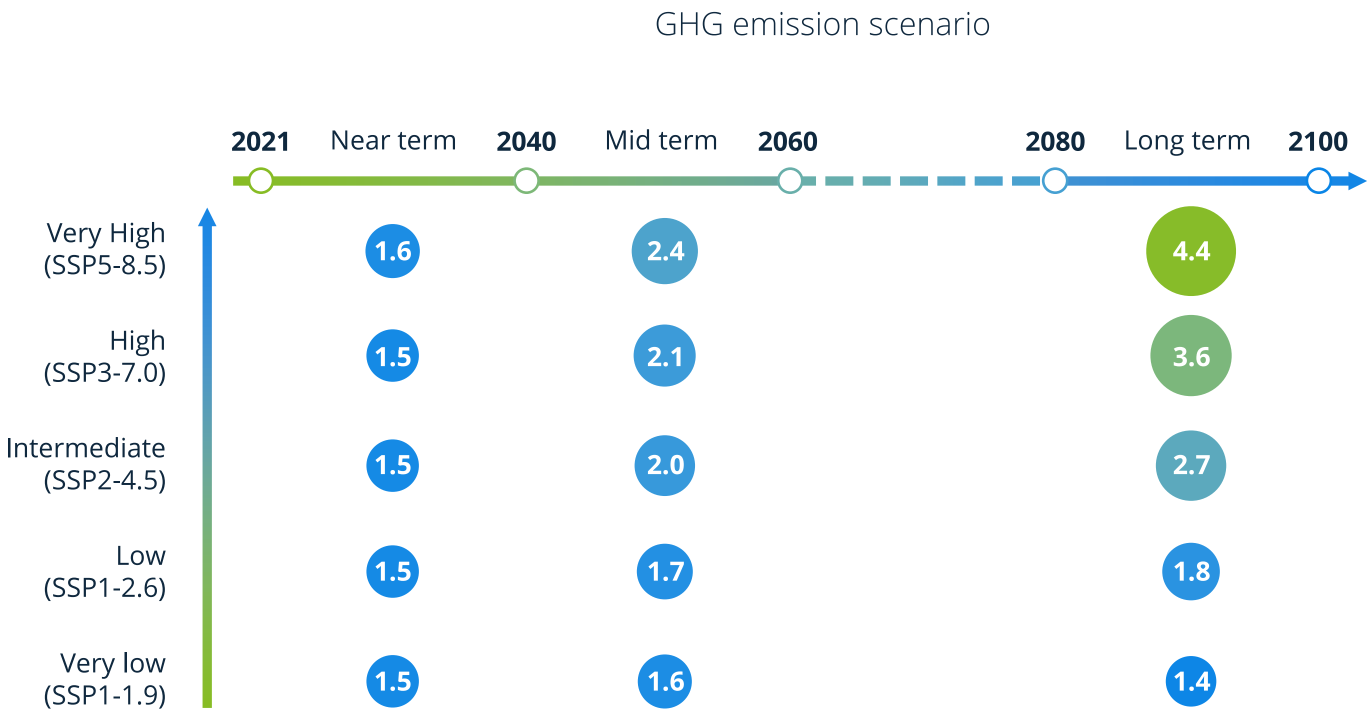
Global ocean surface temperature anomalies from 1880 to 2022



Note(s): Worldwide; 1880 to 2022
Source(s): NOAA; ID 736147

Global surface temperatures will continue to increase under all emission scenarios

Estimated increase in global surface temperature from 2021 to 2100, by scenario (in degrees Celsius)



Global surface temperatures will continue to increase until at least the middle of the century under the expected range of all emissions scenarios. Crossing the two degrees Celsius global warming level in the mid-term (2041 to 2060) and long term (2081 to 2100) is likely to occur in the intermediate, high, and very high GHG emissions scenarios. This temperature rise, in turn, brings about cascading effects like the melting of sea ice and glaciers, sea level rise, and extreme weather.

Even if limiting surface temperature is managed, it will not prevent continued change in climate system components with long timescales of response, such as deep ocean warming and ice sheet melt. According to the IPCC, sea levels will remain elevated for thousands of years.

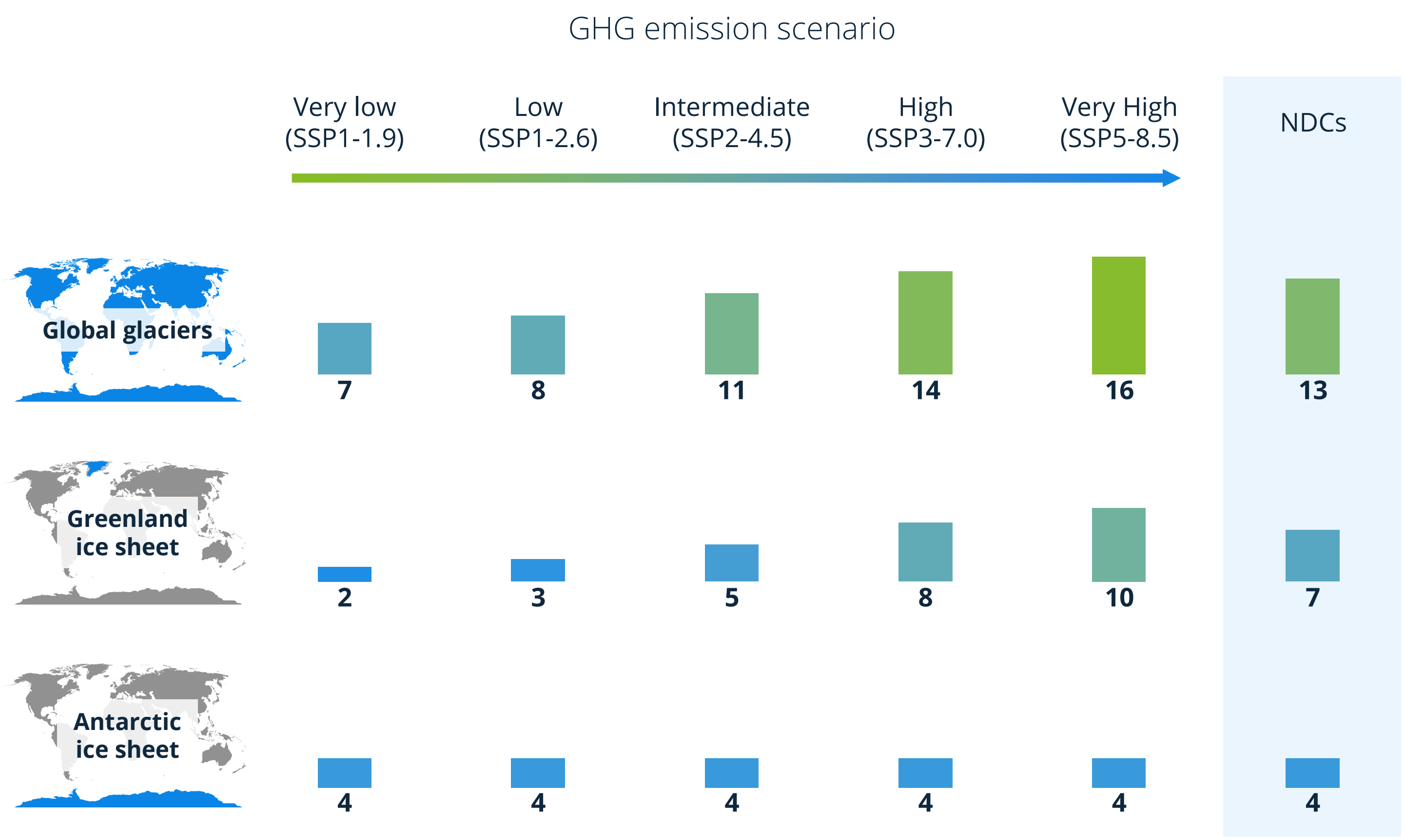
Note(s): Worldwide; 2021; temperature differences relative to the average global surface temperature of the period 1850 to 1900; for SSP definition, see Glossary.

Source(s): IPCC; UNEP; World Meteorological Organization; ID 1257473

Source(s): IPCC

How much are glaciers contributing to sea level rise?

Land ice contributions to global sea level rise until 2100, by scenario (in centimeters)



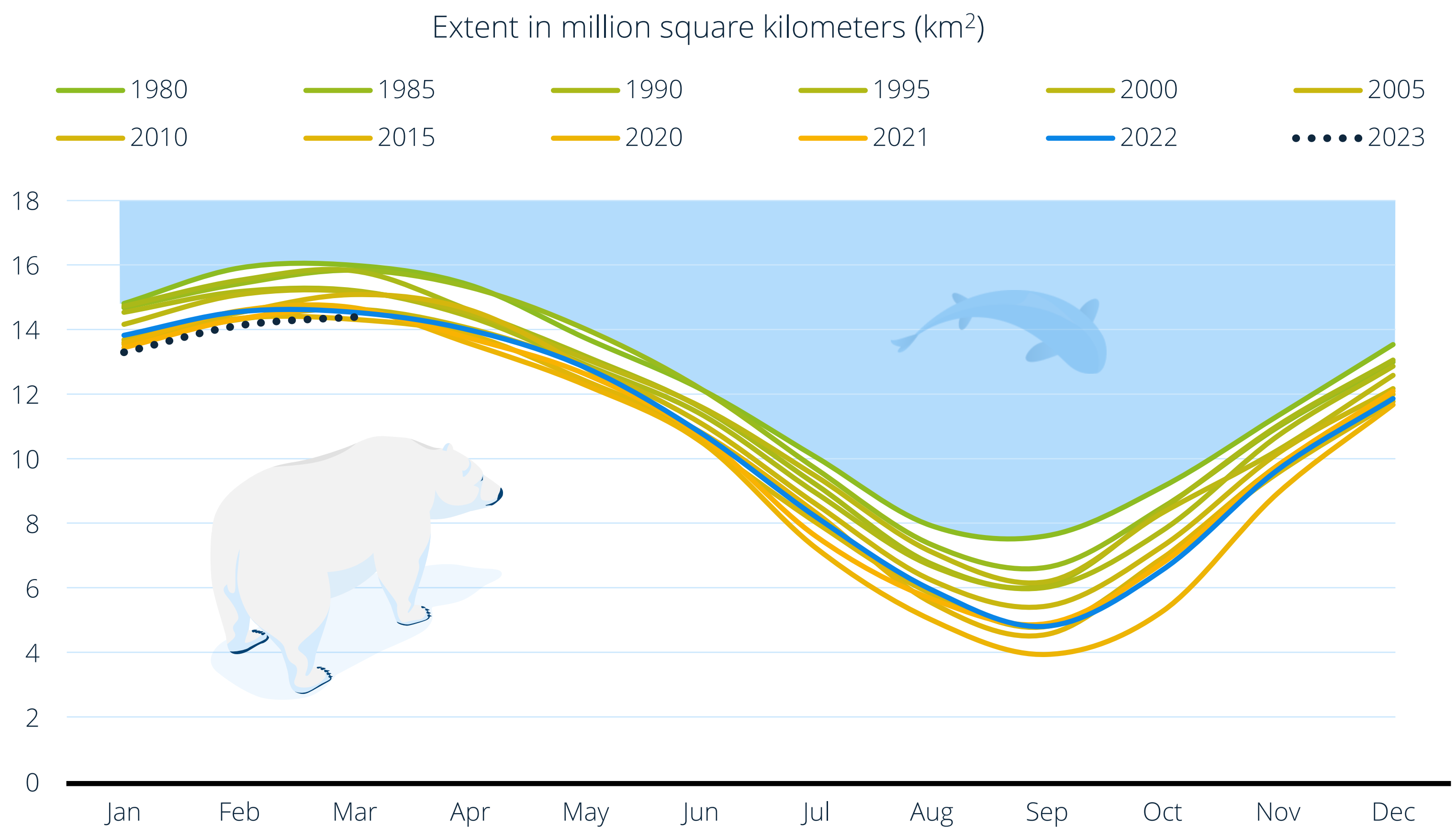
Among the various land ice types, the largest contribution to sea level rise was estimated to be from glaciers across all emission scenarios. Glacier melting worldwide has accelerated over the past decades, and models show that even under the lowest emission scenario, glaciers are estimated to contribute to a nearly seven-centimeter rise in global sea level. Under the same scenario, another six centimeters would be added by melting ice sheets. More than 11,000 km^3 of ice sheets in Greenland and Antarctica have already been lost since the 1970s, equivalent to a rise of three centimeters. According to NASA, the world's most expansive glacier – the Thwaites Glacier, located on the West Antarctic ice sheet – is expected to increase sea level by 16 feet (487 centimeters) if it melts completely.

Note(s): Worldwide; 2021
Source(s): Carbon Brief; Edwards et al; ID 1276983

Source(s): Climate Nexus; Copernicus; IPCC; NASA

Artic sea ice extent reaching record lows

Northern Hemisphere sea ice extent per month from 1980 to 2023



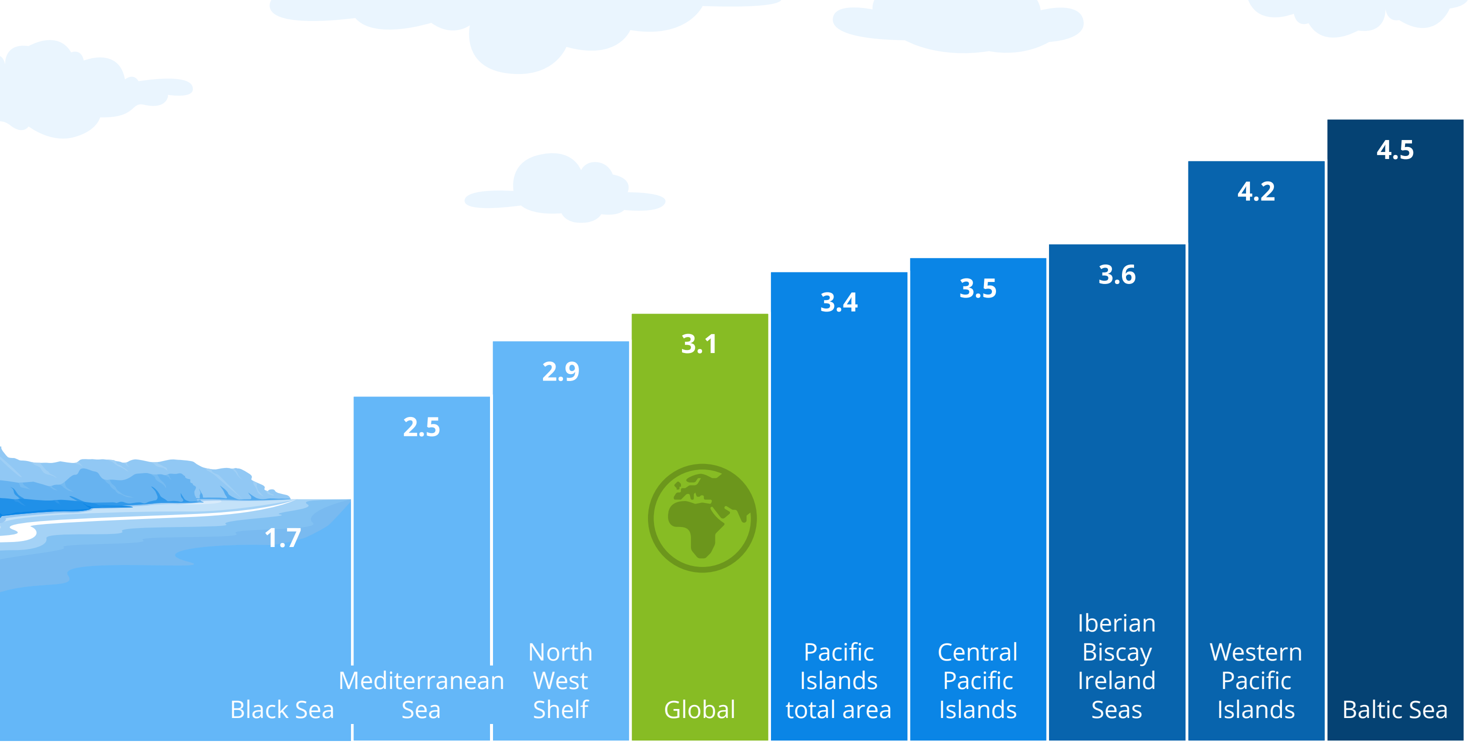
In recent decades, the Arctic has been warming much faster than the rest of the world. This amplification is primarily caused by melting sea ice, where older and thicker sea ice becomes thinner and more mobile. The Arctic sea ice has steadily declined in extent and thickness since the 1980s. Summer (September) sea ice has followed a downward trend since 1979, falling 13 percent per decade, with record lows of sea ice levels in 2020. The continued loss of Arctic sea ice will hasten the erosion of Arctic coastlines and already causes a disturbance in global weather patterns. With sea ice loss, accessibility to these remote areas will increase, leading to increased human activity and further disturbance of Arctic ecosystems.

Note(s): Worldwide; 1980 to 2023
Source(s): National Snow and Ice Data Center; ID 1299082

Source(s): International Science Council

Rise in sea surface temperature and subsequent sea level rise is occurring globally

Rate of mean **sea level rise** worldwide between January 1993 and May 2020, by select location (in millimeters per year)



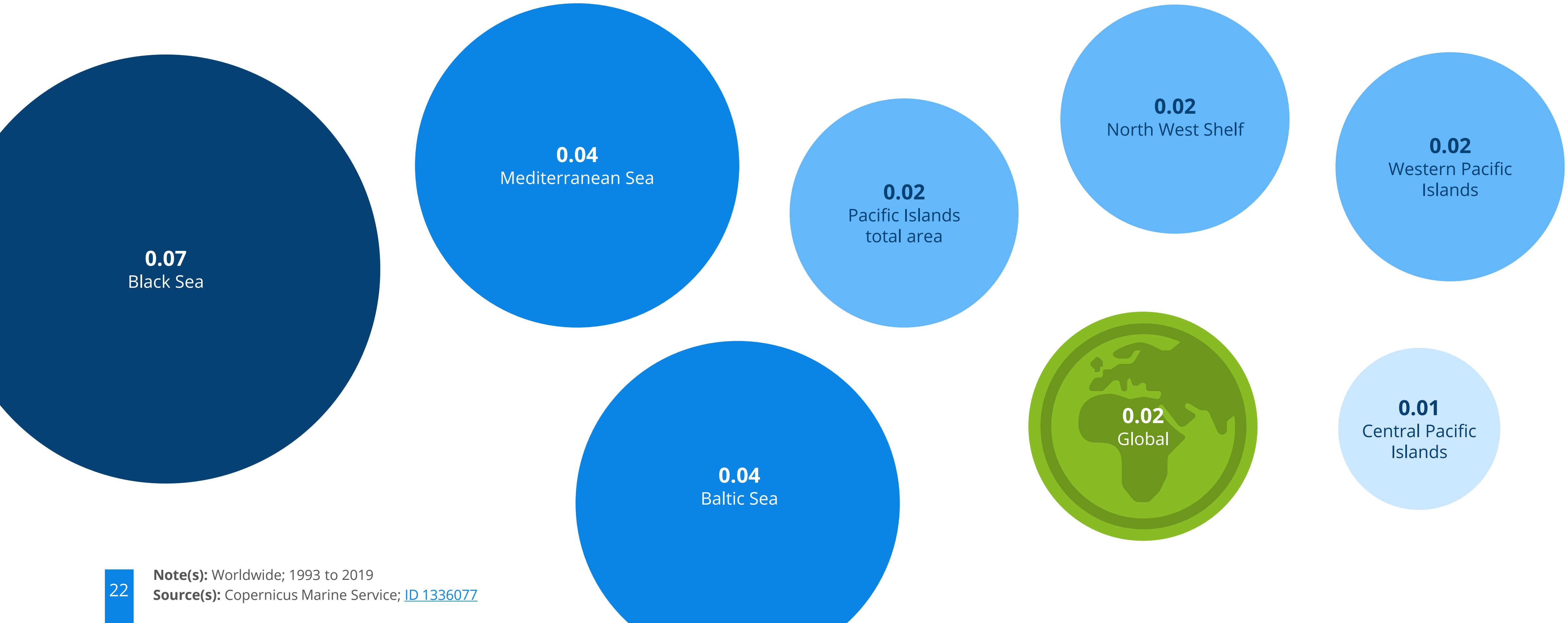
The mean sea level (MSL) is a critical climate indicator that provides information on how the ocean is warming and how much land ice is melting. Between 1993 and 2020, the global mean sea level rose by nearly 3.1 millimeters annually, equating to more than three centimeters per decade. Similarly, most coastal regions in Europe have also experienced increased sea levels. However, the Baltic Sea level rose at a rate slightly higher than the global average.

Regarding sea surface temperature, the Black Sea showed a yearly rise of 0.07 degrees Celsius (see next page). This may seem small, but considering the enormous volume of water held in these water bodies, it takes vast amounts of heat input to bring about minor changes. These changes in sea surface temperature are unprecedented. They lead to effects that negatively impact not only ocean life forms but cause changes in currents that might affect existing shipping lines.

Note(s): Worldwide; January 1993 to May 2020
Source(s): Copernicus Marine Service; ID 1336120

Rise in sea surface temperature and subsequent sea level rise is occurring globally

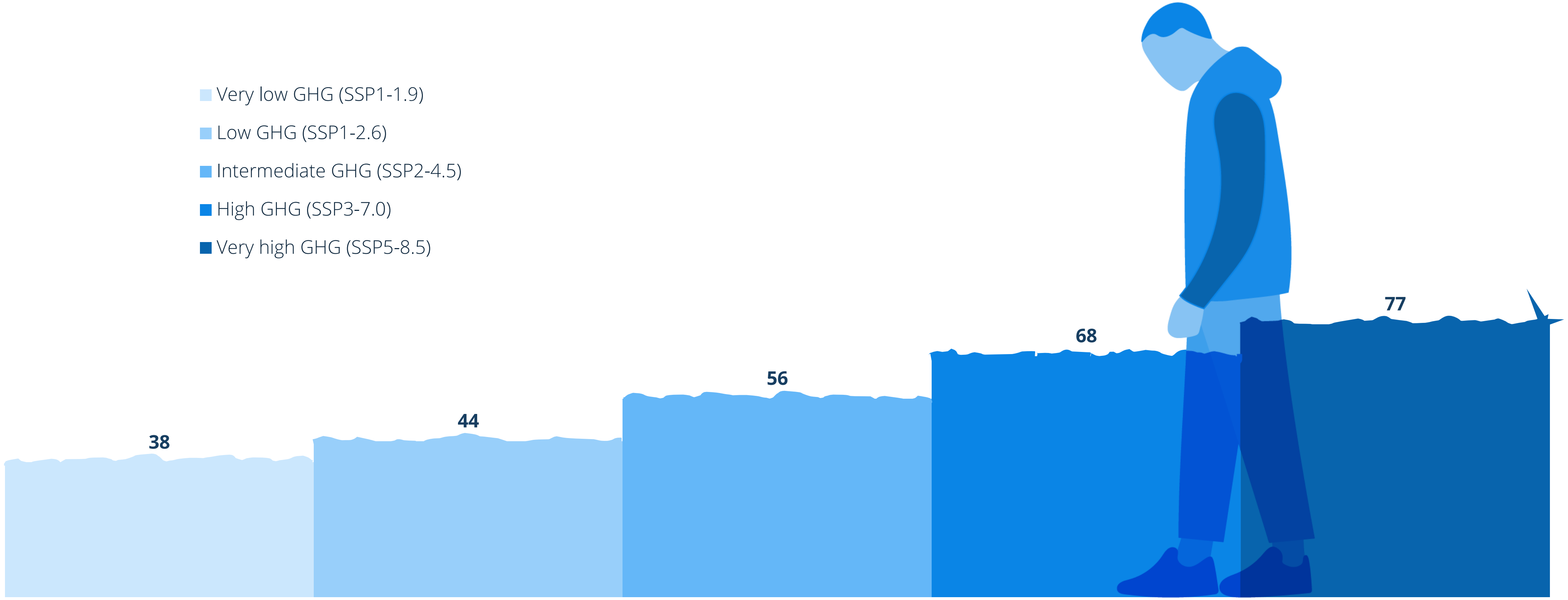
Increase in mean **sea surface temperature** worldwide between 1993 and 2019, by select location (in degrees Celsius per year)



Note(s): Worldwide; 1993 to 2019
Source(s): Copernicus Marine Service; ID 1336077

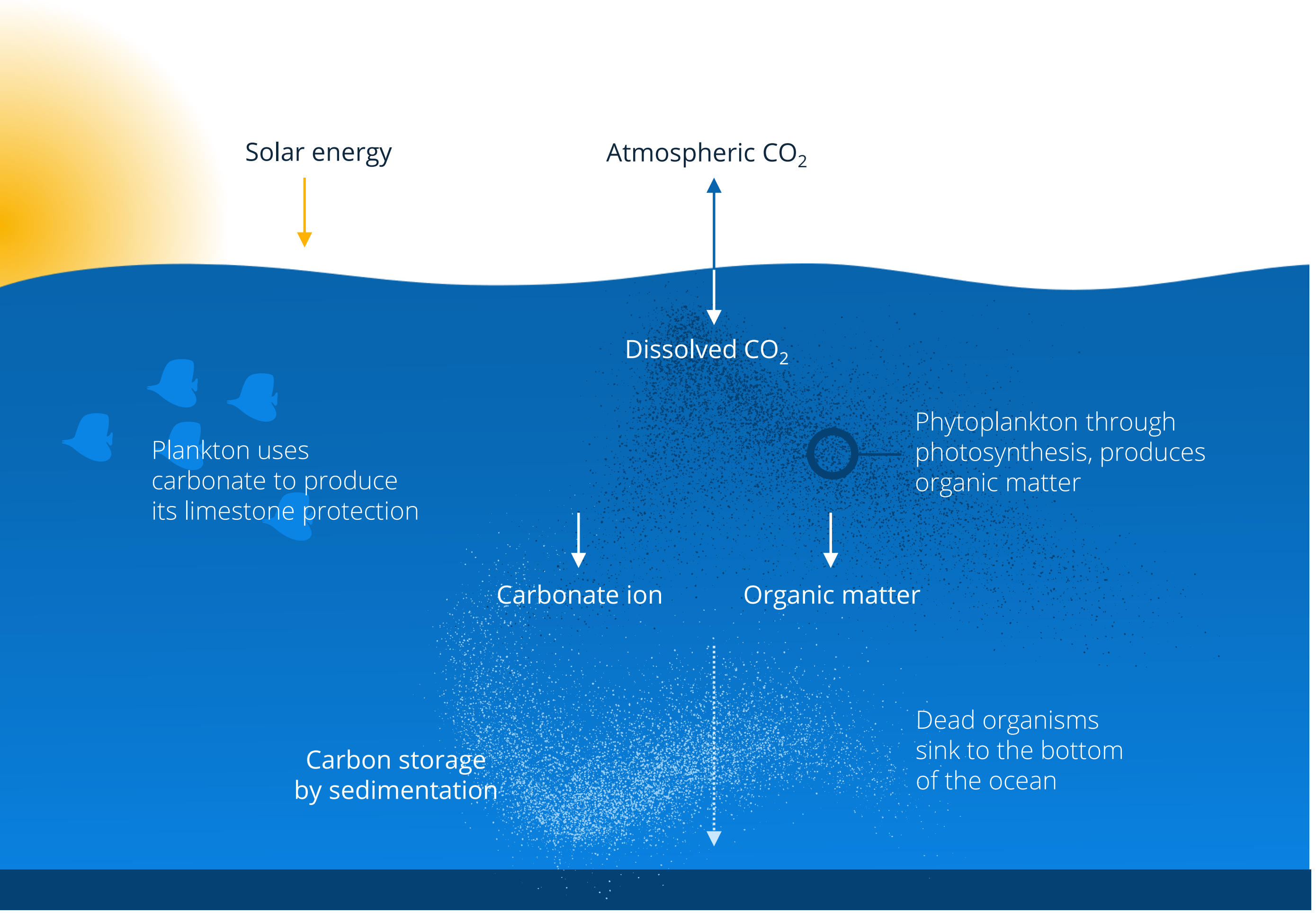
The higher the emissions, the higher the rise

Projected global sea level rise by 2100, by scenario (in centimeters)



Note(s): Worldwide; 2021
Source(s): IPCC; NASA; ID 1341703

Oceans play a vital role in sequestration of atmospheric carbon dioxide (CO_2)



The oceans are responsible for much of the Earth's oxygen production. This is carried out by oceanic plankton – drifting plants, algae, and some bacteria that can photosynthesize. Through the photosynthesis process, carbon dioxide dissolved in the oceans is taken up by organisms. This process, in turn, helps in the removal of atmospheric carbon dioxide that easily dissolves in water. Therefore, carbon is exchanged between the ocean's surface waters and the atmosphere and broken down to be stored in the ocean's depths for long periods.

The carbon captured by the ocean, and coastal ecosystems, such as seagrass, mangroves, salt marshes, and other systems along the coast, is called **blue carbon**. These ecosystems are very efficient in sequestering and storing CO_2. The stored carbon, if emitted back into the atmosphere, will further contribute to rising global temperatures. Therefore, it is crucial to protect and manage these ecosystems in order to halt and reverse their already ongoing degradation (see next page).

Source(s): Ocean climate

Rapid loss of marine ecosystems could impede climate mitigation

Ecosystem	Cover area in km^2	Annual rate of loss in percentage
Mangroves	138,000	0.11
Salt marshes	55,000	1-2
Seagrass	325,000	2-7

Coastal ecosystems such as **mangroves**, **marshes**, and **seagrass** have the potential to sequester and store carbon (see previous page). According to Hoegh-Guldenberg et al., the intensity of soil carbon sequestration rates per hectare is significantly higher than those of terrestrial ecosystems like forests. However, these ecosystems are under constant pressure from rapid coastal development and the over-extraction of resources. For instance, the cover area of seagrass is being reduced at an annual rate of between two and seven percent.

Due to their global distribution, mangroves are the only ecosystems that have been widely mapped, while the worldwide extent of salt marshes and seagrass is disputable. Furthermore, with the current loss rate, their **contribution to climate change mitigation** in terms of carbon sequestration and storage could be highly reduced. Besides, these ecosystems provide other co-benefits, such as coastal protection from storms, improving water quality, and benefiting biodiversity.

Human activities such as urbanization and commercial development at shorelines are changing marine ecosystems at an increasing rate. As a result, **fish nursery grounds** are significantly affected by the loss of seagrass habitat. When damaged or lost, habitats are difficult and costly to restore.

Source(s): Hoegh-Guldberg et al.

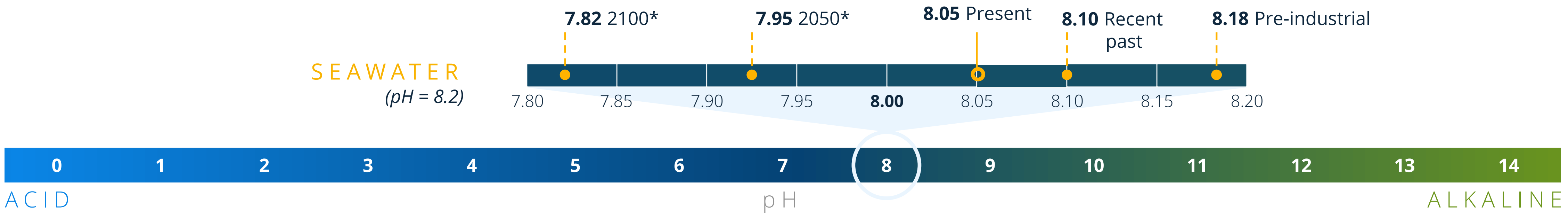
Increased absorption of CO_2 by marine waters leads to ocean acidification

Changes in marine chemical composition

As mentioned before, oceans can absorb atmospheric carbon dioxide (CO_2) and help in carbon sequestration. With the increase in atmospheric CO_2 from human activity, such as burning fossil fuels, there is an increase in the amount of CO_2 absorbed by the ocean. While oceans absorb around one-quarter of the annual emissions of anthropogenic CO_2 from the atmosphere, thereby helping to diminish climate change's impacts, it comes at the cost of altering the chemical composition of seawater. Between 1985 and 2020, the average pH value of the oceans fell from 8.11 to 8.05.

Marine life, such as oysters and corals, make hard shells and skeletons by combining calcium and carbonate from seawater. Carbonate is less available for marine animals to build shells and skeletons as acidity increases. Under such conditions, and with the effects of severe acidification, these shells and skeletons made from calcium carbonate can dissolve. This has been a major cause of concern as corals are experiencing a massive loss of colonies that once formed a haven for other marine animals.

However, the CO_2 absorption capacity of the ocean is limited. As the acidity and temperature of the ocean increase, its capacity to absorb CO_2 from the atmosphere decreases, impeding the ocean's role in moderating climate change.



Note(s): * Projections
Source(s): EPA; WMO; Copernicus Marine Service; EEA; Virginia Institute of Marine Science; ID 1338869

Consequences of ocean warming on coral reefs

The health and functioning of the ocean strongly depend upon marine biodiversity. However, rising temperatures risk irreversible damage to ecosystems that support ocean life. For instance, diverse ecosystems, such as **coral colonies** found in the tropics and subtropics, are sensitive to water temperature and quality changes. Warming caused by climate change, overfishing, unsustainable coastal development, and declining water quality affects the proliferation of coral colonies.

According to the IPCC, in the transition to 1.5 degrees Celsius of warming, changes to water temperatures are expected to drive some marine species to relocate to higher latitudes. However, this increase is detrimental to coral colonies; a warming of 1.5 degrees Celsius threatens to destroy 70 to 90 percent of coral reefs, and a two-degree Celsius increase might completely wipe them out.

Meanwhile, large-scale **coral bleaching** events are becoming more common and severe in recent decades as a result of warming temperatures. Frequent bleaching events impede the recovery of coral colonies, eventually causing the reef structure to collapse. In the South Asia region, live coral cover saw a mean absolute decline of almost 21 percent between 1978 and 2019. Some measures to protect these ecosystems are reducing greenhouse gas emissions and creating **marine protected areas** around coral reefs to limit fishing and shipping activities (see page 50).

Climatic events such as flooding and erosion disturb specific coastal habitats, such as **mangroves** and **seagrass beds**, which are vital fish breeding grounds.

+1.5°C
9 out of 10 coral reefs at risk from severe degradation

+2.0°C
All coral reefs disappear

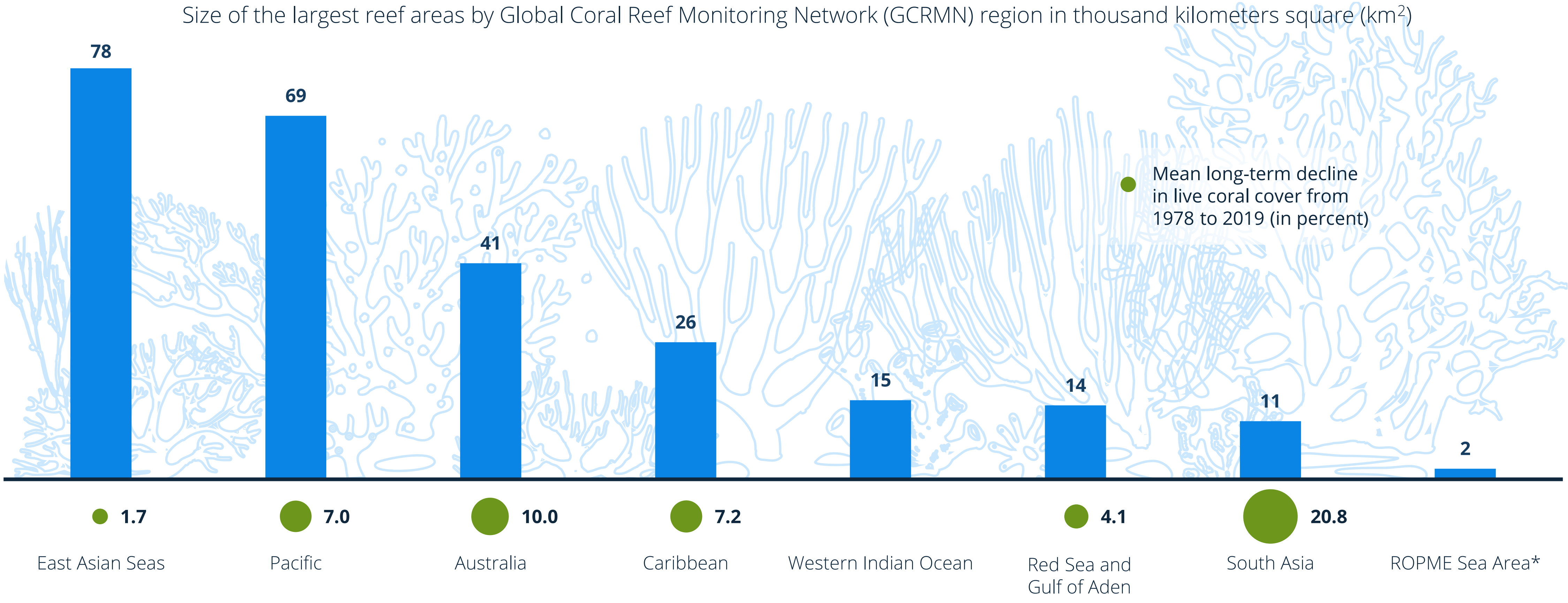
+3.0°C
Marine ecosystems may collapse

+4.0°C
Half of all plant and animal species face local extinction

Source(s): Climate Nexus; IPCC; NOAA

Consequences of ocean warming on coral reefs

Size of the largest reef areas by Global Coral Reef Monitoring Network (GCRMN) region in thousand kilometers square (km²)



Note(s): *Regional Organisation for Protection of the Marine Environment – the sea area surrounded by Bahrain, I.R.Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates
Source(s): Global Coral Reef Monitoring Network; ID 25924

03

Marine pollution

- Marine/coastal environment degradation
- Oil spills
- Plastic pollution
- International Coastal Cleanup

Marine pollution

Despite their importance for the well-being of humans and animals alike, the oceans have been polluted with vast quantities of solid and liquid waste over the past decades. Improper waste management on land and deliberate discarding of waste and toxins by ships and vessels in the ocean are the primary causes of **marine pollution**. Due to regulatory gray areas for international waters, the oceans have been used as illegal dumping grounds.

Plastic pollution is a planetary threat, affecting nearly every marine and freshwater ecosystem. According to IUCN, at least 14 million metric tons of plastic enter the ocean annually, with plastic alone accounting for some 80 percent of all **marine debris**. As the most abundant form of litter in marine environments, debris from plastic waste has been found everywhere, from surface waters to deep-sea sediments (page 35).

Based on the sources of plastic pollution in oceans, plastic debris can be distinguished as **land-based** (improper waste disposal, overflow of rivers) and **ocean-based** (primarily from the fishing industry and aquaculture). Due to many countries lacking proper waste management infrastructure, plastic leakage mainly occurs through ocean waterways (page 33). Plastic waste often degrades into smaller particles – so-called macroplastics, microplastics, and even nanoplastics. Marine life accidentally ingests these smaller pieces of plastic; thus, plastics eventually enter the food chain in a trophic transfer process. As consumers along this food chain, humans end up ingesting microplastics, and the long-term effects are yet to be fully understood.

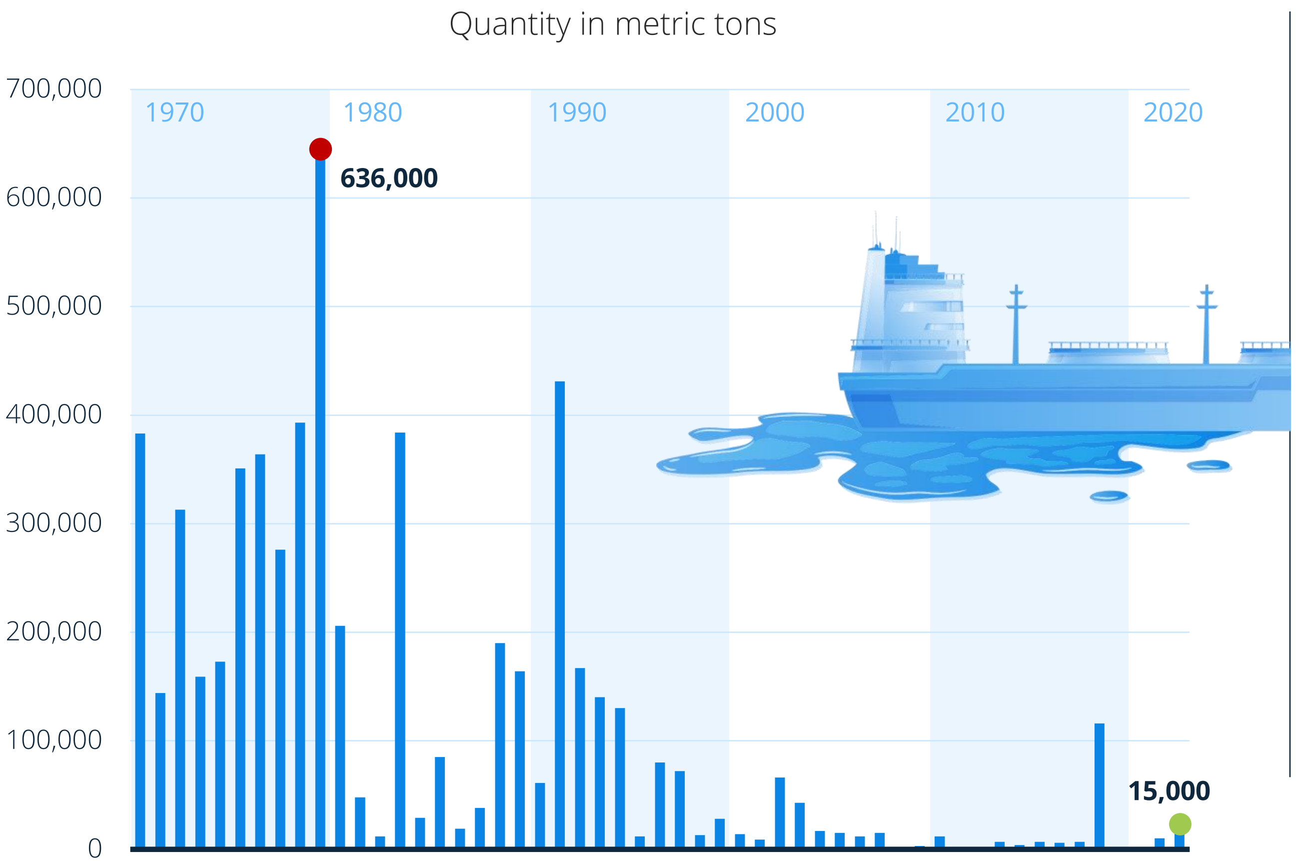
Oil spills – a major threat to marine organisms

Oil spills that happen primarily in the ocean are caused by accidents involving tankers, barges, pipelines, refineries, drilling rigs, and storage facilities. Additionally, ships and boats that use fossil fuels inevitably release fuel residue and waste products into the ocean over the course of operation. Because oil is less dense than water, oil spills spread rapidly across the surface to form a thin oil slick. The presence of oil on the ocean surface is detrimental to marine birds and animals that can either ingest oil or get covered by the oil slick, rendering them with difficulties in movement, resulting in their injury or death if left unaided.

Source(s): IUCN

Oil spills remain a concern, though actual spills have decreased steadily for several decades

Global oil tanker spills from 1970 to 2022, by volume



Most crude oil and natural gas traded between continents are transported across the sea via shipping tankers or undersea pipelines. In 2021, the global volume of crude oil in seaborne trade reached 1.8 billion metric tons. Accidental leaks from oil tankers are uncommon, but their effects are catastrophic.

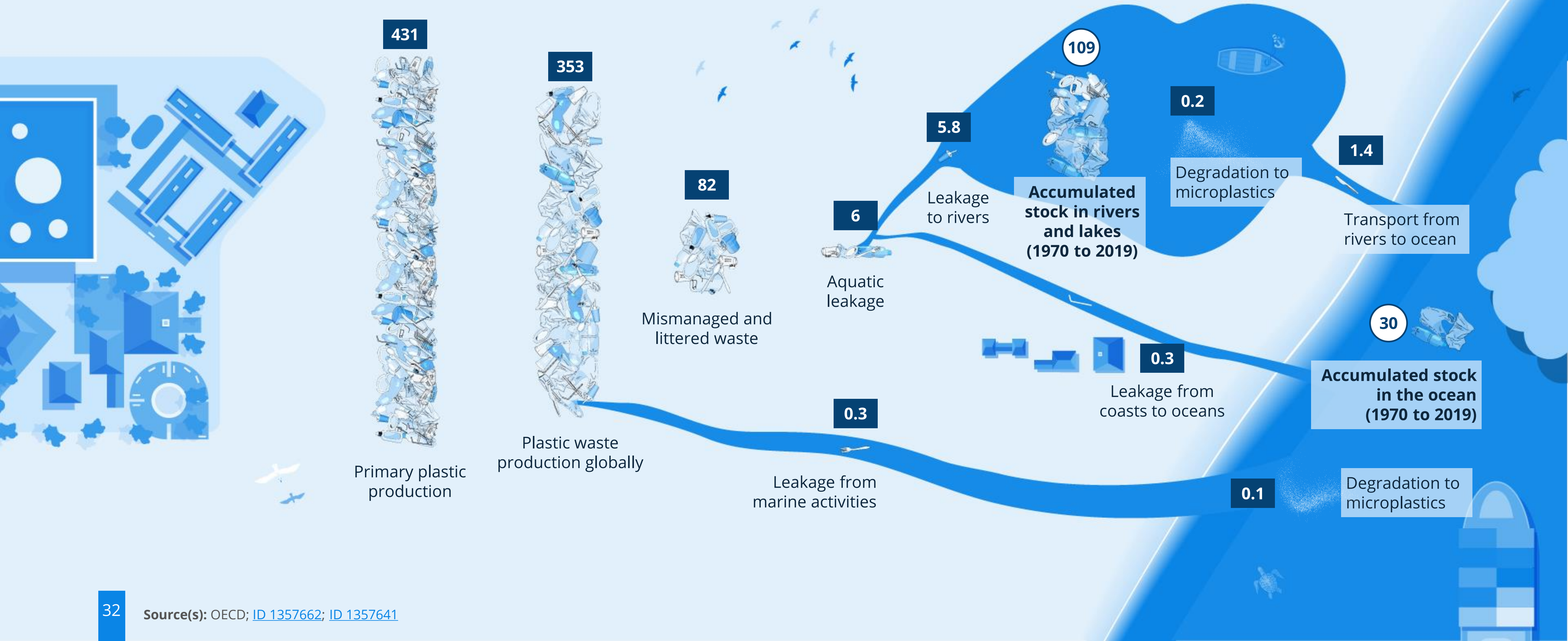
Even though the incident rate of oil spills has been low in recent decades, the amount of oil leaked in a single incident can be devastating. The largest leak in recent history was recorded in 1979, adding up to 636,000 metric tons. In contrast, the oil leaked from tanker incidents worldwide amounted to about 15,000 metric tons in 2022. Despite the lower volume of leakage, the damage caused depends on several factors, from the environmental conditions to the sensitivity of affected areas. Clean-up of such leaks needs a massive effort as oil floats on the surface and can disperse from the point of the leak to affect an area far more expansive.

Note(s): Worldwide
Source(s): ITOPF; ID 268557

Source(s): Clarkson Research Services; VSM; ID 264013; ID 268553

How does human-generated plastic waste enter the marine environment?

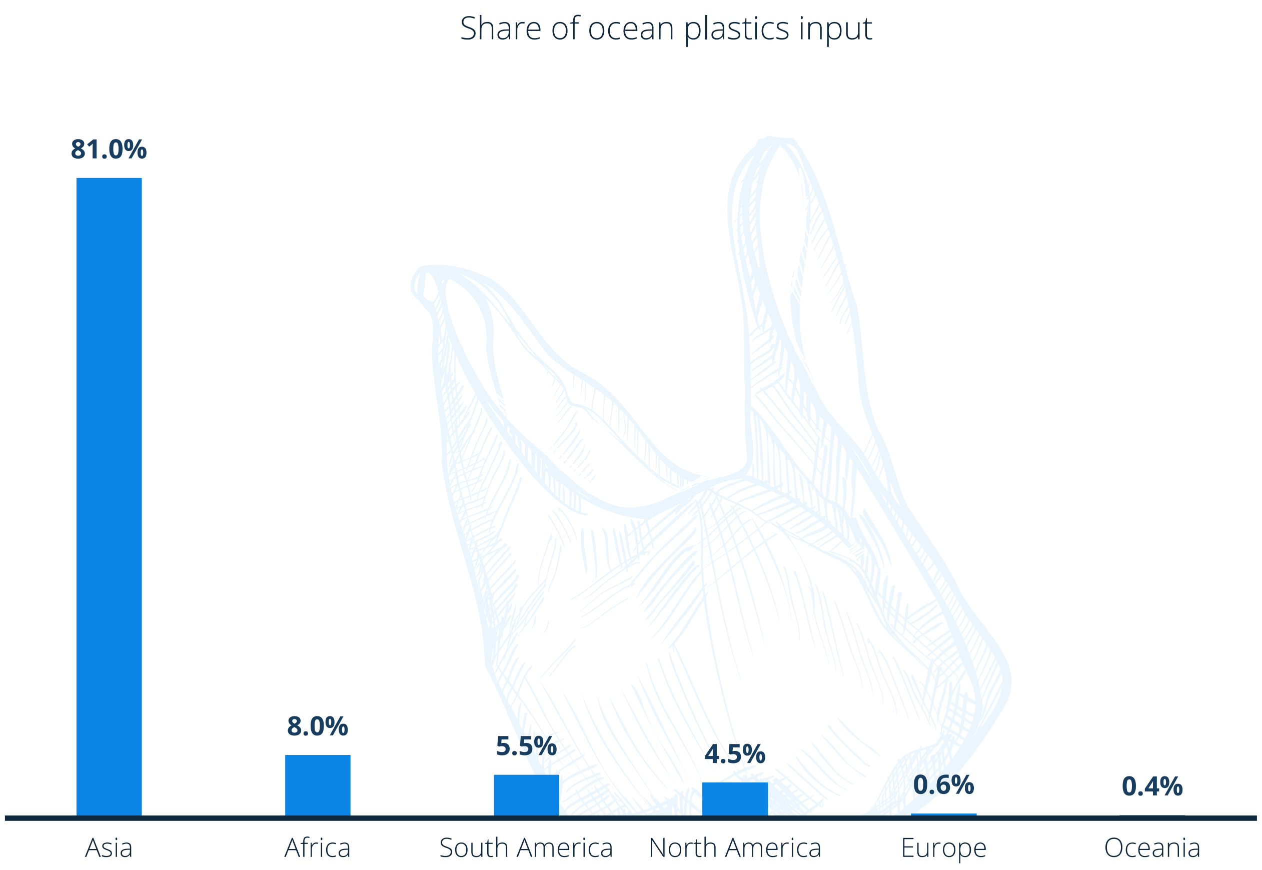
Estimated annual global volume of plastics entering the oceans from land-based resources in 2019 based on the pathway from primary production to marine plastic inputs (in million metric tons)



Source(s): OECD; ID 1357662; ID 1357641

Some of the world's most plastic-polluted rivers are located in Asia

Share of ocean plastic pollution from most polluted rivers as of 2019, by region



In 2019, the vast majority of plastic waste was found to originate in Asia – 81 percent of plastic waste reached the oceans via rivers on the Asian continent. The main reason behind this is that the continent's main waterways all support large populations who rely on poor or nonexistent waste management systems. Imports of plastic waste into the region also play a determinant role. Asian countries like Turkey, Malaysia, and Vietnam are among the leading plastic waste importers, with the three of them collectively receiving almost 1.5 million metric tons of waste only in 2021.

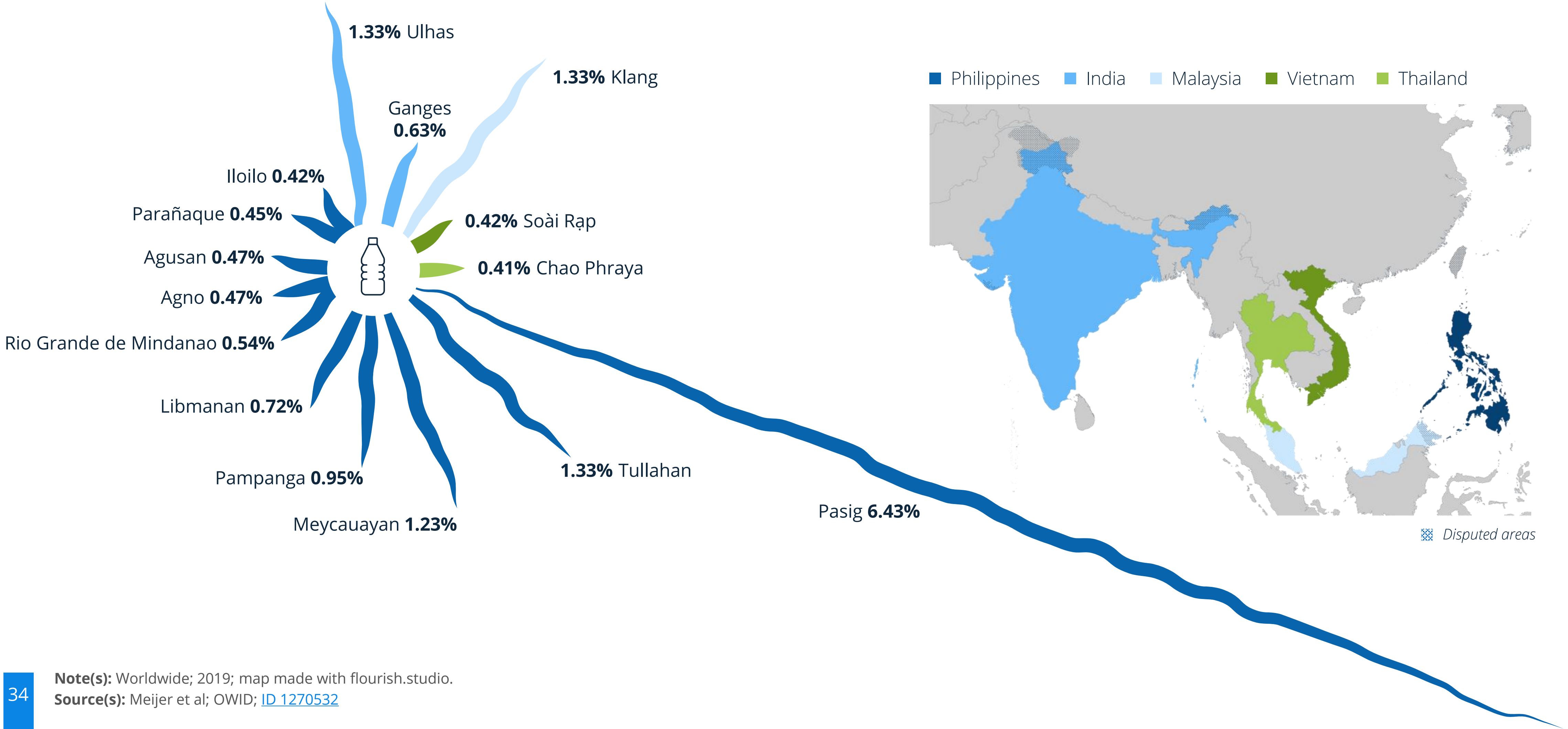
Most of the top polluting rivers are in the Philippines (see next page). The Pasig river was one of the highest polluting rivers, with over six percent of plastic being brought into the ocean via its stream. Considering it is a relatively small archipelago of islands contributing a significant amount of the world's ocean plastics, it reveals the necessity of having functional, sustainable waste management in place.

Note(s): Worldwide; 2019
Source(s): Meijer et al; OWID; World Economics Forum; ID 1270799

Source(s): UN; ID 866958

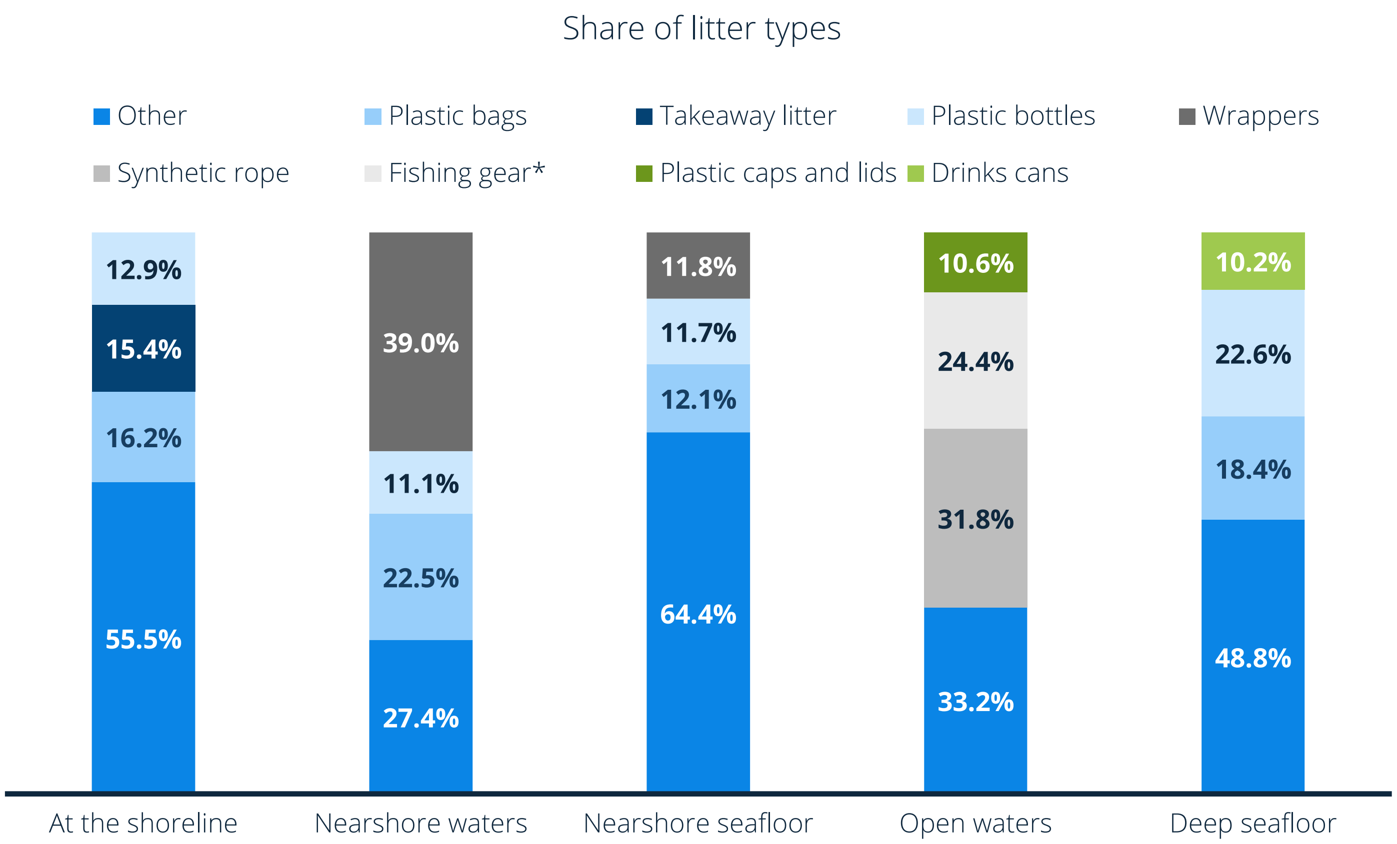
Some of the world's most plastic-polluted rivers are located in Asia

Share of ocean plastic pollution from most polluted rivers worldwide as of 2019



Note(s): Worldwide; 2019; map made with flourish.studio.
Source(s): Meijer et al; OWID; ID 1270532

Extent of marine plastic pollution



Plastic pollution is ubiquitous in many marine environments, with a variety of forms, such as plastic bags, plastic bottles, fishing gear, wrappers, and others, represented in most areas. In a 2021 global study of litter in aquatic environments, plastic bags accounted for more than 16 percent of the waste found at the shoreline.

Levels of marine plastic pollution and the effects on species vary significantly depending on the geographic location and subsequent exposure. Nevertheless, fish, seabirds, sea turtles, and marine mammals can get entangled in or ingest plastic debris, causing suffocation, starvation, and drowning.

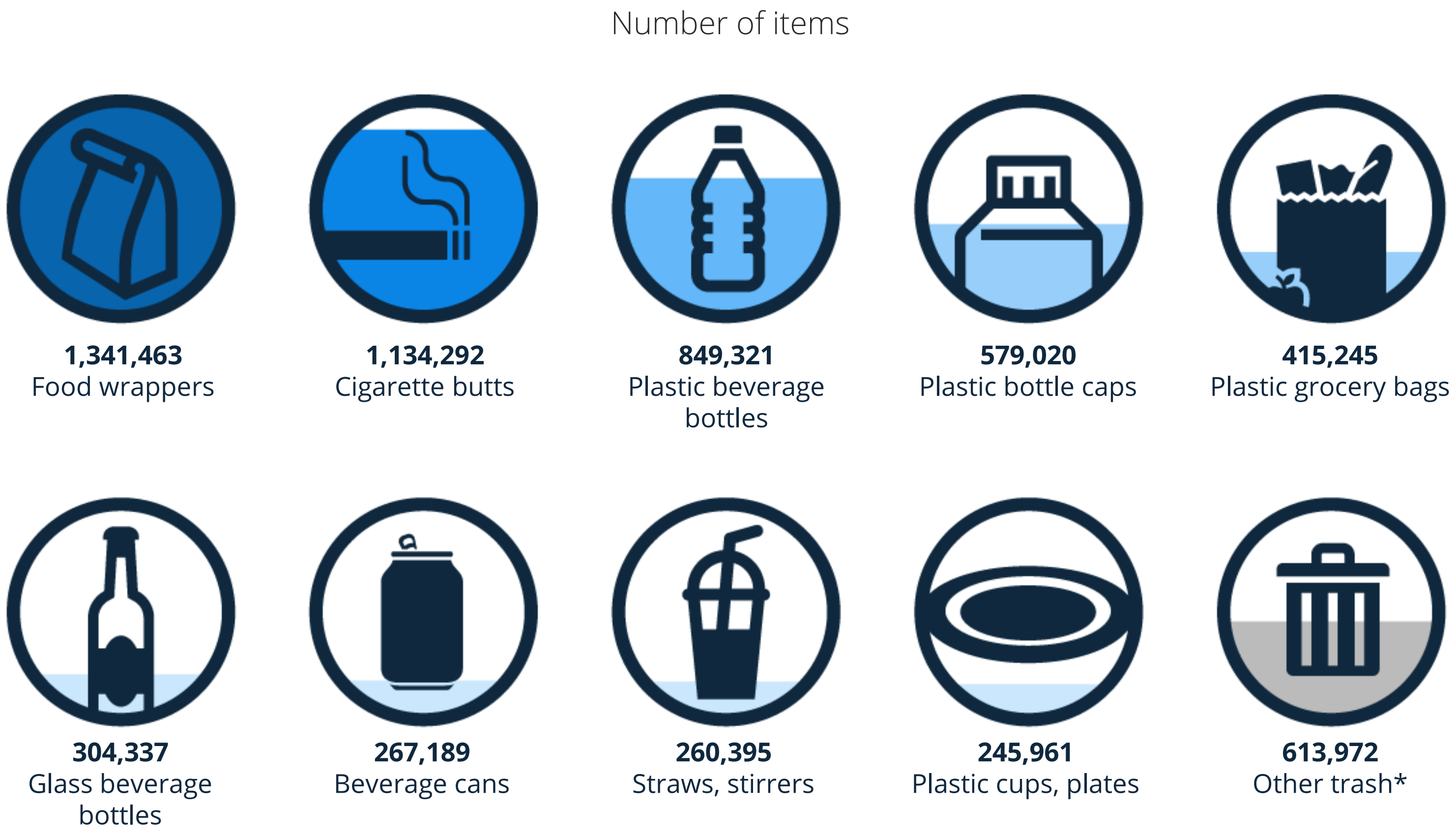
Furthermore, microplastics and nanoplastics have entered the marine food chain and eventually reach humans during seafood consumption.

Note(s): Worldwide; *excludes nets
Source(s): Morales-Caselles et al; The Guardian; ID 1337754

Source(s): World Economic Forum

Most common items found during the International Coastal Cleanup in 2021

Global waste items found in oceans 2021



Many organizations and governmental agencies have taken initiatives to manage and control the waste that ends up in the oceans.

One such effort is the International Coastal Cleanup campaign. During 2021's campaign, it was found that food wrappers were the most collected waste items. They found around 1.3 million wrappers on coasts worldwide, followed by cigarette butts, which were over 1.1 million in number.

Note(s): Worldwide; 2021; *items that are collected by volunteers using the Clean Swell mobile app that do not fall in a specific category. These items range in material type and size. Examples include indiscernible plastic pieces, clothing, and metal pieces

Source(s): Ocean Conservancy; ID 726724

Solutions to tackle accumulated marine litter

Expert
deep dive

Dr. Nikoleta Bellou

Expert for marine litter solutions

Dr. Bellou is co-author of an overview study of solutions for prevention, monitoring, and removal in the renowned scientific journal Nature Sustainability. The study found that reducing ocean pollution requires more support, integration, and creative political decisiveness.

Marine litter accumulates irreversibly in various areas and compartments on small and large scales worldwide [1]. Amongst these accumulation zones are remote ocean surfaces and coastlines, the water column and the deep sea, as well as the bodies of organisms, agricultural soils, and the air. The major entry of marine litter into the marine environment is through rivers, including small rivers, streams, and coastal run-off [2]. As a result, marine litter in general and its large portion of plastic (61 to 87 percent) [3, 4] is globally considered a priority in the stakeholder agendas [5-10] and a threat to a sustainable blue planet.

In our recent study (Bellou et al. 2021) [10], we initially categorized the innovative solutions into ‘Prevent,’ ‘Monitor,’ and ‘Clean’ (PMC). Based on this categorization, we elaborate on the existing solutions' limitations and the challenges of developing new solutions. We recommend funding schemes and policy instruments to prevent, monitor, and clean global marine litter.

In summary, we identified 177 PMC solutions globally, out of which 106 solutions address monitoring, 33 address prevention, and only 30 address cleaning (see the graph on the following page). And although the number of answers might sound high, after looking into the technological readiness level of those solutions, our analyses showed that only 11 percent (20 solutions) are at an operational level (TRL9), and almost 50 percent have not even been demonstrated in the field (TRL7).

Solutions to tackle accumulated marine litter

Expert
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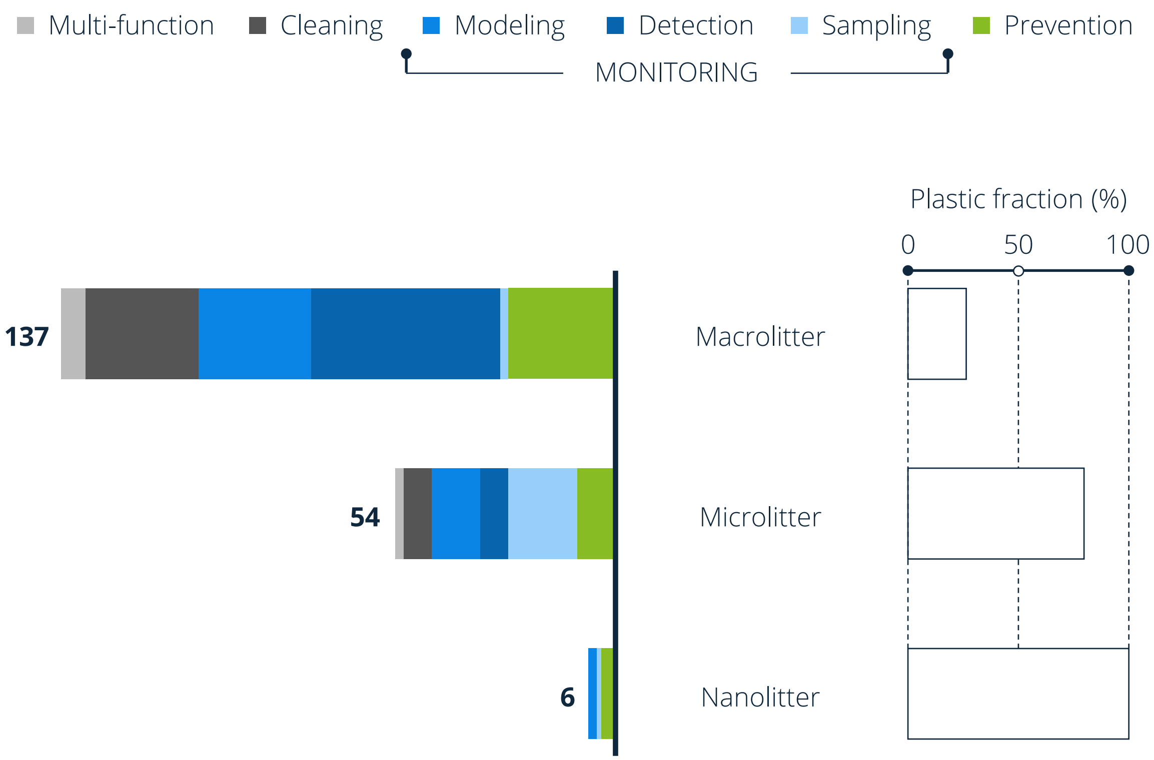

Our data and analyses provide a good basis for assessing the current state of knowledge when it comes to tackling marine litter pollution. Undoubtedly, additional attempts are mandatory to consider PMC solutions for managing marine litter and integrating them into the action plans of the circular plastic economy strategies.

While the technical details of each solution were out of the scope of our work, it is worth mentioning that there is often an overlap or repetition of technology and methodological principles underlying different solutions, whereas new solutions are scarce. A sneak preview summarizing the main methods and technologies used was provided in our study by Bellou et al. 2021 (see the table on the following page). It shows that there is a duplication in efforts, and different developers suggest similar solutions in the same environmental compartments (surface waters, water column, and sea bottom). Our results indicate that many steps are still required to achieve innovative, efficient, sustainable, and environmentally friendly solutions.

Note(s): Size and composition of marine litter by category (color) and the fraction of plastic specifically addressed
Source(s): Adjusted based on Bellou et al. 2021[10]

Solutions to tackle accumulated marine litter

Expert **deep dive**

Horizontal domain function	Surface	Water column	Bottom
Prevention	Booms, traps, conveyor belt, filters	Autonomous underwater vehicles, ROVs, bottom: +Air	
Monitoring:			
Sampling	Grabs, filters, pumps, nets	Filters, rosette, pumps	Video, corer, filters
Detection	Drones, aerial imagery, remote sensing, satellites, multispectral, image analyses, unmanned aerial vehicles	LIDAR	Acoustic remote sensing, sidescan sonar, infrared, ROVs, drop camera, video analysis, annotation
Modeling	2D Lagrangian particle tracking, Markov chain, GIS, beaching, generalized adversarials, source-pathway-receptor, variational analysis, observation simulations	3D Lagrangian particle tracking, Eulerian particle tracking, budgeting, Markov Chain, sinking, multimaterial	
Cleaning	Vessels (various types), bets, booms, water drones, aquarobots, beach robots, vacuum systems	Floaters, nets, booms	ROVs, vessels (various types)

Marine litter has been put into focus on an international level, but there is still an absence of coordinated global strategies. Our results clearly show that for a holistic, sustainable approach to mitigating marine litter, these strategies need to incorporate PMC solutions. To do so, further knowledge and evaluation of the available innovative solutions are needed. Building upon the principle presented in our study [10] and focusing on preventing, monitoring, and cleaning solutions that various developers have suggested and considering that information is spread across a broad range of platforms, we developed the MARLIIN-Portal. The portal is a digitally integrated and engaging marine litter innovation portal that provides the most up-to-date information on marine litter solutions, intending to support the elimination of marine litter pollution. It is expected to be fully operational in 2023.

Note(s): The main technologies and methods used by the marine litter innovative solutions in accordance with their function; GIS is short for geographic information systems; LIDAR is short for light detection and ranging; ROVs is short for remotely operated vehicles

Source(s): Bellou et al., 2021 [9]

Solutions to tackle accumulated marine litter

Expert
deep dive

With reference to this article please cite the following:

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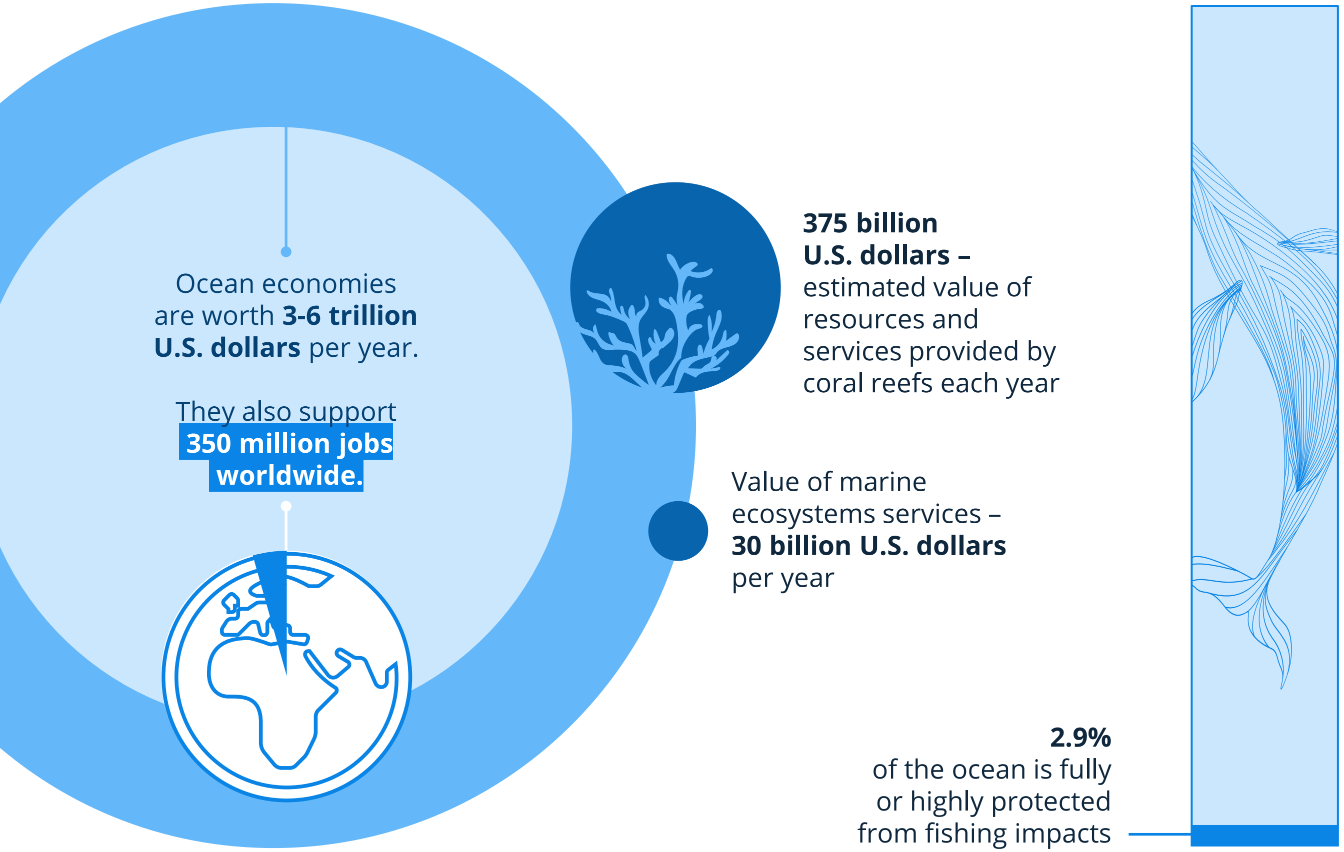
10. N. Bellou, C. Gambardella, K. Karantzalos, J. G. Monteiro, J. Canning-Clode, S. Kemna, C. A. Arrieta-Giron, C. Lemmen, Global assessment of innovative solutions to tackle marine litter, Nature Sustainability, 4 (2021) 516-524, 10.1038/s41893-021-00726-2

04

Sustainable Development Goals (SDG)

- Status quo
- SDG 14 goals
- SDG 14 investments

The actions toward conserving oceans are not purely for environmental reasons



Source(s): UN

Oceans and fisheries continue to support the global population’s economic, social, and environmental needs. Despite the critical importance of conserving oceans, decades of irresponsible exploitation have led to alarming degradation. With the proven and continued benefits of ocean conservation, nurturing the marine environment has never been more important.

- 90 percent of global trade moves by marine transport.
- 95 percent of global communication is through submarine cables.
- 15 percent of the annual animal protein consumption comes from fisheries and aquaculture.
- 30 percent of the global gas and oil is extracted offshore.
- Five percent of global GDP comes from coastal tourism.
- 13 of 20 megacities are coastal.

Source(s): IUCN; UN Conference on Trade and Development

What are Sustainable Development Goals (SDGs), and why are they needed?

In 2015, to combat the planet's massive economic, social, and environmental challenges, governments worldwide, under the auspices of the United Nations General Assembly, set up **Sustainable Development Goals (SDGs)**, a list of global goals intended to be achieved by 2030. It provides "a shared blueprint for peace and prosperity for people and the planet, now and into the future." It is based on 17 SDGs the UN describes as an urgent call for action. The SDGs evolved from the UN Millennium Development Goals of 2000 and the principles contained in the 1992 Rio Declaration on Environment and Development.

SDG 14, which aims to "Conserve and sustainably use the oceans, seas, and marine resources for sustainable development," directly addresses the need for ocean conservation and sustainable management in light of the environmental issues currently troubling the world's oceans.

Source(s): UN

SDG 14: Conserve and sustainably use the oceans, seas, and marine resources

An overview of SDG 14 subgoals

14.1
By **2025**, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.

14.2
By **2020**, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.

14.3
Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels.

14.4
By **2020**, effectively regulate harvesting and end overfishing, illegal, unreported, and unregulated fishing and destructive fishing practices, and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics.

14.5
By **2020**, conserve at least 10 percent of coastal and marine areas, consistent with national and international law and based on the best available scientific information.

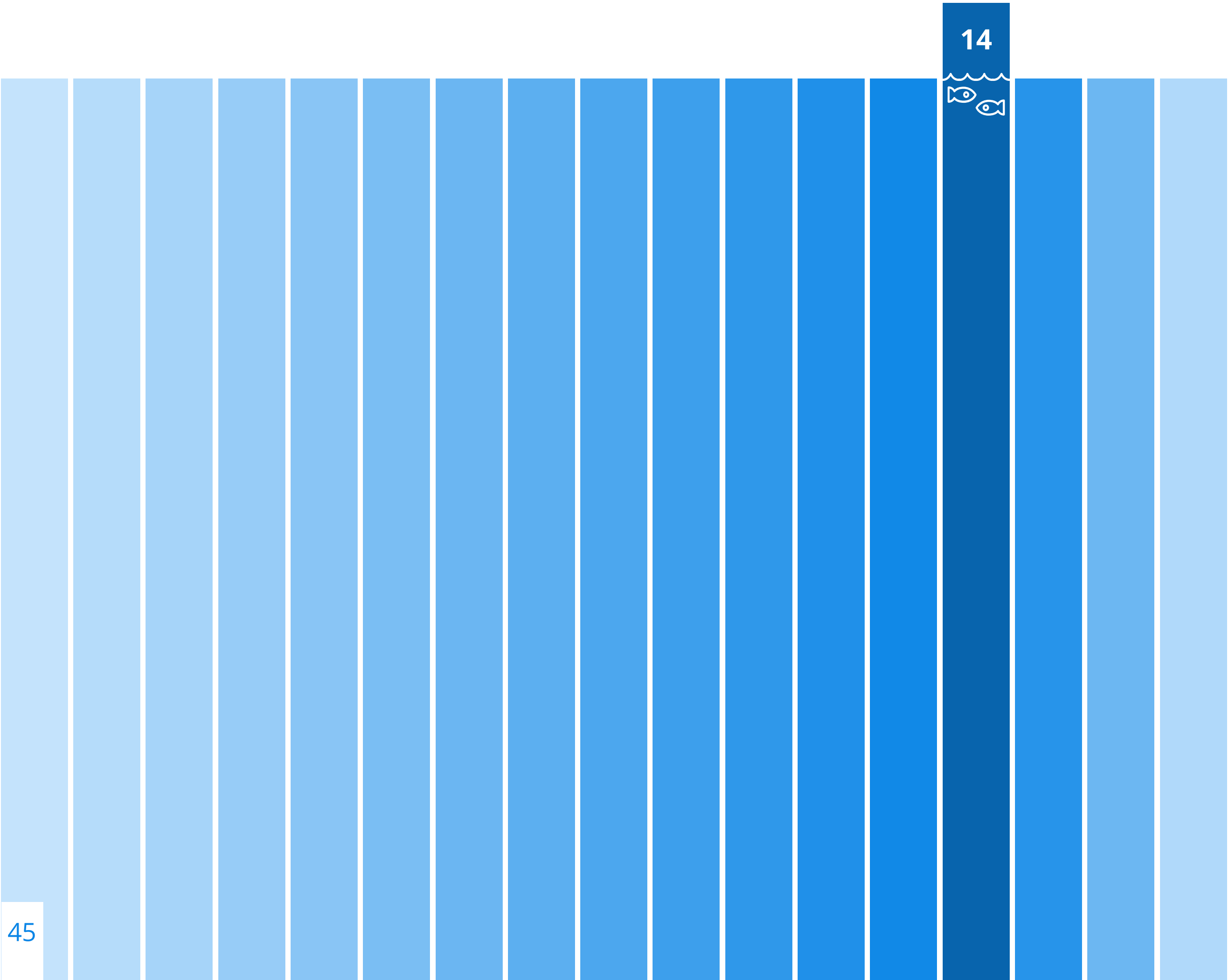
14.6
By **2020**, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported, and unregulated fishing, and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation.

14.7
By **2030**, increase the economic benefits to Small Island Developing States (SIDS) and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture, and tourism.

Source(s): UN

SDG 14: Conserve and sustainably use the oceans, seas, and marine resources

How is the world progressing on these goals and subgoals?



Several of the sub-goals of SDG 14 expired in 2020 without being considered successfully implemented globally. According to the Sustainable Development Goals Report 2022, between 2009 and 2018, the world lost about 14 percent of its coral reefs (see page 28). Coral reefs are often called the "rainforests of the sea" as they support an extraordinary range of biodiversity.

Around 85 percent of marine litter consisted of plastics. It is estimated that roughly 30 million metric tons of plastic accumulated in the ocean between 1970 and 2019, threatening marine life (see page 32).

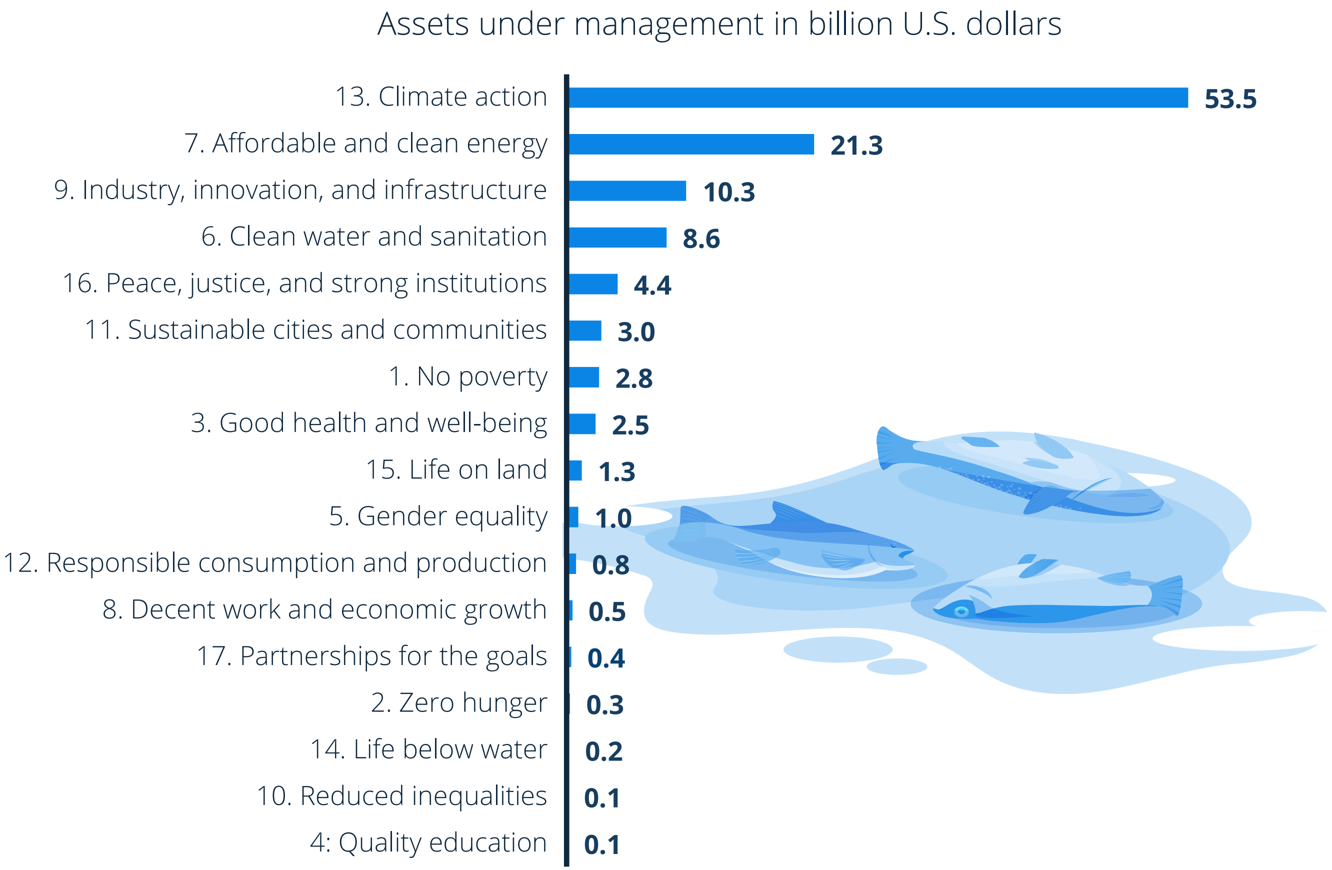
Eutrophication caused by excessive nutrient pollution resulted in the number of dead zones worldwide nearly doubling from 400 in 2008 to 700 in 2019.

Therefore, combatting the decline in ocean health requires intensified protection efforts and sustainable solutions.

Source(s): OECD; UN

Sustainable Development Goal (SDG) 14 was one of the least targeted ESG assets by sustainable investors

UN SDG of ESG ETFs worldwide as of April 2023, by assets



Environmental, social, and governance (ESG) exchange-traded funds (ETFs) give investors a way to invest in issues that are important to them. These ETFs incorporate environmental, social, and corporate governance considerations into their investment approach. Of the 17 SDGs designed by the United Nations, SDG 14 was among the least targeted by global ESG ETFs as of April 2023, with assets worth 0.2 billion U.S. dollars linked to this goal. In contrast, the SDG on climate action (SDG 13) was the most targeted goal in terms of assets.

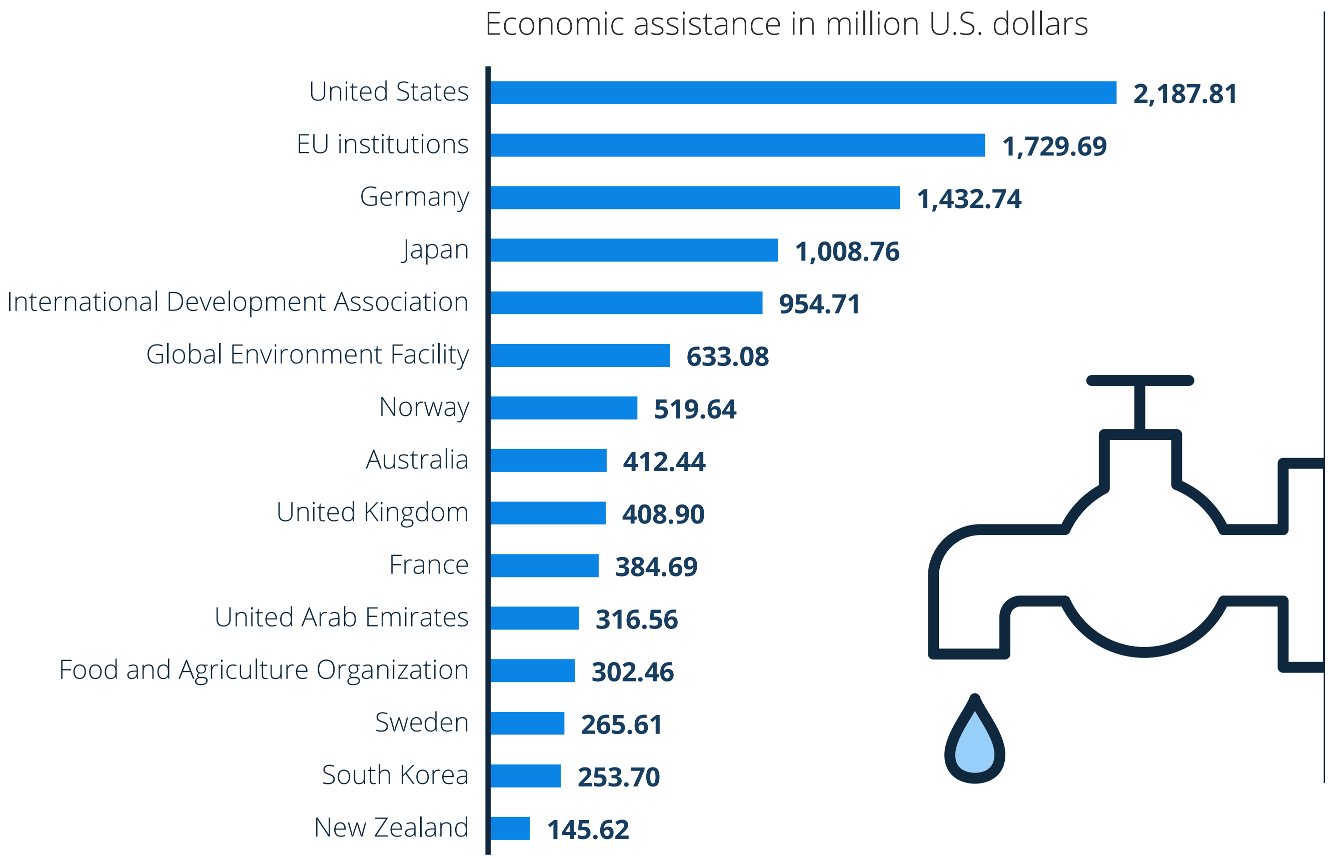
The lack of investment in oceans was addressed at the UN Ocean Conference 2022; UN Secretary-General António Guterres called on all stakeholders to invest in sustainable ocean economies for food, renewable energy, and livelihoods. The next UN Ocean Conference is scheduled to take place in Barcelona in April 2024.

Note(s): Worldwide; 2023
Source(s): Trackinsight; ID 1297621

Source(s): UN

Global effort to invest in SDG 14 is insufficient to reach its goal

Largest SDG 14 official development assistance providers globally from 2012 to 2019



Between 2012 and 2019, the leading official development assistance (ODA) provider for SDG 14 was the United States, with a total disbursement amounting to nearly 2.2 billion U.S. dollars. ODA is government aid that promotes and specifically targets developing countries' economic development and welfare. Of all the Sustainable Development Goals, SDG 14 – Life below water – is by far the least funded, receiving 1.6 billion U.S. dollars in 2019. It is estimated that 175 billion U.S. dollars are needed per year to achieve SDG 14 by 2030.

In this scenario, the United Nations Decade of Ocean Science for Sustainable Development, running from 2021 to 2030, is the current hope to bring about action and funding for ocean science. It is an effort to reverse the decline in ocean health and to gather global ocean stakeholders together using a common framework to ensure that ocean science can support countries in improving the conditions for sustainable ocean development.

Note(s): Worldwide; 2012 to 2019
Source(s): OECD; ID 1334608

Source(s): OECD; UN; UNESCO

05

Conservation and protection of marine environments

- Marine Protected Areas
- Nature-based solutions
- Legislative measures – NDC

Marine protected areas (MPAs) are vital for global ocean protection

Aichi Target 11

By 2020, at least 17 percent of terrestrial and inland water and 10 percent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative, and well-connected systems of protected areas and other effective area-based conservation measures and integrated into the wider landscapes and seascapes.

SDG 14.5

By 2020, conserve at least 10 percent of coastal and marine areas, consistent with national and international law and based on the best available scientific information.

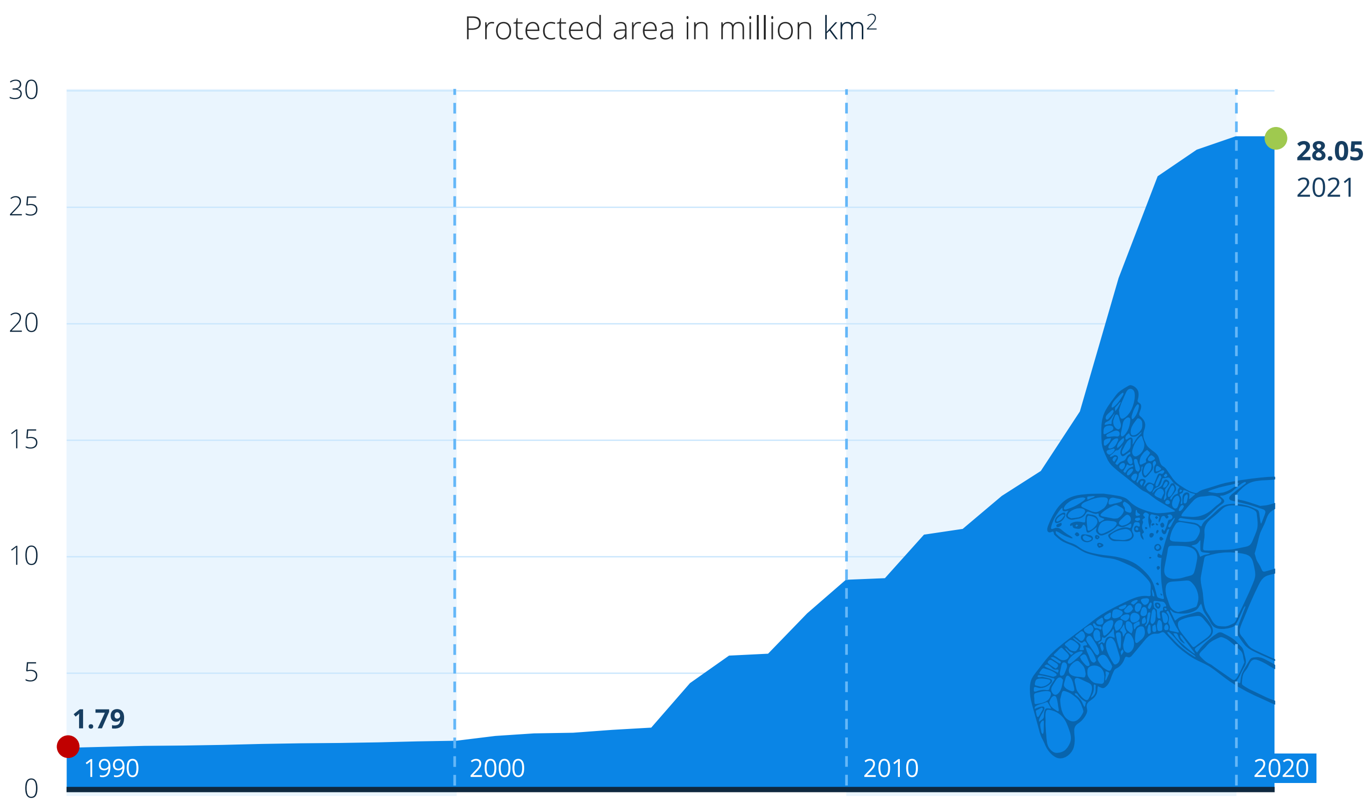
Marine protected areas (MPAs) are an effective tool for restoring ocean biodiversity and ecosystem services. As a policy instrument, MPAs can potentially prevent overfishing, habitat exploitation, and destruction. In addition, coastal protection aids in buffering against storms and erosion and encourages tourism and recreation.

Under the Convention on Biological Diversity (Aichi Target 11) and the Sustainable Development Goals (specifically SDG 14.5), signatories agreed to conserve 10 percent of marine and coastal areas by 2020. In a landmark biodiversity agreement during COP15 in Montreal in December 2022, representatives of over 180 governments agreed to put 30 percent of coastal and ocean areas under protection by 2030. Despite that, the global coverage of MPAs stood at only 8.2 percent in 2023. Nevertheless, numerous countries have met the 10 percent target for regions within their Exclusive Economic Zone (EEZ) (see page 51). This achievement is considered the first milestone for global ocean protection.

Source(s): Convention on Biological Diversity; Marine Protection Atlas; UN

The rise of marine protected areas

Protected marine area worldwide from 1990 to 2021



In the past 20 years, the number of protected marine areas has increased considerably. As of 2021, over 28 million km² of marine areas were considered protected, a more than tenfold increase compared to the beginning of the millennium. This recent growth is a result of international conservation targets and intense advocacy, which have led to the establishment of large-scale marine protected areas (LSMPAs).

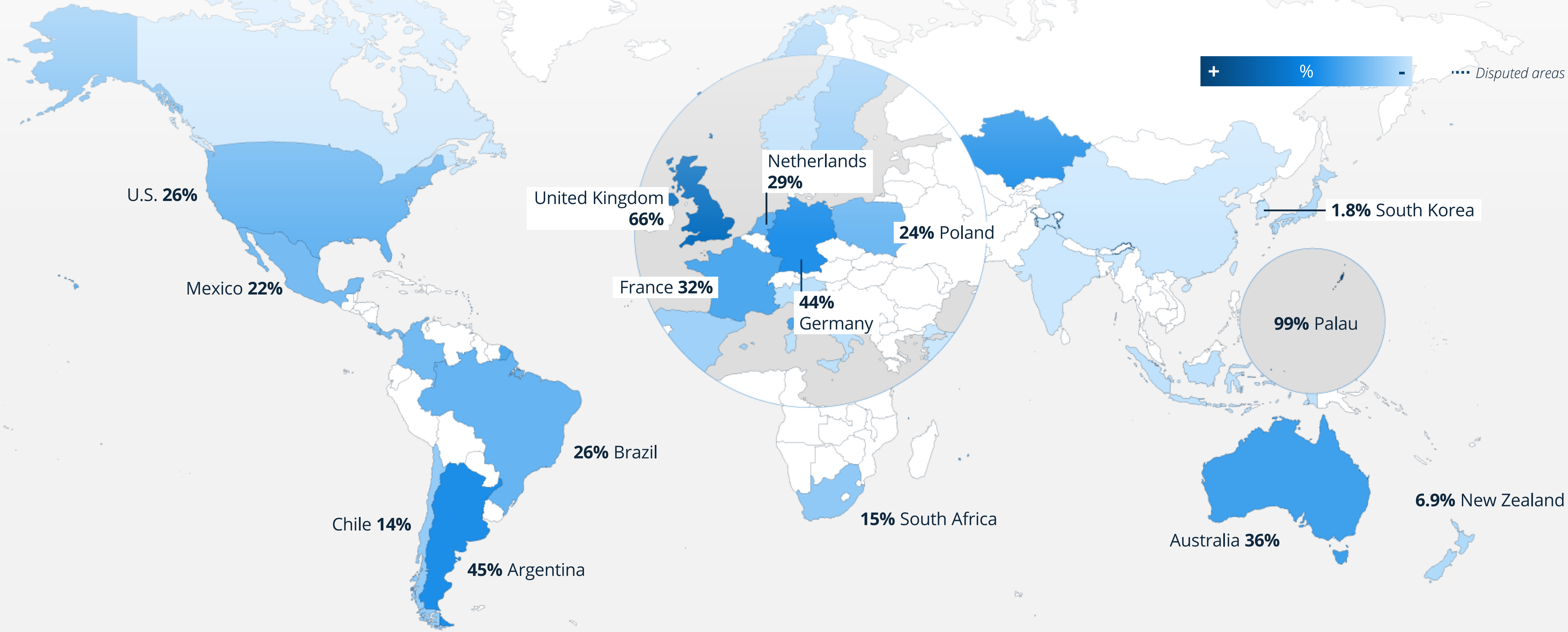
Despite the progress made in protected areas coverage, further efforts are needed to meet existing targets, such as COP15's 30x30 agreement. In March 2023, the Treaty of the High Seas was secured under the UN Convention on the Law of the Sea, offering protection to marine areas beyond national control. The new treaty will enable the establishment of more LSMPAs and will also call for assessing the impact of economic activities on high-seas biodiversity.

Note(s): Worldwide; 1990 to 2021
Source(s): United Nations; ID 1356440

Source(s): OECD; United Nations

Shares of exclusive economic zones (EEZ) that are marine protected areas vary widely between countries

Proportion of marine protected areas in EEZ as of April 2023, by select country

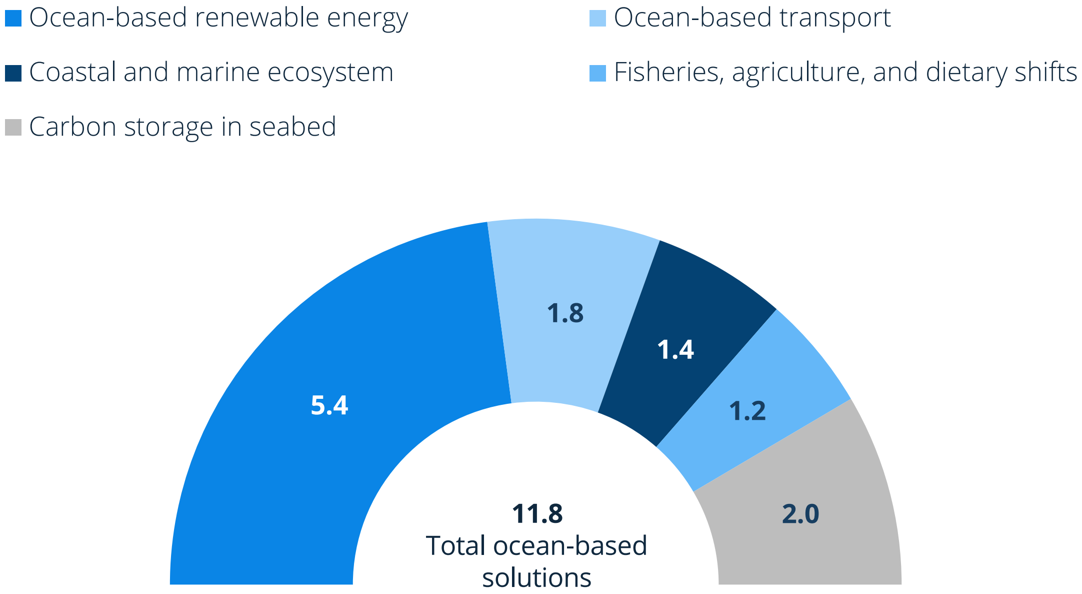


Note(s): Worldwide; 2023; map made with flourish.studio.
Source(s): OECD; ID 1334647

Ocean-based solutions are vital to climate change mitigation

Significant reductions in global emissions are needed every year to stay below a 1.5 degrees Celsius increase

Maximum annual emission reduction by 2050
in gigatonnes of carbon dioxide equivalent ($GtCO_2e$)



According to the IPCC's latest assessment report, it can be stated with high confidence that climate change has already caused increasingly irreversible losses in terrestrial, freshwater, cryospheric, coastal, and open ocean ecosystems, and with every additional increment of global warming, changes in extremes continue to become larger.

Ocean-based climate actions are vital in reducing the world's carbon footprint. In total, ocean-based climate action can achieve a fifth of the annual greenhouse gas (GHG) emission cuts by 2050 to limit global temperature rise to 1.5 degrees Celsius.

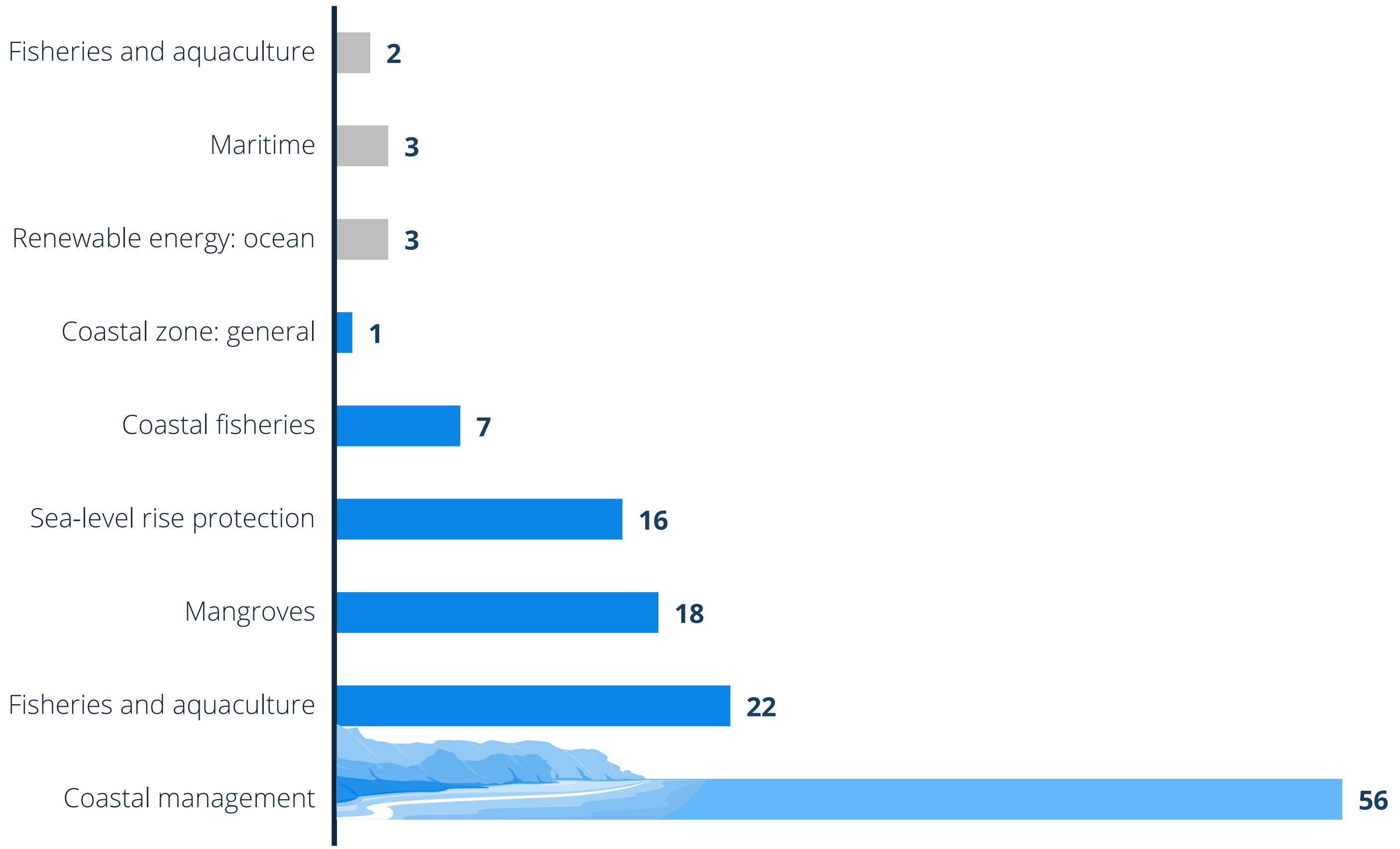
Clean energy technologies hold the greatest emission reduction potential of all ocean-based climate solutions. For example, ocean-based renewable energy could save up to 5.4 gigatonnes of CO_2e annually by 2050, equivalent to taking over a billion cars off the road each year. Decarbonizing marine shipping and transport could cut up to 1.8 gigatonnes of CO_2e.

Note(s): Worldwide; 2022
Source(s): Hoegh-Guldberg et. al; WRI; ID 1338655

Source(s): IPCC; World Economic Forum

Coastal management was the leading ocean-related measure adopted by governments

Number of countries with ocean-related measures in NDCs globally as of 2022, by type



Nationally Determined Contributions (NDCs) are at the core of the Paris Agreement. They are commitments by countries to reduce emissions and adapt to the impacts of climate change. As of 2022, 56 countries had agreed upon NDCs focused on coastal management. Just one country had NDCs on general coastal zone management measures.

There is a dire need for more countries to focus their efforts on protecting the ocean. Even though such NDCs are not legally binding, they form a critical tool for accelerating ocean-based climate action. Commitment towards such targets helps not only to collectively develop solutions but also prepares nations to adjust more quickly to the changes that occur.

Note(s): Worldwide; 2022; gray figures refer to mitigation measures and blue figures refer to adaptation measures
Source(s): WRI; ID 1334832

Key takeaways

Conclusion

The ocean not only works as a food source or transport medium. It also regulates the climate, generates most of the oxygen on Earth, and is home to a plethora of species. Nevertheless, human activity is disturbing the delicate balance of marine ecosystems, threatening not only their existence but life on Earth itself.

IMPACTS OF CLIMATE CHANGE

Oceans strongly affect climate and weather patterns, transferring heat and moderating carbon dioxide levels in the atmosphere, acting as a carbon sink. However, an increase in global temperatures has brought about cascading effects that threaten the physical and chemical composition of sea waters, subsequently threatening both humans and marine flora and fauna.

POLLUTION AND HABITAT DEGRADATION

According to the WEF, the world's oceans will contain more plastic than fish by weight by the year 2050, ultimately threatening many more life forms in the ocean, not only on the surface but also on the ocean floors.

SDGs

SDG 14 (Life below water) is unlikely to be met by 2030 if drastic changes are not made now. To achieve this goal, a sustainable ocean economy backed by sufficient financing mechanisms that generate, invest, align, and account for financial capital is the need of the hour. Achieving this will require immediate action and efforts in both implementation and monitoring throughout the UN Decade of Ocean Science.

CONSERVATION AND PROTECTION OF MARINE ENVIRONMENTS

To conserve existing marine environments and help them revitalize, measures such as sustainable fisheries, pollution reduction, protection of coastal zones, and efforts to regenerate degraded ecosystems are needed if a healthy ocean is ever going to be achieved.

Source(s): WEF

Glossary

Anthropogenic
Resulting from or produced by human activities.

Biodiversity
Variability among living organisms.

Carbon sequestration
The process of capturing and storing carbon.

CO_2
Carbon dioxide is one of the most important greenhouse gases.

Dead zone
A common term for hypoxia, which refers to reduced oxygen levels in water. Dead zones either kill the marine life living there or the marine species leave the area if they are mobile.

Ecosystem services
Many of the basic services required to make life on Earth possible such as plants cleaning the air and filtering water, bacteria decomposing waste, tree roots holding soil in place and preventing erosion, and bees pollinating flowers, are provided by ecosystems. Ecosystem services can be broken down into four main types (see also pages 6 and 7): provisioning services, regulating services (which have been described above), cultural services, and supporting services.

Eutrophication
A process in which bodies of water become enriched with nutrients such as nitrogen and phosphorus, which in turn allows for increased plant and algal blooms that can cause low-oxygen waters and can kill fish and seagrass.

Exclusive economic zone (EEZ)
Under the 1982 United Nations Convention on the Law of the Sea, an EEZ is an area of the sea where a sovereign state has special exploration and marine resource usage rights. These rights include energy production from wind and water.

Fossil fuels
Carbon-based fuels from fossil hydrocarbon deposits, including coal, crude oil, and natural gas.

Greenhouse gas (GHG)
Gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths. Gases include carbon dioxide, methane, nitrous oxide, water vapor, ozone, and certain fluorinated compounds.

Global warming
The long-term increase in the global average temperature.

Glossary

Ice sheet
A mass of glacial ice that is more than 50,000 square kilometers (19,000 square miles) in size. Ice sheets contain about 99 percent of the freshwater on Earth and are sometimes called continental glaciers.

Marine protected areas (MPAs)
Marine protected areas are areas where human activities are restricted or managed to protect important natural resources.

Mean sea level (MSL)
The average height of the entire ocean surface.

Nationally Determined Contributions (NDCs)
The outline of emission reduction and climate change adaptation/mitigation efforts that each signatory party of the Paris Agreement commits to achieving. The NDCs should be republished every five years.

Ocean deoxygenation
A decline in the level of oxygen in oceanic and coastal waters largely as a result of warming ocean temperatures and excessive algae growth.

Shared Socioeconomic Pathways (SSPs)
Scenarios of projected socioeconomic worldwide changes up to 2100. They are used to generate greenhouse gas emissions scenarios with different climate policies. There are five possible scenarios; the lower the ranges indicated in the scenario name, the lower the emissions, according to the IPCC.

Small Island Developing States (SIDS)
A group of developing countries that are situated on small islands. SIDS includes 38 United Nations (UN) member states and 20 non-UN member states, which share similar challenges to sustainable development.

Sustainable Development Goals (SDGs)
A collection of 17 goals to achieve a better and more sustainable future for all.

Trophic level
The group of organisms within an ecosystem that occupies the same level in a food chain.

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European Commission

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Food and Agriculture Organization (FAO)

Global Coral Reef Monitoring Network (GCRMN)

International Monetary fund (IMF)

Intergovernmental Panel on Climate Change (IPCC)

International Renewable Energy Agency (IRENA)

International Science Council

International Tanker Owners Pollution Federation Limited (ITOPF)

International Union for Conservation of Nature (IUCN)

Marine Protection Atlas

Millennium Ecosystem Assessment

National Oceanic Atmospheric Administration (NOAA)

National Aeronautics and Space Administration (NASA)

National Snow and Ice Data Center

Ocean Climate

Ocean and climate platform

Ocean Conservancy

Ocean Panel Organization

Organization for Economic Co-operation and Development (OECD)

Our World in Data (OWID)

Statista

The Guardian

Trackinsight

United Nations (UN)

United Nations Conference on Trade and Development (UNCTAD)

United Nations Educational, Scientific and Cultural Organization (UNESCO)

United Nations Environment Programme (UNEP)

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U.S. Geological Survey (USGS)

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Maps

Polygons, boundaries, and disputed areas: World Bank and Natural Earth Data

Map projection: Miller cylindrical

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German Ocean Foundation

Deutsche Meeresstiftung

The oceans are the common heritage of mankind. They cover two-thirds of the earth's surface and supply us with oxygen. Every second breath we take comes from the sea. But the oceans are under threat: from overfishing, waste, noise, and excessive warming, among other things. That is why we must take responsibility for them together – for the future of our climate and our food.

The German Ocean Foundation is committed to working with partners from business, science, and society to preserve this habitat for the benefit of future generations. On the media and research ship ALDEBARAN, we undertake research expeditions on topics such as coral dieback or plastics in the waters. With our ocean competition, we have been motivating young scientists to do their best for our oceans for 17 years. We produce educational materials for all age groups on marine topics of all kinds. We develop measuring instruments and methods to detect plastic waste and banish it from our oceans. We are collaborating with a large number of partners in the context of the UN Decade of Ocean Exploration for Sustainable Development, for example through a permanent exhibition on the museum ship Cap San Diego in Hamburg or the Ocean Festival in Berlin.

We are closely associated with the Foundation of Prince Albert II of Monaco and were jointly awarded the European Culture Award in 2018. We are supported by our ocean ambassadors: professional yachtsman Boris Herrmann, surfing world champion Sonni Hönscheid, extreme swimmer André Wiersig, and professional mermaid and apnea diver Mermaid Kat.

Contact

Deutsche Meeresstiftung
c/o Katrin Heratsch
katrin.heratsch@meeresstiftung.de
Tel: +49 (0)40-325 721 14 I Fax: +49 (0)40-325 721 21 I
www.meeresstiftung.de

Recommendations

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Environmental commitments of Europe's largest banks

Environmental effects of COVID-19

Environmental impacts of the food industry

Extreme weather in the U.S.

Nature-based solutions

Environmental pollution worldwide

Global climate change

Global geography

Global biodiversity loss

Global plastic waste

Global warming

Melting glaciers and sea ice

Ocean shipping worldwide

Seafood industry

Water access worldwide

Water industry worldwide

Water transportation industry worldwide

Statista Research Department

Dr. Madhumitha Jaganmohan | Erick Burgueño Salas

E-MAIL madhumitha.jaganmohan@statista.com
erick.burgueno@statista.com

Deutsche Meeresstiftung

Kai Pohlmann | Frank Schweikert

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