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Istanbul, Türkiye, 12-13 February 2025

Agenda item 4: Updated MSSD for 2026-2035period

MSSD indicators

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UNEP/MAP
Athens, 2025

Contents

1. During the 25th MCSD Steering Committee (SC) meeting of 18-19 April 2024 (Athens, Greece), Plan Bleu/RAC presented a proposal for 7 core indicators, selected among the existing 28 MSSD indicators as per Decision IG.23/4 of COP 20, 17-20 December 2017 (Tirana, Albania), and that show the region's progress and challenges over the past three decades. The aim of the core indicators is to provide a more in-depth analysis on some key issues and with the objective to communicate key figures at regional level, such as the sea temperature increase and climate change adaptation as one of the main factors affecting sustainable development in the Mediterranean. The core indicators therefore can support MSSD outreach activities towards policy makers and broader stakeholders, by providing an easy path to grasp a picture of the main aspects, challenges and opportunities of sustainable development.
2. The MCSD SC took note of the proposal and asked Plan Bleu/RAC to further elaborate, as far as possible, a proposal on core indicators including also possible new MSSD indicators on health and air quality, on adaptation to climate change, on marine and coastal environment.
3. The further developed proposal of 10 core indicators has been shared with the online Extended MCSD SC of 12 November 2024. Related comments and inputs have been considered for the presentation in this information document.

4. In particular:
   i. The following 7 indicators, which are already MSSD indicators, are to be proposed as MSSD core indicators with a deeper analysis:
      - 1. Demography: a) number of inhabitants; b) share of youth and senior
      - 2. Life expectancy at birth
      - 3. Average years of schooling
      - 4. Real GDP per capita
      - 5. Territorial carbon dioxide emissions per capita
      - 7. a) Water withdrawal per inhabitant; b. Renewable freshwater resources per capita
      - 10. Evolution of protected marine areas (in number and area covered)

      It is to be noted that the titles of the Indicator 5. Territorial carbon dioxide emissions per capita and of Indicator 10. Evolution of protected marine areas (in number and area covered), are to be proposed as slightly updated in order to be more precise in the analysis and better communicate the object of monitoring activities.

   ii. The following 3 indicators are to be proposed as new MSSD indicators and to be considered also as core indicators:
      - 6. Surface temperature: a) Atmospheric; b) Sea surface temperature
      - 8. Plastic leakages at sea
      - 9. Air quality: a) concentration of PM2.5; b) carbon monoxide emission
5. In addition, the online Extended MCSD SC of 12 November 2024 suggested to work on the MSSD dashboard indicator 11, “Food security Index” at the Mediterranean scale and based on new variables and data that didn't exist in 2015.

The 10 Core Sustainable Development Indicators

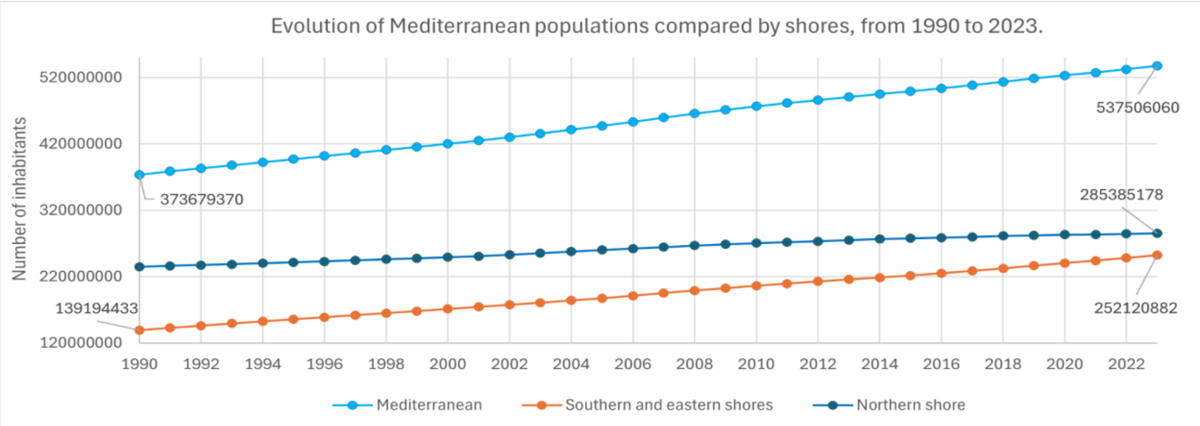
In our complex and changing world, where social, economic, and environmental challenges are multiplying and intensifying with climate changes, the need for reliable, comprehensive, and relevant indicators to assess progress and challenges towards sustainable development in the Mediterranean region is more pressing than ever. In these regards, the Mediterranean Strategy for Sustainable Development provides a broad range of indicators which play an important role in measuring the progress made by the Contracting Parties towards the SDGs set by the United Nations 2030 Agenda. Therefore, this document delves into ten “core indicators” that shed light on the region's progress and challenges over the past three decades. These indicators include the average years of schooling, life expectancy at birth, real GDP per capita, the evolution of protected marine areas, territorial carbon dioxide emissions per capita, surface temperatures (atmospheric surface temperature and sea surface temperature), drought (through water withdrawal per inhabitant per year) and plastic leakages in aquatic environments, at national level for each Mediterranean country (when data were available). Each of these indicators offers a perspective on the Mediterranean's evolution, reflecting the links between education, health, economic vitality, environmental stewardship, and sustainability. As we navigate through the data, it is therefore important to recognize the geographical and temporal nuances and complexities that underpin these figures, acknowledging the disparities within and between the northern and southern shores of the Mediterranean. This analysis aims to provide a comprehensive overview of the region's trajectory, while also highlighting the importance of context and caution in analysing these indicators.

Title of the indicator	Status
1.Demography: a) number of inhabitants; b) share of youth and senior	This indicator is part of the "Human Development Index" which is already part of the initial MSSD dashboard and agreed by CPs at COP 20, Tirana 2017 (Albania) Decision IG.23/4
2. Life expectancy at birth	This indicator is part of the "Human Development Index" which is already part of the initial MSSD dashboard and agreed by CPs at COP 20, Tirana 2017 (Albania) Decision IG.23/4
3. Average years of schooling	This indicator is part of the "Human Development Index" which is already part of the initial MSSD dashboard and agreed by CPs at COP 20, Tirana 2017 (Albania) Decision IG.23/4
4. Real GDP per capita	This indicator is part of the "Human Development Index" which is already part of the initial MSSD dashboard and agreed by CPs at COP 20, Tirana 2017 (Albania) Decision IG.23/4
5. Territorial carbon dioxide emissions per capita	Title is slightly different from the initial MSSD dashboard and agreed by CPs at COP 20, Tirana 2017 (Albania) Decision IG.23/4 The original title is "CO2 emission per unit of value added".
6.Surface temperature: a) Atmospheric; b) Sea surface temperature	Proposed New proposed MSSD Indicators, as per conclusions of the 25th MCSD Steering Committee (SC) meeting of 18-19 April 2024 (Athens, Greece)
7.Water withdrawal per inhabitant; b. Renewable freshwater resources per capita	Analysis for indicators 7a and 7b were over the past years populated as "Freshwater withdrawal as a proportion of available freshwater resources (also known as water withdrawal intensity)" with low available data.
8. Plastic leakages at sea	Proposed New proposed MSSD Indicators, as per conclusions of the 25th MCSD Steering Committee (SC) meeting of 18-19 April 2024 (Athens, Greece)
9. Air quality: a) concentration of PM2.5; b) carbon monoxide emission	Proposed New proposed MSSD Indicators, as per conclusions of the 25th MCSD Steering Committee (SC) meeting of 18-19 April 2024 (Athens, Greece)
10. Evolution of protected marine areas (in number and area covered)	Title is slightly different from the initial MSSD dashboard and agreed by CPs at COP 20, Tirana 2017 (Albania) Decision IG.23/4 The original title is "Percentage of protected coastal and marine areas [under national jurisdiction]"

CORE IDD 1a: Demography (number of inhabitants)

Definition: Number of inhabitants per year in the Mediterranean (sum of annual populations of Med countries)

Graph(s): Evolution of Mediterranean populations compared by shores, from 1990 to 2023



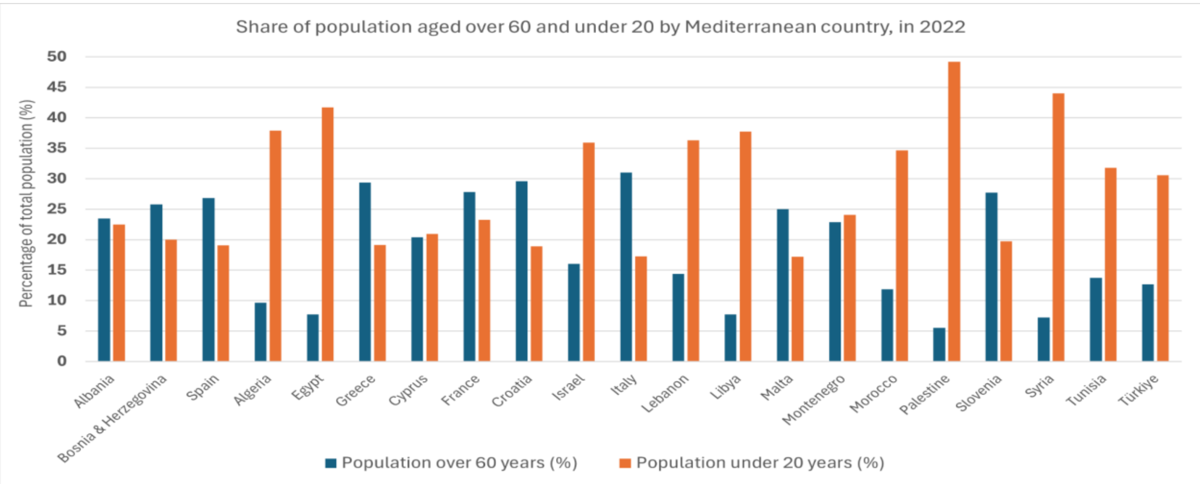
Key Findings: Over the period, more than 163.000.000 Mediterraneans (an increase of 43.8%). The southern rim is increasingly populated, with a higher growth rate than the northern rim.

Precautions: Migrations (emmigrations and immigrations) and the "giver" and "receiver" countries are not taken into account. The coastal population is not differentiated here.
Data source: Data World Bank, 2024 & United Nations Data Portal, 2023

CORE IDD 1b: Demography (share of youth and senior)

Definition: Share of national population over 60 years or under 20 years (in %).

Graph(s): Share of population aged over 60 and under 20 by Mediterranean country, in 2022.



Key Findings: Strong national disparities both for the share of population over 60 and under 20 years. On average, the south shore has a higher proportion of under-20s (37%) than the north shore (21%). On the contrary, the north shore has a higher proportion of over-60s (25%) than the south shore (11%)

Precautions: Other variables should be included in the analyse such as the national birth and mortality rates.
Data source: Data World Bank, 2024 & United Nations Data Portal, 2023

CORE IDD 2: Life expectancy

Definition : Life expectancy at birth is a statistical measure of the average number of years a newborn is expected to live, assuming that current mortality rates at each age will remain constant throughout the life of the newborn. This indicator is often used as a measure of a country's health and well-being. It's a part of the Human Development Index (HDI)

Analytical part:

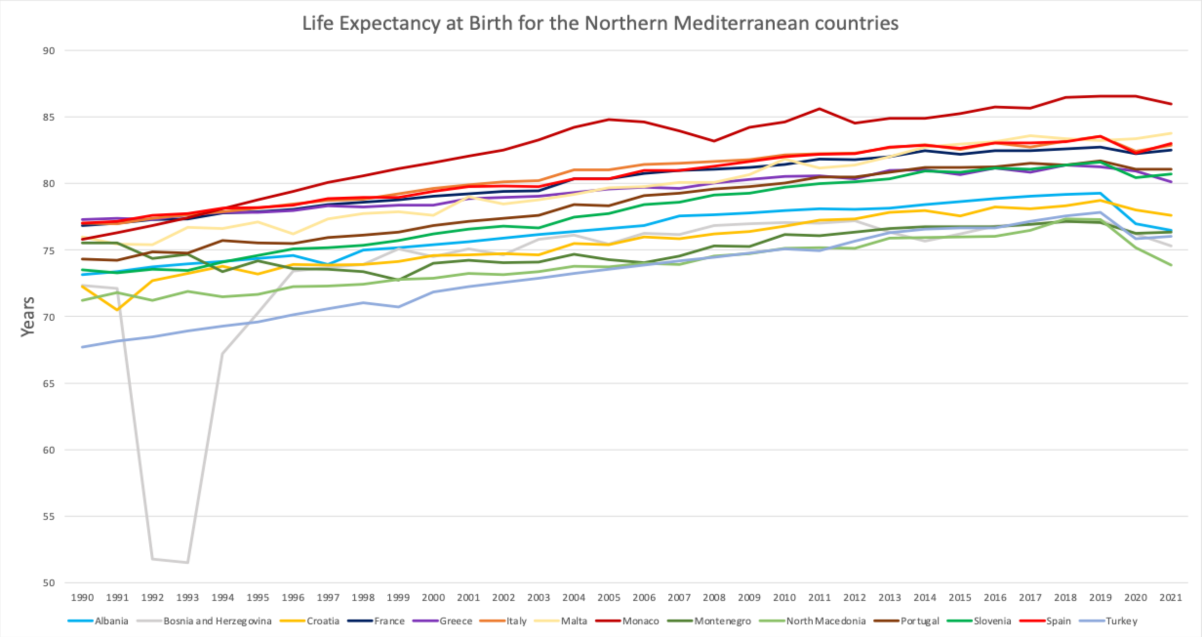


Figure 1- Life expectancy at birth for the northern Mediterranean countries from 1990 to 2021.

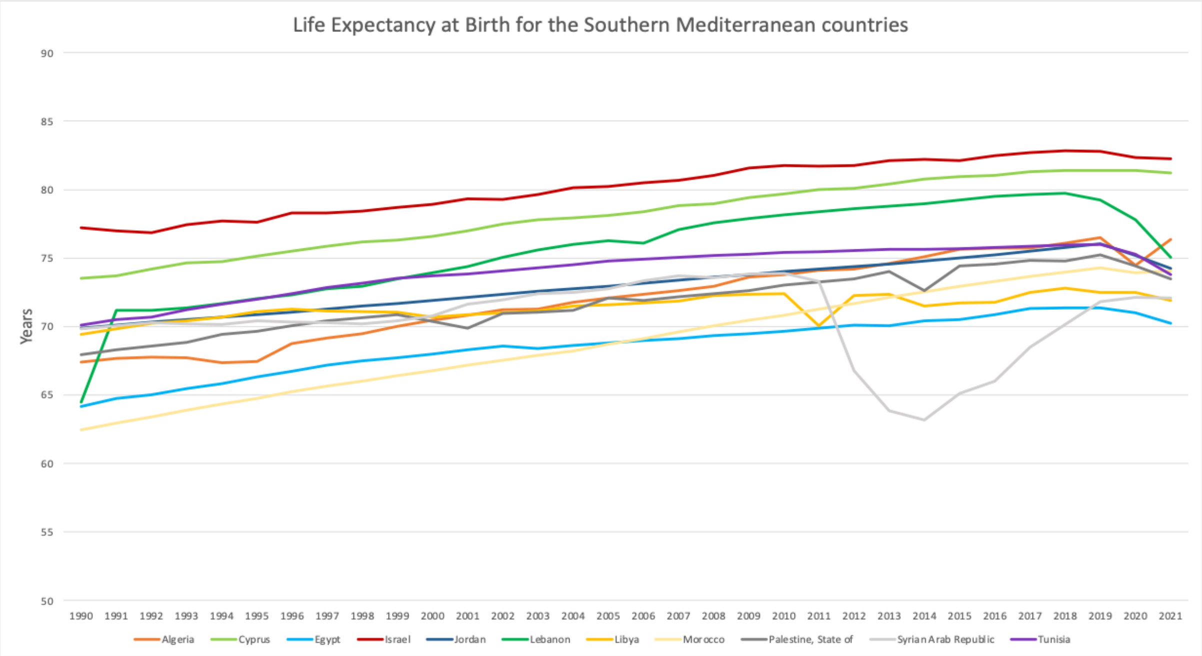


Figure 2-Life expectancy at birth for the southern Mediterranean countries from 1990 to 2021.

There is a general trend of improvement in life expectancy across all the listed Mediterranean countries over the 31-year period, indicating improvements in health and longevity. But there are some significant drops observed for some countries. For instance, Bosnia and Herzegovina experienced a dramatic drop in life expectancy during the early 1990s, likely due to the Bosnian War. It fell from 72.3 years in 1990 to approximately 51.5 years in 1993. Since then, there has been a robust recovery, with life expectancy reaching 75.3 years by 2021. In the same way, Croatia's life expectancy has generally increased, from 72.3 years in 1990 to 77.6 years in 2021, despite a slight dip in the early 1990s, possibly due to the Croatian War of Independence. As expected, Libya's life expectancy has seen fluctuations with a slight dip in 2011, possibly due to the Libyan civil war and the Arab Spring. The Syrian Arab Republic also experienced a dramatic drop in life expectancy between 2011 and 2014, likely due to the Arab Spring and the civil war. From a global point of view, a general inflection is observed by 2020, potentially due to the worldwide Covid pandemic19, but more specific data should be analyzed to confirm such a negative evolution of the annual average life expectancy per country.

However, there is still a gap between the southern Mediterranean countries and the northern Mediterranean countries with a gap of 15.7 years between Egypt (70.2) and Monaco (85.9) in 2021. On average, northern Mediterranean countries (79.7 in 2021) have 4.7 years more life expectancy than southern Mediterranean countries (75 in 2021).

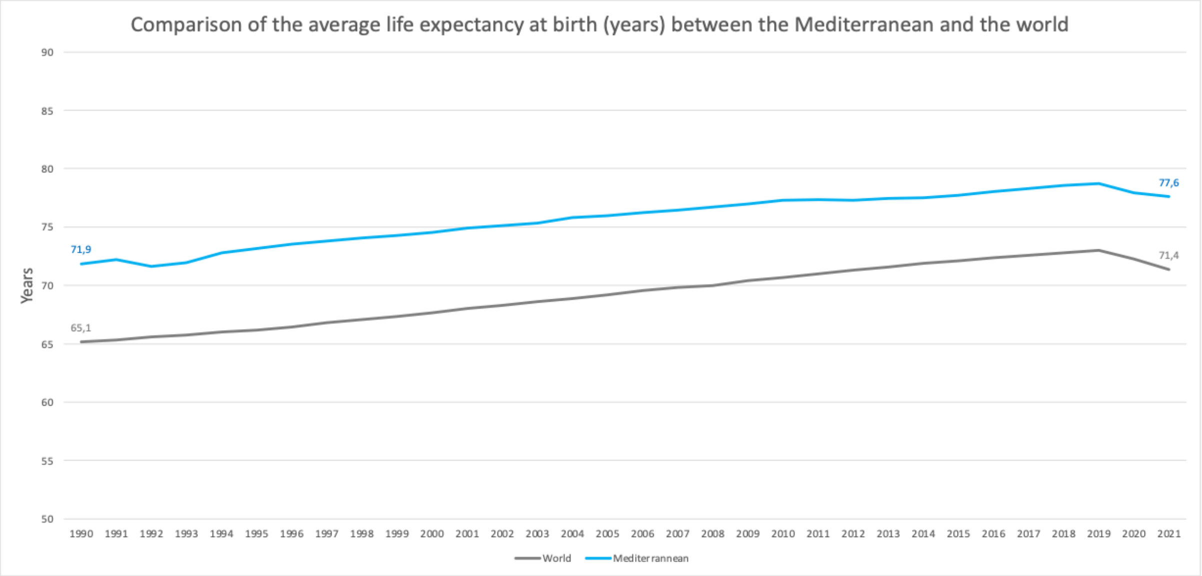


Figure 3- Comparison of the average life expectancy at birth between the Mediterranean and the world from 1990 to 2021.

Mediterranean countries, on average, have higher life expectancy than the world average and maintained a generally higher level throughout the period (1990-2021). Globally, since 1990 the Mediterranean countries have followed the same positive trend of life expectancy as the world.

Precautions / Notes :

- Life expectancy is influenced by a range of factors that may not be captured in the data, such as income inequality, education levels, gender inequalities, and lifestyle choices.
- Life expectancy is an average that does not account for disparities within countries, such as those due to socioeconomic status, gender, ethnicity, or region.
- Events like pandemics or wars can cause temporary or long-term declines in life expectancy, which may not reflect the general trend.
- Changes in the age structure of a population, such as an ageing population, can affect life expectancy figures. Thus, comparing life expectancy across countries requires caution due to differences in demographic profiles.

Source: United Nations Development Programme Database and report, 2021.

CORE IDD 3: Average years of schooling

Definition: The indicator Years of Schooling refers to the average number of years of education received by people ages 25 and older, within a particular geographic area. This metric is often used to assess the educational attainment level of a population, which can influence economic development, employment opportunities, and social outcomes. It's a part of the Human Development Index (HDI).

Analytical part:

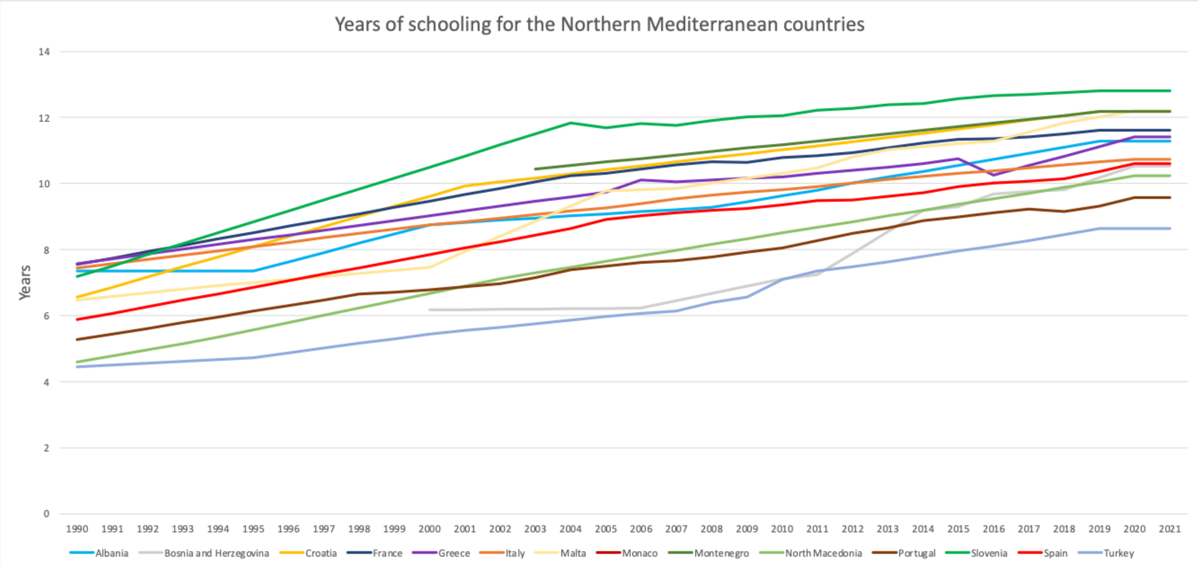


Figure 4- Average years of schooling for the Northern Mediterranean countries from 1990 to 2021.

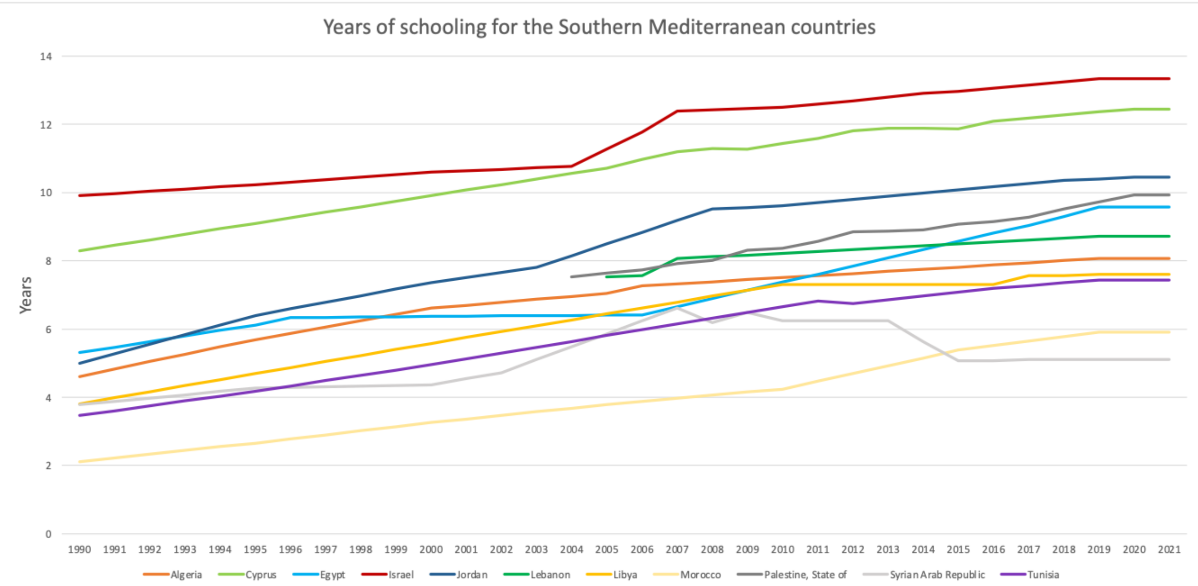


Figure 5-Average years of schooling for the Southern Mediterranean countries from 1990 to 2021.

The years of schooling of Mediterranean countries, on average, have constantly increased since 1990 and maintained a generally higher level throughout the period up to 2021.
Northern Mediterranean countries (e.g., France, Italy, Spain) generally started with higher years of schooling in 1990 and maintained a growth trend, ending with higher averages in 2021 compared to their southern counterparts (e.g., Egypt, Algeria). On average, northern Mediterranean countries (11.1 years in 2021) have 2.1 years more years of schooling than southern Mediterranean countries (9 years in 2021). Moreover, there's significant variability in educational attainment across the region, with countries like Israel and Cyprus showing high levels of schooling, while others, such as the Syrian

Arab Republic and Morocco, exhibit lower averages. To note that the drop of years of schooling for the Syrian Arab Republic is likely due to the Arab Spring and the civil war.

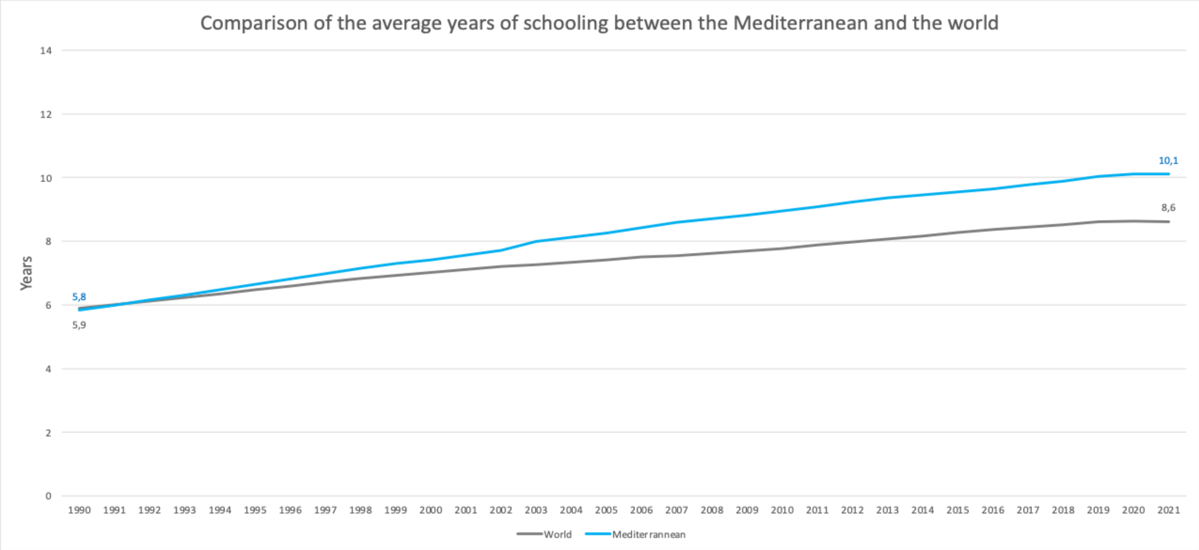


Figure 6- Comparison of the average years of schooling between the Mediterranean and the world from 1990 to 2021.

By comparing the average trends of years of schooling from 1990 to 2021 between the world and the Mediterranean, we can highlight that the Mediterranean region is highly diverging from global average since 1990: in 1990, it was almost the same average, while in 2021 the Mediterranean average was 1.5 years higher (10.1 years) than the global average (8.6 years).

Precautions / Notes :

- Years of schooling are a quantitative measure that doesn't account for the quality of education or cultural, economic, and political factors influencing educational systems. Each country's educational system is influenced by its unique historical, cultural, and socio-economic context, which should be considered when interpreting the data.
- Years of schooling is an average that does not account for disparities within countries, such as those due to socioeconomic status, gender, ethnicity, or region. Likewise, it does not take into account employability after these years of schooling.
- The analysis covers up to 2021. Thus, recent changes in educational policies, economic conditions, or significant events (e.g., the COVID-19 pandemic) may not be fully reflected.

Source: United Nations Development Programme Database and report, 2021.

CORE IDD 4: Real GDP per Capita

Definition : Gross Domestic Product (GDP) is the total market value of all final goods and services produced in a country in a given year. Real GDP per capita is a measure that divides the GDP of a country at constant prices by its population. It's an important indicator used to gauge the economic performance of a country. The annual growth rate of real GDP per capita is calculated as the percentage change in the real GDP per capita between two consecutive years.

The data is presented in constant 2015 US dollars to provide a clearer picture of economic performance by removing the effects of inflation and allowing for a more accurate comparison of economic output over time. Indeed, inflation can significantly distort the true picture of an economy's growth. By adjusting GDP figures to a constant dollar value, analysts can remove the effects of inflation, providing a clearer view of real economic growth or decline. In this regard, for long-term economic analysis, such as examining trends from 1990 to 2022, using constant dollars is essential for accuracy. It ensures that the data reflects real changes in economic activity, rather than changes in price levels.

Analytical part:

While GDP does not fully capture the quality of life or distribution of wealth within a country, it remains an important indicator used to gauge the economic performance of a country.

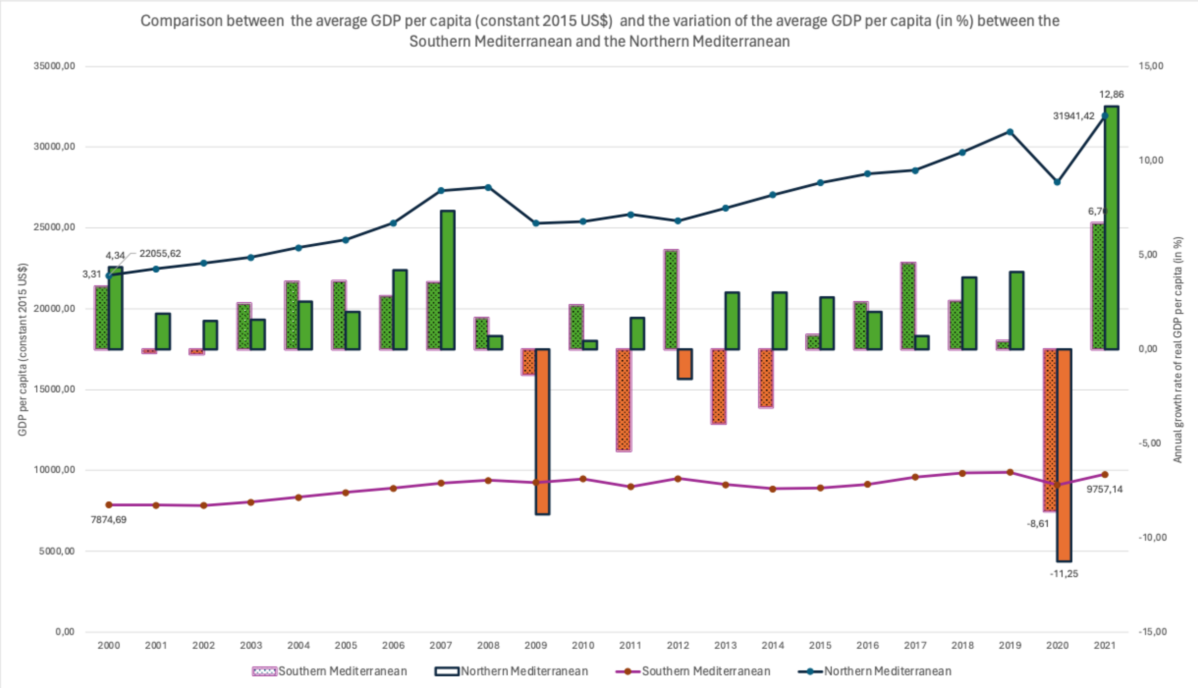


Figure 7- Comparison of the average GDP per capita and the annual growth rate of GDP per capita between the Southern Mediterranean and the Northern Mediterranean from 2000 to 2021.

The Mediterranean region is diverse, with countries varying significantly in economic development. Northern Mediterranean countries tend to have higher GDP per capita compared to their Southern counterparts, reflecting differences in economic structure, stability, and integration into the global economy.

The southern Mediterranean countries' data show fluctuations in GDP per capita over the years, with periods of growth and decline influenced by various factors such as political instability, oil prices, and global economic conditions. For example, the Arab Spring (2011) is reflected in the data through the decline in GDP per capita and in the GDP growth rate (-5,38% compared to 2010).

The northern Mediterranean countries show higher GDP per capita and GDP growth rate levels compared to their southern counterparts. More precisely, the gap between the northern Mediterranean GDP per capita and the southern Mediterranean GDP per capita is increasing in 2000, the GDP per capita of the northern Mediterranean was 2.8 times higher (14 181$ higher) than that of the southern Mediterranean, while in 2021 it was 3.3 times higher (22 184 $ higher). However, they too have faced economic challenges, particularly during the European debt crisis (2009), which is reflected in the data through the decline in GDP per capita and in the annual growth rate of real GDP per capita (-8,75% compared to 2008). Moreover, the COVID-19 crisis (2020) is clearly highlighted in the data through the decline in GDP per capita and the GDP per capita growth rate for both sides of the Mediterranean, with a substantial impact for the northern Mediterranean countries (annual growth rate of real GDP per capita for 2020 for northern Mediterranean countries is -11,25% compared to -8,61% for the southern Mediterranean countries).

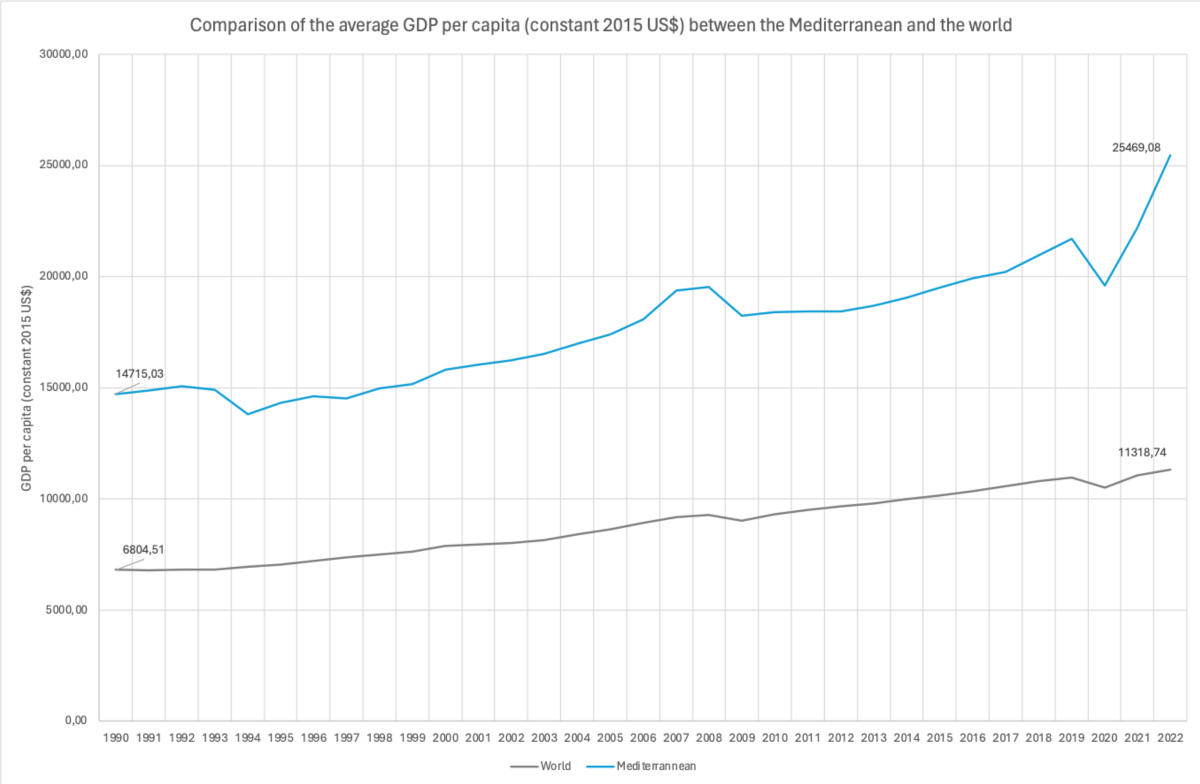


Figure 8- Comparison of the average GDP per capita in constant 2015 US$ between the Mediterranean and the world from 1990 to 2022.

By comparing the trends of GDP per capita from 1990 to 2022 between the world and the Mediterranean, we can highlight that the Mediterranean region is slightly diverging from global economic development patterns (especially since the recovery of COVID-19 crisis): in 1990, the GDP per capita of the Mediterranean was 2.16 times higher (7910$ higher) than that of the world, while in 2022 it was 2.25 times higher (14 150 $ higher). Globally, for 32 years the Mediterranean region has followed the same patterns of global economic development as the world.

Moreover, events such as the global financial crisis and the COVID-19 crisis have impacted more significatively the Mediterranean than global averages: for instance, in 2020, the average GDP per capita decreased 4.8 times more in the Mediterranean (-2097$ between 2019 and 2020 with GDP growth rate of -10,71%) compared to the world (-441$ between 2019 and 2020 with GDP growth rate of -4,20%). On the other hand, the substantial recovery from the COVID-19 crisis provides insights into the resilience of the Mediterranean economies compared to the global average: GDP per capita in 2022 for the Mediterranean is 25 469$ (GDP growth rate of 12,91%) compared to 11 319$ for the world (GDP growth rate of 2,23%).

Precautions / Notes:

- Due to a lack of data for certain Mediterranean countries from 1990 to 2000 and for 2022, we compared the economic performances between the northern Mediterranean countries and the southern Mediterranean countries from 2000 to 2021.
- The data is presented in constant 2015 US dollars to account for inflation. However, currency fluctuations and changes in purchasing power parity (PPP) can also affect the accuracy of comparisons over time. Indeed, adjusting for inflation to constant
- dollars does not account for changes in PPP across countries. Yet, PPP adjustments are necessary for international comparisons to reflect differences in price levels across countries. In addition, over long periods, the structure of an economy can change significantly. Industries may rise or fall, and new technologies can alter productivity. Constant dollar measures may not fully capture these structural changes.
- GDP per capita is influenced by population growth or decline. In this regard, we need to keep in mind that a rapid population change can skew the interpretation of economic growth or

decline and that the high demographic growth of the southern Mediterranean countries impacts our interpretation.

- The world and Mediterranean average can mask significant disparities between countries.
- While GDP per capita is a useful economic indicator, high GDP per capita does not necessarily mean high living standards for all citizens. Indeed, the increase in the share of GDP allocated to the 10% richest between the northern Mediterranean countries and the southern Mediterranean countries is not considered in this analysis.

Source: World Bank national accounts data, and OECD National Accounts data files, 2022.

Core IDD 5: Carbon dioxide emissions per capita

Definition: Carbon dioxide emissions per capita measure the total amount of carbon dioxide emissions produced within a country, divided by the country's population within a given year. It is expressed in tonnes per person. This indicator is crucial for understanding the environmental impact of a country's production processes and lifestyle on a per-person basis, reflecting the efficiency and sustainability of its economic activities.

Analytical part:

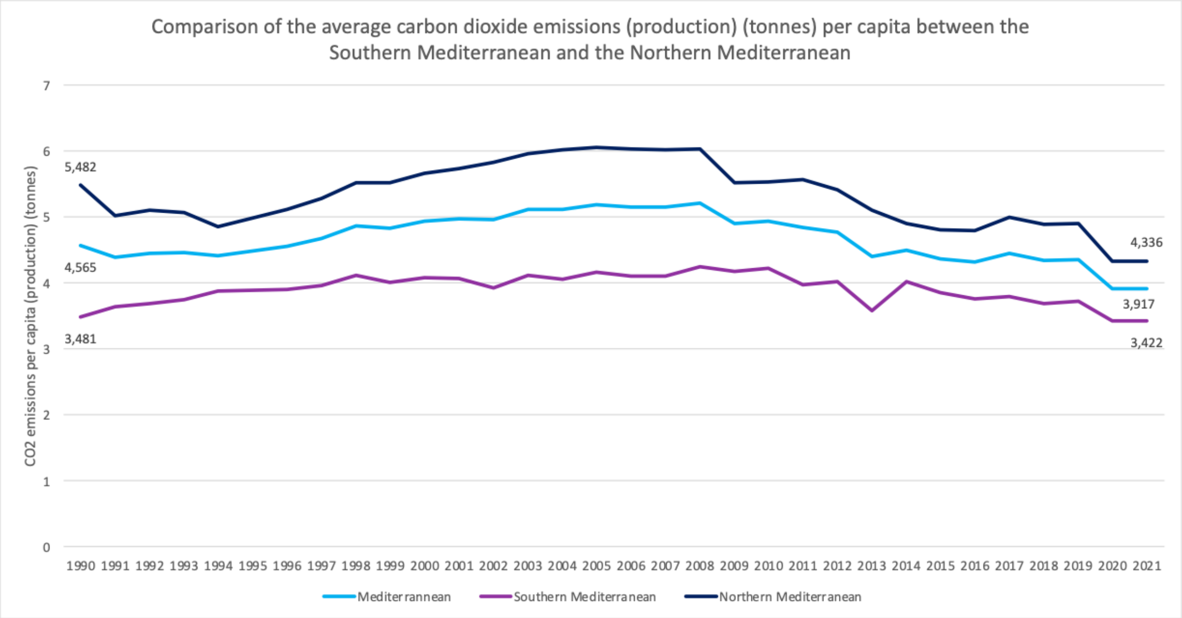


Figure 9-Comparison of the average CO2 production emissions in tonnes per capita between the Southern Mediterranean and the Northern Mediterranean from 1990 to 2021.

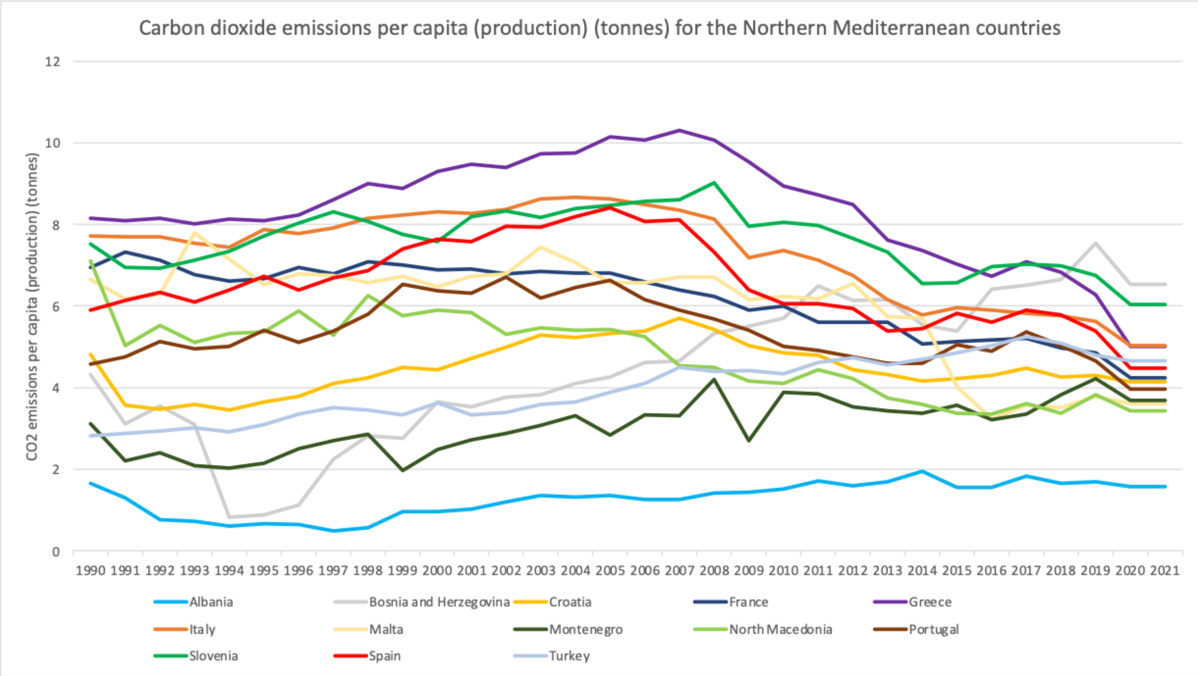


Figure 10-Average CO2 production emissions in tonnes per capita for the Northern Mediterranean countries from 1990 to 2021.

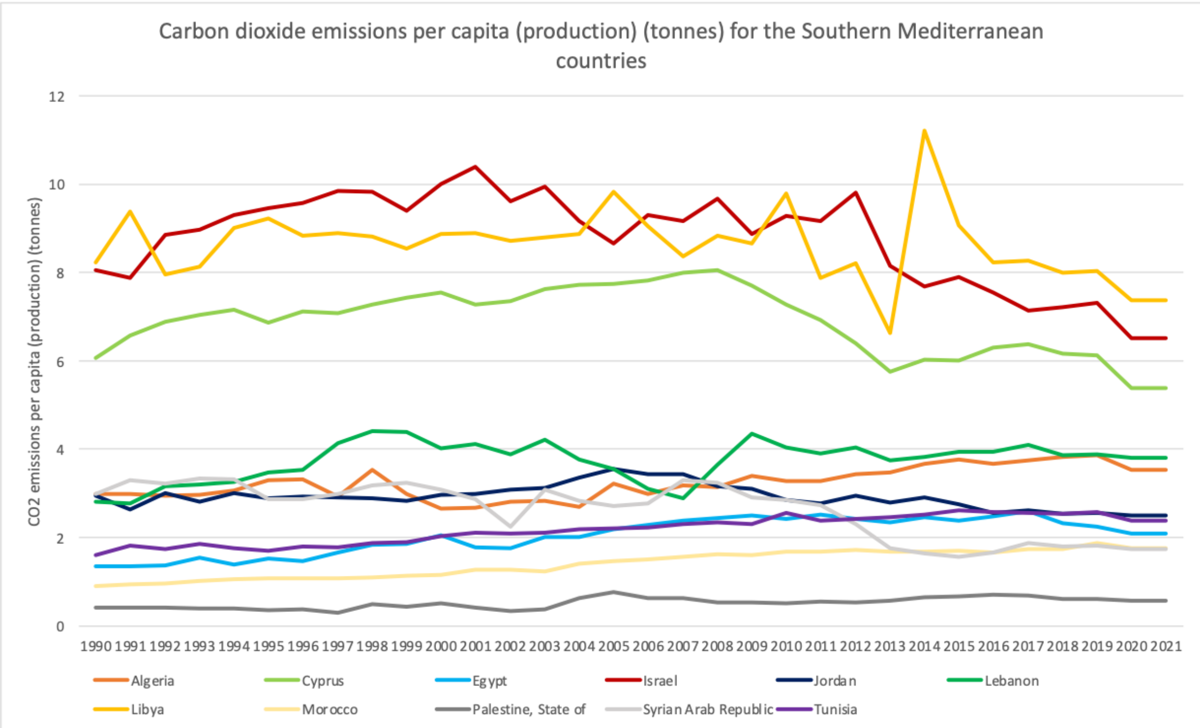


Figure 11- Average CO2 production emissions in tonnes per capita for the Southern Mediterranean countries from 1990 to 2021.

Since 2008, CO2 emissions have decreased in most Mediterranean countries, but more significantly in the Northern Mediterranean countries. Globally, from 1990 to 2022 the Southern Mediterranean seems to follow the same trend of carbon dioxide emissions per capita as the Northern Mediterranean, but less pronounced.

Some countries, like France, Italy and Greece, show a general decrease in CO2 emissions per capita over the period (10.31 tonnes of CO2 per capita for Greece in 2007 compared to 5.01 tonnes in 2020). Conversely, countries like Egypt, Syrian Arab Republic and Jordan initially show an increasing trend, possibly due to industrial development and increased fossil fuel consumption without equivalent efficiency gains or shifts to cleaner energy sources. But since 2011, these countries show a decreasing trend, especially concerning the Syrian Arab Republic (2.74 in 2011 vs. 1.14 in 2020), probably due to the consequences of the Arab Spring. On the other hand, some countries like Morocco, Tunisia or Algeria show a constant increasing trend since 1990.

Moreover, Bosnia and Herzegovina, North Macedonia, Montenegro, Croatia, and Slovenia exhibit significant fluctuations, likely due to the political and economic transformations following the dissolution of Yugoslavia in the early 1990s. Indeed, we notice a significant drop in emissions from 1990 to 1994 with a minimum of emissions reached by Bosnia and Herzegovina in 1994 with 0.81 tonnes of CO2 per capita. This corresponds to a period of war in the former Yugoslavia marked in particular by the Bosnian War (1992-1995) and the Croatian War of Independence (1991-1995).

Furthermore, the data highlights substantial peaks for Libya with, for example, a dramatic increase after 2011 (with a maximum of emissions reached in 2014 with 11.22 tonnes of CO2 per capita), which could be attributed to the political instability and conflict affecting production and energy use patterns following, corresponding to the first Libyan civil war and the military intervention of armed forces.

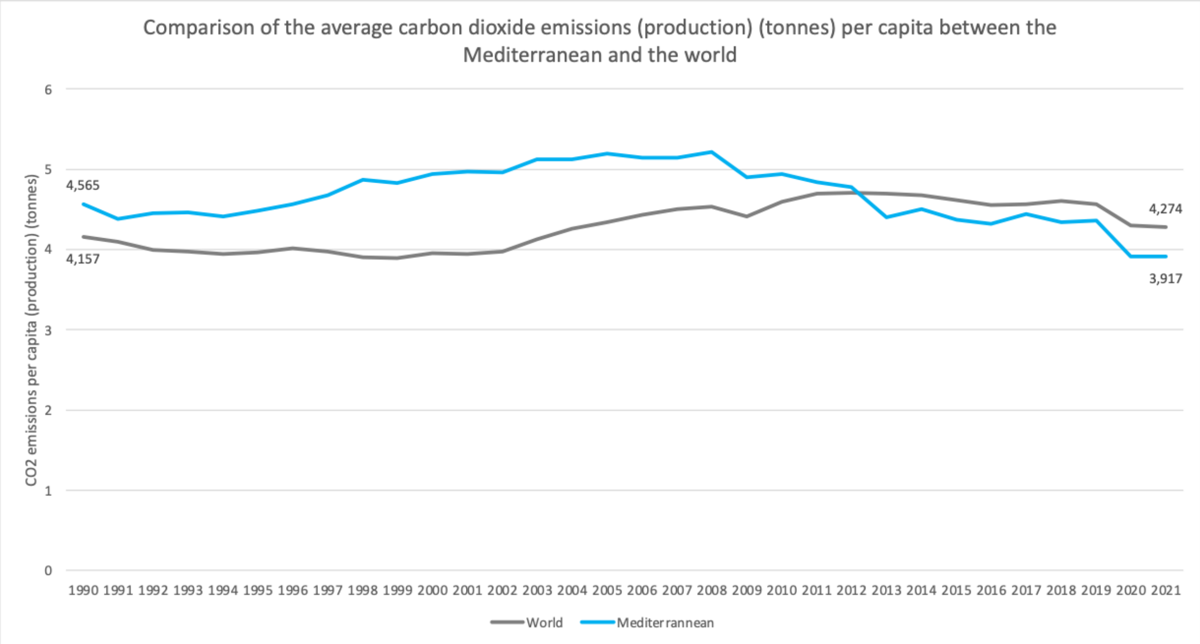


Figure 12-Comparison of the average CO2 production emissions in tonnes per capita between the Mediterranean and the world from 1990 to 2021.

Mediterranean countries, on average, started with higher CO2 emissions per capita than the world average in 1990 (4.57 vs. 4.16 tonnes) and maintained a generally higher level throughout the period up to 2012. But the average CO2 emissions per capita for Mediterranean countries fell below the world average since 2012 (4.77 vs. 4.71 tonnes in 2012 and 4.40 vs. 4.70 tonnes in 2013).

Several factors that could influence such a shift. Economic downturns, such as the global financial crisis that began in 2008, can lead to reduced industrial activity and energy consumption, which in turn can lead to lower CO2 emissions. The effects of the crisis may have lingered in the Mediterranean region, leading to a slower recovery and reduced emissions. Indeed, since 2008, CO2 emissions have decreased in most Mediterranean countries, but more significantly in the Northern Mediterranean countries *(more impacted by this crisis as shown in the CORE IDD 3 GDP per capita)*. In the same way, political events, such as the Arab Spring, which began around 2011, could have led to disruptions in economic activity in North African Mediterranean countries, potentially contributing to lower emissions, as highlighted by the data of Libya, Egypt and Syrian Arab Republic, for instance. Moreover, by 2012, many countries around the world, including those in the Mediterranean region, may have implemented more “aggressive” policies aimed at reducing carbon emissions in order to respect the Paris agreement to achieve "climate neutrality" by 2050. In this regard, some Mediterranean countries may have undergone structural changes in their economies, moving away from heavy industry and toward services and technology sectors that typically have lower CO2 emissions.

Precautious / Notes:

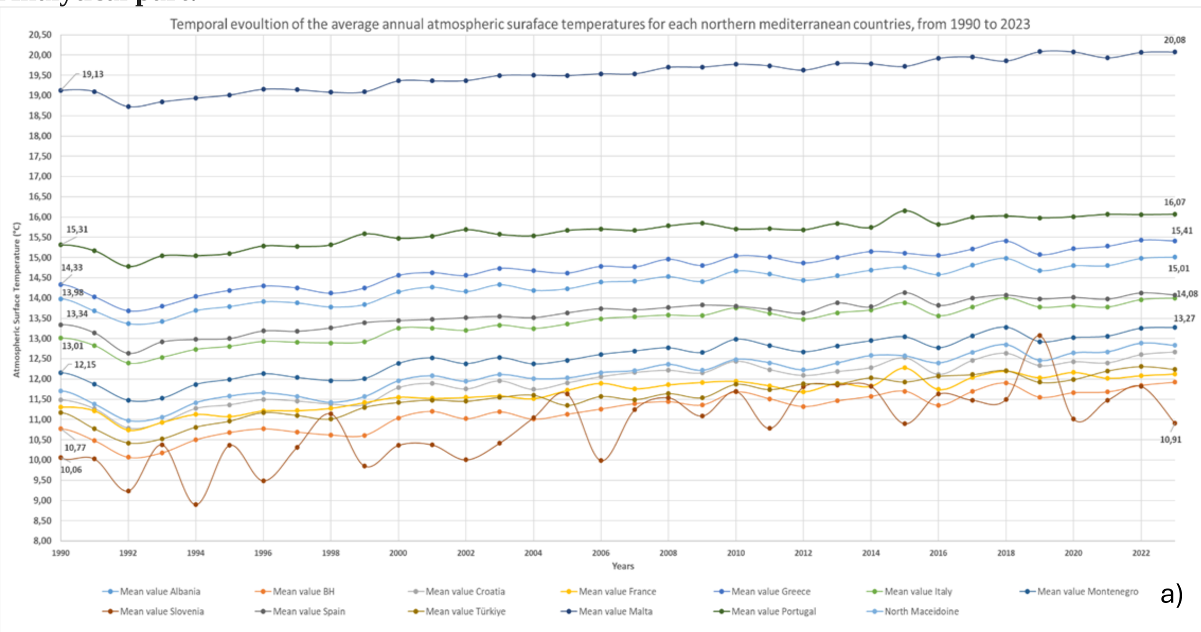
- The accuracy of CO2 emissions data can vary by country due to differences in data collection methods, reporting standards, and the inclusion (or exclusion) of various sources of emissions. In this regard, this core indicator, although similar to the indicator 21 of the MSSD, presents many differences due to the use of a different database because data on periods and countries was missing for the base of indicator 21.
- Economic growth, industrial policies, energy sources, and political instability can significantly affect CO2 emissions, making it essential to consider these factors when interpreting the data.
- When comparing CO2 emissions across countries, it's crucial to consider differences in population size, economic structure, and energy mix. These factors can significantly influence emissions per capita.
- This indicator focuses on production-based emissions within a country's borders. It does not account for emissions associated with the consumption of imported goods and services, which can lead to an underestimation of the environmental impact of a country's lifestyle and consumption patterns.
- While per capita emissions provide insight into the average emissions attributed to an individual within a country, they do not account for the total impact of a country's emissions on global climate change. High per capita emissions in a country with a small population may have a smaller global impact than lower per capita emissions in a highly populous country. In the same way, the CO2 emissions of 1% richest between the northern Mediterranean countries and the southern Mediterranean countries is not considered in this analysis.

Source: United Nations Development Programme Database and report, 2021.

CORE IDD 6-a: Atmospheric Surface Temperature (AST)

Definition:
The atmospheric surface temperature is defined as the air temperature (in °C) at 2m from the ground surface. The sea surface temperature is defined as the temperature 5m below the sea surface (which receives and absorbs a major part of solar radiations). This indicator is a key environmental drivers, which in a sense, has direct and indirect impacts on all biogeochemical processes (chemical reactions, chemical speciation, environmental persistence of the chemical species, etc.) and all related living things (physiological and metabolic modifications, behavioral changes, life cycle stage modifications, etc.). Moreover, such a physical indicator is linked to the whole atmosphere ecosystem and may vary drastically on short temporalities. The AST indicator displays the temporal evolution since 1850 at different geographical scales, from national level to mediterranean shores comparison. For the SST, the temporal evolutions are also considered between the different mediterranean sub-basins (West basin including gulf of Ligurian sea, gulf du Lyon and Alboran sea, Adriatic basin, the central mediterranean basin and the eastern basin). For the AST, the annual variations have been calculated and represented in order to propose a better analysis of the evolution.

Analytical part:



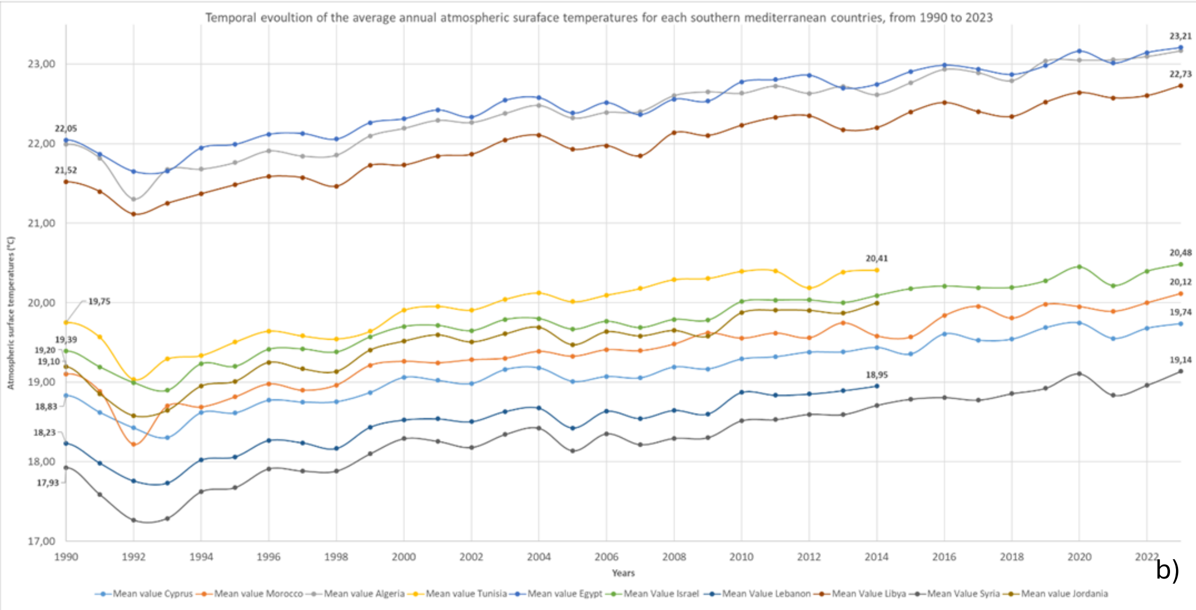


Figure 13-Temporal evolution of the average annual atmospheric surface temperatures for each northern (a) and southern (b) mediterranean countries.

These graphs show highly contrasted temporal and geographical variations between Mediterranean countries, as well as within the same shores. Indeed, in 2022, the average annual AST for the northern countries range between 10,98 °C and 20,08 °C respectively for Slovenia and Malta. For southern countries, the AST varies between 19,14 °C and 23,21 °C respectively for Syria and Egypt. For the northern countries of the Mediterranean, the AST evolutions since 1990 follow approximately linear and positive trends except for Slovenia which display highly contrasted AST between each year, exposing a respective standard deviation of 0,84 °C. Moreover, all the continental countries show AST between 10,91°C for Slovenia and 15,41°C for Greece. For the northern countries, the average annual AST between 1990 and 2000 has increased between +0,73 °C for Spain and 1,15 °C for Bosnia Herzegovina.

Interestingly, the northern countries are more contrasted than the southern ones. Indeed, in 2023, there is a 9,17 °C difference between the hottest (Malta) and coldest (Slovenia) countries in terms of average annual AST whereas there is only a 4,07 °C difference between Syria and Egypt. On the other hand, between 1990 and 2023 the highest standard deviation for the southern mediterranean countries is for Algeria with 1,18 °C. What's more, there is a clear temperature gap (+2,25°C) between Algeria, Libya, Egypt and the other southern Mediterranean countries.

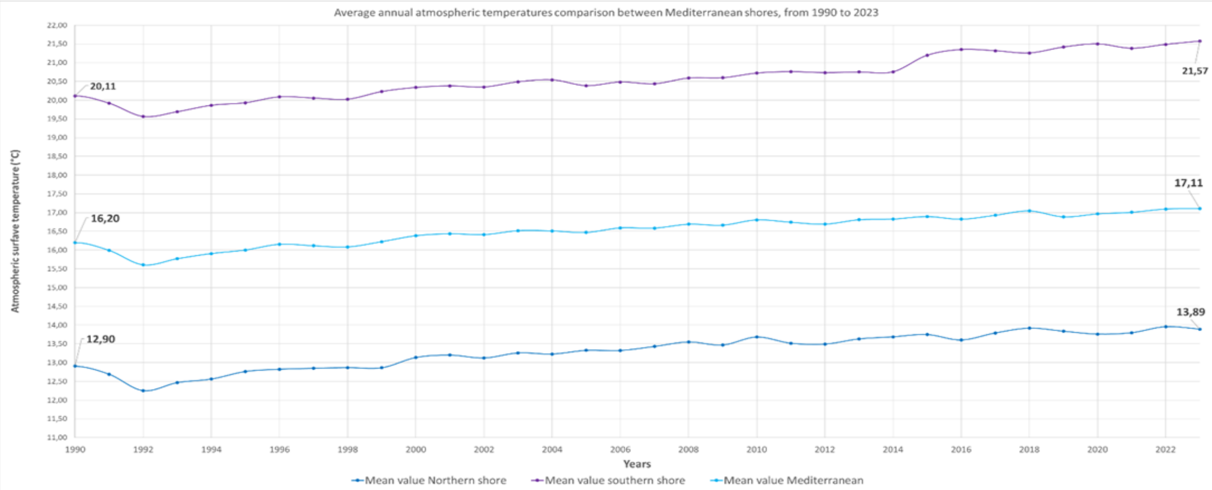


Figure 14-Average annual atmospheric surface temperatures comparison between mediterranean shores and the whole basin.

This graph provides a more general view of the AST variations by integrating a larger geographical coverage, the Mediterranean shores. Therefore, the overall increase since 1990 is more significant for the southern shore (+1,46°C on average in 33 years) than the northern one (+0,99 °C on average in 33 years). The has overcome an average AST increase of 0,91 C since 1990.

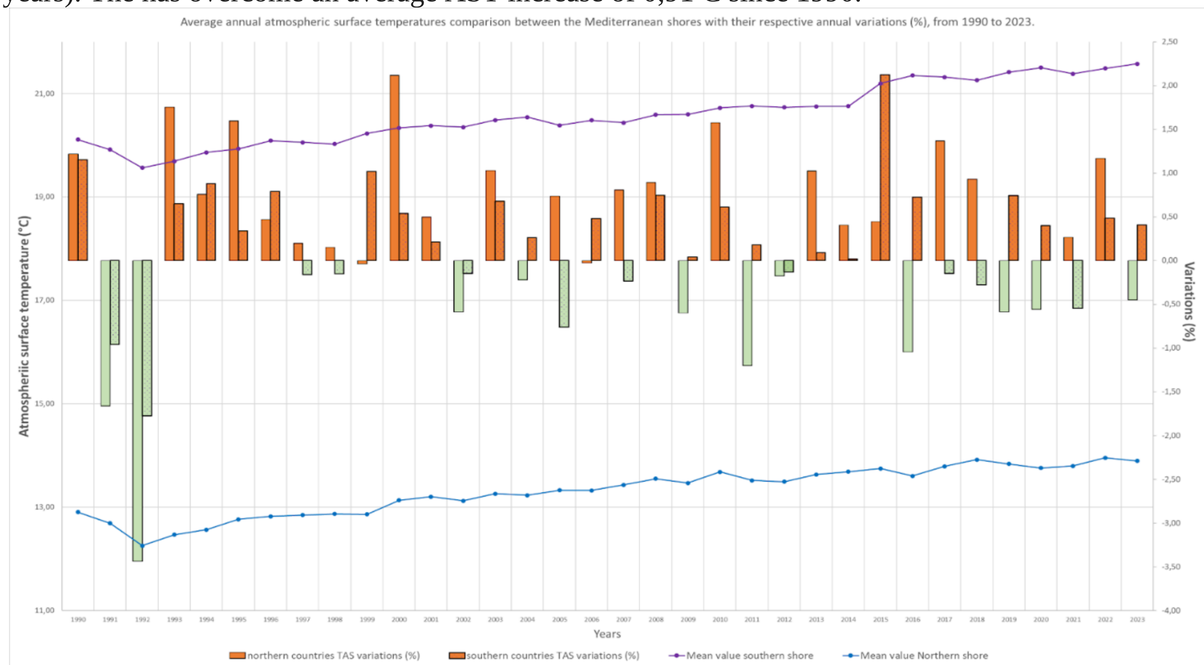


Figure 15-Temporal evolution since 1990 of the AST compared between the mediterranean shores with their respective variations (%) per year.

This combined graph brings more detailed information about temporal AST variations. Although the trends are positive, both the south and north shores have seen negative variations in their respective average annual AST, ranging from -0,03% to -3,44% for the northern shore and from -0,13% to -1,77% for the southern shore. In total, the southern shore exposed 11 negative variations of its AST while the northern shore displayed 13 negative AST variations. On the contrary, the southern shore shows 20 positive AST variations against 21 positive ones for the northern shore. Thus, such results support the idea that the southern shore faces a more intense warming in terms of the number of AST increases than the northern shore of the Mediterranean.

CORE IDD 6-b: Sea Surface Temperature (SST)

Definition:
The sea surface temperature is defined as the temperature 5m below the sea surface (which receives and absorbs the major part of solar radiations). This indicator is also a key environmental driver, which in a sense, has direct and indirect impacts on all biogeochemical processes (chemical reactions, chemical speciation, environmental persistence of the chemical species, etc.) and all related living things (physiological and metabolic modifications, behavioural changes, life cycle stage modifications, etc.). For the SST, the temporal evolutions are also considered between the different mediterranean sub-basins both in terms of °C values (figure 16) and variations (figure 20) around the annual mean for a given year. Same as for the AST, the annual variations have been calculated and represented in order to propose a sharp analysis of the evolution.

Analytical part:

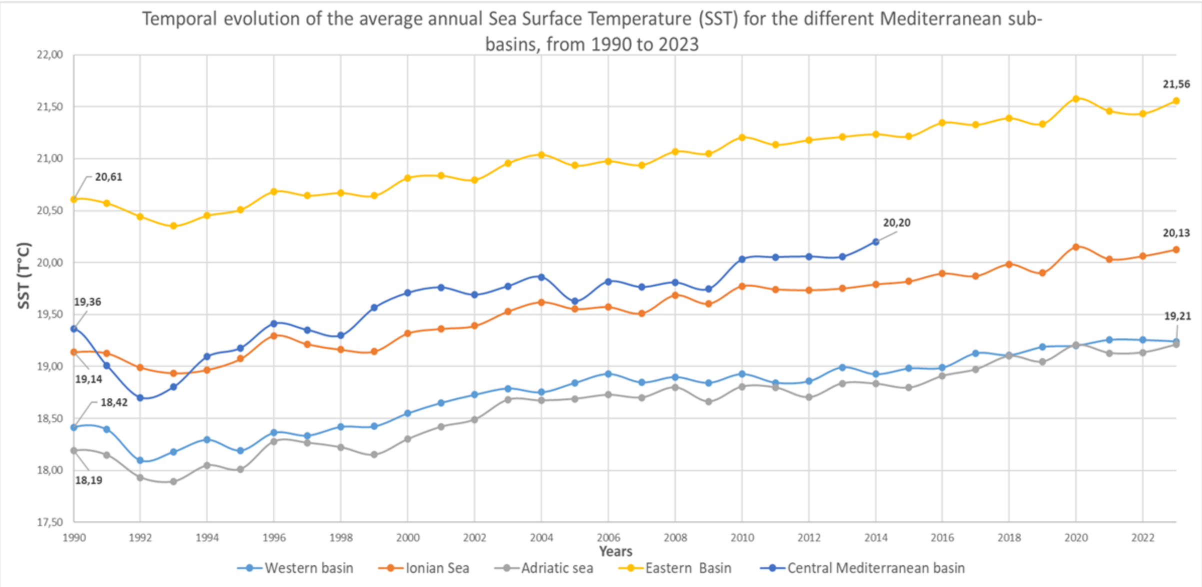


Figure 16-Temporal evolution of the Sea Surface Temperature (SST) since 1990 for the different Mediterranean sub-basins.

Regarding the SST, the warming of the sea surface seems to be more accentuated than the AST since 1990. The Eastern basin is the hottest with an SST of 21,56°C in 2023 when the Western and Adriatic basins are approximately around 19,21°C. Moreover, it’s important to notice the warming of the Adriatic basin towards the western’s basin temperature. Since 1990, the basin which has overcome the greatest SST increase is the Western Mediterranean, with a +1,71°C warming.

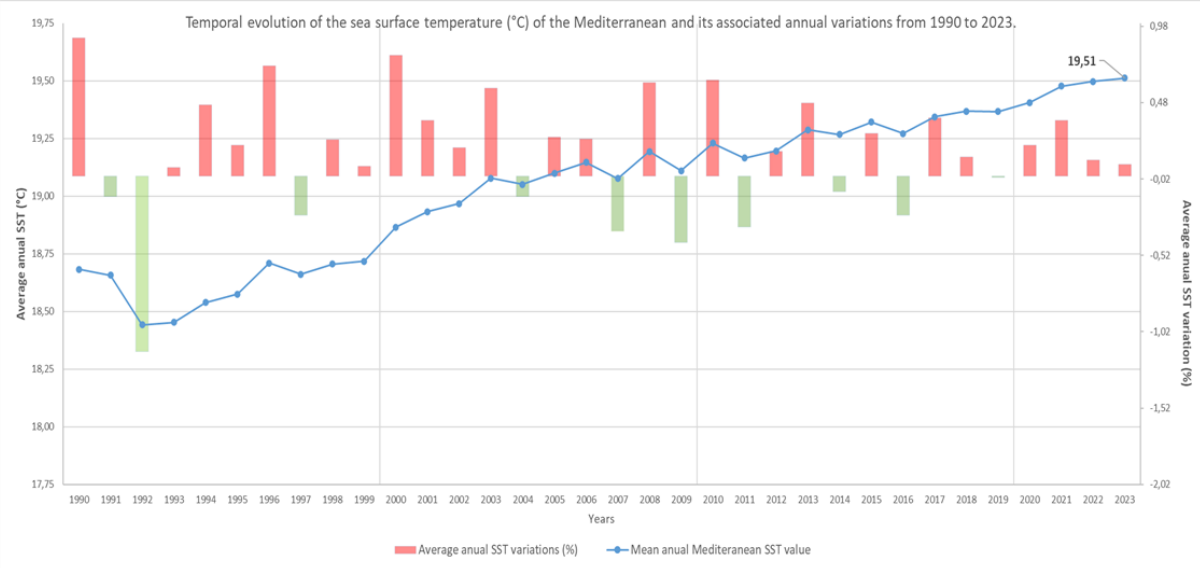


Figure 17-Temporal evolution of the sea surface temperature (°C) of the Mediterranean basin from 1990 to 2023.

Since 1990, the average annual Mediterranean SST variations ranged between -1,15% in 1992 and +0,90% in 1990. Even if the positive variations (related to SST increases) seem minor, their frequencies are elevated. In fact, since 1990, there have been 30 positive variations (8,46% increase in total).

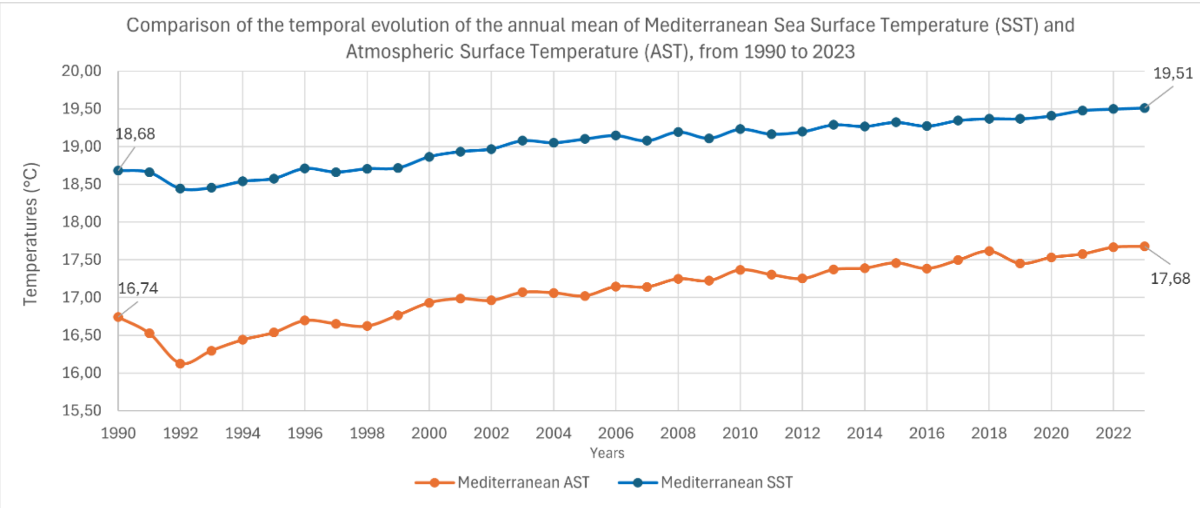


Figure 18-Comparison of the temporal evolution of the Mediterranean SST and AST from 1990 to 2023

The relationship between the SST and the AST is clearly highlighted through this graph. Indeed, the positive and negative trends seem to be correlated. Nevertheless, the average annual warming of the Mediterranean SST seems more intense. In 2023, the SST temperature was 2.4°C higher than the AST temperature for the same year. Comparing the graphs above therefore confirms the calorific property of seawater, which means that seawater heats up slowly but retains its temperature for longer.

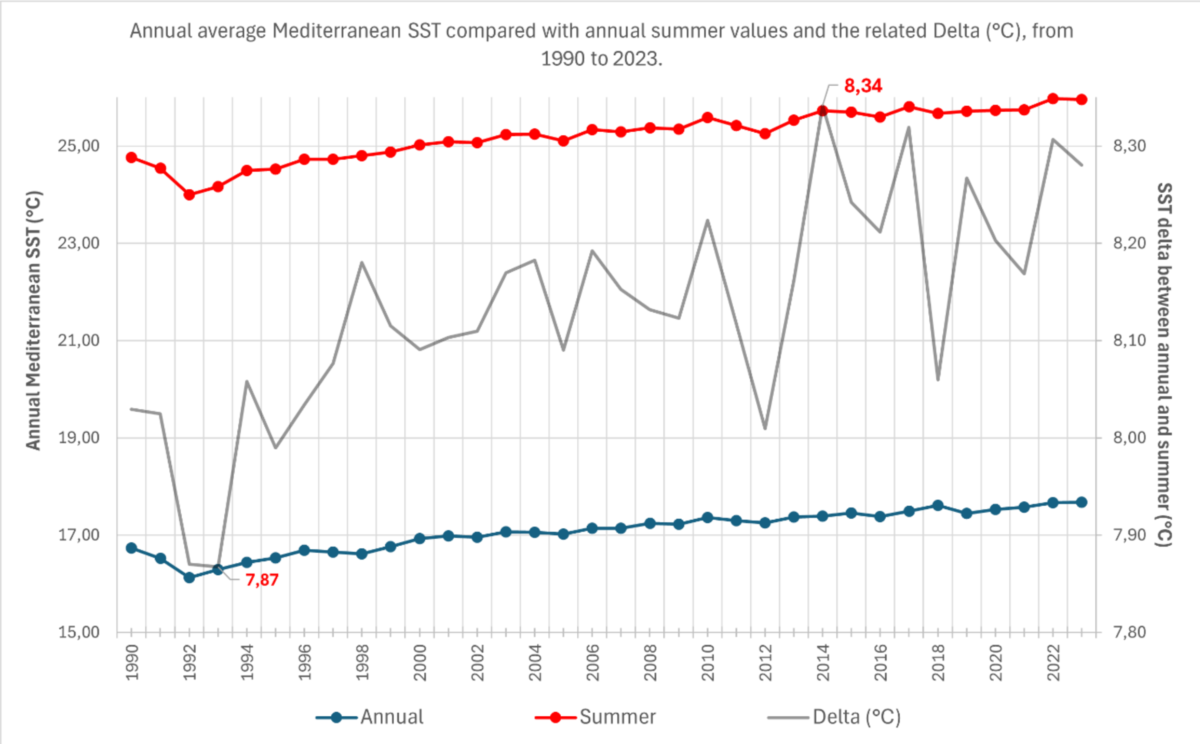
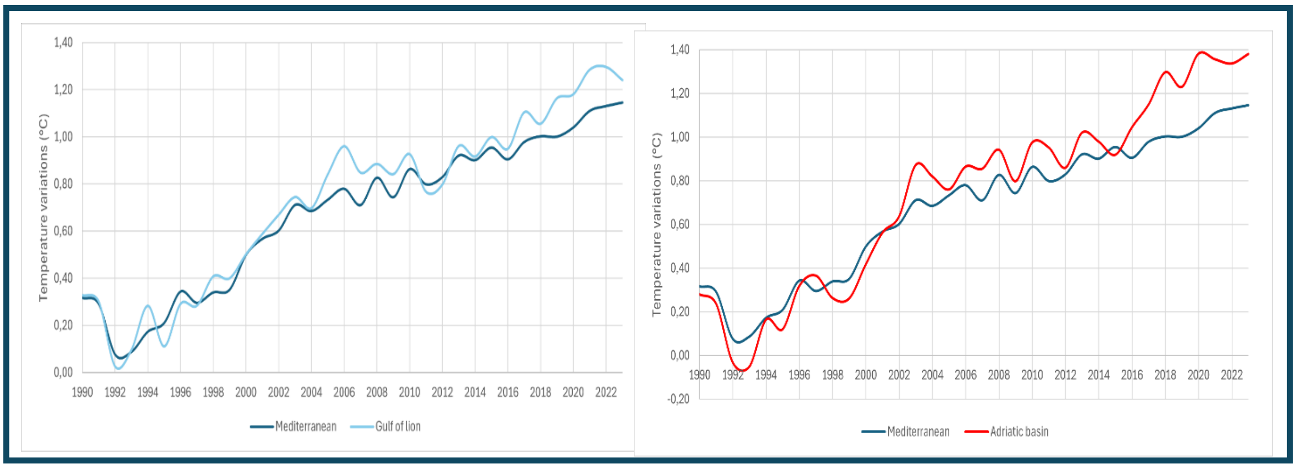


Figure 19-Annual average Mediterranean SST compared with annual summer values and the related Delta (°C), from 1990 to 2023.

The annual and seasonal patterns of SST changes are displayed in figure 19. It's striking how the seasonality, here the summer season, displays its own evolution. From 1990 to 2023, the average summer ST has been much more intense than the annual SST. Indeed, it shows a delta temperature ranging from + 7.89 °C (in 1993) to +8.34 °C (in 2013). The delta is the difference between the two means: annual mean summer and annual mean SST. More importantly, the delta variation is more and more dispersive compared to the annual Mediterranean SST. This number is critical and does not represent extreme SST anomalies which are more intense than the recorded SST. On the other hand, more local variations can be highlighted, notably at the sub-basins scale.
1.15°C for the same year.



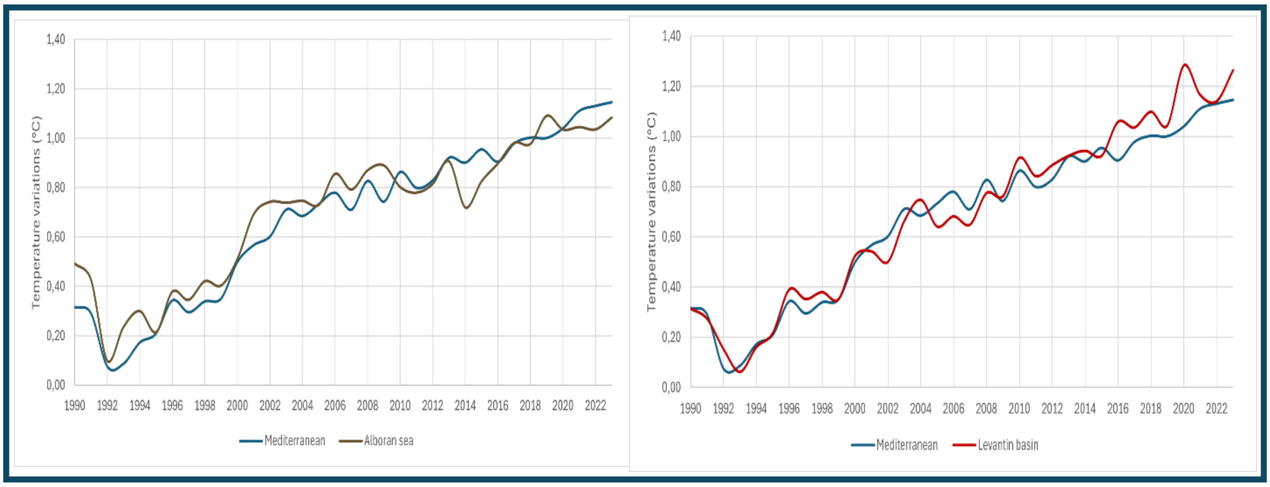


Figure 20-Annual mean SST of the different sub-basins compared to the mediterranean basin evolution (the annual SST mean variation), from 1990 to 2023.

Indeed, the SST anomalies can be monitored and analyzed at smaller scales. The sub-basins approach allows us to scale down the analysis. Indeed, as shown on the figure 20, each sub-basin displays its own SST change's pattern. For instance, in 2006, the Gulf of Lion displayed more intense SST changes (+0.20°C compared to the mediterranean average) while the Levantine basin showed a lower variation (-0.15°C compared with mediterranean average). However, an overall trend can be noticed from 1990 to 2023. Between 1990 to 2000, the curves of the sub-basins were in phase with the one of the Mediterranean. Then, we can observe a graduated disconnection between the mediterranean basin evolution and its related sub-basins. If we take a closer look at the 2020-2023 period, drastic positive changes are observed for each sub-basin. The Adriatic, the Gulf of Lion and the Levantine basins present the highest SST annual changes within the Mediterranean. On the other hand, the Alboran basin displays the lowest annual SST changes compared to the mediterranean basin. Indeed, such local patterns in the SST variations can be explained by the associated local sea surface currents. For instance, the Alboran sea receives daily Atlantic water flows (colder seawater than those of the Mediterranean). Moreover, the cyclonic circulation of the Mediterranean basin induces SST differences. When seawater reached the eastern and northern sides of the Mediterranean basin, surface water had more time to warm up.

Precautions/ Notes for 5a and 5b:
All datasets used for this core indicator have been extracted from the Copernicus Interactive Climate Atlas. Both for the AST and the SST, the raw data were downloaded from the Coupled Model Intercomparison Project Phase 6 (CMIP6) calculation outputs. This project was created by the World Climate Research Programme (WCRP) providing worldwide climate projection to analyze past, present and future climatology for varied environmental drivers. Common numerical models have provided a large number of datasets but with a 100km spatial resolution for all European countries.

- For the AST of southern mediterranean countries, the data have been extracted after having created geospatial polygons (based on administrative national borders) which integrated the historical model's results for the given period (1990-2023). Same for data extractions for the SST variations of each sub-basin. Therefore, potential user biases can be linked to data extraction.
- Moreover, all the presented analysis comes from extracted data which display average annual values without taking into account the seasonal variability, except for summer SST values. However, the other season could be addressed in more detail, both in terms of temperature evolution and variations. Such seasonal overview could bring more insights to the indicators 5a and 5b, notably regarding the climate change dimension which not only induces global warming but also a climate disruption with significant shifts and accentuated extreme values.

- The data resolution can be also criticized from ageographical and temporal point of view. Some Mediterranean countries exposed temporal gaps for the AST, notably Lebanon, Jordania. For the SST, the central basin also displays temporal gaps (values in °C) starting from 2014.
- Finally, the data represent average and annual temperature values at national level for the AST and Mediterranean and sub-basin scale for the SST, whereas greater variability is constantly occurring on smaller spatial scales (regional climates, microclimates, etc.), particularly for SST, which is associated with a very dense physical domain with varied surface current movements and energy transfers. Actually, these superficial layers of the water column regularly overcome drastic and punctual water temperature anomalies due to water masses stratification changes. Indeed, down-welling and up-welling currents (cold water masses) can cool down sea water surfaces. Extreme events (marine storms, oceanic eddies) can also directly affect the SST locally.

Source: Copernicus Climate Atlas, 2024

CORE INDICATOR 7a: Evolution of water withdrawal per inhabitant

Definition:

Water stress can be defined with many indicators and is often related to drought indicators. However, the drought's pressure can be misunderstood and can integrate diverse composite indicators. Indeed, it can be tackled with a precipitation index which gives metrics information on quantities of precipitated water for a given geographical area. On the contrary, the evaporation index represents the amount of evaporated water. The soil's shallow moisture content and the water flows are also used to characterise the water inputs and water volumes in a given ground. Therefore, assessing water quantitative and qualitative depletions may be tricky.

In fact, water volume availability is more adapted to such water stresses analysis and is more commonly used. Indeed, it can be seen as the freshwater taken from ground or surface water (lakes, rivers, aquifers), either permanently or temporarily and transported to a place of use (OCDE, 2020). Moreover, the water withdrawal per capita is very useful when we want to qualify water availability per inhabitant. The indicator displays the available annual water volumes per inhabitant (m3/inhabitant/year).

Analytical part:

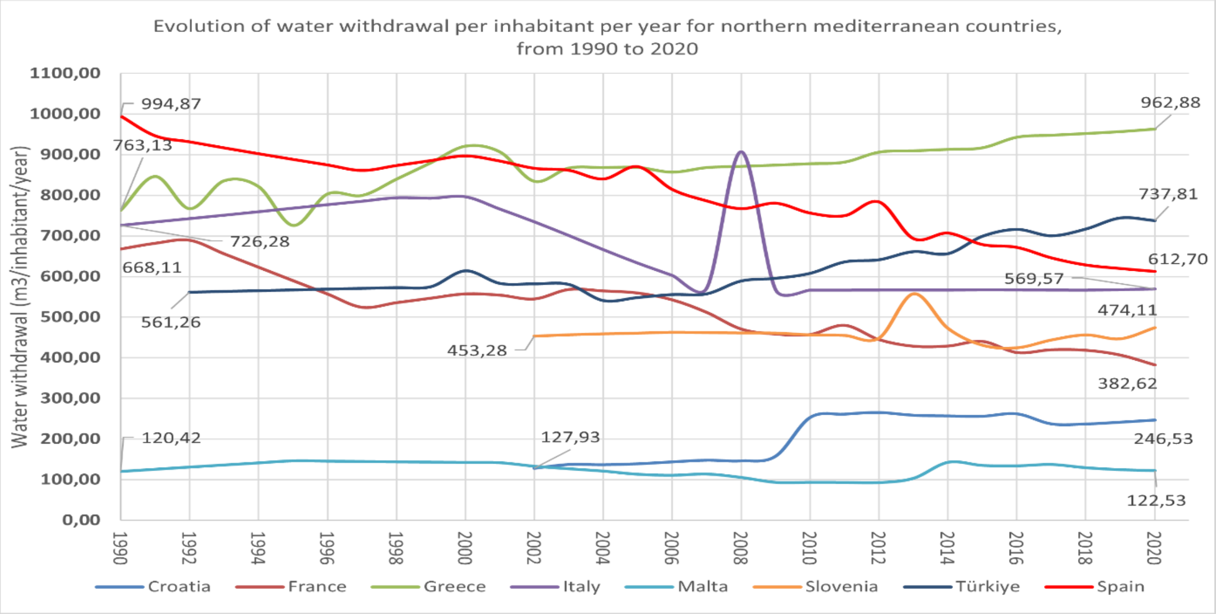


Figure 21-Evolution of water withdrawal (m3) per inhabitant per year for northern mediterranean countries, from 1990 to 2020 (modified from AQUASTAT, 2024).

It's interesting to observe the heterogeneity between northern mediterranean countries. Indeed, even if they gather 67% of the total renewable water resources (RED, 2020), temporal differences are highlighted in the water withdrawal per capita for each country. Moreover, these differences are accentuated with specific national population growth (FAO, 2020).

In 1990, Spain displayed the highest water withdrawal (994,87 m3/inhabitant/year) followed by Greece (763,13 m3/inhabitant/year), Italy (726.28 m3/inhabitant/year) and France (668.11 m3/inhabitant/year). In 2020, we observed a shift in the national water withdrawal patterns. Greece arrives in first position followed by Türkiye and Spain, which was initially at the top. Three northern countries (Spain, Italy and France) overcame significant decreases for their respective national water withdrawal per capita. In 30 years, France displayed a diminution of 42.7% for its water withdrawal capita when Spain and Italy showed water withdrawal reductions of 38.4% and of 21.57% respectively. On the other hand, Malta, Croatia, Slovenia, Türkiye and Greece recorded significant increases in their respective water withdrawals.

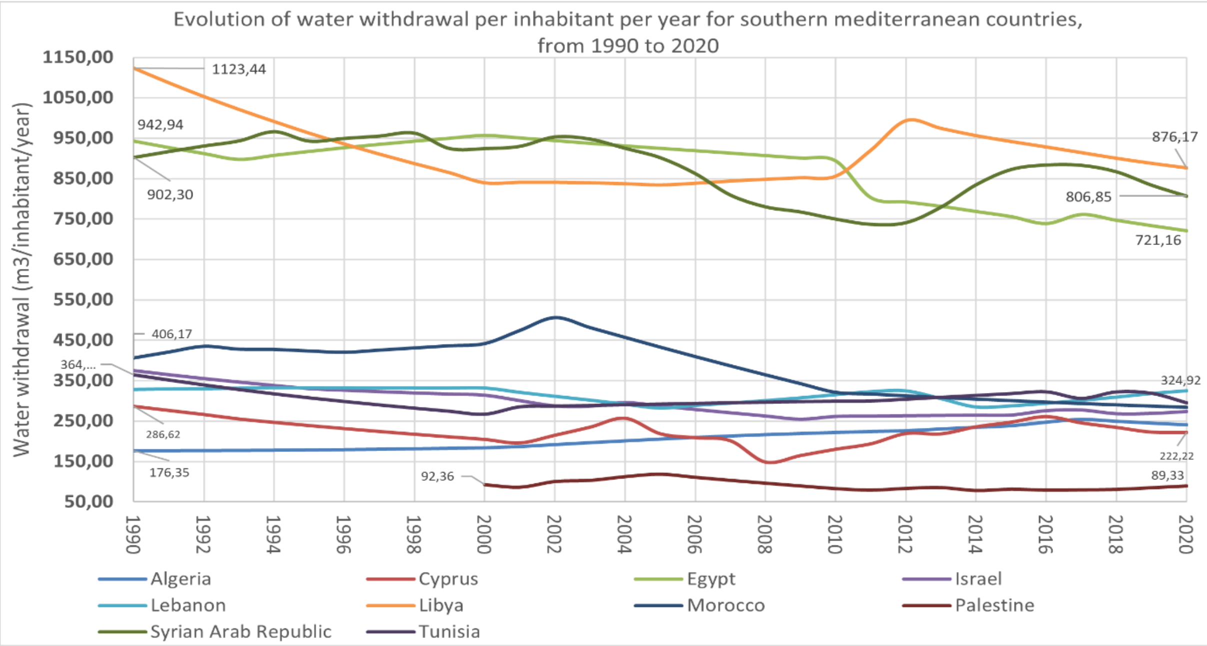


Figure 22-Evolution of water withdrawal per inhabitant per year for southern mediterranean countries, from 1990 to 2020.

The temporal evolution of the water withdrawals for southern mediterranean countries has been represented on figure 22. Same for northern mediterranean countries, the water withdrawals display non-linear evolutions with trays, hollows and peaks. What's more, two distinct groups are identified. Indeed, three countries (Libya, Egypt and Syria) display higher water withdrawals than the remaining southern countries. In fact, in 2020 there was a gap of 396.24 m3/inhabitant/year between Egypt (721.16 m3/inhabitant/year) and Lebanon (324.92 m3/inhabitant/year). All southern countries have recorded drastic diminutions in their respective water withdrawals since 1990. Indeed, the majority of southern Mediterranean countries present lower water withdrawals than the third lowest water withdrawal of the northern mediterranean countries (France), in 2020.

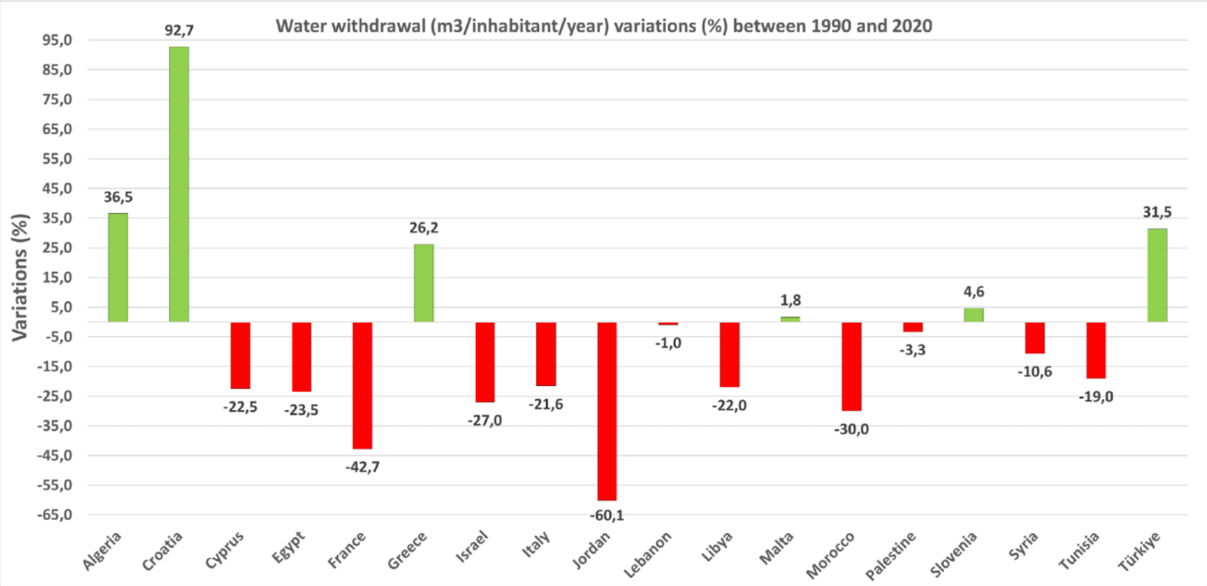


Figure 23-Water withdrawal variations (%) for all mediterranean countries (+Jordan) between 1990 and 2020.

Instead of looking at the annual change in national water withdrawals per inhabitant, the change over the thirty-year period associated with the latter can provide additional information. As suggested by the temporal evolution curves, the majority of mediterranean countries recorded water withdrawal decreases over the 1990-2020 period. The negative variations range from -1.0% for Libya to -42.7% for France (and -60.1% for Jordan). Algeria is the only southern mediterranean country which displays a positive variation (+36%) in its annual water withdrawal. It's important to notice the variations of the two Mediterranean island countries, Malta and Cyprus. Indeed, such countries are initially confronted with water scarcity compared to continental countries. Malta recorded a slight increase in annual per capita water withdrawal (+1.8%) over the 30-year period, while Cyprus fared less well, posting a 22.5% drop over the same period.

Precautions / Notes:

- This indicator is a good representation of water availability facing rising water stresses. However, more punctual and pronounced water scarcities occur in the mediterranean basin and are not necessarily taken into account in the indicator analysis.
- What's more, economic and social factors are not taken into account in the water abstraction indicator, despite the fact that many Mediterranean societies have difficulty gaining access to drinking water. On the other hand, climate change and anthropogenic activities not only affect quantitative water dimensions, but also qualitative ones. Indeed, many natural water tanks are more and more contaminated and may be dangerous for human consumption.
- The seasonal water demand (generally more intense during summer) could be added to the analysis due to its direct effects on temporal water withdrawal per capita balance. Finally the observed variations can't totally be explained. It could be interesting to cross the analysis with other factors which may induce direct changes on water availability, notably non-conventional water resources development.
- Moreover, water distribution between customers (municipalities, industries, tourism activities, etc.) could be integrated into the analysis of water withdrawal evolution, notably for assessing

the direct and indirect influences between customer water requirement and potential water distribution imbalance.

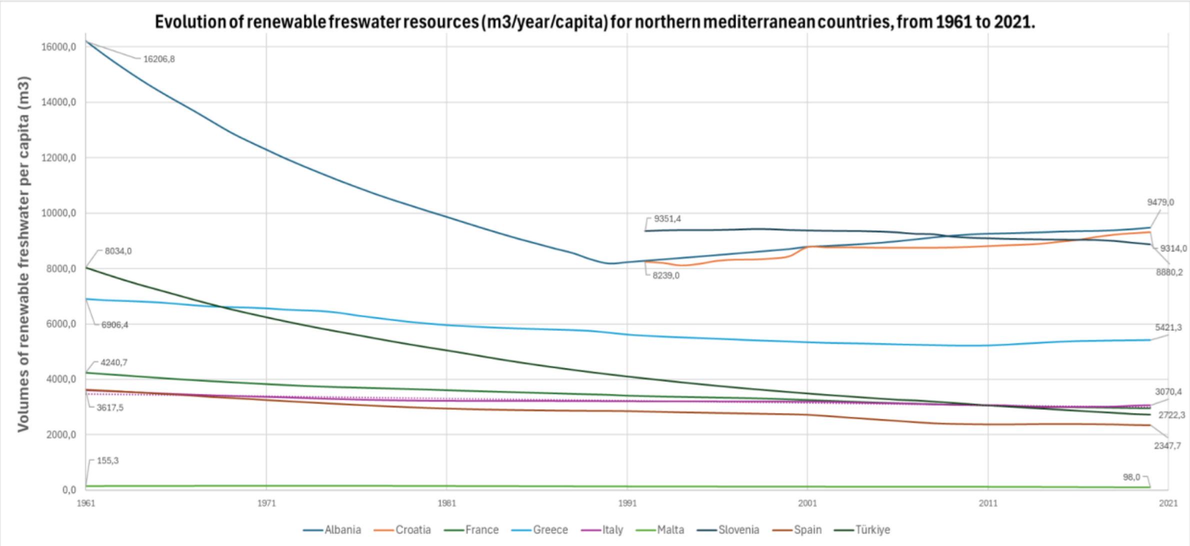
Source: FAO AQUASTAT, 2024

Core IDD 7b. Renewable freshwater resources per capita

Definition

Renewable freshwater resources per capita is an indicator that measures the total volume of renewable freshwater available annually in a given region, divided by its population. It reflects the average water availability per person, accounting for internal river flows, groundwater recharge, and incoming flows from transboundary sources, while excluding non-renewable sources. This indicator is commonly used to assess water stress and availability in the context of human and environmental demands.

Analytical part



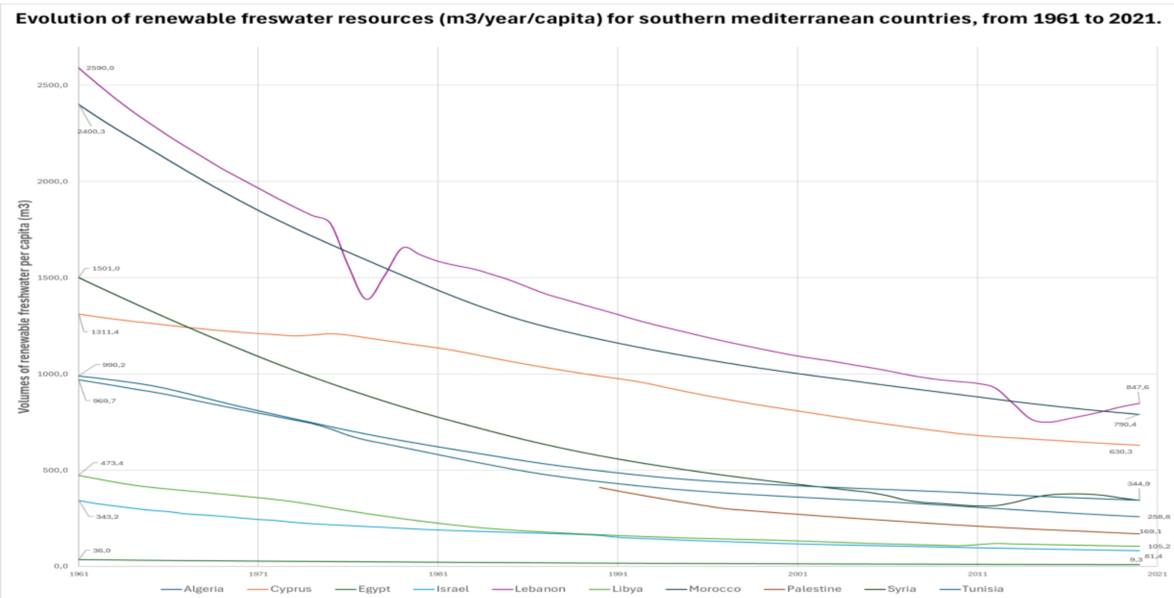


Figure 2- a)Renewable freshwater resources per capita for northern countries in a) and for southern countries in b),from 1961 to 2020.

Renewable freshwater resources show significant national disparities in their development trends (Figure 2b).

In addition, strong geographical differences are observed at regional scale. According to figure 2a, in 2020, none of the northern Mediterranean countries fall into the water stress category (which is defined when the renewable freshwater resources go below 1700 m3/year/capita), with the exception of Malta (98 m3/year/capita).

On the one hand, the northern Mediterranean countries have the highest values for renewable freshwater resources, ranging from 2347.7 m3/year/capita (Spain) to 9479.0 m3/year/capita (Albania). On the other hand, all southern Mediterranean countries face water scarcities (Cyprus, Lebanon, Morocco) and absolute water scarcities (Algeria, Israel, Libya, Malta, Palestine, Syria and Tunisia). According to figure 2b, since 1961, all southern countries have experienced drastic negative trends in their national renewable freshwater resources. For example, over the overall period, Egypt recorded a 73.3% decrease in renewable freshwater resources per capita resulting in a renewable freshwater resource equal to 9.3 m3/year/capita.

Precautions/notes
The analyzed dataset provides reliable national and regional interpretations, but several limitations remain. Indeed the indicator considers that the water is equally available to all people whereas significant geographical and temporal disparities may appear.

Also, the quality dimension of the renewable freshwater resources is not taken into consideration. At more local scales variability in water quality may lead to unusable resources for municipalities, agriculture and/or industries.

On the other hand, water demand is simplified within this indicator. Actually, the population dynamics (migrations, population densities, including seasonal variations in tourist destinations) can significantly affect the renewable freshwater resources per capita estimates. What’s more, finest comparisons with the water withdrawal per capita may lead to relevant trade-off analysis in terms of water uses and water resources.

Moreover, water management aspects are excluded. Indeed, in many situations, conflicts appear between upstream and downstream water allocations.
Finally, the indicator considers that the resources remain constant, potentially underestimating the impact of climate change on the great water cycle and related hydrological processes.

Source: World Resource Institute, Our World in Data database, 2024

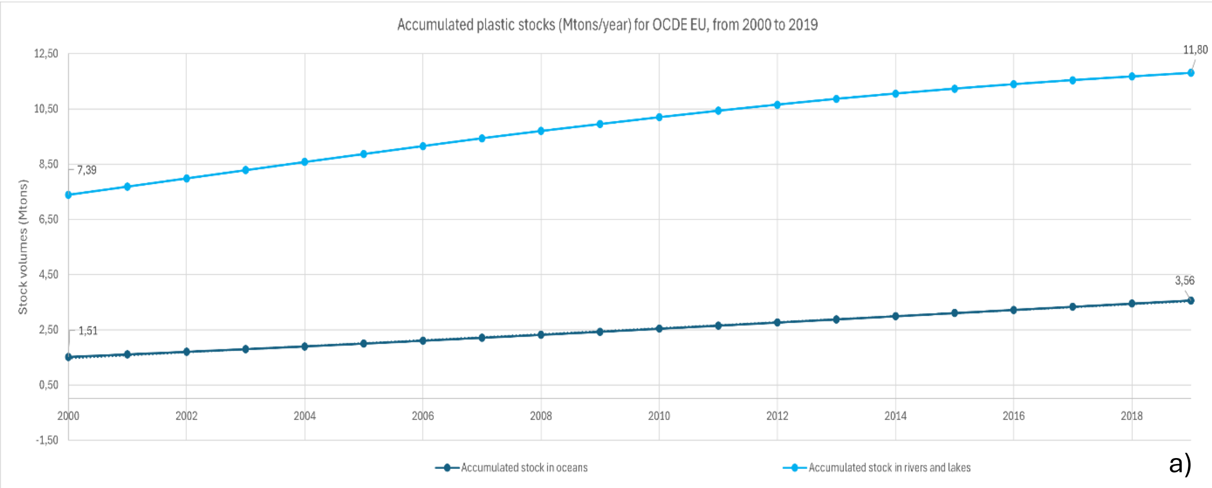
Core Indicator 8: Plastic leakages in aquatic environments

Definition:

Plastic pollution is one of the worst human environmental footprint. Indeed, the quantification of plastic volumes emitted by human societies is a tricky exercise which may presents qualitative and quantitative gaps. Therefore the “great plastic family” is categorized under different sub-classes related to the type of plastic (polymer composition) and the associated scales (microplastic and microplastic). Here, the indicator measures the annual plastic stocks (million tons/year) released at sea.

Moreover, the data have been calculated at interregional level. Therefore, in the aim of proposing a Mediterranean region approach, data from European-Union and Middle-East & North Africa (MENA) regions have been selected and analyzed. The indicator has been analyzed on the 2000-2019 time period. Moreover two stock sub-classes (accumulated stock in oceans and accumulated stock in rivers and lakes) have been compared as follows:

Analytical part:



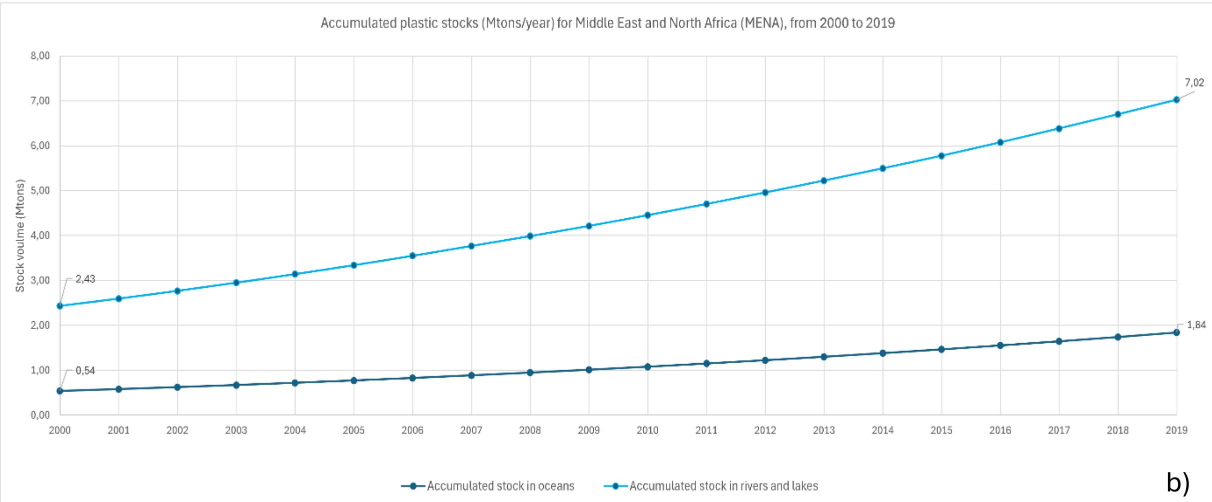


Figure 27-Accumulated plastic stocks (tons/year) for Europe, Middle East and North Africa, from 2000 to 2019, for OECD EU in a), and MENA in b).

The amount of plastic dumped at sea depends on geography and type of stock. Indeed, through figure, we observed significant differences between regions and between stocks. For both regions, it seems that stocks in rivers and lakes are the largest. Moreover, the European region displays the highest stock volumes but with a lower increase compared to the Middle East & North Africa. Indeed, in 2000 the stock accumulated in oceans by the EU was 3 times higher than the one emitted by the MENA region. The MENA region recorded an increase of 188% in its plastic stock volumes measured for rivers and lakes whereas the EU shows a slight increase of 56%. Both for the EU and MENA region, the stock volumes of the river and lakes are higher than the one in the oceans. However, such stocks display more intense variations in this twenty-year period. In fact, the plastic stocks which end up in the ocean have largely increased compared to the other stocks. For MENA, it shows an increase of 240% and a positive variation of 69% for the EU. It’s therefore interesting to look in more detail at the volumes of stocks linked to regulatory frameworks and implemented directives in both regions. To be more precise, it could be useful to assess the impacts of such management tools on plastic leakages in aquatic environments.

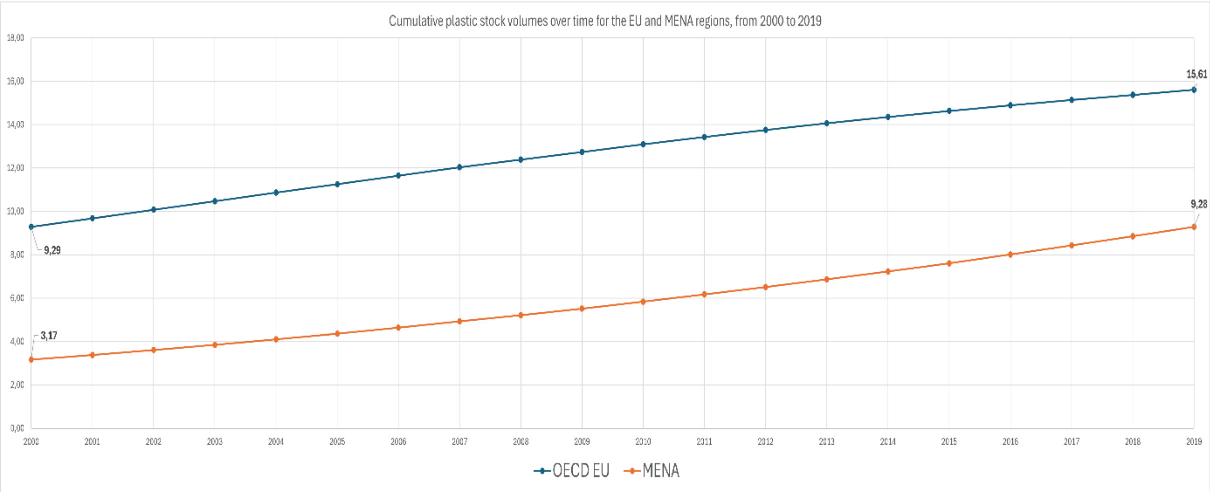


Figure 28-Cumulative plastic stock volumes over time for the EU and MENA regions, from 2000 and 2019.

From an overall perspective both regions are displaying increases when we sum all the plastic stocks. Moreover, the MENA curve seems to reach the EU one. Therefore, for all mediterranean basins, the plastic leakages are increasing from 2000, even if regulatory frameworks and directives are more and more implemented to reduce plastic productions, consumptions and wastes.

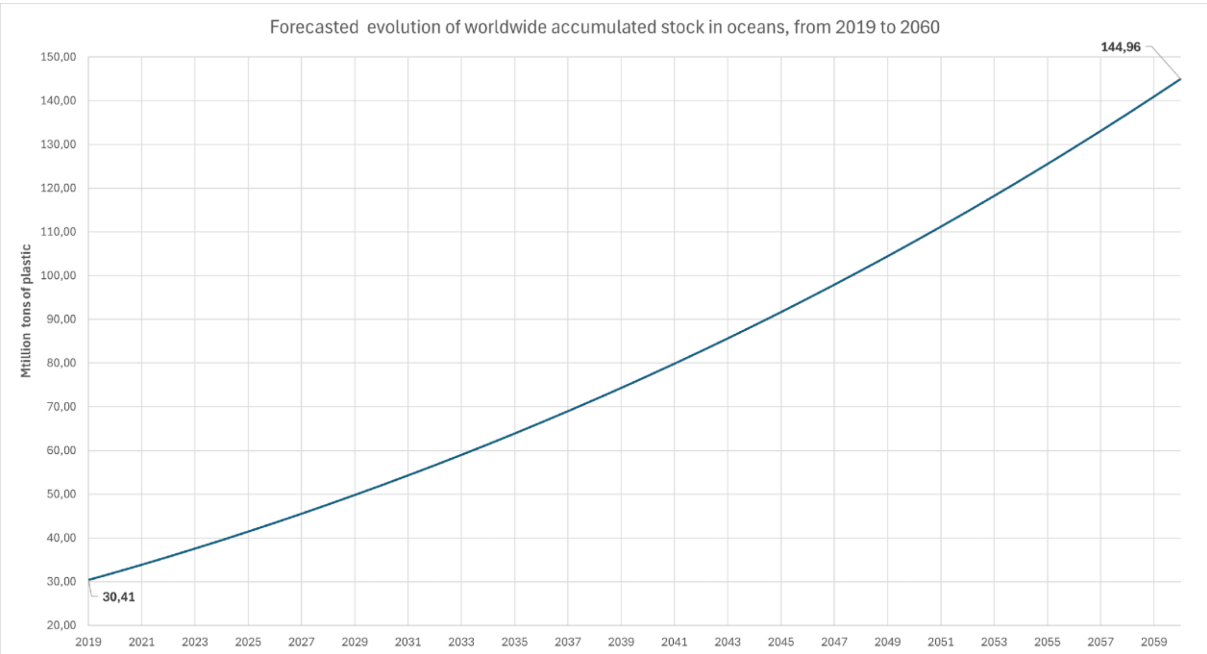


Figure 29-Global forecasted (from 2019 to 2060) evolution of plastic volumes emitted in aquatic environments.

Although there are geographical differences in the volumes of plastic emitted into aquatic environments, the general trend is assumed to be as shown in Figure 29. Indeed, the volumes of plastic discharged into aquatic environments are not expected to slow down; on the contrary, a sharp increase is forecast for the 2060 horizon.

Precautions / notes:

- These indicators tackle a tiny part of the issue. First of all, the analyzed datasets are geographically and temporally biased, notably for Mediterranean basin analysis. Indeed, the available datasets are not declinable at national scales and report for a wider geographical data range. However, each country should at least provide national estimates on this subject.
- On the other hand, the technical side of the issue has been largely simplified, notably regarding the types of plastic emitted and the related sizes. Depending on their composition, they persist in different ways in aquatic environments.
- The notion of "stock" has been simplified. For instance plastic leakage flows (inputs and outputs) in the different aquatic environments could be brought to the analysis.
- There are other gaps in the data, particularly with regard to plastic volume flows, which in a sense are closely linked to the water cycle. In this sense, the volumes emitted could be compared according to the different sources of emission (households, industry, tourism, etc.).
- Underground water sources such aquifers haven't been included whereas such natural water tanks are more and more exposed to plastic pollution.
- Moreover, the stock classes should embed the "living stock" category. In fact, what is more important than the abiotic stocks themselves is their capacity to transfer their plastic volumes into living beings (through consumption, respiration, etc.). Indeed, more and more animals, ecosystems and biospheres are affected by plastic.
- Microplastic is a rising problem under this topic's scope. However, no database gathers such exhaustive information (both on qualitative and quantitative sides) due to the data integrity and measurement challenges (at geographical and temporal scales).

Source : OECD.Stat, 2024.

Core Indicator 9a: Air Quality focus on PM 2.5

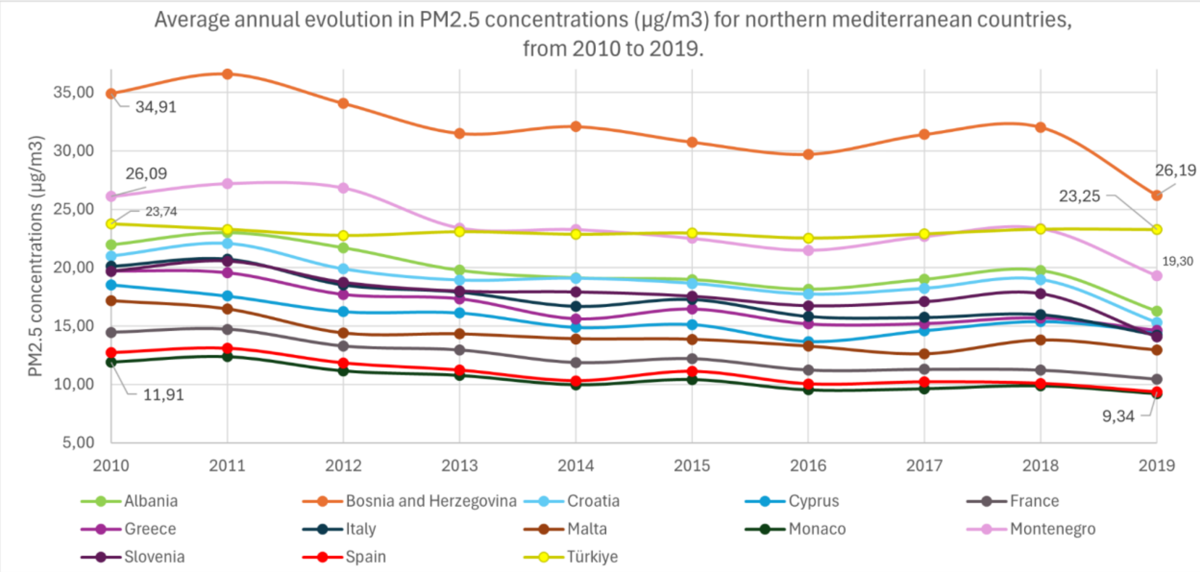
Definition:

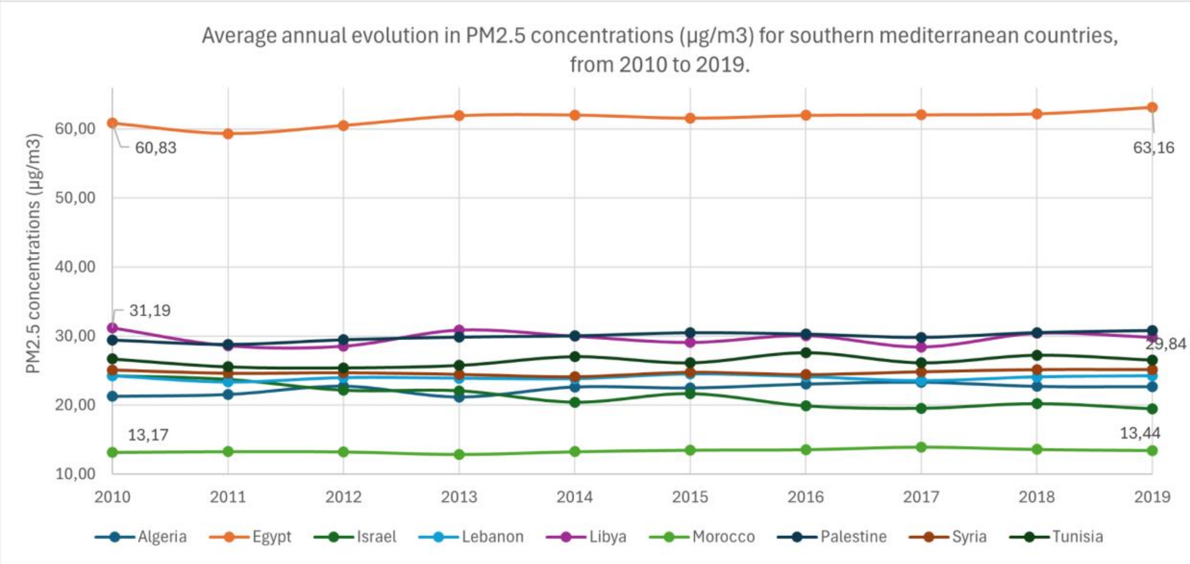
Annual average total atmospheric concentrations of PM2.5 particles (a diameter of less than 2.5 micrometers).

Analytical part:

A significant concentration heterogeneity between countries (true in the north and in the south) with a concentration higher in southern countries. The range of values from the south shore is wider than the northern shore. A regional trend towards a potential improvement in air quality (except for Egypt).

Health and environmental impacts of air pollution exposure remain high across Europe. Just under 240,000 deaths per year in the European Union (EU) can be attributed to exposure to fine particulate matter, a key air pollutant, according to the latest European Environment Agency briefing published today as the new EU rules enter into force. The latest data also confirms, yet again, that Europeans remain exposed to air pollutant concentrations considerably above recommended World Health Organization levels. A separate briefing, published also today, found that nearly three quarters of Europe's ecosystems are exposed to damaging levels of air pollution.





Precautions / notes:

The finest geographical analysis could be brought (at urban, suburban and rural scales). Annual average values exclude extreme daily peaks, notably induced by daily peak traffic times. No information on the chemical composition of the PM2.5 particles is provided but they are very dangerous for human health.

Source : data source: Our World in Data, 2022

Core Indicator 9b: Air Quality focus on Carbon monoxide emissions

Definition:
This indicator measures the total annual emissions of carbon monoxide (CO) in tons within the Mediterranean basin. CO emissions are primarily derived from anthropogenic sources such as industrial processes, vehicle exhaust, residential heating, and agricultural activities, as well as natural sources like wildfires. The indicator provides insights into air quality, environmental health, and the effectiveness of policies aimed at reducing CO emissions, contributing to regional climate monitoring and sustainability assessments.
Analytical part:

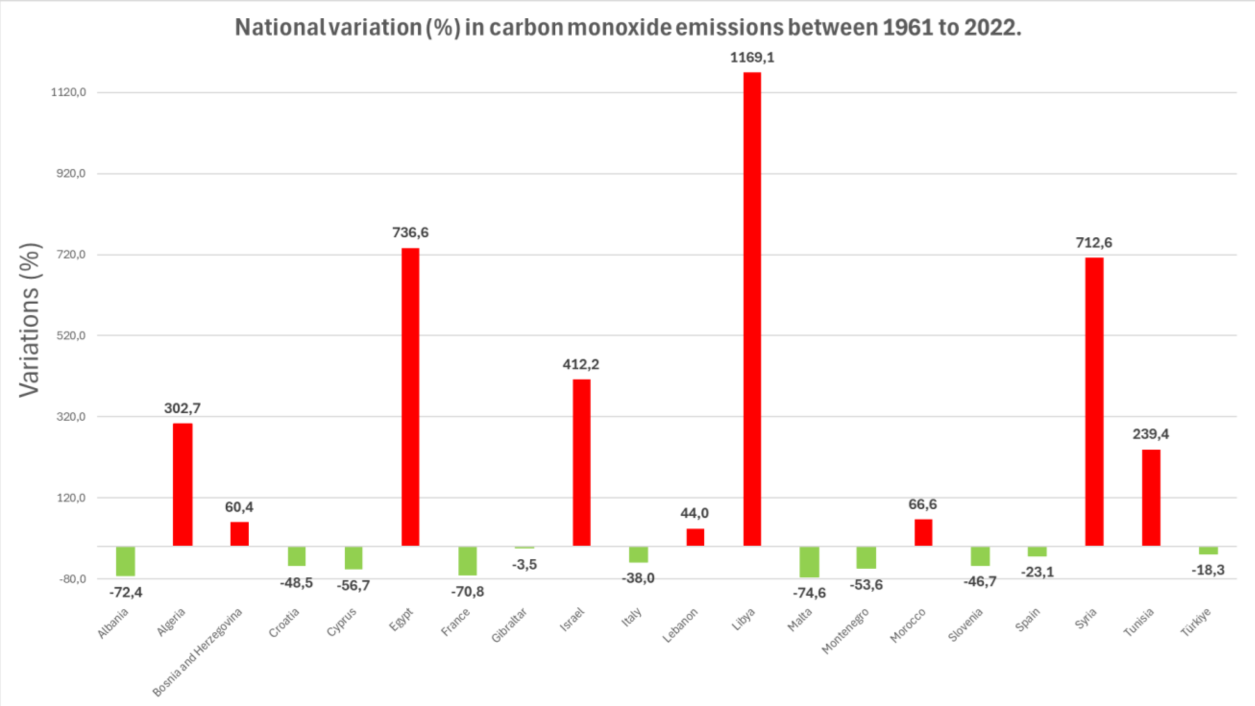


Figure 1-National variation (%) in carbon emissions between 1961 and 2022.

Nota bene: Plan Bleu can also provide national trends (annual values) for the overall period (not only the national variation in % in carbon emissions between 1961 and 2022.

The overall variations observed in CO emissions since 1961 are greatly heterogeneous between mediterranean countries ranging from -70% (for France) to +1169% (for Libya). In total among 20 countries (Monaco is not part of the analysis), 9 showcase positive variations in their total CO emissions while 10 show negative ones.

Precautions/notes:
When analyzing carbon monoxide (CO) emissions in the Mediterranean basin, key challenges include inconsistent data quality (differences in data reporting standards, methodologies, or the availability of monitoring stations), limited monitoring infrastructure, and methodological variability. Transboundary influences, such as emission transport (linked to the diffusion of the gases, coarse particles) and climatic factors, add complexity to source attribution and related analysis.

Political, institutional, and funding barriers can hinder data harmonization and integration across countries leading to data anomalies.

Source: World Health Organization, 2024.

Core IDD 10: Evolution of Mediterranean protected areas and their associated surfaces

Definition: This indicator encompasses the total marine extent of protected sites (MPAs, Other Effective area-based Conservation Measures (OECMs) and Site of conservation interest) in square kilometres (km²) within the Mediterranean region, distinguishing between the Northern and Southern Mediterranean countries.

Marine Protected Areas (MPAs) are defined as marine and/or coastal areas, including lagoons permanently linked to the sea, the oceanic water column and its underlying seabed, that are recognized, dedicated, and managed through legal or other effective means to achieve the long-term conservation of nature with associated ecosystem services and cultural values. These areas are designated to protect and preserve the biological diversity and natural and cultural resources within their boundaries. MPAs vary widely in their objectives, which can range from strictly prohibiting all extractive activities to allowing sustainable use of marine resources.

OECMs are a relatively new concept introduced by the Convention on Biological Diversity (CBD). They are geographically defined areas other than MPAs that are governed and managed in ways that achieve positive and sustained long-term outcomes for the conservation of biodiversity, with associated ecosystem functions and services, and where applicable, cultural, spiritual, socio-economic, and other locally relevant values. OECMs may not have been primarily designated for conservation but achieve significant conservation outcomes through their management.

Sites of Conservation Interest are specific areas identified for their unique ecological, biological, cultural, or scenic values that contribute significantly to the global, regional, or national conservation of biodiversity. These sites might not be formally protected as MPAs or recognized as OECMs but are important for biodiversity conservation efforts. They can include habitats critical for endangered species, areas with high biodiversity, and regions that provide essential ecosystem services.

Analytical part:

Across the Mediterranean, there has been a clear trend towards the establishment and expansion of marine protected areas, with important variations in the approach between Northern and Southern countries. The data shows a significant increase in the extent of protected sites over the period from 1990 to 2022 for the Mediterranean, especially in the Northern Mediterranean. In the Southern Mediterranean, the growth in protected areas is also present but very less substantial compared to the Northern Mediterranean.

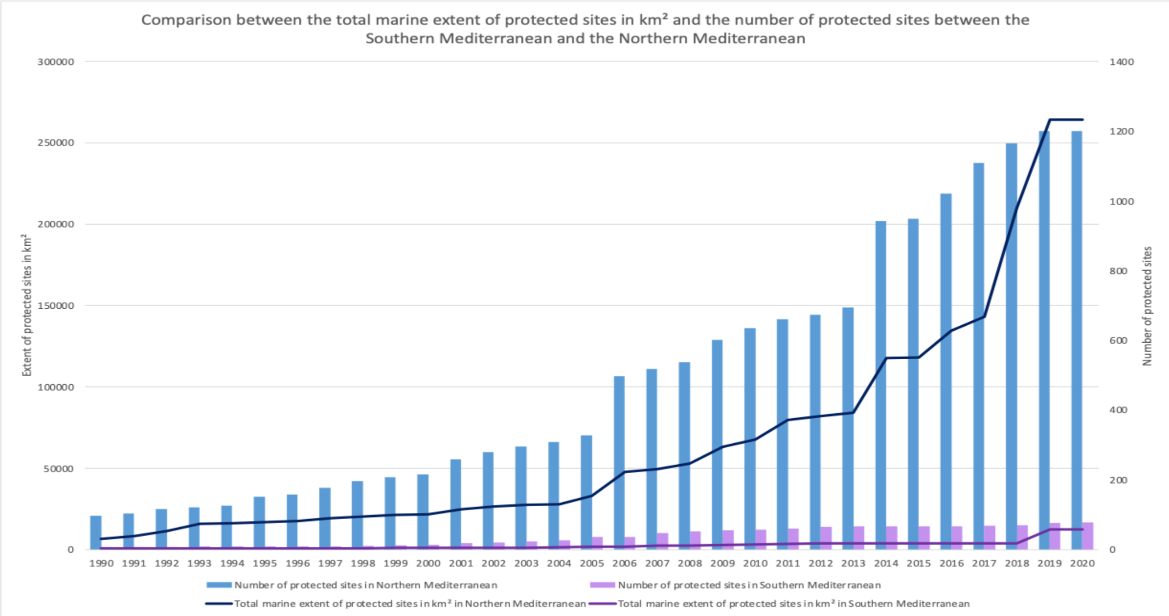
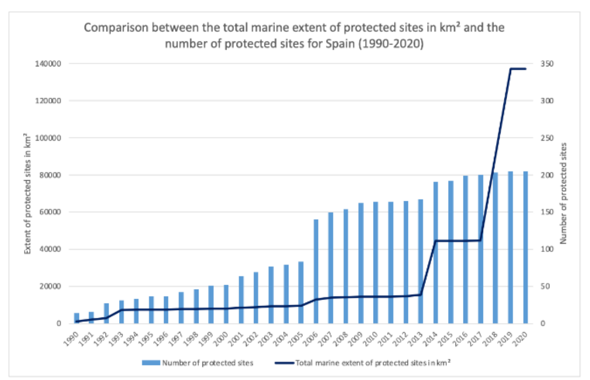


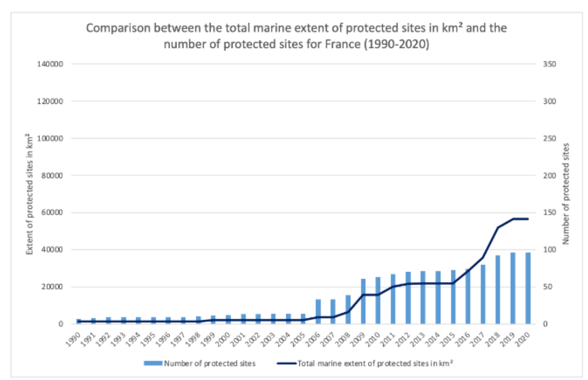
Figure 24-Comparison of the total marine extent of protected sites with the number of protected sites between the Southern and the Northern Mediterranean from 1990 to 2020.

In 2020, the Mediterranean has 1278 protected sites including 1112 MPAs, 162 Sites of Conservation Interest and 4 OECMs. Here, the sites not reported, numbering 34, and the sites shared between several countries, numbering 8, are not taken into account because these cover very large areas. For instance, the Pelagos Sanctuary (France, Italy and Monaco) with 87658,83 km² represents approximately 3.5% of the Mediterranean. Among these 1278 protected sites, 1200 are located in the northern Mediterranean and 78 in the southern Mediterranean. Thus, 94% of protected sites are located on the northern side of the Mediterranean.

The 1,112 MPAs cover 8.9% (224,144 km²) of the Mediterranean (2,516,900 km²) through a wide variety of conservation designations and different levels of protection. If we add the 4 OECMs (4,647 km²) and the 162 Sites of Conservation Interest (47,510 km²) we reach a coverage of 11% of the Mediterranean, 10% in the Northern Mediterranean (264,002 km²) and 1% in the Southern side (12,298km²). In this regard, 95,5% of the extent of protected sites are located in the northern side of the Mediterranean. This distinction is very important in view of Aichi Target 11 aimed at conserving 10% of coastal and marine areas by 2020. Note that we are also probably far from completing Target 3 of the Kunming-Montreal global biodiversity agreement to conserve 30% of Land, Waters and Seas since if we take into account that the AMPs only cover 8.9% of the Mediterranean.

There are therefore significant disparities between the Northern Mediterranean and the Southern Mediterranean as well as between the number of protected sites and the surface area.





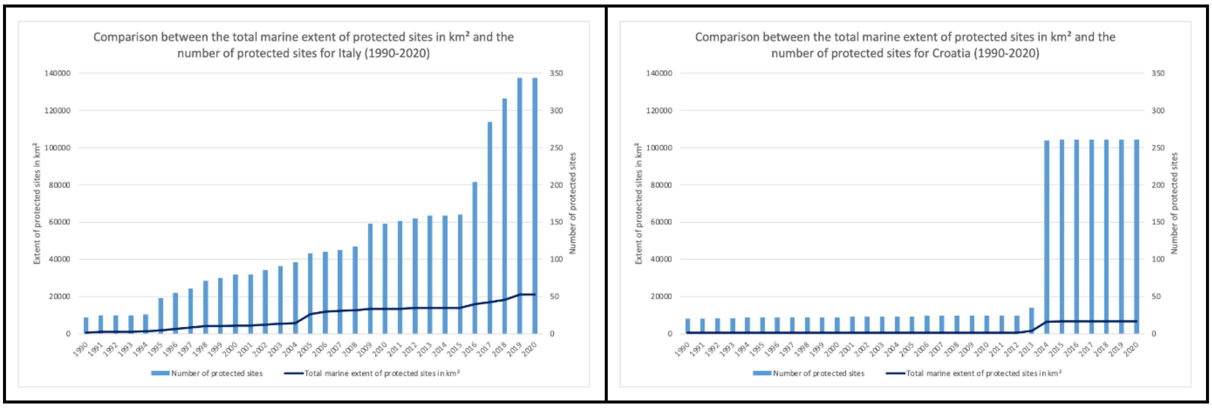


Figure 25-Comparison of the total marine extent of protected sites with the number of protected sites between some northern Mediterranean countries (Spain, France, Italy and Croatia) from 1990 to 2020.

For instance, Croatia has shown remarkable growth, from 20 protected sites in 1990 to 261 by 2020 (with a peak in 2014 with 225 new protected sites, probably due to its entry into the European Union), but with a total marine extent increasing only from 463.62 km² to 6557.2 km². In the same way, Italy saw a consistent rise in the number of protected sites, reaching 344 by 2020. Yet, the total marine extent increased from 443.8 km² in 1990 to 20952.75 km² in 2020.

On the other hand, France saw an increase in the number of protected sites from 7 in 1990 to 96 by 2020, with the total marine extent growing significatively from 1353.39 km² to 56,401.08 km². Spain has also shown remarkable growth in the extent of protected sites, from 1019.57 km² in 1990 to 137,215.54 km² in 2020 with only 205 protected sites in 2020. Note that the Mediterranean Cetacean Migratory Corridor is taken into account here for Spain, with its 46353,27 km² (approximately 1.8% of the Mediterranean).

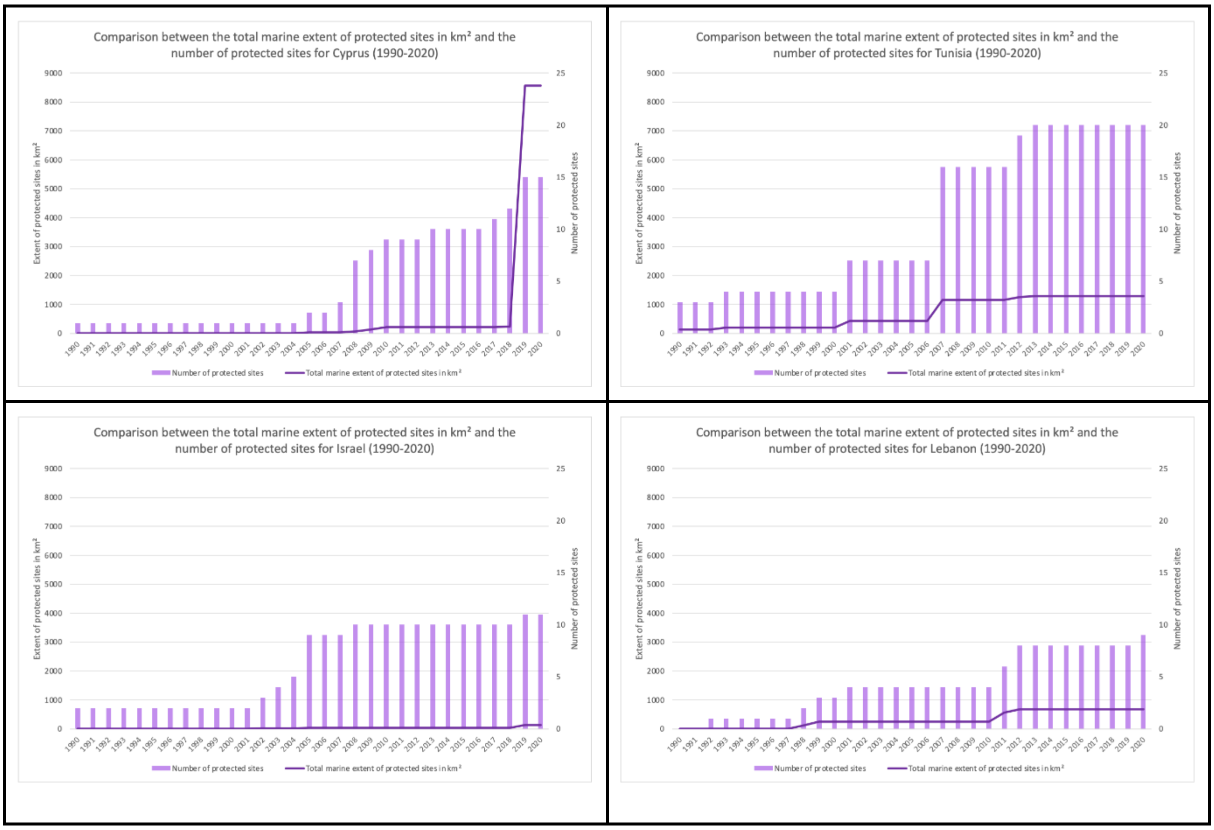


Figure 26-Comparison of the total marine extent of protected sites with the number of protected sites between some Southern Mediterranean countries (Cyprus, Tunisia, Lebanon and Israel) from 1990 to 2020.

Southern Mediterranean countries have smaller numbers of protected sites compared to the Northern countries mentioned.

Indeed, even if Cyprus also demonstrated significant progress, with the number of protected sites growing from 1 in 1990 to 15 by 2020, and the total marine extent expanding dramatically from 6.03 km² to 8563.6 km² (Note that the Proposed Site of Community Importance (Habitats Directive) called Oceanid is taken into account here with its 8331,62 km² in 2019), countries like Tunisia, Lebanon, Israel show smaller numbers and total marine extent of protected sites. For instance, Lebanon's number of protected sites grew from zero in 1990 to nine by 2020, with a corresponding increase in marine extent from zero to 679.58 km² during the same period. Tunisia also shows small numbers with an increase from 3 in 1990 to 20 by 2020 and with the marine extent expanded from 131.62 km² to 1286.7 km². Israel maintained a relatively small number of protected sites over the years, with an increase from two in 1990 to eleven by 2020. The marine extent also expanded from 0.31 km² to 130.16 km² during this period.

Thus, it is not because there are more and more protected sites, as in Croatia for example, that the protection coverage of the Mediterranean is more extensive. It is therefore important to think in terms of the total marine extent of protected sites. In the same way, the designation of an area as an MPA, OECM, or Site of Conservation Interest does not guarantee its effectiveness in conserving biodiversity.

Precautions / Notes:

- The analysis might be affected by the completeness and accuracy of the reported data. Missing data or inaccuracies can skew the results and interpretations. Moreover, some discrepancies could be due to the numerous types of protected areas and their overlapping. Therefore, in numerous instances, a site categorized under one designation may coincide with other sites carrying either a distinct or identical classification. Consequently, certain geographical regions may exhibit numerous instances of overlapping designations, introducing a governance and operational complexity that proves challenging to grasp without a deep understanding of the area. These overlaps complicate rigorous and accurate analyses of areas based solely on attribute data, as combining surfaces yields results significantly divergent from reality.
- The mere designation of an area as an MPA, OECM, or Site of Conservation Interest does not guarantee its effectiveness in conserving biodiversity. Other factors such as the level of protection, enforcement, biodiversity levels, and management practices are crucial for a comprehensive understanding of conservation outcomes.
- The establishment and management of protected areas can be influenced by geopolitical and socioeconomic factors, which might affect the pace and scale of conservation efforts in different countries.
- The Mediterranean is an ecologically diverse region. The significance and impact of MPAs, OECMs, and Sites of Conservation Interest can vary widely depending on the ecological context, making it challenging to generalize findings across the entire region. Indeed, the levels of protection and the specific features associated with a designation, such as marine reserves or national parks, can vary considerably between different countries. Furthermore, it's important to recognize that the extent and execution of conservation efforts may differ even among sites bearing the same designation, both at national and regional levels. These discrepancies could stem from variations in historical precedence, local stakeholders' intentions, available resources, or other contextual differences. Hence, merely relying on the official status of a site is insufficient for evaluating the efficacy of its management.

Sources: MAPAMED, the database on Sites of interest for the conservation of marine environment in the Mediterranean Sea. MedPAN, UNEP/MAP/SPA-RAC. 2022 release.

Proposal for a review at the Mediterranean scale of the MSSD indicator 11 “Food security Index”

Concept note

Scope and Rational:

In the current Mediterranean Strategy for Sustainable Development (MSSD 2016-2025), the Global Food Security Index (GFSI) is represented (indicator 11 of the MSSD).
It informs on the country's ability to maintain sustainable food security in an increasingly contrasting Mediterranean context.
It has been proposed by the extended Steering Committee of the Mediterranean Commission on Sustainable Development meeting of 12 November 2024 to review this indicator based on the latest developments regarding GFSI’s dataset, drivers and variables.

On dataset:
The current GFSI has temporal and geographical gaps in its dataset. In addition, the database used is no longer accessible. Recent studies have also highlighted the complexity of the GFSI.

On drivers:
The current drivers of the index are “national food supply” and “national food availability”. But two other drivers such as ‘national food use” and “national food stability” are increasingly used in certified databases and institutional organisations (such as the FAO) responsible for monitoring the GFSI.

On variables:
These 4 drivers are composed of multiple variables, which are important to take into account. Therefore, a proposed approach is detailed below by Plan Bleu to offer an updated integration of the GFSI monitoring within the MSSD dashboard.

1. Definition

- **What is the Food Security Index?**
  It measures by numeric value the availability, accessibility, utilization, and stability of food in a specific region. The index integrates indicators such as: agricultural productivity, market access, food quality, economic resilience, and environmental factors.
- This composite index considers many variables per “Driver” of the index at national scales: "supply", availability", "use" et "stability".

Drivers	Supply	Availability	Use	Stability
Corresponding variables	1. "Dietary energy supply used in the estimation of prevalence of undernourishment (kcal/cap/day)" 2. "Average dietary energy requirement (kcal/cap/day)" 3. "Food import (% of merchandise imports)" 4. "Food export (% of merchandise exports)"	"Per capita food supply variability (kcal/cap/day)"	"Percentage of population using safely managed drinking water services (percent)"	1. "Prevalence of moderate or severe food insecurity in the total population (percent) (3-year average)" 2. "Prevalence of undernourishment (% of population)" 3. "Food import" 4. "Food export"

As a summary:

- An index: food security
- 4 drivers:
    - “Supply” with 4 variables
    - “Availability” with 1 variable
    - “Use” with 1 variable
    - “Stability” with 4 variables

- **Relevance to the Mediterranean:**
  The Mediterranean basin is a unique region characterized by its climate, agricultural practices, and vulnerability to climate change, political instability, and socio-economic disparities, making food security a critical issue.

2. Geographical and Temporal Scopes

- **Geographical Scope:**
  The analysis of the data sets should include all 21 countries bordering the Mediterranean Sea. National evolutions over time and rim (geographical) comparisons could be realized. If feasible, key focus could include national and sub-national levels (NUTS1, NUTS2), with differentiation between rural and urban areas.
- **Temporal Scope:**
  A reference to a dataset on a 23-year period (2000 to 2023) to capture mean-term trends.

3. Graphs and Maps - *to be carried out under the next PoW (2026-2027) after an in depth analysis of the available datasets*

- **Suggested Graphs:**
  1. **Trend analysis**: Time-series data on food availability, supply, use and stability.
  2. **Comparative analysis**: Bar charts or linear graphics showing disparities in food security across countries.
  3. **Correlations**: Scatter plots between key indicators like GDP and food security levels.
- **Maps:**
  1. A heatmap of food security scores by country or region.
  2. Spatial overlays showing the intersection of food insecurity hotspots with climate vulnerability.
  3. Interactive maps on MapX to visualize temporal changes in key metrics.

4. Source of data:

FAOSTATS and DataWorlBank

5. Limits and Precautions

- **Data limitations:**
  1. Inconsistent data collection methods across countries.
  2. Limited sub-national data granularity.
  3. Historical data may not reflect the full extent of informal food systems.
- **Index limitations:**
  1. May oversimplify complex socio-economic realities.
  2. Difficulty in capturing cultural and traditional factors influencing food security.
- **Precautions in interpretation:**
  1. Regional disparities require contextualized interpretation.
  2. The interplay of external shocks (e.g., conflicts, pandemics, or economic crises) can distort patterns.
  3. Avoiding assumptions of causation from observed correlations.
  4. Depending on the variables chosen by “driver”, we would have different levels of analysis.

Because the data is available and that "Food import (% of merchandise imports)" and "Food export (% of merchandise exports)" are two common variables for 2 key drivers (supply and stability) of the GFSI, Plan Bleu would advise to monitor them.