



Impact of climate change on oceanic ecosystems: Challenges, adaptations and strategies.

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Introduction

Climate change is one of the greatest challenges of our time, with profound impacts on ocean ecosystems, the foundation of life on Earth. Rising global temperatures, changing precipitation patterns, glacier melt, and rising sea levels are key consequences of climate change that threaten marine biodiversity and human communities dependent on the oceans. This poster examines the major challenges facing ocean ecosystems due to climate change and outlines key strategies for adaptation and mitigation to protect these vital environments.

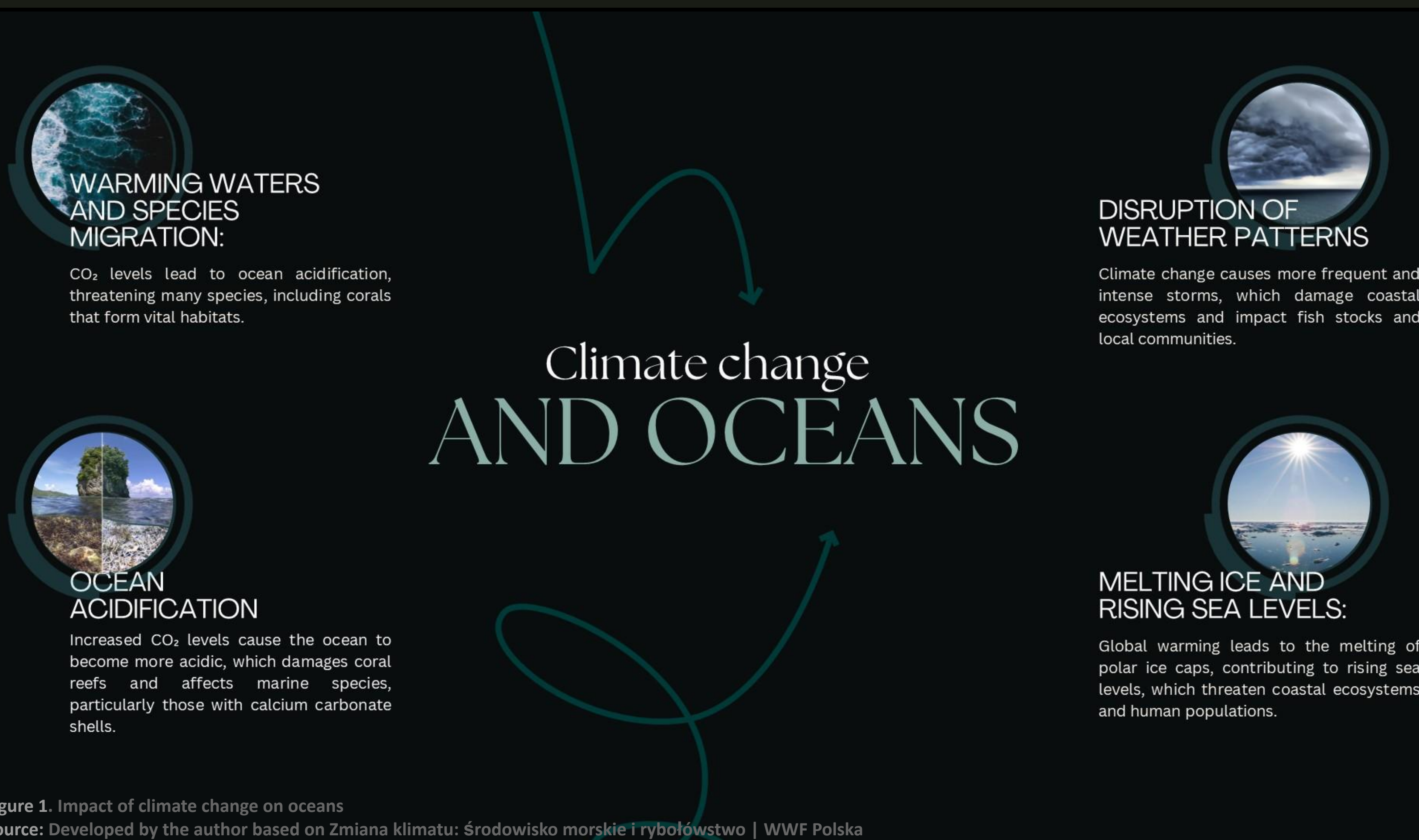


Figure 1. Impact of climate change on oceans
Source: Developed by the author based on Zmiana klimatu: środowisko morskie i rybolówstwo | WWF Polska

Adaptations

Marine organisms adaptation

Some marine species may develop greater tolerance to environmental changes, like reduced pH.

Increased phytoplankton production:

In certain areas, phytoplankton growth may increase, offsetting declines elsewhere.

Migration of fish and other species:

Many marine organisms move towards cooler waters to cope with rising temperatures.

Evolution of new survival strategies:

Species may evolve new strategies, such as diet changes or adapting to new ecological conditions.

Material and methods

- ❖ This poster discusses the specific impact of climate change on oceanic ecosystems. The study is based on the analysis of secondary data. To gather the necessary information, the documentation method was employed, and a review of specialized literature was conducted. The research results are presented using the descriptive method.
- ❖ The information used in this study was obtained from official reports by environmental organizations, governmental institutions, and scientific literature, with data accessed on August 24, 2024. The adopted research methodology included the analysis of reports containing information on the effects of climate change on marine environments, species distribution, and adaptation strategies.
- ❖ The tables included in the study were prepared using Microsoft Excel. To achieve the desired results, modifications to formulas were made, and data formatting was adjusted.

Ocean-based industries

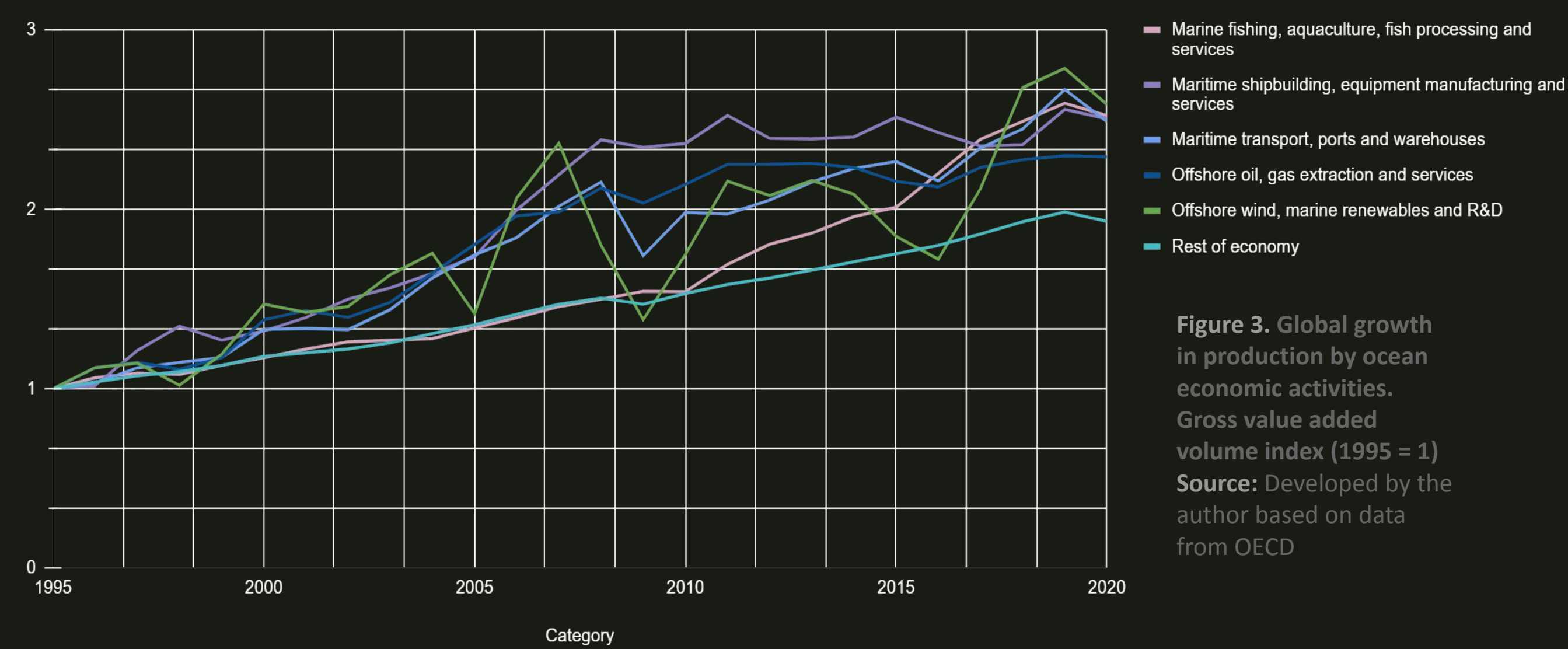


Figure 3. Global growth in production by ocean economic activities. Gross value added volume index (1995 = 1)
Source: Developed by the author based on data from OECD

Dominant Sectors

From 1995 to 2020, maritime shipbuilding, equipment manufacturing, and services saw significant growth, with the GVA index reaching 2.504, over 2.5 times higher than in 1995.

Highest Growth

The offshore wind, marine renewables, and R&D sector experienced the most rapid growth, with the GVA index rising to 2.786 in 2019—nearly a threefold increase.

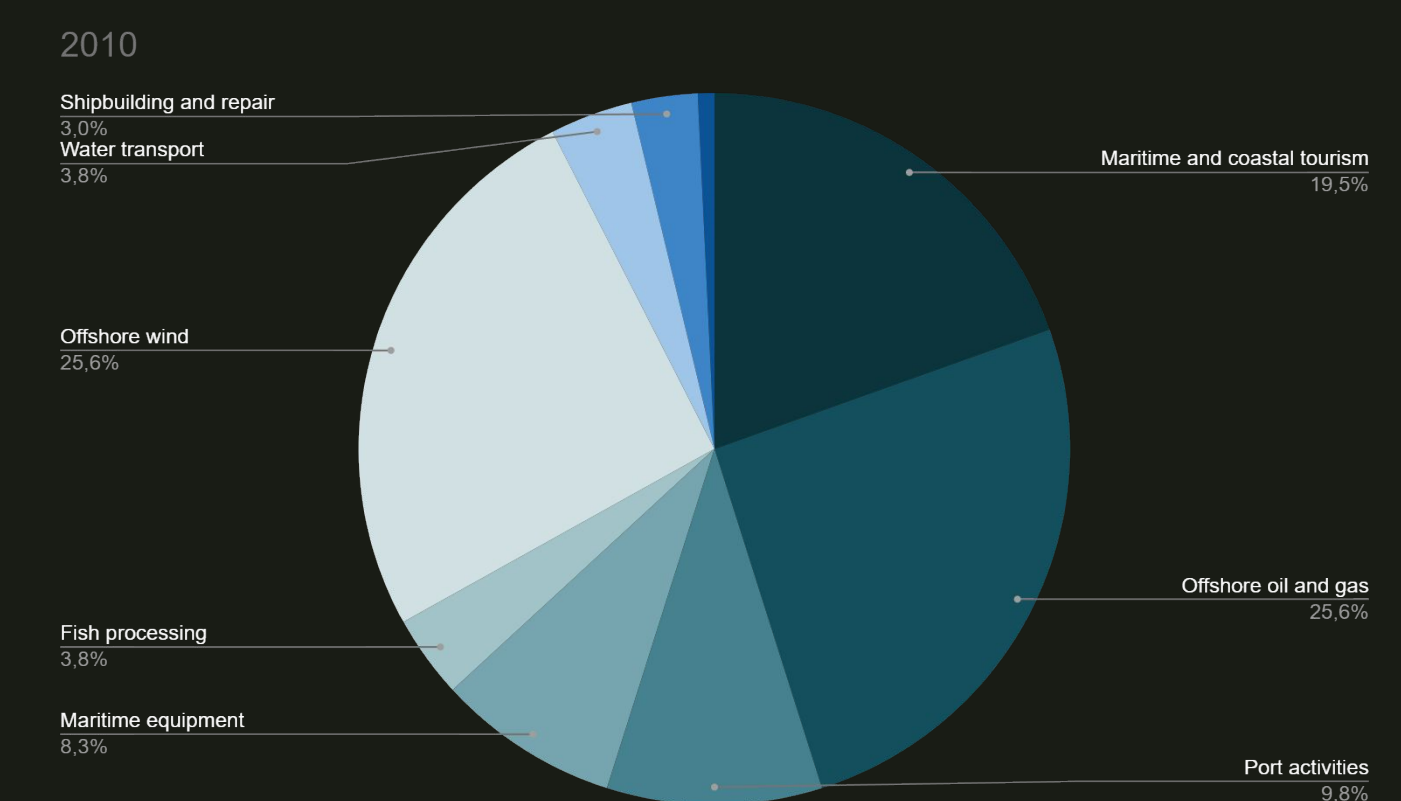


Figure 4. Value-added of Ocean-based Industries in 2010
Source: Developed by the author based on OECD (2016), The Ocean Economy in 2030, OECD Publishing, Paris, <https://doi.org/10.1787/9789264251724-en>.

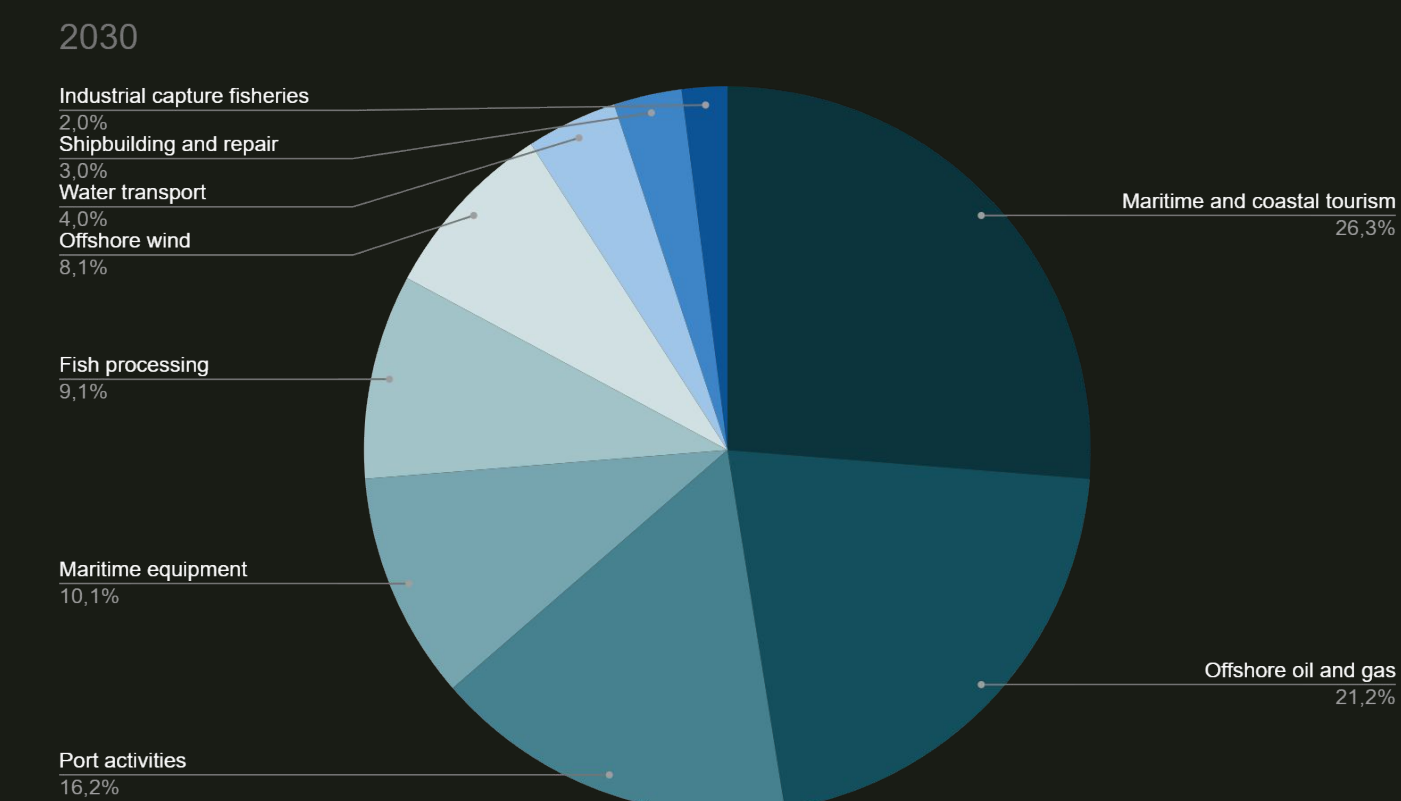


Figure 5. Value-added of Ocean-based Industries in 2030
Source: Developed by the author based on OECD (2016), The Ocean Economy in 2030, OECD Publishing, Paris, <https://doi.org/10.1787/9789264251724-en>.

Between 2010 and 2030, the offshore oil and gas sector's share fell from 34% to 21%, and offshore wind energy dropped from 34% to 8%

At the same time, sectors like fish processing and port activities increased their shares from 5% to 9% and from 13% to 16%, respectively.

Strategies

MARINE PROTECTED AREAS (MPAS)

Establishing and expanding MPAs helps protect critical ecosystems like coral reefs, mangroves, and seagrass meadows. These zones restrict harmful activities such as overfishing and pollution, allowing marine life to recover and adapt to changing conditions

REDUCING CO2 EMISSIONS:

One of the most important strategies to mitigate climate change's impact on oceans is reducing greenhouse gas emissions. By adhering to international agreements like the Paris Agreement, countries aim to limit global temperature rise, thus slowing ocean warming and acidification

SUSTAINABLE FISHERIES MANAGEMENT

Implementing sustainable fishing practices helps maintain fish populations and ecosystems. This includes enforcing catch limits, avoiding overfishing, and protecting fish habitats to ensure marine biodiversity remains resilient to environmental changes

COASTAL RESTORATION PROJECTS

Restoring coastal habitats, such as wetlands, marshes, and mangroves, helps protect coastlines from rising sea levels and storm surges. These ecosystems also act as carbon sinks, absorbing CO2 and helping mitigate climate change

Summary

- ❖ Rising ocean temperatures and sea levels disrupt marine ecosystems, affecting species migration, coastal erosion, and increasing flood risks. Concurrently, changes in ocean acidity and extreme weather conditions damage coral reefs and coastal communities, necessitating adjustments in economic development and environmental protection strategies.
- ❖ Solutions include creating and expanding marine protected areas, reducing CO₂ emissions in line with international agreements, implementing sustainable fishing practices, and restoring coastal habitats such as wetlands and mangroves to prevent erosion and protect shorelines.
- ❖ Between 2010 and 2030, climate change impacted maritime sectors. Offshore oil and wind energy declined, while fish processing and port activities grew, reflecting shifts in energy demands, marine resources, and trade routes. A move away from fossil fuels toward renewable energy sources and changes in energy policies can reduce the growth of offshore oil and wind energy sectors. Stricter environmental regulations may impact traditional offshore industries, while promoting sustainable practices in fish processing and port management.

References:

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