Committee: Environmental Commission 1 EC1

Topic: Measures to protect marine ecosystems from water acidification

Student Officer: Can Altınova

Position: Deputy President

Personal Introduction

Dear delegates!

My name is Can (pronounced John). I am sixteen years old, and CSMUN 2025 will be my first time chairing. I study at St Catherine's British School, and by the time of the conference, I'll be an IB1 student. I am originally from Turkey, and I have a great interest in music production and law!

I started participating in MUN back in 2023 in order to gain valuable insight into global issues and the critical thinking skills needed to solve these issues. I believe that MUN provides these benefits for the students who truly put effort into making the most out of each conference. I am glad to be serving as the Deputy President in such a committee as the Environmental Commission (EC), which deals with fundamental and essential questions about the geopolitical state of the world. I believe that our debates on these topics will make everyone more aware of the significance of our planet when it comes to international relations. I am ecstatic to meet you all in person, and I wish you the best of luck while creating your clauses for the resolution.

Feel free to contact me through the email below should you have any questions regarding the preparation of the conference!

Best regards,

Can Altinova

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Topic Introduction

Ocean acidification is a growing issue that threatens our seas and the ecosystems within them. The term refers to the gradual decrease in the pH levels of seawater caused by the ocean absorbing excess carbon dioxide (CO_2) from the atmosphere, produced by human activities. This has been a concern amongst many marine biologists since the industrial revolution in the 1800s, as global CO_2 emissions have increased significantly due to industrial activity, fossil fuel use, and deforestation, leading to a 26% rise in ocean acidity[1]. However, the most significant rise in the rate of ocean acidification has occurred in the past 70 years, largely due to combustion engines becoming more widespread around the globe.[2]

This constant decrease in water pH jeopardises the stability of marine ecosystems, as food chains are disrupted as phytoplankton, a vital part of the chain, is directly harmed by low pH. The collapse of the coral reefs, which is a direct consequence of acidification, also greatly affects sea life, as they harbour 25% of all marine species.[3] All of this creates a plummet in the amount of healthy marine organisms, including commercial seafood, which in turn leads to widespread impact on the human population.

Over one billion people worldwide rely on fish as their main source of protein[4], and countless coastal communities depend on healthy oceans for their livelihoods. Acidification, if left unaddressed, will worsen food insecurity, damage local economies, and increase vulnerability to climate-related disasters. Additionally, fisheries and the aquaculture sector employ millions of workers globally, and thus the loss of biodiversity and plummeting fish stocks lead to reduced income for these sectors, resulting in unemployment and economic stress amongst local communities. When it comes to climate, coral reefs act as a natural barrier and reduce up to 97% of wave energy, protecting many

[1] National Oceanic and Atmospheric Administration. *What Is Ocean Acidification?* NOAA, 2020, https://www.noaa.gov/education/resource-collections/ocean-coasts/ocean-acidification. Accessed 25 July 2025.
[2] Penn State Earth 103: Earth in the Future. "Ocean Acidification." *E-Education Institute*, Pennsylvania State University, https://www.e-education.psu.edu/earth103/node/647. Accessed 8 Aug. 2025.
[3] National Oceanic and Atmospheric Administration (NOAA). *Coral Reefs*. NOAA Ocean Service, 1 Mar. 2024, oceanservice.noaa.gov/habitats/corals/. Accessed 18 Aug. 2025.
[4] Food and Agriculture Organization of the United Nations. *The State of World Fisheries and Aquaculture 2020: Sustainability in Action*. FAO, 2020, https://www.fao.org/documents/card/en/c/ca9229en.

Small Island Developing States (SIDS) from erosion and storm surges[5]. The dissolving of the reefs results in floods and cyclones, which prove fatal for already struggling communities.

Despite its urgency, ocean acidification remains difficult to address. Its main causes—such as carbon emissions from transport, manufacturing, and agriculture—are deeply rooted in global economic systems. If left unsolved, it will threaten food security, coastal protection and the livelihood of millions worldwide.

Definition of key concepts

Ocean Acidification

"A reduction in the pH of the ocean over an extended period, typically decades or longer, caused primarily by uptake of carbon dioxide (CO_2) from the atmosphere."[6]

Carbon Emissions

"Carbon dioxide and carbon monoxide released into the atmosphere, produced by vehicles, electricity generation, deforestation, heating and various other industrial processes."[7]

Sustainable Development Goal 14 (SDG 14)

"Sustainable Development Goal 14 is the UN's commitment to 'conserve and sustainably use the oceans, seas and marine resources for sustainable development.'[8] It emphasises reducing marine pollution, addressing ocean acidification, regulating fisheries, and supporting small island and coastal states."

Marine Protected Area (MPA)

[5] Ferrario, Filippo, et al. "The Effectiveness of Coral Reefs for Coastal Hazard Risk Reduction and Adaptation." *Nature Communications*, vol. 5, 2014, article no. 3794, doi:10.1038/ncomms4794.
[6] Oxford University Press. *Ocean Acidification*. *Oxford Reference: A Dictionary of Environment and Conservation*, edited by Michael Allaby and Chris Park, 3rd ed., Oxford University Press, 2020, https://www.oxfordreference.com/. Accessed 25 July 2025.
[7] Oxford University Press. *Ocean Acidification*. *Oxford Reference: A Dictionary of Environment and Conservation*, edited by Michael Allaby and Chris Park, 3rd ed., Oxford University Press, 2020, https://www.oxfordreference.com/. Accessed 25 July 2025.
[8] United Nations. *Sustainable Development Goal 14: Conserve and Sustainably Use the Oceans, Seas and Marine Resources for Sustainable Development*. United Nations, https://sdgs.un.org/goals/goal14. Accessed 25 July 2025.

"A clearly defined ocean space, designated for the protection of natural or cultural resources."[9]

Blue Economy

"An economic model that seeks to use ocean resources sustainably for economic growth, improved livelihoods, and ocean ecosystem health."[10]

Resilience

"Resilience is the capacity of communities to prevent a short-term hazard event from turning into a long-term community-wide disaster."[11]

Coastal Resilience

"Building the ability of a community to 'bounce back' after hazardous events such as hurricanes, coastal storms, and flooding."

Ecosystem Services

"Ecosystem services are the benefits people obtain from ecosystems, including food and water, climate and flood regulation, cultural value, and processes like nutrient cycling."[12]

Ecosystem-Based Adaptation (EbA)

"Ecosystem-based adaptation promotes the conservation and sustainable use of land, water, and living resources in a fair and balanced way."[13]

Marine Ecosystem Integrity

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[9] National Oceanic and Atmospheric Administration. *What Is a Marine Protected Area?* NOAA National Ocean Service, https://oceanservice.noaa.gov/facts/mpa.html. Accessed 25 July 2025.

[10] World Bank. *The Blue Economy*. The World Bank, 6 March 2017, https://www.worldbank.org/en/news/infographic/2017/06/06/blue-economy. Accessed 25 July 2025.

[11] National Oceanic and Atmospheric Administration. *What Is Coastal Resilience?* NOAA National Ocean Service, https://oceanservice.noaa.gov/facts/coastalresilience.html. Accessed 25 July 2025.

[12] United Nations Economic Commission for Europe. *Learning from Each Other: Achievements, Challenges and Ways Forward – Second Environmental Performance Review of Montenegro*. UNECE, 2013, https://unece.org/DAM/env/documents/2013/ece/cep/ece.cep.2013.8.e.pdf. Accessed 25 July 2025.

[13] United Nations Environment Programme. *Ecosystem-Based Adaptation (EbA)*. UNEP, https://www.unep.org/explore-topics/climate-action/what-we-do/climate-adaptation/ecosystem-based-adaptation-eba. Accessed 25 July 2025.

"Marine integrity is the unimpaired health and functionality of ocean environments, where ecosystems remain balanced, resilient, and capable of sustaining biodiversity and essential processes."[14]

Background Information

Cause of Ocean Acidification

The issue of ocean acidification has its roots in the Industrial Revolution, which began in the mid-18th century[15], and led to a sharp increase in burning fossil fuels such as coal, oil, and gas, largely for production purposes, since global demand for industrial goods was surging. Acidification occurs when these processes release carbon dioxide into the atmosphere, which is absorbed by the sea, resulting in the lowering of seawater pH.

Impact of ocean acidification

Ocean acidification has disrupted marine ecosystems on a global scale. Coral reefs, which provide shelter for 25%[16] of marine species, are weakened. Their skeletal structure gradually corrodes as ocean acidity rises, leading to habitat loss, reduced biodiversity, and lower resilience against storms and bleaching. As coral reefs degrade, they no longer provide shelter and breeding grounds for countless marine species, disrupting food webs and fisheries. The decline in biodiversity weakens ecosystem stability, making oceans less able to recover from disturbances. Additionally, with fewer healthy reefs to act as natural barriers, coastlines become increasingly vulnerable to erosion, flooding, and storm damage. Shell-forming species, such as oysters, clams, mussels and certain plankton, struggle to produce calcium carbonate because ocean acidification lowers the availability of carbonate ions, the key building blocks for their shells and skeletons, which is an essential compound for growth, shell strength and life expectancy. With less calcium carbonate being produced, these species experience sluggish growth, with weaker and thinner shells and a higher mortality rate. In the U.S. Pacific Northwest, oyster hatcheries have reported over 80% larval losses

[14] International Union for Conservation of Nature (IUCN). *Marine Integrity*. IUCN, www.iucn.org/our-work/marine-integrity. Accessed 18 Aug. 2025.
[15] Stearns, Peter N. *The Industrial Revolution in World History*. 5th ed., Routledge, 2018.
[16] National Oceanic and Atmospheric Administration. *What Is Coral Reef Ecology?* NOAA Coral Reef Conservation Program, 21 Apr. 2023, https://oceanservice.noaa.gov/education/tutorial_corals/coral07_ecology.html.

during severe acidification events.[17] Furthermore, plankton populations, which are vital as the base of marine food webs, are severely affected. Phytoplanktons, which are primary producers, are harmed, affecting herbivores such as zooplankton. This decrease in the abundance of healthy primary and secondary producers results in complications with predator-prey relations, as the predators cannot consume enough to satisfy their nutritional requirements. If ocean pH drops by the projected 0.3–0.4 units by 2100[18], irreversible biodiversity loss and collapse of critical ecosystems such as coral reefs and polar habitats would be likely.

The consequences of ocean acidification on the human population are almost equally severe. Fisheries and aquaculture, which employ over 40 million people globally[19], face a rapid decline in productivity as fish stocks and shellfish abundance diminish. The economic value of marine ecosystem services at risk is estimated to reach up to $1 trillion within 70 years.[20] In addition to global economic distress, coastal communities, specifically those in developing nations, are most vulnerable due to their direct reliance on fishing for income and subsistence. Food security is also under threat, as over 1 billion people[21] rely on seafood as their main source of protein. A reduced availability of seafood can lead to mass malnutrition amongst communities. Combined with biodiversity loss, the economic and nutritional effects of ocean acidification may lead to long-term socioeconomic instability, especially in areas that are already experiencing poverty and stress from climate change.

Challenges of addressing ocean acidification

As aforementioned, ocean acidification is largely caused by industrial human activities, which release excess carbon dioxide to the atmosphere. These processes, such as burning fossil fuels, deforestation, and cement production, are seen as essential and profitable for many countries worldwide. As harmful as the processes are, nations view them as a keystone of their economy,

[17] Barton, Andrew, et al. “Impacts of Coastal Acidification on the Pacific Northwest Shellfish Industry.” *Estuaries and Coasts*, vol. 38, no. Suppl 1, 2015, pp. S171–S186. Springer, https://doi.org/10.1007/s12237-013-9594-0.
[18] Intergovernmental Panel on Climate Change. *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*. Edited by H.-O. Pörtner et al., Cambridge University Press, 2019, https://www.ipcc.ch/srocc/.
[19] Food and Agriculture Organization of the United Nations. *The State of World Fisheries and Aquaculture 2022: Towards Blue Transformation*. FAO, 2022, https://doi.org/10.4060/cc0461en.
[20] Bradbury, Danny. “Ocean Acidification Will Cost Global Economy $1 Trillion by 2100.” *Trellis*, 9 Oct. 2014 (updated 24 July 2024), citing a report by the United Nations Convention on Biological Diversity.
[21] Food and Agriculture Organization of the United Nations. *The State of World Fisheries and Aquaculture 2020: Sustainability in Action*. FAO, 2020, https://www.fao.org/documents/card/en/c/ca9229en

especially for those which rely on the manufacturing industry for employment and economic growth. For example, combustion-based car manufacturing has been a leading sector in many countries since the 1950s[22]; infrastructure building in cities, which heavily relies on concrete production, accounts for a substantial amount of global emissions. Giving up these processes can be challenging for countries which rely on them, as transitioning to cleaner alternatives often requires significant financial investment, technological innovation, and political commitment. Many developing nations, in particular, face the dilemma of balancing economic growth with environmental protection, and may lack the resources to invest in renewable energy infrastructure or low-carbon technologies. Even in wealthier countries, entrenched industries such as oil, gas, cement, and automotive manufacturing wield substantial political influence, often lobbying against strict emission regulations.

Many organisations and treaties attempt to target ocean acidification. An example is the Paris Agreement of 2015, which set global goals to reduce greenhouse gas (GHG) emissions, in turn slowing ocean acidification. However, most nations remain off track to meet their commitments. The UN has also attempted to resolve the issue and persuade countries to cut carbon emissions, an example being the Sustainable Development Goal 14.3. However, progress has been hindered due to limited funding and a lack of binding enforcement mechanisms.

Case study: Pacific Northwest Oyster Industry, United States

In the late 2000s, oyster hatcheries along the coast of Oregon and Washington experienced a catastrophic amount of larva deaths, with some facilities reporting over 80% mortality rate.[23] Scientists traced the cause to the event and found that cold, carbon dioxide ridden waters from the deep ocean were brought to the surface. The water's pH was already lower than normal, and the water condition was further exacerbated due to the rapid acidification in the last decades, bringing it to its now fatal state. The high acidity of the water reduced carbonate ion availability, preventing oyster larvae from forming shells during their most vulnerable stage of development. The result was

[22] International Energy Agency (IEA). *CO_2 Emissions from Fuel Combustion: Overview*. IEA, 2022, www.iea.org/reports/co2-emissions-from-fuel-combustion-overview. Accessed 18 Aug. 2025.
[23] NRDC (Natural Resources Defense Council). "The Great Oyster Crash." *NRDC*, 21 Mar. 2016, www.nrdc.org/stories/great-oyster-crash. Accessed 19 Aug. 2025.

the collapse of several spawning seasons, threatening an industry worth approximately $270 million annually.[24]

To deal with the issue, the hatcheries cleverly adapted by installing seawater monitoring systems, which buffered the intake water with sodium carbonate. They also started timing larval introduction to periods of lower acidity. While these measures were adequate at the local scale for aquaculture, global avoidance of excess carbon emissions is still required to prevent ocean acidification and biodiversity loss on a wider scale, especially for the wild marine life.

Date	Description of the event
1750[25]	Massive increase in the burning of fossil fuels begins, leading to rising atmospheric CO_2 — the root cause of ocean acidification.
14 March 1957[26]	Scientist Charles David Keeling begins tracking CO_2 levels at Mauna Loa Observatory in Hawaii, showing a steady annual rise.
15 September 2003[27]	The term "ocean acidification" is formally introduced in scientific literature, bringing global attention to the chemical threat facing marine environments.
1 December 2005[28]	UNESCO and NOAA jointly recognise ocean acidification as a critical global environmental issue requiring international monitoring and action.

[24] "Pacific Northwest Oyster Farms Adapt to Rising Ocean Acidity." *Axios*, 9 July 2025, https://www.axios.com/local/portland/2025/07/09/oyster-farms-ocean-acidity-pacific-northwest.
[25] Stearns, Peter N. *The Industrial Revolution in World History*. 5th ed., Routledge, 2018.
[26] Keeling, Charles D., et al. "Atmospheric Carbon Dioxide Variations at Mauna Loa Observatory, Hawaii." *Tellus*, vol. 28, no. 6, 1976, pp. 538–551, https://doi.org/10.1111/j.2153-3490.1976.tb00701.x.
[27] Caldeira, Ken, and Michael E. Wickett. "Anthropogenic Carbon and Ocean pH." *Nature*, vol. 425, 2003, p. 365, https://doi.org/10.1038/425365a.
[28] Intergovernmental Oceanographic Commission of UNESCO. *Symposium on the Ocean in a High-CO_2 World*. UNESCO, 2005, https://ioc.unesco.org/.

30 April 2009[29]	SDG 14.3 was first drafted in the UN Sustainable Ocean Summit. Ocean acidification is included in international development discussions under the theme of marine sustainability.
25 September 2015[30]	Goal 14, "Life Below Water," is adopted with Target 14.3 specifically calling for action to minimise and address ocean acidification.
25 September 2019[31]	The Intergovernmental Panel on Climate Change (IPCC) confirms acidification is accelerating and harming marine ecosystems worldwide, urging immediate global response.

Major countries, organisations and alliances

United States

The United States plays a dual role in the ocean acidification issue. As one of the world's largest historical emitters of carbon dioxide, it has significantly contributed to acidification through decades of industrial activity, fossil fuel use, and agricultural emissions. However, the U.S. has also made significant efforts to develop innovative solutions to leave its footprint. The National Oceanic and Atmospheric Administration (NOAA) operates extensive acidification tracking programmes and co-founded the Global Ocean Acidification Observing Network (GOA-ON)[32]. The U.S. also funds research into the impact of acidification on fisheries and coastal communities, particularly in Alaska

[29] United Nations. *Report of the World Ocean Conference*. United Nations, 2009, https://sdgs.un.org/goals/goal14.
[30] United Nations. *Transforming Our World: The 2030 Agenda for Sustainable Development*. United Nations, 2015, https://sdgs.un.org/2030agenda.
[31] Intergovernmental Panel on Climate Change. *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*. Edited by Hans-Otto Pörtner et al., Cambridge University Press, 2019, https://www.ipcc.ch/srocc/.
[32] NOAA. "What Is Ocean Acidification?" *NOAA Ocean Service*, oceanservice.noaa.gov/facts/acidification.html. Accessed 20 Aug. 2025.

and the Pacific Northwest, where hatcheries have already suffered major losses. Despite creating setbacks in environmental policy under past administrations, the U.S. remains an essential player in the scientific and diplomatic response to this crisis.

China

China is currently the largest emitter of carbon dioxide globally, accounting for a significant share of the emissions driving ocean acidification. Rapid industrialisation, heavy reliance on coal, and high energy consumption levels have contributed to increased atmospheric CO_2. While China is a major contributor to the problem, it has also recognised the environmental and economic risks that acidification poses, especially to its massive aquaculture industry. The Chinese government has begun investing in renewable energy, emissions reductions, and coastal ecosystem research, though it still faces international pressure to accelerate its green transition. China also participates in regional marine protection agreements and acidification monitoring through collaborations with the UN and neighbouring countries.

Norway

Norway is a leader in scientific research and international advocacy on ocean acidification. As a developed, high-latitude country with significant fishing and maritime interests, Norway has prioritised ocean health in both policy and diplomacy. The Norwegian government supports the Arctic Council's work on acidification in polar waters, where the issue is especially urgent due to cold temperatures increasing CO_2 absorption. Norway has also funded national and international research programmes, including acidification impact assessments on cold-water coral reefs and fisheries. Though it benefits economically from oil exports, Norway has invested heavily in clean energy, marine monitoring, and ecosystem-based adaptation, positioning itself as a model for balancing economic and environmental interests.

Seychelles

The Republic of Seychelles, which is a small island developing state (SIDS), has become a global innovator in marine finance and climate resilience. Despite not contributing significantly to global CO_2 emissions, Seychelles is under severe risks due to ocean acidification, including coral bleaching,

fishery decline, and coastal erosion. In 2018, Seychelles launched the world's first sovereign Blue Bond, raising $15 million to support sustainable marine projects[33], ecosystem protection, and scientific monitoring. The country also leads advocacy for SIDS in the United Nations, demanding greater financial and technological support from developed nations to help combat acidification and other climate threats. Seychelles demonstrates how vulnerable nations can still drive international attention and innovation on environmental issues.

International Maritime Organization (IMO)

The International Maritime Organization (IMO), a specialised agency of the United Nations, acts as a big contributor in monitoring transatlantic shipping to reduce its environmental toll. As shipping is a major source of carbon emissions and marine pollution, the IMO has created frameworks to battle climate change and protect ocean health, which includes mitigating ocean acidification indirectly by reducing CO_2 emissions from ships.

The IMO's Initial Strategy on the Reduction of GHG Emissions from Ships in 2018 set goals to reduce greenhouse gas emissions by a minimum of 50% by 2050, in contrast to 2008 levels[34]. While not specifically targeting acidification, this strategy contributes to limiting the primary cause of acidification: atmospheric CO_2. The IMO also promotes and supports energy-efficient ship design, alternative and less damaging fuels (such as ammonia and hydrogen), and carbon intensity indexing through instruments like the Energy Efficiency Design Index (EEDI) and Carbon Intensity Indicator (CII).

Moreover, the IMO supports institutional strengthening for developing countries through technical cooperation programmes, helping small island and coastal states build their maritime resilience. Its work displays how global governance mechanisms can shape sustainable maritime practices and contribute to broader climate goals, including the fight against ocean acidification.

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[33] Republic of Seychelles. *Seychelles Launches World's First Sovereign Blue Bond*. The World Bank, 29 Oct. 2018, www.worldbank.org/en/news/press-release/2018/10/29/seychelles-launches-worlds-first-sovereign-blue-bond . Accessed 10 Aug. 2025.

[34] International Maritime Organization. *Initial IMO Strategy on Reduction of GHG Emissions from Ships*. IMO, 2018, https://www.imo.org/en/MediaCentre/HotTopics/Pages/Reducing-greenhouse-gas-emissions-from-ships.aspx.

Previous attempts to solve the issue

Seychelles Blue Bond (2018)

In 2018, the Republic of Seychelles launched the world's first sovereign "Blue Bond", raising $15 million[35] from international investors (with support from the World Bank and Global Environment Facility). The bond's funds were used to support sustainable marine and fisheries projects, including the expansion of MPAs, promotion of climate-resilient aquaculture, and improved monitoring of ocean health. Although small in scale, it was a pioneering example of using financial instruments to invest in long-term ocean resilience, including combatting acidification. The success of this bond inspired similar efforts in other coastal nations and showcased how environmental goals can align with economic innovation.

Sustainable Development Goal 14.3, United Nations (2015–present)

In 2015, the United Nations adopted the Sustainable Development Goals as part of the 2030 Agenda for Sustainable Development. Target 14.3 under SDG 14 ("Life Below Water") specifically calls on countries to:

> *"Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels."*[36]

This was the first time ocean acidification was given its own dedicated international target. It encouraged member states to monitor their marine environments, collaborate scientifically, and incorporate acidification into national ocean policies. Through this framework, the UN has supported coordination between agencies like UNESCO-IOC, UNEP, and the IPCC to provide funding, technical guidance, and global assessments. While implementation is still uneven, SDG 14.3 has made acidification a visible policy issue and has helped drive research networks like the Global Ocean Acidification Observing Network (GOA-ON) and promote capacity building in developing countries.

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[35] World Bank. *Seychelles Launches World's First Sovereign Blue Bond*. The World Bank, 29 Oct. 2018, https://www.worldbank.org/en/news/press-release/2018/10/29/seychelles-launches-worlds-first-sovereign-blue-bond. Accessed 25 July 2025.

[36] United Nations. *Sustainable Development Goal 14: Conserve and Sustainably Use the Oceans, Seas and Marine Resources for Sustainable Development*. United Nations, https://sdgs.un.org/goals/goal14. Accessed 25 July 2025.

Possible solutions

Enforce Penalty-Based CO_2 Reduction Policies

Because ocean acidification stems from carbon dioxide released from human activities, an effective solution is to implement a strict, enforceable limit – paired with a financial penalty for non-compliance. Countries or corporations that exceed their carbon allowances would face significant fines, carbon taxes, or trade restrictions, creating a direct economic incentive to cut emissions. These consequences, while ideally standardised across all types of carbon emissions, would place particular emphasis on activities that directly affect marine life, such as shipping and offshore drilling. Revenues from the penalties could be reinvested into projects which support ocean biodiversity preservation, as well as renewable energy development, in order to further efficiently prevent harm to marine species due to carbon dioxide absorption by the sea. These limitations could be enforced by regional bodies as well as international alliances, in collaboration with the United Nations Environmental Program (UNEP).

Local Mitigation via Ecosystem Restoration

Restoring coastal ecosystems such as seagrass meadows, mangrove forests, and salt marshes can support the absorption of carbon dioxide in the air, which ultimately increases pH of the nearby waters. For example, seagrass beds have been shown to reduce acidity in shellfish habitats. This can be utilised to increase shellfish stock and decrease mortality rates if restored correctly. These habitats also support biodiversity, protect shorelines from erosion and keep local fisheries profitable. To successfully implement the restorations, partnerships with both governmental and non-governmental organisations (NGOs) could be formed, helping local communities facilitate such a project. The government could provide subsidies and expand MPAs, whereas an NGO can raise awareness and encourage community engagement in such restoration projects.

Scientific Monitoring and Early Warning Systems

Establishing a large-scale monitoring network where coastal communities are present can help introduce an early warning system, which would indicate when ocean acidification would become a threat to nearby sea life. This can be carried out by the implementation of ocean sensors, satellite imagery, and data sharing platforms through organisations like GOA-ON, where scientists can detect

dangerous pH shifts in real time. This allows governments and conservation groups to take immediate action, such as restricting industrial activity until the pH value returns to a safe level or initiating rapid-response restoration efforts. Strengthening international cooperation in ocean monitoring ensures that vulnerable marine ecosystems are identified and shielded before irreparable damage occurs.

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