REVIEW OF SDG14: IMPLEMENTATION STRATEGIES AND POLICIES IN EU COUNTRIES FOR SUSTAINABLE COASTAL/MARINE AREAS AND MARINE LIFE

DOI: 10.26341/issn.2241-4002-2024-4c-6-T02093

Nikolaos Moraitakis
Ph.D. candidate
Department of Political Science, University of Crete
nemoraitakis@yahoo.com

Constantine Manasakis
Associate Professor of Economic Analysis
Department of Political Science, University of Crete
manasakis@uoc.gr

Abstract
The European Union plays a critical role in the global pursuit of Sustainable Development Goal 14, aimed at conserving and sustainably using marine resources. This paper critically examines the EU's implementation strategies and policies, highlighting the need for effective management of marine ecosystems and mitigation of human-induced degradation. By analyzing policy documents and performance reports across various EU instruments like the Marine Strategy Framework Directive and the Common Fisheries Policy, the review identifies both progress and significant challenges in areas such as overfishing, habitat destruction, and pollution. The paper underscores the importance of evidence-based policymaking, enhanced governance, and the scaling of successful local initiatives to achieve a sustainable and resilientblue Europe.

Key words: *SDG 14, EU, Sustainable Coastal Management, Marine Life Conservation, Policy Review, Implementation Strategies*

Introduction

Sustainable development, characterized by the balanced integration of environmental stewardship, economic progress, and social equity, lies at the core of the European Union's policy landscape. The EU's dedication to sustainable principles predates the significant 2030 Agenda for Sustainable Development led by the United Nations. This paper undertakes a comprehensive review of the EU's efforts in achieving Sustainable Development Goal 14 (SDG 14), which focuses on the conservation and sustainable use of oceans, seas, and marine resources. Through a critical examination of the evolution, implementation, and impact of related policies across member states, this review illuminates the successes and challenges within the EU's approach, offering a nuanced understanding of its policy effectiveness and strategic directions.

Beginning with a retrospective look at the EU's foundational policies prior to 2015, the paper traces the early commitments that set the stage for current environmental policies. It then transitions to discuss how these principles have been recalibrated and reinforced following the adoption of the 2030 Agenda, emphasizing the EU's strategic responses and policy coherence. A detailed examination of key legislative measures, such as the Marine

Strategy Framework Directive and the Common Fisheries Policy, follows, highlighting the variability in implementation across the union and shedding light on best practices and areas for improvement. The concluding sections delve into the challenges of aligning economic, social, and environmental objectives within the EU's policy framework, proposing forward-looking strategies aimed at enhancing governance and policy efficacy.

1. The Roots of Sustainable Development in the EU before 2015

Historical Context of Sustainable Development in the EU: The inception of sustainable development within the EU context finds its roots in the aftermath of the United Nations Conference on the Human Environment in Stockholm in 1972, a pivotal moment that brought environmental issues to the forefront of global policy discussions (McCormick, 2001). In response, the EU's First Environmental Action Programme (EAP) of 1973 marked a significant step in integrating environmental concerns into broader policy frameworks, setting the stage for an evolving understanding of sustainability within the EU (Kraemer and McGlade, 2006).

Key Policies and Initiatives Pre-2015: Several key initiatives prior to 2015 significantly impacted sustainable development within the EU. The Fifth Environmental Action Programme (1992-2000), titled "Towards Sustainability," represented a crucial shift, promoting the integration of environmental policies with economic and social policies, reflecting a growing recognition of the interconnectedness of these domains (European Commission, 1992). The Lisbon Strategy, launched in 2000, further emphasized sustainable development in the context of economic growth and competitiveness, marking a nuanced approach in EU policy (Borrás and Radaelli, 2011). These policy frameworks were instrumental in promoting a more integrated and holistic approach to sustainability within the EU.

Role of EU Institutions in Shaping Sustainable Development: The advancement of sustainable development within the EU was significantly influenced by its key institutions. The European Commission played a pivotal role in proposing legislation and policies aligned with sustainability goals, acting as a catalyst for policy development and implementation (Lenschow, 2010). The European Parliament, as a directly elected body, influenced the shaping and approval of sustainable development legislation, serving as a democratic forum for debate and decision-making on sustainability issues (Burns, 2013). The collaboration and sometimes contention between these institutions and member states were essential in the evolution of a cohesive sustainable development policy.

Challenges and Critiques: Despite these efforts, the EU's approach to sustainable development faced several challenges. Criticisms centered on the lack of policy coherence, where economic priorities often overshadowed environmental and social concerns (Jordan and Lenschow, 2010). The effectiveness of these policies in achieving tangible environmental outcomes was also questioned, as was the adequacy of stakeholder engagement, particularly in terms of inclusiveness and representation (Bäckstrand, 2006).

The EU's engagement with sustainable development before 2015 can be characterized as a period of gradual evolution and learning. These early initiatives were instrumental in shaping the EU's current approach to sustainable development, particularly considering the 2030 Agenda. Lessons learned, such as the importance of policy coherence and stakeholder engagement, continue to inform the EU's trajectory towards sustainability.

1.2 Sustainable Development in the Post- "Agenda 2030" EU Development Agenda

How the EU adopted and integrated the 2030 Agenda into its policies: The adoption of the United Nations' Agenda 2030 in September 2015 marked a pivotal moment in global efforts towards sustainable development. The European Union (EU), as a significant actor in global governance, faced the crucial task of integrating these ambitious goals into its complex policy framework. This review critically analyzes how the EU has adopted and integrated the 2030 Agenda into its policies, exploring the strategic alignment of EU policies with the SDGs, focusing on the mechanisms and challenges of embedding sustainability into various policy domains.

Conceptualizing Sustainable Development: Sustainable development, as defined in the Brundtland Report (1987), is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This concept has evolved to encompass a balance between three core elements: environmental protection, social inclusion, and economic growth. Understanding the EU's approach to the SDGs necessitates an exploration of how these elements are integrated into policy-making.

Policy Integration and Sustainable Development: The integration of sustainability into policy-making is complex, especially within a multi-level governance structure like the EU. Policy integration theory provides a lens to examine how different policy domains are coordinated and harmonized to achieve overarching objectives (Jordan and Lenschow, 2010).

Multi-Level Governance in the EU: The EU's policy-making process involves multiple levels of governance, from the European Commission to individual member states. This structure presents both opportunities and challenges for the integration of international agendas like the 2030 Agenda.

1.3 EU's Adoption of Agenda 2030

Historical Context: The EU had already laid a foundation for sustainable development through various policies and initiatives. However, the Agenda 2030 provided a renewed impetus to strengthen these efforts.

Policy Response: Key policy documents such as the European Green Deal demonstrate the EU's commitment to the SDGs. This ambitious plan aims to make Europe climate-neutral by 2050, addressing areas such as clean energy and biodiversity.

Strategic Alignment: The SDGs have been embedded into economic and social strategies. The European Pillar of Social Rights addresses goals related to poverty and inequality, while the Digital Europe Programme aims to leverage digital transformation for sustainable development.

1.4 Integration of SDGs into EU Policies

Environmental Sustainability: Initiatives like the EU Biodiversity Strategy for 2030 and the Circular Economy Action Plan showcase the EU's commitment to preserving natural resources and promoting sustainable use patterns.

Social Inclusion: The European Pillar of Social Rights is a commitment to deliver new and more effective rights for citizens, directly addressing goals related to education, gender equality, and reducing inequalities.

Economic Development: Policies promoting innovation, fair trade, and responsible business practices align with the SDGs' call for decent work, economic growth, and industry innovation.

1.5 Challenges in Integration

Political and Economic Barriers: The varying political and economic landscapes of EU member states present significant challenges in uniformly adopting and implementing SDG-aligned policies. The disparities in economic development and political priorities among EU member states significantly impact the uniform adoption of SDG-aligned policies. For instance, while Germany has advanced in renewable energy, some Eastern European countries still rely heavily on fossil fuels. This divergence poses a challenge in crafting EU-wide sustainable policies. For example, the variance in renewable energy adoption, as per Eurostat, shows a disparity from over 30% in some countries to less than 10% in others (Börzel and Risse, 2003).

Policy Coherence: Achieving coherence across different policy domains remains a formidable challenge, ensuring that policies across sectors work synergistically. Conflicts between different policy domains present significant challenges. For example, the Common Agricultural Policy (CAP) has often been criticized for its negative environmental impacts, despite the EU's environmental commitments. This is confirmed from the from the analyzes so far of CAP subsidies and their environmental impacts as reported by the European Environment Agency (Nilsson et al., 2012).

Measuring Progress: Monitoring and evaluating progress towards the SDGs are complex due to the breadth and interconnectedness of the goals. The complexity of SDGs requires sophisticated metrics for assessment. The EU's Eurostat provides a set of indicators; however, these often fail to capture the qualitative aspects of certain goals, particularly those related to social equity and justice. Eurostat's SDG indicators show progress in areas like renewable energy, but less clear advancements in goals like reduced inequalities (European Commission, 2021).

1.6 Comparative Analysis and Global Impact

Comparative Approach: The EU's centralized approach to SDG integration contrasts with approaches in other regions like ASEAN, where SDG adoption is more fragmented. For example, the African Union's Agenda 2063, while sharing similar goals, operates with a different implementation mechanism, influenced by the region's unique socio-economic context. A comparative study of policy integration in the EU and the African Union shows differences in centralization and policy adaptation (Fioramonti and Kimunguyi, 2011).

Global Leadership: The EU's influence in global climate negotiations, exemplified by its commitment to the Paris Agreement, demonstrates its leadership in driving global sustainability efforts. Its commitment to the Paris Agreement and active participation in international forums like the G20 and COP meetings position it as a key player in shaping global sustainability policies, (Keukeleire and Delreux, 2014).

The European Union's integration of the United Nations' Agenda 2030 into its development agenda represents a significant step towards achieving a sustainable future. The strategic alignment of its policies with the SDGs showcases its commitment to sustainable development. As the EU continues to refine and implement these policies, its role as a global leader in sustainability remains crucial.

2. Sustainable Development Goal 14 – Relevant Policies at the EU Level

The Sustainable Development Goals (SDGs), adopted by the United Nations in 2015 as part of the transformative 2030 Agenda, underscore a global ambition to protect and sustainably use marine resources. Among these, SDG 14 - Life Below Water - is pivotal in addressing the health of our oceans and seas. This section delves deeply into the European Union's (EU) strategies and initiatives towards achieving SDG 14, focusing on marine protection, fisheries management, and pollution reduction. Drawing on a diverse array of academic sources, such as the United Nations' "Sustainable Development Knowledge Platform: SDG 14," and scholarly works like Barnett et al.'s "Ocean Governance and Sustainable Development: Implementing SDG 14" (Ocean Yearbook, 2019), this section provides an in-depth overview of the EU's comprehensive approach and the multifaceted challenges it faces.

The EU's Marine Protection Policies: The Marine Strategy Framework Directive (MSFD) is the EU's flagship policy in marine conservation, aiming to achieve 'Good Environmental Status' (GES) of marine waters by 2020. However, realizing GES across diverse marine territories presents considerable challenges, as detailed in the European Environment Agency's comprehensive report "European Waters: Assessment of Status and Pressures" (2018). Furthermore, scholarly evaluations like Harvey et al.'s "Evaluating the Effectiveness of the MSFD as a Tool for Marine Conservation" (Marine Policy, 2020) provide critical insights into the directive's implementation challenges, highlighting the need for enhanced coordination and integration of environmental objectives with maritime spatial planning. Additionally, the Habitats and Birds Directives, integral to the EU's Natura 2000 network of protected areas, face hurdles in ensuring effective management and sustainable funding.

Fisheries Management and Sustainable Practices: The reformed Common Fisheries Policy (CFP) plays a central role in the EU's strategy for sustainable fisheries management. This policy, updated in 2013, emphasizes sustainable fishing practices by setting quotas and fishing opportunities based on scientific advice. Despite these measures, significant challenges persist. The Scientific, Technical and Economic Committee for Fisheries (STECF) reports detail ongoing issues with overfishing in the Mediterranean. This is further corroborated by Wallace's analysis in "Assessing the Impact of the Common Fisheries Policy" (Journal of Marine Systems, 2021), and the European Commission's "Report on the State of the EU Fishing Fleet" (2019), which offer a critical assessment of the CFP's efficacy and suggest areas for policy improvement.

Pollution Reduction Efforts: The EU's commitment to reducing marine pollution is evidentin its Plastics Strategy and the Single-Use Plastics Directive, part of the broader European Green Deal initiative. These policies aim to significantly curb the presence of plastics in marine environments. However, addressing the larger issue of marine pollution, including chemical and nutrient pollutants, remains a significant challenge. In-depth research on the impacts of microplastics, as discussed in Jensen et al.'s study "Microplastics in European Coastal Environments" (Environmental Pollution, 2020), and Greenpeace Europe's "Tackling Plastic

Pollution in the Oceans" (2019), highlight the need for comprehensive strategies that extend beyond plastic waste management to include other pollutants affecting marine ecosystems.

Challenges and Prospects: The EU's journey towards achieving SDG 14 is fraught with challenges that include varying levels of commitment among member states, the need for comprehensive and integrated environmental policymaking, and balancing economic interests with ecological imperatives. Moving forward, the EU must focus on enhancing enforcement mechanisms, facilitating cross-border cooperation, and fostering innovation in sustainable marine technologies.

The EU's multifaceted approach to achieving SDG 14, despite making significant headway, confronts challenges in uniform policy implementation and effective enforcement across its member states. Future success in achieving SDG 14 requires robust, integrated policy frameworks and collaborative efforts among government, private sector, and civil society. Thisneed for a more cohesive and inclusive approach is underscored in Marino et al.'s "Integrating Marine Conservation into European Policy" (Marine Environmental Research, 2022), which advocates for comprehensive governance models to preserve marine ecosystems sustainably.

2.1 The effectiveness of the EU and Greece's approaches to sustainable development, particularly in achieving SDG 14

The European Union (EU) and Greece have adopted strategic approaches to sustainable development, particularly in achieving Sustainable Development Goal 14 (SDG 14), which focuses on the conservation and sustainable use of oceans, seas, and marine resources. This essay critically analyzes the effectiveness of their approaches, incorporating an array of bibliographic references to provide a comprehensive understanding.

EU's Comprehensive Marine Policy Framework

The EU's approach to achieving SDG 14 is encapsulated in policies like the Marine Strategy Framework Directive (MSFD), aiming to achieve good environmental status of marine waters by 2020. The directive emphasizes an ecosystem-based approach to marine management, integrating various aspects such as biodiversity, fisheries, and pollution (European Commission, Marine Strategy Framework Directive).

Greece's Implementation and Challenges

In Greece, the MSFD is implemented through national legislation, focusing on marine conservation and sustainable use of ocean resources. The country faces unique challenges due to its extensive coastline and dependence on marine resources, requiring tailored approaches for effective implementation (Hellenic Ministry of Environment and Energy).

Marine protected areas in Europe's seas

The EU has made substantial progress in designating new marine protected areas, both as part of the EU Natura 2000 network and through complementary national designations. As a result, marine protected area coverage more than doubled, to 12.1%, between 2012 and 2021. However, efforts will need to increase significantly to achieve the EU biodiversity strategy target of protecting at least 30% of EU seas by 2030, while also ensuring that all protected areas are effectively managed. Whether or not this target will be met is uncertain but also rather challenging.

The conservation of coastal and marine areas *is important for maintaining biodiversity and* ensuring that ecosystems and their services are fully functional. Marine protected areas (MPAs) play a key role in conserving coastal and marine ecosystems and provide significant economic and societal benefits and support local livelihoods.

To protect the EU's seas, the EU biodiversity strategy for 2030 set the target that, by 2030, atleast 30% of the sea area should be legally protected (with 10% of the sea area to be strictly protected).

Over the last decade, the total area covered by MPAs in the EU has increased substantially —from 5.9% in 2012 to 12.1% in 2021. This is the result of both the expansion of the Natura 2000 network — a network of protected areas designated under the EU Birds and Habitats Directives — and protected areas established through complementary national designations.

Although this trend is positive, the area protected will need to expand at a significantly faster rate than it has in the last decade if the EU is to meet the 30% biodiversity strategy target by 2030. The submission of protected area pledges by EU Member States, expected by the end ofFebruary 2023 and subject to review in 2023, will provide initial insights into how realistic achieving this target is and identify any major gaps that remain.

Furthermore, the EU biodiversity strategy for 2030 highlights the importance of building a truly coherent trans-European network of protected areas through improving their connectivity. It will therefore be particularly important to base the designation of new protected areas in EU seas on sound scientific analysis, to ensure that these areas are ecologically representative and coherent, enhancing connectivity.

In addition, ensuring more effective management of individual MPAs and their networks should become a major focus in the coming years, as the designation of new MPAs alone will not guarantee the conservation of the EU's marine ecosystems. Although no comprehensive information is yet available to provide an overview of how effectively EU MPAs are managed, developing such indicators in the coming years will be essential for tracking progress towards implementing the targets of the EU biodiversity strategy for 2030.

Progress in Marine Conservation: Both the EU and Greece have made significant progressin expanding Marine Protected Areas (MPAs). According to the European Environment Agency, MPAs now cover a significant portion of EU marine waters, surpassing the global target under the Convention on Biological Diversity (European Environment Agency, Marine Protected Areas Report).

By 2021, several EU Member States had made significant progress in protecting their marine ecosystems through the designation of MPAs. Germany, Belgium and France had designatedmore than 30% of their waters as MPAs, while the Netherlands, Lithuania, Poland and Romania had expanded their MPA networks to cover more than 20% of their waters. In most countries, the majority of MPAs are part of the Natura 2000 network, with nationally designated MPAs adding to some countries' networks, most notably in Sweden, Spain, Finland, Italy and Portugal.

Although most Member States have made progress in designating new MPAs over the last 10 years, this progress has been slow in many countries. However, differences between countries are in part the result of the wide variation in ecological conditions between Europe's marine regions. While it is important that Member States continue efforts to define new MPAs at the national level, cooperation across regional seas will also be crucial to support the developmentof a coherent MPA network across the EU and achieve the target of protecting at least 30% ofseas across the EU.

For Greece, with its extensive coastline and marine biodiversity, the integration of MSFD directives and national policies is crucial. The country's approach to marine

conservation, including the establishment of new MPAs and sustainable fisheries, will be instrumental in preserving its unique marine ecosystems and contributing to the overall EU goals.

Overall, while significant strides have been made, realizing the full potential of MPAs for sustainable marine conservation in the EU and Greece requires a concerted effort in expandingcoverage, enhancing ecological connectivity, and ensuring effective management.

3. Greece's Marine Conservation Achievements (2015-2023)

Greece has made notable strides in marine conservation from 2015 to 2023, aligning with the EU's broader environmental goals and Sustainable Development Goal 14 (SDG 14). This includes the expansion of Marine Protected Areas (MPAs) as part of both the Natura 2000 network and national initiatives. Efforts have been geared towards enhancing maritime pollution controls and promoting sustainable fisheries, crucial for preserving Greece's extensive marine biodiversity. The country's unique geographical features and reliance on marine resources underscore the importance of these conservation measures in maintaining ecosystem health and supporting local communities. For a detailed overview of Greece's achievements in marine conservation during this period, further investigation into specific policies and their impacts would be beneficial.

Greece has shown significant commitment to marine conservation, particularly between 2015 and 2023. The Hellenic Ministry of Environment and Energy has conducted a comprehensiveevaluation of 183 areas for potential inclusion in the national part of the Natura 2000 network. From these, 95 areas were selected, mostly marine or coastal, to be either new additions or expansions to existing protected areas. This expansion is focused on preserving habitats like Posidonia oceanica meadows and species including birds, mammals, and cetaceans. The inclusion of these areas is expected to increase the coverage of marine protected areas in Greece's territorial waters from 6% to around 20%, significantly exceeding the SDG target 14.5 of 10% conservation. This initiative represents a major step towards meeting internationalconservation targets and highlights Greece's proactive approach to marine ecosystem protection.

Sustainable Fisheries: The European Common Fisheries Policy (CFP) is a key component of the EU's approach, focusing on sustainable use of living marine resources. It sets catch limits to ensure fish stocks are used sustainably and empowers member states to regulate fisheries ina way that aligns with biodiversity conservation objectives. Despite efforts, challenges remainin achieving sustainable fisheries, including issues like bycatch and seabed degradation.

European fisheries affect fish stock productivity and stock size through catches. However, because stock size also varies naturally, the management of fisheries is a complex exercise. Controlling fishing mortality is one way of managing fisheries. Fishing mortality (F) reflects the proportion of fish of a given age that is caught by fisheries for one year. For fisheries to besustainable, fishing mortality should not exceed the maximum sustainable yield value (FMSY), which will provide the largest catch that can be taken from a fish stock over an indefinite period without harming it.

The model based median value of all F/FMSY assessments can be used to estimate fishing pressures on fish stocks. Values above 1.0 mean the current fishing mortality (F) exceeds the estimated maximum sustainable yield (FMSY). The results for EU marine waters mirror the downward trend in overexploited overall stocks and show a 37% reduction in fishing pressure, from 1.87 in 2005 to 1.17 in 2020. However, this overall figure masks the fact that while fish stocks in the North-East Atlantic (including the Baltic Sea) — where about three-quarters of the EU's catch originates — were on average fished sustainably (F/FMSY median

of 0.76 in 2021), the Mediterranean and Black Sea fish stocks were still heavily overfished (F/FMSY median of 1.71 in 2020). If the EU is to meet its own targets for sustainable fisheries, efforts need to be increased substantially in these sea regions.

At the same time, there has been an improvement in the number of stocks fished below FMSY in the North-East Atlantic. In 2003, only 27% of stocks in this region were fished below FMSY, whereas in 2021, this figure had risen to 74%. In turn, however, this means that a quarter of North-East Atlantic stocks were still overfished.

The EU's approach to sustainable fisheries is not limited to respecting MSY. The Marine Strategy Framework Directive requires commercially exploited fish and shellfish populations to have a healthy distribution of age and size.

The status of stocks and their reproductive capacity can be measured and described by fish stock biomass as well as by spawning stock biomass (SSB). Biomass estimates are, however,associated with high levels of uncertainty due to the high annual variability of stock biomass. Fish stocks can also take time to respond to changes in management measures, and results can be masked by other factors, such as environmental conditions and predation. For this reason, analyses of stock biomass trends should always focus on longer term patterns. There has been an estimated 22% increase in biomass in EU marine waters between 2005 and 2020. The increase has been stronger in the North-East Atlantic, gaining about 43%, while stock biomassonly grew by only 3% in the Mediterranean and Black Sea.

3.1 Status of marine fish and shellfish stocks in European seas

As of 2024, the status of fish stocks in EU waters shows a mixed picture, with notable improvements in some areas but continued challenges in others.

In the North-East Atlantic Ocean and Baltic Sea, there has been a significant improvement infish stock sustainability. After experiencing high levels of fishing mortality in the late 20th century, which put a strain on reproductive capacity, concerted efforts have led to a decline infishing mortality rates towards sustainable levels. However, it's important to note that severalstocks still remain outside safe biological limits.

Contrastingly, in the Mediterranean and Black Seas, the situation is less encouraging. Despite some progress, most stocks in these regions continue to be fished at unsustainable levels, andthere hasn't been a substantial improvement in reproductive capacity since 2003. Fishing mortality rates remain a concern, with the latest data indicating rates still significantly above recommended sustainability levels.

The European Commission acknowledges that while the overall sustainability of EU fisheries has improved, with fewer stocks being overfished, more efforts are necessary to ensure resilience and continuous improvement in fish stock status. Specific challenges include addressing issues related to climate change, illegal, unreported, and unregulated fishing, and external factors like Russia's military aggression against Ukraine, which has impacted fisheries, particularly in the Black Sea.

Looking ahead, the Commission is focused on maintaining sustainable levels for those stocks that have already achieved them and aiding the recovery of others. This includes a comprehensive approach involving public consultation, scientific advice, and considering various environmental and economic factors.

The Role of Greece in the Management and Sustainability of Fish Stocks in EU Waters. Greece has been making significant strides in sustainable fisheries and ocean conservation. The country is hosting the 9th Our Ocean Conference in 2024, which underscores its commitment to addressing various challenges affecting the oceans, including unsustainable fishing practices. This event reflects Greece's broader efforts to promote sustainable use of ocean resources and to address issues such as marine pollution and overfishing.

Additionally, Greece is set to receive substantial funding from the European Maritime, Fisheries and Aquaculture Fund (EMFAF) for the 2021-2027 period. The total allocation for Greece's program is €519.6 million, with the EU contributing €363.7 million. This funding will support a range of activities aimed at enhancing sustainable fisheries, aquaculture, and the broader blue economy in coastal and island regions. The program prioritizes investments in sustainable practices, including compliance with landing obligations, conservation policies, and measures against illegal, unreported, and unregulated (IUU) fishing. It also focuses on modernizing fishing ports and shelters, promoting sustainable aquaculture, and addressing environmental challenges such as marine litter.

In the realm of aquaculture, Greece is advancing towards more environmentally responsible practices. The country recognizes the importance of aquaculture as a major source of seafood and protein and is committed to sustainable development in this sector. This includes adhering to environmental laws and regulations, implementing best aquaculture practices, and maintaining a thorough system of traceability from sea to plate. By doing so, Greece aims to preserve the marine environment and ensure the sustainability of its seafood industry.

3.2 Reduction in Marine Litter Post-Directive (2018-2023)

The European Union has been proactive in addressing the issue of marine litter, particularly in the wake of directives and action plans aimed at curbing this growing problem. However, despite these efforts, the EU is not entirely on track to meet its goals in waste prevention, reduction, and management. Key reports from the European Environment Agency (EEA) indicate that marine litter, predominantly comprising plastic, is a significant issue, with land-based sources accounting for about 80% of this litter. A substantial portion of this litter, approximately 85%, is plastic, which is particularly concerning due to its impact on marine life and human health via the food chain. The persistence of plastic in the environment, with some types lasting up to 500 years, exacerbates the issue.

The EU's strategies include the Zero Pollution Action Plan and the Circular Economy Action Plan, which encompass the Plastics Strategy. These initiatives aim to transform how plastic products are designed, produced, used, and recycled, with a focus on transitioning to a sustainable and resource-efficient plastics economy. The EU policies strive not only to reduce marine litter but also to address broader environmental and human health concerns associated with plastics.

Nevertheless, there is a growing recognition that more comprehensive measures are needed. The EU's approach has evolved towards a more integrated strategy based on monitoring and robust policy feedback loops. A significant challenge is achieving an 'absolute decoupling' ofwaste from economic growth, especially as the demand for plastic continues to rise. This increase in demand leads to more plastic waste generation per person, particularly in packaging, which quickly becomes waste. While there are signs that waste generation is increasing at a slower pace than GDP, this trend does not hold for plastic waste, which is growing at a faster pace than economic growth. This disconcerting trend underscores the need for improved waste management systems and targeted efforts to reduce waste leakage into the marine environment, especially from coastal regions and river basins.

The situation calls for a pan-European approach, where policymaking considers the cross- border nature of marine and riverine ecosystems. In addressing marine litter, the EU aims to set an example at the global level, advocating for sustainable and safer consumption and production patterns for plastics. The path forward involves not only policy interventions but also active engagement from various stakeholders, including local waste collection authorities,national and EU leaders, businesses, civil society, and educational institutions.

The Single-Use Plastics Directive, an integral part of the EU's strategy to tackle marine litter, has been remarkably effective in reducing the usage of plastic bags. This directive specifically targets single-use plastic products, which are major contributors to marine litter. The impact of this directive has been significant in various EU member states, including Greece, where it has led to a reduction in plastic bag usage by up to 80%.

This substantial decrease is a testament to the effectiveness of policy interventions in changing consumer behavior and reducing environmental impact. By targeting commonly used items like plastic bags, the directive has made a tangible difference in reducing the presence of theseproducts in waste streams and, consequently, in marine environments.

The success in Greece and other EU countries underscores the potential of targeted environmental policies to achieve meaningful results in combating pollution and promoting sustainability. As the EU continues to advance its green initiatives, such efforts provide valuable insights into the strategies that can effectively drive environmental change.

The impact of climate change on marine ecosystems is a pressing concern in Europe, including Greece. Climate change can account for up to half of the combined impacts on marine ecosystems, with areas such as semi-enclosed seas and shallow coastal zones being particularly vulnerable. Key factors of climate change affecting Europe's seas include increasing levels of carbon dioxide, rising global temperatures, and lower oxygen levels in the water. These factors contribute to the 'deadly trio' for marine biodiversity: ocean acidification, sea warming, and deoxygenation.

Ocean acidification, primarily caused by increased carbon dioxide emissions, compromises the structural integrity of organisms like corals, molluscs, and some plankton, impacting the entire food web. Sea warming alters organisms' metabolisms and distribution ranges, leadingto changes in food webs and ecosystem dynamics. Deoxygenation, a result of ocean warming and increased nutrient concentration, creates hypoxic or anoxic conditions lethal to many marine species.

In Greece, the impact of climate change on marine life has been notable. Since the mid-1990s, catches of local fish such as sardine, anchovy, hake, and red mullet have dramatically fallen inGreek waters, with climate change identified as a key factor. This decline threatens Greece's traditional way of life and the country's economy, where fisheries and maritime sectors accountfor around 3% of the GDP. To mitigate these issues, marine spatial planning, including the creation of protected areas, is being considered. This planning must account for the activities of various maritime sectors, including aquaculture and shipping.

There's evidence of marine populations moving towards higher latitudes, although migrationpatterns are complex, making effective and sustainable marine planning challenging. Changes in the chemical composition of Greece's territorial waters due to increased carbon dioxide levels are expected, affecting the skeletal growth of key marine species and impacting the entire food chain.

Efforts are being made to support fisheries in Greece's territorial waters, with research institutes like the Plymouth Marine Laboratory and the Hellenic Centre for Marine Research joining forces to understand the changing marine ecosystems and their effects due to climate change. They aim to identify areas sensitive to climate change and those that might be more resilient to aid in effective marine spatial planning.

These findings and efforts underscore the importance of understanding and addressing the impacts of climate change on marine ecosystems, not only for biodiversity conservation but also for the sustainability of fisheries and related economic activities in regions like Greece.

The statistics on the impact of climate change on marine ecosystems, particularly in the context of the European Union and Greece, are quite detailed and multifaceted. Here are some key figures:

Ocean Warming: The average temperature of the seas has warmed by 0.88°C from 1850-1900 to 2011-2020. This warming trend is expected to continue, impacting marine life's metabolism and distribution.

Ocean Acidification: Since the pre-industrial era, ocean acidification has increased rapidly, with pH dropping by approximately 30%. This affects the ability of organisms like corals and molluscs to maintain their structural integrity.

Deoxygenation: The global ocean is projected to lose 3-4% of its oxygen by 2100 due to warming and other factors. This loss of oxygen can lead to the expansion of hypoxic or anoxic conditions, which are lethal to many species.

Impact on Greek Fisheries: In Greek waters, iconic local fish like sardine, anchovy, hake, and red mullet have seen dramatic declines in catches since the mid-1990s, linked to climate change. These declines pose significant threats to traditional ways of life and the economy in Greece.

Marine Species Migration: Many marine populations are shifting towards higher latitudes due to changing environmental conditions. However, these migration patterns can be complex and pose challenges for marine planning and conservation efforts.

Vulnerability of Marine Ecosystems: The Mediterranean Basin, including Greek waters, is identified as a 'climate change hotspot' due to its vulnerability to warming, acidification, and deoxygenation. The region faces significant risks to its marine ecosystems and biodiversity.

3.3 Mitigation Strategies

Mitigation strategies aimed at addressing climate change and its impact on marine ecosystems have increasingly focused on marine spatial planning (MSP) and the establishment of climate-resilient Marine Protected Area (MPA) networks.

Marine Spatial Planning (MSP): MSP is a strategic tool that helps in managing human activities in marine areas to reduce conflicts among uses, facilitate compatible uses, and protect marine ecosystems from overuse. It's a key approach in ecosystem-based management and allows for a comprehensive assessment of the various demands on marine areas, including conservation, energy, and resource extraction. MSP enables efficient allocation of space for different activities in marine areas while ensuring environmental sustainability and biodiversity conservation.

Climate-Resilient MPA Networks: The establishment of climate-resilient MPA networks is another crucial strategy. These MPAs are designed to be effective under changing climatic conditions and can help in safeguarding biodiversity, protecting habitats, and sustaining ecosystem services that are vital for the marine environment and human wellbeing. Climate-resilient MPAs focus on preserving a range of habitats, allowing for species migration and adaptation, and enhancing the overall resilience of marine ecosystems to climate change impacts such as ocean acidification, sea level rise, and temperature changes.

These strategies represent a comprehensive approach to manage and protect marine ecosystems in the face of climate change. They are crucial for achieving SDG 14 by ensuring sustainable use and conservation of marine resources, thereby preserving ocean health, and supporting the livelihoods and food security of communities that depend on these ecosystems.

3.3.1 Impact of Climate Change Mitigation Strategies (2015-2023) in SDG 14

The impact of climate change mitigation strategies from 2015 to 2023 has had significant implications for Sustainable Development Goal 14 (SDG 14), which focuses on life below water. The period has seen a heightened global emphasis on climate action, particularly through the Paris Agreement and various national and international initiatives, which indirectly contribute to the conservation and sustainable use of oceans, seas, and marine resources.

The UN High-level Political Forum on Sustainable Development has been crucial in tracking progress on SDGs, including SDG 14. It has identified climate change as a major threat multiplier, exacerbating challenges related to health, poverty, hunger, and, notably, marine life. Climate change directly impacts marine ecosystems, affecting biodiversity, fish stocks, and the overall health of oceans. The reports released during this forum have highlighted how climatechange impacts are undermining progress on sustainable development, threatening to reverse the gains made in improving people's lives and conserving marine environments.

The United Nations Development Programme (UNDP) has emphasized the importance of scaling up climate action to achieve the SDGs. Their reports and initiatives demonstrate the critical interlinkages between climate change and sustainable development. Specifically, they highlight the role of climate action in delivering on the SDGs and provide examples of ongoing work on the ground towards this end. This aligns with the understanding that actions to mitigate climate change, such as reducing greenhouse gas emissions and enhancing carbon sinks, also support the goals of SDG 14 by creating a more stable and sustainable environment for marine life.

Overall, these developments underscore the importance of integrated approaches in climate change mitigation that consider not just the immediate impacts on temperature and weather patterns, but also the broader implications for marine ecosystems and the resources they provide. The focus has been on developing comprehensive strategies that address both mitigation and adaptation, recognizing the interconnected nature of these challenges and the need for holistic solutions.

4. Challenges and Strategies in Implementing Marine Spatial Planning and Climate-Resilient MPAs in Greece

Greece has been actively working on marine spatial planning (MSP) and the establishment of climate-resilient Marine Protected Areas (MPAs) as part of its strategy to mitigate the impacts of climate change on marine ecosystems. However, as of the information available, Greece has not yet fully implemented a comprehensive MSP. The ongoing MSP process in Greece also addresses MSP-related issues in "Special Frameworks for Spatial Planning" that cover specific economic sectors, including aquaculture and tourism. These sectoral plans incorporate spatial planning guidelines for land-based, coastal, and marine segments of each sector.

In response to the declining catches of local fish like sardine, anchovy, hake, and red mullet, which have been linked to climate change, Greece recognizes the importance of MSP in managing its marine resources effectively. MSP involves mapping out areas of concern and managing the ocean in a sustainable manner, including the creation of protected areas. The challenges presented by the changing ocean environment and species distribution make

effective and sustainable marine planning particularly challenging. This is crucial for Greece, where the fisheries and maritime sectors account for around 3% of the country's GDP.

To address these challenges, initiatives like the Plymouth Marine Laboratory and the Hellenic Centre for Marine Research collaboration have been established. They focus on understanding the complex ecosystems below the ocean surface and how they are affected by climate change.

This includes identifying areas sensitive to climate change and those that might be more resilient, which is vital for effective spatial planning from both environmental and human perspectives. Such efforts are crucial for developing climate-smart marine protected areas and supporting the sustainable use and management of marine resources in Greece.

Overall, while Greece is progressing in its efforts to implement MSP and establish climate resilient MPAs, there is an ongoing need for comprehensive and effective strategies to address the challenges posed by climate change to its marine ecosystems and the dependent economic *se*ctors.

4.1 Future Policy Directions for Sustainable Development in the EU and Greece

The pursuit of sustainable development within the European Union (EU), with a specific focus on Greece, calls for a nuanced understanding of both regional and global dynamics. This expanded section builds upon previous analyses to offer a detailed exploration of future policy directions that can enhance the effectiveness of sustainability initiatives.

Enhancing Local Governance Models

Local governance is crucial for effective sustainable development. Enhancing local governance structures in the EU, particularly in Greece, involves empowering local bodies to customize sustainability initiatives, reflecting the European Committee of the Regions' emphasis on local autonomy in policymaking (European Committee of the Regions, 2022).

Fostering Public-Private Partnerships

Public-private partnerships (PPPs) are essential for driving sustainable practices. The EU's Horizon 2020 program illustrates the potential of such partnerships in fostering innovation and leveraging private resources (European Commission, Horizon 2020).

Investing in Green Technologies and Innovation

Investment in sustainable technologies is key to advancing sustainable development. Greece, supported by EU funding initiatives like the LIFE program, can lead in green technologies, particularly in its dominant sectors like tourism and agriculture (LIFE Programme, 2023).

Climate Change Adaptation and Resilience

Adapting policy frameworks to include climate change strategies is vital. The EU's Adaptation Strategy provides a template for Greece to develop climate-resilient approaches, particularly in vulnerable coastal regions (EU Climate Adaptation Strategy, 2021). For Greece, this means enhancing coastal defenses, developing climate-resilient infrastructure, and preserving biodiversity in response to changing climatic conditions.

Balancing Economic Development and Environmental Protection

Harmonizing economic growth with environmental sustainability is crucial. The EU's Green Deal offers a model for such a balance, which Greece can emulate, especially in sustainable tourism (European Commission, The European Green Deal, 2019). Greece's approach to

sustainable tourism serves as a model, illustrating how economic activities can be aligned with environmental stewardship.

Enhanced Regional Cooperation

Strengthening cooperation and knowledge sharing among EU member states is key to effective environmental management. Greece, with its unique maritime environment, stands to benefit greatly from shared marine conservation efforts in the Mediterranean region. Regional cooperation, as seen in the Mediterranean Action Plan under the Barcelona Convention, is critical for effective environmental management, benefiting Greece's unique maritime environment (UNEP/MAP, 2023).

Educational Initiatives and Public Awareness

Raising awareness about sustainability and integrating it into educational curricula can foster long-term environmental consciousness. In Greece, this could involve public campaigns and educational reforms highlighting the importance of sustainable living. Initiatives similar to the EU's Erasmus+ program should be implemented in Greece to foster sustainable education and public awareness (Erasmus+, 2023).

Robust Monitoring and Evaluation

Developing comprehensive monitoring and evaluation mechanisms will be vital to assess the impact and progress of sustainable initiatives. This includes establishing clear metrics for renewable energy adoption, waste reduction, and biodiversity conservation in Greece. The European Environmental Agency's indicators can guide Greece in assessing the impact of its sustainability initiatives (European Environment Agency, Environmental Indicators, 2023).

The future of sustainable development in the EU and Greece is contingent on a coherent and collaborative approach that integrates local governance with broader regional goals. By implementing the recommendations, the EU, particularly Greece, can forge a path towards a sustainable future that balances ecological integrity with economic and social progress. A coordinated approach that combines local initiatives with EU-wide strategies is essential for effective and lasting sustainability.

Conclusions

The key findings of the literature review

Based on the literature review titled "Review of SDG 14: Implementation Strategies and Policies in EU Countries for Sustainable Coastal/Marine Areas and Marine Life," several key findings emerge. The EU's sustainable development journey is marked by a gradual evolution, integrating environmental, social, and economic factors. Early initiatives and policies have shaped its current approach to sustainability, highlighting the importance of policy coherence and stakeholder engagement. The EU has strategically aligned its policies with the UN's 2030 Agenda, emphasizing sustainable development's three core elements. This includes significant policies like the European Green Deal and integration of SDGs into economic and social strategies.

Uniform policy implementation across the EU remains a challenge due to varying political andeconomic landscapes of member states. This is evident in renewable energy adoption and theCommon Agricultural Policy's environmental impacts. EU member states exhibit diverse approaches to achieving Sustainable Development Goal 14 (Life Below Water), balancing marine conservation with socio-economic development. The effectiveness of these policies varies, underscoring the need for regional cooperation and tailored strategies.

The EU's commitment to the SDGs positions it as a global leader in sustainability. Its approach is compared with other regions, revealing differences in centralization and policy adaptation. Greece's policies reflect a blend of local and EU-wide sustainability goals. This includes circular economy transition, sustainable tourism, water resource management, and renewableenergy strategies, addressing both local needs and EU directives. Empowerment of local governance in Greece is central to its sustainable development strategy. This ensures that initiatives resonate with local needs while aligning with broader EU goals.

In conclusion, the literature review reveals that the EU, and Greece in particular, have made significant strides in sustainable development, balancing global directives with local needs. Challenges in policy coherence, stakeholder engagement, and regional disparities remain keyareas for further improvement.

References

Agterbosch, S., Meertens, R.M., and Vermeulen, W.J.V. (2009) The relative importance of social and institutional conditions in the planning of wind power projects, *Renewable andSustainable Energy Reviews,* pp. 393-405.

Bäckstrand, K. (2006) Multi-stakeholder partnerships for sustainable development: Rethinking legitimacy, accountability, and effectiveness, *European Environment*, 16(5), pp. 290-306.

Barnett, J. et al. (2019) Ocean Governance and Sustainable Development: Implementing SDG 14, *Ocean Yearbook*, 33, pp. 1-36.

Bello-Bravo, J. (2016) Localizing the SDGs for effective implementation, *Journal of Global Development*, 7(1), pp. 51-67.

Borrás, S. and Radaelli, C.M. (2011) The European Union governance of sustainable development: policy instruments and market-based approaches, *Journal of EnvironmentalPolicy & Planning*, 13(1), pp. 1-22.

Burns, C. (2013) The European Parliament: Environmental Champion or Policy Laggard?, *Environmental Politics*, 22(6), pp. 960-980.

Carter, L.N. and Thompson, M.E. (2022) Environmental impact assessments in marine settings: case studies from the North Sea, *Marine Environmental Research*, 99, pp. 50-65.

Community Conservation Research Network (2023), *Community-led marine conservation in Europe*.

Easterly, W. (2019) The tyranny of experts: Economists, dictators, and the forgotten rights of the poor, Basic Books, New York, NY.

European Commission (1992) *Fifth Environmental Action Programme: Towards Sustainability*, Brussels: European Commission.

European Commission (2008) *Marine Strategy Framework Directive (2008/56/EC)*.European Commission (2019) *Report on the state of the EU fishing fleet*.

European Commission (2020) *Circular Economy Action Plan*. European Commission (2020) *EU biodiversity strategy for 2030*.European Commission (2020) *Farm to Fork Strategy*.

European Commission (2020) *Subsidiarity and proportionality*.European Commission (2020) *Urban Agenda for the EU*. European Commission (2021) *Common Agricultural Policy*.

European Commission (2021) *Eurostat report on SDG indicators*. European Commission (2021) SDG indicators for the European Union European Commission (2021) *SDG indicators for the European Union*.

European Commission (2024) *Maritime Affairs and Fisheries Report*.

European Environment Agency (2008) *Marine Strategy Framework Directive*.

European Environment Agency (2018) *European waters: Assessment of status and pressures*. European Environment Agency (2020) *Greece water management*.
European Environment Agency (2021) *Greece – Building resilience*.
European Environment Agency (2023) *Europe's environment: An assessment for sustainable development*.
European Environment Agency (2023) *The state of the environment in the EU*.
European Environment Agency. (2020) *State of Europe's Seas.* EEA Report No 3/2020, Publications Office of the European Union, Luxembourg.
European Marine Board (2024) *Evaluating marine policy effectiveness in the EU*. Eurostat (2023) *Sustainability in the EU: A statistical overview*.
Fioramonti, L. and Kimunguyi, P. (2011) The European Union's development policy: a balancing act between 'normative' and economic interests, *World Development*, 39(6), pp. 985-996.
Harvey, E. et al. (2020) Evaluating the Effectiveness of the MSFD as a Tool for Marine Conservation, *Marine Policy*, 117, article 103957.
Henley, J. and Patterson, K. (2024) Economic impacts of marine environmental regulations on small island economies, *Journal of Marine Economics and Policy*, 8(2), pp. 134-153.
Jensen, L. et al. (2020) Microplastics in European Coastal Environments, *Environmental Pollution*, 258, article 113707.
Keukeleire, S. and Delreux, T. (2014) The European Union's global climate leadership: from Copenhagen to the Paris Agreement, *European View*, 13(2), pp. 219-227.
Kraemer, L.A. and McGlade, K. (2006) The European Union and Environmental Policy, in Jordan, A. and Adelle, C. (eds.) *Environmental Policy in the European Union: Contexts, Actors and Policy Dynamics* (3rd ed.), London: Earthscan, pp. 52-68.
Lenschow, A. (2010) Environmental Policy: Contending Dynamics of Policy Change, in Wallace, H., Pollack, M.A., and Young, A.R. (eds.) *Policy-Making in the European Union*(6th ed.), Oxford: Oxford University Press, pp. 307-330.
McCormick, J. (2001) *Environmental Policy in the European Union*, Palgrave Macmillan, Basingstoke.
Morrison, T. & Greenfield, L. (2021) Navigating conflicts in marine spatial planning: comparative approaches in the European Union, *European Journal of Spatial Development*, 54(1), pp. 88-104.
Nilsson, M. et al. (2012) Understanding Policy Coherence: Analytical Framework and Examples of Sector-Environment Policy Interactions in the EU, *Environmental Policy andGovernance*, 22(6), pp. 395-423.
O'Neill, K., Fernandez, M., Herzog, L. and Jørgensen, D. (2018) Comparative marine conservation policies: EU and Australia, *Marine Policy*, 92, pp. 178-185.
Pedersen, C., and Khare, A. (2020). *Technology as a Catalyst for Achieving the Sustainable Development Goals*. Routledge.
Rodriguez, A.P. and Jenkins, S.R. (2023) Management and effectiveness of marine protected areas in the Mediterranean: lessons for policy makers, *Ocean and Coastal Management*, 198, pp. 12-29.
Smith, G. and Daniels, J. (2021) Innovative approaches to sustainable fisheries: a European perspective, *Journal of Environmental Management and Sustainability*, 35(4), pp. 1124-1141.
United Nations. (2015). *Transforming our world: the 2030 Agenda for Sustainable Development*.
UNU-IAS (2018). *The Satoyama Initiative*. United Nations University Institute for the Advanced Study of Sustainability.