

# SUSTAINABLE ENVIRONMENTAL MANAGEMENT OF MARINE REGIONS: THE BLACK SEA CASE STUDY

## ODRŽIVO UPRAVLJANJE OKOLIŠEM U MARINSKIM PODRUČJIMA: PRIMJER CRNOG MORA

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Pregledni članak

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The EU Marine Strategy Directive (2008/56/EC) proposes four marine regions as a political geographic framework for implementation of the Community's environmental policy. This study critically analyzes the state-based approach, which the Directive uses to outline the regions' boundaries. It suggests that environmental sustainability of marine bodies strongly depends on the geographic congruence between their watersheds and the borders of the respective environmental management system, i.e., marine regions have to be environmentally managed within their watersheds. The proposed watershed-based approach also takes into consideration all elements – water, land, and air – of marine regions, which is a *conditio sine qua non* for their integrated and sustainable management. In the case of the Black Sea region in particular, the borders of a watershed-based environmental management system include a much wider set of stakeholder countries and enable a higher level of environmental cooperation among them.

**Key words:** EU marine regions, environmental policy, environmental sustainability, integrated watershed-based management

Direktiva marinske strategije Europske unije (2008/56/EC) predlaže četiri marinska područja kao političko-geografski okvir za primjenu politike o zaštiti okoliša u Europskoj uniji. Ovaj rad kritički analizira pristup koji se temelji na državnim granicama, a kojim se Direktiva koristi za određivanje granica regija. Autor također smatra da održivost okoliša u marinskim područjima uvelike ovisi o geografskom podudaranju između pojedinih sljevova i granicama njihovih sustava upravljanja okolišem, tj. okolišem u marinskim područjima treba upravljati unutar njihovih sljevova. Predloženi pristup koji se temelji na granicama sljevova također u obzir uzima sve elemente marinskih sustava (voda, zemlja i zrak), koji su *conditio sine qua non* za integralno i održivo upravljanje. Crno more je dobar primjer u kojem sustav upravljanja okolišem koji je određen granicama slijeva uključuje puno veći broj zemalja dionika te omogućuje višu razinu suradnje među zemljama vezano uz upravljanje okolišem.

**Ključne riječi:** marinska područja Europske unije, okolišna politika, održivost okoliša, integrirano upravljanje unutar slijeva

### Introduction

An active interstate cooperation to protect the Black Sea environment has united the six littoral states (Bulgaria, Georgia, Romania, Russia, Turkey, and Ukraine) since at least 1992, when they signed the Bucharest Convention (CONVENTION, 1992). In 2007, the eastward expansion of the European

Union (EU) reached the Black Sea and raised the issue of its protection and sustainable use to an all-Europe level. The same year, the EU further developed its European Neighborhood Policy with the "Black Sea Synergy" initiative, which stressed the environment, fisheries, and maritime policy as some of the main areas of trans-boundary regional cooperation (BLACK SEA SYNERGY, 2007). The EU

Marine Strategy Framework Directive accepted the Black Sea, which is facing an "unprecedented ecological disaster" (FIGHT AGAINST HARM TO THE ENVIRONMENT IN THE BLACK SEA, 2008), as the fourth EU marine region, in addition to the Mediterranean, the Baltic Sea and the North East Atlantic (DIRECTIVE 2008/56/EC). The Community will need to adapt the existing institutional cooperation structure to achieve the necessary environmental criteria and enhance regional security at its borders. Bulgaria and Romania - the only EU members, which are also Black Sea littoral states - will have to set the example and lead in setting up a sustainable environmental management system in the marine region.

The EU Marine Strategy Directive does not suggest a method for identification of the external, as well as internal, geographic borders of the marine regions. Boundary definition, however, is a necessary condition for the efficient functioning of any environmental management system, particularly of such magnitude. Regional borders will determine the countries or parts thereof which should necessarily participate in the Black Sea environmental management system, the type and level of their participation, as well as the degree of cooperation that they need to achieve.

The main goal of this investigation is to study from a geographic point of view the compatibility between the Black Sea water body and its environmental management system. On that basis, it aims to identify principles and approaches on which management of the environmental protection of marine regions should rest. To achieve this goal, the paper will first reveal and critically analyze the object of the 2008 EU Marine Strategy Framework Directive – the individual member-states waters - and its approach, which is based on political boundaries and border zones. Next, the paper will review specific characteristics, including unique features, of the Black Sea and reveal the problems for its sustainable environmental management, which stem from the current state-based management approach. Finally, this paper will propose the integrated watershed-based approach to environmental management, as a way to improve its efficiency.

### **The 2008 marine strategy framework directive: a state-based approach to environmental management**

The 2008 EU Marine Strategy Framework Directive aims at achieving good environmental status of the marine environment by the year 2020, per EU-approved criteria, through the development and implementation of respective environmental protection strategies. The Directive instructs the strategies to apply an ecosystem-based approach to the management of human activities, i.e., to manage the anthropogenic pressures and impacts that center on the specific marine ecosystem (DIRECTIVE 2008/56/EC, Paragraphs 8 and 44). The Directive itself, however, is methodologically rather contradictory (e.g., see Article 15 from the Preamble and Chapter 1, Article). Rather than ecosystem-based, its approach is decisively state-based.

The Directive classifies its assumed object - EU marine ecosystems - in three different types: waters under the sovereignty and jurisdiction of member states, waters under sovereignty and jurisdiction of other states, and waters outside state sovereignty and jurisdiction (DIRECTIVE 2008/56/EC). Next, instead of requiring respective strategies designed from the point of view of each specific marine ecosystem and prepared with the help of the respective group of stakeholders, the Directive instructs each EU member to develop its own marine strategy and determine a set of "good environmental status" characteristics for its own waters (DIRECTIVE 2008/56/EC, Article 11).

Marine ecosystems, however, generally belong to more than one state, so marine strategies have to be necessarily trans-state. Separate state-based strategies will hardly be efficient. Furthermore, marine ecosystems are divided ad hoc in zones and only the Contiguous Zone and the Exclusive Economic Zone are targets of the Marine Strategy Framework. The rest of the ecosystems are subject to regulation by two other sets of legal documents: the Community Water Policy – for the territorial sea waters, and the United Nations Law of the Sea – for the, so called, "high seas" (DIRECTIVE 2008/56/EC; DIRECTIVE 2000/60/EC). Designed from the point of view of state governance, these regulations serve a number of diverse interests, which may or may not coincide with protection, preservation, and restoration of marine environments. Such an approach certainly contradicts the principles of integrated ecosystem management.

Additionally, the Directive extends excessively large leeway to the individual member states to decide whether there is "significant risk to the marine environment", or whether "the costs would be disproportionate..." (DIRECTIVE 2008/56/EC, Chapter 1, Article 2.2). Due to the quite different economic, social, and cultural levels of EU member states, their governments are likely to have significant difficulties justifying these kinds of decision on the basis of environmental problems in an area, which could be quite removed from their particular jurisdiction, cultural sensitivities, or political agenda. Finally, the Directive fails to recognize that environmental security is an increasingly important aspect of state and regional security and, in fact, excludes national security activities from its scope of application.

The 2008 EU Directive does call for the individual state strategies to reflect the "overall perspective of the marine region or sub-region concerned" (DIRECTIVE 2008/56/EC, Article 11), which is a step in the right direction. It also acknowledges the transboundary nature of the marine environment and encourages coordination among member states and third countries, as well as using the already established institutional structures and in particular Regional Sea Conventions (see DIRECTIVE 2008/56/EC, Article 13). While these Conventions are certainly good examples of interstate environmental coordination and a promising basis for future work, the Directive state-based approach stakes the success of the respective strategies on coordination among a large number of very different actors - member states, non-EU members, inter-governmental, and non-government stakeholders. Moreover, they will have to abide by EU-devised environmental criteria, methodological standards, and requirements for their joint implementation. Even with EU assistance, implementation of such a convention seems rather problematic.

The state-based approach is certainly a necessary and useful tool for energizing and mobilizing the full potential of the individual countries at the initial stage of planning a marine environmental strategy. However, the challenges of coordination such an endeavor among a multitude of actors with diverse capacities, often with conflicting interests, can hardly be overlooked. Moreover, the sheer magnitude of the geographic scale of marine bodies plus the land areas that affect them, as well as of the enormity of the possible effects of their deterioration, suggest that sustainable environmental management of marine environments

can hardly be achieved at state level. The Marine Strategy Framework only suggests the possibility of EU action at Community level (DIRECTIVE 2008/56/EC, Preamble paragraph 43), but does not seem to have accepted it philosophically and methodologically. Instead of focusing on the health of the whole marine ecosystems, as stated, its basis is the environmental management of separate parts of them: jurisdictional marine areas of individual states.

### **The challenges of application of a state-based approach to Black Sea environmental cooperation**

The state-based approach already has a significant history in the Black Sea environmental management process, dating as far back as at least the Bucharest Convention on the Protection of the Black Sea against Pollution (CONVENTION, 1992). The 2008 European Marine Strategy Framework Directive calls on the six littoral states to raise the level of their environmental cooperation and produce a Black Sea Strategy, which will include a Community-wide set of comparable environmental criteria, methodological standards, and requirements for their joint implementation (DIRECTIVE 2008/56/EC, Article 25). The study of the specific characteristics of the Black Sea, however, demonstrates that the use of a approach, focused on state's Contiguous and the Exclusive Economic zones, will face significant challenges.

First, the Black Sea ecosystem is largely defined by the upper, 150 to 200 meters deep, aerobic layer of the water body. A unique quality of the Black Sea is that it contains the largest anoxic water body in the world. About 90 percent of its total water mass of 538 124 cubic kilometers (Практическая, 1990) is virtually "dead". The complete lack of oxygen is combined with the presence of the poisonous gas "hydrogen sulfide", formed by bacterial reduction of sulfates. The anoxic part of the water body is situated at the sea floor and ends about 150 to 200 meters below the surface.

At the same time, Black Sea is the largest water body in the world with permanent stratification of its water layers (Михова, 2002). While thermohaline circulation brings oxygen even to the greatest depths in the other seas and oceans, in the Black Sea, even during large storms and despite the winter cooling, the maximum direct vertical mixing is limited to about 150 meters (БЛАТОВ ET AL., 1984). A decreasing mixing is noticeable down to 150-200 meters and oxygen and aerobic

organisms are found only to that level. The higher salinity and greater density of the bottom layers limit water circulation below the 200 m horizon. Only the very limited inflow of water from the Sea of Marmara plays a role in the vertical water exchange below the 200-meter upper layer of the Black Sea. Rozhdestvenskii's research shows that the full water exchange of the deeper waters takes about 480 years (ВЪЛКАНОВ ET AL., 1978: 75-78).

A third specific feature highlights Black Sea basin hydro-morphology, which is very close to that of a lake: the narrow (about 0.7 km minimal width) and shallow (a minimal depth of 27.5 m) Bosphorus Strait determines a very low flushing rate. The upper, oxygenated sea layer provides the out-flowing water and, on balance, the largely anaerobic Black Sea loses twice more oxygen-rich water to the Mediterranean than it is gaining (ВЪЛКАНОВ ET AL., 1978: 69).

Thus, for most useful purposes, the Sea is, in fact, rather "shallow", which increases the exposure of the ecosystem to both natural hazards and anthropogenic pressures, lowers its resistance and elasticity to stress, and makes it much more vulnerable than an "average" marine ecosystem. A number of authors (e.g., ÖZSOY ET AL., 1997: xix) point out that, compared to the other EU marine regions, like the Baltic and the North Seas, the Black Sea can offer little resistance to degradation.

Finally, this relatively shallow marine ecosystem has an extremely large watershed. The very high watershed to water surface ratio - over 5:1 - allows the Sea to collect "ten times more water per square meter of surface area than other seas" (CARTER, 1997: 61). Almost a third of continental Europe - and certainly not the part that spends the most on environmental protection - drains into the Black Sea. This includes the second-to-fifth-largest European rivers - the Danube, Dneper/Dnipro, Don, and Dniestr/Dnister. The Danube watershed alone (817 000 square km) is almost twice larger than the surface area of the Black Sea (431 000 square km), while its water input (on average around 202 cubic km per year) is about two thirds of the total river inflow (ATLAS, 2003). The large discharges of the Black Sea rivers determine their high capacity to carry transported material: the sedimentation layer on the Sea floor is ten times thicker than in the Atlantic (МИШЕВ ET AL., 1978: 41). Fresh and oxygenated river waters, as well as sedimentary load, are by far the largest inputs in the Black Sea ecosystem.

The European rivers that flow into the Black Sea are also the continent's most polluted. The Danube alone carries at least 75 percent of the waste water discharges (measured by BOD), 66 percent of the total phosphorus, and 53 percent of the total nitrogen discharge entering the Black Sea (BLACK SEA TRANSBOUNDARY DIAGNOSTIC ANALYSIS, 1997, iv; Keondzhayan, Kudina, and Terehena, cited in BROADUS ET AL., 1994: 40). Polluted water causes eutrophication, which, according to Aubrey (1995) and Mee (1998), is the main factor for anthropogenic damage in the Black Sea. It results from the decreasing water discharge and increasing nutrient delivery by the rivers and, to a much lesser extent, atmospheric transfer (BLACK SEA TRANSBOUNDARY DIAGNOSTIC ANALYSIS, 1997, iv). The large increases in water use in the watershed - for irrigation, urbanization, industrialization, and tourism development - has led to sharp reduction of fresh water input (MANDYCH ET AL., 1991; BRONFMAN ET AL., 1985). Hanley (1990) estimates that dams and irrigation projects reduce the freshwater influx by about six percent (50 cubic kilometers) of the total water inflow annually. The resulting increase in anaerobic conditions includes the much thinner aerobic zone and classifies the Black Sea as an exceptionally ecologically-sensitive water body (МИХОВА, 2002: 256).

In summary, the unique features that characterize the Black Sea describe a marine ecosystem, which is, effectively, much smaller in size, than the actual water body. In addition, it is hosted in a relatively quite shallow, surface layer of water with salinity (around 17 per thousand) twice lower than the global ocean. All of these characteristics ascertain and ecosystem that is exceptionally dependent on the much larger watershed, which provides the majority of the inflow of fresh, oxygenated water, but also its pollution.

The Black Sea watershed, however, encompasses an area much larger than the territories of the six coastal states, which the EU Marine Directive calls upon to cooperate in elimination of the most significant sources of man-induced environmental problems. The signatories to the 1992 Convention and members of the World Bank - and UN - sponsored Black Sea Environmental Program - Bulgaria, Georgia, Romania, Russia, Turkey, and Ukraine - are certainly not without fault in the environmental arena. These states, which have significant experience with state-based approaches to environmental management, also stand to suffer the most from the degradation of the Black Sea ecosystem.



Figure 1 Countries in the Black Sea Watershed in 2012  
Source: Modified from UNEP/GRID-ARENDAL.

The above mentioned coastal states, however, are hardly the only countries that use and affect Black Sea ecosystem resources. In addition to them, sixteen or seventeen countries - Albania, Austria, Belarus, Bosnia and Herzegovina, Croatia, the Czech Republic, Germany, Hungary, Italy, Kosovo (not recognized by the majority of UN Member States), Moldova, Poland, Slovakia, Slovenia, Switzerland, Serbia, and Montenegro - own parts of the Black Sea watershed (Fig. 1) and, therefore, need to be acknowledged as parties responsible for the sustainable management of the Sea.

Rather than a state-based approach, environmental sustainability principles, e.g., the "precautionary" principle that requires states to practice caution in the face of uncertainty

and rectify environmental damage at source, the "polluter pays" principle, the "stakeholders" principles, need to be applied at the geographic scale of the whole marine watershed.

#### A watershed-based approach for sustainable environmental management of marine ecosystems

The state-based concept of environmental management of marine ecosystems confines international cooperation solely to the coastal states. At the same time, public and private users of ecosystem resources and services are often situated far from the sea coast, where the pressures they cause cumulate and multiply. Far-off users

seldom feel responsible to the degree necessary to participate in the environmental protection and rehabilitation activities.

Furthermore, most environmental management systems are created, financed, and operated predominantly at the state level, which makes their structures relatively inflexible, hierarchical, and discriminating in respect to certain stakeholders. Quite often, environmental management systems use the state's regular administrative-territorial divisions to administer natural ecosystems' protection, rehabilitation, and sustainable use, ignoring their natural boundaries. This geographic discrepancy between the damaged or endangered nature areas and the systems which manage them invariably decreases the effectiveness and sustainability of environmental management.

According one of the basic cybernetic principles, in any system of management, the scale of the managing sub-system should correspond to that of the managed sub-system. Therefore, the application of the watershed-based approach to environmental management necessitates, first, bringing the external boundaries of the managing subsystem in congruence with those of the managed subsystem. Scientists could differ over where the actual borders of a marine ecosystem lie and they will certainly be influenced by the purpose for which the managed region is defined. The ecosystem borders, however, definitely have to include all areas of the water body, rather than only those, over which states have certain jurisdiction or can exert their authority.

Marine geosystems, including ecosystems, significantly differ from terrestrial ones which should necessarily influence the principles of their environmental management. The higher dynamics makes their environmental status much more dependent on the surrounding territory where most anthropogenic pressures and impacts originate. Surface and, to a lesser degree, ground waters, as well as air currents play the role of transport infrastructure for the majority of the pollution that affects seas and oceans. That is why it is paramount that a geographic approach which necessarily takes into consideration all elements – water-, land-, and air-based – of marine watersheds is a *conditio sine qua none* for the integrated and sustainable management of marine regions.

This analysis suggests that the territorial organization of marine environmental management should be similar to that of river systems, i.e., it should be watershed-based, rather than rely on the immediate coastal areas only. The application of

the integrated watershed-based approach is even more relevant in the Black Sea case, given the extraordinarily large dependence of that particular marine ecosystem on its watershed.

Another benefit for the inclusion of the whole watershed area in the environmental management of the Black Sea ecosystem involves the required participation of all and any stakeholders to the degree to which they own, use or affect the territory and waters within these limits. A hierarchically flatter, open, functionally dynamic, and spatially flexible management structure will be able to make better use of the wealth of specific knowledge and long practical experience they possess, as well as their direct interests in the protection and sustainable use of the local resources. More importantly, the inclusion of eighteen more states to the six, which already participate in Black Sea environmental management, would make a very significant difference in terms of know-how and funding, which could prove crucial to this ecosystem's environmental health.

#### **Marine regionalization: an instrument of sustainable environmental management of the Black Sea**

The application of the watershed-based approach to environmental management significantly facilitates marine regionalization. The identification of internal boundaries of the marine regions can be used both for scientific, as well as management purposes. Marine regionalization is relatively less researched aspect of Black Sea geography and marine studies, and even less used as an instrument of sustainable environmental management. Due to political, economic, and utilitarian reasons, very few scientific investigations part with the state-based view and study the Sea as a whole (but see ЧЕРНО МОРЕ, 1978). Everyday marine activities also follow closely the respective political administrative marine zones.

In view of the 2008 Marine Strategy Framework suggestion of the relevance of marine sub-regions, however, a Northwestern marine sub-region in the Black Sea will certainly prove rather useful proposition from an environmental management point of view. This sub-region has the potential to concentrate environmental activities in the Black Sea region and its environmental rehabilitation and protection will bring maximum benefit to the whole marine region at least cost. Furthermore, fewer countries, mostly EU members, will have to

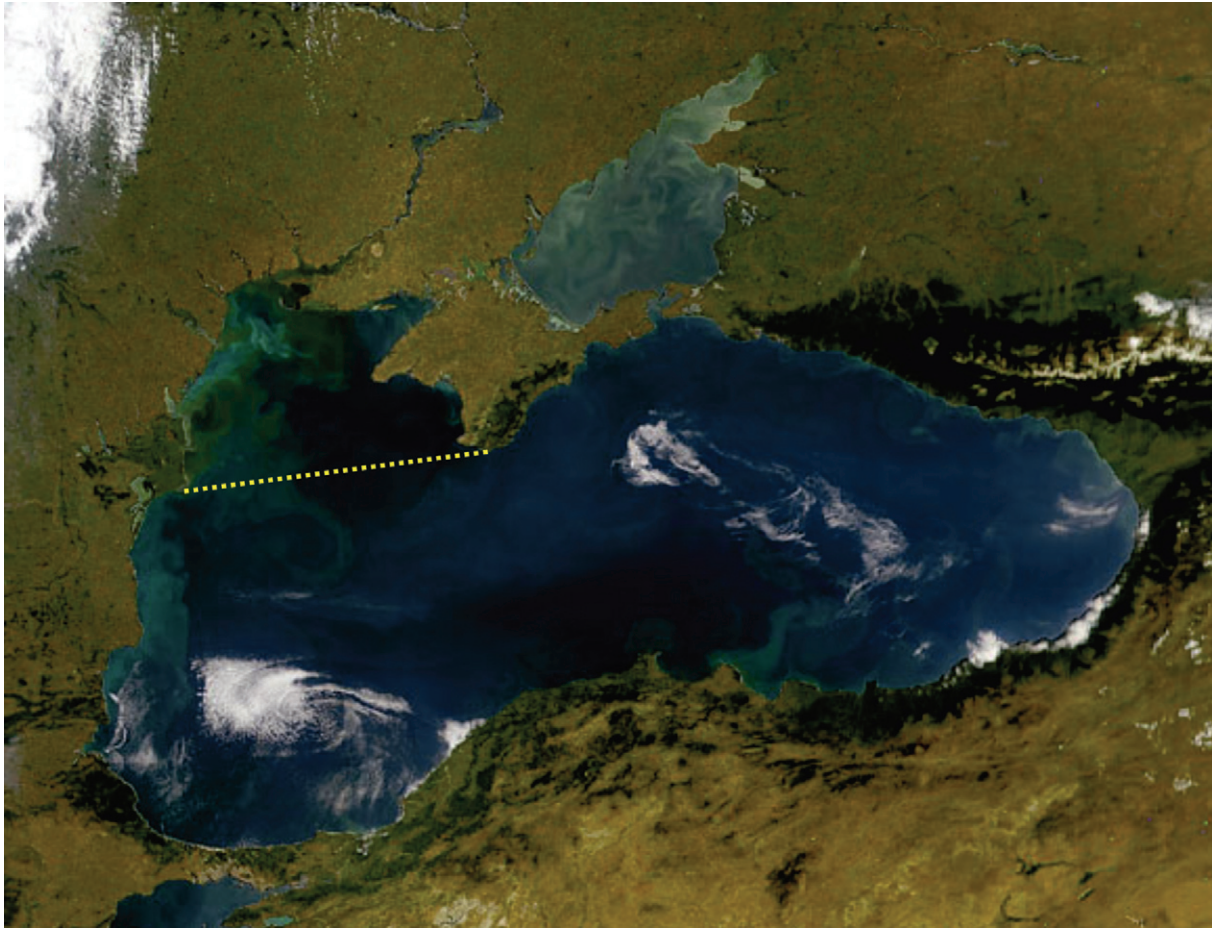


Figure 2 The Northwestern Black Sea Sub-region

Source: Based on an image from NASA, EARTH SCIENCE DATA AND INFORMATION SERVICES CENTER

cooperate in this sub-region, which will additionally facilitate the environmental management process.

The Northwestern Black Sea Sub-region is a large, self-contained area in the respective part of the Sea region (Fig. 2).

Its designation as sub-region is mainly due to the extremely strong influence of the rivers in the northwestern part of the watershed. According to МИХОВА (2002: 251), the rivers flowing in this marine sub-region (Danube, Dnepr/Dnipro, Dniester/Dnister, and other smaller rivers) discharge about 97 percent of the total annual river input (338 cubic km) in the Black Sea. River discharge, especially from the Danube, provides the most significant share (42 percent) of water inflow and, respectively, the pollution in the Black Sea, which would fully justify the application of

this sub-region for a designated pilot project under direct EU supervision and funding (DIRECTIVE 2008/56/EC).

The Northwestern Black Sea Sub-region is naturally shaped like a bay. It is enclosed by land on all sides, except for its southeastern marine boundary, which, according to this proposition, should connect Cape Sarich, the southernmost tip of the Crimean Peninsula in Ukraine, with Cape Kaliakra in Bulgaria (Fig. 2). The 14-degree mean annual temperature of the surface water isotherm almost completely coincides with the thus outlined boundary. About 90 percent of the sub-region is within the shelf zone, which reaches its maximum width of 200-250 km here (МИШЕВ ЕТ АЛ., 1978: 36). This fact explains also to the higher biological productivity and biodiversity of the selected sub-regional ecosystem.

Among the physical geography characteristics which distinguish the Northwestern Black Sea Sub-region is the lowest salinity in the Sea (13 to 15 parts per thousand), due to the high river discharge. The hydro-dynamics of the Black Sea Northwest also facilitates the description of the area as a sub-region with its own gyre, formed by the surface currents to the North of the Western Black Sea Cyclonic Current (ВЪЛКАНОВ ET AL., 1978: 74). The Azov Current, which travels to the west of the Kerch Strait, splits in two after passing to the south of the Crimean Peninsula: its northwestern arm goes towards the town of Odessa, Ukraine, joins the "river" current and continues south. A part of the powerful "river" current runs into the Crimean Current, which goes toward the town of Varna, Bulgaria and returns east to form the southern arm of the northwestern gyre.

In sum, the described combination of physical geography characteristics possesses enough internal homogeneity and differs sufficiently from the neighboring aquatory to sanction the designation of this section of the Black Sea marine region as a separate Northwestern Sub-region for environmental management purposes. This sub-region includes marine waters under the jurisdiction of Bulgaria, Romania, and Ukraine – the last one being the only non-EU member state – and qualifies uniquely to serve as a pilot sub-region in the meaning of Article 14 of the EU Marine Strategy Framework (DIRECTIVE 2008/56/EC). If the watershed-based principle is applied, the majority of participating states would be EU members, which should facilitate the cooperation among them.

## Conclusion

The analysis of geographic complexity and the anthropogenic challenges in the Black Sea region and, particularly, the very high dependence of the water body on its watershed, amply demonstrate the contradiction between the state-based world view of the EU Marine Strategy Framework Directive and principles, like the ecosystem-based approach and watershed-based cooperation in environmental management that it claims to employ. This research posits that environmental policies in marine regions can produce sustainable results only if implemented at the watershed scale, since it embraces almost all natural and anthropogenic elements that affect the respective water bodies. The use of the integrated watershed-based approach in the case of the Black Sea region dramatically increases the number of the stakeholders and, thereby, the funds available for environmental management. This approach institutionalizes greater environmental responsibility, improves the efficiency of environmental management cooperation on all levels, and facilitates joint designation of marine protected areas.

The use of watershed-based marine regions for environmental policy making connotes transformations in principle and scale, but also in the level of complexity of the managing system. In the case of the Black Sea this requires the inclusion of 25 states with very different interests, priorities, economic potential, environmental legislation, and culture. New supra-state, multi-level management institutions have to ensure that stakeholders of greater number and higher diversity achieve the degree of integration necessary for the environmental sustainability of marine regions.

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