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Boat traffic characteristics in three passages of the Aegean Sea: evidence, risk of maritime accidents, strategy for protection

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Abstract

Boat traffic characteristics, in three main passages in the Greek part of the Aegean Sea and neighbouring international waters, were assessed between November 2009 and April 2010. Data on fleet characteristics (vessel type, size flag, hazardous substances carried and speed) passing through these passages were collected on a 24-hour basis using the Mariweb system.

Dense ship traffic was found in all three areas, along with a lack of traffic lanes and routes. In the three passages a total of 7568 vessels were recorded, out of which 65% were cargo boats, 32.3% were tankers and 0.3% were passenger vessels. Out of the total recorded fleet, 50% flew “flags of convenience”. Shipping positions demonstrated odd and erratic movements. These are happening in precarious maritime conditions, where there are sensitive sea areas rich in biodiversity, endangered species and protected habitats.

The areas studied represent three passages of different traffic frequencies, and most likely reflect shipping conditions in other parts of the Aegean. The lack of efficient mechanisms in place to manage, monitor and regulate ship traffic conditions is exacerbated by the fact that there is no established collaboration - plan of action - between Greece and Turkey to deal with potential maritime accidents, which could result in an ecological or socio-economical disaster for both countries.

The Aegean Sea could be protected through designation from the International Maritime Organization (IMO) as a Particularly Sensitive Sea Area (PSSA) with navigation and monitoring measures to be applied. Universities in Greece and Turkey, as well as in other countries, can work together to undertake risk assessments, scientific studies, develop proposals for protection and highlight scientific and conservation reasons for protecting the Aegean Sea. A joint collaboration could promote PSSA designation and protective measures for the whole Aegean Sea.

Keywords

Aegean, Sea, Pollution, Maritime, Accident, Spills, Flags

Introduction

The Mediterranean Sea is considered to be of high risk for major spills from large boats and oil tankers. However, there exists only a medium level of preparedness in the Mediterranean to deal with such accidents (Moller et al., 2003). The main shipping areas in the Aegean Sea between Greece and Turkey, where there exists significant tanker traffic, are considered to be areas with even higher risk of maritime accidents, as over 75% of the shipping accidents recorded in the Mediterranean Sea have been recorded in this region (Anonymous, 2008). The navigation conditions in this part of the Aegean are very precarious, given the high number of islands, islets and submerged rocks in the waters, along with complex meteorological patterns and differing types of vessels in congested areas.

Protecting Seas from Ship Traffic and Ship Operations

In most of the densely trafficked, enclosed or semi-enclosed seas of the world, measures are being applied to better regulate and monitor boat traffic, so as to reduce the possibilities of maritime accidents and ensure pollution prevention compliance from boats. Internationally adopted measures are considered to help prevent maritime accidents and increase shipping safety “for safer shipping and cleaner oceans” (Akten, 2006). The IUCN in 2009, in addressing such problems for the Mediterranean as a whole, stated that maritime traffic governance could be improved through the implementation of International Maritime Organization (IMO)-based instruments (IUCN, 2009).

Under the IMO, 11 sea areas have been designated Particularly Sensitive Sea Areas (PSSA), and have Associated Protective Measures (APMs), with the aim to protect the waters from pollution and collisions caused by shipping activities. Such protective measures include: ship traffic lanes and separation schemes, routing and monitoring systems, reporting systems, pilotage systems, and areas to be avoided. PSSAs with APMs have been designated for areas such as: the Baltic Sea (except for Russia's sovereign waters), the Wadden Sea (Germany, Denmark, the Netherlands), the Great Barrier Reef (Australia), waters around the Florida Keys (USA) and the Canary Islands (Spain).

As some of the above PSSA designations indicate, a single PSSA application can be submitted by multiple countries, in order to achieve PSSA protection status for a sea area that is bordered by more than one country. For example, the PSSA for the Wadden Sea was submitted by and is enforced by the Netherlands, Germany and Denmark. The PSSA in the Baltic Sea was submitted by and is enforced by all countries bordering the Baltic Sea, except for Russia.

The strict shipping regulations in place in the Bosphorus Straits of Turkey are also comparable to such PSSA APMs, including reporting systems for vessels entering and passing through the Straits and continuous monitoring/identification systems (i.e., position; sea speed; port of departure; port of destination, pilotage requests; type of cargo and description of any dangerous, nuclear, and pollution goods; any defects, damage, deficiencies, or other limitations; and ship type, size, overall length, and present position with date and time). When visibility is low, vessels travelling in the Bosphorus Straits are required to constantly provide radar readings, and ships longer than 200 meters are

generally required to travel only during the daytime. The Bosphorus Straits scheme also establishes traffic lanes and speed limits. (Cerrahogullari T.A.S (CTAS), 2010).

Some countries also give heightened scrutiny and inspections to ships bearing “flags of convenience”, in order to combat substandard ships and illegal ship-based pollution. A ”flag of convenience” ship was defined in 1974 by the International Transport Workers' Federation: “where beneficial ownership and control of the vessel is found to lie elsewhere than in the country of the flag the vessel is flying” (ITF, 1974). For example, a ship with a European owner might bear the flag of Panama in order to fall under the jurisdiction of Panama for any violations and wrongdoings for which the ship is accused. The primary incentives to use “flags of convenience” are to circumvent stringent maritime and shipping regulations, and avoid lawsuits, labour laws and accountability for violations committed on the seas, and to perform illegal marine-polluting activities. This is because ”flags of convenience” countries loosely (if at all) regulate and monitor those ships flying their flags. “Flags of convenience” are frequently found on poorly maintained ships, including ships that have inadequate pollution prevention facilities in accordance with international standards and regulations. Therefore, the high occurrence of these ships in any given area of sea greatly increases the risk of maritime accidents.

"Flags of convenience" fill a legal loophole because international maritime law traditionally allows flag state jurisdiction to pre-empt coastal and port state jurisdiction on violation proceedings commenced against flag state boats. (UNCLOS, 1982) The International Transport Workers’ Federation currently lists 32 flags as “flags of convenience”, with Liberia and Panama being the most notorious flag issuers on the list. (ITF, 2010)

Recently, however, international conventions and laws have been trying to combat some of the problems caused by “flags of convenience”. For example, considering laws and conventions applicable to Greece, Greece is a signatory of the Paris Memorandum of Understanding (Paris MOU, 2007). Under the Paris MOU, a central database is kept in France, and shared with MOU signatories, of ships with a history of compliance violations; ships not passing inspections are to be detained at port until the problems are fixed; and ships passing inspection are given compliance certificates that award them with passes from inspections at other MOU ports. In addition, recent EU Directives also try to combat problems of “flags of convenience” (e.g., Council Directives *95/21/EC* and *2002/59/EC*) by increasing emphasis on port inspections and controls. Yet, in the Aegean Sea, problems associated with “flags of convenience” are still present, as evidenced with such ships travelling in sporadic routes, illegally dumping operational pollution into the waters and producing damaging oil slicks.

It is thus of utmost importance for comprehensive management schemes to be developed and applied in both the Greek and Turkish parts of the Aegean Sea, as well as the international waters, in order to bring the whole Aegean Sea region up to date with the most sophisticated measures and best practices available for protecting the Aegean Sea against dangerous and potentially devastating polluting shipping activities.

Why the Aegean Sea Requires Protection

The Aegean Sea requires heightened protection for a multitude of reasons. It holds significant parts of both Greece's and Turkey’s national wealth and heritages. It is a highly

dynamic ecosystem and vital not only for the important populations of marine protected and endangered species, but also for supporting economic, scientific, and cultural sectors.

The Mediterranean Sea is characterised by an unusually high biodiversity supporting between 4% - 18% of the world marine species, although the Mediterranean Sea is only 0.82% in surface area and 0.32% in volume as compared to the world ocean (Bianchi and Morri, 2000). The relatively limited coastal development and industrialisation of the Aegean region makes it today one of the most biodiverse seas of the Mediterranean. The Aegean still supports some of the most important remaining populations of marine mammals and turtles in the Mediterranean, as well as the last remaining extensive areas of protected priority habitats, such as Posidonia seagrass beds and coralline algae reefs.

Yet, the preservation and integrity of the Aegean Sea has survived largely by chance, and is heavily vulnerable to the impacts of shipping. Were pollution levels to increase, or a shipping disaster to occur, the results could devastate all the sectors in Greece and Turkey supported by the Aegean Sea. Such damage could be long lasting and permanent (as demonstrated by other shipping disasters in the world), and would far surpass any economic gains from shipping transport activities in the region.

Methodology

Boat traffic characteristics in three main passages of the Greek part of the Aegean Sea, were recorded on a 24hr basis with the use of the Mariweb system (http://www.mariweb.gr/ecs). The passages monitored (Fig.1) were between Evia – Andros, Mykonos – Ikaria and Ikaria – Samos. Data collection was carried out between November 12, 2009, and April 29, 2010.

For each vessel, the length (in meters), type of vessel (cargo, tanker, and passenger ship), flag type (national flags, flags of convenience, flags from countries with loose enforcement of international laws & regulations) and speed (in knots) were recorded.

The total number of vessels that went through each passage was recorded, from which the percentage of each type of vessel and flag was calculated. The percentage of cargo ships carrying hazardous substances was also calculated where data was available, namely between 12/11/09 – 17/01/10.

The total number of vessels recorded from all three passages between November 2009 and April 2010 was 7568.

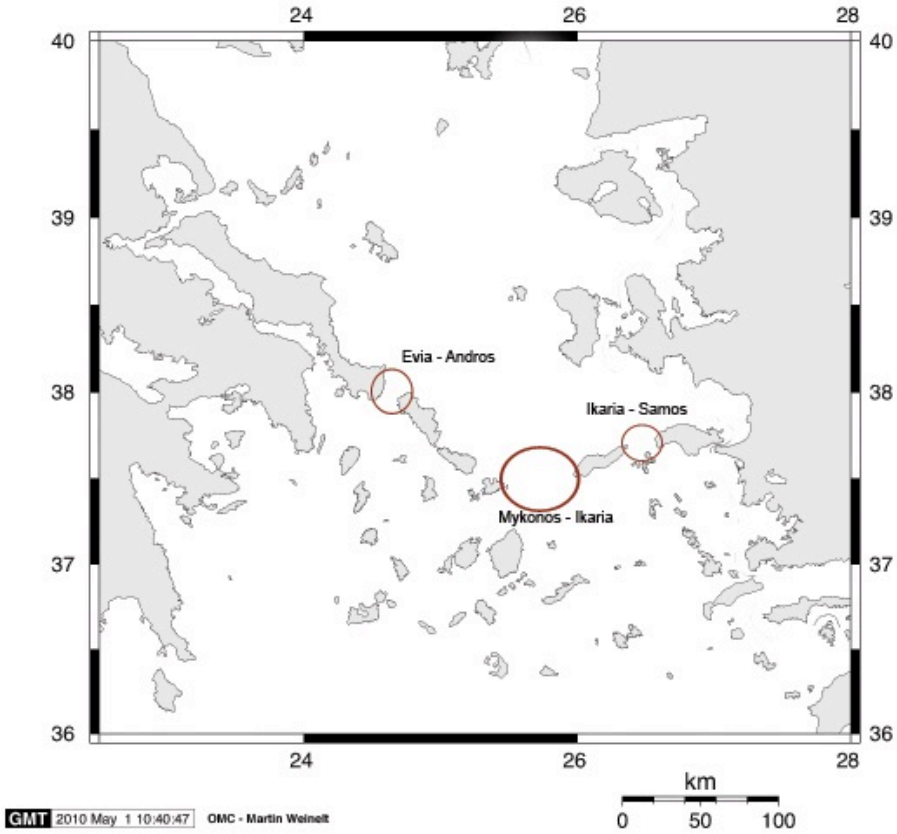

Figure 1: The 3 main passages in the Aegean Sea (Evia - Andros, Mykonos – Ikaria and Ikaria – Samos) from which data was recorded between November 2009 and April 2010 (Map created online at http://www.aquarius.geomar.de using Generic Mapping Tools)

Ship Type:

In the Evia –Andros passage a total number of 5566 vessels were recorded, out of which 4038 (75.5%) were cargo boats, 1429 (25.7%) were tankers, 4 (0.1%) were passenger boats and 95 (1.7%) were of an unknown type (Fig.2).

The cargo boats travelling through this passage recorded a range in speed between 0.3 and 25.4 knots with an average speed of 12.3 knots. Tankers ranged in speed between 4.2 and 20.2 knots, with an average speed of 12.3 knots. The passenger boats had a speed between 10.5 and 20.2 knots with an average speed of 15.4 knots. Finally, records of speed for the unknown category of ship type showed a range of 7.1 to 17.7 knots with an average of 11.7 knots.

In the Mykonos –Ikaria passage a total number of 1582 vessels were recorded, out of which 685 (43.3%) were cargo boats, 810 (51.2%) were tankers, 10 (0.6%) were passenger boats and 77 (4.9%) were of an unknown type (Fig.2).

The cargo boats travelling through this passage recorded a range in speed between 0.1 and 10.2 knots with an average speed of 12.8 knots. Tankers ranged in speed between 4.9 and 19.1 knots, with an average speed of 12.9 knots. The passenger boats recorded did not have available speed data. Finally, records of speed for the unknown category of ship type showed a range of 5.6 to 18.8 knots with an average of 12.5 knots.

In the Ikaria –Samos passage a total number of 421 vessels were recorded, out of which 203 (48.2%) were cargo boats, 206 (48.9%) were tankers, 6 (1.4%) were passenger boats and 6 (1.4%) were of an unknown type (Fig.2).

The cargo boats travelling through this passage recorded a range in speed between 0.1 and 19.0 knots with an average speed of 11.5 knots. Tankers ranged in speed between 5.4 and 15.3 knots, with an average speed of 11.1 knots. The passenger boats recorded did not have available speed data. Finally, records of speed for the unknown category of ship type showed a range of 6.4 to 11.7 knots with an average of 9.3 knots. Overall, in the three passages, the speed was recorded on average to be 12.28 knots for cargo boats, 12.32 knots for tankers, and 10.95 knots for vessels of unknown type.

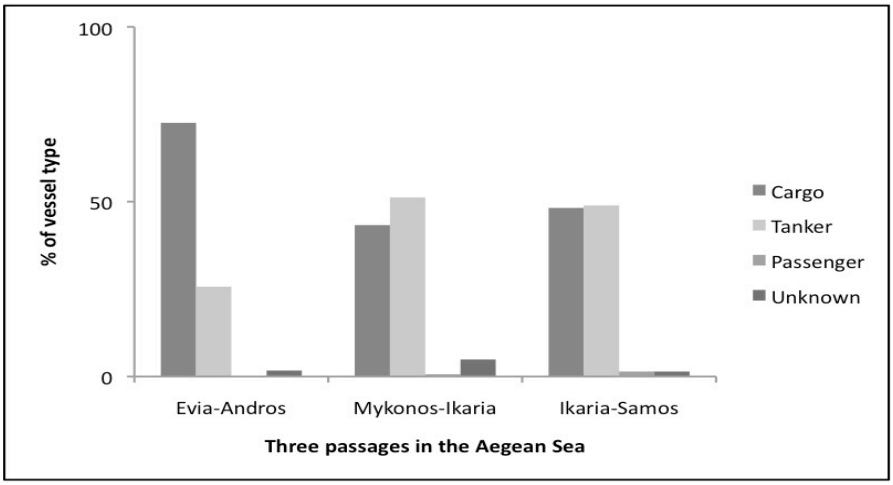

Figure 2: Vessel Type (%) recorded to cross the 3 selected passages of the Aegean Sea (Evia-Andros, Mykonos- Ikaria and Ikaria- Samos) between 12/11/09 and 29/04/10

Hazardous Cargo:

During the period 12/11/09 – 17/01/10, when information on the hazardous cargo was available, out of the total recorded cargo fleet 19.8% carried hazardous substances. In the Evia – Andros passage 13.9% of the cargo boats (121 out of 573 cargo vessels) were recorded to carry hazardous substances, 15.7% in the Mykonos –Ikaria passage (122 out of the 591) and 5.7% (8 out of 110) in the Ikaria –Samos passage.

Vessel size:

For all three passages, the lengths of the vessels were grouped into 6 categories: 50 – 100m, 101 – 150m, 151 – 200m, 201 – 250m, 251 – 300m and 301 – 350m (Table 1). There was, however, some unavailable data, including for 235 (4.4%) vessels recorded in the Evia – Andros passage, 104 (7.0%) vessels recorded in the Mykonos – Ikaria passage and 13 (3.2%) vessels recorded in the Ikaria – Samos passage.

The most common length of vessels recorded in the Evia – Andros passage were between 101 -150m long including 33.6% (1792 vessels) of the total vessels recorded, for data taken in the Mykonos –Ikaria passage the most common length of vessel recorded was within the range 151 -200m long including 41.2% (608 vessels) of the total vessels recorded. Finally, the most common length of vessels recorded in the Ikaria – Samos

passage were between 101 – 150m long including 54.6% (219 vessels) of the total vessels recorded.

Vessel size / Passage	50 - 100	101 - 150	151 - 200	201 - 250	251 - 300	301 - 350
Evia-Andros	24.4	33.6	28.6	9.9	3.0	0.4
Mykonos-Ikaria	13.8	26.7	41.2	9.0	9.3	0.0
Ikaria-Samos	39.7	54.6	5.2	0.5	0.0	0.0

Table 1: Size Classification (%) of the fleet crossing the 3 selected passages of the Aegean Sea (Evia- Andros, Mykonos- Ikaria and Ikaria- Samos) between 12/11/09 and 29/04/10

Flag Types:

The data showing the breakdown of the types of flag for the vessels recorded showed that 2862 vessels (51.4%) recorded in the Evia – Andros passage had a flag of convenience, 812 vessels (51.3%) recorded from the Mykonos - Ikaria passage had a flag of convenience and 107 (25.4%) recorded from the Ikaria - Samos passage had a flag of convenience (Table 2, Fig.3). The analysis of the complete dataset showed that a total of 50% (3784 vessels) of the vessels recorded from all three passages had a flag of convenience.

Passage / Flag type	Evia-Andros	Mykonos-Ikaria	Ikaria-Samos
Flags of convenience	2862 (51.4%)	812 (51.3%)	107 (25.4%)
National flags	2455 (44.1%)	631 (39.9%)	290 (68.9%)
Flags from other countries with loose enforcement of international laws & regulations	133 (2.4%)	71 (4.5%)	20 (4.8%)
Unknown flags	116 (2.1%)	67 (4.2%)	421 (1.0%)

Table 2: Flag Type Classification of the fleet crossing the 3 selected passages of the Aegean Sea (Evia- Andros, Mykonos- Ikaria and Ikaria- Samos) between 12/11/09 and 29/04/10

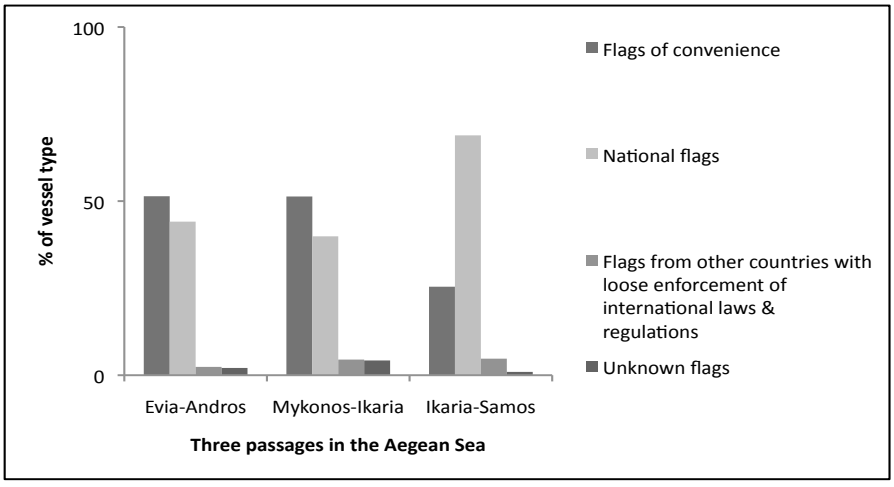

Figure 3: Flag Type Category of the fleet crossing the 3 selected passages of the Aegean Sea (Evia- Andros, Mykonos- Ikaria and Ikaria- Samos) between 12/11/09 and 29/04/10

Vessel positions:

Based on the location of vessels in the Aegean Sea on the 29/04/10, a map was created showing the routes of the vessels after port departure. A snapshot taken at 10:30am shows that there were 842 vessels (tankers, cargo boats, passenger boats and high speed vessels) in the Aegean Sea. The routes illustrated are gathered from a series of GPS points submitted by the vessels to Marinetraffic.com, a service provided by Google Earth (Fig.4).

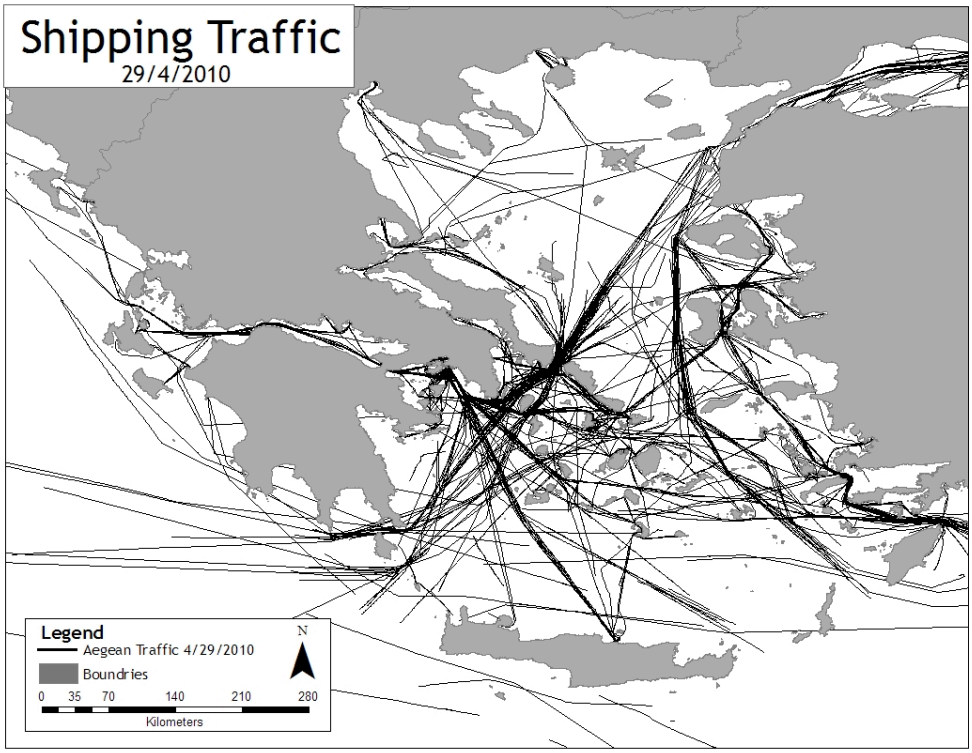

Figure 4: Routes of 842 vessels travelling in the Aegean on 29/04/10

Discussion and Conclusion

According to the results of this study, 65.1% of the vessels were cargo boats, 32.3% were tankers, whereas 43.5% of the vessels travelling through the three passages were larger than 150m. The above combined with the fact that 19.8% of the cargo boats carried hazardous substances and 50% of the vessels travelled under “flags of convenience”, travelling in a dense traffic through narrow passages with an average speed of 11.85 knots, increase greatly the risks of maritime accidents occurring, as well as risks of collisions, pollution and major spills with catastrophic environmental and socio-economic consequences.

The risks of environmental pollution and catastrophes that the Aegean Sea is facing every day, due to the lack of an adequate and comprehensive management scheme to regulate

and monitor shipping activities, is demonstrated from the data presented in this study. This study illustrates a clear lack of shipping lanes in place in (at least significant parts of) the Aegean Sea; and as a result, ships of all types and with varying hazardous levels, are free to travel at will, formulating routes according to the best judgement of each captain (which may also favour economic or other competing considerations). As a result, in most cases the safest travel routes are not being taken or adhered to.

Rather than approaching the problems of shipping traffic in the Aegean Sea piecemeal, immediate comprehensive action is needed. Thus, an IMO PSSA designation for the whole Aegean Sea with appropriate APMs can swiftly bring such improvements and safe navigation methods to the Aegean Sea. Such a PSSA designation would be based on its ecological, socio-economic and scientific significances, and could result in the application of a number of Associated Protective Measures (APMs) to prevent, reduce or eliminate threats of damage caused by international shipping activities. APMs for which there is an immediate need for comprehensive application in the whole Aegean Sea, include the creation of adequate reporting and monitoring systems, separation lanes, traffic separation schemes, 24-hour traffic control, response mechanisms to deal with small or large maritime accidents, areas to be avoided and properly enforced operational discharge prohibitions, as well as for ballast water discharge prohibitions.

While, for the main passages of the national waters in the Aegean Sea of each country, management measures could be readily applied solely through national laws and regulations, a combined effort is needed to gain protection for the whole Aegean Sea so as to avoid local pockets of vulnerabilities and marine environment degradation.

The shared role of universities in trying to gain such a protected status designation could be: (1) to collect the necessary environmental and socio-economic data, which would prove the need for such a designation; (2) to research and design the necessary APMs that could be applied to diminish the possibilities of maritime accidents; and (3) to provide scientific expertise and advice, in a non-political form, to national authorities, international bodies and the IMO, with the overall aim to contribute to protecting the environment of the Aegean Sea region from the risk of maritime accidents.

The final application for PSSA designation and APMs must be submitted to the IMO directly by the coastal country government(s). However, universities in Greece and Turkey can present the scientific data and arguments to the right authorities in respective countries, both in the national and international arenas. The universities can also stir up support for PSSA protection of the Aegean Sea from a bottom up approach – i.e., focusing directly on scientific evidence, data analysis, risk assessments and the environmental concerns– rather than a top down approach – i.e., focusing on the political players and stakeholders. Furthermore, studies on aspects of the Aegean Sea region that are already being carried out at Greek and Turkish universities and research organizations/institutes could be utilized for this combined objective to preserve and protect the Aegean Sea.

In addition, including even more universities within Europe and in other parts of the world in such a cross-border collaboration, can help underscore the message to the international and national communities that scientific and other evidence demonstrate the overwhelming need for immediate and serious shipping anti-pollution protection measures for the whole Aegean Sea.

A PSSA designation for the entire Aegean Sea would also work to create a 'whole' that is greater than its individual parts. To give an example, if Greece were to go forward and gain PSSA designation for the Greek Aegean Sea, without the inclusion of Turkey's Aegean Sea waters, imbalances in protections and pollution levels may occur, with pollution spills and disasters still potentially affecting the whole Aegean Sea area. Thus, an international collaboration for PSSA protection that starts in Greek and Turkish universities could be an effective method for establishing a holistic approach to protecting all of the Aegean Sea. This strategy in turn can achieve the *pareto optimal* scenario for the natural environment of the Aegean Sea as well as for both Greece and Turkey, in protecting their cultural, economic and social interests that depend on a clean Aegean Sea environment.

In this way, international collaboration between universities and research organisations/institutions can be a powerful tool to help advance and protect one of the most bio-diverse seas in both Europe and the world, one that still supports many important populations of rare and protected species and habitats.

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