

# Adapting the legal framework of natural marine resources management to climate disruption: The case of Greece

Vicky Tzatzaki

*Special Secretariat for Water, Hellenic Ministry of Environment and Energy*

## Abstract

The impacts of climate change on marine resources are well known and demand mitigation and adaptation measures in order to protect the ecosystems. This entails more than simply altering management practices; it requires altering goal setting and managing transitions to new ecosystemic conditions. In the European Union, the main legal tool for protection of the marine environment is the Marine Strategy Framework Directive. Greece, as a member state of the European Union, has transposed the Marine Strategy Framework Directive into its national legal order and has developed legal structures to protect its marine resources from various threats, including climate change.

The present paper aims to present the legal and policy management tools in Greece, relevant to implementation of the Marine Strategy Framework Directive and climate change adaptation. For methodological reasons, the paper is divided into two parts: The first part deals with those legal tools that apply to an initial assessment of the environmental quality of Greek marine waters, while the second part analyzes legislative activities pertinent to the design and implementation of programs and measures. The aim of the national legislation is to maintain the ecosystemic integrity of the marine waters of Greece and to preserve the unique characteristics of the aquatic environment with respect to present and future generations. However, the analysis shows that a holistic legal framework demands explicit provisions for climate change impacts, while the existing framework focuses primarily on anthropogenic pressures on the marine environment.

**Keywords:** *climate change; marine ecosystems; mitigation; adaptation; Marine Strategy Framework Directive; good environmental status*

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\*Correspondence to: Vicky Tzatzaki, v.tzatzaki@gmail.com

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## I. Introduction

Water, in its natural form, does not recognize boundaries; the same applies to climate change and its impacts on natural resources. Climate disruption affects *inter alia* the conservation of marine resources by triggering changes in biological, physical and chemical processes, which calls upon states to adopt effective management strategies. Due to its vital importance for humans, ecosystems and economic development, the protection of the marine environment from the detrimental effects of climate change constitutes a challenge which is on the forefront of international, regional and national policies.

Apart from the ecosystems, the aforementioned policies are also affected by changes in climate. Adaptation requires more than simply altering management practices; it requires altering goal setting and managing transitions to new ecosystemic conditions.<sup>1</sup> In 2008, the European Union adopted the Marine Strategy Framework Directive,<sup>2</sup> which establishes a framework within which Member States shall achieve or maintain good environmental status in the marine environment by the year 2020 at the latest.<sup>3</sup> According to the preamble of the Marine Strategy Framework Directive:

In view of the dynamic nature of marine ecosystems and their natural variability, and given that the pressures and impacts on them may vary with the evolvement of different patterns of human activity and the impact of climate change, it is essential to recognize that the determination of good environmental status may have to be adapted over time.<sup>4</sup>

Greece has transposed the Marine Strategy Framework Directive into its national legal order and has developed its marine strategy,<sup>5</sup> bearing in mind the need to protect natural marine resources. The Greek marine waters are part of the Mediterranean Sea, and thus they are oligotrophic and have the physical characteristics of semi-closed seas.<sup>6</sup> Therefore, their ecosystems are more vulnerable to climate change compared to the open ocean; this fact makes their conservation even more challenging, especially if we take into account that they are also subject to other pressures, such as anthropogenic pressures and marine pollution.<sup>7</sup>

Regarding the natural marine environment in Greece, almost all climate change scenarios predict a rise in sea level,<sup>8</sup> which is expected to raise major issues regarding coastal ecosystems. Specifically, climate change modifies the functions of marine ecosystems and the spatial distribution of fish populations. Temperature changes also affect fish-farming.<sup>9</sup> There are even scenarios of sea flooding in the Aegean and the Ionian Seas, due to an expected intensification of extreme storm surges and waves caused by climate change.<sup>10</sup>

The Greek coastal environment is of high biological, geophysical, aesthetic, cultural and economic value, while, at the same time, it constitutes a natural resource and shared heritage for the entire Mediterranean region. In this sense, it is extremely significant to design, implement and evolve policies and strategies adapted to the

ever-increasing implications of climate change, in order to safeguard the marine environment for present and future generations.<sup>11</sup>

The present paper discusses the legal and policy management tools available for the protection of the marine environment in Greece, with a view to responding to climate disruption. It is divided in two parts, followed by a summary of conclusions. The first part deals with the initial assessment of the environmental quality of Greek marine waters and how this assessment is regulated according to the national legal order. The second part focuses on the monitoring programmes and programmes of measures for the achievement or preservation of good environmental status of marine waters. Finally, the conclusion summarizes the initial assessment, the monitoring programmes and programmes of measures, and provides future considerations for ameliorating the legal framework by including explicit provisions on climate adaptation and mitigation.

## **II. Climate disruption and the initial assessment of the environmental status of Greek marine waters**

According to article 5 of the Marine Strategy Framework Directive, Member States must develop a marine strategy for their marine waters at the level of marine regions or marine sub-regions.<sup>12</sup> Every marine strategy requires a preparation phase, which includes an initial assessment of the current environmental status of the waters concerned and the environmental impact of human activities thereupon, the determination of good environmental status for the waters concerned, and the establishment of a series of environmental targets and associated indicators.<sup>13</sup>

First of all, the initial assessment of the environmental status of the marine waters of Member States must take into account all existing data and it must comprise the following:

- i) analysis of the essential features and characteristics and current environmental status of those waters, covering physical and chemical features, habitat types, biological features and hydro-morphology;
- ii) analysis of the predominant pressures and impacts, including human activity, on the environmental status of those waters;
- iii) economic and social analysis of the use of those waters and of the cost of degradation of the marine environment.<sup>14</sup>

Furthermore, determining the good environmental status of marine waters is a cornerstone of the Marine Strategy Framework Directive, which requires that Member States determine a set of characteristics for good environmental status, by taking into account the indicative lists of elements set out in Table 1 of Annex III of the Marine Strategy Framework Directive, and, in particular, physical and chemical features, habitat types, biological features and hydro-morphology, as well as pressures

or impacts of human activities based on the indicative lists set out in Table 2 of Annex III.<sup>15</sup>

The Marine Strategy Framework Directive also provides that Member States proceed with the establishment of environmental targets on the basis of their initial assessment. In this context, Member States must establish a comprehensive set of environmental targets and associated indicators for their marine waters so as to guide progress towards achieving good environmental status of the marine environment.<sup>16</sup>

The aforementioned provisions of the Marine Strategy Framework Directive clearly indicate its purpose, which is the achievement of good environmental status in the marine waters of all member states, based on an ecosystemic approach, providing legislative and policy coherence with other agreements in force, such as the United Nations Convention on the Law of the Sea.<sup>17</sup> In this context, more scientific data is required in order to proceed with effective assessment and implementation.<sup>18</sup> In Greece, the first phase of implementation of the European Union legislation, the initial assessment, started with public participation. The information and data collected during consultations with the public were assessed and the characteristics of good environmental status were identified. In this context, a set of environmental targets and indicators was established by a Ministerial Decision,<sup>19</sup> based on the qualitative descriptors of the Marine Strategy Framework Directive.<sup>20</sup> The list of environmental descriptors, provided in the Marine Strategy Framework Directive, as well as the set of environmental targets and indicators provided in the Greek legal order, aim to achieve good environmental status and therefore, preserve the ecosystems of marine waters and control the adverse impacts of human activities. The network of environmental targets and indicators integrates special characteristics of the waters in every Greek marine sub-region.

Specifically, the first qualitative descriptor aims to preserve biodiversity. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.<sup>21</sup> In the framework of this qualitative descriptor, a set of environmental targets has been established, which focuses on certain species that breed and live in the Greek waters, such as the Mediterranean monk seal “*Monachus monachus*” and the loggerhead sea turtle “*Caretta caretta*”. Therefore, the environmental indicators specify characteristics of the populations of these species, such as their size, distribution and areas of reproduction.<sup>22</sup> The second qualitative descriptor provides that non-indigenous species introduced by human activities are restricted to levels that do not adversely alter the ecosystems.<sup>23</sup> The environmental targets in the Greek Ministerial Decision focus on invasive non-indigenous species and their impacts on marine ecosystems, while the indicators deal with frequency of appearance per species.<sup>24</sup>

According to descriptor 3, populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock, while the environmental targets and

indicators relate to the monitoring of fishing mortality, reproductive biomass and fishing exploitation.<sup>25</sup> Environmental descriptor 4 states that all elements of the marine food webs, to the extent that they are known, occur at levels of normal abundance and diversity, and levels capable of ensuring the long-term abundance of the species and retention of their full reproductive capacity.<sup>26</sup> For descriptor 4, the Ministerial Decision provides for environmental targets and indicators relevant to the monitoring and assessment of the ratio between the caught species biomass and the fish catch in total.<sup>27</sup>

Moreover, descriptor 5 requires that human-induced eutrophication is minimized, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters.<sup>28</sup> The environmental targets for this descriptor in the Greek Ministerial Decision deal with a reduction of the organic load and nutrients in marine waters from point and non-point sources, while the indicators refer to chlorophyll concentration, the presence of harmful plant species and the concentration of macrophages.<sup>29</sup> In the same vein, the sixth descriptor provides that sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.<sup>30</sup> The environmental targets aim at the preservation of a balance in benthic macropanidae, and the environmental indicators include monitoring of the percentage of resistant species in relation to the total occurrence of benthic macropanidae.<sup>31</sup> Also, according to descriptor 7 permanent alteration of hydrographical conditions does not adversely affect marine ecosystems.<sup>32</sup> In the Greek legislation, this descriptor comprises an assessment of alterations in vertical stratification with certain key indicators, such as temperature and pressure, while it aims at the prevention of environmental impacts by a permanent alteration in local hydrographic conditions due to anthropogenic activities.<sup>33</sup>

Descriptors 8 and 9 regulate concentrations of contaminants, the first providing that contaminant levels do not give rise to pollution effects and the second that contaminant levels in fish and other seafood for human consumption do not exceed those established by European Union legislation or other relevant standards.<sup>34</sup> For descriptor 8, the target set by the national legislator is a specification of the impacts of pollutants and a determination of their concentration in the waters, sediments, marine organisms and ecosystems, and the environmental indicators are the concentration and types of pollutants.<sup>35</sup> As for environmental descriptor 9, keeping polluting substances in fish and other seafood for human consumption at permissible levels is the target, and the concentration and amount of pollutants in fish and other seafood intended for human consumption are the indicators.<sup>36</sup>

The last two descriptors, 10 and 11, provide that the properties and quantities of marine litter do not cause harm to the coastal and marine environment and that the introduction of energy, including underwater noise, is at such a level that it does not adversely affect the marine environment, respectively.<sup>37</sup> The environmental target of

descriptor 10 is the reduction of marine litter, while the indicator is the distribution, amount and origin of litter found along Greek coasts and in their waters.<sup>38</sup> Finally, the environmental target for descriptor 11 is the control of energy levels so as not to adversely affect the marine environment, and the indicator is the measurement of underwater noise and the assessment of its impacts on species, populations and main functional groups.<sup>39</sup>

On the one hand, climate disruption is not referred to in the main text of the Marine Strategy Framework Directive – apart from the preamble<sup>40</sup> – nor is it found in the indicative list of descriptors for achieving good environmental status. Neither of the indicative lists of characteristics to be taken into account for setting environmental targets includes the notion of climate change. On the other hand, our understanding of climate change and its effects is improving,<sup>41</sup> due to the availability of new data and evolution of existing data, as well as the development of new scientific techniques.<sup>42</sup> Therefore, a coherent regulatory framework, which will encompass this new evidence, is necessary at the European Union level; in its turn, it will oblige national legislators to take into account climate change for the protection of marine ecosystems. In this sense and due to a lack of explicit provisions on climate adaptation, the question of whether the current legal framework, both European and national, constitutes an efficient legislative tool for the protection of the marine environment from the impacts of climate change may arise.

It could be argued that provisions in the Marine Strategy Framework Directive include climate change adaptation scenarios indirectly. For instance, certain environmental descriptors included in the Directive are closely connected and inter-related with climate disruption, even though such a connection is not mentioned explicitly.

Maintenance of biodiversity is a descriptor which could be used as a tool against possible alterations due to climate change. The relationship between climate change and biodiversity and the impacts of the first on the latter are significant.<sup>43</sup> Biodiversity and climate change are interconnected, and at the same time climate change and the loss of biodiversity are twin challenges, threatening to undermine efforts to achieve sustainable development.<sup>44</sup>

The first descriptor on biodiversity refers to climatic conditions; the study of the distribution of the species population in connection with changes in climate reveals shifts due to climate disruption. Climate disruption jeopardizes not only biodiversity but also resources available to humans, while maintaining biodiversity levels and functioning ecosystems is critical in order to mitigate climate change.<sup>45</sup> In the case of marine waters, the resources are the fish and shellfish. According to the Marine Strategy Framework Directive, food species must be in abundance and their reproduction safeguarded. Furthermore, changes in the temperature of the seas could allow some species to expand and establish in new regions, whilst some species that have already been introduced could take advantage of warmer conditions to become more abundant. Some of these non-native species can be considered invasive if

they spread rapidly and cause economic or environmental harm, or harm to human health.<sup>46</sup>

In the Marine Strategy Framework Directive, the maintenance of the biodiversity of the Member States' marine environment is the ultimate aim.<sup>47</sup> Taking this into account, the impacts of climate change on biodiversity reduction or loss are already regulated. However, are references to climate change in the biodiversity provisions and the preamble sufficient so as to claim that climate change effects can be tackled through implementation of the Marine Strategy Framework Directive?

The vulnerable marine ecosystems of the Mediterranean require a robust and resilient regulatory framework, given that climate change is underway and affects every realm of the environment. Sea temperatures in the area are increasing and extreme climatic events are becoming more frequent.<sup>48</sup> Due to the special features mentioned above, the marine waters of Greece, as part of the Mediterranean, allow different pressures, impacts and disturbances to interact and the effects of climate change obtain wider dimensions.

So far, implementation of the Marine Strategy Framework Directive on a national level has proven to be efficient; however, a regulatory framework that would encompass climate adaptation scenarios, when setting the initial assessment, seems to be a necessity for the near future, since climate change is rapid and compelling.<sup>49</sup> Following the example of the European Union Directive, the effects of climate change are not included in the Ministerial Decision, at least not explicitly. Given the fact that some of the changes in biodiversity, species distribution and abundance could be naturally induced, with regards to climate, a distinction between the effects of human impacts and those caused from climatic variability would be useful. As such, each case could be examined separately, albeit with the same purpose: to mitigate adverse climate change effects.

For the next implementation cycle of the Marine Strategy Framework Directive in Greece, it is important that national legislators follow a holistic approach, which takes into account the synergies between climate change and human-driven effects, such as pollution and over-exploitation of fisheries.<sup>50</sup> Therefore, future amendments to the Greek Ministerial Decision, necessary for the next implementation cycle of the Directive, should comprise a new set of targets and indicators that integrate climate change impacts in order to achieve good environmental status of the marine waters of Greece.

### **III. Climate disruption and the monitoring programmes and programmes of measures for continuous evaluation of the environmental status of Greek marine waters**

According to the Marine Strategy Framework Directive, Member States shall establish and implement monitoring programmes for continuous assessment of the environmental status of their marine waters. These monitoring programmes constitute

legislative instruments, based on the initial assessment and on the indicative lists of characteristics, pressures and impacts and environmental targets.<sup>51</sup> Development of the monitoring programmes requires data which covers all thematic areas relevant to the marine environment; data collected from other monitoring programmes should also be used, such as those from the Water Framework Directive,<sup>52</sup> Birds Directive<sup>53</sup> and Common Fisheries Policy.<sup>54</sup>

Data availability has always been a major challenge for marine assessment and monitoring, since methods, such as sampling and direct observations, may prove to be adequate for coastal but not for offshore areas.<sup>55</sup>

In the case of climate change, data is abundant but highly complex,<sup>56</sup> due to the continuously changing nature of the object of observation. This not only raises in its turn complex scientific questions,<sup>57</sup> but makes it even more challenging to understand their impact to a full extent, especially when this data is analyzed and studied along with monitoring data for the marine environment. In this context, implementation of monitoring programmes in terms of climate adaptation strategy is an issue that requires attention.

Given the technical nature of monitoring programmes, the Marine Strategy Framework Directive provides a list of requirements for Member States, regarding *inter alia* the nature and generation of information, corrective measures, the comparability of assessment and thus, the comparability of information and an assessment of major changes in environmental conditions, as well as pressures and impacts on the marine environment.<sup>58</sup>

Law 3983/2011, which incorporates the Marine Strategy Framework Directive into the Greek legal order, provides that monitoring programmes for ongoing assessment of the environmental status of marine waters must be duly coordinated. Special emphasis is put on Mediterranean sub-regions that extend beyond the national territorial sea in order to achieve coherence in monitoring, while potential trans-boundary impacts are also taken into account. According to the aforementioned Law, monitoring programmes are approved by Ministerial Decision,<sup>59</sup> this separate procedure is justified by their technical nature and the fact that they regulate a separate field for the ongoing assessment of the environmental status of marine waters.

On this basis and after six months of public consultations, a relevant Ministerial Decision was published,<sup>60</sup> followed by a Joint Ministerial Decision, providing for the competent authorities and their obligations in order to implement the monitoring programmes.<sup>61</sup> According to the Ministerial Decision, the monitoring programmes cover the requirements of the eleven descriptors for determining the good environmental status analyzed above. Moreover, they include information on networks of the sampling locations, sampling frequency (times per year) and type of scientific parameter for every descriptor, according to the Guidance Documents of the European Union.<sup>62</sup>

The Annex of the Ministerial Decision includes the coordinates of the sampling locations for each parameter of the descriptors, as well as the sampling frequency.



Existing networks designed for the implementation of other relevant Directives have also been taken into account. Of major importance are the NATURA network of the country, the network of coastal stations designed under the Water Framework Directive, and the National Fisheries Data Collection Programme according to the common fisheries policy. There is an additional provision for the utilization of national environmental monitoring infrastructures as well as the international environmental monitoring networks.<sup>63</sup> The overall goal is to collect data and information from the monitoring programmes which will allow assessment methods to classify a marine area as reaching or failing to reach the desired status. The pressures and impacts caused by climate change as key transboundary issues are indirectly addressed through the monitoring programmes of the Marine Strategy Framework Directive.<sup>64</sup> New or previously unknown pressures may emerge in a marine region, while ongoing pressures may decrease or cease to apply.

Climate disruption makes the situation even more challenging; it constitutes a pressure *per se* that exacerbates the intensity and impact of other pressures, and can change the functioning of ecosystems. A marine region's environmental state may degrade, and identification of the causes requires more data and information as well as investigative monitoring. The frequency, intensity and whole rationale of monitoring programmes may need adjustment to better respond to ongoing developments.<sup>65</sup> The effectiveness of such adjustments relies heavily on the collection, analysis and interpretation of available and new data on anthropogenic pressures, which include information on climatic variabilities.

Climate alterations and their ecological manifestations call for a holistic interpretation of monitoring data, which cannot be achieved without taking into account the effects of climate change. On this basis, the existence of adequate monitoring programmes able to describe large-scale changes in climatic conditions together with datasets on anthropogenic pressures on marine ecosystems is a prerequisite for assessing the environmental status of the seas.<sup>66</sup> Such integrated monitoring programmes, established through legal and policy mechanisms, are of vital importance for sustainable management of the Mediterranean Sea. Through their implementation, possible ecosystem responses to both human and climate change impacts will emerge and demand consideration when defining necessary programmes of measures in order to achieve or maintain good environmental status in marine waters.

According to the Marine Strategy Framework Directive, the next step after adoption of monitoring programmes is adoption of programmes of measures. Specifically, Member States set the measures which need to be taken in order to achieve or maintain good environmental status in their marine waters, giving due consideration to sustainable development, as well as to the social and economic impacts of the measures envisaged. In this sense, the national programmes of measures must be cost-effective and achievable, and Member States shall carry out impact assessments prior to adoption of new measures.<sup>67</sup> Finally, programmes of measures shall include

spatial protection measures in order to represent networks of marine protected areas, and the diversity of these ecosystems adequately.<sup>68</sup>

Approval of programmes of measures for marine waters in Greece requires certain administrative procedures, as envisaged in Law 3983/2011.<sup>69</sup> First of all, public consultation is held on the draft report of the programmes of measures, during which participation of all stakeholders is encouraged. Protection of marine waters is of everyone's interest, since the marine environment and quality of the seas are exemplary characteristics, assets for the country and a valuable resource not only for the environment but also for the economy. Public participation through consultation in marine issues stems from the principles of democracy and transparency, and ensures the environmental and economic benefits of marine resources on the basis of inter-generational equity.<sup>70</sup>

Following public consultation, an intergovernmental body comprised of representatives of all co-competent Ministries, the so-called National Committee for Marine Environmental Strategy (NCMES),<sup>71</sup> is consulted on the programmes of measures. The first programmes of measures in Greece were unanimously accepted by the NCMES. For transparency reasons, transcripts of the meeting were signed and published on the internet site of the Hellenic Ministry of Environment and Energy.<sup>72</sup>

The final step is adoption of the programmes of measures through a Ministerial Decision.<sup>73</sup> After concluding this procedure, they constitute an integral and important part of the national strategy for the preservation of marine ecosystems *in toto*.

Safeguarding marine waters in environmental terms is imperative, given the major role that they play in the tourism and recreation sectors of the country's economy. In this sense, the national legal framework for implementation of the Marine Strategy Framework Directive not only has an ecosystemic character, but it also contributes to economic prosperity and social development.

Climate disruption does not only affect ecosystems and the atmosphere, but it also interferes with the economy<sup>74</sup> and society.<sup>75</sup> Interactions between the seas and the climate are more than evident; the seas absorb and store heat, influencing the weather and impacting already existing climate change pressures,<sup>76</sup> while at the same time, changes that occur in the marine environment result in alterations in the atmosphere. This cycle affects major economic sectors such as tourism,<sup>77</sup> agriculture<sup>78</sup> and energy, as well as aspects of life not primarily related to economic activity, such as environmental quality and security, mortality rates and cultural well-being.<sup>79</sup>

Given the dynamic synergies between the seas and the climate and the pervasive socio-economic consequences of climate disruption,<sup>80</sup> the call for policy action with both adaptation and mitigation measures is strong. Therefore, ecosystem resilience<sup>81</sup> has evolved into policy and strategy resilience. In this context, programmes of measures must address human pressures, as well as climate change impacts and thus, be flexible and adaptive.<sup>82</sup> In other words, in order to manage ecosystems sustainably, it is important to understand how they react to this combination of impacts and pressures.<sup>83</sup>

The programmes of measures in Greece meet the requirements of the Marine Strategy Framework Directive and follow its ecosystemic approach. As explained above, adaptation measures related to climate change are not found in the Directive or in the national legislation; in this sense, the programmes of measures focus mainly on the adaptation and mitigation of anthropogenic effects on the national marine waters.

It should be noted that in the Marine Strategy Framework Directive and Law 3983/2011, there are provisions for deviating from the achievement of good environmental status when certain reasons occur.<sup>84</sup> These reasons include *inter alia* “natural causes” and “force majeure”. In such cases, national measures may prove to be insufficient. Reference to “natural causes”<sup>85</sup> and “force majeure”<sup>86</sup> could serve as a vehicle for adopting ad-hoc measures for adaptation to climate disruption and mitigation of climate change impacts. However, even if these exceptions are triggered, there is still an unclear distinction between anthropogenic causes and climatic causes, due to the fact that the general legal framework in force does not distinguish whether measures to be taken stem from reactions of the marine environment to each of the aforementioned causes.

Thus, there is still room for improvement regarding the inclusion of climate change impacts in the next cycle of programmes of measures. The acceleration of climate and environmental changes in the Mediterranean region implies numerous risks and therefore, it is crucial to introduce new and update existing adaptation and mitigation policies<sup>87</sup> in order to manage transitions to new ecosystemic conditions. Climate change demands special accommodation of policy, since the occurrence of climate change events and the gravity of their effects is of high intensity. When developing programmes of measures, it is imperative to identify drivers behind changes that resulted in insufficient – in terms of climate adaptation – indicators, targets and measures, so new targets can reflect the new climate regime.<sup>88</sup>

In this direction, revision of the initial assessment should also include an assessment of the risks associated with climate change.<sup>89</sup> Climate change risk assessment will assist in identifying the vulnerability of marine ecosystems, their exposure to impacts of climate change and underlying hazards.<sup>90</sup> This type of identification requires the right indicators, and in the case of the Marine Strategy Framework Directive, an interpretation of the existing indicators as both anthropogenic pressures as well as climate disruption impacts. In order to do so, the acquisition, review and preparation of data for the risk assessment is necessary; this data, both quantitative and qualitative, linked to the indicators allows for an analysis and modeling of risk. Thus, the resilience of the existing management strategies can be tested and new strategies can be introduced where necessary.

The measures produced after the climate change risk assessment will constitute the mitigation and adaptation efforts of policymakers, aiming at decreasing the vulnerability of marine waters –either by decreasing their sensitivity or by increasing their capacity- or their exposure to climate change signals.<sup>91</sup> The revised measures,

will intersect with other policy domains, such as the economy, and they will have both short-term and long-term implications, creating sustainable and integrated policy.<sup>92</sup> Such policy constitutes a reflection of the precautionary principle,<sup>93</sup> a cornerstone principle of European Union environmental law, also enshrined in the Marine Strategy Framework Directive.<sup>94</sup>

#### **IV. Conclusion and considerations for the future**

The sea has always played a pivotal role for Greece; as a landscape, it is the main characteristic of the country along with its islands; as a resource, it contributes to the country's social and economic development. Tourism, fisheries and other recreational activities at sea constitute Greece's 'blue economy'. This economy is in turn part of a bigger framework aimed at the sustainable development of the seas and not relying solely on their market exploitation. On the contrary, it also provides for their conservation, as well as for the protection of their resources.

Anthropogenic pressures on the marine environment are standard and up to a certain level predictable. Unfortunately, they do not stand alone, but occur in combination with the impacts of climate change, such as higher temperatures, sea level rise and acidification, changes in regional precipitation patterns and in the intensity of extreme weather events. The marine environment is being severely affected by climate change, since the alterations in physical and ecological processes increase the vulnerability of the ecosystems and reduce their resilience to pressures.<sup>95</sup>

Specifically, the Mediterranean Sea is warming at two to three times the rate for the global ocean and climatic models predict rapid mean warming in the region along with extremely high temperature events, all affecting the marine environment. Its position on the boundary between two climatic regimes – the arid climate of North Africa and the temperate and rainy climate of central Europe – and its semi-closed nature, restricting hydrological exchange with the ocean, render it climate vulnerable.<sup>96</sup>

Bearing in mind that the marine environment is already fragile, due to insensible human practices, such as urban sprawl and unregulated fishing, holistic and integrated strategies for its protection are required. In the European Union the main tool for the protection of the marine environment is the Marine Strategy Framework Directive, which explicitly states that the marine environment "is a precious heritage that must be protected, preserved and where practicable restored".<sup>97</sup> In the Greek national legal order, the Directive has been transposed with Law 3983/2011, which actually describes the national marine strategy, while a nexus of Ministerial and Joint Ministerial Decisions regulates more technical issues, such as the initial assessment, monitoring programmes and programmes of measures. The national Law reflects the obligations and requirements of the Directive in general, while the Decisions refine special scientific issues included in the Directive, providing flexibility if amendment is required.

Both the European Union and the national legislation provide for sufficient targets, indicators and measures to be taken in order to safeguard the seas and their resources. However, they focus mainly on the impacts of anthropogenic pressures on the marine environment, leaving aside the effects of climate disruption. Provisions on biodiversity are the only ones that refer to climatic conditions, while there is ambiguity regarding whether notions of “natural causes” or “force majeure” include climate change.

The achievement of good environmental status is an ambitious goal of the Marine Strategy Framework Directive, given the prevailing conditions of these fragile ecosystems, as well as difficulties in the collection and interpretation of data.

Climate change aggravates the impacts of anthropogenic pressures on the marine environment and despite the fact that some of these impacts are anticipated, their extent and location is harder to predict or estimate with certainty. The situation becomes even more challenging if we take into account that the regime in force does not encompass provisions for the protection of marine ecosystems from climate disruption.

In this context, marine strategies –both European and national- need to include mitigation and adaptation scenarios in their policies, in order to reduce the vulnerability of ecosystems to climate change effects.<sup>98</sup> Stable climatic conditions belong to the past, and new practices for the viable management of the marine environment and its resources must be designed. Member States of the European Union are now urged to re-examine their objectives according to the complexity of the climate change related effects and implications.<sup>99</sup>

Consequently, adaptation and mitigation strategies need to be included in the national legal order for the preservation of the marine environment. The existing provisions on impacts from anthropogenic pressures must be combined with specific measures for the protection of marine ecosystems from climate change effects. This combination can result in a holistic and integrated regulatory framework for the conservation of the marine environment. Given the important role of the seas for Greece’s prosperity, this framework can prove to be the right legal tool for their sustainable enjoyment.

## NOTES

1. For the adaptation of management strategies see Vasiliki Maria Tzatzaki and A. Dan Tarlock. “International Water Law and Climate Disruption Adaptation”, in *The UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes*, eds. Attila Tanzi at al. (Leiden: Brill-Nijhoff, 2015), 379–393, 280–318.
2. Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive), Official Journal of the European Union L 164/19, <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0056&from=EN> (accessed September 12, 2018).

3. Ibid., article 1, paragraph 1. Specifically, according to the Marine Strategy Framework Directive the marine strategies of all Member States “shall apply an ecosystem-based approach to the management of human activities, ensuring that the collective pressure of such activities is kept within levels compatible with the achievement of good environmental status and that the capacity of marine ecosystems to respond to human-induced changes is not compromised, while enabling the sustainable use of marine goods and services by present and future generations”. Ibid., article 1, paragraph 3.
4. Ibid., preamble, paragraph 34.
5. The marine strategy of Greece is described in Law 3983/2011 “National strategy for the protection and management of the marine environment-Harmonization with the Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 and other provisions”, *Government Gazette A 144* (2011).
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