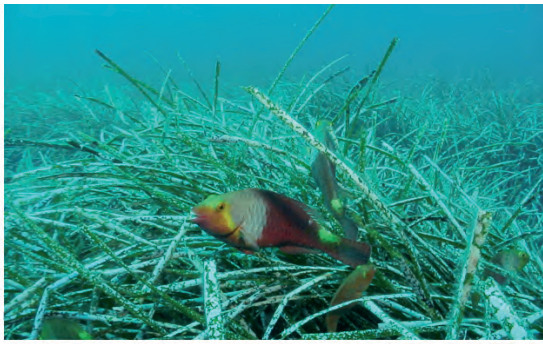
STATE OF THE ENVIRONMENT AND DEVELOPMENT IN THE MEDITERRANEAN - 2009



Under the coordination of
UNEP/MAP's Regional Activity Centre

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Foreword

This new report on the environment and sustainable development in the Mediterranean is the result of collective efforts by Mediterranean Action Plan components, led by Plan Bleu during the 2008-2009 biennium. In five main chapters, it shows the major impacts that climate change will have in the Mediterranean, describes the region's resources and natural environment together with the challenges posed by their conservation, explains the dynamics of the various areas, calls into question the sustainability of the main economic activities and, lastly, evaluates the effects of the measures taken by Mediterranean countries to protect the environment.

Globally, the report presents us with a contrasting picture of the Mediterranean because, while there has been progress as regards marine pollution in particular, very significant efforts still have to be made in order to manage as efficiently as possible natural resources that are scarce or, as in the case of water, are unequally distributed.

But leafing through the pages shows that it is also a Mediterranean in movement where environmental concerns are increasingly being shared and joint efforts being made. The Union for the Mediterranean is one example of this.

This report does not claim to be exhaustive and the reader may sometimes be surprised at the lacunars nature of certain data. This is partly deliberate and partly because of the availability of statistical data. The report is in fact arranged around some quite simple questions: what natural resources are available in the Mediterranean? Are marine species threatened? What are the major sources of pollution? The quality of the replies given is closely linked to the robustness of the data collected and the reliability of the sources. In this respect, despite the efforts made by many countries, there is considerable room for improvement.

MAP's aim is henceforward to prepare a status report on the environmental situation in the Mediterranean and the major trends in sustainable development every two years when the Parties to the Barcelona Convention meet.

I have no doubt that, in time, the MAP reports will show the commitment by Mediterranean countries to making the Mediterranean an exemplary area as far as protection of the environment and promotion of sustainable development are concerned.

Maria Luisa Silva Mejias
Deputy Coordinator
Officer in Charge
Coordinating Unit of the Mediterranean Action Plan

Executive summary

This 2009 report on the State of the Environment and Development in the Mediterranean aims to contribute to the elaboration of a common reporting template for the Mediterranean. It is structured around the work conducted by the Mediterranean Action Plan components, led by Plan Bleu. It presents a view of the main Mediterranean issues on environment and sustainable development.

This report, divided in 5 main parts, contains 17 chapters, presents the major impacts of climate change in the Mediterranean, the characteristics of the natural resources and environment in the region, as well as the challenges linked to their conservation; it also describes the existing dynamics of the coastal zones and urban areas; it examines the sustainability of the main economic activities and lastly, it assesses various sources of pollution and their effects, such as marine biological invasions. The statistics in annex presents the main data and key indicators.

Climate change : already visible effects in the Mediterranean

Since 1970, temperatures have risen by nearly 2°C in Europe's South-West region (Spanish peninsula, South of France). Temperatures have also increased in North Africa, although this is more difficult to quantify due to less complete information. Rainfall has dropped by 20% in several Southern European regions.

The following forecasts are put forward by climate specialists for the 21st century:

- An increase in air temperature of 2.2°C to 5.1°C in Southern European countries over the period 2080-2099 versus 1980-1999.
- Marked modifications and sharp decline in rainfall, expected to drop to between -4% and -27% in Southern Europe and in the Mediterranean, while increases of between 0% and 16% are forecast in Northern European countries.
- Increased periods of drought resulting in more frequent occurrences of day temperatures above 30°C. The frequency and violence of extreme climatic events such as heatwaves, droughts or floods could also increase.
- Several studies point to a potential 35 cm rise in sea levels by the end of the century.

Climate change in the Mediterranean will more particularly impact:

- Water resources, where natural cycles will suffer from increased evaporation and decreased rainfall (sever depletion of run-offs expected for the Rhone, the Po and the Ebro rivers). The issue of water will become a major challenge for sustainable development in the Mediterranean region;
- Biodiversity, due to a northward and upward shift of certain species, the extinction of more sedentary or climate-sensitive species and the appearance of new species; warming of deep-sea waters; and aggravated flooding of low-lying coastal lands, accelerated cliff and beach erosion;
- Soil, due to the acceleration of the already visible phenomenon of desertification, and forests, due to increased fire hazards and parasitical risks.

These impacts are expected to aggravate current pressures from human activities on the natural environment.

Climate change will also impact agriculture and fishing (reduced yields), the attractiveness of tourism (heatwaves, rarefied water resources), coastal zones and infrastructures (high exposure to waves, coastal storms and other extreme climatic events, higher salination, depletion of underground fresh water resources, sea water penetration in aquifers), and public health (heatwaves).

The most vulnerable Mediterranean zones will be those closest to deserts in North Africa, the large deltas, more specifically the Nile, the Po and the Rhone rivers, the coastal zones of Northern and Southern rims as well as high-demographic growth and socially vulnerable areas such as the Southern and Eastern rims, densely populated cities and suburbs.

Vulnerability seems higher in Southern and Eastern Mediterranean countries (SEMC) than in Northern rim countries (NMC). They are more exposed to accelerated desertification and soil aridity and to the rarefaction of water resources. Furthermore, their economic structures are more dependent on natural resources and they lack the sufficient technical and

financial means to implement large-scale climate change adaptation solutions.

For instance, the Mediterranean region is finding it difficult to raise the necessary funds for carbon finance; the Clean Development Mechanism (CDM) only accounts for less than 0.2% of the emission credits issued by only 6 Mediterranean countries in June 2009. This also applies to the collection of adaptation funds available from the Global Environment Facility.

In the Mediterranean, knowledge on climate change is restricted by the available information, limiting its capacity as a decision-aiding tool: resolutions of climate models ill-suited to the relevant geographical scale, low availability and insufficient robustness of data on greenhouse gas emissions. Other knowledge management tools must therefore be developed, such as impact indicators based on the modifications observed in ecosystems and on GHG emission calculations based on consumption. Today, national priorities involve the development and implementation of adaptation strategies rather than of mitigation policies. Several countries have already implemented specific action programs in this regard.

Resources and the natural environment

Water: the challenge of scarcity

The region suffers from conjectural or structural water shortages. 180 million inhabitants benefit from less than 1,000 m^3 per year per capita and 80 million are facing scarcity (less than 500m^3/year/capita). Water deficits are striking in SEMCs, justifying recourse to other, non-conventional water resources: reuse of wastewater, desalination, and technical developments to increase exploitable potential of water resources (reloading of underground water in Tunisia).

Water demand has doubled over the past 50 years (280km^3/year in 2007), with agriculture being the main consumer (64%). Losses, leaks and waste are estimated at 40% of total water demand (particularly in the farming sector). Although countries are beginning to deploy their efforts to limit and reduce these losses and wastages, tensions on water resources remain high, in particular in Egypt, Malta, Syria, Libya and Israel. To satisfy growing domestic demand, countries are increasingly overusing a share of non-renewable resources (16 km^3/year), triggering preoccupying salination issues.

As regards infrastructures, although 20 million Mediterranean inhabitants are still deprived of access to improved water sources, access to potable water in the SEMCs is above the global average and showing real progress (+75 million inhabitants between 1990 and 2006).

It however appears that the traditional response of increasing supply has now reached its limits and demand-based management is emerging (reduction of losses and poor usage, improved water use efficiency). In the SEMCs, the implementation of water demand management strategies and approaches is still dependent on the support of international cooperation and development aid.

Energy: towards more rational consumption

Energy resources are essentially composed of oil and gas (5% of the world's reserves, concentrated in the South). In 2006, fossil energy (gas, oil, coal) accounted for 80% of the energy supply in all Mediterranean countries, and up to 94% in SEMCs (75% in NMCs). Over the past three decades, the share of natural gas (1 000% since 1971) and of nuclear energy (from 1 to 3%) has grown steadily, while the share of oil has dropped to 43% vs 68% in 1971. Despite the considerable potential in renewable energy and the spectacular growth in windmill-produced electricity, reaching 21 GW in 2007 vs 3 GW in 2000, these forms of energy only still represent 6% of the regional energy balance.

Hydrocarbons are exported from four countries (Algeria, Libya, Egypt, Syria) which accounted for 22% of oil and 35% of gas imports throughout the Basin in 2005. All the other countries in the region are net energy importers.

Total energy demand is marked by the growth of demand on electricity, at a much faster pace than GDP, of primary energy consumption and of demographics, particularly in the SEMCs: fourfold increase in total demand and multiplication by a factor of 14 in electricity consumption since 1971.

In the NMCs, final demand per sector shows that transport has recorded the strongest rise in consumption in 30°years, posting 35% in 2005. In the SEMCs, consumption has increased in all sectors, and is highest in the industrial and residential sectors.

Along with the growing awareness of the importance and interest of energy efficiency, it can be globally observed that since 1980, the NMCs show a reduction in energy intensity, pointing to cumulative savings of 1 300 Mtoe over the period 1980-2006, i.e. the equivalent of nearly 2 years of consumption (2006 levels). In the South, observations show no real evolution in global energy intensity levels, although more rational consumption levels are posted by several SEMCs.

Marine ecosystems

The Mediterranean, biodiversity hot-spot, is home to 7/8% of known marine species, while only representing 0.8% of the planet's ocean surface. Over 50% of marine species originate from the Atlantic Ocean, 17% from the Red Sea, including ancient species and more recently introduced species following the installation of the Suez canal, and 4% are relic species. Diversity is essentially concentrated in the West of the basin and in shallow depths (between 0 and 50m deep). Two remarkable ecosystems, magnoliophytes grassbeds (such as Posidonia, a key Mediterranean ecosystem) and coralligenic concretions can be found in coastal zones. There is no extensive knowledge on marine ecosystems as study programs only cover coastal ecosystems.

19 % of known Mediterranean species are threatened both locally and worldwide. The Mediterranean emblematic monk seal is classified as a species in critical risk of extinction. This is also the case for cartilaginous fish, with 42% of shark species threatened with extinction.

63 % of the fish and 60% of the mammals listed in the Protocol concerning Specially Protected Areas and Biological Diversity have endangered status, from increasing pressures (construction/ disappearance of such ecosystems as lagoons, grassbeds), coastal erosion, over-exploited marine resources and expansion of invasive species.

Conservation initiatives to respond to biodiversity erosion are now strengthened through the development of legislative and regulatory instruments, species identification and protection, and the creation of protected areas. There are today 800 Specially Protected Areas covering 144 000 km^2.

Natural terrestrial ecosystems

Mediterranean natural land ecosystems, composed of forests and natural pastoral areas are seeing the more or less vigorous return of forests in the NMCs, due to the abandonment of marginal zones and to reforestation campaigns. In the South, particularly in the Maghreb countries, ecosystems are still exposed to pressures from the clearing and cultivation of marginal lands, the overexploitation of firewood and overgrazing. In the South and East, large-scale reforestation programs are underway.

Traditional usage of wood and grazing lands, a historical component of local and regional economies, is gradually disappearing in the North but remains essential in the South (firewood, pastureland). The function of these areas as producers of public assets is more widely recognized, as they protect soil and water resources, contribute to the combat against erosion and desertification, absorb greenhouse gases and help to maintain the biodiversity of fauna and flora.

But these areas regularly fall prey to devastating fires. In the North, despite efficient but costly measures of containment, the frequency of fires is increasing (600 000 ha in 2007). In the South and East, the occurrence of such fires remains limited but flare-ups are more frequent (61 000 ha in the South in 2005, 80 000 ha in the East in 2007). Fire hazards are accrued by the declining practice of grazing and overgrowth, and by the foreseeable increase in the length and severity of dry periods induced by climate change. Estimations show that, if efficient measures to combat fires and destruction are maintained, the carbon sink capacity of natural Mediterranean lands could account for the absorption of 10 to 15 million tons of carbon per year throughout the Basin.

Spatial Dynamics

Coastal zones: a coveted asset

Coastal zones are the Mediterranean's most appealing asset, the showcase of long-standing natural, cultural and economic heritage. These zones are submitted to stringent pressures from land-based pollution, urban development, fishing, aquaculture, tourism, extractions of materials, sea pollution, marine biological invasions. Constructions currently cover 40 % of the coastal surfaces. Recent studies show that development should be focused on coastal zone conservation and cluster

rather than linear development initiatives, to ensure better cost control.

Constructions and modifications of ecosystems are detrimental to future coastal resilience. Estimations highlight that 1,000 million tons of sediments are carried to the sea by running water every year, 45% of which are retained in dams or extracted from river beds to exploit sand and gravel, thus disrupting the sedimentary balance and causing coastal erosion.

Mediterranean countries are applying more global approaches and strategies to mitigate coastal vulnerability, by involving all stakeholders to promote more sustainable coastal zone management. Although measures to protect coastal zones against land development pressures remain unsatisfactory as they are hampered by legal frameworks traditionally separating land and sea, the ratification of the Protocol on Integrated Coastal Zone Management on January 21, 2008, is a decisive step towards the implementation of sustainable coastal zone management. The Protocol was ratified in October 2009 by France and Slovenia.

Urban Areas: new territorial scales for zones under urban influence

Two out of three Mediterranean inhabitants live in urban areas and over half of the urban population lives in small cities (less than 300 000 inhabitants). These areas under urban influence are characterized by scattered populations and employment and by the expansion of periurbanization and metropolization on ever-larger territories. The fragmentation and specialization of urban areas lead to accrued demands for mobility and endanger social cohesion (development of spontaneous habitats).

Urban sprawl and fragmentation jeopardize the concept of neighborhoods, transforming operational scales and requiring new forms of governance.

The historical vulnerability of Mediterranean cities (climatic events, earthquakes, coastal erosion, …) has increased under the impact of climate change: threats from rising sea levels (in the South and East, 50% of the urban population reside in areas located less than 10 m away from current sea levels); public health risks (pollution, higher mortality risks); climatic migrations. More vulnerable than other regions worldwide, Mediterranean cities are prime candidates for the development of adaptation strategies to face climate change.

Economic activities and sustainable development

Agriculture in the Mediterranean is essentially dependent on rainfall (dry farming) and is therefore impacted by the state of natural resources. Productivity gains are highest in irrigated areas; these areas have grown by a factor of two over 40 years to exceed 26 million ha in 2005, i.e. over 20% of cultivated land. Agricultural production focuses essentially on cereals, vegetables and citrus fruits. Over the past 40 years, total agricultural production in the SEMCs has made spectacular progress, with improved forms of production; and yet, these countries are more and more dependent on secure food supplies. Climate change will have a greater impact on agriculture due to deficits in available water resources and threats of farm land degradation.

Trends in agricultural practices are evolving towards specialization and intensification to maximize yields and increasing the use of fertilizers and pesticides. As an alternative, organic agriculture has been growing heterogeneously since the 70s and essentially in the NMCs (Italy and Slovenia).

Fishing in the Mediterranean is characterized by its biodiversity which allows the development of region-specific fauna and fisheries. Production is essentially concentrated on the continental shelf and capture fishing on the coasts. In the Mediterranean, yearly volumes are limited (1.5 to 1.7 million tons/year), representing less than 1% of global catches, but they are significant in view of the fact that the fishing areas represent less than 0.8% of the world's oceans.

After a period of virtually unbridled development, fishing seems to have reached its limits. There is serious cause for concern as regards the status of economically and commercially important species (hake, red mullet, common prawn, sole, sardine and tuna), victims of such unsustainable overexploitation. In response to this situation, the General Fisheries Commission for the Mediterranean (GFCM) has implemented measures to restore stocks and to protect vulnerable habitats. Aquaculture has also undergone significant growth since the 90s (seawater fish farming for sea bass, sea bream, and « fattening up » of tuna). However, the development of this activity has direly degraded the quality of the marine environment and habitats.

Tourism is an essential economic activity in all riparian countries of the Mediterranean. At the crossroads between 3 continents, the countries attract 30% of the world's international tourism; in 2007 alone, they attracted close to 275 million international visitors. Purveyor of employment and foreign currencies, international tourism contributes to the growth of national economies. However, the economy of highly specialized destinations where tourism is the prevalent economic sector, is highly vulnerable to downturns in tourism activity. Plane (40% of arrivals in 2006) and car (52%) travel are the main modes of transport, and significant contributors to increased air pollution. The seasonal and spatial concentration of touristic activities strongly amplifies their impacts on the environment, generating pressures on water resources and natural environments (coastal construction), and increasing waste production. But tourism in non-coastal areas is still much less popular.

In the Mediterranean **transport** sector, enabler of exchanges and trade, growth is swift and virtually uncontrolled. Trends reveal the race to build larger cargo ships and to increase traffic, challenging harbor reception capacities and threatening marine environments (accidents, degassing operations). Road transport remains the prevalent alternative, accounting for over 90% of the final energy consumption of land transport (98% in the NMCs, 99% in the SEMCs), with air transport growing sharply since 1990.

Transport accounts for 30 % of the total final consumption of energy (32 % in the SEMCs and 26% in the NMCs) and remains a major contributor to economic growth. There does not seem to be any real decoupling between transport and economic growth. Economies are finding it difficult to improve transport efficiency: in the SEMCs, transport energy intensity is still high but has improved gradually since 1990 (from 69 to 57 toe for € 1 million of GDP between 1990 and 2005). Energy intensity levels in the NMCs on the other hand, have remained at 33 toe for € 1 million for the last 15 years.

In 2005, the transport sector in the Mediterranean accounted for 20 % of total CO_2 emissions (13 % SEMCs, 23 % NMCs) and for a little under 2 % of global transport-related CO_2 emissions. However, this relatively small share hides a stronger trend: emissions in the SEMCs have grown by 65 % from 1990 to 2005, and by only 25 % in the NMCs. In terms of local pollution, changes in car fleets and fuels have stemmed NOx and lead emissions. On the other hand, particle emissions have not been reduced, due to the increasing use of diesel oil in the North and South. Alternative fuels are still only rarely used, with only 1.5 % of vehicles circulating in the NMCs.

Environmental policies in the field of **cleaner industrial production** have made progress over the past 10 years. In the SEMCs, ad hoc clean production centers are gradually being installed with the support of international cooperation programs and agencies. However, possible synergies and exchanges of best practices in this area are hampered by the fact that clean production initiatives are not generally covered by national policies applied to all stakeholders. As regards the regulatory framework, the new regulations developed in the SEMCs on emission thresholds, monitoring procedures and polluter obligations have not been enforced. In the North, the vast number of environmental laws and decrees are detrimental to efficient application.

Along with measures that aim at minimizing environmental impacts from production, other mechanisms are being implemented to reinforce the market's role as driver. This is the case for such tools as ecological labels and Green Public Procurement (GPP). In the NMCs, ecological labels are proving to be powerful instruments and are growing in popularity in such sectors as tourism and textiles. In the SEMCs, there is no political framework as yet for GPP, although several countries have included the concept in their new sustainable development strategies.

Pollution and environmental protection

As regards **pollution** from heavy metals, their content in sea water remains globally low and even seems to be improving. Although eutrophication from nutritional substances has been increasing for 20 years, it is limited to such sectors as the North Adriatic Sea, the Gulf of Lions and the Nile delta. However, local marine pollution from cities, the industry and tourist resorts, is large, with the significant presence of macro-waste on beaches and in the high seas.

Regarding the monitoring of pollution from marine transport, countries seem better prepared to face major pollution events, via the adoption of national or sub-regional contingency plans. But the lack of

trained personnel and appropriate infrastructures in some countries weighs heavily on their capacities in this field.

Over the years, incidents have evolved from major spills to frequent collisions and groundings. Accidents are most frequent in the Eastern Mediterranean where smaller-scale pollution incidents occur in harbors during berthing or loading/unloading operations.

As regards pollution control, most Mediterranean countries have ratified international conventions on the environmental impacts of ships (MARPOL, AFS, BWM Conventions). However, in reality, it appears that international regulations are not applied by all operators. A satellite surveillance program for illegal discharges has been in operation for several years. In 2004, 454 possible discharges were sighted in the waters of Morocco, Algeria and Tunisia.

The Northern countries seem more proficient in matters of coastal pollution monitoring than the SEMCs. It seems that general parameters such as BOD and nutrients are more easily monitored than hazardous substances which are more specific and therefore more difficult to measure. The monitoring data sent to the MED POL program by the countries reveal that energy, metal, cement, oil refining and waste water treatment sectors are responsible for the highest emissions of hazardous substances. Preliminary data collected in the National Action Plans implemented to cover land-based pollution sources show a visible reduction in pollution from industrial activities since 2003.

These forms of pollution, and particularly discharges of household waste water, constitute a major risk for public health. Since the 90s, Mediterranean countries have been monitoring the microbiological quality of coastal waters, increasing the global number of sampling points over the years. Between 1996 and 2005, the percentage of bathing waters in compliance with national norms has remained stable (from 92.3 % to 92.8 %). Nonetheless, despite clear improvement in the application of monitoring programs, further progress is required in the Eastern and Southern Mediterranean Basin countries.

Waste is responsible for the greatest pressures on the environment. Closely correlated with economic growth and in particular with consumption patterns and production trends, the quantity of waste generated has steadily increased. In the NMCs, the yearly volume increased by 19 % over the period 2000-2005 versus a growth of only 1.9 % in GDP over the same period. In the SEMCs, the situation is comparable. Although the organic fraction of waste is diminishing, the fraction of high calorific value waste is growing strongly to the increased number of packaging. The use of hazardous substances, such as heavy metals, has been kept in check by technological progress. However, there is a visible increase in the use of other hazardous substances which present a risk for public health in view of the lack of specialized treatment capacity (small home appliances). In the North, progress is ongoing in the field of cleaner treatment and elimination methods, and in the South, there are initiatives for more waste recycling and enhancement.

In the Mediterranean as in the rest of the world, access to **sewerage and wastewater treatment systems** is not on a par with access to potable water, but the situation is notably better than the global average. In 2006, approximately 27 million inhabitants of rural areas still do not have access to basic sewerage systems. Since the 90s, with the support of regional and international cooperation, major investments have been made in Southern and Eastern countries. However, collected wastewater is neither treated nor purified. Thus, the rate of collected and treated wastewater through a public sewerage system varies from 7 % to 90 %. With the exception of Morocco, where 80 % of collected wastewater is treated, Southern countries are not well-equipped in treatment plants and at regional level, there are no treatment plants in 40 % of the cities with over 2,000 inhabitants, representing nearly 14 million people in 2004. Delayed availability of sewerage systems and even more of wastewater treatment facilities contributes to the degradation of resources, aggravates water supply difficulties and fuels conflicts between the two « services »: potable water supply and wastewater purification.

After the destruction of habitats, **biological invasions in the marine environment** are the second cause of biodiversity loss. They threaten indigenous species, local economies and public health. 56 % of the 925 exotic species currently inventoried in the Mediterranean have established sustainable populations and continue to prosper. Almost half of these species have penetrated the Mediterranean through the Suez Canal, 28 % via marine transport and 10 % via aquaculture. Since 1995, observations show a clear increase in the appearance of such species, with new introductions every 1,3 weeks vs one every 4,5 weeks in 1995.

The majority of these species are tropical water species, fueling the concept of the « meridionalization » of the Mediterranean. Treated as a priority by many international conventions, the issue of alien species must be monitored and information must be exchanged.

Conclusion

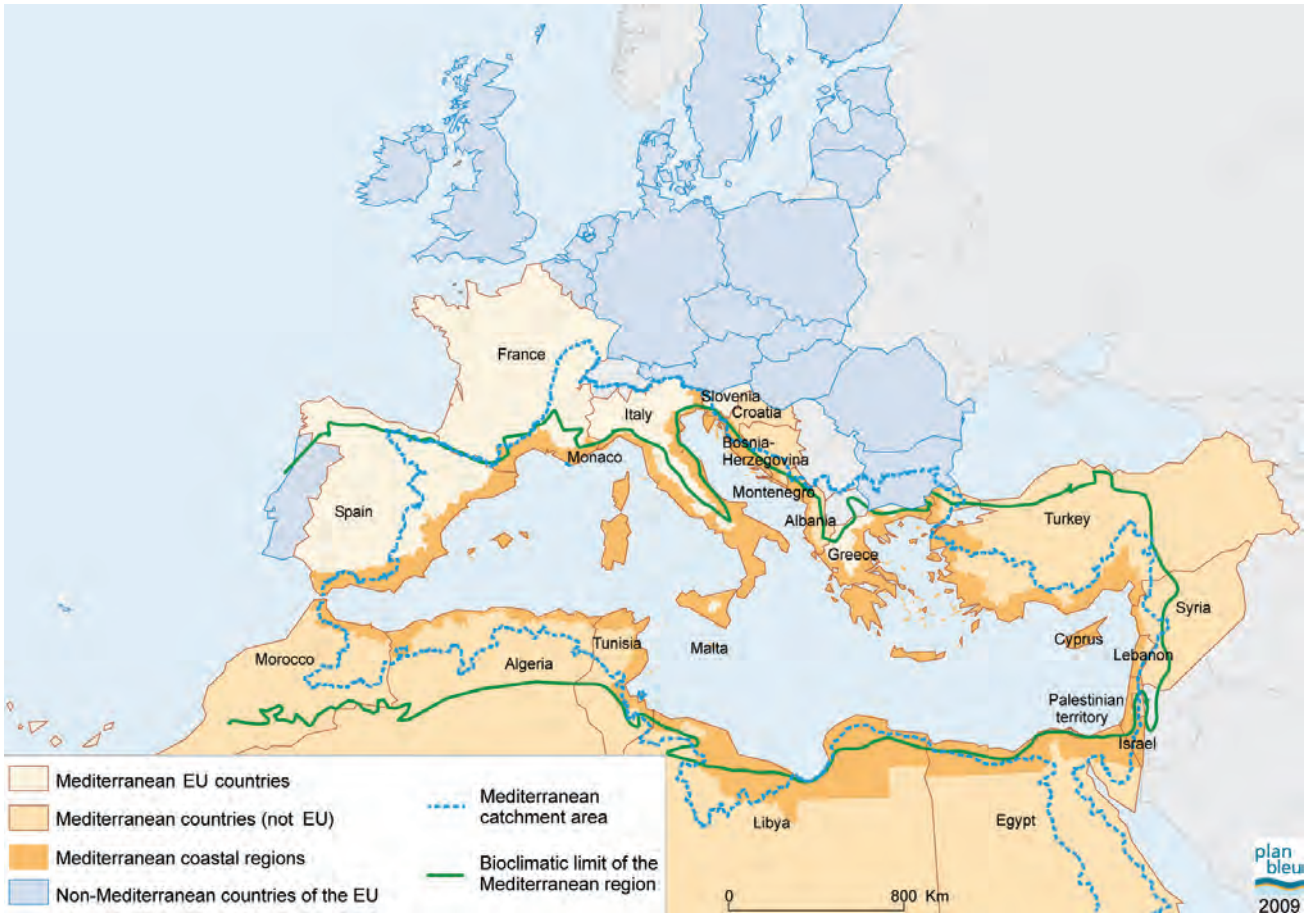
Globally, the current environmental status and development patterns of the Mediterranean are highly contrasted. Despite undeniable progress over the recent years in terms of marine pollution and biodiversity conservation, considerable efforts are still required to anticipate the impacts of climate change, to better manage rare natural resources, in particular water and energy, support regional dynamics and promote genuinely cleaner modes of consumption and production. The essence of progress also lies in improving the quality of existing information which remains incomplete and lacks in reliability, thus weakening analyses and hampering prospective exercises. This constitutes a major field for research which can only be regional and that such initiatives as the Union for the Mediterranean should quickly make available.

Introduction

The Mediterranean region, strong of its 460 million inhabitants (2008) is located at the crossroad of three continents; its basin shares a unique climate and natural and cultural heritage among the twenty two riparian countries and territories where environmental and development issues are particularly acute. Considered as an “eco-region”, its economies remain mostly dependent - especially on the southern rim – on natural resources. Zone of exchange and of fracture at the same time, the region is still in search of stability which must be built from common approaches on shared issues.

This 2009 report on the State of the Environment and Development in the Mediterranean aims to contribute to the elaboration of a common reporting template for the Mediterranean.
It is structured around the work conducted by the Mediterranean Action Plan components, led by Plan Bleu. It presents a view of the main Mediterranean issues on environment and sustainable development. According to the issues discussed, the analyses refer to countries in general or on some part of their territories (watersheds, coastal zones, cities).
For the Mediterranean is – and it is one of its characteristics – a multidimensional space that implies permanently to refine its perimeter as well as the pertinence of it.

A multi-dimensional Mediterranean region



Source: Plan Bleu

The 22 riparian countries and territories constitute a contrasted group.In 2008, it accounted for:

- 5.7% of the planet's land mass, including a large number of desert and mountain areas,
- 10% of known higher plant species, and 7% of marine species in less than 0.8% of its total ocean area,
- 7% of the world's population with 460 million inhabitants (stable) which two thirds are urban,
- 30% of international tourism, with 275 million visitors,
- 12% of world GDP (decreasing),
- 60% of the population of the world's "water-poor" countries,
- 8% of CO_2 emissions (increasing).

And every year, 30% of international maritime freight traffic and some 20 to 25% of maritime oil transport transits the Mediterranean Sea.

This report, divided in 5 main parts, contains 17 chapters aiming at answering to hundreds of questions relating to the environment and development in the Mediterranean. It is therefore detached from the usual reports of this type, based on the commonly used "pressures, state, responses" approach. This editorial choice is essentially due to the availability and robustness of the used data.

The **1st part** addresses the question of climate change and draws its main impacts in the Mediterranean.

The **2nd part** gives the state of the resources and natural environment and links to their preservation: water, energy, marine and natural terrestrial ecosystems.

The **3rd part** describes the existing dynamics on coastal and urban areas.

The **4th part** asks on the sustainability of the main economic activities, such as agriculture, fisheries, tourism, transport and industry – especially with the implementation of measures to decouple development from environmental degradation.

The **5th part** is structured around the environmental protection theme and describes the pollution sources (marine pollution, sanitation, wastes), the crossed-effects such as marine biological invasions and appraises the realizations achieved in the pollution control.

Finally, a statistical annex presents the main data and key indicators.

Part 1

Climate Change

Climate change in the Mediterranean: already visible effects

Patrice Miran (Plan Bleu)

Although the Mediterranean itself emits relatively low levels of greenhouse gases (GHGs), climate change is already starting to make itself felt through environment change. These changes will in turn disrupt a whole series of essential economic activities within the region. Pre-empting the impact means gaining a clear understanding of the phenomenon and its consequences, and overcoming the limitations of the data currently available.

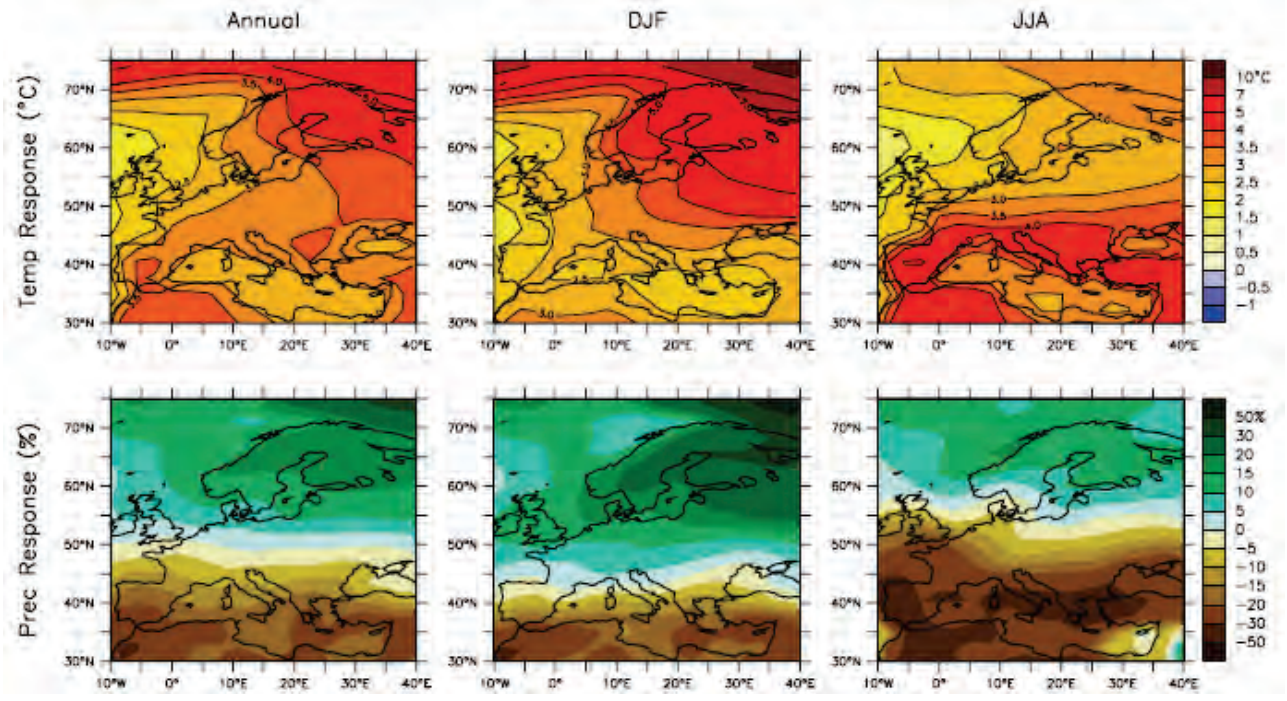
How is the climate evolving in the Mediterranean?

Figure 1 The Mediterranean 18 000 years ago

Source : France 2 Malaterre from J. Guiot, R. Cheddadi, C. R. Geoscience 336 (2004).

Over the 20th century and with a clear acceleration since 1970, South-Western Europe (the Iberian Peninsula, South of France) recorded an increase in temperature of almost 2°C. The same increase can also be noticed for the North of Africa, although a lack of data makes it more difficult to estimate. The only exception is Greece, which until the early 2000s saw its temperatures falling. The rise in temperature is more marked in winter than in summer and for the minimum rather than the maximum figures. Thus the range of the diurnal cycle is shrinking. As far as rainfall is concerned, it has increased to the north of the Alps and diminished in Southern Europe. In the Mediterranean, some regions to the south have recorded a 20% drop in rainfall. The trend is less even as far as North Africa is concerned.

Figure 2 Comparison of current temperatures (°C) and precipitations (%) with 2100 projections



Source : 4th IPCC report

What are the forecasts for the 21st century?

Future major changes to the climate are set first and foremost to affect temperature (air and sea), rainfall systems and sea level rise.

Generally speaking, the trend in the region is towards a rise in temperature. By the end of the century, the average annual temperature increase is likely to be between 2.2°C and 5.1°C for 2080-2099, compared with 1980-1999. The probability of temperatures rising by between 3 and 4°C is estimated at 50%.

Figure 3 Expected Variations of temperatures and precipitations

	Temperatures variations (C°)		Precipitations variations (%)		Frequency of extreme events (%)		
Season	Min.	Max.	Min.	Max.	Hot	Humid	Dry
Winter	1.7	4.6	-16	6	93	3	12
Spring	2.0	4.5	-24	-2	98	1	31
Summer	2.7	6.5	-53	-3	100	1	42
Fall	2.3	5.2	-29	-2	100	1	21
Annual	2.2	5.1	-27	-4	100	0	46

Source : 4th IPCC report

The expected rise in surface temperature varies from one region to the next- in the Sub-Saharan regions it could well be as much as 4°C in summer. On the other hand, on the Northern shores, the rise is likely to be more marked in winter, at around 3°C. Nonetheless, this overall rise in temperature could well hide some local falls in temperature relating to changes in air mass.

The number of rainy days is likely to decrease and the risk of drought to increase considerably.

More specifically, at a sub-regional level simulations show four levels of extreme rainfall and temperature variation in the Mediterranean basin, based on an overall rise in temperature of 2°C.

The greatest rises in temperature- circled in the table below- are likely to be recorded in the Mashreq (Palestinian Territories, Jordan, Lebanon, Syria and Iraq). Higher temperatures should thus produce summers with an increasing number of very hot days.

Figure 4 Simulations of temperatures and precipitations variations in the Mediterranean region

	HIGH TEMPERATURE					LOW TEMPERATURE			RAINFALL			
	Summer Days	Hot Days	Tropical Nights	Days> 90 quantile	Nights> 90 quantile	Frosts Nights	Ice Days	Days< 10 quantile	Relative Var.	Dry Days	Rain 1-10 mm	Max. 3-day Rain
New Iberian Peninsula	1	1		1	1	-1		-2		2	-2	3
South of France (Inland)	3	1	1	2	2	-1		-2	-1	3	-2	3
Coast Southern France	1		2	2	2	-1		-2	-1	2	-2	3
Corsica	1	1	2	2	2	-1		-2	-1	2	-1	2
Sardenia	1		3	2	2			-3		2	-1	1
Sicilia	3		3	3	2 3			-3		3	-1	3
N. Adriatic	3	3		2	2	-2	-1	-2	-1	3	-2	1 2
Central Balkans	3	3		2	2	-2	-1	-2		3	-3	
Central Greece	2	1	2	2	2	-1		-2	-1	2	-2	1
Peloponese	3		3	2	2			-3	-1	2	-1	2
Crete	3		3	3	3			-3	-1	2	-1	
Coastal Turkey	1 2	1	1 2	2	2	-1		-2	-1	2	-1	-1 2
Turkey Inland	3	3		2	2 3	-2	-1	-2		3	-2	
Cyprus	1		3	1	1			-3	-1	1	1	
Lebanon/Israel Nile Delta	1	1	3	3	3	-1		-3		1	-1	
E. Egypt E. Lybia	3	1	3	2	3			-3			-1	
W. Lybia	3	1	3	2	3			-3	-3		-1	
E. Maghreb	2	3	3	2	2	-2		-2	-3	2	-2	
W. Maghreb	3	3	3	2	2	-2		-2		2	-2	-1
South Iberian Peninsula	2	2	2	2	2	-1		-2	-1	2	-2	
Central Spain	3	3	1	2	2	-2		-2	-1	3	-2	-1

Large Change: at least 1month duration

Small Change: 1 week duration

Moderate change: 2-3 weeks duration

No change

Source : Giannakopoulos et al., WWF Report 2005

As for rainfall, the models converge on a clear increase in continental drought (fewer rainy days, longest periods without rain becoming even longer). Thus river-flow is likely to decrease on average over the year despite a possible seasonal redistribution (more water in winter, less in spring and summer).

The greater frequency of extreme events will also lead to increased flooding (both in terms of occurrence and intensity).

As for storm-induced waves and floods, the results of the models are only preliminary, but the drop in the number of depressions and wind should lessen the risk, although this assessment should be reviewed locally.

Finally, it is highly unlikely that real tropical cyclones will develop in the Mediterranean over the 21st century, inhibited by wind shearing at altitude and the limited expanse of sea.

How can the current information limits be overcome?

Despite the efforts of the international scientific community, the tools for learning about climate change in the Mediterranean continue to be hampered by uncertainty relating to the climate models and the paucity of the greenhouse gas emission inventories for the Mediterranean states. Although there has been considerable improvement over recent years, the resolution of the climate models is still not refined enough to be able to cope with territorial management issues at the level at which they arise. As for the greenhouse gas emissions inventories, only the European Union states, Israel and Turkey draw them up on an exhaustive and regular basis. The drawing up of such GHG emission inventories is hampered both by the availability of data on fluorinated gases and di-nitrogen monoxide in particular, and by the as-yet limited knowledge about emissions from certain sectors, particularly as regards changes to land and forest use. Even if these shortcomings can eventually be substantially reduced by building states' capacity and enhancing the resolution of climate models, it is important right now to move tools enabling decision-making in the Mediterranean community. Two approaches look promising in this respect:

- Establishing impact indicators based on observation of the ecosystem changes already visible today (phenology, meteorological indicators, areas where certain pandemics spread, coastline configuration, etc.);
- Calculating GHG emissions based on consumption (*box 1*)

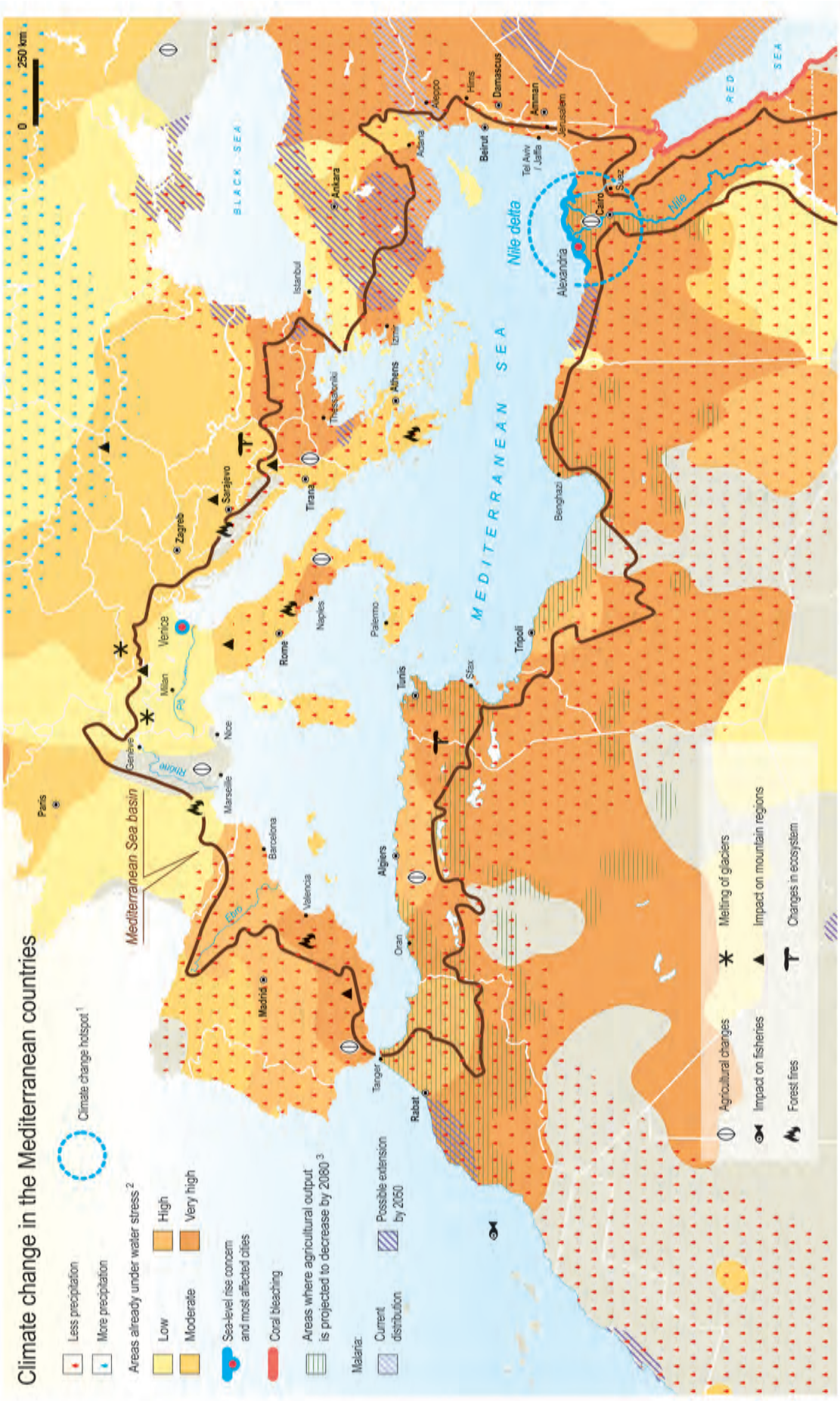
Box 1 Greenhouse gas emissions from a consumption perspective: An essential approach for the Mediterranean region and the post-Kyoto regime

The traditional method of approaching the problem of climate change has been to evaluate the sources of greenhouse gases in the different production sectors (energy, industry, transport, etc.) and in the different countries, in order to plan and implement policies aimed at alleviating the problem. Nevertheless, in order to provide a more complete vision of the problem, what is also required is an analysis of the way in which consumption models affect levels of GHG emissions.

Thereby, in 2007, the Regional Activity Centre for Cleaner Production (CP/RAC) embarked on an important line of work to address climate change from the perspective of models of final consumption and related trade. This type of analysis, particularly through the calculation of the carbon footprint, takes into account GHG emissions that are produced to satisfy the population's needs (housing, food, mobility, leisure, etc.), including emissions associated with the manufacture and transport of products imported from other countries. In this sense, the carbon footprint is considered to be the measurement of emissions induced (directly or indirectly) by the consumption of goods and services, regardless of the physical location of the site of production.

The consumption-based approach to GHG emissions provides new elements for designing mitigation strategies for climate change within the context of a globalised economy, on both national and international levels. Firstly, it allows the true extent of the impact a population's consumption norms have on emissions to be determined, which, beyond its intrinsic educational value, facilitates the prioritisation of the areas and consumer products on which to act. On the other hand, viewed from a consumption perspective, emissions provide a framework for measuring consumer responsibility, an aspect which may be highly relevant in negotiations for setting out international policies on climate change.

Source: CP/RAC, 2008.



1: At a global scale, the overall Mediterranean basin is considered a hotspot. 2: Ratio between withdrawal and availability (2000). 3: Africa only.

Source : : UNEP GRID-Arendal / Zoï from IPCC, 2007 ; World Resources Institute, 2007 ; Rogers and Randolph in : Sciences, 2000 ; Fischer et all., 2005.

What are the most significant climate change impacts in the Mediterranean?

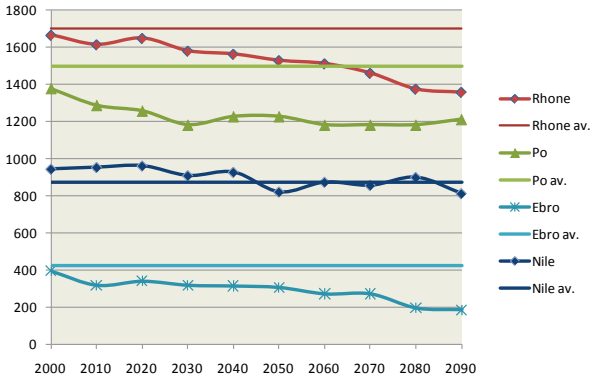
The analysis of impact is complex as it implies the major trends relating to temperature, rainfall and sea-level against the natural and anthropogenic characteristics of the Mediterranean. The Mediterranean's natural environment is already heavily marked by the pressures of societies in constant development, set to be further exacerbated by climate change. Thus the major impact of climate change in the Mediterranean is to be found in terms of water availability, biodiversity and the economic activities on which they depend.

An increasingly strained water context

Water is at the heart of the main impacts of climate change on the natural environment, reflected particularly in the rapid alteration of the water cycle as a result of increased evaporation and decreased rainfall.

The figure 5 below shows average annual run-off for the main rivers in the Mediterranean basin (including the Black Sea as regards freshwater input), when applied to the model for the Mediterranean Sea for each decade studied in terms of the IPCC's A2 Mediterranean scenario. These averages stem from the data which emerged from rainfall modelling for the 21st century and are based on OPAMED8[1]. They show a major decrease in run-off for the Rhône, Pô and Ebro.

Figure 5 Annual average flow of the main rivers, 2000 - 2090 (m^3/s)



Note: av. = average over the 20th century.

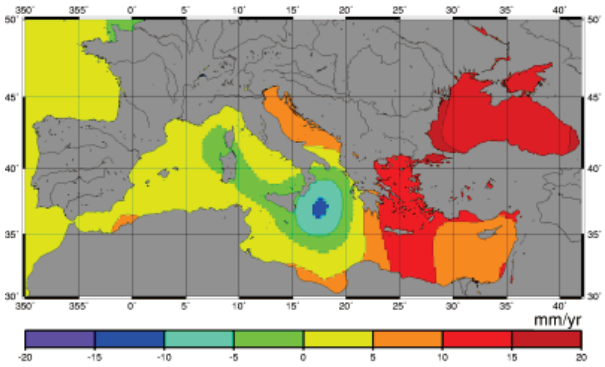
Source: Somot S. (2005)

Will climate change affect the marine environment?

The limited data available still indicates that climate change is already visible at sea level, with both the deep waters and the coastal waters of the western basin becoming warmer (by around 1°C for coastal waters over the last 30 years). As on dry land, extreme events have increased, with thermal anomalies arising (summer temperatures above the seasonal norm in 1999 and 2003) on an ever increasing geographic scale, while sea levels are rising by about 1mm per year.

However, it is still not possible to provide a sound assessment for the basin as a whole. Tsimplis's 2007 study alone gives a rise of 0.35m by the turn of the century, with marked differences between the West (slight rise) and East (major rise). Moreover, the satellite monitoring conducted by the Topex/Poseidon programme on variations in the level of the Mediterranean sea between January 1993 and June 2006 shows an obvious east-west differentiation, with a clear trend towards a sea level rise in the Eastern Mediterranean (*Figure 6*).

Figure 6 Variations of sea-level rise observed between 1999 and 2006 by the TOPEX/Poséidon project, mm/year



Note: From negatives values (black blue to black green) to positives values (light green to red).

Source : LEGOS-GRGS-CNES

Many Mediterranean regions will be increasingly exposed to a major risk of submersion and erosion, affecting several parts of the coast in Mediterranean states. The main consequences to be feared are as follows:

- Worsening flooding along low-lying coasts, particularly in delta areas, lagoon coasts, tideland and some islands;

- Accelerated cliff and beach erosion;
- Increased salination in the estuaries;
- Shrinkage of freshwater water-tables and saltwater infiltration in the aquifers as well as groundwater salination issues.

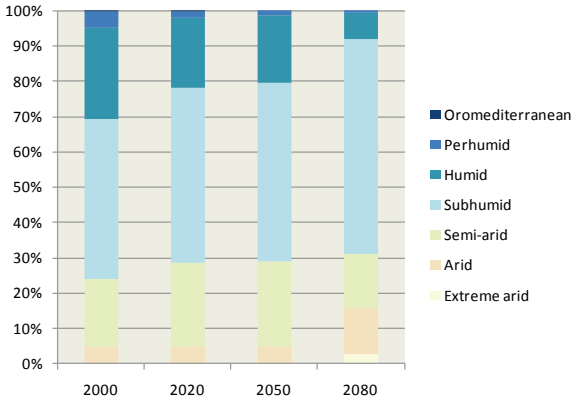
Because of their particular topography, which means that they are only just above sea-level and are scattered with ponds and lagoons, delta areas are most vulnerable to a sea level rise. While the existence of dams upstream prevents the normal circulation of sediment, which cannot reach the delta to consolidate it. This is occurring in the major Mediterranean deltas (Nile, Rhône, etc.).

Is there a direct threat to biodiversity?

A northward and upward shift of species was observed throughout the 20th century. This is mainly linked to species gradually migrating from their ecological niche (in other words the area where the species can live) as temperatures rise. A temporal shift has also been observed in terms of the dates at which certain species migrate and certain fruits are harvested. More generally, the seasonal cycles of a large number of species have changed (early nesting season, for example). In parallel to these changes, parasites are also appearing and emerging in increasing numbers. In Europe, these phenomena have been reasonably comprehensively quantified in certain countries and for certain species. The same applies in the Mediterranean, where in the North-Western basin in particular an increase has been noted in the range of distribution and/or density of warm-water species of fish and sea-urchins, and fewer of the more northern species. This has prompted various authors to talk of a southward shift in character of the region. When these various elements are taken in conjunction, it points towards the disappearance of land and marine species and a major decrease in biodiversity, either because the migration of ecological niches will outstrip that of species (trees in particular, which will have to cope with parasites from hotter climates), or because species migration will run into insurmountable physical barriers (sea, mountains), or quite simply because certain niches will disappear (those at altitude, for example). Plain-dwelling mammals in the Mediterranean would appear to be particularly vulnerable (between 5 and 10% of the species at risk of dying out by the end of the century).

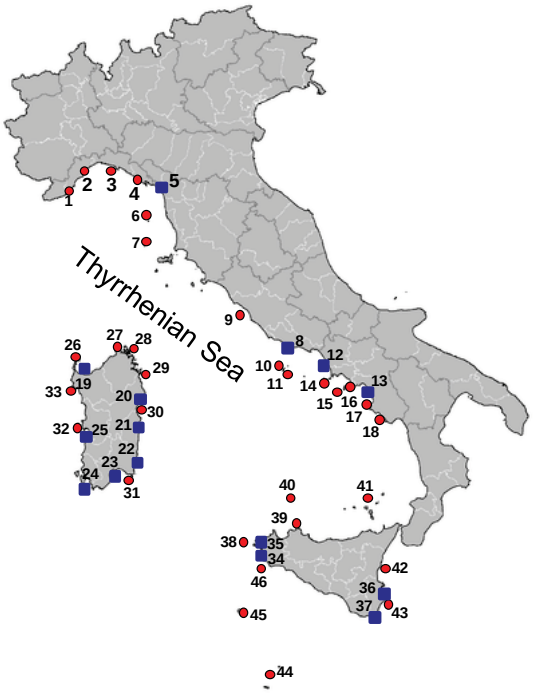
Two illustrations of these phenomena are shown below:

Figure 7 Area estimates of the bioclimatic levels in Lebanon (% of the total area)



Source : Samir Safi , Lebanon University, Beyrouth, 2004

Figure 8 Number of marine and coastal sites considered to be especially at risk (or endangered) in the short-term by the effects of climate change in Italy (Adriatic excluded).



Note: Squares refer to areas at risk from rises in sea level and circles refer to areas at risk of impact on biodiversity.)

Source: UNEP-MAP-SPA/RAC, 2008

Certain countries such as Greece, for example, are starting to set up systems to monitor and evaluate the impact of climate change on biodiversity (*Box 2*).

Box 2 Good practices in climate change monitoring: the case of Greece

Greece developed an effective method and strategy to monitor climate change and its impact on marine biodiversity, and recommend appropriate solutions. A growing number of scientific publications issued from national research efforts are being published on climate change issues. The ongoing scientific research at the national and international level is at a good level, regarding namely climate issues (including oceanic observation and forecasting), and cataloguing and detecting changes in marine biodiversity likely to be directly or indirectly linked to climate change. Also, the spread of alien species and the thermal tolerance of important marine species are topics approached through research coordinated projects.

Monitoring actions include: sea level and surface water temperature, water quality, response of marine organisms to sea temperature rise, changes in commercial fish species and communities (through fisheries data), changes in coastal planktonic assemblages, shifts in spatial distribution of marine habitats.

International cooperation actions are being developed on the establishment of European networks of infrastructures for marine observation and research (including coastal observatories and ships), and on the development of climate change forecasting models.

Different awareness-raising activities (conferences and meetings) have been recently organised for policy-makers and managers, researchers, university students, stakeholders, NGOs and the general public.

Source: SPA/RAC

Economic activities are also set to be widely affected by climate change. The overview provided here is not exhaustive since impact chains are highly complex and sometimes still relatively unknown. What is presented here is an overview of how climate change will indirectly affect certain key sectors of the Mediterranean economy.

Fisheries hanging in the balance?

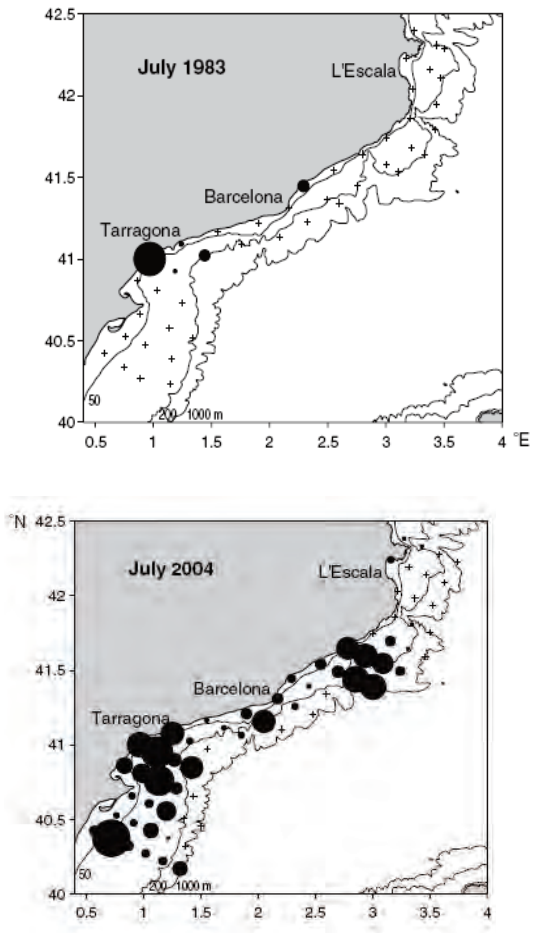
The role of hydro-climatic variations in regulating the abundance of fish stocks is now a known fact. Thus, the structure and dynamics of fish stocks on the Mediterranean continental shelf are likely to react both to the effects of human activity (fishing) and to climate change (warming, sea level rise, decreased rainwater run-off, etc.), with consequences for the fisheries which subsist on them. The changes to the breeding zones off Catalonia of a warm water sardine species (*Sardinella aurita*) between 1983 and 2004 illustrates well these changes (*Figure 9*).

Increasingly risk-prone forests?

The rise in CO_2 levels in itself changes how all plants function by acting on photosynthesis. Doubling the concentration of CO_2 can increase the forests' photosynthetic production by 20-30%. Conversely, this phenomenon can be affected if not reversed by excessive temperatures, periods of drought and ozone deposits. This is likely to alter the distribution range of the various forest types and lead to a northwards shift of Mediterranean forests (See *Natural ecosystems* Chapter).

These developments will lead to an increased risk of forest fires and the spread of parasites. For the Mediterranean regions of Europe, the number of days with a risk of fire marked by increased from 1958 to 2006. The summer of 2007 in Greece showed magnitude of human and socio-economic cost of such fires.

Figure 9 Breeding zones of *Sardinella aurita*, Catalonia in 1983 and 2004



Source: Sabatés 2006

A less attractive region for tourism?

Climate is an essential criterion on the choice of destination of international tourists. If heat-waves and summer temperatures increase, the Mediterranean regions could become less attractive to the benefit of more northern destinations. Extreme natural events or a significant rise in the cost of transport relating to global warming prevention programmes could also harm tourist activity as could potential clashes with other users over scarce water resources.

To take this issue into account, a so-called Tourism Climate Index (TCI) grades tourist destinations. When this index is applied for Europe, an unfavourable trend clearly emerges for the Mediterranean sea-front.

Will the health of Mediterranean people be affected?

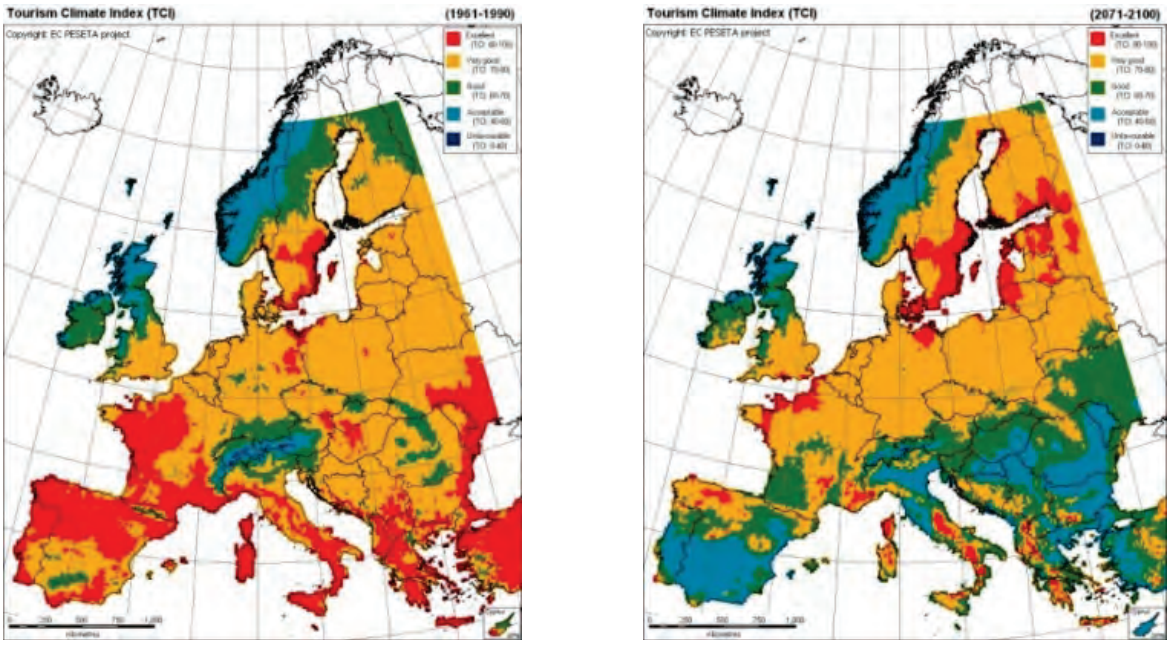
Whilst it is not possible to establish an inventory of the health consequences of climate developments along the lines described by the IPCC, various health impacts will emerge, either directly in the form of increased heat stress (greater mortality linked to temperature peaks), or indirectly in the form of the extension of the areas in which certain parasitic and infectious diseases develop.

As far as increased mortality relating to peaks in temperature is concerned, this would be expected to show a relative drop in winter and conversely a sharp hike in the summer, much less due to the fact that heat regulating mechanisms are compromised (hyperthermia, heatstroke, acute dehydration) than to the upsurge in all manner of cardiovascular, cerebrovascular, respiratory, metabolic or mental disorders.

A European study conducted in 2004 on increased mortality linked to temperatures rising to levels above the summer average, concludes that Mediterranean cities are becoming more vulnerable to summer heat-waves.

The indirect effects can be illustrated using the case of the *Aedes albopictus*, a mosquito of Asian origin, which is a carrier of dengue fever but also of Rift Valley fever and the West Nile virus (at the outset of usually benign attacks of fever, but sometimes degenerating into meningo-encephalitis) (*Figure 12*). Since 1990 this mosquito has been colonising the northern half of Italy and could now spread to the rest of Italy and the south of France, where its ecological requirements would be met, and from there invade part or all of the country if the warming being forecast actually materialises.

Figure 10 Tourism Climate Index, summer tourism in Europe over the period 1961-1990 (left) and 2071-2100 (right), under high level of emissions scenario



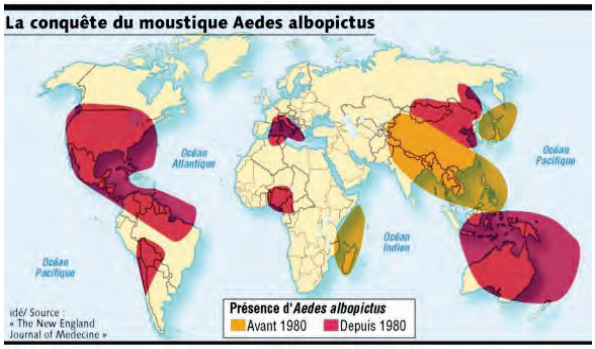
Sources: JRC/EIC/UE

Figure 11 Comparison of mortality related to the summer heatwaves over the period 1990-2000 between Euro-Mediterranean and North European cities

	Mediterranean Cities			Continental cities		
Total mortality						
	% variation	95% CrI		% variation	95% CrI	
All ages	3.12	0.60	5.73	1.84	0.06	3.64
15-64 years	0.92	-1.29	3.13	1.31	-0.94	3.72
65-74 years	2.13	-0.42	4.74	1.65	-0.51	3.87
75 + years	4.22	1.33	7.20	2.07	0.24	3.89
Cardiovascular mortality						
	% variation	95% CrI		% variation	95% CrI	
All ages	3.70	0.36	7.04	2.44	-0.09	5.32
15-64 years	0.57	-2.47	3.83	1.04	-2.20	4.92
65-74 years	1.92	-1.49	5.35	1.50	-1.12	4.62
75 + years	4.66	1.13	8.10	2.55	-0.24	5.51
Respiratory mortality						
	% variation	95% CrI		% variation	95% CrI	
All ages	6.71	2.43	11.26	6.10	2.46	11.08
15-64 years	1.54	-3.68	7.22	3.02	-1.55	7.42
65-74 years	3.37	-1.46	8.22	3.90	-0.16	8.92
75 + years	8.10	3.24	13.37	6.62	3.04	11.42

Source: ec.europa.eu/research/environment/pdf/env_health_projects/climate_change/cl-phewe.pdf

Figure 12 Expansion of Mosquito *Aedes albopictus*



Source: The New England Journal of Medicine

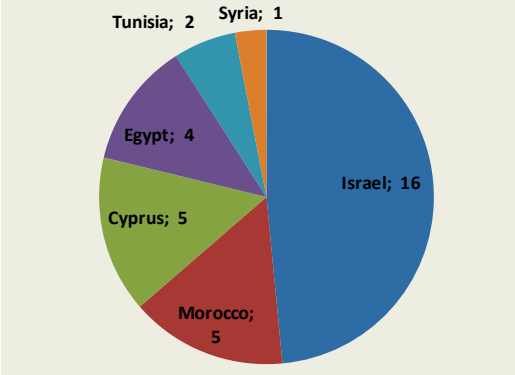
Is the Mediterranean making enough use of carbon finance?

Carbon finance at State level is subdivided into two major mechanisms, one focused on reducing greenhouse gas emissions - the Clean Development Mechanism (CDM) - and the other aimed at adapting to climate change- the Adaptation Fund.

Until 2007 (Bali conference) implementation of the Kyoto Protocol largely focused on efforts to reduce greenhouse gas emissions. Knowing that the Mediterranean accounts for only a small share of global GHG emissions (7.6% in 2005), and that only a minority of Mediterranean states are required to reduce or stabilise their GHGs, their priority is weighted more on the side of adaptation than on emissions mitigation.

Thus scant use has been made of the Clean Development Mechanism in the Mediterranean. By June 2009, the secretariat of the Climate Convention had recorded less than 0.2% of emissions credits issued by only 6 Mediterranean states.

Figure 13 Number of registered projects in the Clean Development Mechanism (CDM), June 2009

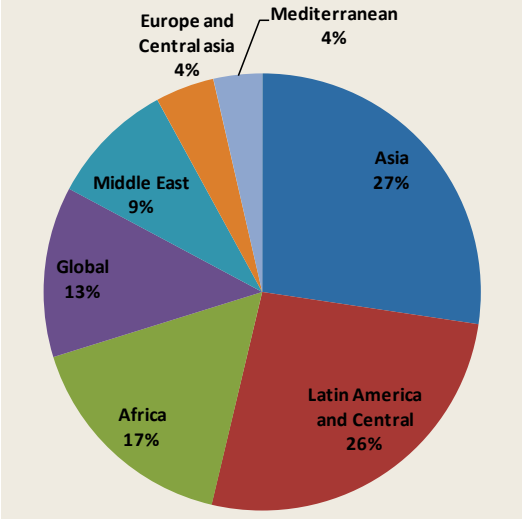


Sources: UNFCCC, UNEP Risoe Centre (URC)

As far as the adaptation funds available from the Global Environment Facility (GEF) are concerned, the region is much better represented than for CMDs, it is still not equal to the risks. $320 million have currently been dedicated to adaptation through the Strategic Priority on Adaptation (SPA), the Least Developed Country Fund (LDCF) and the Special Climate Change Fund (SCCF).

For the time being, only 13% of the SPA projects amounting to a total value of $50 million have been granted to the MENA region and 4% to the region of Central and Eastern Europe. Priority has been granted to the biodiversity, land degradation, international aquifers and climate change sectors. The LDCF, with its National Adaptation Programmes of Action (NAPAs), and the SCCF, prioritise development and poverty issues, focusing their efforts on water management, food security and coastal management.

Figure 14 Distribution per region of the project funded in the Strategic Priority on Adaptation (SPA), mid-2009



Source: Global Environment Facility

Who are the actors for climate change in the Mediterranean?

Three main groups of actors can be identified in the area of climate change:

1. scientists (meteorologists, climate change experts and economists)
2. political decision-makers, who have objectives to reach in terms of emissions reduction and adaptation strategies,
3. the private sector, keen to remain competitive in a changing physical environment.

In the Mediterranean, the first group of players- the scientists- is relatively structured, and major regional programmes have been established both on modelling and for deepening scientific knowledge on impacts. As far as the economic approach is concerned, even though several analyses have tackled the issue (CIHEAM 2009, Plan Bleu 2008) major consolidation is still required, which will mean quantifying the vulnerability of the environments and societies concerned.

The political decision-makers include: Climate Convention's Focal Points (all the Mediterranean states are signatories); the Mediterranean Action Plan and Plan Bleu focal points and,- in the wake of the Kyoto Protocol's flexibility mechanisms, the designated national authorities appointed to check the reality of investments made towards reducing GHG emissions.

In each country, around this core of experts, the Ministry of the Environment tends to be responsible for this issue. In Turkey, Bosnia-Herzegovina and France, specific inter-ministerial authorities have been set up. They coordinate efforts undertaken in each sector, track developments in international negotiations and define mitigation and adaptation strategies.

In the Mediterranean the priority for the states continues to be adaptation. Some countries have already implemented action programmes in this sector. Thus, Bosnia-Herzegovina (inter-ministerial Commission) implemented a series of emission limitation and adaptation measures for 2002-2006. Egypt (special unit of the Egyptian Environment Agency) has run techno-economic simulations in agriculture in order to identify the best dates for sowing and harvesting depending on the future climate, the varieties to retain or exclude depending on their water needs, etc... The setting up of an environmental information system on managing coastal zones under stricter climatic conditions is currently under study, and various early warning systems for health problems potentially linked to the climate are being introduced. In Slovenia, the Ministry of the Environment already has an adaptation strategy. France has set up a National Observatory on the Effects of Climate Change (ONERC), which produces a set of impact indicators and supports local communities interested in embracing adaptation.

Most countries have no specific tools for monitoring progress on the prevention of or adaptation to climate change. The Mediterranean decision-makers are calling strongly for impact indicators and for adaptation strategies. The desire for enhanced regional cooperation is also widely supported.

NGOs such as the Climate Action Network, Greenpeace and the WWF have included the climate change issue in their medium term programmes.

Certain initiatives are emerging at a regional level, to tackle climate change from the point of view of the final consumer and associated trade flows in the Mediterranean, providing new arguments for designing climate change mitigation strategies (*Box 1*), or to promote green competitiveness and private sector involvement in emissions reduction and energy efficiency experiments (See *Industrial Development and Environment* Chapter).

What is the Mediterranean's contribution to global GHG emissions?

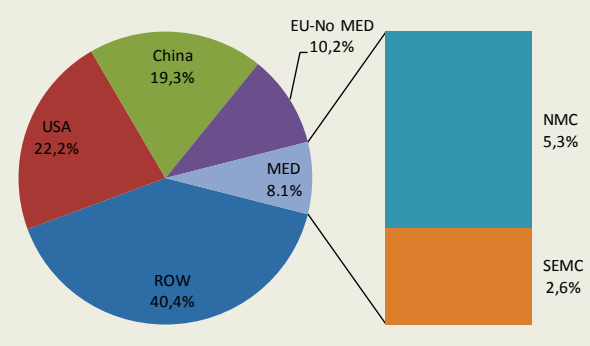
As previously mentioned, no exhaustive GHG emissions inventories exist for countries bordering the Mediterranean as a whole. Relatively comprehensive estimates do exist, however, which allow the Mediterranean to be placed within the global picture.

In 2005 the 21 Mediterranean states together emitted 7.6% of global greenhouse gas emissions[2]. In the past this was largely attributable to the northern rim, but during the 90s a major increase (+34%) in greenhouse gas emissions took place in the southern and eastern Mediterranean countries (SEMCs), whilst over the same period the EU-27 cut their GHG emissions by 5%.

The Mediterranean basin is marked by anthropogenic GHG emissions with a high CO_2 content, produced by the use of fossil energy. CO_2 emissions in the Mediterranean are almost exclusively generated by the use of energy such as oil, gas or coal, which are naturally present on the region's southern rim (See *Energy* Chapter).

In the Mediterranean, changes in land and forest use[3] produce very few CO_2 emissions in contrast to the emissions balances of other African countries. Basically, CO_2 emissions from energy use represented around 64% of GHG emissions in the SEMCs in 2000, with the figure standing at 77% for the northern Mediterranean countries (NMCs) and a mere 57% globally.

Figure 15 Distribution of world CO_2 emissions from energy use, 2005 (%)



Source: WRI - CAIT 6.0

In SEMCs, the high levels of emissions produced from waste (methane emissions mainly produced by the unsupervised burning and decomposition of waste) and the cement industry appear particularly significant compared with the structure of global or even NMC emissions.

Cumulative CO_2 emissions from energy in the SEMCs since 1850 represent a mere 1.4% of cumulative global emissions over the same period. In 2005, this region was emitting less than 3% of global energy-related CO_2 emissions. The NMCs' historic contribution to the cumulative emissions stands at 6% and they still account today for almost two thirds of Mediterranean emissions.

Unless stakeholders change their behaviour, the different rates of growth in emissions on the two Mediterranean shores could well mean that by 2020 the SEMCs will be producing almost half of Mediterranean emissions. The rate of increase in SEMC emissions already outstripped global growth between 1990 and 2004.

The demographic challenge and South/North economic convergence expected in the SEMCs places a great burden on policies for pre-empting and combating GHG emissions. The NMCs are already facing a legitimate need to immediately curb their emissions.

Sectorally the most pressing issue in NMCs is the question of emissions from transport. Decoupling them from economic growth emerges as one of the main challenges (see *Transport* Chapter). This sector was the greatest contributor to the rise in CO_2 emissions in the NMCs between 1990 and 2004.

CO_2 emissions from the SEMCs underline the importance of the emissions produced by electricity generation. These countries are witnessing an outright explosion in electricity demand, particularly for the housing sector. Generally speaking, the various emissions from buildings (construction, cement works, electricity, direct energy combustion…) and thus the residential, commercial and institutional sectors now represent the main issue in terms of controlling GHG emissions. Buildings already constitute a strategic sector, particularly since by its very nature the sector hinges on long-term investment and sits at the crossroads between the issues of combating GHG emissions and adapting to climate change. The transport sector (passengers and goods) is also a point of concern in the countries on the southern rim, given the expectation that demographic pressure and demand for mobility are likely to increase and drive emissions in this sector.

Suitable physical and human investment, development and implementation of legislation on the multi-dimensional building sector as well as transport should make a major contribution towards curbing GHG emissions from the SEMCs over coming decades.

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Notes

[1] OPAMED8: A high resolution Mediterranean version model derived from OPA and NEMO climatic models to show climate variability/change in the Mediterranean basin (according to Somot, 2005).

[2] Blue Plan estimates based on aggregate data for the 6 greenhouse gases (CO_2, CH_4, N_2O, PFCs, HFCs, SF_6) for 2005 provided by the on-line WRI CAIT 6.0 interface. Emissions relating to land use change are not included, whilst those for international bunkers are. Data gleaned from a sectoral approach tend for the SEMCs in particular to under-estimate the total emissions of non CO_2 gases.

[3] Estimates of CO_2 emissions relating to land use change are highly uncertain. Following some changes in methodology, estimates for this sector have been revised downwards (Houghton, 2008)

Part 2

Resources and Natural Environment

Water

Energy

Marine Ecosystems

Natural Terrestrial Ecosystems

Water

Mohammed Blinda (Plan Bleu)

Water is an increasingly scarce resource in the Mediterranean today, thus, given demographic growth, climate change and economic and social changes, its management continues to pose a major challenge for the XXIst century.

Water demand has shot up over the last fifty years, the Millennium Development Goals on access to drinking water[1] have still not been reached, particularly in the rural areas of the countries to the south and east of the Mediterranean, and efficient water use is far from satisfactory.

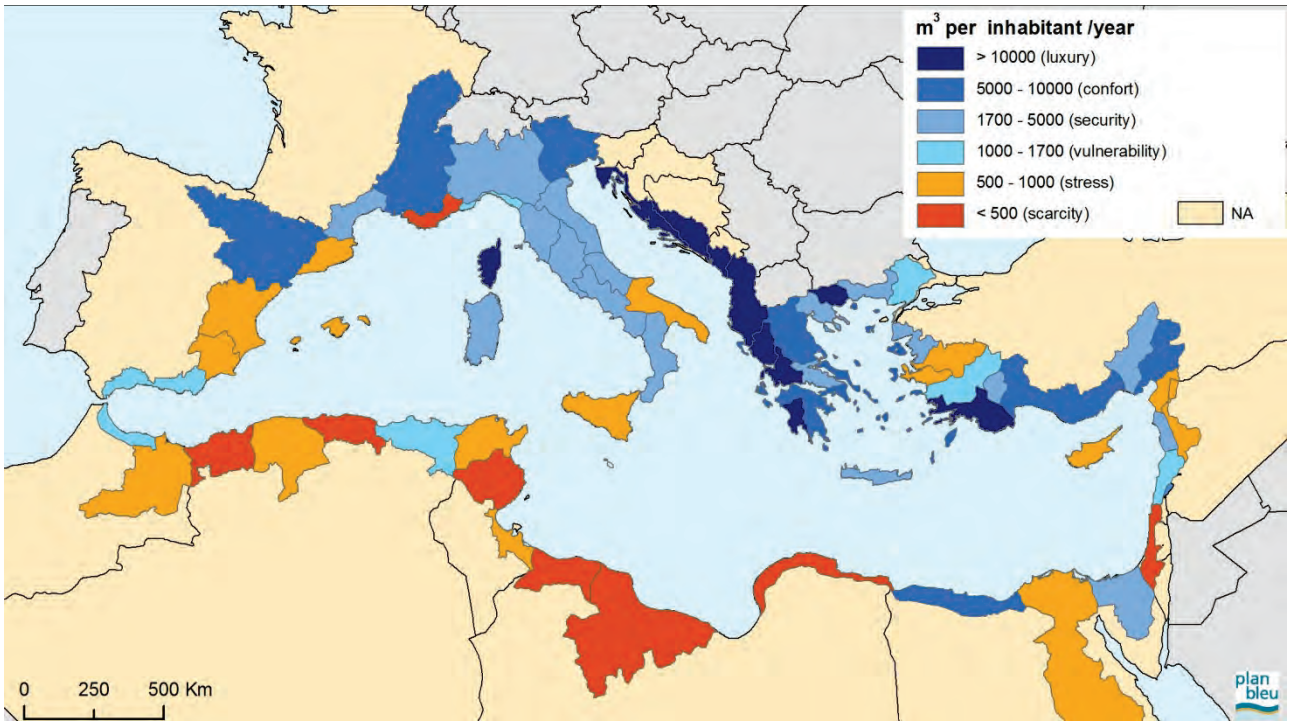
The current situation is already strained and clearly calls for the thriftier, more sustainable and fairer management of what is a vital resource.

Is there enough water in the Mediterranean region?

In the countries around the Mediterranean[2], water resources are limited and unequally distributed in space and time. The countries to the south receive a mere 10% of total annual average rainfall. On average, the Mediterranean receives only 3% of global water resources, 1/10 of which come from non-Mediterranean states. Certain countries are thus highly dependent on outside resources: 97% in Egypt (Nile), 55% in Israel (Jordan River and Mountain Aquifer) and 43% in Syria (Euphrates).

Water shortages of both a contextual and a structural nature exist. The number of « water-poor» Mediterranean people (Morocco, Egypt, Cyprus and Syria), in other words those living in countries with less than 1000 m^3 per capita per year of renewable water resources, currently amounts to 180 million. Those faced with a shortage, in other words with less than 500 m^3/capita/year, number 60 million (Malta, Libya, Palestinian Territories, Israel, Algeria and Tunisia). These countries to the south and east have run up a 160% renewable water resources deficit to meet the 1700 m^3/capita/year, deemed to be the minimum threshold of water required to fully meet the peoples' needs (*Figure 1*).

Figure 1 Renewable Fresh Water Resources per inhabitant in Mediterranean elementary river basins (between 1995-2005)



Source : Plan Bleu from national sources

Albeit still difficult to quantify for any given moment in time, the effects of global climate change on the water cycle- rainfall, evaporation, run-off- are highly likely to deplete water resources, and already several countries to the south have recently revised their resources estimates downwards(Algeria by 20% and Morocco by 25%).

Given this state of affairs, Mediterranean countries are turning to other alternative resources such as the reuse of treated sewage to a tune of some 30 Mm^3 per year or the desalination of seawater or brackish water with a total installed capacity of 1825 Mm^3 per year.

In an arid country such as Tunisia, techniques are already being developed to boost the exploitable potential of water resources. The challenge is one of better managing rainwater by regulating rises in water levels to replenish groundwater through artificial seepage, water and soil conservation techniques (planting, cropping practices, biological processes), which curtail the need for irrigation whilst curbing erosion and the subsequent silting-up of retaining reservoirs downstream.

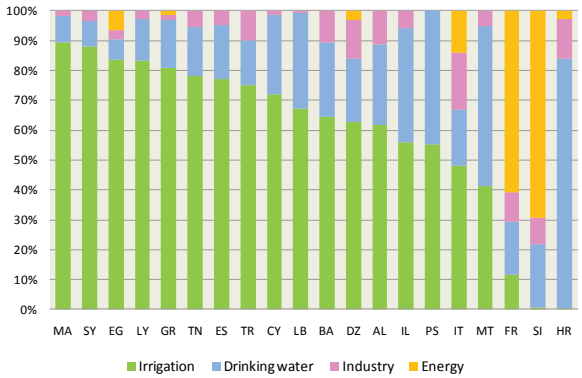
With the exception of France, the Mediterranean countries are also net importers of virtual water[3], with a total estimated volume of 150 km^3/year in 2004. Virtual water could prove an effective means for regulating and saving water resources.

How is water demand developing in the Mediterranean countries?

Over the last fifty years, water demand[4] for all sectors of activity together doubled to reach 280 km^3/year in 2007. Agriculture still heads the major consumption with 64%, followed by industry (including the energy sector) at 22% and the domestic sector with 14% (*Figure 2*). Irrigation water accounts for over 50% in all countries apart from those in the eastern Adriatic and France, reaching almost 90% in Syria and Morocco. Water demand for irrigation varies from 5000 m^3/hectare/year in the north to almost twice (9600 m^3/hectare/year) to the south and east, depending on irrigation techniques and climate conditions.

Although total per capita water demand to the south and east is still slightly below demand to the north, at 600 m^3/capita/year and 680 m^3/capita/year respectively, per capita demand for drinking water varies from around 65 m^3/capita/year (175 litres/day) to the south and east to almost 120 m^3/capita/year (330 litres/day) to the north.

Figure 2 Total water demand per use (period 2005-2007)



Source : Plan Bleu

Are efforts being made to save water and avoid wastage?

Generally speaking, water use efficiency is far from satisfactory. It is estimated that losses, leaks and wastage account for some 40% of total water demand across the Mediterranean region as a whole. In 2007, total water use losses amounted to between 15 and 50% in the majority of Mediterranean countries, Cyprus and Israel being the most efficient with losses verging on 16% and 19% respectively.

Such major losses can be attributed to dilapidated water distribution networks (leaks) and limited funds for network maintenance, but also high levels of wastage at plot level due to irrigation techniques such as surface irrigation.

Box 1 Agricultural water-saving policies in Morocco

In Morocco, a methodology based on the economic approach to water demand management in agriculture has been developed by comparing the cost per m^3 of water saved with the cost of developing new water resources. The study shows that the cost per m^3 of water saved by adopting localised irrigation is less than that of tapping into freshwater, thus the volume of water saved was turned to good effect by improving the yield of market garden and orchard crops. The expected productivity gains were beneficial, thus generating further added value. An assessment of the cost/benefit ratio showed profits of over 30% of the cost of investment.

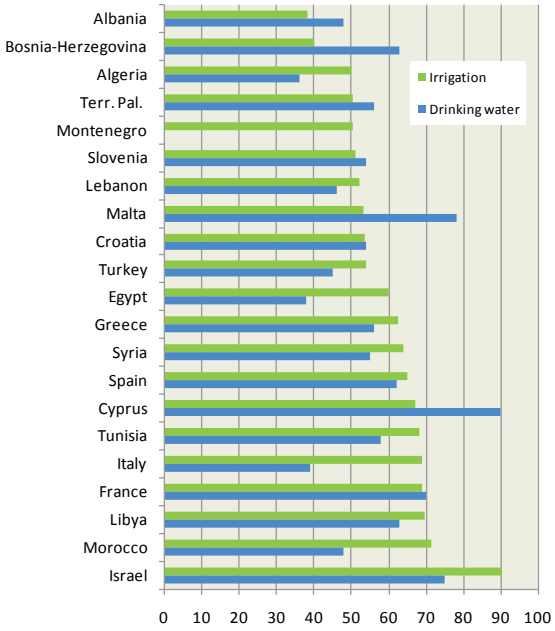
Source : Belghiti (2008)

A country-by-country comparison of the losses recorded during water use in the drinking water and irrigation sectors reveals a variety of situations (*Figure 3*). A first group registers greater water loss in irrigation than in the domestic sector (drinking water), a second group loses basically the same amount in both, and in the last group, water loss in the domestic sector outstrips the losses in irrigation.

The agriculture sector chalks up the greatest losses. With the same added value, the quantity of agricultural water consumed can vary from 21 m^3 to over 4200 m^3 depending on the situation and the irrigation technique applied.

Efforts are, however, underway to curb and reduce this loss and wastage, particularly through the funding of major programmes for restoring and replacing networks in a state of disrepair or providing more water-saving irrigation systems.

Figure 3 Efficiency of the water use in two sectors (drinking water et irrigation), 2005 (%)



Source : Plan Bleu from national sources

Is the pressure on renewable natural water resources decreasing?

The growing demand for water, whether to meet agricultural needs or for industrial or domestic ones, is bringing increasingly perceptible pressure to bear on water resources. This pressure, expressed by the exploitation index of renewable natural water resources, reveals a varied and sometimes pessimistic picture for the future.

Already as of now, in certain countries the water being abstracted almost equals if not outstrips the average annual volume of renewable natural resources (index above 80%). The natural resources in these five countries (Egypt, Malta, Syria, Libya and Israel) are already severely strained, and a growing share of demand is being met through other, so-called «non-conventional» sources.

A second group of countries (Italy, Spain, Morocco, Tunisia, Algeria, Lebanon, Palestinian Territories and Cyprus) is also faced with local or contextual tension, with an exploitation index between 20 and 60%. Finally, with an index of below 20%, it is in Turkey, France, Greece and the Balkan countries that tension is least.

A growing share of water demand is being met on the one hand through the over-exploitation of part of the renewable groundwater, prompting seawater seepage which leads to soil salination problems when this water is used for irrigation, through the use of non renewable resources (including fossil water). It is thus estimated that 16 km^3/year of so-called « non sustainable » water is produced, two thirds of which comes from the abstraction of fossil water and the remainder from the over-use of renewable resources or the re-use of drainage water, allowing gross abstractions to exceed the primary renewable resources (Egypt's case).

These values, which are calculated at a national level, may mask major disparities either at river basin level or locally, as is the case in Mediterranean Spain (*Figure 4*). These situations appear even more alarming when account is taken of exploitable natural resources alone, which comprise about a half or a third of renewable natural resources.

Box 2 The main obstacles to the implementation of water demand management approaches in Syria

Lack of coordination between the ministries involved in water resource management,

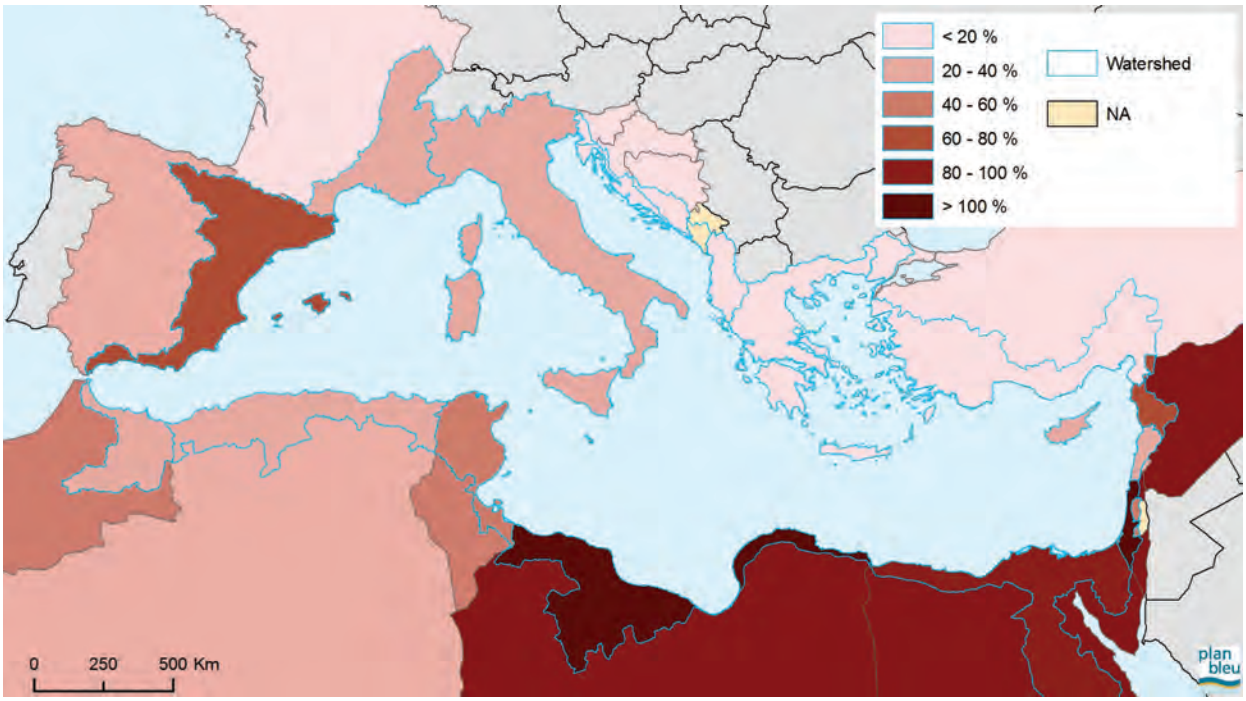
Contradictory policies: the assistance policy for farmers to buy modern irrigation systems is not, for example, coordinated with the pricing policy for irrigation water (the price depends on the area irrigated rather than the volume consumed, thereby not encouraging water savings),

Inadequately skilled personnel (regarding the technical and administrative aspects),

Drinking water wasted due to a lack of public awareness about the importance of this scarce resource and the need to preserve it, because water is so cheap.

Source : Abed Rabboh (2007)

Figure 4 Exploitation index of renewable natural water resources, at national and river basin level, 2005 (in %)



Source : Plan Bleu

Added to the strains on natural water resources, degradation and pollution of human origin is also affecting their regime and quality, further limiting the possibilities for use. This is leading to increasingly vulnerable supply as a result of higher costs (particularly for water treatment), health risks and conflicts over use between users, major sectors, regions or countries (See *Pollution* and *Sanitation* Chapters).

Are any of the Mediterranean population still without access to drinking water?

Between 2006 and 2008, the proportion of the population enjoying sustainable access to an improved water source[5] stood at over 90% in the majority of Mediterranean countries. However, 20 million Mediterranean inhabitants, mainly in rural areas, have no access to such sources (*Figure 5*). Many countries (the European states, Croatia, Israel and Lebanon) have already achieved a 100% rate of access to drinking water. In the urban areas, the level of access to drinking water is high- close to 99%- in most countries apart from the Palestinian Territories and Algeria. The most marked improvements have taken place in Morocco, Tunisia, Syria and Turkey.

Progress is underway in the rural areas, particularly in the Palestinian Territories, Syria, Tunisia, Algeria and Morocco, with access rates of between 80 and 90%. From 1990 to 2006, the number of Mediterranean people enjoying access to drinking water advanced significantly by a further 75 million.

In conclusion, access to drinking water in the Southern and Eastern Mediterranean countries is above the global average. This is also true for access in rural areas. As for access in the urban areas, it is close to the global average.

Observations and forecasting alike reveal that increases in supply -always the traditional water policy response in the Mediterranean- are now reaching their limits. Given this state of affairs, a vast area for progress lies in water demand management (WDM), which involves curbing losses and misuse (wastage, leaks), and improving use of this resource in a more efficient way.

Strategy documents and national legal and regulatory texts are making increasing reference to WDM (*Boxes 1 and 3*), either explicitly or, still too often, implicitly. For the member states of the European Union, the Water Framework Directive (WFD) has had a particularly beneficial effect in ensuring that water policies take speedier account of

Box 3 Pricing as an instrument for managing demand for drinking water in Tunisia

Over the last three decades, the Tunisian pricing system has undergone several reforms, which have led to the setting up of a highly progressive and selective pricing system intended to reconcile social and financial aims as well as the objectives of economic efficiency.

A reform was carried out in 2005 in order to simplify the pricing method, encourage the rational use of water and reinforce solidarity between users. The current pricing system is still progressive according to use: i) domestic, public, trade and industry; ii) tourism (hotel business); iii) standpipes and water consumption brackets (5 consumption brackets, each with its own rate).

The use of this pricing model has proven its efficiency as an instrument for managing water demand, the growth of which has been curbed. As a matter of fact, each consumer is prompted to ensure that they do not exceed the ceiling of their usual consumption bracket, since their water bill increases substantially with each over-shoot. Elasticity of demand in accordance with variations in the price of water nevertheless varies according to use (demand for drinking water is highly inflexible in the industry and tourism sectors) and, for the domestic sector, according to the consumption brackets (relatively marked price elasticity in the highest bracket, limited elasticity in the lower ones).

Source : Liman (2007)

WDM. Whether it is a matter of integrating management principles at catchment area level or involving the various users in the planning process, the WFD has brought fresh « know-how » to light.

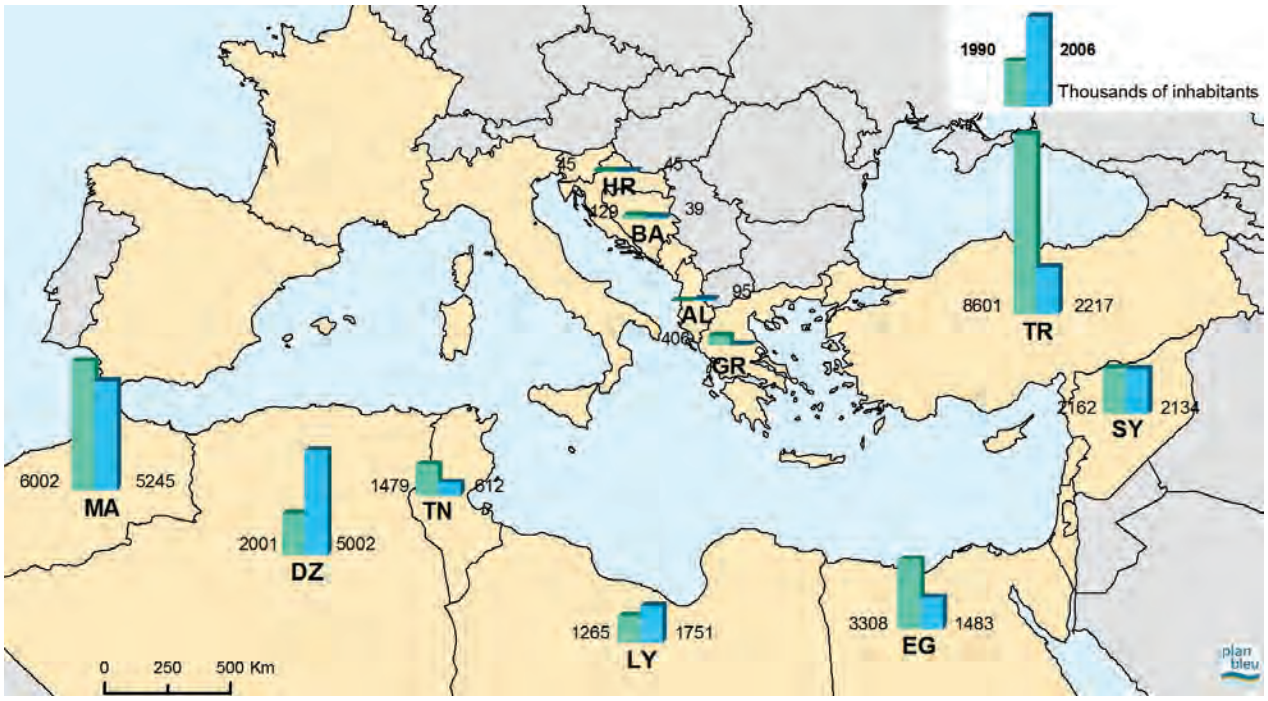
For the Southern and Eastern Mediterranean countries, the setting up of WDM strategies and approaches continues to depend on international cooperation and development aid.

The Mediterranean countries are constantly confronted with obstacles and brakes of various types as they roll out their WDM strategies and policy (*Box 2*).

Strengthening regional cooperation must play an important role in the transfer of know-how and capacity building, the exchange of experience, the sharing of best practices and the funding of projects, particularly in the South and East. It will doubtless be shaped by the Strategy for Water in the Mediterranean, drawn up within the framework of the Union for the Mediterranean.

The building of public-private partnerships could also have a positive effect through technology (rehabilitation of water distribution networks, detection of leaks…), and the application of economic instruments (subsidies, pricing…) to optimise the allocation of the available resources.

Figure 5 Population without access to drinking water, 1990-2006



Source : Plan Bleu

Box 4 Sea water desalination: A highly energy-dependent solution

Sea water desalination has become indispensable to secure drinking water supply to the populations of coastal cities, as well as required by the rapid increase in water demand in the agriculture and industry sectors. It has thus become a necessity for a certain number of Mediterranean riparian countries. However, the major constraint to this system is the energy consumption for the m^3 produced, together with the environmental impacts due to the operation of desalination stations, they being related mainly to brine disposal in the natural medium, but also to their contribution in the increase of CO_2 emissions.

In the Mediterranean, fresh water production via sea water or brackish water desalination started initially in insular situations (Malta, Belarus, Dalmatia, Cyprus, Cyclades...), coastal situations (Libya) or desert situations (Algeria), and has been very rapidly spreading around the Mediterranean. Algeria and Spain, for instance, have taken this option to resolve their water scarcity problem. Spain, the leading Mediterranean country in water desalination, ranks in 4th position globally, with around 1500 operating stations (2.5 Mm^3/d) and Algeria commissioned (in 2006 and 2008) 2 desalination stations totalling a capacity of 0.3 Mm^3/d and envisions to construct 11 other stations by 2011, thus bringing the total capacity to 2.3 Mm^3/d.

Some other ten Mediterranean countries are active in the desalination field: Cyprus and Malta, two water scarce islands; three energy importing countries: Morocco, Israel and Tunisia; and three energy exporting countries: Libya, Egypt and Syria.

To date, the Mediterranean has accounted for a quarter of global desalination. By 2030, the region would be close to the figure for current global desalination (that is, 30 to 40 Mm^3/d).

Nevertheless, energy dependence for water mobilisation is particularly acute in arid countries. The level of water abstractions is quite significant there, above all for irrigation purposes. Pumping and transfer induce strong dependence on electric energy, which increases in line with the increasing needs, and relate more and more to costly energy resources (groundwater resources, transfer of remote resources, treatment, desalination).

For desalination alone, in terms of electrical power, a desalinated water volume of 30 million m^3/d in the Mediterranean equals a desalination dedicated electrical power of 5000 MWe, that is, the equivalent of 8 to 10 gas combine cycle power plants, or 4 to 5 nuclear sections.

The large potential of Mediterranean countries in solar and wind energy can serve for CO_2 emissions-free desalination. Around a hundred desalination stations coupled with renewable energies have been constructed worldwide. These are mostly small experimental or demonstration installations (0.5 to 200 m^3/d) of which several are located in the Mediterranean (Egypt, Algeria, Tunisia). They operate based on accumulator energy storage inducing high costs (limited lifecycle, energy losses) and require local expertise, especially for maintenance. However, experience shows that small capacity solar- and wind-fired desalination plants can allow, when properly designed, for water supply of isolated sites at costs which are, as of now, interesting.

The environmental impacts due to the operation of desalination stations are basically related to the disposal of brine that is of high concentration and insufficient dilution, which is likely to impoverish or destroy water ecosystems and cause a deterioration of water quality. An assessment and monitoring of disposals of brine and chemical products must, in addition, be accompanied by a monitoring of the land and, above all, marine fauna and flora.

Finally, GHG emissions are higher when the desalination electrical power is produced by fossil fuels. Inverse osmosis, at lower energy consumption, is better in this respect than thermal power. On the other hand, inverse osmosis discharges more chemical products into the water (de-scaling, preliminary treatment).

Source : Boyé Henri (2008)

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Notes

[1] Drinking water is water free of pathogens or chemical agents at levels detrimental to health; this includes drilling water, wells and treated and non-treated surface waters which are not contaminated (e.g. Spring water). Waterways and lakes are considered as drinking water if water quality is regularly monitored and acceptable to Public Health authorities.

[2] The data used throughout the text refers to the country as a whole

[3] Virtual water corresponds to the volume of water needed to produce a foodstuff (not to be confused with its water content). It is usually expressed in litres of water per kilogramme. For example, it takes about 1,500 litres of water to produce one kilo of wheat, 4,500 l for one kg of rice and 15,000 litres for one kg of beef.

[4] Total water demand corresponds to the sum of water directly abstracted, including losses in transport and the use and production of non-conventional water.

[5] According to the World Health Organization, Improved water sources include household connections, public standpipes, boreholes, protected dug wells, protected springs, and rainwater collections. Unimproved water sources are unprotected wells, unprotected springs, vendor-provided water, bottled water (unless water for other uses is available from an improved source) and tanker truck-provided water.

Reasonable access is broadly defined as the availability of at least 20 liters per person per day from a source within one kilometer of the user's dwelling.

Energy

Habib Elandaloussi (Plan Bleu)

With the half billion people living in the Mediterranean Basin, the Mediterranean region accounts for 10.2% of the world electricity consumption and 8.2% of the primary energy consumption. This primary energy consumption - being overwhelmingly dominated by fossil fuels (80%, and only 6% renewable energies) - accounted for around 8% of the global CO_2 emissions in 2006.

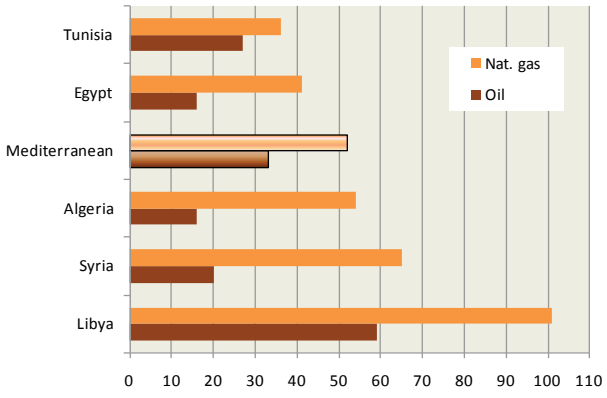
Based on a retrospective review since 1971 of energy issues, overall socio-economic indicators and trends prevailing to date, several major distinctions can be made, not only on the level of distribution of hydrocarbon resources and the level of energy consumption and supply, but also on the level of the efforts invested in matter of energy efficiency and renewable energies. This retrospective review reveals tensions in matter of energy which are likely to become significantly more acute if no measures are taken in the future.

What are the available energy resources in the Mediterranean?

The Mediterranean region holds 5% of the world oil and gas reserves, concentrated at 98% in the South, and has a considerable potential of renewable energies, especially solar and wind energies.

These oil and gas reserves (8200 Mt and 8900 Gm^3, respectively) are held by four countries of the Southern rim of the Mediterranean: Libya holds the largest oil reserves, with 5400 Mt, followed by Algeria (1545 Mt) and, to a lesser extent, Egypt (524 Mt) and Syria (400 Mt). As for gas, the main reserves are found in Algeria (4580 Gm^3), followed by Egypt (2148 Gm^3), Libya (1500 Gm^3) and Syria (300 Gm^3). These four countries have a well developed infrastructure for the production of oil and gas and the exportation of hydrocarbons, mainly to Europe.

Figure 1 Reserves to production ratio for oil and natural gas in the Mediterranean region on 01/01/2007 (Number of years)



Sources : Plan Bleu from BP, CEDIGAZ, OGJ, World Oil, WEC Survey of Energy Resources & national sources

Although most of the countries of the region have been thoroughly explored for hydrocarbons, the South-Western part of the Mediterranean remains still insufficiently explored. Less than a half (40%) of the ultimate recoverable resources have been produced in the Southern rim of the Mediterranean and, accordingly, with the current production level, the lifecycle (R/P ratio) of the current oil reserves is around thirty years, with around fifty years for gas (*Figure 1*).

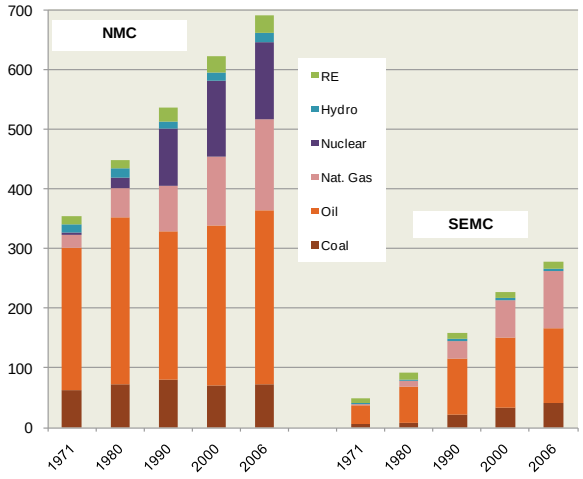
Coal reserves, concentrated in Greece and Turkey, amount to around 9 billion tons for the region as a whole.

As for renewable energies, the Mediterranean holds a significant potential, particularly solar and wind, which is as yet under-exploited, even though their production has been on the rise over the past few years (*Figure 6*). Yet, the share of renewable energies in the energy mix remains modest, with only 6% of the primary energy supply.

What is the energy and electricity demand in the Mediterranean? How are Mediterranean countries supplied?

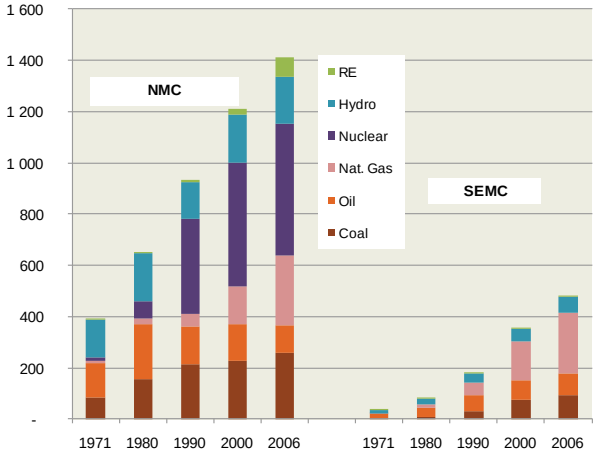
Over the period 1971-2006, the primary energy consumption of the Mediterranean Basin grew twofold (passing from 402 to 968 Mtoe) (*Figure 2*), and the electricity consumption grew fourfold (passing from 384 to 1665 TWh). The major portion of this increase is due to the Southern and Eastern Mediterranean Countries (SEMCs) which have seen their energy demand grow fourfold and their electricity consumption multiplied by 14 over the same period (*Figure 3*).

Figure 2 Energy demand by source in the Mediterranean region (Mtoe)



Source : OME

Figure 3 Electricity generation by source in the Mediterranean region (TWh)



Source : OME

As regards final energy consumption, transport continues to be the main consumer compared with the other sectors in the Mediterranean. Nevertheless, industry accounts for the highest increase in total final consumption, particularly due to the increase in consumption in the countries of the Southern rim of the Mediterranean. The structure of energy demand has changed drastically over the last three decades. From an energy-based industry, the Mediterranean now offers a more balanced consumption, with the transport and residential sectors thus seeing their share on the rise.

Energy demand has been characterised by a much more rapid growth in electricity demand than in primary energy demand or in population. Indeed, electricity consumption in the Mediterranean grew fourfold for the region as a whole over the period 1971-2006. The consumption of the countries of the Northern rim represents, with 1235 TWh in 2006, around three times that of the SEMCs (430 TWh). The level of energy consumption being closely connected with economic and demographic growth, the trends reported confirm a more steady increase in the countries of the Southern rim, for which the average annual growth rate has been of 7.7% per year over the past 25 years, due in particular to high consumption levels especially in Turkey, Egypt, Tunisia, Algeria and Morocco.

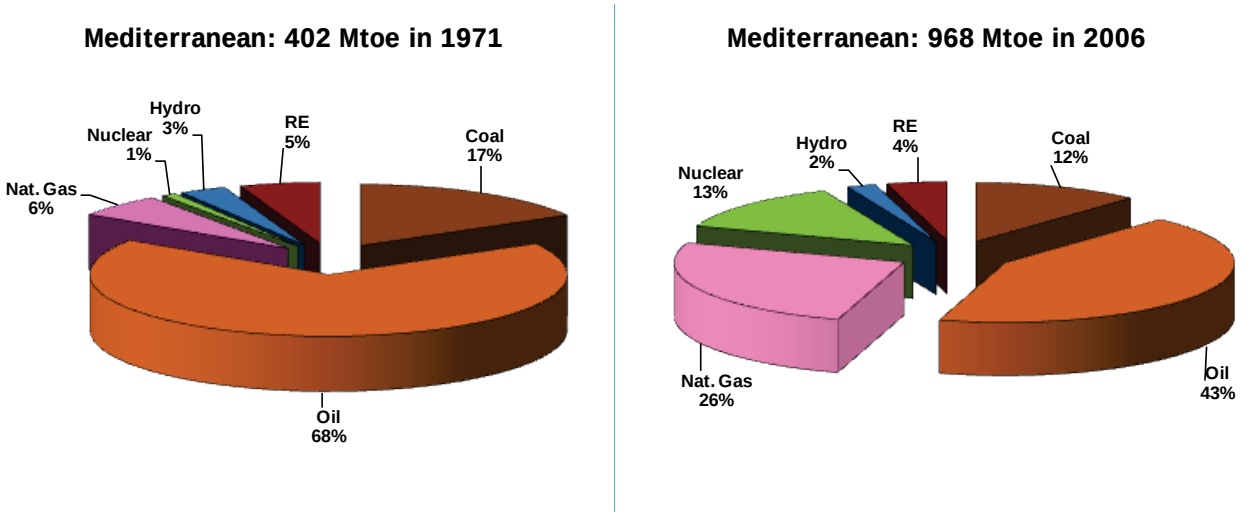
The progress made in terms of power generation capacity is considerable. The installed capacity in the countries of the Northern rim stood, in 2006, at over 300 GW for a population of 192 million inhabitants, as against 102 GW at most in the countries of the Southern rim for a higher population counting 261 million inhabitants. For the sake of illustration, the installed capacity in France alone (116 GW) is higher than that of the countries of the Southern rim altogether. The fourfold rise of total electricity generation (between 1971 and 2006) had required a 224 GW additional capacity in the Mediterranean Basin, of which over 36% (81 GW) in the SEMCs.

A catch-up has been observed over the past few years. The South-North ratio in terms of energy consumption per capita, which was of 1 to 7.8 in 1971, stood at 1 to 3.9 in 2006.

In order to address this high growth in energy demand, all energy sources are being tapped (*Figure 4*). Fossil energies remain quite significantly predominant, accounting for over 80% of the total energy demand in the Mediterranean in 2006. While accounting for 75% of the demand in the NMCs, they claim over 94% of the energy balance in the SEMCs. This difference is, in fact, due above all to the significant share of nuclear power in the NMCs.

On the whole, while most energy sources have been concerned by this rise, natural gas stands out with a considerable growth by over 1000% from 1971 to 2006 (passing from 24 to 249 Mtoe) to reach 26% of the total energy demand. While remaining the dominant fuel in the Mediterranean energy mix, oil has seen its share strongly decrease from 68% to 43% of the total, this being due to a decrease in the share of oil in electricity production in favor of gas, set off by an increase in the share of fuels in transport (notably of diesel and gasoline).

Figure 4 Structure of the primary energy consumption in the Mediterranean region, 1971, 2006 (%)



Source : OME

As for coal, even though the quantities in absolute values have almost doubled, its share has dropped by 5 points, this being due to its use in the electricity sector together with the use of new clean production technologies. On the other hand, nuclear power has seen its share increase from 1% to 13% over the same period. As regards renewable energies, their contribution has remained quite modest with respect to the resources potential, even though there was observed a doubling up in terms of absolute values between 1971 and 2006.

With regard to energy consumption, the gap between North and South—though narrowing—remains significant, still generating substantial South-North exchanges and little South-South exchanges.

The four producing countries (Algeria, Egypt, Libya and Syria) supply around a fourth of the oil imports and over a third of the gas imports of the whole Mediterranean Basin. In 2006, the total international exchanges of Mediterranean countries amounted to around 450 Mt of crude and oil products, 207 bcm of gas and around 249 TWh of electricity. On the other hand, the net intra-Mediterranean energy exchanges amounted in 2006 to around 97 Mt of oil and oil products, 72 bcm of gas and 70 TWh of electricity.

Concerning oil, the countries of the Mediterranean basin depend on 26 exporting countries, of which the four Mediterranean ones (Algeria, Egypt, Libya and Syria). With around a hundred million of tonnes, the SEMCs cover over 25% of the crude oil needs of the countries of Southern Europe (France, Greece, Italy and Spain).

As regards gas, the countries of the Mediterranean basin depend on 14 exporting countries, of which 3 are Mediterranean (Algeria, Egypt, Libya). The 3 exporting countries of the Southern Mediterranean cover over 35% of the natural gas needs of France, Italy, Spain, Greece, Slovenia and Turkey.

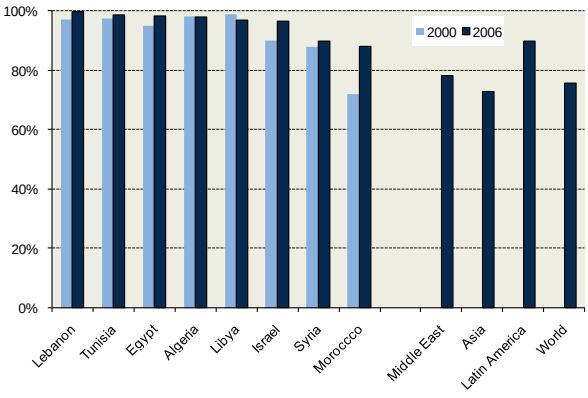
Electricity exchanges remain marginal with respect to the total electricity consumption. Their volume reached 249 TWh (125 exported and 124 imported) in 2006, of which 28% constituting intra-Mediterranean trade (70 TWh), marked by electricity exchanges in France, Spain, Italy, Slovenia and Croatia, with 10% only concerning South-South exchanges.

Are we heading towards the objective of reducing the portion of the population not having access to electricity? What role can renewable energies play in this regard?

One of the objectives of the MSSD is to increase access to electricity in the rural areas of the SEMCs in such a way as to reduce by a half, within the time frame 2015, the part of the population of developing countries not having access to it. The answer lies in the electrification rate, an indicator of a social order which is intended to chart the progress made in terms of access to energy. It corresponds to the number of persons having access to electricity in percentage of the total population.

If the electrification rates were fairly low in certain SEMCs, this was due, for the major part, to delays of servicing of rural areas in electrification. In 2000, around 16 million Mediterraneans in the SEMCs did not have access to electricity, mainly in Egypt, Morocco and Syria. Since then, ambitious national electrification programmes have been conducted in these countries, helping to reach, in 2007, an access rate of 90% in Syria, 93% in Morocco and 96% in Egypt (*Figure 5*).

Figure 5 Electrification rate in the SEMC and in some other developing countries, 2000, 2006 (%)



Note : The data for Asia concern only the developing countries

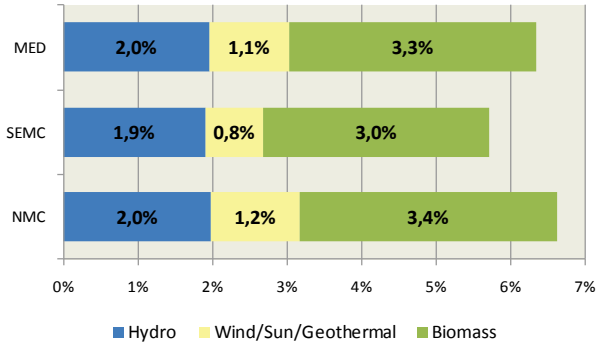
Sources : OME, national sources

Thus, currently, the average rural electrification rate exceeds 95% in the SEMCs. For very remote and scattered population without access as yet to electricity (8 million people), renewable energies—via photovoltaic systems—represent an opportunity. This is already the case in a few countries where the rural electrification programme via electricity distribution grids is relayed by an electrification programme based on renewable energies and, particularly, on the equipment of households with individual photovoltaic systems. It is in this way that the Moroccan electrification programme has involved over 3163 villages and 44,719 households in photovoltaic system, which corresponds to the electrification of over 1,766,960 households and a rural electrification rate of 93% in 2007, as against 18% in 1996.

To what extent are renewable energies integrated in the energy mix in the Mediterranean?

As pointed out above, renewable energies account for a mere 6% (biomass included) in the energy balance of the whole region, and this, despite a significant increase in volume (+88%) since 1971 (*Figure 6*).

Figure 6 Share of renewable energy in the primary energy demand in 2006 (%)



Sources : OME, national sources

Indeed, prompted by incentives, policies and technological progress, renewable energies in the Mediterranean have reported exceptional growth. Since 2000, there has been considerable progress in terms of installation of renewable energies (not including hydroelectric power) with an exceptional average annual growth of over 36%, reaching 26 GW in 2007. This trend is due to a spectacular increase in wind-based electrical capacity, reaching 21 GW in 2007, as against 3 GW in 2000.

Nevertheless, it is hydropower which is currently the most exploited source in the Mediterranean, contributing in 2006 to over 76% of the electric production based on renewable energies.

Despite the high renewable energies potential, particularly in the countries of the Southern rim, the contribution of renewable energies to meet the demand is low. The quantity of renewable energy produced in absolute value is on the increase, but in view of the simultaneous increase in demand, the share of renewable energies (water, wind, solar, geothermal) in primary energy supply increases very slowly (from 2.5% in 2000 to 3.1% in 2006, biomass not included), which is far short of the MSSD objective of 7% (exclusive of biomass) by 2015.

Efforts are underway, notably in Egypt, Morocco and Tunisia, with regard to wind energy, and in Israel and Turkey, concerning solar water heaters.

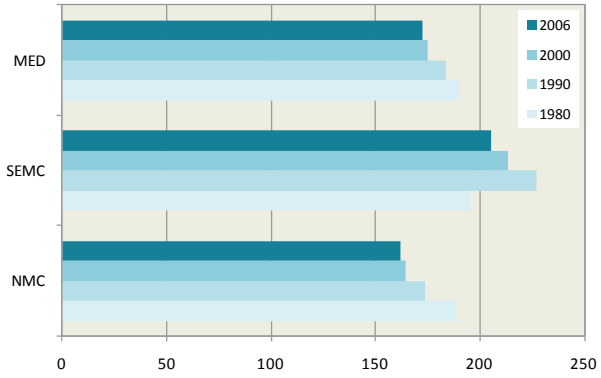
Is energy used efficiently in the Mediterranean?

The measurement of energy efficiency is made based on a total primary energy intensity (EI) indicator corresponding to the ratio between energy

consumption and Gross Domestic Product (GDP), the latter being calculated in Purchasing Power Parity (PPP), in order to consider standard of living.

This indicator (expressed in TOE per GDP unit) characterises the extent of the "energy sparing" of a given country or mode of development: it measures the quantity of energy consumed for the same comfort or production level. Energy intensity depends, quite obviously, on such factors as climate (the more it is cold, the more energy is consumed for heating, at equal economic level), as well as on the structure of the economy: the more a country has heavy industries, the higher its EI. However, when we compare countries of similar economic structures, the main factor is the efficiency with which energy is produced and consumed: very roughly speaking, the lower the intensity, the greater the efficiency (*Figure 7*).

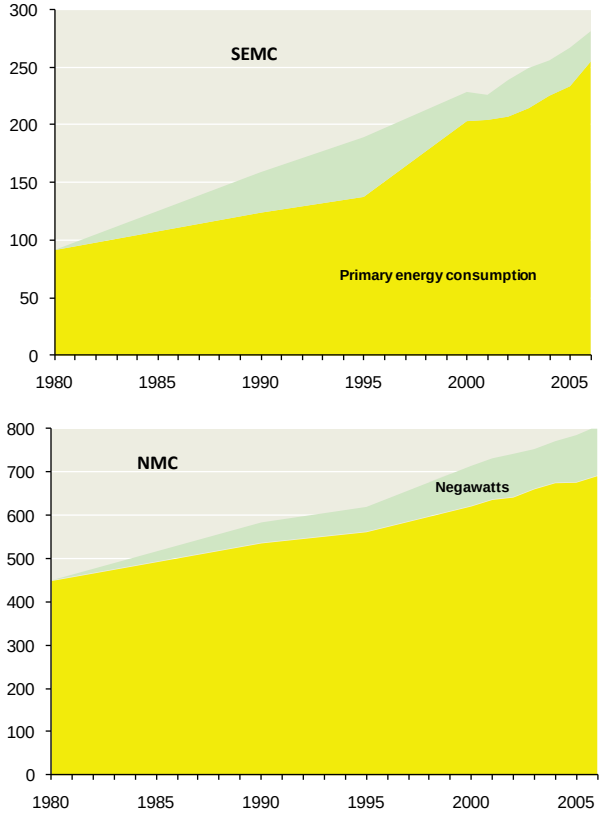
Figure 7 Trend in energy intensity, 1980-2006 (toe per GDP unit - Millions of Euros 2005 ppp)



Sources : OME, WDI, Plan Bleu computation

Awareness of the importance and usefulness of energy efficiency and of the indisputable linkages between environment and development in the Mediterranean is on the increase. In the countries of the Northern rim, energy efficiency (EE) policies began to be implemented in the wake of the first oil crisis of 1973, and are pursued with the promulgation of the energy – climate package (20/20/20). These energy efficiency achievements correspond to energy savings made every year and which can be expressed in "negawatts" or "negajoules". These are calculated on the basis of the improvement of the energy intensity since 1980 for the Northern Mediterranean Countries (NMCs). The figure 8 shows the evolution of primary energy consumption over the period 1980-2006. The lower curve represents the real primary energy consumption, while the upper curve shows what this consumption would have been if the energy intensity of the whole NMCs had remained at its value of 1980. The uppermost portion of the diagram (negawatts) represents the savings made in respect of energy consumption due to an increase in total energy intensity[1]. In 2006, the quantity of negawatts for the NMCs was around 114 Mtoe, that is, 16% of the primary energy consumption, which is, for instance, the equivalent of 1.5 times the oil consumption in the NMCs. Accordingly, the NMCs reported, thanks to the improvement of their EI over the period 1980-2006, cumulative savings in the order of 1300 Mtoe, that is, the equivalent of around 2 years of consumption (2006 level).

Figure 8 Energy economies potential in the global energy intensity, 1980-2005 (Mtoe)



Source : OME

As regards the SEMCs, one observes a quasi-stabilisation of the EI level since 1980. However, since 1990, several SEMCs have opted for greater "energy sparing", and a slight decrease in their EI may be observed. The same exercise has been conducted for the SEMCs to estimate the energy efficiency gains which could have been achieved if the SEMCs had, at least, maintained the same EI level of 1980 over the period 1980-2006. These (non realized) energy savings could have ranged between

5% and 14% per year, that is, an aggregate of 286 Mtoe over the period 1980-2006, which is the equivalent of over a year of consumption (2006 level).

Besides, for the sake of information, studies presume that there is a significant potential which could be tapped via demand side management by improving the energy efficiency in the industry and gaining better control over the demand related to transport, heating and air-conditioning. The benefit was estimated at 208 Mtoe/year for the timeframe 2025[2].

What contribution by the energy sector to the greenhouse effect?

In 2000, 72% of the Mediterranean greenhouse gas (GHG) emissions were due to CO_2 arising from energy use, with 77% in the NMCs and 64% in the SEMCs. In 2006, the NMCs accounted for around two thirds of the CO_2 emissions due to energy use of the whole Mediterranean Basin (*Figure 9*).

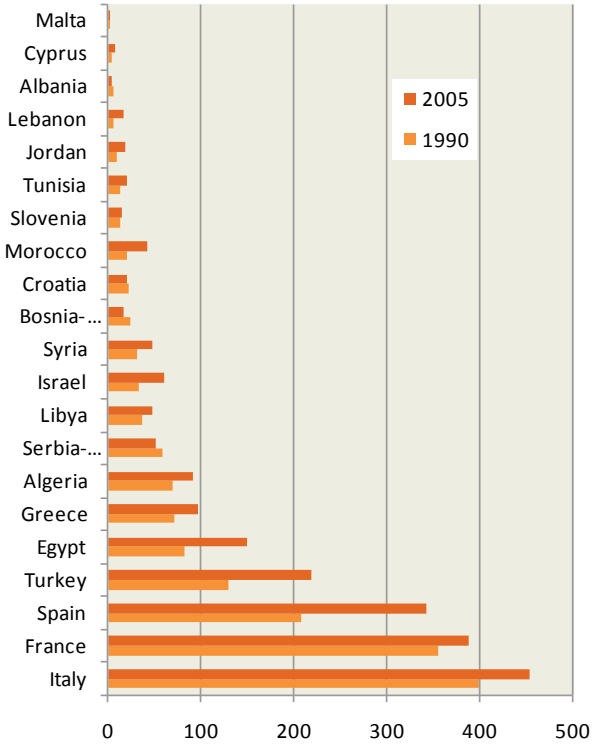
However, the increase in CO_2 emissions appears to be more rapid in the SEMCs than in the NMCs. The NMCs reported an increase by 23% between 1990 and 2006, while the SEMCs reported an increase by 76% over the same period. This growth pace is twice as fast as the global pace.

In the SEMCs, electricity and heating are the chief contributors to the rise in emissions between 1990 and 2006, while, in the NMCs, it is the transport sector that is the chief contributor (*Figure 10*).

Over the period observed, one notices a continuous weight of fossil fuels, with persistence by coal (high CO_2 emitter) in the energy mix, due to its use mainly in the power generation sector.

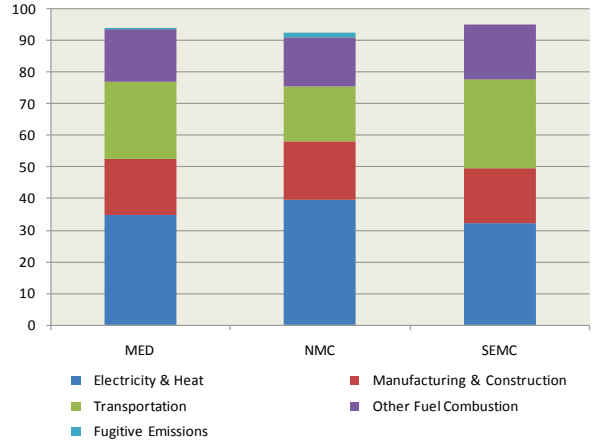
A comparison between the EU-27 as a whole and the Mediterranean region is worthwhile, they being two sets with approximately the same population level[3]. Primary energy and electricity consumption in the Mediterranean amounts to a mere half of that of the EU-27; the per capita consumption of primary energy and electricity in the Mediterranean is around a half of that of the EU-27. The CO_2 emission/toe is 6% superior in the Mediterranean compared to the EU27's. This illustrates that Mediterranean energy mix is emitting more CO_2 than the European mix, even more when it comes to the SEMCs' emission (+19%).

Figure 9 CO_2 emissions from energy use (Mt CO_2)



Source : WRI - CAIT 6.0

Figure 10 Distribution per sector of the CO_2 emissions from energy use since 1990 (%)



Source : WRI - CAIT 6.0

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Notes

[1] Approach used by Bernard Laponche, in « Prospective et enjeux énergétiques mondiaux : un nouveau paradigme énergétique » (Global Energy Stakes and Prospects: A New Energy Paradigm), 24-26 Nov 2006.

[2] The Plan Bleu 's sustainable Development Outlook for the Mediterranean), 2005. Difference between the primary energy consumption of Mediterranean countries within the framework of a trend scenario without special effort in matter of energy saving, and the same consumption if these countries invest effort, such as adoption of tax incentives for saving, with allowances targeted at sustaining innovative approaches in matter of energy-saving housing, etc.

[3] The Mediterranean has a population of 452 million that is 92% of that of the EU-27.

Marine Ecosystems

Christine Pergent Martini (SAP/RAC, University of Corsica)

What do we know about the Mediterranean marine ecosystems?

The Mediterranean is one of the world's 25 hot spots for biodiversity[1]. Whilst constituting a mere 0.8% of the world's ocean area and 0.3% of its volume, it is home to 7 to 8% of all known marine species (according to the groups considered). Over 12,000 species have been described. This vast wealth of biological diversity should be considered within the context of the basin's specific geo-morphological features, its geological history and its location as an interface between the temperate and tropical biomes, enabling it to support both warm and cold-adapted species.

Over half the Mediterranean marine species are native of the Atlantic Ocean, 4% are « relic » species, testimony of times way back in history when the Mediterranean had a tropical climate, and 17% have come from the Red Sea. The latter category includes both very ancient species, which date from the times when the Red Sea and the Mediterranean comprised a single entity, and species which recently entered the Mediterranean after the Suez Canal was built, for example, and which are deemed to be introduced species (See Chapter *Marine Biological Invasions*). The high percentage of endemic species present (over 25%), in other words ones which only exist in the Mediterranean, can also be attributed to its history.

This exceptional wealth of flora and fauna is relatively unequally distributed, depending on distance from the coast, longitude and depth. There is greater diversity, for example, in the western basin, whatever the taxonomic group being considered. Similarly, at bathymetric level, almost 90% of the known benthic plant species[2] and over 75% of fish species are to be found in the shallow waters (from 0 to 50 m) although they account for a mere 5% of Mediterranean waters.

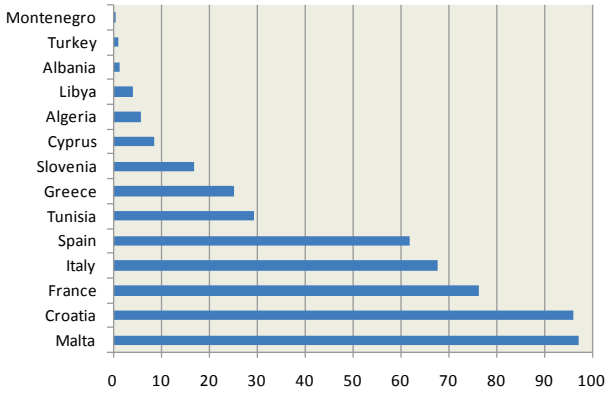
Posidonia oceanica, Cymodocea nodosa

The coastal zones (between 0 and 100 m) support some major ecosystems[3]. Thus, within the framework of the instruments established by SPA/RAC to assist the Mediterranean states in drawing up their inventories of sites of conservation interest, a reference list has been established, which identifies 27 major types of benthic habitat, the main ones of which are the magnoliophyte beds and the coral concretions:

- Magnoliophytes are land-based flowering plants, which returned to the marine environment some 120 to 100 million years ago. There are about sixty species around the world and five in the Mediterranean (*Cymodocea nodosa*, *Halophila stipulacea*, *Posidonia oceanica*, *Zostera marina* and *Zostera noltii*), which form vast underwater meadows (also known as beds) at a depth of between 0 and 50 metres in the open seas and in the brackish and saltwater coastal lagoons. Amongst these species, the Posidonia (*Posidonia oceanica*), a species endemic to the Mediterranean, plays a key role, often compared to that of the forests. The Posidonia beds comprise the leading Mediterranean ecosystem in terms of biodiversity, since they support a quarter of its species over an area estimated to cover almost 1.5% of the seabed (35 000 km²). A spawning ground and nursery for many commercial species and the source of major primary production, the beds constitute one of the Mediterranean's sensitive habitats for preserving sustainable non-industrial fishing. Playing an important role in oxygenating the water, they trap and fix sediment (like beach-grasses on the dunes). By protecting the beaches against erosion (by reducing hydro-dynamism) and by encouraging water transparency, they are the guarantors of seaside tourism and provide an effective tool for monitoring the quality of coastal waters. It is estimated that in terms of the services they provide, at global level these underwater meadows have an economic value in excess of over 15,000 € per hectare per year, which is 100 times greater than land meadows.
- The corallogenic reefs are the Mediterranean equivalent of the inter-tropical coral formations, albeit not as spectacular. Corallogenic concretions are built up through the accumulation of calcareous algae (Corallinales), which grow in poor light conditions. Such concretions, which are common throughout the basin with the exception of the Israeli and Lebanese coasts, are mainly to be found at a depth of between 40 and 120 m, but also closer to the surface in caves, on the vertical walls and in poorly lit spots. They provide a home for a vast range of sessile invertebrates (bryozoans, gorgonians, sponges) and comprise the second Mediterranean ecosystem in terms of biodiversity, with over 17,000 species, many of commercial interest and the traditional exploitation of which dates way back in history (e.g. sponges, red coral). The concretions also host many small sharks.

With the exception of these coastal habitats, the information available is extremely patchy and varies widely from one sector of the Mediterranean basin to the next. Looking at the Posidonia beds alone, which for two decades have benefited from numerous specific study programmes and have been the subject of over 1,000 publications indexed in international data bases (« Web of Science »), it has to be said that, in spite of a well-known theoretical spread and an area estimated at 35,000 km², in some Mediterranean states only a tiny stretch of coastline has been inventoried (*Figure 1*).

Figure 1 Percentage of coastline's priority habitats (Magnoliophytes and corallogenic reefs)



Source: Leonardini et al. 2008, Agnesi et al. 2009

At regional level, at least for the eastern basin and the southern portion of the western basin, knowledge is clearly lacking. This is linked both to the fact that *in situ* investigation techniques (e.g. scuba, ROVs, observation submarines…) are relatively recent as well as to the technical difficulties and high cost of their implementation. This state of affairs, which was highlighted by the states in 2003 is still on-going and makes it difficult to assess the « resource » with any accuracy (geographic distribution, vitality), though such an assessment should be the first step in any management process.

Are the Mediterranean marine species endangered?

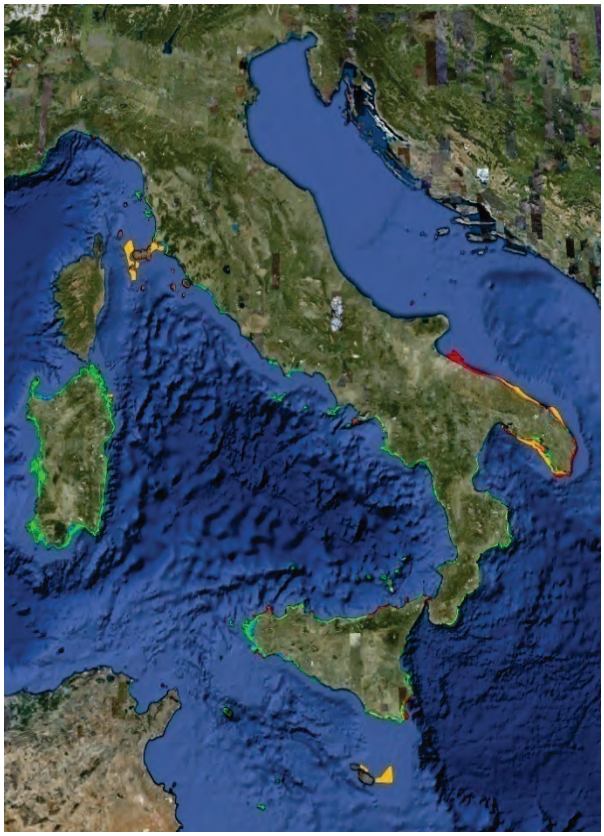
At Mediterranean level, the latest edition of the IUCN red lists shows that, generally speaking, 19% of Mediterranean known species[4] are endangered[5] *in the Mediterranean or in the world* and 1% are already extinct at regional level.

Looking more specifically at marine biodiversity, the data is much patchier, since regional assessment procedures have until now only been completed on fish and mammals.

The most endangered species amongst these taxonomic groups are the monk seal (*Monachus monachus*) and cartilaginous fish (chimaera, rays and sharks):

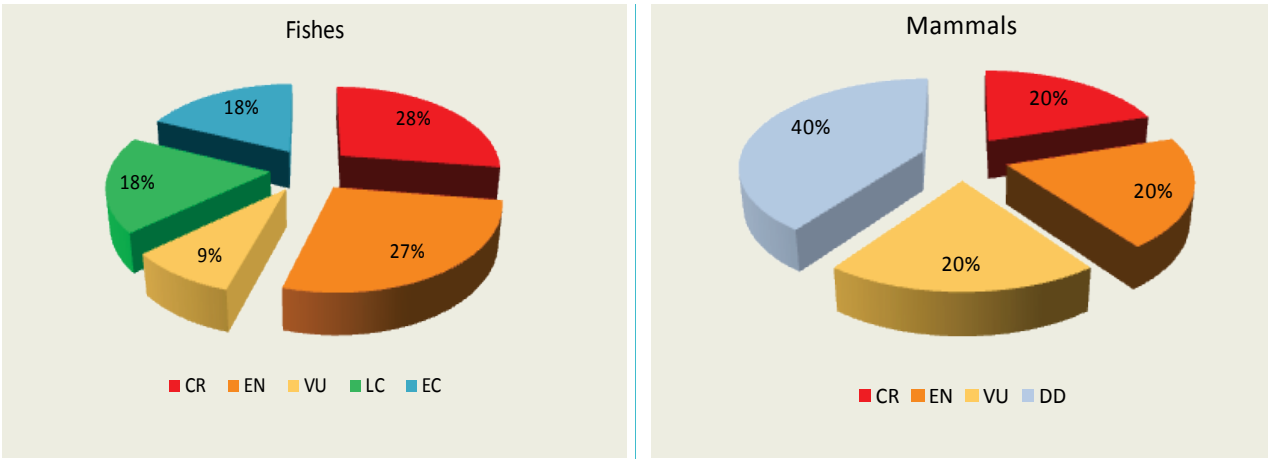
- Whereas the monk seal was present throughout the basin in 1900, there are very few sightings nowadays, mainly limited to the Aegean coasts, with something in the order of 350 to 450 individuals. The species is deemed to be one of the 10 most endangered in the world and has been classified by the IUCN as being at critical risk of extinction.
- Sharks are also in a particularly worrying situation, with a drop of over 97% in catches (by number and by biomass) over two centuries and with almost 42% of Mediterranean shark species at risk of extinction, as opposed to only 17% at global level. It should be stressed, moreover, that this data is possibly under-estimated since a lack of knowledge about the state of stocks and their distribution means that it was not possible to assess the status of 18 of the 71 cartilaginous fish species studied.

Figure 2 Distribution of Posidonia beds (in blue and green) and corallogenic reefs (in orange and red) along the Italian coast.



Source: Léonardini *et al*. 2008 modified

Figure 3 Percentage of fishes and mammals species as in ASP/DB protocol in accordance with the IUCN's categories



CR : Critically endangered	Threatened species	LC : least concern
EN : Endangered		EC : under evaluation
VU: Vulnerable		DD : data deficient

Source: Annexe II and III of ASP/DB protocol

Looking only at the species in Annex II of the Protocol concerning Specially Protected Areas and Biodiversity (SPA/BD), it appears that 63% of the fish and at least 60% of the mammals on the list have endangered status according to the IUCN's most recent assessments (*Figure 3*). The situation is extremely worrying (critically endangered) for three fish and one mammal species. For the other groups of species, it is difficult to provide a clear diagnosis in the absence of any up-to-date assessment at regional level or of a baseline concerning the state of these species in the past, hence the importance of the inventory and mapping work initiated both at national and regional levels (Natura 2000 site inventory, MedPosidonia Programme...).

Amongst the threats to Mediterranean biodiversity, Cuttelod *et al*. (2008) mentions the degradation and fragmentation of habitats, by-catches, over-exploitation, pollution and invasive introduced species. At regional level, 149 different threats have been identified by the Mediterranean states.

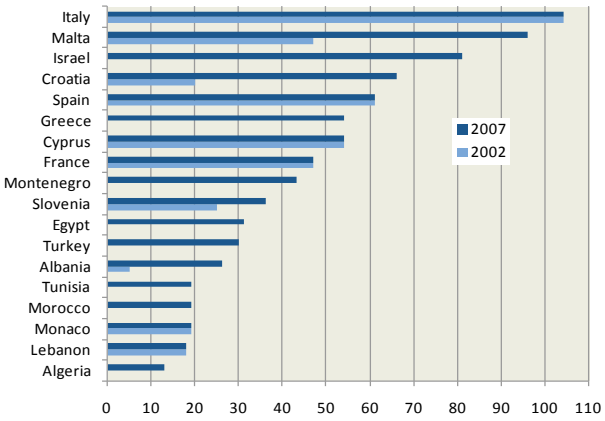
Given the multitude of sources, it is difficult to propose a classification for these threats. It would nevertheless appear that:

- For surface coastal ecosystems, the most serious threat is posed by the construction of facilities and coastal artificialisation, since they lead to the loss of ecosystems with a high level of biodiversity (coastal ponds and lagoons, Posidonia beds and surface bio-concretions), a loss which is virtually irreversible on the human scale. Indeed, even if these projects were to be scrapped, re-colonisation, identical with the degraded environment, more often than not proves impossible given the ecological constraints (slower growth of the original formations, low rates of natural re-colonisation, competition with highly opportunistic and/or cosmopolitan species). Moreover, such projects often affect currents in such a way as to encourage coastal erosion, a phenomenon which is likely to get worse as a result of climate change.
- The over-exploitation of resources currently appears to be one of the major threats to fish, highly migratory ones in particular, but also certain target mollusc, sea urchin and shellfish species, particularly since little is known yet about the potential impact of climate change on these species.
- Finally, although climate change is not the root cause of the introduction of exotic species into the Mediterranean (which is the second cause of biodiversity erosion worldwide), it would nonetheless appear to encourage the geographic spread of these species introduced through the Suez canal in particular, by providing them with more favourable environmental conditions than in the past.

How can the erosion of biodiversity in the Mediterranean be curbed?

At a time when the erosion of biodiversity remains an international challenge[6], particularly due to the uncertainty created by climate change, the importance of the Protected Areas for preserving this biodiversity speaks for itself. At regional level, the Contracting Parties to the Barcelona Convention have committed themselves to a joint approach adopting in 1995 a new Protocol concerning Specially Protected Areas and Biological Diversity (SPA/BD Protocol) and the implementation of a Strategic Action Programme for the Conservation of Biological Diversity in the Mediterranean.

Figure 4 Number of species from annexes II and III protected at national level, 2002, 2007



Source: National report on the implementation of the ASP/DB protocol during the 2000-2007 period

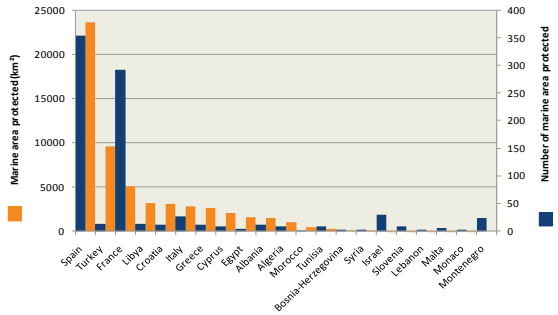
An analysis of the country reports over the 2001 – 2007 period shows that the focus has been on introducing legislative and regulatory instruments and consolidating existing legal ones. The adoption of the SPA/BD Protocol has led to the identification of 104 endangered or threatened species (Annex II), which are now to some extent included on the

national lists of protected species for 18 Mediterranean countries.

The legal instruments intended either directly or indirectly to set up Specially Protected Areas (SPAs) and/or protect priority habitats have also been strengthened. From around fifty in 2000, they had increased to over 90 by 2007, and the states which do not have any specific texts yet for the purpose, for example, of creating marine protected areas (Libya, Syria and Tunisia), are actively working on this front (*Figure 4*).

Efforts to preserve endangered species, particularly the adoption of seven regional action plans dedicated to Mediterranean heritage species from 1995-2008, have resulted in greater account being taken of certain key habitats or species (*Box 1*) and in the development of ecosystem approaches (*Box 2*). At the same time, the setting up of SPAs has been particularly promoted. Indeed, in an assessment conducted in 1995, 122 SPAs were identified, representing a total area of over 17 670 km². Now more than 800 SPAs have been placed by the Mediterranean states under the auspices of the Barcelona Convention, i.e a total area of over 144 000 km², almost 2/3 of which are marine areas.

Figure 5 Number and total area of Specially Protected Areas in the Mediterranean, 2000-2007



Source: National report on the implementation of the ASP/DB protocol during the 2000-2007 period

These SPAs are very unequally distributed between the western and eastern basins (82% and 18% of SPAs respectively), but also between the European (712 SPAs) and non-European states (131 SPAs) (*Figures 5 & 6*). This marked difference is partly due to the fact that the European states have designated sites of community importance within the framework of the implementation of the « Habitat » Directive and the « Natura 2000 » network, sites which Spain and France have included in their SPA lists. Moreover, with the exception of the « Pelagos » sanctuary for marine mammals set up in 1999 by France, Monaco and Italy, the SPAs basically cover wetlands and coastal habitats as well as shallow seawaters; only the « Pelagos » sanctuary includes, in its territory, waters outside the national jurisdiction of any of its three founding states.

Box 1 Close monitoring of the Posidonia beds

For several decades Posidonia and the beds it comprises have been a particular focus of attention, which has been reflected in direct protection measures:

- Recognition of the beds as a priority community habitat under the Habitat Directive (1993) ;
- Inclusion on the list of threatened species under the Barcelona (1996) and Berne (1999) Conventions;
- Introduction of legal protection status for the species in 11 of the 21 Mediterranean states;

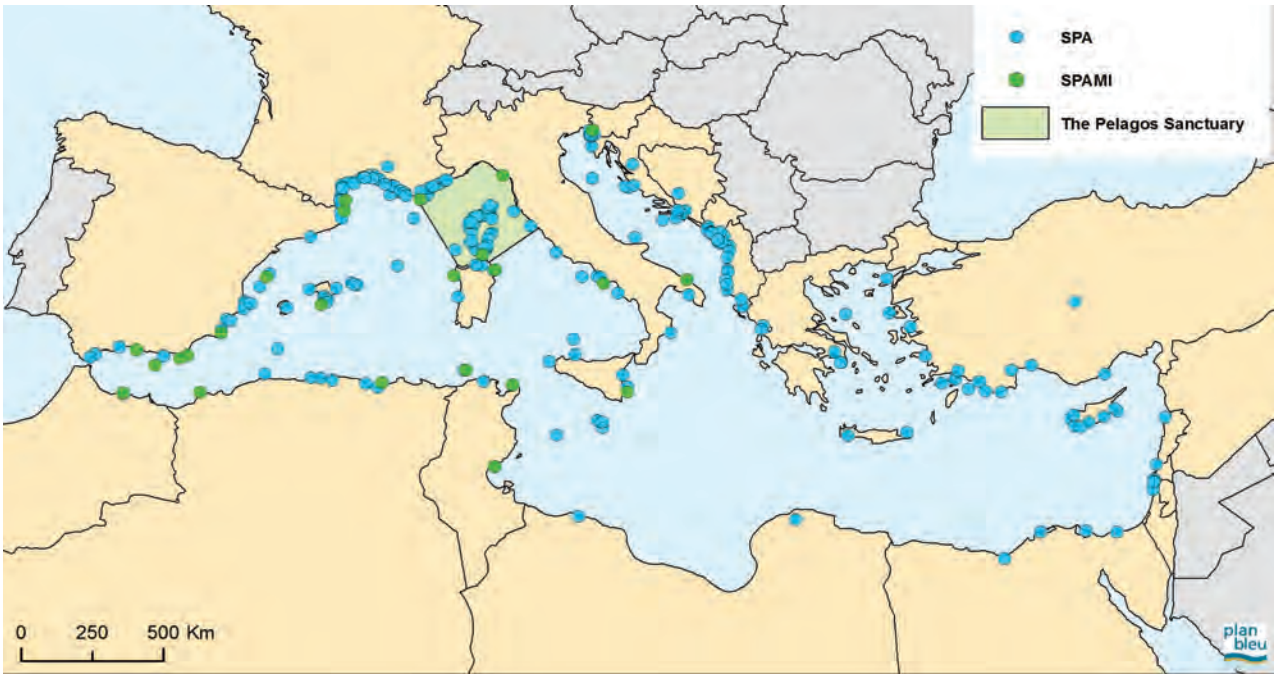
and measures to curb threats likely to affect the beds:

- A ban on the use of certain fishing gear (dragged gear, trawl nets) on seabeds at depths of between 0 and 50 metres and/or at less than 3 miles from the coast;
- Improved treatment of sewage prior to discharge into the sea;
- A ban on aquaculture production (fish farming) above the beds;
- Taking account of the beds in the mandatory impact assessment procedures when coastal facilities are being constructed.

These various measures have led to greater awareness about the beds and their functions, have ensured that they are taken into account as a factor of the ecological quality of bodies of water within the framework of the implementation of the European Water Framework Directive and the implementation of specific observation and monitoring programmes for these formations in several Mediterranean states (Algeria, France, Greece, Italy, Malta, Slovenia, Spain, Tunisia and Turkey). Monitoring conducted since 1987 has led to the identification of localised re-colonisation of beds phenomena in the area since 2000, after the City of Marseilles' sewage treatment plant was built.

With climate change, maintaining the existing Posidonia beds in good health is a major objective, to the extent that, just as the forests on land, they play an important role in carbon sequestration, and their destruction would lead to a decrease in the oceans' capacity to trap carbon.

Figure 6 Specially Protected Areas and Specially Protected Areas of Mediterranean Interest, 2009



Sources: SPA/RAC, Plan Bleu

Within this context, initiatives to identify potential sites for the setting up of protected areas outside waters under national jurisdiction and in deep waters are of particular importance towards rendering the Mediterranean SPAs more representative, meeting the international objectives of protecting 10% of marine ecosystems by 2012 and effectively curbing the erosion of biodiversity in the Mediterranean. The setting up of a representative network of Protected Areas is increasingly emerging as a means to facilitate the adaptation of certain species to climate change, by allowing them to migrate from one protected area to another one, geographically better suited to meet their needs (e.g. migration of temperate species from the south of the basin to the north to escape rising water temperatures).

Box 2 Further development of the Ecosystem Approach within the Barcelona Convention.

The Ecosystem Approach (ECAP) has been introduced as aiming at improving the way human activities are managed for the protection of the marine environment. Following the World Summit on Sustainable Development, the ECAP has been adopted by many International Conventions and Regional Seas Organizations. The Contracting Parties to the Barcelona Convention have adopted it in January 2008 at their Almeria meeting.

In this context, any environmental policy should be developed in a way that secures an effective protection of the marine environment and that makes possible the continued provision of marine goods and services for the wealth of the population. The application of the ECAP helps reaching a balance between the requirements of human activities and the conservation of the marine environment.

To ensure the sustainability of the exploitation of marine goods and services in the Mediterranean Sea, the ECAP and its related conservation and management measures will be applied not only to areas under the jurisdiction of States, but will cover also the habitats and ecosystems located beyond the national jurisdiction. As a consequence, the implementation of the Ecosystem Approach is not only a task for the Convention and its subsidiary bodies, but also and mainly for its Parties.

Within this framework, the MAP has received funding from the European Commission to undertake a project aiming at providing support to the Barcelona Convention for the Implementation of the Ecosystem Approach, including the establishment of Marine Protected Areas in open seas areas, including deep sea.

The implementation of the road map for the application of the ecosystem approach to the management of human activities is on-going. Three of the five first steps, identified to implement the road map until July 2012, are already completed. The ecological vision for the Mediterranean and the common strategic goals have been defined. The identification of important ecosystem properties and assessment of ecological status and pressures have been discussed. Thus, the preparation of the assessment document is being undertaken by a group of experts (national and international experts with the support of the MAP components). The development of a set of ecological objectives corresponding to the vision and strategic goals of the ecosystem approach and the derivation of operational objectives with indicators and target levels will follow.

Source : Atef LIMAM, SPA/RAC

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Notes

1 According to the Convention on Biodiversity, biodiversity means the variability among living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes biodiversity within species, between species and of ecosystems.

2 The term benthic applies to species which live on or close to the seabed (species attached to the seabed, for example) as opposed to pelagic species, which live in the water column.

3 The term ecosystem refers to the unit formed by a community of living beings (or biocoenosis) and its environment (or biotope).

4 As the assessment is limited to certain taxonomic groups, it is land species in particular which have been taken into account

5 Species classified as Critically Endangered, Endangered or Vulnerable

6 In 2002, at the 6th Conference of Parties to the Convention on Biological Diversity, countries have committed themselves to stop the erosion of biodiversity by 2012.

Natural terrestrial ecosystems

Jean de Montgolfier (Plan Bleu)

The Mediterranean natural and semi-natural terrestrial ecosystems considered here consist of forest (according to the FAO definition, in other words areas of land where canopy cover by large trees exceeds 10%), other wooded land (bush, scrub, matorrals, wooded steppe) and natural pastoral areas (mountain pastures, mountain steppes, pre-desert steppes, alfa grass steppes…). Intensely cultivated areas (fields, hay meadows, orchards, vineyards…) or aquatic ecosystems are not included.

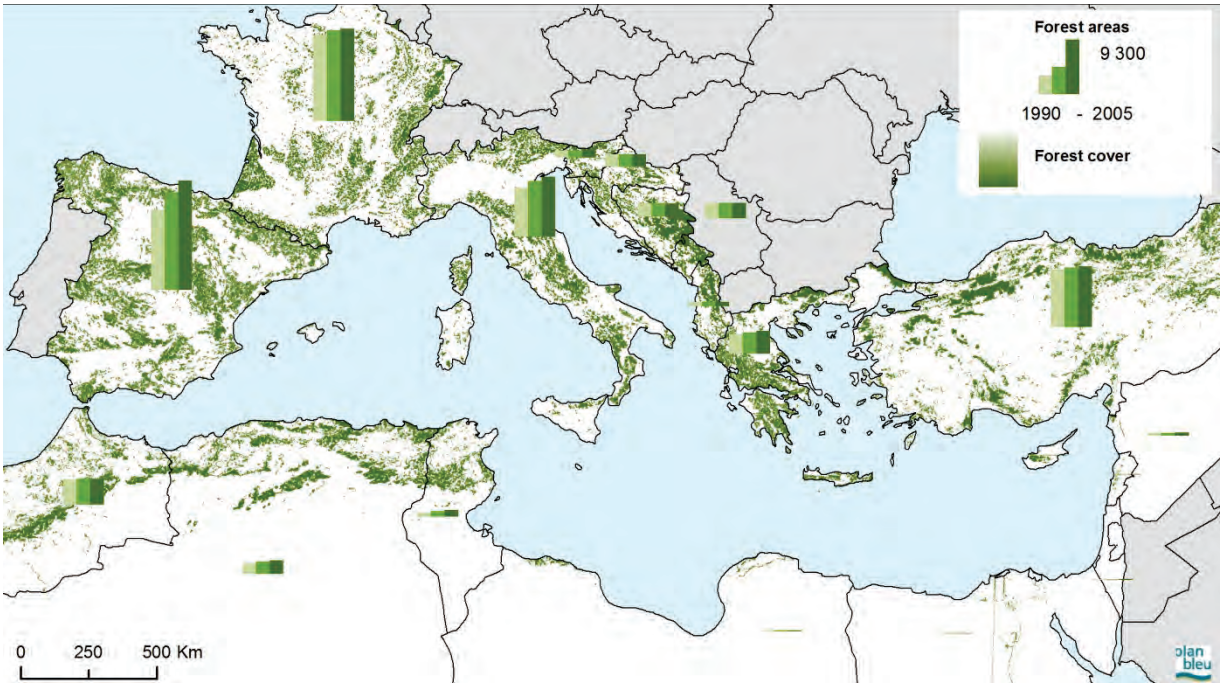
National statistics (included in the FAO ones) generally provide a relatively good overview of forest evolution, since they were originally designed mainly in order to establish a knowledge base about wood as a resource and production in the timber industry. Much less is known, on the other hand, about the other wooded areas, particularly their pasture resources.

How are the Mediterranean natural ecosystems evolving?

For thousands of years, the Mediterranean natural ecosystems have been under huge pressure from the human societies which exploit their timber, use them to graze their animals or clear them in order to grow their crops. At certain points in history and depending on the region, the intensity of such use far outstripped the natural environment's capacity to renew itself and led to the degradation of the plant cover, erosion and even desertification (soil degradation). At other times the pressure eased and, thanks to the marked resilience of the Mediterranean ecosystems, a relatively speedy « biological recovery » was able to take place, bringing forests back to areas previously used for grazing or growing crops.

There is currently a huge disparity between the situations prevailing on the two banks (*Figure 1*). To the north, following a period of major over-exploitation and regression over the 18th and 19th centuries, the forests are now making a more or less strong comeback in many areas, due to the abandonment of farming and grazing on soils having a low productivity. Conversely, pressure to the south is generally still very strong- over-exploitation of firewood, over-grazing and erosive ploughing- but tending to stabilise. To the east, a midway situation prevails. Moreover, several major reforestation programmes have been implemented to the north as well as in the south and east.

Figure 1 Trends in forest area, 1990-2005 (thousand hectares)



Source: FAO

What kind of services are provided by Mediterranean natural ecosystems?

In rural Mediterranean societies, wooded and grazing areas have since antiquity always been closely integrated with the local and regional economy- firewood (for domestic hearths, but also as a source of energy for the metal-working, glass-making and pottery industries and thermal baths…), timber for naval or land construction, numerous hunting and harvesting products and an essential grazing resource for all flocks and herds…

Nowadays, many of these uses have been widely abandoned to the north, although several of them continue to play an essential role to the south, particularly firewood and grazing. Moreover, in certain regions to the south, flock and herd size has increased considerably. Although the food resources provided there by natural grazing lands are often over-exploited, most animal feedstuff comes from grown or purchased resources.

The Mediterranean forests, on the other hand, have rarely found their niche within the modern timber industry- slow growth, heterogeneity of production, exploitation difficulties are all sticking points. New uses have emerged with urban and industrial civilisation- spots for relaxation and leisure, landscape backdrop for residents or tourists, eco-tourism, nature sports. Whilst these often non-market environmental goods and services tend to be predominantly in the north, they have already also taken a firm foothold in the south.

The « protection function » of these ecosystems has been known since centuries. Nowadays, in a scope of sustainable development, their major value as producers of local or global public goods is being increasingly recognised- soil and water protection, combating erosion and desertification, combating greenhouse gases, preserving plant and animal biodiversity. This latter aspect is all the more important given that the Mediterranean region is one of the world's « hot-spots » for biodiversity.

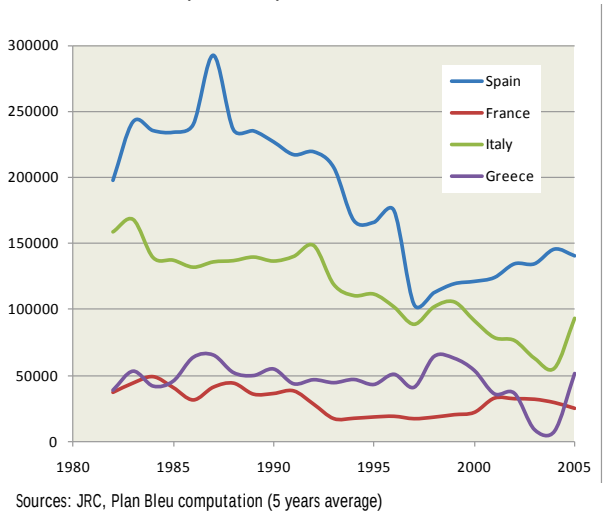
Classical forest management methods are well adapted to timber production, constrained by soil conservation and forest regeneration. The intensification of new social uses and fresh concerns relating to conserving biodiversity and combating global climate change impose major innovation in woodland management.

Are fires a threat to the Mediterranean natural ecosystems?

Forest fires regularly hit the headlines in summer, devastating vast areas (almost 600,000 hectares destroyed by fire in 2007 in the Northern Mediterranean countries (NMC) alone). In the NMC, outbreaks of fire are on the increase, and combating the major fires which cause considerable damage is becoming increasingly expensive. The battle is currently effective. Consequently, despite the fires, the total area covered by forests in these countries is growing. Nevertheless, the risk of fire is increasing with the « biological comeback » which causes the spread of vast and highly flammable brushwood area. Hence the need to develop prevention operations (clearance) and constantly boost land and air-borne combat capacity, particularly through cooperation between countries.

Fires are still quite limited to the south and east (61,000 hectares in 2005, and a marked upsurge to the east -Cyprus, Slovenia, Croatia, Turkey- in 2007, with almost 80,000 hectares burnt) (*Figure 2*), because traditional woodland grazing does not allow the massive growth of brushwood. Less grazing, however, could make the risk much greater in coming years. Moreover, by increasing the length and dryness of the dry season, climate change will doubtless bring about a major increase in risk to the north as well as to the south.

Figure 2 Burnt area in four European countries, 1980 - 2007 (hectares)



Sources: JRC, Plan Bleu computation (5 years average)

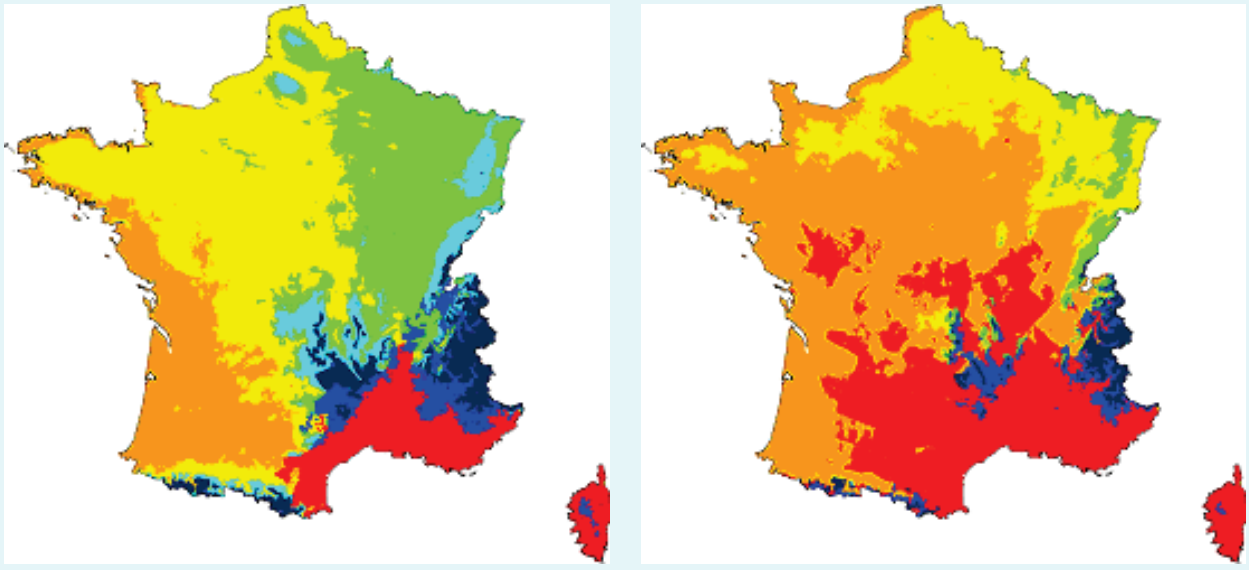
Box 1 Does global climate change threaten natural ecosystems?

Every plant species has its own ecological requirements in terms of soil and climate (rainfall distribution and temperature throughout the year). These requirements determine a potential area within which it is likely to grow. Climate change, which will be reflected in the Mediterranean in higher temperatures and increased aridity, will therefore lead to a shift in these climate belts, both northwards and to higher altitudes. If they are to survive, plant populations will therefore either need to find sufficient variability within their intra-specific genetic biodiversity to be able to adapt in situ, or reseed and thereby move generation by generation northwards and upwards, following shifts in their potential area.

Very little is known at present about how plants will be able to adopt one or other of these « strategies ». However, there has been some modelling of the potential shift in the distribution areas of the major forest species (*Figure 3*). Furthermore, the threat of pest attack or forest decline will increase within this context.

Given the large number of endemic species to be found within relatively limited areas in the Mediterranean, the spectre arises that many plant species may die out, with the consequent extinction of animal species linked to specific plant species or communities. Careful management of these areas will be required in order to minimise the risk, and corridors and green belts established to facilitate species migration.

Figure 3 Shift in the spatial distribution of forest species in France



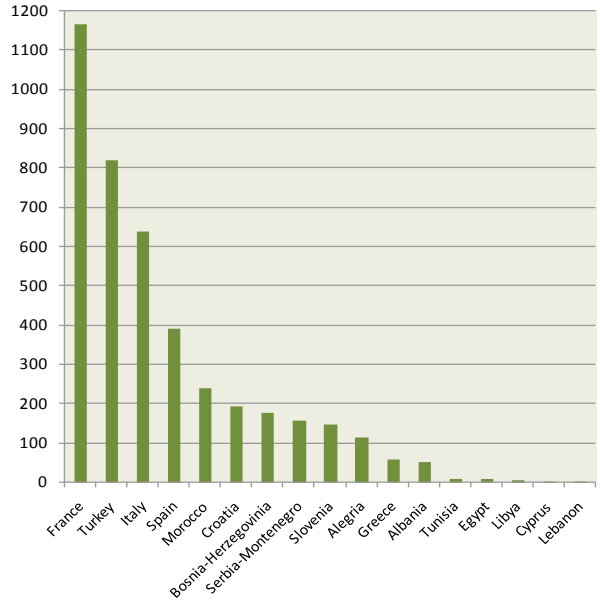
Source: CARBOFOR project

Can Mediterranean natural ecosystems help combat greenhouse gases?

The capacity of the Mediterranean ecosystems to fix carbon is markedly lower than that of the temperate or tropical forests, albeit still noteworthy. It may be estimated at between 10 and 15 million tonnes of carbon per year[1] for the basin as a whole, providing that fire-fighting and the battle against forest decline remain effective.

These ecosystems can also provide energy resources biomass or renewable materials. There has been a notable resurgence of interest in the use of firewood throughout the north at both individual and local level, often with public financial backing. Its widespread use (major plants using chips, second generation bio-fuels, bio-products for chemistry) will, on the other hand, run into the same handicaps as faced by current production of industrial timber- low productivity and exploitation difficulties. It should not be forgotten that in many regions to the south, the over-use of firewood continues to be a major cause of degradation of soil and plant cover, hence desertification. In any case, the watchword for the use of the natural ecosystems' resources should continue to be that of "prudence" to avoid undermining their sustainability

Figure 4 Stock of carbon in biomass[2], 2006 (million tonnes)



Source: FAO

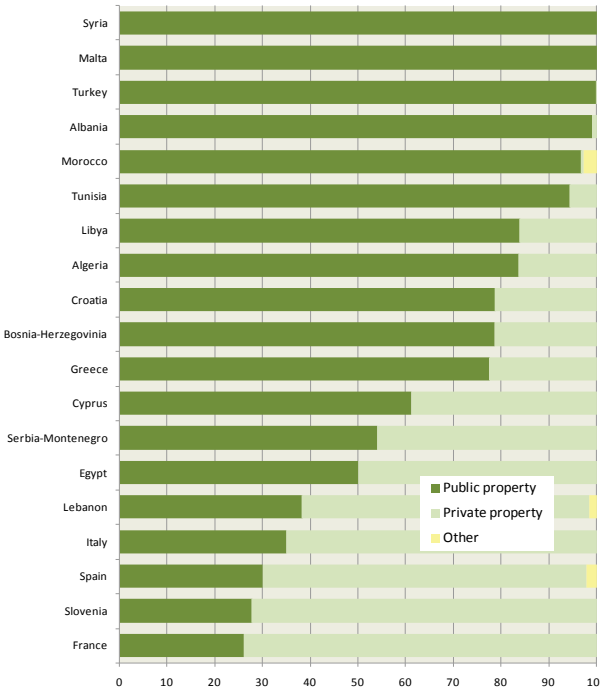
How are the Mediterranean natural ecosystems managed?

The woodland ownership structure varies widely from country to country (*Figure 5*) - in the EU countries, private property largely predominates. It often stems from the property of small-scale rural owners and is therefore highly fragmented, but also includes some major properties of ecclesiastical or noble origin. State ownership clearly predominates in the SEMCs, albeit with relatively widespread traditional- often community- user rights (for grazing in particular). In the countries in transition, collective ownership has been at least partly returned to the former owners or shared between the inhabitants.

Over the last century the Mediterranean's major forest countries built up efficient, well-staffed and well-trained forestry services, well-established on the ground, based on relatively comprehensive legislation and with strong administrations. They have conducted soil improvement and reforestation work often on a large scale, and rolled out robust protection policies, given the highly divergent social and economic contexts. But they are now facing what are often strict budgetary restraints as a result of the redeployment of State activity. They are increasingly focusing on projects towards sustainable territorial development, involving new stakeholders - economic operators, associations, and particularly the territorial communities. This trend is already well advanced in highly decentralised countries (Spain, Italy) and is underway in the others.

One of the major questions currently being asked regards the sustainable management and funding of the environmental goods and services provided by the Mediterranean ecosystems (market and non-market resources, landscape, reception of the public, protection of biodiversity, land, water, carbon sinks…) or payment for them. Which stakeholders may legitimately intervene? Who could arbitrate if usage conflicts arise? According to what procedures? When is minimum action sufficient? When, on the contrary, does more robust action need to be taken? What are the correct assessment criteria for such action, the correct decision-taking processes? Who should pay- the European, national, regional or local taxpayer, the consumer or the user? Through what mechanisms - the market, taxes, dues or voluntary contributions?

Figure 5 Distribution of forest area by type of property, 2000 (%)



Source: FAO

The territorial approach to sustainable rural development often provides a well-adapted framework for addressing such issues. Around the Mediterranean many innovative experiences are being conducted in an attempt to come up with new answers to these questions, and a highly fruitful field of cooperation is emerging.

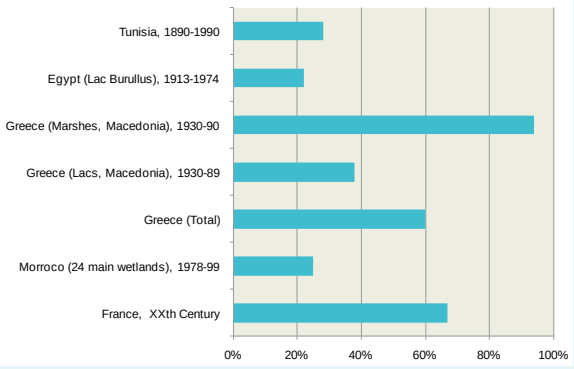
Box 2 What are the key issues at stake for the Mediterranean wetlands?

The wetlands, (deltas, lagoons, marshes etc.), support an outstanding biodiversity and provide a wealth of environmental services to Mediterranean societies. To date, no exhaustive inventory of the Mediterranean wetlands has been drawn up, but 13,500 wetlands in 12 Mediterranean countries have been identified by MedWet. However, they have long been drained or degraded to intensify certain uses, particularly within socio-economic development processes- food security, access to drinking and domestic water, curbing malaria, followed by commercial farming, urbanisation and industrialisation.

France thus lost 2/3 of its wetlands over the last century (50% of which in 30 years); in Morocco 25% of the total area of the 24 main wetlands was lost between 1978 and 1999 (*Figure 6*). Besides these obvious causes of disappearance, other factors also affect the quality of the wetlands- water pollution, invasive species, sectoral and non-sustainable water management, climate change (leading towards decreased water input), the over-exploitation of certain resources…

An increasing part of Mediterranean wetlands benefits from various forms of legal protection, but these laws are not always effectively implemented and controlled. The future of the wetlands, however, can only be assured by management which also extends upstream (catchment basin). It is also essential to gain better understanding of their state and evolution, and the Mediterranean Wetlands Observatory (MWO), a MedWet initiative facilitated by the Tour du Valat (running since early 2009), should provide an answer thereto. By sharing knowledge about the state of play between the 25 states involved in the initiative, the MWO instrument thus aims to analyse the forces both internal and external acting on the wetlands, as well as the scope attributed to the wetlands within the context of sustainable development in the Mediterranean, in order to influence decision-makers to enhance their conservation and protection and make more rational use thereof.

Figure 6 Examples of loses of wetlands in various Mediterranean countries (or part of countries)



Source: Mediterranean wetlands observatory's national reports

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Notes

[1] It is a matter of net value that takes into account the forest's complete carbon cycle

[2] Biomass includes biomass above and below the ground and dead wood. Carbon in biomass excludes carbon in dead wood, waste and ground.

Part 3

Spatial Dynamics

Coastal Zones

Urban Areas

Coastal Zones

Marina Markovich (PAP/RAC)

There are number of perceptions of what constitutes coastal zone in the Mediterranean. However coastal zone, as defined and adopted by Contracting Parties to the Barcelona Convention, is clearly indicated within the new Protocol on Integrated Coastal Zone Management in the Mediterranean (2008). Coastal zone, therefore, "means the geomorphologic area either side of the seashore in which the interaction between the marine and land parts occurs in the form of complex ecological and resource system made up of biotic and abiotic components coexisting and interacting with human communities and relevant socio-economic activities".

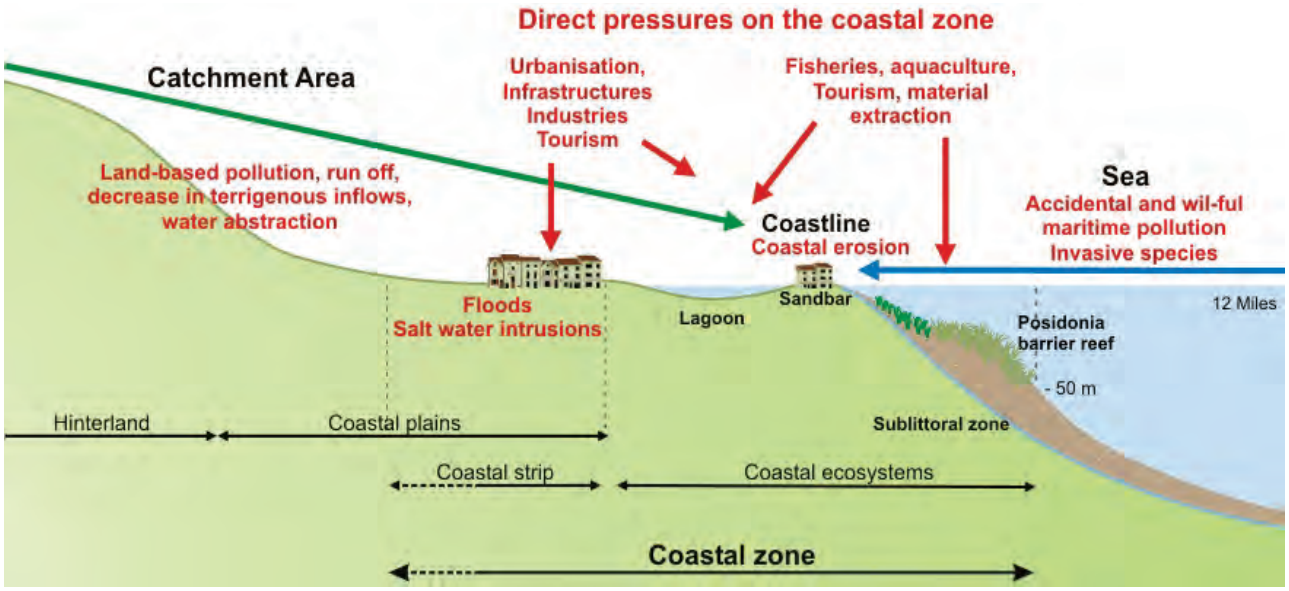
The Mediterranean coastline is approximately 46,000 kilometres long, with nearly 19,000 kilometres of island coastline. 54% of that coastline is rocky and 46% is sedimentary coast that includes important and fragile ecosystems such as beaches, dunes, reefs, lagoons, swamps, estuaries and deltas.

Other than great natural heritage, Mediterranean is known for its cultural heritage as well. In 1987, the Mediterranean countries started an initiative of “100 historical coastal sites of Mediterranean-wide interest” of which 48 are UNESCO world heritage sites. As an attractive area, Mediterranean coastal includes numbers of countries’ capitals and coastal cities. In 2008, the permanent population of the Mediterranean coastal states was approximately 460 million, with projection growth to 520 million by 2025. Projections for the coastal regions are approximately 186 million by 2025.

In addition, number of activities such as fisheries, industry, agriculture and tourism have been established and rapidly developed along the Mediterranean coastline (See Chapter on *Tourism*). Maybe the most important activity in the Mediterranean Region is tourism development. Such intensified urbanisation and tourism development has led to significant pollution threats: inventories showed that there are 101 priority pollution hotspots, mainly resulting from land-based sources. In addition, there are about 200 large oil tankers navigating in the Mediterranean Sea daily posing another threat to marine life in the Mediterranean (*Figure1*).

All these current and potential threats call for an immediate action for the preservation of important natural and cultural resources of Mediterranean biggest asset – its coastline.

Figure 1 The pressures on the littoral



Source: Plan Bleu

Why is it important to save Mediterranean coastal biodiversity?

The Mediterranean basin is recognised as biodiversity hotspot, rich in endemic flora and fauna – with 60% of unique flora species, 30% of endemic fauna and approximately 7% of all the marine species known world-wide. Nearly 19% of assessed species to date are considered threatened with extinction.

Species are important as they provide us with basic services such as food, medicine, clothes and fuel. Poorer regions of the Mediterranean depend even more on the natural resources and the loss of biodiversity is undermining their potential for economic growth and limiting their options. In daily life, rural households depend, to varying degrees, on farming, fishing and hunting to help meet their basic needs. In addition, they depend most immediately upon local ecosystem services and are often the least able to afford substitutes when these become degraded. For example, decline in fresh water sources and/or marine fishery production can jeopardise their direct source of revenue with little chance of substituting that with some other activity.

On the other hand, richness and variety of species in the Mediterranean lead to outstanding aesthetic values that are a vital resource for coastal tourism development. As sun-sand-sea experiences still dominate travel motives to the Mediterranean, favourable climatic conditions and preserved environmental resources are an important precondition for holidaymaking.

However the large numbers of people visiting places with outstanding nature features and building of new infrastructure suitable for large quantities of visitors can affect the natural environment, leading to habitat loss and loss of biodiversity. Such nature degradations can result in undesirable aesthetics and an uncomfortable experience for the visitors. This can cause a decrease in tourists, leading to economic degradation and social tension. Such destination decline symptoms could be prevented with the introduction of sustainable tourism development practices (*Box 1*).

Saving of coastal nature diversity is one of the most important resources of number of coastal activities. However, regional assessment done so far for nine species groups show that almost a fifth of these species are threatened with extinction mainly as a result of human activities. Conservation actions implemented to date have had positive results and some species have already been saved from extinction. Namely, from 2004 to date 175 large biodiversity projects have been identified within the Mediterranean region. However, in a region like the Mediterranean, where biodiversity is so strongly influenced by human activities, biodiversity loss is a constant reality that will only be stopped when humans realise that safeguarding biodiversity will ensure favourable environmental conditions that lead to increased economic and social benefits for all.

Box 1 Example of sustainable tourism development in Mallorca: Local Agenda 21 in Calvià (Spain)

Calvià, a municipality on the Spanish island of Mallorca, is a typical example of a Mediterranean high-volume holiday destination, with 60 kilometres of coastline, 27 beaches, quality natural landscapes, and a variety of ecosystems. In 2002, tourism accounted for 95% of the municipality's economic activity, with some 1,6 million visitors per year filling the municipality's 120,000 tourist units.

Until late 1980s, Calvià grew rapidly as a tourist destination. This growth resulted with short-term economic expansion based on high volumes, price competition and standardised holiday "sun, sea and sand" experiences. However, such growth led to overloading the capacity of the coastlines, adversely affected the attractiveness of Calvià as a tourist destination. This resulted in tourism fell by almost 20% between 1988 and 1991. Degradation of the island environment, weakening of social systems and threat to further tourism decline, impelled the Municipality of Calvià to undertake radical changes and introduce more sustainable approach in tourism planning and development.

In the early 1990s, Calvià Town Council set up a Local Agenda 21 (LA21) project based on the principles of environmental sustainability, local economic development, quality tourism, and citizen participation, resulting with Calvià Local Agenda 21 Action Plan approved in 1997. Local Agenda 21 process led to closing of many run-down hotels, landscape restoration, establishment of new protected areas, improvements in transport infrastructure, setting up various schemes with hotels in order to address high water and energy consumption levels and alike. The environmental development was joint by public awareness raising and marketing campaigns to improve the city's image, leading to increased employment opportunities as well as popularity amongst the visitors.

Overall, the formulation and adoption of the LA21 process has been successful. Calvià has demonstrated that process of careful planning and introduction of regeneration measures, use of continuous monitoring and adaptive management approach, followed by involvement of all interested stakeholders on a local level could be successfully applied in order to develop, disseminate and implement common vision sustainable tourism practices.

Sources: UNEP and UNWTO (2005)

Land settlement or preservation, what cost for development?

Mediterranean coastal area has always been attractive area for development. The urbanisation rate in 1995 was 62%, forecasted to grow to 72% in 2025. However, the urbanisation rate in the north will increase only from 67% to 69%, while in the south it is expected to be from 62% to 74%. But the biggest problem in continued growth in population and infrastructure is linear nature of coastal urbanisation resulting in nearly 40% of the total length of the coastal area already being occupied (*Figure 2*).

Figure 2 The Mediterranean by night

Source: NOAA

Numbers of studies have shown that people are favouring coastal residences, both for living and for recreation. In monetary values, such preferences are leading to higher values of the coastal facilities, compared to the ones distant from the coast. A study showed that there is indication of property price association with an ocean view; an unobstructed sea view adds 59% to house price.

A study in Israel, as part of Coastal Area Management Programme (CAMP), compared room rates for hotels along the coastline. It found that an accommodation within 2 kilometres of the coast charged 39% higher prices than similar classes of hotel further away from the sea. It can be expected that similar results could be found elsewhere in the Mediterranean.

Recently developed study on protecting coastal zones in the Mediterranean used two different development models, comparing their costs and benefits: the first in which coastal development is compared with beachfront conservation, and second that included comparison of costs and benefits between ribbon and cluster development (*Box 2*). Even the data in this study were limited and mainly based on assumptions; the evidence is in favour of conservation, as well as cluster against ribbon development.

Box 2 Modelling of benefits and costs of coastal development versus conservation

The first model is using two different cases of development: housing for personal occupation (case A) and building hotels with higher density of occupation (case B). In the Case A, the figures show that if the present users (personal housing) loose 5% of their benefits, the total benefit for beach users would be up to 10 times bigger. This makes strong case for the conservation. In Case B, if we take an example of a high-density hotel development the calculations are still favouring the conservation, but not as in the first case. The value of the development is now much higher, so the losses of benefits to present users have to be around 25% for the conservation option to apply.

Similarly, the comparisons of ribbon development along the entire coastline with a cluster development, where a limited amount of coastline taken for the development while the rest is left untouched, shows similar findings. Even if both types of development show lower benefits then costs, the loss of benefits is smaller with a cluster development that from the ribbon development.

The models show that the losses are much greater from ribbon development than for cluster development.

This also indicated that stronger measures for coastal protection are needed. These should include legal and fiscal instruments in place, followed by strong political will to preserve the valuable coastal resource.

Source: Markandya *et al*., 2007.

The beach: between attraction and security?

Beach quality has a major impact on the value of the coastal zone to both residents and visitors. This can be seen in high property values, development, tourism, employment and tax revenues. The beach has a primary importance for the bulk of holiday tourists. Beaches bring in tourists, which equates to money.

Repeated surveys have shown that five factors are extremely important in determining safe and pleasant beach enjoyment. These are safety, water quality, facilities, scenery and litter. The choice and order of priority of these five parameters was determined on the basis of their high rating by beach-user preferences and priorities and frequent consideration in beach management guidelines, beach rating and beach award systems as well as the information gleamed by the beach user questionnaire surveys.

A new system for beach evaluation - BARE the Bathing Area Registration and Evaluation system - has been developed in 2001 and applied ever since mainly in the Mediterranean region. The system incorporates the finding previously described in that it evaluates beaches, among others, based on its nature values, safety, water quality, facilities, scenery and litter. Also, carrying capacity for each natural beach is defined. BARE system is classifying beaches into five main categories, based on their accessibility and coastal scenery (remote, rural, village, urban and resort bathing areas).

In conjunction with the use of BARE, a Bathing Area Management Model (BAMM) is used as a management tool related in particular to any proposed management plan for local bathing areas but also applicable to coastal area management plans in general. This system has not yet been officially adopted in any state. However, it gains number of recognitions like in Croatia and its more intense application is being encouraged.

In past decades, concern about risks posed to public health as a result of human exposure to polluted seawater through bathing and other forms of marine recreation, has risen increasingly. In the Mediterranean, the rapid development of coastal tourism has resulted in deterioration of the bathing water quality. Such intensive increased municipal sewage discharges cause adjacent water bodies pollution. Bathing water quality is a good indicator of the microbiological state of coastal waters that is important for human health (see chapter on *health issues*). Not surprisingly, bathing water quality is one of the top five criteria people use to select their recreational destination, maybe even the most important one.

General trends show that the bathing water is improving in number of Mediterranean countries (European in particular), mainly due to improved sewage treatment systems. However, big pollution hotspots still remain in areas with high eutrophic conditions (see Chapter on *Pollution*). The problems usually affect those bathing sites after rainy and stormy periods that bring polluted water to the sea.

Different beach management practices - adopted in recent years by number of Mediterranean countries - are the first step towards bathing water quality's follow-up. To date, water quality has been a single element used worldwide as a tool for assign the quality of bathing areas. However, in order to achieve overall improvement of bathing areas quality (not just bathing water) integrated approach in managing and assessing those areas would be necessary.

How resilient coasts are to the uncertainties of the future?

Coastal areas world-wide and in the Mediterranean are particularly vulnerable to natural disasters (*Figure 3*). In Europe, earthquakes have killed more people than any other extreme events. Mediterranean basin is the major earthquake area of the Europe (*Box 3*). Other events, such as tsunamis happened relative infrequently over long periods of time but they do exist. For example, approximately 70 tsunamis affected Italian coastline over the last 900 years. The largest happened in Messina (1908) when 10,000 lives were lost.

As described in the first part of the document, climate change may have a wide range of negative consequences on the Mediterranean coastal area including sea level rise potentially leading to coastal erosion. Sea-level rise is likely to cause an inland migration of beaches and the loss of up to 20% of coastal wetlands. Coasts, deltas, estuaries, lagoons are vulnerable coastal systems that are affected by sea level rise. Moreover, these vulnerable coastal ecosystems can be used as indicators of climate change, and can help further understand effectiveness of adaptation and mitigation strategies for climate change.

In the Mediterranean, many ephemeral aquatic and permanent ecosystems are projected to disappear (see Chapter on *Climate Change*).

In addition to possible negative impacts of climate change, coastal zones are becoming more and more vulnerable, in particularly due to growth in artificial surfaces. Disturbed equilibrium in sediment balance and ecosystem health is increasing the level of coastal risks, especially in heavily populated coastal areas with little protection from natural sedimentation processes, such as are Mediterranean lagoons and deltas. On a global scale, around 25% of sediment from land is trapped in river reservoirs. According to Collins and Poullos natural sediment discharges by rivers in the Mediterranean basin may be in the range of 1,000 million tonnes per year. Because of the massive construction of reservoirs ~45% of these sediments might be retained behind dams or extracted from the river beds, for sand and gravel. Problems in sediment balance lead to coastal erosion that became one of the most important issues along the Mediterranean coast.

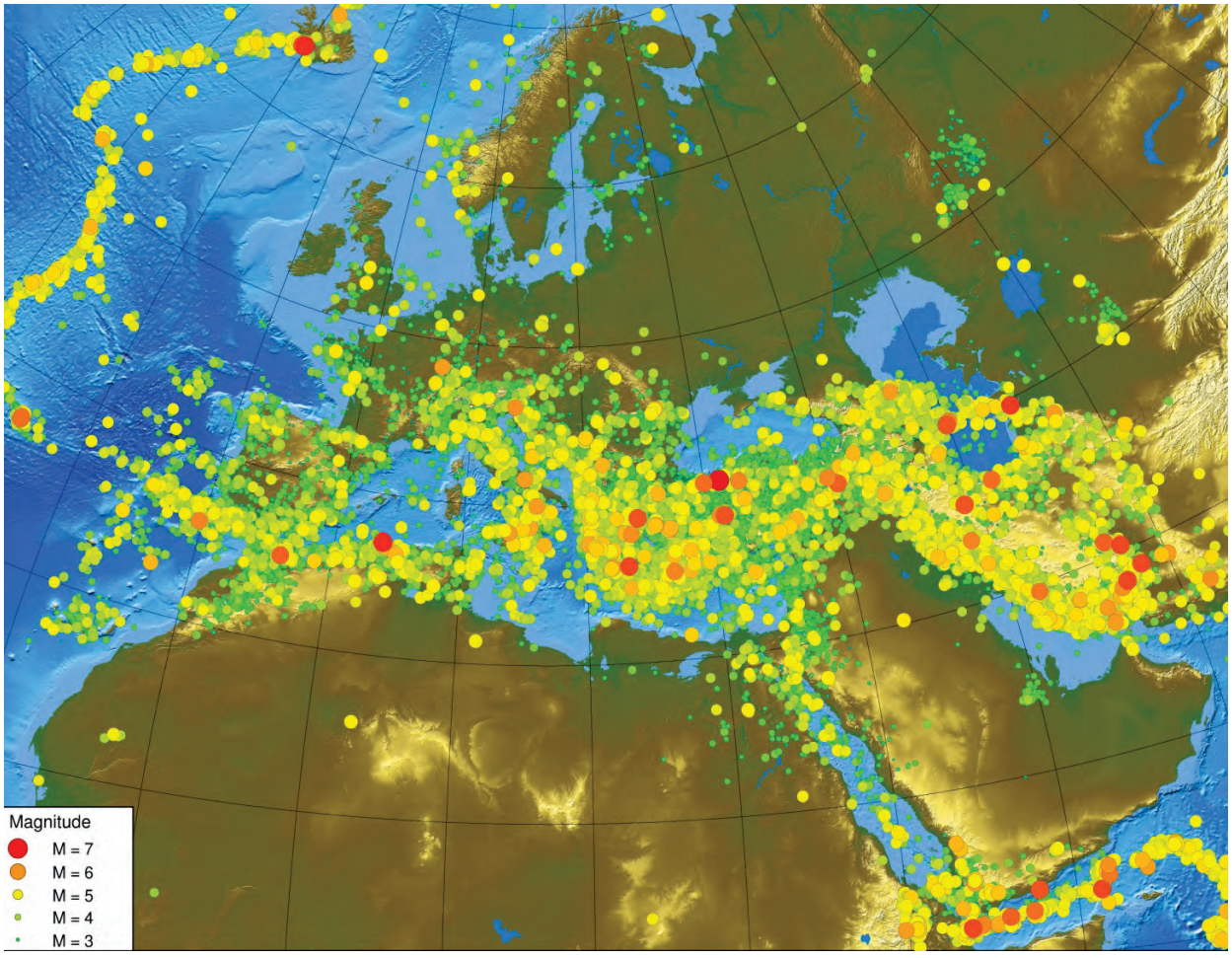
Based on results of the Erosion Project (2005), approximately one fourth of the EU coastline suffers from erosion. However, these data differ from country to country. For example, Cyprus has 37.8% of eroding coastline, Greece 28.6%, France 24.9%, Italy 22.8% and Spain 11.5%. In order to stop such processes sea defences have been constructed along 10% of European coastline. However, these defences often caused undesirable effects on sedimentary processes. They create new eroded areas. In addition, upstream dam construction on discharging rivers is causing severe reduction of sediments reaching the sea. This is leading to overall deficit of sediments on the coast.

To conclude, it can be stated that the Mediterranean is not frequently affected by great natural disasters. Taking into consideration the future challenges resulting from climate change appropriate measures that would decrease a level of vulnerability of the coasts to these uncertainties need to be undertaken.

Local authorities' commitment in a sustainable development process: fiction or reality?

There are many stakeholders and stakeholder groups in the Mediterranean: government organisations, private sector, non-governmental organisations (NGOs), researches and coastal citizens. Stakeholders are nowadays greatly invited to participate in coastal planning and management processes. However their real engagement is still very limited as there is usually no systematic way in actively involving them into planning and management arrangements. Response to the question "in your opinion, have the main interests of the above stakeholder groups been considered in the preparation of your country's Integrated Coastal Zone Management (ICZM) strategy", as part of ICZM Evaluation Questionnaire, is summarised in Figure 4.

Figure 3 Seismicity in the Mediterranean region, 1998-2007



Source : EMSC

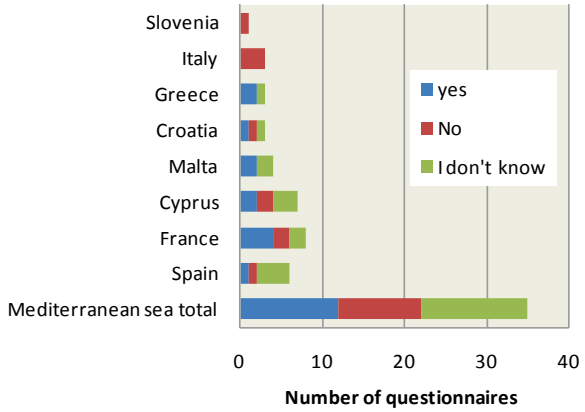
Box 3 Earthquakes in the Mediterranean Region

In past thirty years several dramatic earthquakes affected the Mediterranean region. One of the dramatic ones was the 1980 earthquake in southern Italy that killed 4,500 people and made more than 250,000 homeless. The most powerful and destructive was the Izmir earthquake (Turkey) in August 1999 that killed approximately 17.000 people, causing EUR 15 billion in losses. Just one month after a seismic tremor hit the northern areas of Athens, killing 140 people but leaving more than 60,000 homeless. The latest earthquakes were recorded in Turkey (April, 2003) and in Algeria (May, 2003). The effects of the latter were felt in Balearic islands in a form of a small tsunami that did not cause dramatic effects except sinking several boats.

The latest severe earthquake was recorded in Italy, in the L'Aquila area (central Italy) on April 6th 2009. The earthquake had a magnitude of Mw 6.3. At least 287 people were killed, 1,000 injured, 40,000 homeless and 10,000 buildings damaged or destroyed. The earthquake was felt throughout central Italy. In addition, the central Apennine region has experienced several significant earthquakes in recorded history. In 1997, a significant Mw 6.0 earthquake killed 11, injured over 100 and destroyed approximately 80,000 homes in the Marche and Umbria regions. This 1997 event was part of a series of earthquakes known as the Umbria-Marche seismic sequence, which included eight events of magnitude greater than M5.0 in a two-month period between September and November of that year.

Sources: EEA, 2006; U.S. Geological Survey, accessed in 2009.

Figure 4 Results of stakeholder participation question within ICZM questionnaire



Source: PAP/RAC from RC and IOI, 2006

In the recently published UNEP/MAP/METAP – SMAP III[1] Mediterranean Awareness-raising Strategy (2008), for the efficient awareness-raising a creation of a self-sustaining community of "Awareness-Raisers" is proposed. It will include empowered and informed stakeholders who understand their relationship with the coast and the importance of their heritage. As a first step in creating such community, preliminary survey has been carried out. A synthesis of the first survey findings shows that:

- The majority of respondents consider politicians to be key decision-makers and opinion-formers on the coast. National and local politicians therefore constitute a key target group if awareness-raising is to translate into tangible ICZM action. Awareness raising needs to encompass both the actual assets themselves (coastal values, as well as risks and opportunities inherent in different development paths), as well as awareness of the ICZM process itself (e.g. importance of working with other stakeholders and open processes within a set of strategic principles).
- Large-scale industries, such as transport, ports and harbours and tourism, are considered the most significant economic drivers on the coast. Smaller-scale industries do not appear significant. To promote sustainable development, awareness raising should focus on values contributed by community businesses – not just in an economic sense, but also socially and environmentally.
- NGOs need to address sustainability not just from an environmental point of view, but also take on the potential of business and industry in achieving sustainable coastal communities. In order to become key promoters of sustainable coasts, NGOs need to "learn the language of sustainable economic development" and become pro-active, seeking allies in the development sector rather than be perceived as defensive.
- Awareness-raising needs to be linked to the creation of a "database of coastal value", which identifies coastal assets and values at different levels and including both tangible and intangible values.

There are number of initiatives that are mobilising civil society on the importance of sustainable coastal management. One such initiative in the Mediterranean, aimed at raising awareness on the value of the coast and necessity of using an ICZM as an approach in managing the coasts has been launched in 2007, as part of the SMAP III project (Coast Day, 2007). The key event in the initiative is the Coast Day, initially observed on 24th October. It is a day dedicated to the protection of natural coastal environment and its interaction with human culture and socio-economic activities. However, success of such and similar initiatives may be realised only if supported continuously, beyond the life span of one project.

What's the legal/institutional ICZM framework?

All the littoral Mediterranean states have undertaken some measures to protect their coastal zones from development pressures. However, all the responses to achieve stable development have been inadequate. Most of the countries have some form of coastal regulation and different activities to stop and reverse degradation of coastal areas. However, strategic initiatives that would include integrated approach to spatial notion of coastal zone, sectoral and administrative co-ordination and efficient participation are yet to be developed.

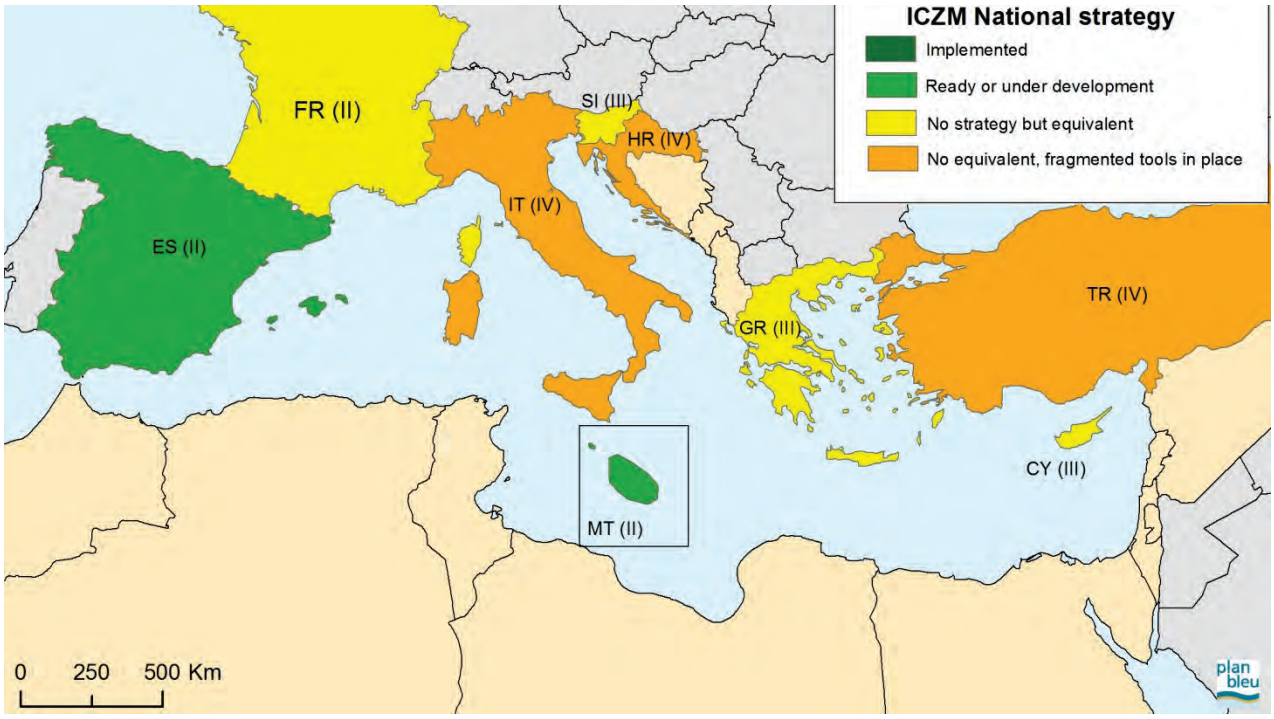
The main characteristic of Mediterranean legal framework is that there is administrative separation between land and the sea that creates insufficiency in sustainably managing the coastal areas. By 2006, only five Mediterranean countries had framework law for the coastal zone (Greece, 1940; Lebanon, 1966; France, 1986; Spain, 1988; Algeria, 2002) while Morocco and Israel are under process of preparation. However, most of the countries have some type of coastal regulation, such as construction regulations and alike (*Box 4*). One of the main problems in managing Mediterranean coastal areas is inadequacy of institutional and sectoral co-ordination. Four countries created specialised coastal agencies (Algeria- Commissariat national du littoral; France – Conservatoire du littoral; Morocco – Cellule du Littoral; and Tunisia – Agence de protection et d'aménagement du littoral – APAL) and Region of Sardinia. Competencies and roles of these agencies vary, from inventorying coastal zones, through preparing and implementing legal documents to creating protected areas. In other countries, such as Malta, Slovenia, Croatia, Lebanon, Spain, Italy (Tuscany) have or have been proposed establishment of some kind of coastal centres. However all these institutions were, either, week, administrative units (such is an example of Croatia) or did not manage to obtain some form of horizontal and vertical co-ordination as a prerequisite for sustainable management of coastal areas (*Figure 5*).

Box 4 Coastal regulation in some Mediterranean countries

Country	Specific legislation related to coastal zone	Framework Law	Definition of littoral zone/ Construction Limits set by law
Algeria	yes	Yes, 2002	Littoral zone is from 800 m to 25 km. Also defines littoral plain of 3 km. No construction within 100-300 m.
Bosnia -Herzegovina	No		No limits set by law. Construction limits defined by regulation plans.
Croatia	Yes, 2004 Regulation (2008, part of Physical planning Law)		Marine property is a 6-metre strip. Regulation of 2004 defines coastal zone of 1,000 meters. No construction within 70 metres (housing) and 100 m (tourism) in urban areas and 100 m in other areas.
Egypt	Yes		Very general littoral zone (up to 30 km.). No building normally within 200 metres. Building within 200 m requires an EIA.
France	Yes	Yes, 1986	Littoral zone is defined by coastal municipalities. No building within 100 metres.
Israel	Yes		Varies from 1-2 km. No building allowed within 100 metres.
Italy	Yes		Varies according to ecological region. No building within 300 metres. Some regional variations (e.g. Sardinia).
Malta	No		Littoral zone is 250 metres. No construction within zone of variable depth.
Morocco		Draft Law	No construction within 100 m besides for activities that require the nearness of the sea.
Spain	Yes	Yes, 1988	Land bound limit is 500 metres. Construction allowed within 100-200 metres is restricted but not banned.
Tunisia	Yes		Limits vary from site to site. No construction is permitted within 100 metres. Within settlements construction is permitted within 25 m.
Turkey	Yes	No	Landward limit is 100 metres and is uniform along the whole coast. Construction prohibited within 50 metres but exceptions are made.

Source: PAP/RAC from Markandya *et al*. 2007.

Figure 5 Status of ICZM Implementation for the Northern Mediterranean Countries, 2006



Source: PAP/RAC from RC and IOI, 2006

In order to strengthen the process of integrated management of Mediterranean coastal zones but also to help Mediterranean countries to formulate and develop coastal strategies, plans and programmes, a new legal document for managing the Mediterranean coastal zones has been signed on 21 January 2008. The Integrated Coastal Zone Management Protocol, as the seventh Protocol in the framework of the Barcelona Convention, represents a crucial milestone in the history of MAP and which is a unique legal instrument on ICZM in the entire international community and could serve as model for other regional seas.

For Protocol to enter into force, at least six countries need to ratify it. By now (October, 2009), two countries ratified it. On 25 September 2009, the Slovenian Parliament adopted the Law on Ratification of the ICZM Protocol for the Mediterranean; therefore Slovenia is the first Contracting Party to the Barcelona Convention that has ratified this important international legal instrument. France joined Slovenia as the second country that ratified the ICZM Protocol. On 28 September, the French National Assembly adopted a bill allowing France to ratify the ICZM Protocol.

Therefore, some concrete results of this legal document still cannot be presented, but some pre-assessments on its importance could be underlined. Implementation of the protocol can help in tackling some of the issues described in the previous chapters. Namely,

- Using the ecosystem approach to planning and management can greatly contribute in preserving our coastal biodiversity;
- Applying the coastal setback of at least 100 meters can help stopping over-development of coastal resources;
- Introducing sustainable beach management practices would assess and monitor beaches in a holistic, ecosystem manner;
- Undertaking necessary measures to respond to natural disasters and to address, in a timely manner, their affects, mainly through means of international co-operation and co-operation among national, regional and local authorities and other stakeholders;
- Strengthen exchange of information, capacity building and raising awareness on the importance of protecting our coastal heritage.

The Protocol can help improving national coastal legislation. However, actual implementation needs to start in order to make early, on-the-ground evaluations.

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Notes

[1] SMAP III Mediterranean Awareness-raising Strategy, Mars 2008.

Urban areas

Plan Bleu

What are the chief characteristics of urban areas in the Mediterranean?

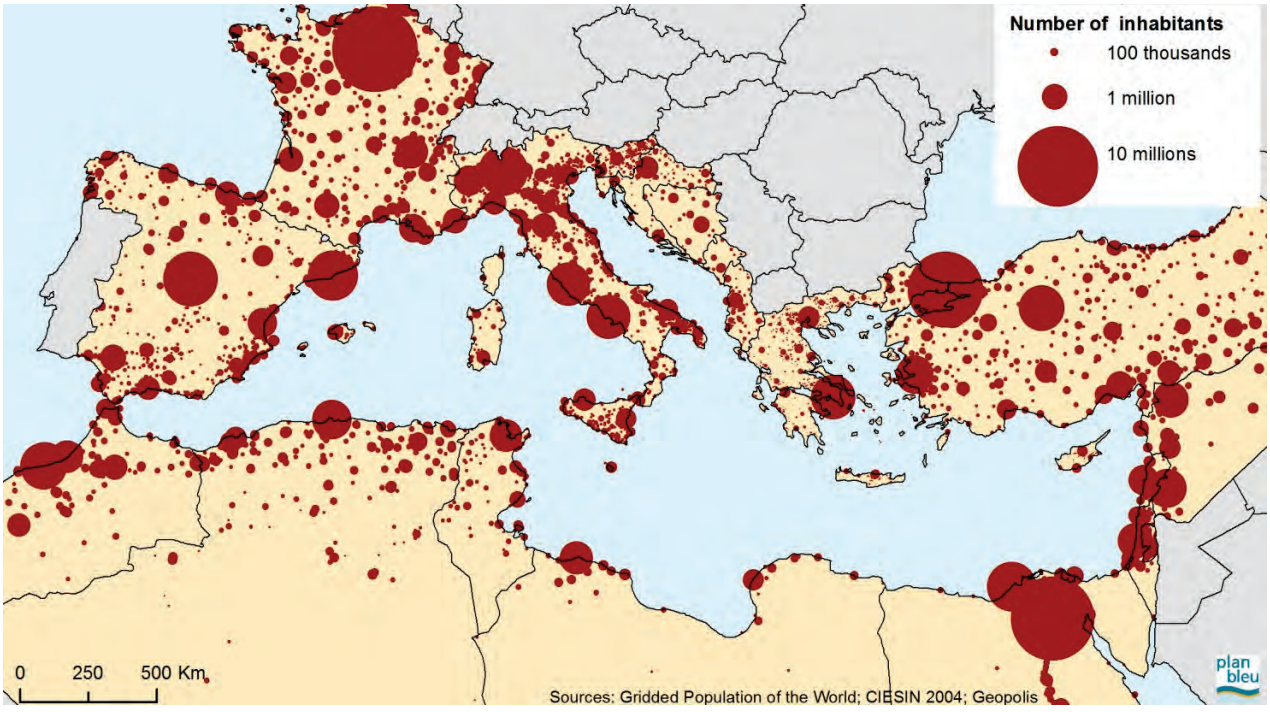
While over a half of the world population may now be said to be urban, in the Mediterranean riparian countries, two out of three inhabitants already live in urban areas[1]. Demographic growth—coupled with internal redistribution, inter-urban migration and rural migration—prompts urban growth, especially in the Southern and Eastern Mediterranean Countries (SEMCs) which count over 150 million urban inhabitants.

Some thirty political or economic capitals and some big cities of several million inhabitants concentrate the activities, the financial resources and the most well-to-do populations, while residing only one third of the countries' urban populations. Apart from the two megalopolises of global size, i.e. Cairo and Istanbul (ranking, with some 16 and 11 million inhabitants, respectively, as 13th and 28th largest world cities), around 18% of the city-dwellers live in 85 medium-sized cities (between 300,000 and 1 million inhabitants), and almost a half of the urban population live in over 3,000 cities of less than 300,000 inhabitants (*Figure 1*). Although progress has been made over the past twenty years in matter of supply of services, significant disparities remain between large and small Mediterranean cities[2], central urban and periurban areas, privileged and needy neighbourhoods.

How do urban areas develop in the Mediterranean?

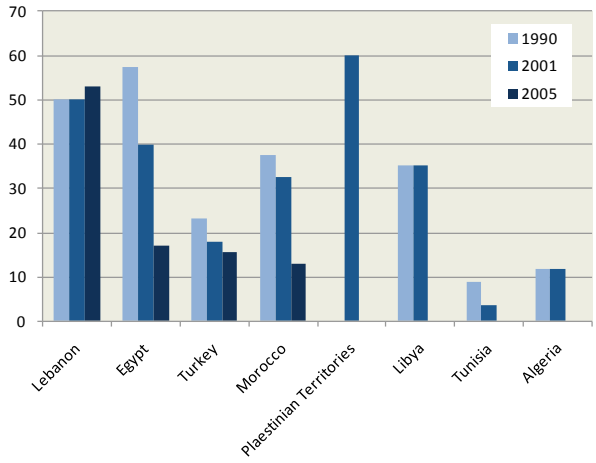
On the Northern rim, the metropolitan areas–made up, by integration of large urban-influenced areas to multiple transport, research, knowledge or financing networks–are very few to have any real international influence. Their recent development–marked by a scattering of the population and of employment, as well as by a twofold movement of sub-urbanisation and of metropolisation over increasingly extended territory, where access to housing, especially that of a high environmental quality, remains problematic–constitutes a real challenge for the future.

Figure 1 Population distribution, 2004



Sources : Gridded Population of the World, CIESIN 2004, Geopolis

Figure 2 Proportion of urban population living in slums, 1990, 2001, 2005 (%)



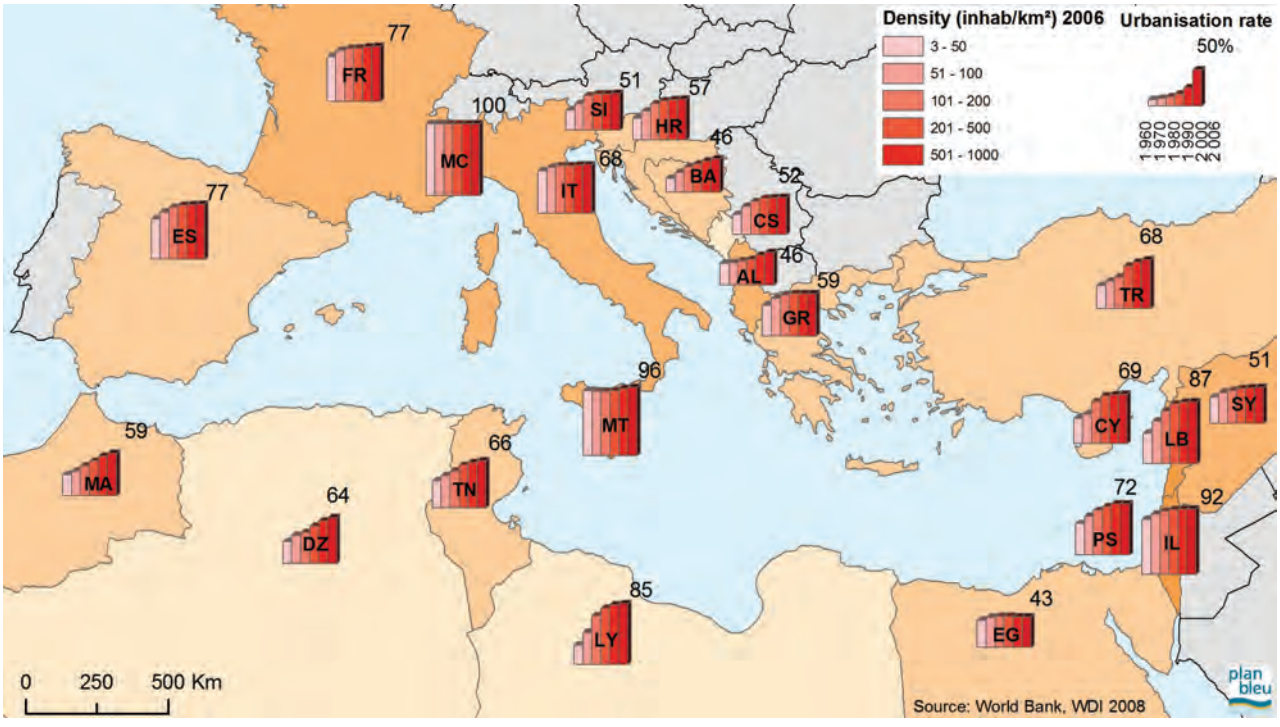
Sources: UNSD, UN-HABITAT

On the Southern and Eastern rims of the Mediterranean, the extension of cities is particularly driven by a buoyant so-called "informal" housing (*Figure 2*). According to the countries and urban centres, between 30 and 70% of the citizens cannot, however, manage to build their dwelling without resorting to the informal sector and are faced with difficult conditions of access to water, sanitation and other basic urban services. Due to insufficient job opportunities in the formal sector, informal activities employ millions of people (around 30% of the urban active population in Turkey, 45% in Egypt and in Tunisia, 40% in Algeria and in Morocco).

The structural changes experienced by the cities around the Mediterranean call for methods of governance that are tailored to their new operating scales. Indeed, in the SEMCs, the medium and small-sized cities report a rapid growth without, quite often, a matching increase in their resources and technical capacity. As of now, less than 600 urban centres have engaged processes similar to those of the Agenda 21.

In view of the current dynamics observed, by 2050, in the North Mediterranean Countries (NMCs), the urban population would stabilise, thus reaching around 170 million (140 million in 2005), while in the SEMCs, it would double up, thus reaching over 300 million inhabitants (151 million in 2005). This mainly endogenously-driven urban growth, prompted by internal redistributions, inter-urban migrations and rural migration, whose inflows are on the decrease (Egypt, Tunisia) or tending to be steady (Turkey, Syria, Morocco), would involve—for a major third of it—coastal regions and, more particularly, coastal cities (*Figure 3*).

Figure 3 Trend in the urbanisation rate, 1960-2006 (%) and population density in 2006 (inhab/km²)



Sources : World Bank, WDI 2008

What are the consequences for the urban populations in the Mediterranean?

The growth prospects of Mediterranean cities forebode an aggravation of the problems currently experienced and, particularly, an excessive land consumption (soil artificialisation, irreversible loss of arable land), accelerated degradation of the cultural heritage sites, exacerbated pressure on water resources, pollution of aquifers, inefficient waste management, and cumulative impacts of these factors on the environment and public health.

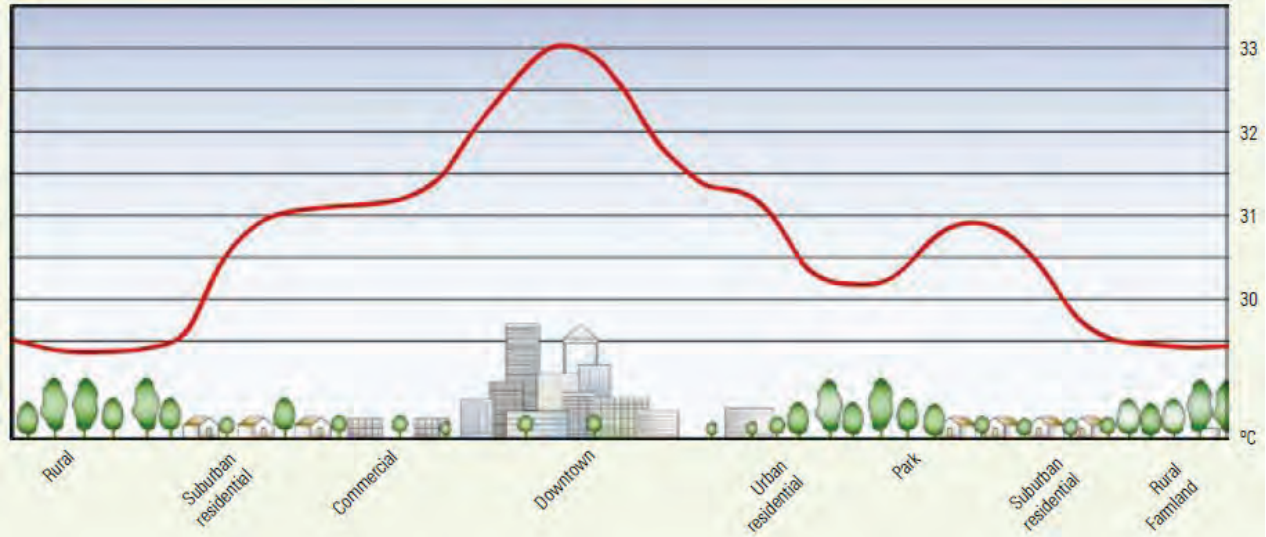
Generally speaking, slow-spreading urban sprawl along the coastline consumes suburban arable land. This induces at the same time a significant artificialisation of natural areas, thus increasing the pressure on the natural environment, and a significant atmospheric pollution on local level, as well as highly increasing green house gases emissions. This also induces dynamics of fragmentation and of specialisation of urban areas giving rise to a greater transit demand and a questioning of social cohesion.

While walking remains a prevailing transit mode in the Mediterranean cities of the SEMCs, the increasing use of the private car, as well as the deterioration of the service quality of public transport, have fostered an increased dependence on the car. The time wasted by the population due to congestion of transit roads, together with the increasing weight of the energy bill and its impact on the trade balance are the major consequences. The costs incurred by the community heavily impact the competitiveness and attractiveness of Mediterranean cities.

Finally, the clear anti-cyclonic periods–which are frequent in the Mediterranean in the summer season–give rise, in downtown areas, to temperature reverse phenomena[3] likely to induce quasi-permanent pollution domes in several cities: such is the case in Athens, Cairo, Genoa, Barcelona and Marseilles-Aix.

These phenomena concentrate the main chemical pollutants (carbon monoxide CO, nitrogen oxide NOx, sulfur dioxide SO_2) and physical pollutants (particulate matters emitted PM) related to transport, housing and industrial activities. In those cities, the climate, the relief and the wind regimes play a particularly significant role in the photochemical pollution (ozone) likely to induce or aggravate respiratory pathologies (allergy, asthma).

Figure 4 Schematic view of heat island effect in urban areas



Source : F. Butera (2008)

Box 1 A partnership network for air quality observation, the example of ATMO PACA

In France, a air quality observation mechanism was specified by the Air Act of 1996. It rests on a network of 35 French associations approved by the Minister in charge of the Environment. Within the framework of the "Grenelle de l'Environnement" ("Environment Forum"), this topic was put forward by the participants.

In the Provence-Alpes-Côte d'Azur (PACA) region, ATMO PACA is a partnership entity that groups the various constituencies of the air quality stakeholders: State, Local Government, Industrialists, Consumer Associations, Environment Protection Groups, and qualified persons. It is entrusted with the tasks of observation, information and support to decision making.

Since 2006, the works it conducted on several cities of the region have helped develop an innovative approach aimed at ensuring a more dedicated observation of the territories, in line with the needs of the local stakeholders (figure 5). It rests on establishing a better alignment between diagnostic, support to decision making and action plans, with the latter point being implemented by the local authorities.

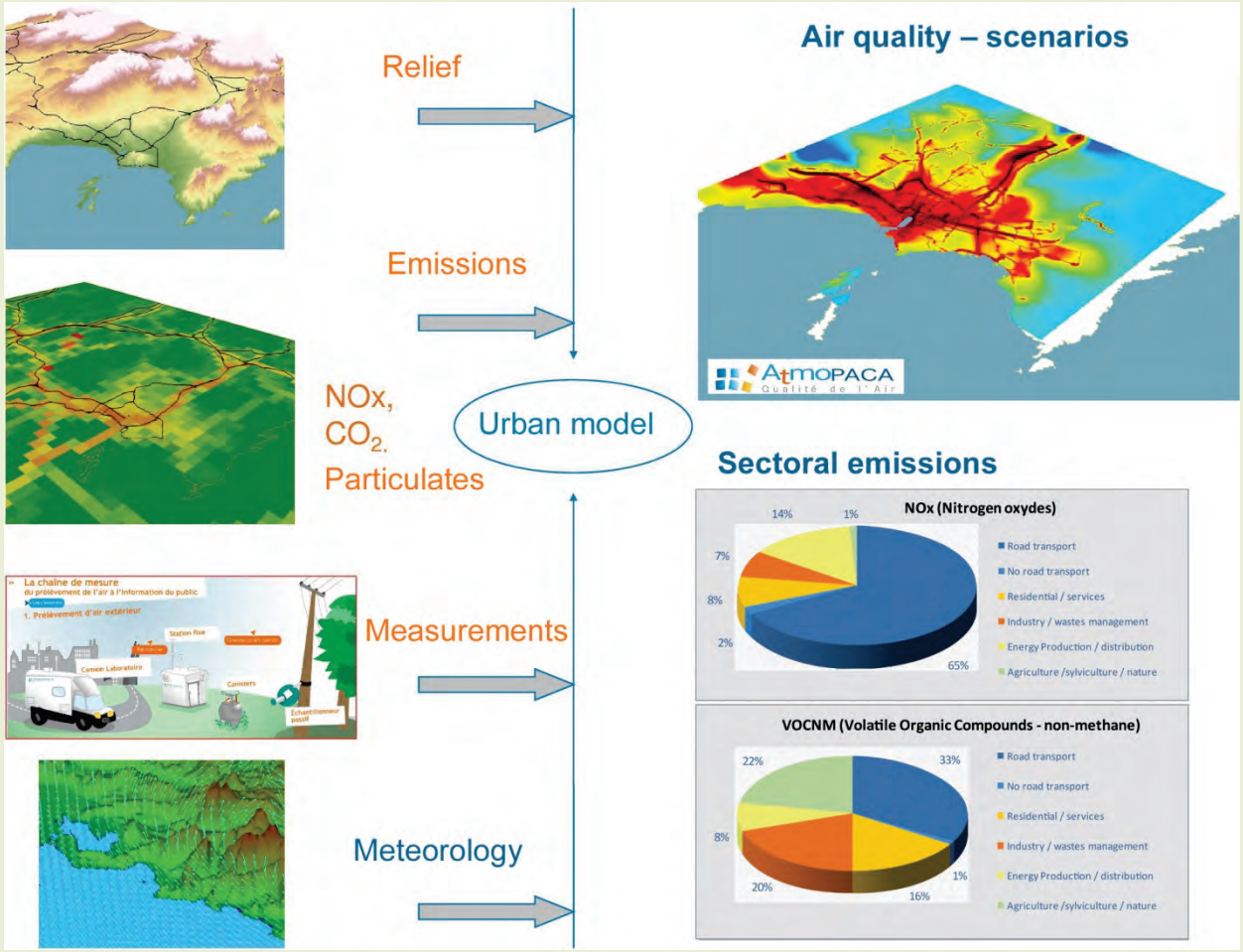
The first step consists in boosting the exchange with the various technical and decision-making players on the various topics concerned (environment, health, town planning, transit, energy, school life). The objective is to present the air quality challenges, elicit the needs in question, enhance the common cultural level and, in fine, share the conclusion as to the need for a necessary concerted action.

The next step aims at establishing a more precise diagnostic of the territory: a precise, high resolution, region-wide inventory of the air pollutants of which the main GHGs, conducting an intensive measurement campaign and developing an urban model. The outputs of these works are: an emissions map for the various pollutants and a sector-based analysis of the respective contributions, a high resolution map of concentrations and the construction of a prospective tool (model).

The third step consists in the implementation of air quality evolution scenarios based on the hypotheses of the local partners: pedestrianisation of certain precincts, modal shift of the share of private cars and public transport either locally or on city scale, reduction of speed and limitation of access to certain areas.

Apart from the technical character of the approach, the de-compartmentalisation of trades and crafts and upstream integration of the reflections pertaining to the evolution of the territory have allowed a better mainstreaming of air quality in consideration of the territories.

Figure 5 Processes and results



Source : ATMO PACA

What particular vulnerabilities for Mediterranean cities?

The Mediterranean region is subject to numerous and strong risks. It is, especially, sensitive to meteorological accidents and earthquakes, of which the cities—due to their concentration—exacerbate the impacts. Thus, unregulated housing areas, being very densely populated, are particularly vulnerable to earthquakes, floods, landslides, etc. Floods, being sometimes due to the violent rainfall of Mediterranean climate (flash floods), but whose impacts are aggravated by deforestation, soil artificialisation and construction on slopes, represent a major risk for many Mediterranean cities in Spain, France, Italy, Algeria, Greece and Turkey.

This historical vulnerability of Mediterranean cities is further aggravated by the impacts of climate change:

- Even though the extent of the expected sea level rise in the Mediterranean remains still uncertain to date, on the Southern and Eastern rims, over 50% of the urban population (18% of the total urban areas) currently live in coastline areas located within 10 metres of the current sea level. These populations are likely to be under threat.
- Mediterranean cities present specific health hazards, partly related to the impacts of air pollution (ozone, particulates), to located and concentrated heat islands effect (urban radiance) (*figure 4*) and to water stress. Thus, mortality was higher there than in the other European cities during the heat waves over the period 1990-2000.
- Finally, the climate migrations observed and the massive ones expected, especially in arid countries, would give rise to increasing pressure on infrastructures and on urban services, with the potential major social conflicts attendant thereupon.

Mediterranean cities, though less GHG emitting, and yet more impacted than other regions of the world, are, therefore, at the forefront of those required to develop strategies of adaptation to climate change.

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Notes

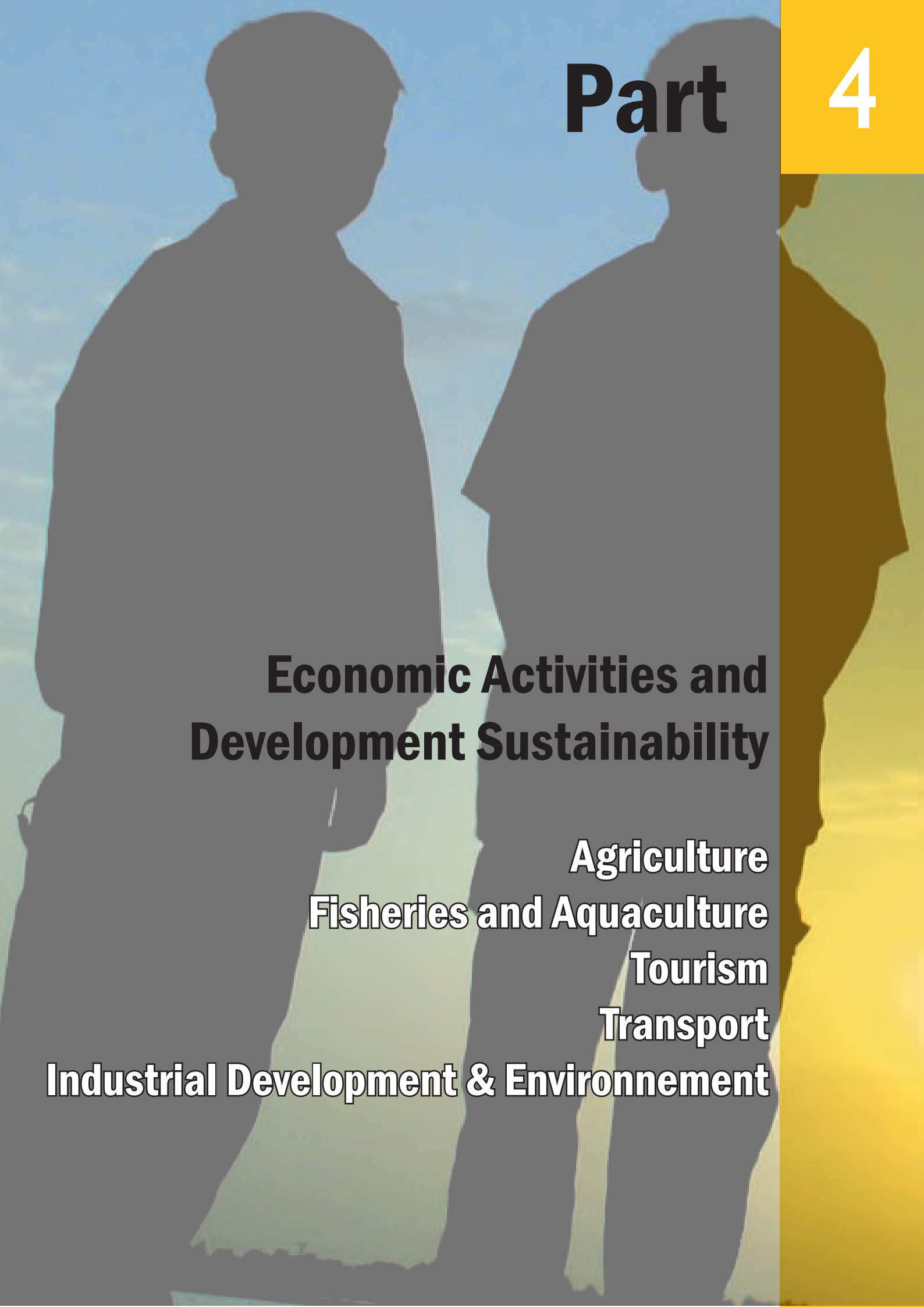
[1] The notions of "urban area" and "city", such as they are used in the present document, one may consider of urban-influenced areas in the broadest sense of the term, covering a veritable morphological diversity.

The distinction between urban and rural population has not been given a single and simple definition that would be applicable to all countries or, for most cases, even to countries of the same region, and this, due to national differences. Where there is no regional recommendation in the matter, countries set out their own definitions in accordance with their specificities. For further information on such definitions, refer to:

http://unstats.un.org/unsd/methods/m49/m49.htm.

[2] The Mediterranean space considered in the present document concerns specifically the 21 riparian countries. Wherever reference is made to Mediterranean cities, the term designates, therefore, the urban-influenced areas of the 21 riparian countries influenced areas of the 21 riparian countries.

[3] At night, low-lying layers of air are prevented from rising by higher level warmer air. This temperature inversion creates a stable low-lying mass of air in which air pollutants accumulate. This phenomenon occurs principally in winter with cloudless nights.



Part 4

Economic Activities and Development Sustainability

Agriculture
Fisheries and Aquaculture
Tourism
Transport
Industrial Development & Environnement

Agriculture

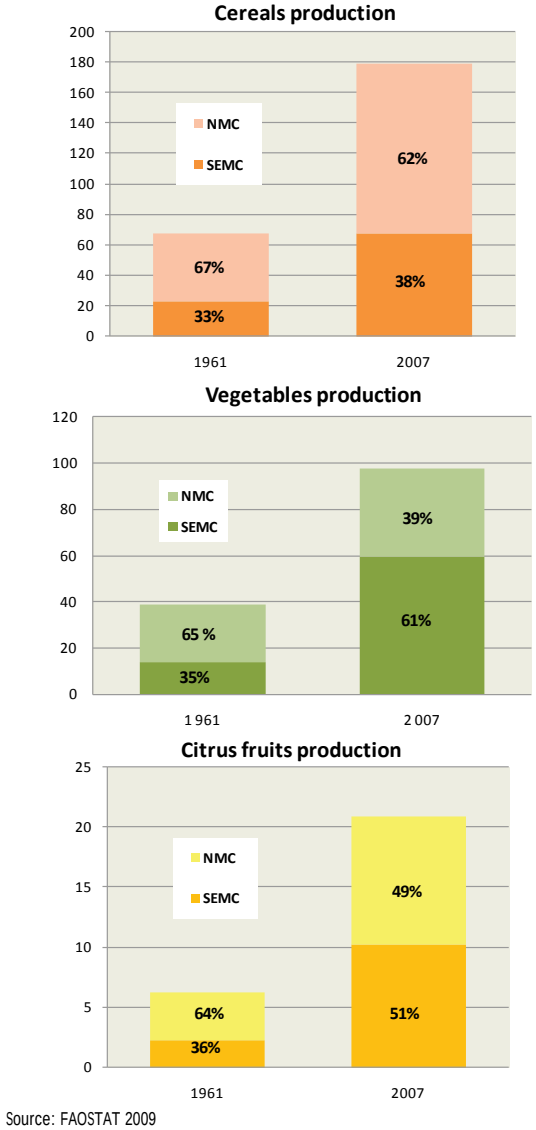
Florence Pintus (Blue Plan)

Agriculture in the Mediterranean is mainly rain-fed. Cereals, vegetables and citrus fruits make up the great majority of agricultural production. Total production has made spectacular progress over the past forty years, but social, environmental and climate factors are compromising the sustainability of export-oriented production models.

For how long can agricultural performance remain on a growth curve?

Cereals, vegetables and citrus fruits account for over 85% of the Mediterranean's total agricultural production. From 1961 to 2007, the volumes produced in the MED countries grew considerably, increasing 3-fold for cereals[1], 2.5-fold for vegetables[2] and 5-fold for citrus fruits (*Figure 1*).

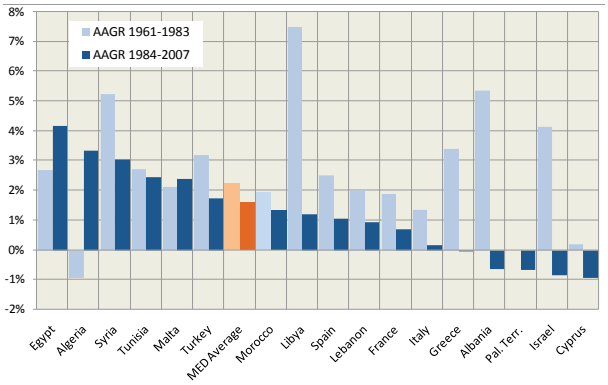
Figure 1 Main Mediterranean production, 1960-2007 (million of tonnes)



Source: FAOSTAT 2009

Average annual growth rates (AAGR) of production for these three types of products, all Mediterranean countries included, shows a recent slow-down from 2.25% for 1961-1983 to 1.62% for 1984-2007 (*Figure 2*).

Figure 2 Annual average growth rate of the main Mediterranean production (cereals, vegetables and citrus fruits), 1961-2007 (%)



Sources: FAO, Plan Bleu computations

Moreover, over the last two decades these three main Mediterranean crops have witnessed a down-turn in yield. For 1961-1983 and 1984-2007, the AAGRs for cereals, vegetables and citrus fruits yields fell from 2.52 to 1.33%, from 1.32 to 1.10% and from 0.83% to 0.53% respectively. It should be noted for vegetables, however, that the growth in average yield between NMCs and SEMCs followed a comparable trend from 1961 and 2007, rising over this period from 12.02 to 23.63 Tonnes/hectare in the SEMCs and from 14.46 to 27.89 Tonnes/hectare[3] in the NMCs (ex Balkans).

These examples illustrate the remarkable progress of the performance and of the agricultural production apparatus in the Mediterranean countries achieved over the second half of the XXth century, in particular in the SEMCs. In spite of this, these countries are experiencing a degradation of their trade balances and are becoming increasingly dependent on foreign food. According to the IPCC, SEMCs shall be the most impacted by global warming, putting additional strain on agriculture already seriously constrained by natural resources.

Water and land, asymptotic limits to agricultural development?

Cultivated land have increased to a much smaller extent than the volumes harvested, therefore most of the progresses can essentially be attributed to the intensification of production. Although rain-fed agriculture predominates in the Mediterranean, it is on irrigated land that the greatest productivity gains have been achieved. Thus, although the areas of arable land and permanent crop tended overall to stabilise if not decrease from 1961-2005, the annual average growth rate for irrigated land remained unchanged and the total irrigated area in the Mediterranean countries thus doubled in 40 years to exceed 26 million hectares in 2005, i.e. over 20% of land under cultivation.

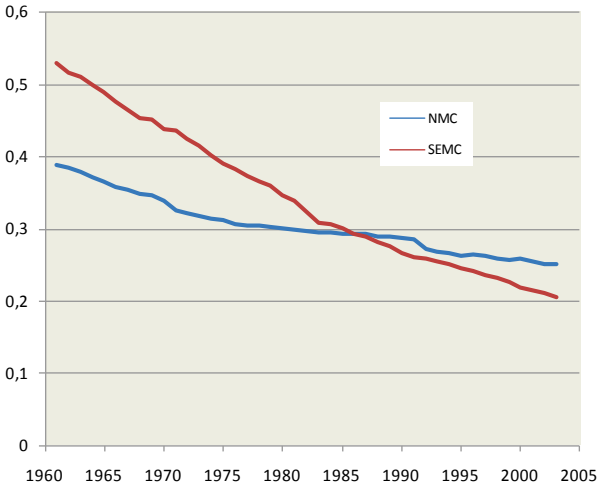
It would be wrong to believe that only rain-fed agriculture will be affected by climate change, since both types of farming will be affected in different ways. Indeed, one of the expected effects of climate change is an increase in the frequency and intensity of extreme events (rain, drought, wind, temperature…). Dry farming will suffer increased water stress, but high temperatures have the effect of blocking the phenological stages of certain crops, driving yield down even in non-constraint water conditions.

Southern and Eastern Mediterranean countries can expect to face structural water deficits, whilst northern countries can expect a 19-35% increase in their areas under water stress by 2070. With the moisture content in the soil having been to a great extent artificially maintained over recent decades through irrigation, a decrease in water reserves in those areas of land most sensitive to dehydration cycles can also be expected as a result.

The threat of cropland degradation as a result of global warming underpins the draft European framework directive on soil protection. Since 40 years, arable land per capita in the Mediterranean has halved (*Figure 3*). In absolute value new land suitable for cultivation has been gained. Nevertheless masks the fact that cultivable land is lost every year, sometimes irreversibly, as a result of erosion, loss of fertility, urbanisation, etc.

It is generally difficult to collect data on desertification, and more specifically on land fertility losses. It is, however, impossible to avoid linking this phenomenon to the afore-noted drop in yield, even though other explanatory factors also come into play, such as the lack of investment in agriculture or in the implementation of good environmental practices in the NMCs.

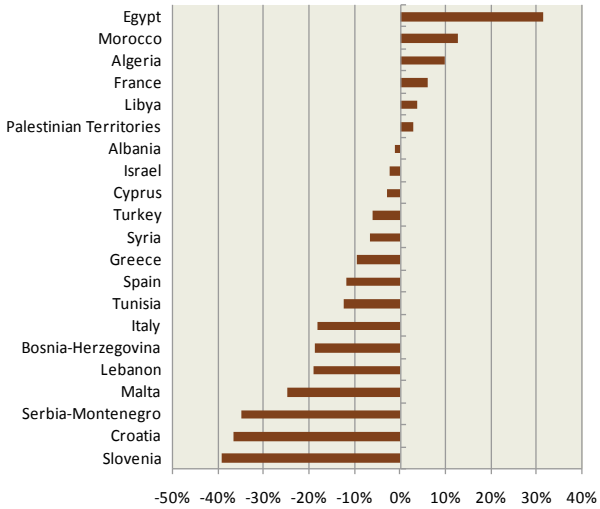
Figure 3 Trend of arable land per capita in the Mediterranean countries, 1961-2005 (hectare)



Source: FAO

Figure 4 shows that most of the Mediterranean countries have been losing arable land for more than 20 years. These values are net, in other words they mask any counter-phenomena. In the case of Egypt, for example, the overall positive balance comprises on the one hand reclaimed land from the desert and on the other the loss of ancient land as a result of galloping urbanisation, desertification and salination.

Figure 4 (Net) loss or gain of arable land between 1980 and 2005 (%)



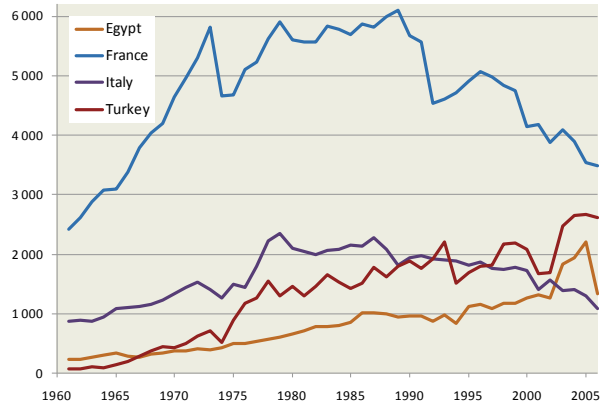
Source: FAO, Plan Bleu computations

How have farming practices changed?

Since 1980, the trend has been towards maximising per hectare yields through crop intensification and specialisation, which is also reflected in increased input use.

On the one hand, the NMCs have recently started to decrease the use of fertilisers; on the other hand, except for Egypt and Turkey, consumption levels of fertiliers in the SEMCs are still around 10 times lower than in the NMCs (*Figure 5*).

Figure 5 Fertilizer consumption in some Mediterranean countries, 1961-2006 (thousand tonnes)



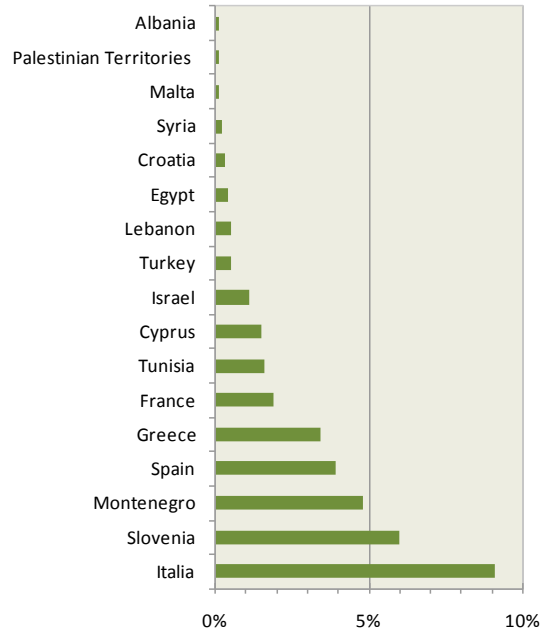
Sources: FAO, WDI, Plan Bleu computations

Nitrogen, potassium and phosphate fertilisers (NPK) consumption levels in Turkey and Egypt[4] currently outstrip those of Spain and Italy, behind France, and as yet show no signs of starting to drop. One of the phenomena which accompany climate change is the increase in atmospheric carbon. This should contribute at first stage to enhance soil nutrients availability, thus boosting yields, in non-limiting water conditions. Only initially however, because further on this will contribute to a loss of soil organic matter and thus to a growing need for fertilisers.

Data on pesticide use are available only for recent years and time series are scarced. For the Mediterranean as a whole, the period from 1990 to 2001 witnessed a drop in total use of pesticide of around 30%. This trend is mainly due to the spectacular drop registered by Italy, the main user of pesticide in the region (more than +150%). There was no significant decrease over the same period for other NMCs.On the contrary, Greece has seen a constant increase in use of pesticide. The consumption gap between the NMCs and SEMCs tended to persist, with the former showing a 5–6 fold lead. No correlation has been established between increases in agricultural pollution and farm structure.

Organic farming is one way of tapping into agricultural added value whilst protecting the environment. Having emerged in the 60s and 70s, it has developed in heterogenic fashion in the Mediterranean (*Figure 6 and Box 1*). In the NMCs, apart from the national structures which exist for marketing and producer organisation, high quality products also benefit from the support of European mechanisms for product quality enhancement and origin, which have been applied since 1991.

Figure 6 Share of the agricultural land area used by organic farming, 2007 (%)



Source: Research Institute of Organic Agriculture FiBL (2009)

Climate change, a reminder of the converging interests between agriculture and the natural environment?

The human effect on the environment is worrying enough in itself, but it should also be borne in mind that global warming is soon set to further exacerbate the main impact already being observed on the natural environment. Nitrate and pesticide pollution is one of the main reasons for the deterioration of water quality in the rural environment. The nutrient load, particularly of nitrogen and phosphorus, a large share of which comes from fertilisers and agricultural effluent, is also driving change within the ecosystems (see chapter on marine pollution).

Faced with climate change, species have the choice between adapting, migrating or disappearing. The speed of forecast change raises the spectre of the last option taking the upper hand. This issue has largely been approached from the point of view of wild species but seldom domestic biodiversity, or in terms of the interactions between the two.

Box 1 100% Organic farmers Markets in Turkey

In June 2006, Bugday Association, Supporting Ecological Living, has started the first "100% Organic Farmers Market" in Turkey located In Istanbul (Sisli region), in partnership with the local municipality. The association has built the market's vision and strategy by its practical experience and knowledge on both consumer and producer affairs. A lot of achievements were made to make it happen in the previous years by the association such as lobbying for changing the act in the Municipal low that did not allow the producer to sell their products directly in the city, a lot of consumer education, building a strong farmers network and support system, research on domestic and foreign markets, etc.

The 100% Farmers Market in Istanbul has grown from around 40 to 180 stalls and from few to over 1500 customers every week (opened one day a week). Customers of the market are a very mixed crowd from different economic income groups, different backgrounds and different places in the city. Especially the young parents are the most counted party.

Bugday has developed and started two more market places one in Antalya as an example for the Mediterranean region and other one in Samsun as an example for the Black sea region again with the local municipalities' partnership.

During the 3 years of intensive experience on those market places, Bugday has now developed a draft national standard for %100 marketplaces and is having debates on it with all stakeholders including NGO's, Municipalities, Ministries, Producer's and Consumer groups. The standard includes guidelines about responsibilities of the Municipalities, ecological footprint calculation on the whole chain, production planning, logistics, marketplace rules, corporate identity, public relations, consumer education, social event planning, marketing, bookkeeping, contracts, documentation, food safety, legal obligations, etc.

Bugday aims to share the standard and experiences gained on this project with all national and international interest groups to able more initiatives be build in similar ways in order to have fare, socially and ecologically sustainable production-consumption chains all over the world.

Source: CP/RAC

But climate change is likely to lead to a shift in the bioclimatic belts, change species distribution areas, alter varietal cycles, increase health risks and affect the ability of the ecosystems (forest ones in particular) to resist attack by parasites. There can be no doubt in such conditions that all agro-sylvo- pastoral activities will also be affected, and not only in terms of production levels.

This is why it is essential that policy encourage research into the issues of genetic diversity, rustic races and varieties which exist in the developing countries, particularly in those under arid conditions. Several countries in the Mediterranean have genetic resource inventories- Tunisia since 2003, Egypt since 2004, Greece since 1990, but also Spain, Algeria and France[5], which are of undoubted interest to work on the adaptation of a sector vulnerable to climate change.

Given what has just been said, it would be rash to believe that technical and agronomic progress alone could offset the growing environmental and climatic pressures being exerted on yield and agricultural production as a whole, against the backdrop of an expected increase in food needs. Conversely, in addition to « permanent emergency » situations already being faced by most SEMCs, the need to re-launch agricultural production following the 2008 food crisis may lead to focus production means on those areas already most intensively exploited. And consequently cause further damage to the natural resources often under threat of non-renewal or irreversible impact (fossil water, soil salination, loss of fertility…).

Environmental sustainability conditions must represent an integral part of agricultural and rural development project analysis, as should the study of changes to the natural balance induced by production systems changes, conditions for natural resources exploitation and migratory flows.

Box 2 Governance and sustainability

Although structural improvement aid for farms and agricultural production is still essential in the Mediterranean countries, institutional specificities would appear to be even more important. Indeed, the success or failure of a rural development policy depends on the institutions' ability to implement a sustainable development strategy.

The territorial, integrated and participation-based approaches have proven themselves in Europe in terms of employment, the effect on private investment or the promotion of new forms of governance. But their limits have been identified: the areas covered are still small, the ensuing profusion of institutions leads to excessive territoriality, achievements do not always survive the project period and the results are heavily dependent on local and regional governance.

A three-pronged difficulty exists in the SEMCs: the lack of a regional framework along the lines of what exists at European level, which has a decisive influence on national policy, the switch from concept to reality and consultation mechanisms which are still shaky. Moving towards more decentralisation will therefore require investment, which besides being well-targeted must also be uninterrupted and adapted to building the capacity of the local population. Hence the need in these countries more than elsewhere is to focus on human capital and expertise.

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Notes

[1] Cereals include wheat, rice, maize, oats, barley, millet, sorghum, triticale…

[2] Vegetables basically include market gardening and melons according to the FAOSTAT definition

[3] 25.42 T/hectare including the Balkans

[4] In Egypt, the amount of fertiliser used rose from 131.2 kg/ hectare in 1970/71 to 404.3 kg/hectare in 1989/90.

[5] Cf. Mediterra 2009 and the national studies jointly conducted by the Plan Bleu and the CIHEAM on the mid-term review of MSSD implementation.

Fisheries and Aquaculture

Document drawn up by SPA/RAC assisted by Prof. Hadj-Ali,
Completed and Revised by C. Pergent-Martini (SPA/RAC, University of Corsica)

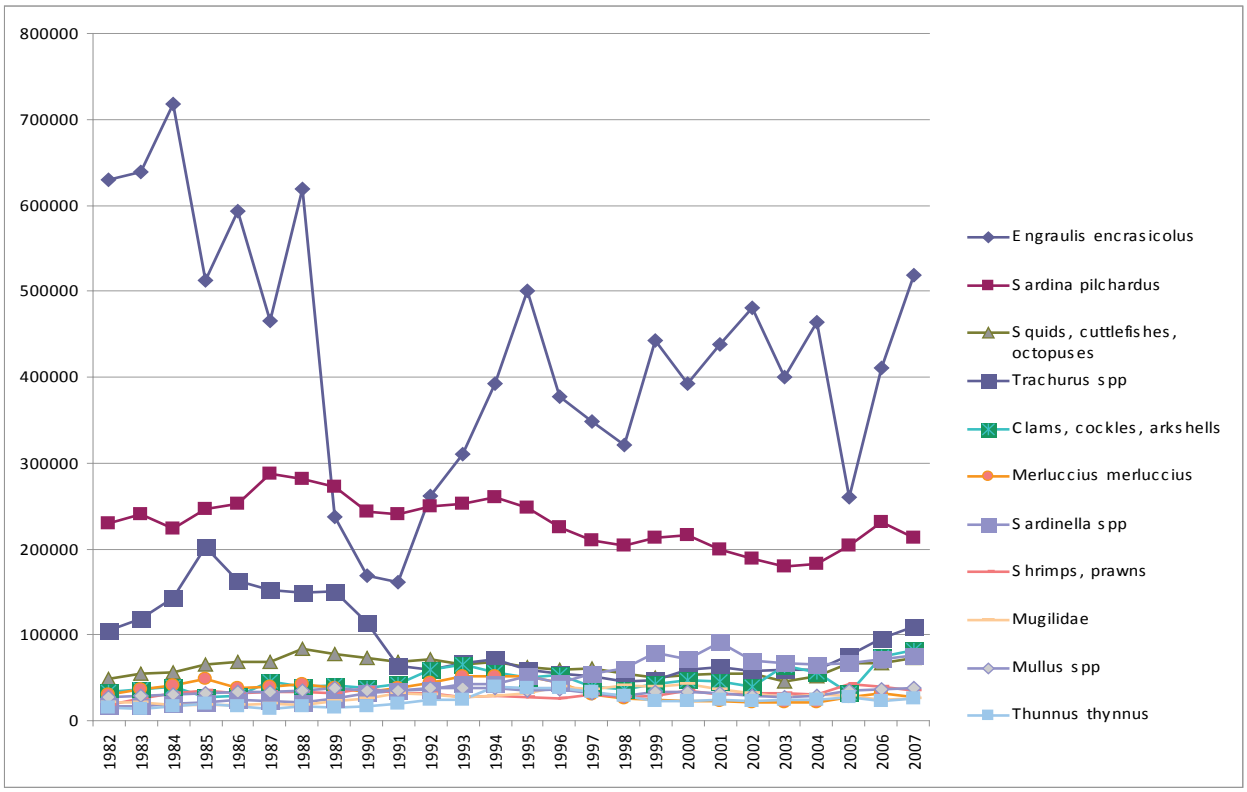
What do we know about fisheries in the Mediterranean?

The Mediterranean, a semi-enclosed sea with a particularly long turnover time for the water (about 90 years) is an oligotrophic[1] sea with low levels of biological and halieutic[2] productivity. However, its high salinity gradients and temperatures are the key to its rich biodiversity (see Chapter on *Marine Ecosystems*) and allow the development of a fauna and fisheries of a unique diversity. The abundance and distribution of fish and other living marine resources (shellfish, molluscs, sea-urchins, corals) vary widely depending on depth, but most biological production is concentrated on the continental shelf (which extends from the coast a depth of 250 m approximately) and is still the preferred habitat of species with an economic and commercial value. The shelf, which is relatively narrow with the exception of certain areas such as the Gulf of Lion, the Gulf of Gabes and the Adriatic, limits the potential for fishing.

In the Mediterranean, fishing and aquaculture fall under the jurisdiction of the General Fisheries Commission for the Mediterranean (GFCM), the oldest of the Food and Agriculture Organization's (FAO) regional fisheries organisations. Fishing activities are highly diversified and based on historic traditions, with non-industrial fishing featuring strongly and essentially carried out from small boats (<15m long). This fishing fleet was estimated at 140,000 vessels in the early 2000, although it is difficult to have a precise idea of its current size since only boats over 15m are counted at a regional level by the GFCM, an update is currently underway. The only available data concerns the Mediterranean EU Member States, with 39,104 vessels declared by States (Parties to GFCM) with a very high percentage of small vessels in certain countries (of the 18,000 vessels declared by Greece, 16,900 are less than 12m long).

Mediterranean fish catches represent a small part of total catches worldwide (a bit more than 1% of total catches).This volume is significant given that the Mediterranean sea represents less than 0,8% of global oceans. Moreover, fishing in the Mediterranean tends to be concentrated in in-shore areas, with some boats fishing on the continental slope for prized species such as the pink shrimp, the deepwater rose shrimp, and hake, (particularly as the deep areas are currently not exploited and are highly unlikely to start being exploited in the short term). Production currently ranges between 1,500,000 t to 1,700,000 t per year, 85% are attributable to six countries (Italy, Turkey, Greece, Spain, Tunisia and Algeria). Mediterranean fishing no longer satisfies demand in the riparian states (1/3 of demand). Market globalisation has changed consumer habits, making the Mediterranean one of the regions of the world which is most dependent on imports.

Figure 1 Evolution of main commercial fishes catch annually in the Mediterranean and the Black sea (metric tonnes)



Sources: SPA/RAC, SIPAM

Is fishing in the Mediterranean sustainable?

The increase in fish catch to the mid 80s (reaching 2 million tonnes) was only possible through a reckless, virtually uncontrolled fishing, which is reflected in a subsequent 25% drop in landings compared with this period due to a fall in the production of certain species (*Figure 1*).

According to the GFCM, certain species of economic and commercial importance are in an alarming state as a result of over-fishing. Such is the case for hake *Merluccius merluccius*, red mullet *Mullus barbatus*, the deep water rose shrimp *Parapenaeus longirostris* (from the north of the Alboran Sea, the Balearic islands, northern Spain, the Gulf of Lion, the Ligurian Sea and southern Sicily), sole *Solea solea (*from the northern Adriatic), sardine *Sardina pilchardus* and anchovy *Engraulis encrasicolus (*from the north of the Alboran Sea, northern Spain, the Gulf of Lion, southern Sicily and the northern Adriatic). The situation is also of major concern as regards blue fin tuna (*Thunnus thynnus*), which is widely over-fished in the Mediterranean (*Box 1*) and the Eastern Atlantic. A fish stock recovery plan has been adopted by the International Commission for the Conservation of Atlantic Tunas (ICCAT) with the aim of reducing annual catches by 6 thousand tonnes over 5 years.

How can the management of fisheries resources be improved?

Similarly, the GFCM has adopted and implemented measures intended to bring about a recovery in the Mediterranean fisheries, re-establish resources and enhance the protection of sensitive habitats.

The measures adopted involve:

1. Reduce fishing of deepwater resources, by:
   - Setting a minimum square mesh size of 40 millimetres for trawlers,
   - Monitoring stocks through the improvement of fishing statistics and the introduction of a register of authorised fishing boats and non-authorised ones (black list), a satellite tracking system for fishing boats (VMS) and a standardised fishing data collection matrix,
   - Port state related measures,
   - A 20% reduction in catches,
2. Combating illegal, unregulated and unreported fishing (*Box 2*).

3. Setting up of sensitive or Fisheries Restricted Areas (FRA). These measures were adopted to protect sensitive high seas areas (apart from the Pelagos sanctuary between Monaco, France and Italy); they comprise the «Lophelia reef» off Cape Santo Maria di Leuca in Italy, the cold hydrocarbon seep in the Nile delta and the « underwater seamount Erastosthemis». At its March 2009 meeting in Tunis, the GFCM also declared a fisheries restricted area in the Gulf of Lion's canyon region in order to protect the breeding stock of hake and other associated species.

Box 1 The sad story of the Mediterranean blue fin tuna

The blue fin tuna is one of the large, ocean-living fish (it can weigh up to 700 kg). Tuna fishing has been going on for thousands of years in the Mediterranean and was practised as far back as the Phoenicians and the Romans. However, the state of this imposing fish has been in constant, rapid decline for the past twenty years or so. As far back as 1999, a Greenpeace study reported an 80% fall in stocks compared with the previous 20 years and scientific committees sounded the alarm in the face of a unsustainable situation, due in particular to juvenile tuna being fished.

Various fishing techniques exist, but the purse seine is without a doubt the main one. Since the late 90s, there has been a boom in what is known as « fattening ». Schools of tuna are located using cutting-edge technology and are trapped alive in a seine net by powerful industrial fishing ships. The fish are then towed to the fattening farms just off-shore and are released into cages where they are fed on small fish usually caught in distant seas. In 2004 alone, the quantity of tuna raised in fattening farms in the Mediterranean has amounted to almost 225 000 tonnes. No-one can assess the real number of catches with any precision, since many of them are not declared. According to certain estimates, the figure may have been 44 000 tonnes in 2005, in other words almost 37% above the « legal » authorised quota, which is itself above the quota recommended by scientists (26 000 t). It can therefore be concluded that the real volume of catches is 77% above what is advocated by the experts.

Apart from the marine ecosystems, tuna populations and future generations, which will see the availability of this fish threatened, many are those who suffer the direct or indirect consequences of this state of affairs. Such is the case in particular for distant lands sometimes facing food problems, as in West Africa, which see the fish caught in their waters being exported to feed the penned and fattened tuna, in the knowledge that it takes 25 kg of fattening fish to produce one kilo of tuna.

Fishermen using trap nets (a tuna fishing technique practised for thousands of years in the Mediterranean, much more sustainable and labour intensive) are also suffering as a result of this situation, even going so far as to demonstrate in southern Spain alongside environmental pressure groups, demanding strict policies to check the plundering of blue fin tuna stocks in the Mediterranean.

Source: CP/RAC, 2008, Conscientious fish consumption, available on line: http://www.cprac.org/pdf/triptics/peix/peix_eng.pdf

Again in order to protect sensitive deep sea habitats and despite the lack of adequate scientific data, in accordance with the precautionary principle the GFCM has adopted a restrictive measure intended to ban the use of trawlers and towed gear in waters over 1,000 metres.

Box 2 Combating illegal, unregulated and unreported fishing (IUU)

IUU fishing is a scourge which seriously affects stocks, destroys sensitive habitats and breaks the rules of good fisheries conduct and resource conservation. In 2001 FAO established a response plan to tackle such practices at regional level, and the GFCM is rolling out a strategy to the same end, which comprises the following:

- Drawing up a register of fishing boats over 15 metres in overall length including the register of boats presumed to have carried out IUU practices;
- Satellite tracking of fishing boats (VMS);
- Checking and inspection measures relating to port state;
- Standard format for collecting fishing statistics for research and catch monitoring purposes;
- Setting up of a compliance committee to monitor the implementation of the fishery management measures adopted.

Major steps still need to be taken in terms of catch fishing, however:

- the integrated management of fish resources and associated fisheries, particularly through regulating capacity and fishing effort (more specifically regarding demersal resources, which are deemed to be fully or over-fished);
- more intensively combating IUU fishing, which over-fishes resources of commercial importance, blue-fin tuna, hake and swordfish in particular.

Finally, in terms of the delimitation of marine areas, it is still not easy in the Mediterranean to set up Exclusive Economic Zones (EEZs), with most Mediterranean countries still not having declared, let alone delimited such zones. Several states have thus extended their sovereignty beyond 12 nautical miles and set up a special area, which allows them to monitor fishing and pollution more closely (Algeria, Croatia, France, Italy, Libya, Malta and Spain) or as Tunisia, declared an EEZ with no geographic delimitation. The general trend would appear to be towards the « regulation » of this sea, which could help towards the better management of living resources, pollution and the conservation of biodiversity.

Efforts to promote responsible consumption are also underway (*Box 3*).

Box 3 What initiatives have been undertaken to encourage the responsible consumption of fish and seafood in the Mediterranean states?

Man's appetite for fish and seafood has increased, giving rise to unsustainable fishing practices and damaging ecosystems. Recently, in response to the fisheries crisis, considerable efforts have been made to raise consumer awareness in Europe and North America: information campaigns have been introduced, intended to influence demand for fish and seafood and establish a sustainable supply of fish.

The situation varies quite widely between the Mediterranean countries, but the general trend clearly illustrates the lack of consumer information regarding origin, catch method and date of catch of the products they buy. In the study "Sustainable fisheries in the Mediterranean", national experts from the various Mediterranean countries stressed, when asked:

- That there is an urgent need to improve the traceability of marine products and inform consumers about sustainable fishing practices and develop labelling systems,
- That initiatives for raising consumer awareness and promoting local fishing are being developed in some Mediterranean countries, but they need to be consolidated.

The "slow fish" movement should be flagged up amongst the international initiatives particularly active in the Mediterranean, of which one of the aims is to educate consumer behaviour by stressing the support they could bring to the preservation of marine species if they would adopt a more responsible purchasing behaviour.

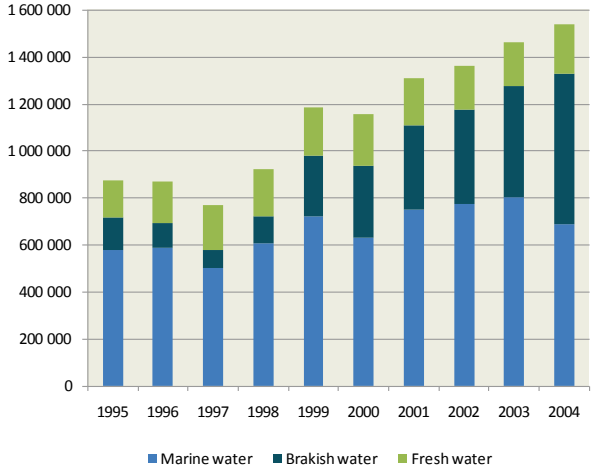
Source: CP/RAC, 2009

Is aquaculture a response or an alternative to over-fishing in the Mediterranean?

In order to satisfy the demand in fish and sea-food products estimated at over 5 million tonnes per year for a production of around 2 million tonnes for a fishery and fish farm), the Mediterranean countries have long resorted to breeding aquatic organisms (mussel and oyster farming in Spain, France and Italy in particular).

According to FAO and SIPAM (information system for the promotion of aquaculture in the Mediterranean), the Mediterranean countries' production, including those with a dual seafront (Mediterranean and Atlantic; Spain and France) as well as inland fish farming, rose continuously over the 90's to reach 1,350,000 tonnes in 2000 (an annual growth rate of 10.4%). It then stagnated between 2000 and 2002 to increase again between 2002 and 2004 with an average annual growth rate of 8.4% (*Figure 2*).

Figure 2 Evolution of aquaculture production in the Mediterranean from 1995 to 2004 (metric tonnes)



Source: SIPAM

The strongest production growth rates were witnessed in marine aquaculture, which has been booming since the early 90's, particularly for gilthead sea bream *Sparus aurata*, sea bass *Dicentrarcus labrax*, mussels *Mytilus galloprovincialis* and the cupped oyster *Crassostrea gigas*. Half of this growth was actually achieved in these types of marine farming (mainly in floating cages for bass, bream and blue fin tuna fattening and on lines for mussels) from 1996 to 2000, followed by fish farming in brackish waters (particularly in Egypt for tilapia, Oreochromis genus). 58% of production comes from the western European countries, although Greece is the leading marine off-shore fish farming producer with over 120 000 tonnes of bass and bream annually. As for bivalve mollusc farming, mussels and cupped oysters take first and second place respectively, with a joint annual production of some 500 000 tonnes for Spain and France. Notwithstanding attempts, fish farming is limited to certain species.

In several production sites (Croatia, Greece and Spain) and for the farming of certain species (the intensive production of bass and bream, tuna fattening), the increased development of fish farming activities has also led to a marked deterioration in the quality of the environment and priority habitats in the Mediterranean. In the light of these environmental effects, the EU has proposed a strategy and developed specific research programmes intended to better identify the risks relating to certain types of production.

If aquaculture wishes to take up the challenge of relieving the pressure on natural stocks whilst meeting the growing increase in demand without causing serious environmental problems, it must improve production methods. Certain countries have already taken such steps by introducing impact assessment procedures prior to authorizing the installation of aquaculture structure or by commanding the shift of existing structures beyond the lower limit of the Posidonia beds and sheltered bays. IUCN, the Federation of European Aquaculture Producers (with the support of the Spanish authorities), GFCM and SPA/RAC will publish a series of guides for the sustainable development of Mediterranean fish farming.

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Notes

[1] Oligotrophic : low in nutrients

[2] Halieutic productivity: fishing productivity

Tourism

Elisabeth Coudert (Plan Bleu)

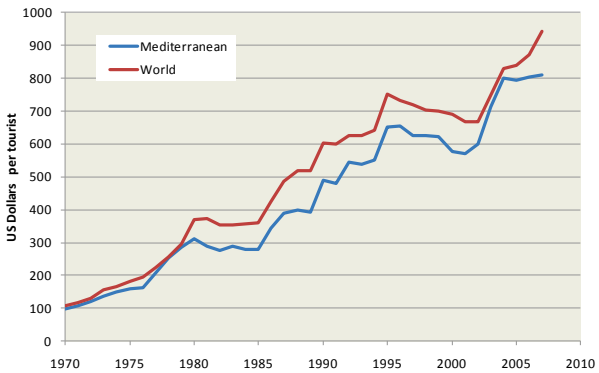
Tourism is a vital economic activity for all Mediterranean riparian countries. Drawing upon their geographical location at the crossroads of three continents, these countries attract 30% of global international tourism arrivals. In 2007, they received around 275 million international tourists. Being a job-creating and foreign currency-generating sector, international tourism contributes to the countries' economic development. However, the development sustainability of this sector implies an equitable redistribution of the wealth it generates, as well as a minimisation of its environmental impacts.

Is international tourism sufficiently remunerative? Do the local populations benefit from this tourism?

International tourism receipts, presenting over the past 40 years an overall rising trend, totalled US$ 208 billion in 2006 for the whole Mediterranean countries, which represents an average expenditure of US$ 803 per international tourist.[1]

Since the early 80s, the receipts per individual tourist arrival in the Mediterranean have been slightly lower than on global level, which means that Mediterranean tourism is cheaper (*Figure 1*). By way of comparison, an international tourist in the USA spends two times and a half more (US$ 2075), which is informative about the growth margin for Mediterranean tourism in matter of foreign currency contribution. On national level, this foreign currency contribution generated by direct and indirect tourism activity is significant.

Figure 1 Trends of receipts of the international tourism per tourist, 1970-2007 (US Dollars)



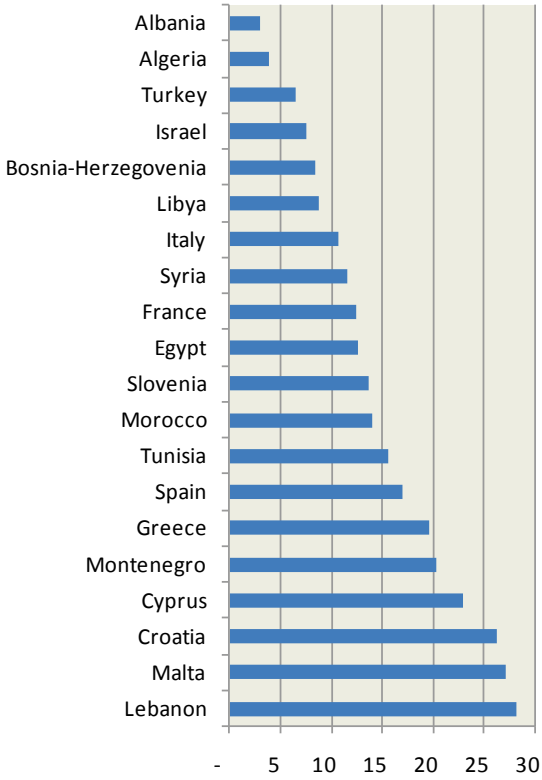
Sources : WTO, Blue Plan

Employment in the tourism sector constitutes, in view of the income it provides, the most tangible form of redistribution of the wealth generated by the sector. It involves various crafts, ranging from beach attendants (direct employment) to banking services (indirect employment), and from travel agents to hotel services. Tourism is a very labour-intensive activity. According to World Travel and Tourism Council (WTTC), a direct job induces an indirect one.

The share of tourism employment in total employment depends not only on the development level of the tourism activity, but also on the development level of the economy as a whole. Indeed, in countries with a diversified economy, the share of tourism employment is lower than in highly specialized countries where tourism constitutes a dominant sector of the economy (*Figure 2*). For the countries of the latter category, a certain vulnerability to a slack tourism activity may be observed. Thus, in the Mediterranean, events such as the second Intifada (2000), or such as those of 11 September 2001, have caused a slackening of the activity in all Southern and Eastern Mediterranean Countries (SEMCs). More recently, the economic crisis, too, has negatively impacted the activity of this sector.

However, not all jobs created in tourism are of benefit to the local population. Various factors, such as recourse to cheaper foreign unskilled labour or recruitment abroad of qualified staff, stand on the way of hiring local labour. Training, too, plays a significant role, especially in matter of enhancing the skills of local manpower.

Figure 2 Estimation of the share of employment in the tourism sector – 2009 (%)



Note: Tourism sector includes travel agent and tourism transport

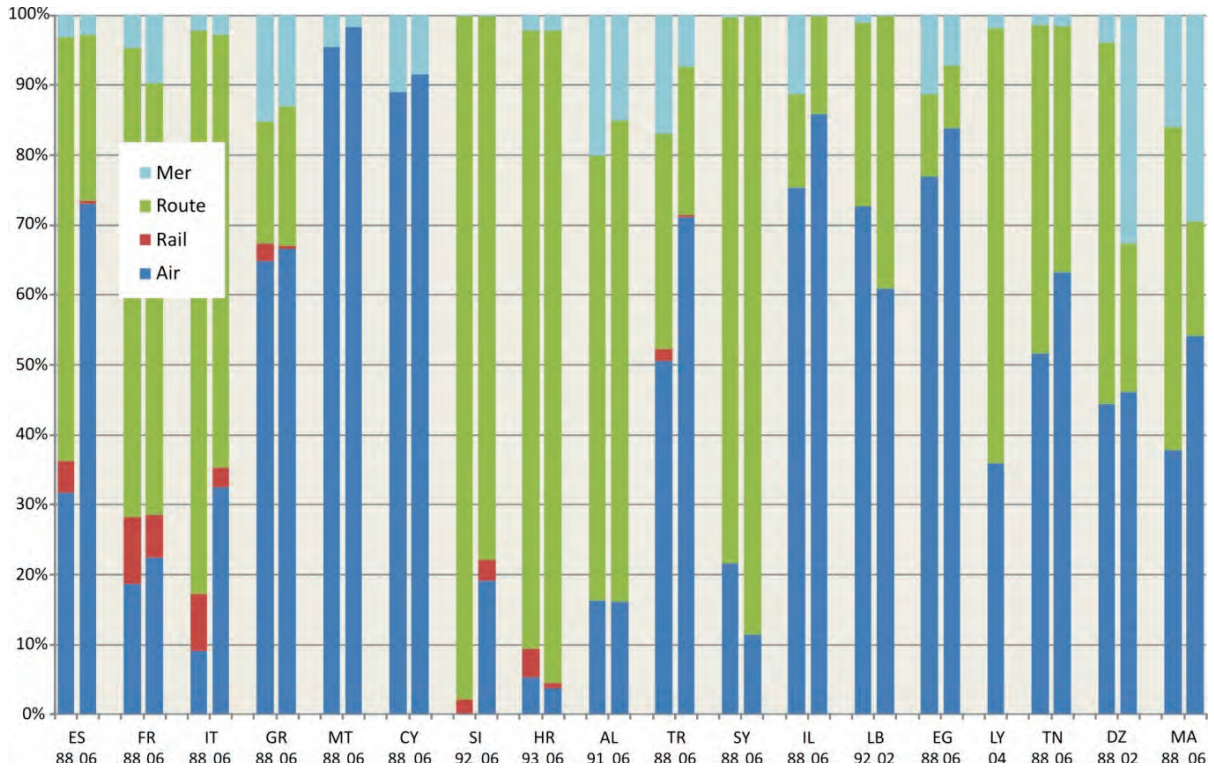
Source : WTTC

What are the environmental impacts of the tourism activity?

Tourism activities generate two series of environmental impacts: those related to transit and those related to out-of-home stays. These impacts are strongly aggravated by their seasonal concentration (summer and school holidays) and spatial concentration (coastline, mountain, certain cities, a few major sites) and quite often tend, paradoxically enough, to make tourism less attractive.

Tourism-related transport is a major source of environmental impacts. Those last twenty years have seen the air transportation significantly increasing, passing from 23% of the arrivals in 1988 to 40% in 2006, the arrivals by sea increasing by a modest 2% over the same period (*Figure 3*). However, the arrival of international tourists still takes place, for the major part, by road (52% in 2006, as against 67% en 1988). Declining by two thirds between 1988 and 2006, arrivals by rail have slumped down. The international tourists coming, for the major part, from countries located on the northern rim, insular countries and SEMCs, are increasingly dependent on air transport.

Figure 3 Distribution of arrivals of tourists and international visitors by mode of transport in 1988 - 2006 (%)



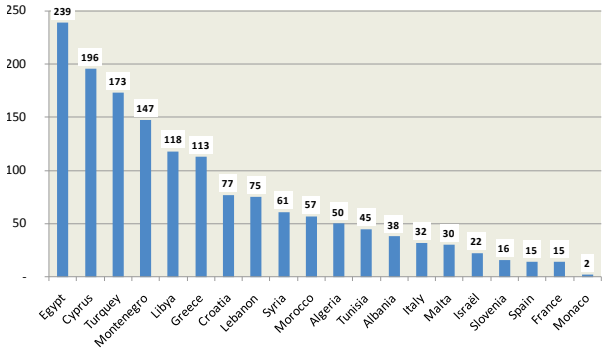
Source : UNWTO

Nevertheless, broadly speaking, international tourism in the Mediterranean presents a marked sub-regional character resting on proximity: in 2006, Libyans and Algerians accounted for 37% of tourists in Tunisia; in Turkey, 30% came from Central and Eastern Europe, notably from Bulgaria, Georgia, Romania and Russia; 40% of tourists in Italy came from Germany, France and Austria; in Slovenia, 43% of tourists came from Hungary, Austria, Italy and Croatia. This proximity tourism gives precedence to the use of land transport modes, the road claiming the lion's share, unlike the rail which is either insufficiently developed or poorly adapted to current lifestyles.

These trends – giving precedence to aircraft and car – participate in the increase of air pollution and green house gases emissions in the region. The transport sector alone accounted in 2005, all Mediterranean countries considered, for around 20% of the total CO_2 emissions (13%, for the SEMCs, and 23%, for the NMCs) (See *Transport* chapter). In view of the Origin / Destination structure of tourism in the Mediterranean and the proximity tourism predominance, rail and bus alternatives could be put in place in order to encourage a certain number of tourists to use less energy-consuming transport modes. Such a modal shift requires the development of new transit strategies: for Northern rim destinations, this would consist in a greater use of the already quite dense railway network; at destination, this would require the provision of good local mobility for tourists: electric cars, public transport, etc. For insular destinations and those on the Southern and Eastern rim, being quite dependent on air transport, other adaptations are to be envisioned in order to stabilise, if not reduce, CO_2 emissions, based, for instance, on the promotion of long-duration stay offer, instatement of a carbon tax, etc.

As Mediterranean tourism is predominantly of a seaside character, all installations constructed specifically on the coastline contribute to the artificial coasts cover. The development of boating also contributes in exacerbating this phenomenon via the construction of ports and of marinas, both of which are large area consuming. For instance, Monaco and Gibraltar report the highest density of marinas per km of coast, with an average distance between the ports ranging from 2 to 4 km, while Egyptian coasts report not more than one boating port every 239 km (*Figure 4*).

Figure 4 Average distance between marinas in the Mediterranean countries, 2008 (km)



Sources : A. Capatto, Plan Bleu

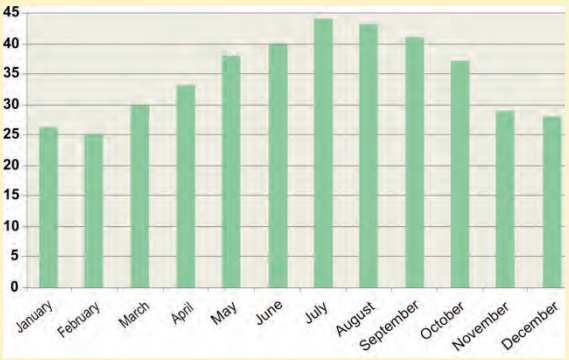
These impacts are strongly aggravated by seasonal and spatial concentration of tourism activities. Thus, the high population density on holiday sites exerts pressure on water resource and natural medium, as well as generates an increase in waste production (*Box 1*).

Box 1 Tourism and wastes in the Balearic Islands

In view of its characteristics (size, population, frequenting by visitors, differentiated evolution of the constituent islands), the archipelago of the Balearic Islands is considered as a laboratory for assessment of the impacts of tourism on an area in full growth process.

Regarding the production of wastes –- and even though the Balearic Islands do not have data concerning wastes of an exclusively tourism origin –-, parallel analysis of the total waste production and seasonal quantities reveals a strong correlation between waste production and tourist arrivals. One thus observes a more marked production in the tourism season from April to October (*Figure 5*).

Figure 5 Urban waste collected in Mallorca, 1999 (million tons)



Source : Segui Llinas, d'après Conselleria d'Economia, Govern de les Illes Balears

Although the total water consumption of tourists remains low (4.5% of the water demand in Malta or in Cyprus; 2% in high tourism countries such as Greece or Tunisia; less than 1% in as yet low tourism countries such as Syria), it represents a marked competitive character in dry period due to tourism needs (balneotherapy, golf course watering, swimming-pools) and the habits of tourists from non arid countries (higher daily consumption).

Is tourism diversification on the increase? Does tourism develop in areas other than the coastline which offers the Sea/ Sun/ Sand triptych?

Sustainable development of tourism requires a diversification of the tourism offer that optimises Mediterranean diversity (ecotourism; cultural, urban and rural tourism).

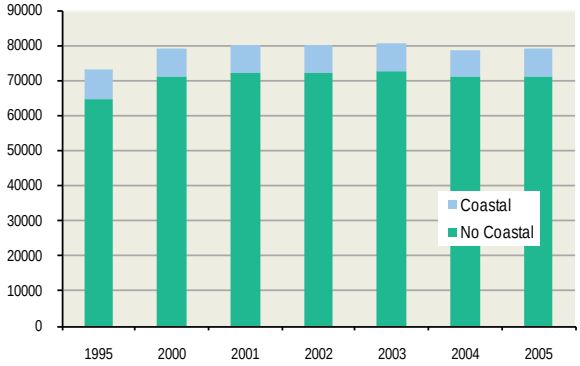
This diversification may be measured in Mediterranean regions or countries by the evolution of the non-seaside offer which, according to Mediterranean Strategy for Sustainable Development (MSSD) objectives, could divert 1/3 of the coastline-bound tourism flows.

At present, the absence of data (especially for the Southern and Eastern Mediterranean Countries) does not allow a comprehensive analysis of the trend pertaining to the non-seaside offer.

In Italy, the non-seaside offer (exclusive of coastal municipalities) accounted, in 2004, for 42% of holiday beds. In Israel, where the larger portion of tourism entries is connected with pilgrimage trips and family visits, the non-seaside offer is dominant and stood, in 2004, at around 77%; on the other extreme, the non-seaside offer stood at 3.8% in Malta in 2005. In Slovenia, in 2005, out of the 79 000 holiday beds (all categories considered), 57 000 were non-seaside beds. Their share rose from 70 to 73% between 1995 and 2005.

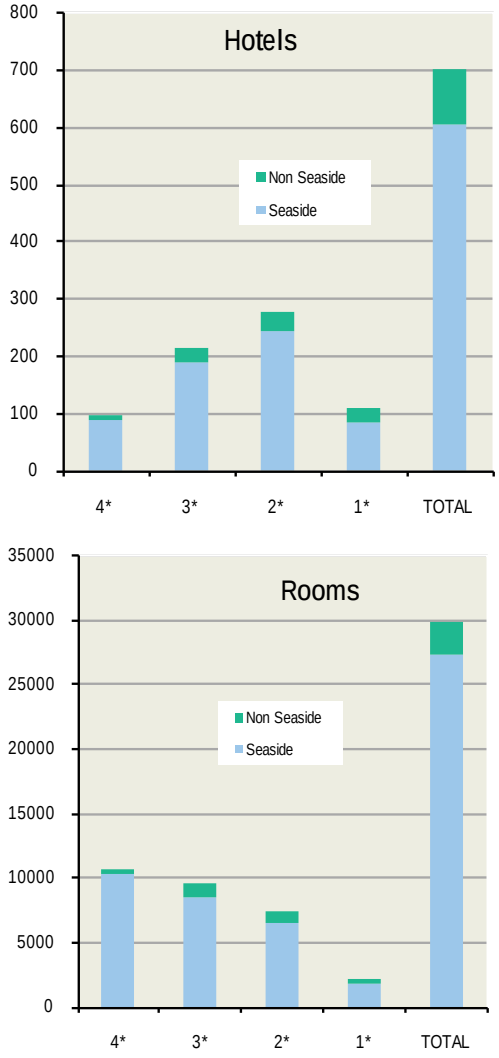
In France, the 3 coastal departments of the Provence-Alpes-Côte-d'Azur region claim 74% of the holiday beds capacity. On the Côte d'Azur, including Monaco, the inland areas hold a mere 14% of the hotels and 9% of the hotel rooms. According to the Côte d'Azur Tourism Observatory, hotel capacity has grown unevenly between 1994 and 2006, depending on the zones. The coastline presents a strong decline on the supply side: Mandelieu (-31%), the Western coastline (-23%), the Eastern coastline (-17%) and Antibes-Juan (-12%).

Figure 6 Distribution of the tourism beds in Slovenia, 1995-2005 (thousands)



Source : Statistical Office of the Republic of Slovenia

Figure 7 Distribution of hotels and rooms per category on the Côte d'Azur (France), 2006

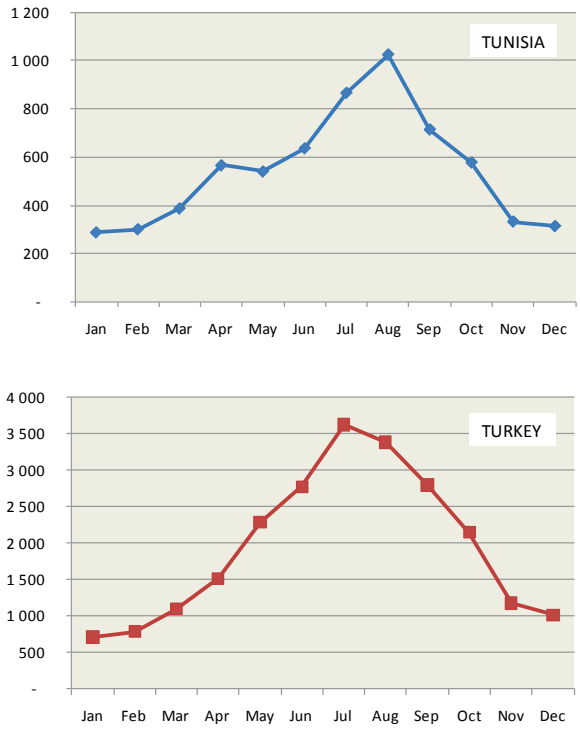


Sources : Observatoire du Tourisme de la Côte d'Azur, Comité Régional du Tourisme Riviera-Côte-d'Azur

Are seasonal tourism peaks on the decrease?

On the whole, seasonality remains quite marked, reflecting the school calendars of the countries of origin. The countries or destinations having managed to diversify their offer can extend their tourism frequenting. Such is the case of Côte d'Azur in France, for instance, thanks especially to business, fair and festival tourism. It is worth mentioning, however, a certain extension of the tourism season which now runs from April or May to September or October (*figure 8*).

Figure 8 Arrivals of non-resident tourist per month in Tunisia (2006) and Turkey (2007) (thousands)



Source : Plan Bleu from national sources

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Notes

[1] That is US$ 168 per overnight stay.

Transport

Philippe Vallouis (Plan Bleu)

What challenges for transport in the Mediterranean?

Being at the very foundation of the development of commerce and trade, transport associated activities are still buoyant in Mediterranean countries, contributing to their growth and regional and global integration.

Transport is essential economically and is the *raison d'être* of key industries: car manufacturing; ship building; aviation; petroleum; insurance and banking; It also shapes land use planning and infrastructure development; and enables social intercourse through mobility. However it is also now synonymous to environmental challenges. The development of transport in the Mediterranean must now contend with new limits imposed by environmental but also social issues when dealing with access to energy.

Consuming up to 30% of the total final energy consumption: 32% for the North Mediterranean Countries (NMCs) and 26% for the South and East Mediterranean countries (SEMCs), the transport sector is fast becoming the issue for Mediterranean countries.

When discussing transport in relation to the environment or broader economic issues, an analysis by mode (road, rail, air and sea) is essential as each mode is characterised by its own set of impacts. For example, urban public transport or railways emit fewer pollutants per passenger/km than private road vehicles. Each mode also satisfies different economic needs: road transport is the most flexible when it comes to goods, and air transport is indispensable for the development of tourism in Mediterranean countries.

Statistics still lack the capabilities of generating indicators on passenger and goods transport for all modes and across all Mediterranean countries; while it is often difficult to distinguish between national and international traffic. However, studies show that individual mobility is rapidly increasing regionally, particularly through air transport, for international travel, and road domestically, and sea transport has seen a marked growth for international freight.

Mediterranean maritime transport: chasing gigantism?

Maritime transport in the Mediterranean reported significant growth between 1997 and 2006, with a 50% rise in the capacity in the Mediterranean. A shift from 2,565 to 3,815 million Dead Weight Transport (DWT), and a 58% rise in transit, from 312 million to 492 million DWT. This growth is due mainly to ship traffic and to an increase in the size of ships. The number of calls of port has increased by 14% (from 220 665 to 252 538) and that of transit by 20% (from 8 169 to 9 812 passages) for a ship size which increased by approximately 30%.

These evolutions are testing the reception capacities of ports, particularly in SEMCs which lack deep-water ports. The race to make such capacities available further impacts on the coastline and marine ecosystems but also feeds the continued growth in ship sizes.

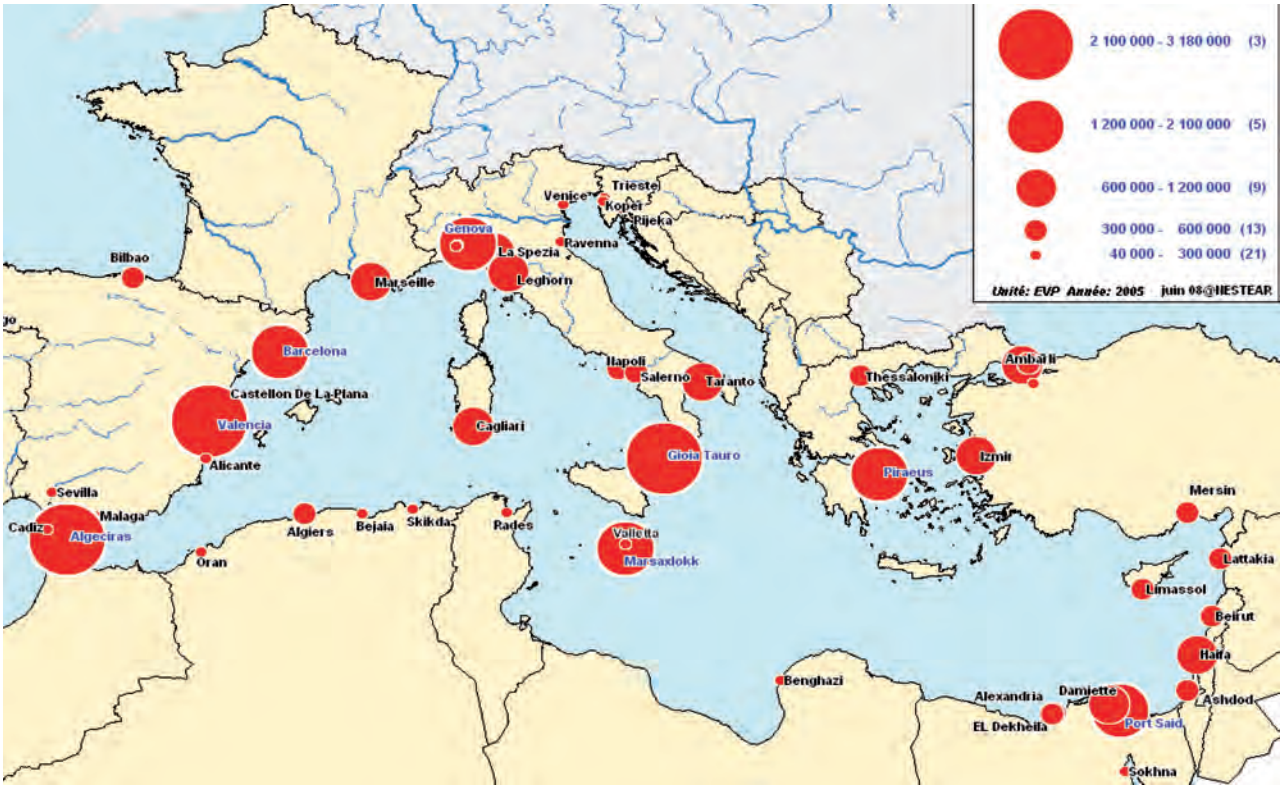
This high increase in traffic over the period 1997-2006 is due in particular to the increasing flows of energy products (+78% of capacity for oil, and +114% for liquefied natural gas) and for container traffic (+165%). The latter having experienced the greatest growth in volume over the 10 year period. This volume in container traffic however, translates in a relatively lower rise in port traffic (71%), expressed in number of ships. This can be explained by the significant rise (55%) in ship size.

While the mouvement of container-ships is quite concentrated in the Northern rim, i.e. where demand is located (*Figure 1*), SEMCs all have deep-water port projects perhaps even beyond projected demand.

The TangerMed project (Tangiers-Med), whose first bid package was commissioned in July 2007, will increase its capacity to 3.5 million TEUs[1] by 2012 and could even reach 8 million in 2015, with the second batch under TangerMed 2. The port reported traffic of 1 million TEUs in 2008. This project follows a trend arising from the need of transhipment from very large ships to smaller ones. At present, the size of the ports of North-Western Europe (Hamburg, Rotterdam, Antwerp…), the main EU entrance and exit ports, remain the determining factor in transhipment even though the ports of Southern Europe offer a shorter distance. This explains why ships cross the Mediterranean when they could stop in Southern Europe (*Figure 2*).

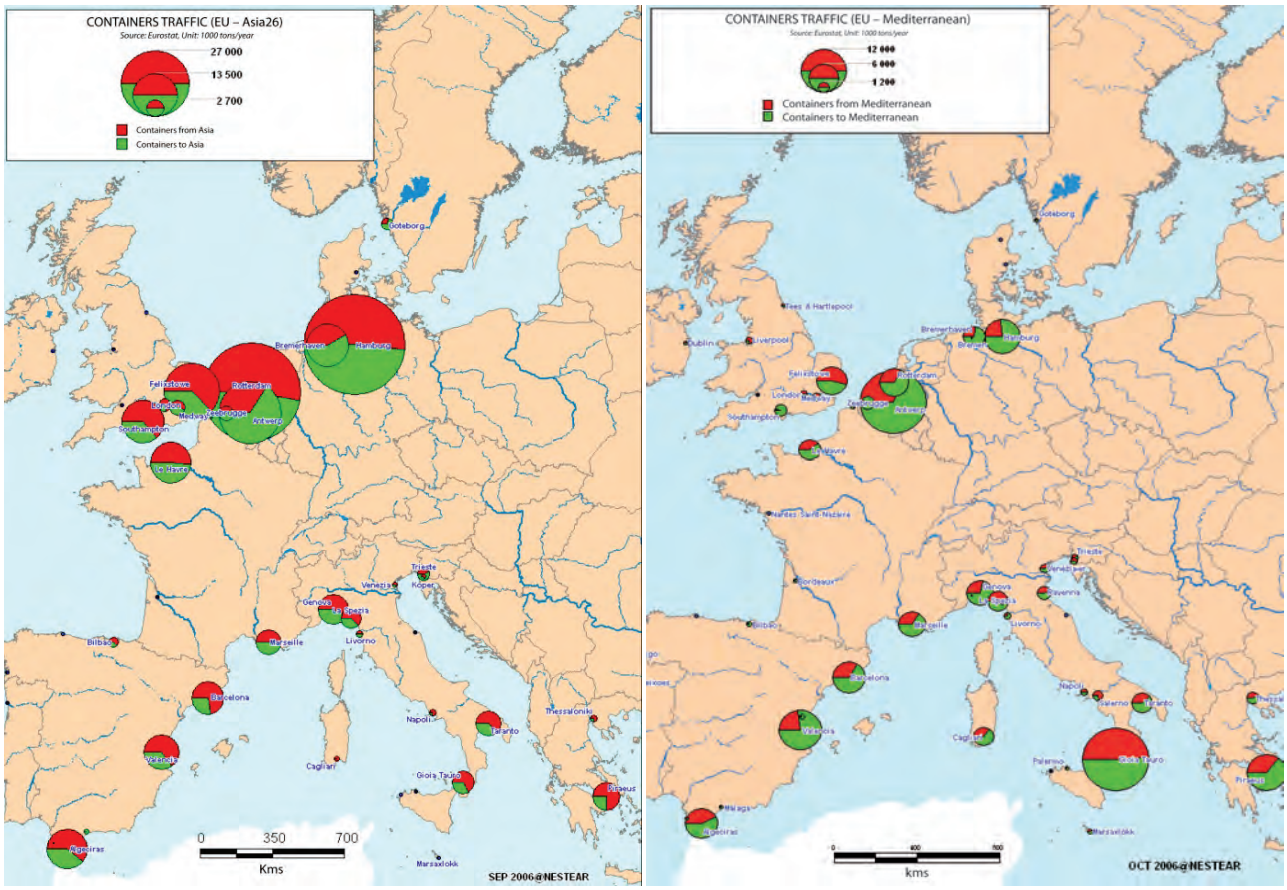
Apart from infrastructure related issues, maritime transport is a source of environmental impacts. The ship and its cargo constitute a direct threat to the environment. Besides accidents, certain practices, such as tank cleaning, leave a plume of pollution sometimes with significant impacts. The next chapter deals with this issue in greater detail.

Figure 1 Container traffic in Mediterranean harbors, 2005 (TEU)



Sources: AFD, Nestear, Plan Bleu

Figure 2 Container traffic on the EU-Asia and EU-Mediterranean routes, 2005 (TEU)



Sources: AFD, Nestear, Plan Bleu

What outlook for the other modes of transport?

Despite the calls prompting a shift to low-fuel consumption transport modes contained in the MSSD, road and air transport have reported a steady growth since the 1990s (*Figure 3*).

In 2005, surface transport remained largely dominated by road transport which accounted for 98% and 99% of the final energy consumption of the sector respectively for the NMCs and the SEMCs. Between 1990 and 2005, road transport reported an increase of 35% in the NMCs and 49% in SEMCs.

Rail transport-largely absent in the Mediterranean-was just stabilising in the NMCs and slightly decreasing in the SEMCs between 1990 and 2005.

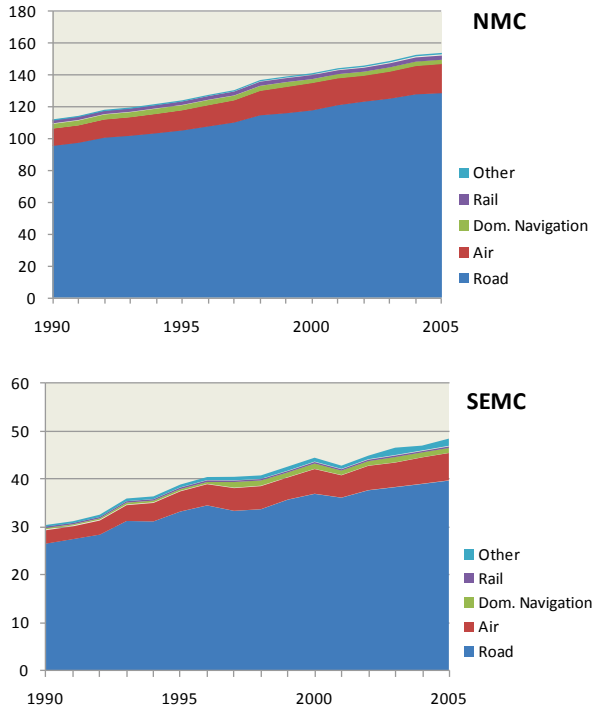
Air transport saw an accelerated growth since 1990, and energy consumption of this mode increased by 103% in the SEMCs, and 70% in the NMCs, between 1990 and 2005. These developments result from two concurrent phenomena: the number of passengers and the volume of goods carried continue to increase as well as the average route length. In the meantime, there have been significant technical advances with respect to consumption per passenger or ton carried (down from 8 litres of fuel for 100 km per passengers on average to 5 litres in 2005), notably due to the commercialisation large carriers and enhanced engines. However, these technological advances have not been able to compensate the high increase in the use of this transport mode.

As to the final energy consumption of inland navigation, it has decreased by 4% in the NMCs over the period 1990-2005 and reported a significant increase by 320% in the SEMCs, though remaining as yet at a very low level.

If road transport accounts for most of the increase in the final energy consumption of the transport sector, this is largely due to the increase in the use of the private car. The rate of car ownership continues to rise even in the NMCs. The car has become a functional need for households, in particular in NMCs which have seen an explosion in suburban development. It also corresponds to a strong social aspiration especially for the developing economies of the SEMCs. Its growth and with it traffic

congestion, pushes decision makers to invest in more and more infrastructures which in turn feed urban sprawl. The car also constitutes an economic sector that is often vital not only for countries that have car assembly lines or spare parts production plants (European countries and, shortly, Morocco), but also for those with a strong repairs trade, particularly in SEMCs. It follows, that questioning the place of the car in society has become politically charged, but is becoming important in cities where congestion is responsible for significant costs (economic, public health related, environmental).

Figure 3 Energy use per transportation mode, 1990 - 2005 (Mtoe)



Source: IEA/OME

In NMCs, car ownership in 1995 was already 388 cars/1000 inhabitants and has steadily increased to reach 472 cars/1000 inhabitants in 2004. Suburbanization has led many households to purchase housing that is dependent on possessing two cars, in the absence of a suitable public transport service whose costs rise with suburbanisation. SEMCs are also experiencing a high increase in motorisation although from a very low base rate. From less than 60 vehicles/1000 inhabitants (with a major disparity between Israel, 204, and the Palestinian Territories, less than 25) in 1995, it passed to 80 vehicles in 2004. This figure must be read in relation to the economic growth and energy consumption of transport which is dealt with below. Trade liberalisation and the creation of free trade zone will also increase the rate of penetration of new vehicles in the South.

This rise in the number of vehicles of course increases infrastructure needs. Significant investments have already been made all around the Mediterranean, especially in the construction of highways and roads. Thus, over the period 1997-2005, the SEMCs reported a growth in the length of highways and roads of 60% and 15% respectively. The number of airports has also increased by 25% and of ports by 7%, while railway infrastructures have stabilised.

Notwithstanding these investments increasing congestion attests that the supply in infrastructure is not meeting demand. This is especially true in the major cities of the South where public transport is still poorly developed and lacks funding.

What is the likelihood of a decoupling between economic growth and energy consumption in transport?

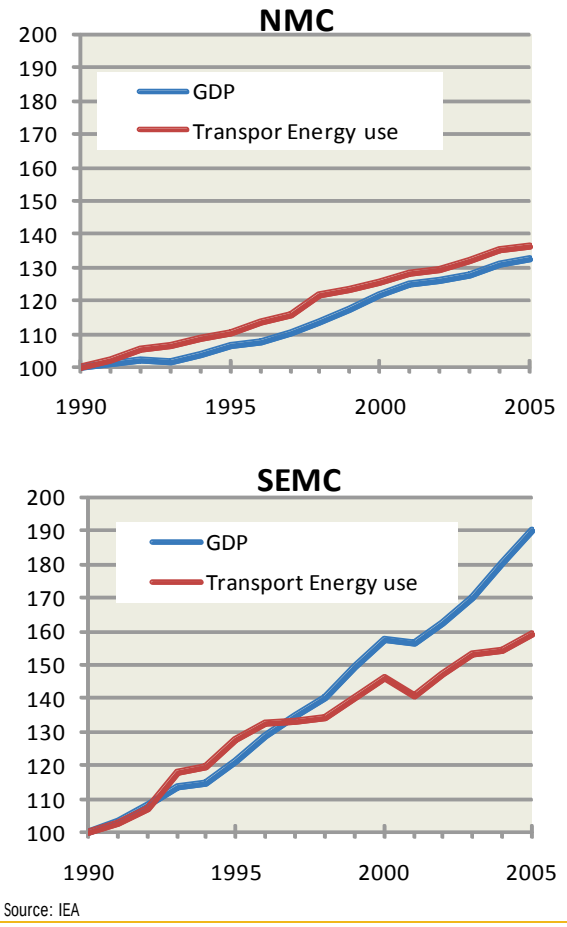
Transport in NMCs remains closely connected with economic growth and this despite a willingness to reduce energy consumption and dependence in favour of a “low energy” economy. Studies show that the growth in final energy consumption in transport in NMCs still outpaces GDP growth: +37% against +32% for GDP between 1990-2005. Thus, NMCs are struggling to improve the efficiency of their transport in relation to their economic growth (*figure 4*).

Over the same period, the GDP of the SEMCs had increased significantly by 91%, while the final energy consumption of transport increased at a slower rate (60%), but particularly since 1996. However, this decoupling must be seen against the growth in non-transport energy consumption which has progressed faster than in NMCs. This strong growth corresponds to policy reforms in SEMC which have created wealth without necessarily increasing transport needs. Such an increase in wealth also corresponds, for certain countries (Algeria, Libya, Egypt, Syria), to significant energy earnings over the past few years.

This observation may be further detailed by considering the overall energy intensity of the transport sector, by calculating the ratio between the energy consumption of transport, expressed in ton of oil equivalent (toe) and GDP expressed in million of

euros: the lower the ratio the higher the transport performance.

Figure 4 GDP and energy use in transport, 1990-2005 (index 100 en 1990)



Source: IEA

The energy intensity of the SEMC is high but has been improving since the 1990s. It passed from 69 to 57 toe/million of € of GDP between 1990 and 2005, while it has been of 33 toe/million € of GDP in the NMCs over the past 15 years.

Is transport becoming less polluting?

Transport related emissions and particularly air emissions fall into two broad impact categories: climate change and urban pollution.

From a regional standpoint, in 2005 the transport sector in the Mediterranean accounted for 20% of the total CO_2 emissions (13%, for the SEMCs, and 23%, for the NMCs), and 2% of global transport CO_2 emissions.

Expressed in tons per inhabitant, CO_2 emissions from transport in SEMCs remain lower than those of the NMCs (1.1 t/capita/year, compared to 1.7 t/capita/year, in 2005). However, this low share of emissions in SEMCs masks dynamic growth. The growth in emissions from SEMCs was of 65% between 1990 and 2005, while it was of 25% in Europe over the same period.

Transport is also responsible for local air pollution. The emissions of nitrogen oxides (NOx; precursors of the tropospheric ozone), volatile organic compounds (VOCs), and fine particulates (PM), due mainly to an increase in car traffic (exhaust fumes, fuel vapours, brake and tyre wear), generate considerable pollution in urban areas, with strong impacts on human health.

NOx emissions, from road transport, decreased by 38% in the EU-25, between 1990-2004. However, transport as a whole continues to account for 55% of the total NOx emissions of the EU-15, although slightly downward from the 57% of 1990.

In the South, despite the technical progress, there is a strongly rising trend of these emissions, due to evolution of the fleet and to the increasing number of old vehicles, except in Israel which imported recent vehicles from Europe and the USA and for which NOx emissions dropped by 30% between 2000 and 2004, though Israel remains—in absolute per capita value—the largest emitter of the SEMCs region due to its high motorization rate.

In terms of air quality, certain polluting emissions arise from the use of specific fuels, of which leaded petrol. Progress has been made, even though the ban on leaded petrol still does not apply to all countries in the SEMCs. In 2008 leaded petrol was still in use in Tunisia, Morocco and Algeria. While Egypt and Israel banned its use in 1999 and 2003 respectively Lebanon and Tunisia have introduced a ban to new vehicles since 2002. The introduction of unleaded petrol has resulted in a significant decrease in lead emissions in the countries for which data are available: -39% between 1990 and 2003 for Israel, -57% between 1993 and 1998 for Lebanon also helped by the relatively recent fleet.

The use of diesel as a fuel results in a drop in emissions of common pollutants (CO, CO_2, SO_2, NOx, etc), but is responsible for an increase particulate emissions (PM 10, PM 2.5) responsible for respiratory and cardio-vascular diseases.

Thus, in the NMCs, particulate emissions reported only a moderate decrease because of the generalised shift to diesel. The share of registration of new diesel vehicles increased from 41% in 1990 to 61%

in 2006. Particle filters should be generalised in the wake of the future Euro 5 standard and the pace in reduction of emissions will follow the rate of new registrations.

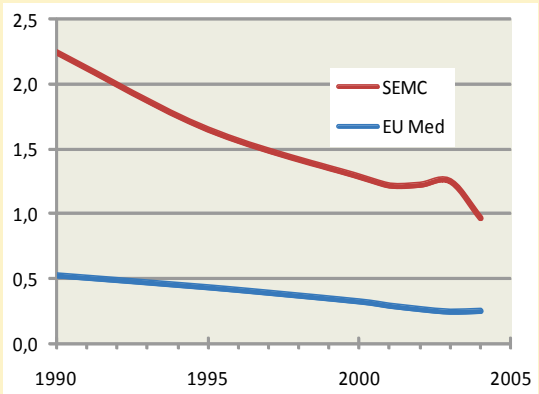
The significant penetration of diesel fuel may also be observed in the South. In 2006, diesel vehicles accounted for 25% of the fleet in Tunisia, 44% in Morocco, 31% in Syria. In Algeria, the diesel fleet passed from 10 to 15% between 2000 and 2006. It is Israel which holds the lowest rate with less than 5% because of the high incidence of unleaded petrol meeting EU and US standards.

Box 1 Is the road still more risky?

It is in the countries of the South that the problem of road safety is most severe. The increase in traffic, urban development and lack of road signs aggravate one of the major social impacts of road traffic, i.e. deaths on the roads. In SEMCs the number of deaths on the roads passed from 14 300 to 17 300 between 1990 and 2005. This figure, which does not include statistics for Libya and Egypt, probably underestimates. However, even though the death toll continues to rise in absolute terms, it does not increase as fast as the number of vehicles. For the 5 SEMCs for which statistics are available, the number of deaths passed from 2.2 deaths per year per 1000 vehicles to less than 1 from 1990 to 2005.

This figure remains, however much higher than that of the NMCs which stood in 2005 at 0.26 deaths/1000 vehicles. This rate has dropped thanks in particular to the various road safety measures conducted in the NMCs, which brought down the number of road casualties from 26 200 to 17 800 deaths/year between 1990 and 2005.

Figure 5 Number of deaths per thousand of vehicles, 1990-2005



Note: SEMC average = Average (Algeria, Morocco, Tunisia, Israel, Turkey)

Source: Eurostat

Concerning alternative fuels, these remain limited, although on the rise in the EU-27. Biofuels passed from less than 1% (0.1%) in 1995 to 1.5% in 2006 of the road vehicles. The use of natural gas accounted in 2006 for a mere 0.3% of the total fuels used in the NMCs.

Concerning SEMCs, gas (Liquefied Petroleum Gas LPG and Natural Gas for Vehicle NGV) accounted in 2006 for 4.5% of the total energy consumption of transport, and this, due mainly to Turkey (11%) and Algeria (6%) which invested heavily in LPG equipment. This share for Egypt and Tunisia stood at 3% and 2% respectively but is dominated by NGV.

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Notes

[1]TEU Twenty foot Equivalent Unit

The impact of maritime transport on the environment

Frédéric Hebert (REMPEC)

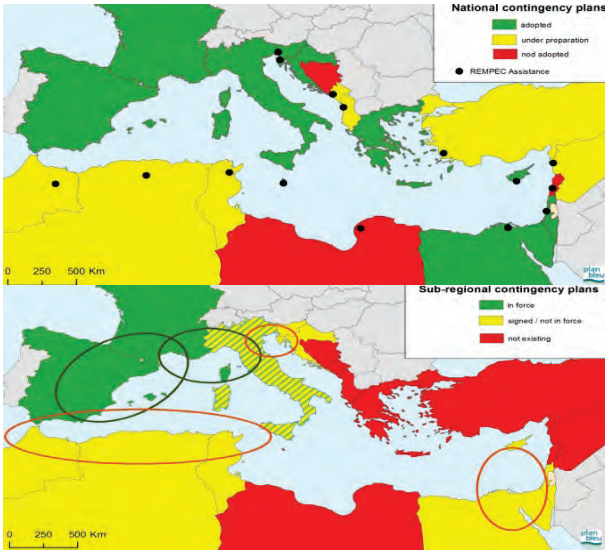
When compared with other modes of transport, maritime transport has a lower impact on the environment for a same proportion to the quantity of goods and passengers carried. At the same time ships and their cargoes represent a direct threat for the environment; should an accident occur and given their daily operations, they may leave an irreversible footprint on the natural environment. It has also been established that the majority of transfers of aquatic pathogens and invasive species can be attributed to shipping. Finally, although international conventions, particularly the international convention for the prevention of pollution from ships (MARPOL) regulate or ban certain types of discharge at sea, the adequacy of port infrastructure to receive waste produced at sea remains problematic.

How prepared are the Mediterranean states for coping with a major marine pollution incident?

The degree of preparation can be perceived at several levels: the existence of a national organisation set up according to a national contingency plan, specific, trained staff and the availability of specific equipment.

As is shown in Figure 1, most Mediterranean states have adopted a national contingency plan, and several of them have drawn up sub-regional plans, which define operational procedures in advance.

Figure 1 State of adoption of national and sub-regional contingency plans, 2009



Source: REMPEC

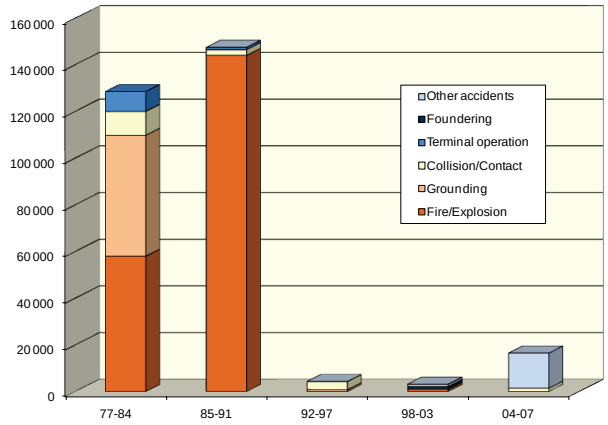
Most of these plans, which have been drawn up to deal with oil pollution, also deal with hazardous and noxious substances (HNS), notwithstanding the difference in response technique.

The main difficulties identified by the states relate to the level of staff preparedness (the number of exercises varies widely from one country to the next) and certain shortcomings in terms of heavy equipment in some countries. As far as the latter issue is concerned, regional cooperation could play an important role by facilitating assistance from other countries of the Barcelona Convention or from the European Union. In this respect, since 2007 the European Maritime Safety Agency has launched a system for chartering commercial vessels which, once fitted out as pollution response vessels, can be mobilised in a matter of hours. Five of such vessels are stationed in the Mediterranean.

Being well prepared also requires the close involvement of the oil industry upstream, which needs to have well-trained staff in its terminals and agreements with service companies to respond to a potential pollution incident. The Mediterranean Oil Industry Group (MOIG) has been set up for this purpose furthering the Global Initiative, which was jointly launched by the IPIECA[1] and the IMO[2] for the effective implementation of the Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC 90).

Generally speaking, the nature of accidents has changed over recent years, with less major disasters but still many collisions and groundings producing small-scale pollution. The eastern part of the Mediterranean with its many islands is the leading accident spot of this type. Most pollution incidents occur in ports during mooring, loading and unloading operations, albeit involving tiny quantities (*Figure 2*).

Figure 2 Trend in distribution of accident types and released quantities (releases above 700 tonnes), 1977-2007, (tonnes)



Source: REMPEC, alerts and accidents database

Is there any check on the impact of shipping on the environment?

Several international conventions address the impact of ships on the environment, first and foremost the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), which contains 6 annexes covering the various types of discharge likely to be caused by ships, but also the 2001 International Convention on ship anti-fouling substances (AFS 2001) and the 2004 international convention on the management of ships' ballast water (BWM 2004).

Most of the Mediterranean countries ratified these conventions. Box 1 describes the current status of ratification of these agreements among Mediterranean countries.

This specific issue apart, the daily operations of ships of whatever type leads to the production of oily residues, and tank washing operations for oil tankers create residues, which must be disposed of by the vessel. As far as the Mediterranean is concerned, it has been declared a special area under annex I of the MARPOL convention, which regulates such discharge. Its designation as such means that tankers are banned from discharging from their cargo tanks, and all vessels are required to limit their bilge discharge content to 15 ppm as measured by mandatory equipment (oil-water separator). Discharge is prohibited in the absence of such equipment.

Box 1 Status of ratification of maritime environmental protection conventions in the Mediterranean, 2009

	MARPOL 73/78 (Annex I/II)	MARPOL 73/78 (Annex III)	MARPOL 73/78 (Annex IV)	MARPOL 73/78 (Annex V)	MARPOL Protocol 97 (Annex VI)	ANTI FOULING 01	BALLAST WATER 2004
Albania	■	■	■	■			■
Algeria	■	■	■	■			
Bosnia & Herzegovina							
Croatia	■	■	■	■	■	■	
Cyprus	■	■	■	■	■	■	
Egypt	■	■	■	■			■
France	■	■	■	■	■	■	■
Greece	■	■	■	■	■	■	
Israel	■	■					
Italy	■	■	■	■	■		
Lebanon	■	■	■	■			
Libya Arab Jamahiriya	■	■	■	■			
Malta	■	■		■		■	
Monaco	■	■	■	■			
Montenegro	■	■	■	■			
Morocco	■	■	■	■			
Slovenia	■	■	■	■	■	■	
Spain	■	■	■	■	■	■	■
Syrian Arab Republic	■	■	■	■	■	■	■
Tunisia	■	■	■	■			
Turkey	■			■			

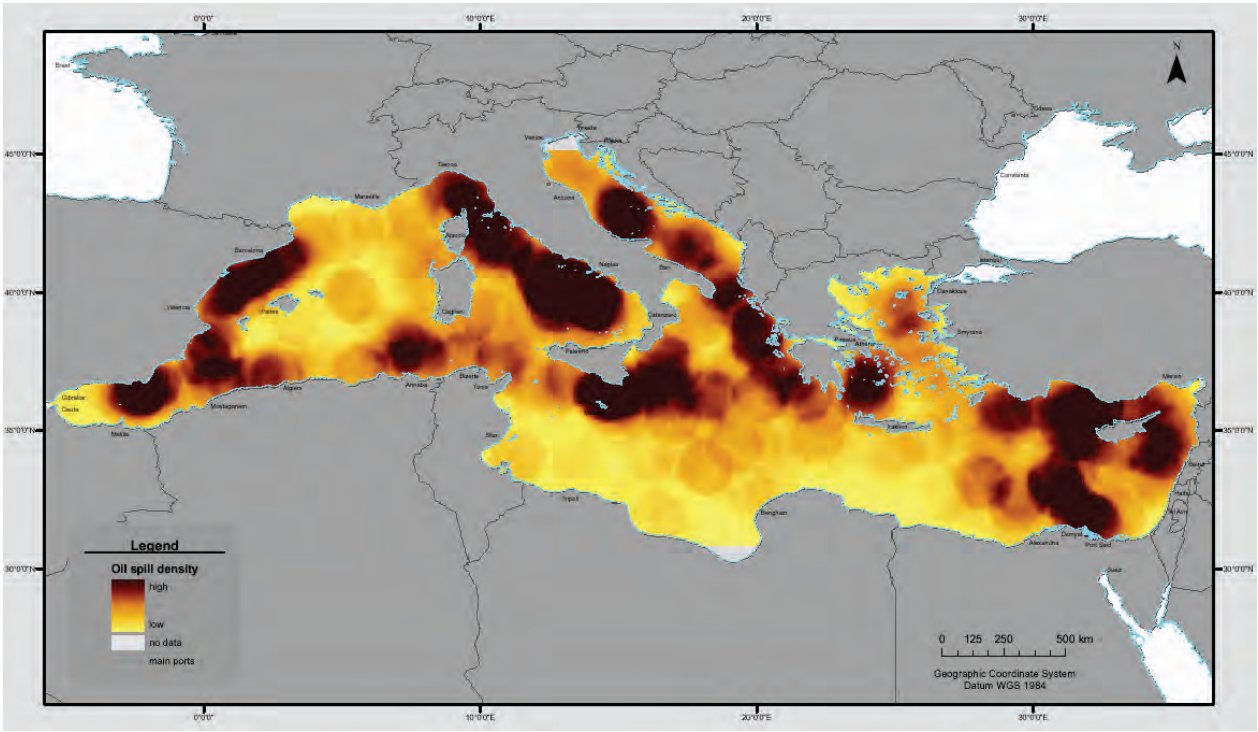
As far as annex VI of the MARPOL convention is concerned, which addresses air pollution by ships, ratification of this annex by a certain number of Mediterranean states is problematic in terms of national fleets, which are not in a position to respect the emission values defined in the annex. However, under the « regional strategy for the prevention of and response to marine pollution from ships » adopted in 2005, one of the specific objectives set by the Contracting Parties is to make the Mediterranean an emission control area.

The 2004 convention on the management of ballast water has still not come into force, but the Mediterranean has been identified as a priority area under the global programme established by the GEF, UNDP and the IMO, which aims at the adoption of regional strategies, taking account of what is stipulated by the convention, to combat the proliferation of exogenous and invasive species. The situation is indeed worrying, with more than 925 species having been identified (see Chapter on *Marine Biological Invasions*), which makes the Mediterranean the leading region to be affected by this phenomenon.

Source: State of ratification by country, IMO

Unfortunately, the situation in reality shows that not all operators apply the international rules. Satellite technology can help to establish the scale of the phenomenon. The European Commission has been conducting a satellite monitoring project since 1999, which is expanding its coverage year on year. In 2004, coverage provided by 4,473 satellite photos pinpointed 1,425 oil spills under the European « Monitoring Illicit Discharges from Vessels (MIDIV) » programme. *Figure 3* shows illicit discharge and its density, which particularly affects the North and East of the Mediterranean. Since 2008, the European Maritime Safety Agency has been providing Member States with snapshots of their monitoring zone, allowing potential oil spills to be spotted. In 2007-2008, REMPEC in collaboration with the European Space Agency under the MARCOAST project circulated identical images on an experimental basis for Morocco, Algeria and Tunisia. From 240 images received, 454 potential cases of discharge were spotted.

Figure 3 Localisation and density of illicit oil spills in the Mediterranean in 2004



Source: European Commission/JRC http://serac.jrc.it/index.php?option=com_content&task=view&id=42&Itemid=89

This situation calls first for the strengthening of the national legal frameworks to end with fast dissuasive sanctions and second to improve in aerial surveillance and cooperation.

Specialised Port State Control teams such as the ones set up by the US coastguard could also improve the extent to which the provisions of the convention are implemented.

At the same time, States should ensure that suitable reception facilities are available, able to meet the needs of ships calling into their ports without delay and at marginal cost. According to a study conducted by REMPEC in 2005, the estimated total cost of equipping the main Mediterranean ports of the non EU Member States stood at around thirty million Euros. However, the financial analysis of these projects recommends the creation of public –private partnerships, since there is insufficient investment at national level to awaken the interest of the main international financial institutions.

As far as litters are concerned (See *Waste* Chapter), everyday rubbish from ships and all types of waste the crews want to eliminate, progress has been recorded at regulatory level following the entry into force of the Mediterranean's special area status under annex V of MARPOL on 1st May 2009. The only discharge authorised henceforth is that of organic waste, all other types of household waste (all types of metal, plastic or cardboard packaging) having to be unloaded on land.

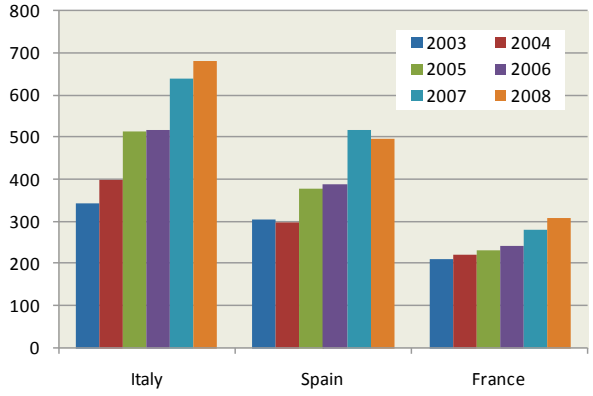
Are the new modes of consumption in shipping generating new pollution flows?

In parallel to the increase in goods shipping, the last few years have also witnessed an exponential rise in maritime transport, both in the field of sailing or in the new form of mass tourism involving huge passenger ships with a capacity of several thousand people.

This development raises questions about its effects on the environment, not of the actual ship itself, because these new units are of a high standard and equipped to avoid any direct impact on the marine environment, but rather through the land flows created in the ports of call.

Besides this historic passenger transport, over the last decade the Mediterranean has witnessed a cruise boom. According to sources from the industry[3], between 1998 and 2007, the annual growth rate in terms of passengers number was over 12%, Italy (third largest cruise market in Europe after the UK and Germany) even showed a jump of 97% over the last five years (*figure 4*). This increase is not only attributable to an increase in the number of port calls, but more specifically to an increase in the size of cruise ships in conjunction with a longer annual season. Among the 5 leading countries of destination in Europe, four are in the Mediterranean. As an example of the new trend, in 2008 the Maltese archipelago, with a population of approximately 400,000, received over half a million cruise passengers. The situation is identical in other spots whose past is closely tied in with the Mediterranean cultural heritage such as Dubrovnik (Croatia).

Figure 4 Trend in cruise passengers in main Mediterranean destinations, 2003-2008 (thousand)



Source: ECC/IRN research

Local authorities must give some thought to such a leap in the growth of this industry in order to ensure the sustainability of its development, taking account of the increased pressure created by the influx of visitors (water resources, waste management, import of consumer goods/services which themselves create traffic, traffic flows and CO_2 emissions…).

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Notes

[1] International Petroleum Industry Environment Conservation Association

[2] International Maritime Organisation

[3] Source: Medcruise and the European Cruise Council (ECC)

Industrial Development and Environment

Enrique De Villamore Martin (CP/RAC)

Are Mediterranean countries adopting environmental policies promoting a proactive approach to environmental management in the industrial sector?

Throughout this first decade of the XXIst Century, Mediterranean environmental policies for industrial development are progressively moving from a "react and treat" or end-of-pipe approach (EOP) to a Cleaner Production (CP) approach. Indeed, the latter has shown to be a more effective way to decouple industrial development from environmental degradation while it contributes to further upgrade industrial performance in both developing and developed countries. In this sense, both environmental and economic reasons have backed this change in environmental policy strategies:

- EOP solutions require big investments involving an additional cost that is constant and grows as company's production increases; is external to the company's performance and do not add any value;
- EOP have no other benefit than the mere fulfillment of environmental regulations;
- Most EOP solutions involve static and fragile technologies whose application frequently generates the transfer of environmental impacts from one vector to another (e.g. the treatment of wastewater generates sludge that further requires additional treatment);
- By adopting the CP approach, industries address environmental management, not as an economic development burden but further as an opportunity to increase productivity, improve efficiency and improve corporate image. Likewise, reducing the overall pollution load and resource consumption throughout production process also reduces the costs in the implementation of EOP measures;
- CP involves an integrated approach to environmental management to reduce pollution at the very source of the production processes by optimizing the use of energy, water and resources and reducing waste flows.

Box 1 Overview of Cleaner Production centers or assimilates in Mediterranean countries, 2009

Country	Centre's name	Year of creation	Supervisor
Algeria	Centre National des Technologies de Production Plus Propre (CNTPP)	2003	Ministère de l'Aménagement du Territoire et de l'Environnement (MATE)
Bosnia-Herzegovina	Centre for Environmentally Sustainable Development (CESD)		Hydro-Engineering Institute of Civil Engineering, Faculty of Sarajevo created in 1954
Croatia	Croatian Cleaner Production Centre	2000	Member of UNIDO
Egypt	Egypt National Cleaner Production Centre (ENCPC)	2005	Joint initiative between the Ministry of Trade and Industry (MTI) and UNIDO
France	Agence de l'Environnement et de la Maîtrise de l'Energie (ADEME)	1990	Ministère en charge de l'Ecologie, de l'Energie, du Développement durable et de la Mer, en charge des technologies vertes et des négociations sur le Climat et Ministère de l'Enseignement Supérieur et de la Recherche.
Israel	Israel Cleaner Production Center	2001	Ministry of the Environment and the Manufacturers Association of Israel
Lebanon	Lebanese Cleaner Production Centre	2002	Member of UNIDO
Malta	Cleaner Technology Centre	1993	University of Malta and Government of Malta
Morocco	Centre Marocain de Production Propre (CMPP)	2000	Member of UNIDO
Slovenia	Steng-National Cleaner Production Centre	1997	Private initiative
Syria	Syrian National Cleaner Production Centre (SNCPC)	2007	Syrian General Commission for Environmental Affairs
Tunisia	Centre International des Technologies de l'Environnement de Tunis (CITET)	1996	Ministère de l'Environnement et du Développement Durable

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Aware of that, Mediterranean countries have adopted or updated their National Environmental Action Plans/Strategies, including CP as key element to introduce sustainable patterns in the industrial sector. Accordingly, actions promoting sustainable production have been developed within sectorial planning initiatives, e.g. waste, water management, environmental upgrading of industrial cities, pollution reduction in the Mediterranean (e.g. National Action Plans within the framework of the Strategic Action Programme).

In most South and East Mediterranean Countries (SEMC), ad hoc national centres have been established (the most recent in Syria and shortly in Montenegro) (*box 1*), through the support of programmes and agencies for international and/or bilateral cooperation, to promote CP and to provide technical assistance to small and medium enterprises (SMEs). Nevertheless, many of these centres still lack of enough human resources and of effective backing from the corresponding ministries and remain dependant on support of host institutions/international donors.

CP is often promoted through one-off disperse actions that are developed with no coordination/communication between agents in charge, as there is no national policy on CP involving all concerned actors, i.e. ministries of Environment and Industry, private sector, etc . This situation may result in duplication of efforts, no consideration of synergies and insufficient dissemination and replication of the results and outputs obtained in the projects developed. In recent years, some countries are tackling the creation of national policies for identifying CP needs and priorities. This is, for example, the case of Croatia and Egypt, where ministries dealing with environment, industry, economy, agriculture, health welfare, etc are involved in this process, together with industrial associations and other stakeholders.

Are current regulatory instruments being effective in encouraging Mediterranean industries to improve their environmental performance?

The development and application of adequate regulatory frameworks to control and prevent industrial pollution is another crucial factor to encourage the industrial sector to internalize its environmental impacts and to shift to sustainable production. On that regard, countries with less developed legal frameworks, such as SEMC, show continued progress in the enactment of new regulations establishing emission limit values, pollution thresholds, monitoring procedures, polluters' obligations, etc. In addition to the enactment of new regulations, some countries have also undertaken a revision of the existing ones, and have introduced diverse modifications and amendments to update and improve their content and their effective application.

Nevertheless, progress in the consolidation of the legal frameworks of these countries has not been yet accompanied by effective enforcement in the implementation of both the existing and new laws and regulations. The principal causes include the lack of secondary and executive regulations, lack of human and financial resources for governmental authorities in charge of applying the regulations; over-lapping and imprecise distribution of responsibilities among the different authorities involved in environmental protection, etc.

Moreover, command and control regulations are rarely accompanied by mechanisms facilitating progressive compliance with environmental regulations as for example, voluntary agreements and partnerships government-industry, though countries as Algeria, Egypt, Morocco, Tunisia and Turkey are taking steps to address that challenge.

In addition to that, it is perceived that the application of environmental taxes in many Mediterranean countries is not well balanced with economic instruments facilitating investment in CP. This trend may result in a negative impact on the sector's performance, as for big companies "polluter pays" would become "payer pollutes", while it places excessive pressure on the capacity of SMEs to respond to environmental requirements.

Many of the existing instruments promoting proactive attitudes still focus on corrective actions (end-of-pipe) rather than on preventive ones (CP). In order to reverse those trends, funding or granting of soft loans for CP projects are facilitated by some institutional agents such as in Morocco, Egypt or Tunisia. In some SEMC the existence of subsidized prices for water or energy consumption is also major barrier hindering the shift to sustainable patterns of production by the industrial sector as it does not encourage companies' innovation to optimize resources consumption.

EU Mediterranean countries generally have more highly developed legal and institutional mechanisms. However, many of them share as common problem the excessive number of environmental laws and related legislative acts (e.g. around 40,000 in Italy) due to the obligation of continuously updating their legal frameworks according to new European Union regulations. As a consequence of this, some countries have encountered an overlapping of legislative tools and responsibilities of the various administrations in charge of monitoring and controlling their implementation, as well as a lack of means and human resources to ensure their effective application. Some initiatives have already been undertaken in order to tackle these problems. In Italy, for example, a law has been issued to rearrange, complete, coordinate, simplify and clarify the diverse components making up the country's environmental law system – these include Integrated Pollution Prevention and Control (IPPC), Environmental Impact Assessment (EIA), air, water and waste management regulations, contaminated sites, etc.

Within the European Union, the IPPC system has become the reference mechanism through which countries can progressively introduce CP, through the so-called Best Available Techniques (BAT), as element in the authorization process for the most polluting industrial installations. Accordingly, both Mediterranean EU members and countries in the European orbit (Croatia, Turkey, Albania, Bosnia & Herzegovina and Montenegro) as well as Israel have adopted laws based on the IPPC/BAT system. While non-EU members are still at the preliminary stages to adapt their regulatory frameworks accordingly, EU Mediterranean countries, for which the application of the IPPC directive is legally binding, face problems related to the compliance with the time span given by the EU as regards the full implementation of the Directive in both existing and new industrial activities by 2007. In this sense, out of the seven EU Mediterranean countries, only two have met that deadline.

South Mediterranean countries lack specific legislation regulating the application of CP mechanisms by the industrial activities. However in some countries (e.g. Egypt) it can be taken into consideration during the EIA stage within the permitting process for new facilities.

Can industry development be decoupled from the Mediterranean degradation by solely combining EOP and CP?

The answer is no. Nowadays it is commonly recognized that the qualitative environmental improvements in terms of production processes are being offset by the sustained growth experienced by the consumption levels and flows of raw materials, energy and products, along with international trade, given that supply chains have become more and more international.

In the Mediterranean area, trade flows show a continuous increase. Currently the EU receives around 47 % of MED exports, with an annual average growth of more than 10 % since 1999. EU imports from the MED have thus doubled over ten years. Likewise, EU exports to the MED countries have grown at an annual average of 8 % since the mid 1990s. These trends are expected to increase with the progressive establishment of the Euro-Mediterranean Free Trade area which aims at benefiting economic growth and stability in the region. Nevertheless the corresponding growth on transport and trade flows will entail as side effect a greater consumption and depletion of resources.

In this respect, perspectives on consumption trends show to be especially critical; this is particularly the case for electricity consumption (in SEMC, it may triple by 2025), and the induced CO_2 emissions (between 2006 and 2025, CO_2 emissions from energy consumption could rise by 55 % in the Northern Mediterranean countries (NMC) and by 119 % in the SEMC). Concerning pollution trends, waste generation is expected to triple in SEMC while doubling in NMC. Moreover, in SEMC pollution risks are expected to increase greatly given the strong industrial growth projected for those countries to meet increasing demands due to population growth and rising living standards (e.g. steel production could reach 50 million tonnes by 2025 and cement production increase by more than 150 %).

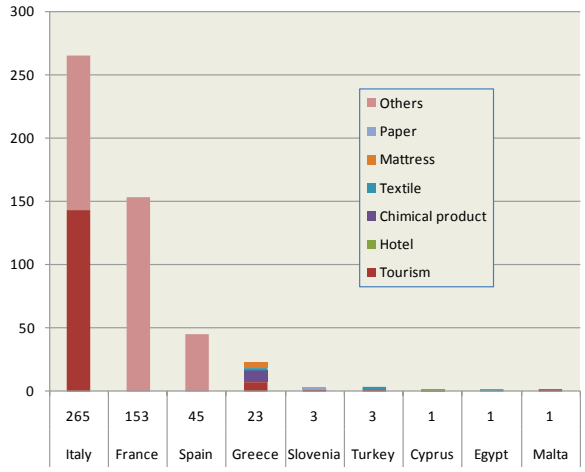
According to that, along to the measures addressed to minimize the environmental impacts associated to the "production side" – i.e. cleaner production, energy efficiency, etc – other mechanisms have arose to turn the market into a lever to encourage the reduction of environmental impacts and the use of natural resources throughout the production and trade flows. This is the case of tools as eco-labelling

and green public procurement (GPP). Those are tools attempting to green the market and the whole value chain of organizations and enterprises.

Are tools to green the Mediterranean market set in place?

The eco-labelling schemes reward the environmental performance of companies and increase their visibility and corporate image in the global market. These schemes contribute to increase consumers' awareness and choice towards sustainable products. Eco-labelling has revealed itself as a powerful voluntary instrument to approach sustainable consumption and production to goods and services providers from the NMC. It is possible to highlight the success that the application of eco-labelling is taking place, especially in some product groups and services and in certain sectors like the tourism. As an example, some tourist accommodations from Cyprus, Greece, Malta, Slovenia and Turkey have been certified with the eco-flower (EU eco-labelling scheme).

Figure 1 EU ecolabel licenses by producer's country, 2008



Sources: European Commission, DG Environment

France, Italy, Spain and Greece are among the EU members with a great number of producers, products and services registered with the eco-flower (*figure 1*).

The growth of eco-label certified products is, in many cases, due to the fact that environmental criteria have started to be included in biddings processes of public administrations. That has led to a significant increase in the interest from companies towards eco-labelling schemes. This incentive has worked significantly in product groups as detergents, textiles and paper.

In most SEMC eco-labelling is still poorly developed though some progresses are being made. Israel and Croatia have already established national schemes while Tunisia and Egypt are setting out the regulatory framework for an eco-labeling and an energy efficiency label, respectively. Also in those countries, as well as in others like Morocco and Turkey some companies are joining international label initiatives focused on specific sectors as textile and tourism (e.g. Oeko Tex, Green Key).

The second instrument refers to Green public procurement (GPP). A GPP takes place when contracting authorities use social and environmental criteria to decide who to buy goods or services from and what to buy. Therefore, by shifting the public purchase policy to environmentally and socially preferable products and services, the substantial buying power of the administration becomes a powerful driver for the delivery of sustainable development policies and the stimulation of markets for sustainable products and services.

In the Mediterranean region, GPP is a very recent instrument for which only few countries have already adopted regulatory instruments. National plans for GPP have recently been approved in Cyprus, France, Israel, Italy and Spain and efforts are focused on the ways to include environmental parameters in public tenders and to raise awareness in local authorities and other public organizations. In EU Med countries, the greening of public procurement appears as a major challenge for public administrations. In this sense, the European Commission has adopted a Communication in which it proposes a political target of 50% GPP to be reached by the Member States by the year 2010.

There is not a policy framework for GPP in SEMC yet. In the last years, most of them have updated their regulatory frameworks on public procurement according to market opening processes, governance improvements and the increasing relationship with international markets and foreign investors. Nevertheless none of them have incorporated specific provisions taking into account environmental criteria in bidding or tender proceedings. However, some countries have already included GPP in their new strategies for sustainable development (e.g. Croatia) and other like Morocco and Tunisia have started to develop GPP feasibility studies through the support of agencies for international and regional cooperation.

Box 2 Case study: 100 Mediterranean SME linking environmental protection and economic benefits

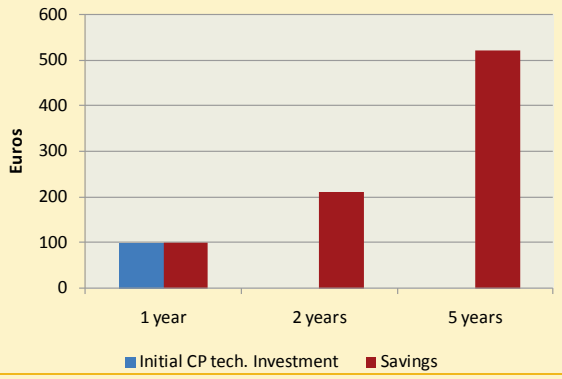
The Regional Activity Centre for Cleaner Production has collected and analyzed the results of the application of Cleaner Production (CP) techniques and strategies by one hundred Mediterranean SME. They represent investments that generated altogether total annual savings of 14,133,452 €, and cumulated net benefits, after five years, of 56,866,505 €.

The analysis identifies a majority of CP cases in which companies generate, through small investments, important benefits in both environmental and financial terms. Nearly all CP techniques generated substantial economic savings to Mediterranean companies with relatively short payback periods, and high return on investment (ROI). As an illustration, many techniques implied payback periods shorter than 1 month, some of them virtually requiring no investment. Moreover, 87 out of 176 CP techniques identified in the analysis represented investments with less than 6 months payback period (50% of all techniques recorded). These have a large potential of replication, and are logically expected to grow significantly more than other relatively less profitable ones in the coming decades.

Financial dimension

On aggregate, the case study shows that in the middle-term CP has produced large annual savings to Mediterranean companies guaranteeing economic feasibility of their application and success in pursuing a sustainable behaviour (*figure 2*).

Figure 2 Total savings for each 100 € invested in CP techniques in the first years (euros)

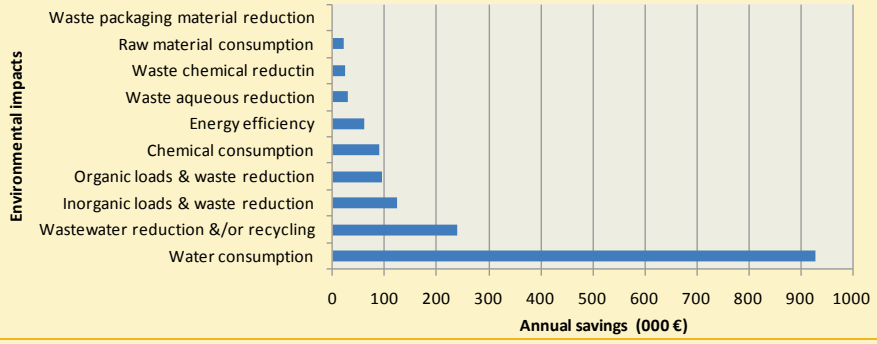


Good housekeeping and organizational measures

Among all techniques applied, "Good housekeeping and organisational measures" is one of the groups with most diverse environmental benefits and the one recording the largest amount of annual savings (nearly 1.5 millions €) (*figure 3*). It is of utmost interest from both an environmental and financial perspective for Mediterranean companies and demonstrates that even by means of limited, but selective changes, important outcomes can be expected.

From the case studies analyzed, the impact of this type of measures in reducing water consumption in production processes was found remarkable (such as the corresponding annual savings). Therefore, in many cases "simple measures" can make a big change.

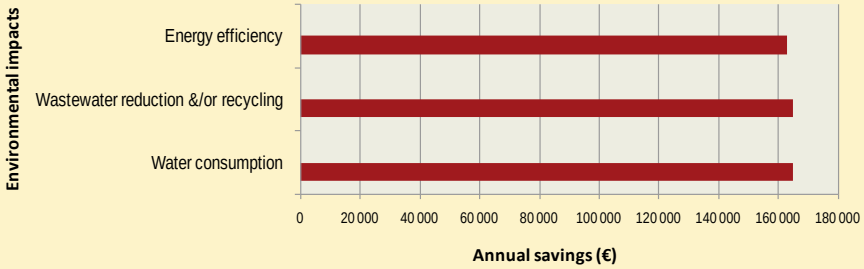
Figure 3 Annual savings from good housekeeping and organisational measures (000 euros)



Energy savings

The techniques analyzed under "Energy savings" have the following characteristic: with a clear purpose to achieve efficiency in energy consumption, they exert an important effect on two other water consumption-related actions. It is the case of wastewater reduction and/or recycling and water consumption (*figure 4*).

Figure 2 Annual savings and environmental impacts of energy savings technics (euros)



Source : GRECO

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Part 5

Environment Protection

Introduction : pollutions, impacts and responses

Pollution

Waste

Sanitation

Health issues

Marine Biological Invasions

Pollutions, Impacts and Responses

European Environment Agency

Human activities and economic development in the Mediterranean have strongly impacted the environment, particularly coastal and marine ecosystems, from point – and diffuse sources of pollution. A large range of different industrial activities (from mining, heavy industry complexes, manufacturing, waste management, and commercial harbours) are situated all around the Mediterranean and are often the cause of environmental hotspots from the release of polluted effluent and atmospheric emissions. These affect the most productive areas of the Mediterranean marine environment, including estuaries and shallow coastal waters. This chapter on pollution reviews the causes and effects of key anthropogenic activities.

Awareness of environmental and societal issues related to pollution has grown significantly over last three decades, but the implementation of adequate responses remains timid, uneven, and visible through pollution monitoring. This also serves to evaluate the responses of public policies (infrastructure and regulation).

In South and East Mediterranean countries, the main environmental problems of coastal water pollution are due to poor treatment of urban waste and management of chemicals, compound by inadequate technical capabilities and economic incentives. In North Mediterranean countries, particularly in the EU with its more prescriptive regulations, considerable effort has gone into wastewater treatment, chemicals management, pollution prevention or more curative measures.

Five sectors: transport, energy, agriculture, industry and households; contribute most to current problems and are expected to do so in the foreseeable future. Point sources of pollution such as industrial plants, or car exhausts are easily identified and can be addressed through regulatory standards and the application of abatement technologies. These sectors are also sources of diffuse pollution which prove harder to control.

Even when new technologies have been introduced, increased demand through unbanisation, for instance, make them inadequate or obsolete. A mix of instruments, or integrated approaches, are needed which encourage societal changes as well as promoting technical progress and economic development. An Ecosystem Approach seems particularly useful for the Mediterranean and can be cost-effective by addressing environmental and economic considerations, and tackling cross-sectoral problems

In response to this necessity, the Contracting Parties to the Barcelona Convention have adopted the Ecosystem Approach in January 2008 in Almeria, strengthening previous commitments in the framework of the Mediterranean Action Plan. These included: assessment and control of pollution, integrated coastal zone management, environment and development, biodiversity, marine pollution indicators, Environmental Quality Standards.

The improvement of the institutional capabilities of the Mediterranean countries in the sustainable management of their environment and its rational integration in development policies is also a major challenge for the region.

The EU Marine Strategy provides the framework for fostering strengthened cooperation between North and South Mediterranean countries through the Barcelona Convention. Within this framework, and particularly through its regional implementation, cooperation to protect the Mediterranean marine environment which reflect different socio-economic capacities, is already underway.

The Union for the Mediterranean (UfM) and the EU Neighbourhood Policy constitute a good political base for developing the required multilateral cooperation. The Mediterranean Strategy for Sustainable Development (MSSD) also aims to increase the synergies between the various regional bodies, the UfM and the MAP, along with the enhancement of regional cooperation towards capacity building and fund mobilisation.

In spite of the lack of environmental information in South and East Mediterranean countries, the following chapters review the state of pollution in the Mediterranean (marine pollution, waste, waste water) and some of its impacts including public health, the environment, and other anthropogenic effects such as invasive biological species.

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Pollution

Fouad Abousamra and Michael Angelidis (MED POL)

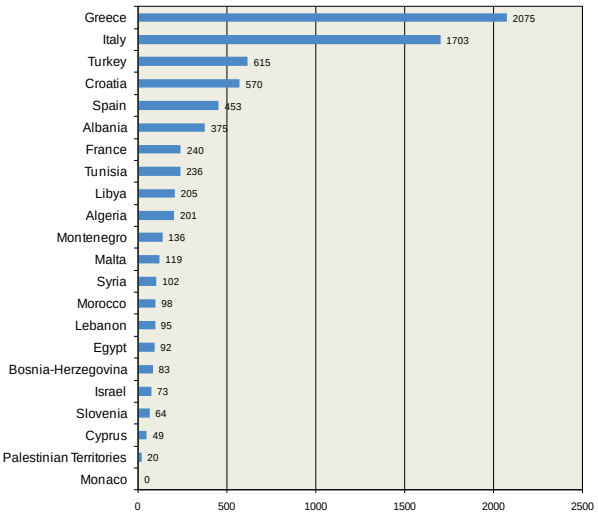
Which are the major industrial pollution sources in the Mediterranean coastline?

In 2003, MED POL launched, in the framework of the implementation of Strategic Action Programme on land-based sources of pollution in the Mediterranean, a region-wide effort to inventory industrial point-sources of pollution potentially affecting, directly or indirectly, marine ecosystems in the Mediterranean Sea.

The objective is to gather national and regional baseline data of the releases in order to track eventual trends in relation to the implementation of pollution reduction policies, strategies and initiatives as prescribed in key texts and programmes, notably: the Barcelona Convention's Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities[1] (LBS Protocol); the Strategic Action Programme[2] (SAP-MED); the EU Horizon 2020 initiative (*box 2*); the GEF-MA-World Bank Strategic Partnership for the conservation of Large Marine Ecosystem of the Mediterranean.

The National Baseline Budget (NBB) complied by MED POL contains about 7600 records. Each record indicates the emission of a substance for a given industrial sector and subsector, in an administrative region or country.

Figure 1 Number of records per country, 2003



Source: MED POL NBB

Data transmission by countries was disparate with the majority of data (77%) reported by north Mediterranean countries (NMCs), while eastern and southern countries account for 12% and 11% of records, respectively (*Figure 1*). The reasons for such differences: country size and level of industrial development; the sectorial scope of the inventory; data availability; and the variations in the level of detail of the inventories between countries.

The NBB inventory focuses on those industrial sectors responsible for the release of a list of key pollutants referred to in the LBS protocol (*Box 1*). The choice is also dictated by the possibility of taking further policy measures to reduce pollution, while taking into account socio economic factors.

Which pollutants are released by industrial sources into the Mediterranean coastal environment?

The NBB inventory treats 80 different substances or groups of substances or parameters, split into 3 categories: 'substances of concern' (mainly hazardous substances) for the marine environment as defined in different international lists, 'other substances' or groups of non-hazardous substances and 'general parameters' that are usually considered to monitor pollution to air and water such as Biochemical Oxygen Demand (BOD), Volatile Organic Compounds (VOC), Total Suspended Solid (TSS), etc. Indicators for nutrients (e.g. Total Nitrogen or Total Phosphorus) also fall under this latter category.

Generic parameters or non hazardous substances account for the majority of records (68%), while substances of concern, which represent 68% of the number of different considered substances, account for 32% of total records. This is not surprising, as general parameters like BOD or nutrients are commonly recorded by many different sectors and countries, while substances of concern are more sector specific and difficult to measure.

Within this group, it can be generally observed that there is more information for heavy metals, dioxins and phenols, than for Polycyclic Aromatic Hydrocarbons (PAHs[3]) and benzenes, and

organohalogens, for which very few records have been reported (*Figure 3*).

The dominant or most observable impacts of these releases on the marine environment concern: eutrophication and the formation of Harmful Algal Blooms' (HAB), as well as the number of intoxication incidents from the consumption of toxic sea food; or the decrease in fish stocks and biodiversity.

Which industrial sectors are responsible for the discharge of the different pollutants?

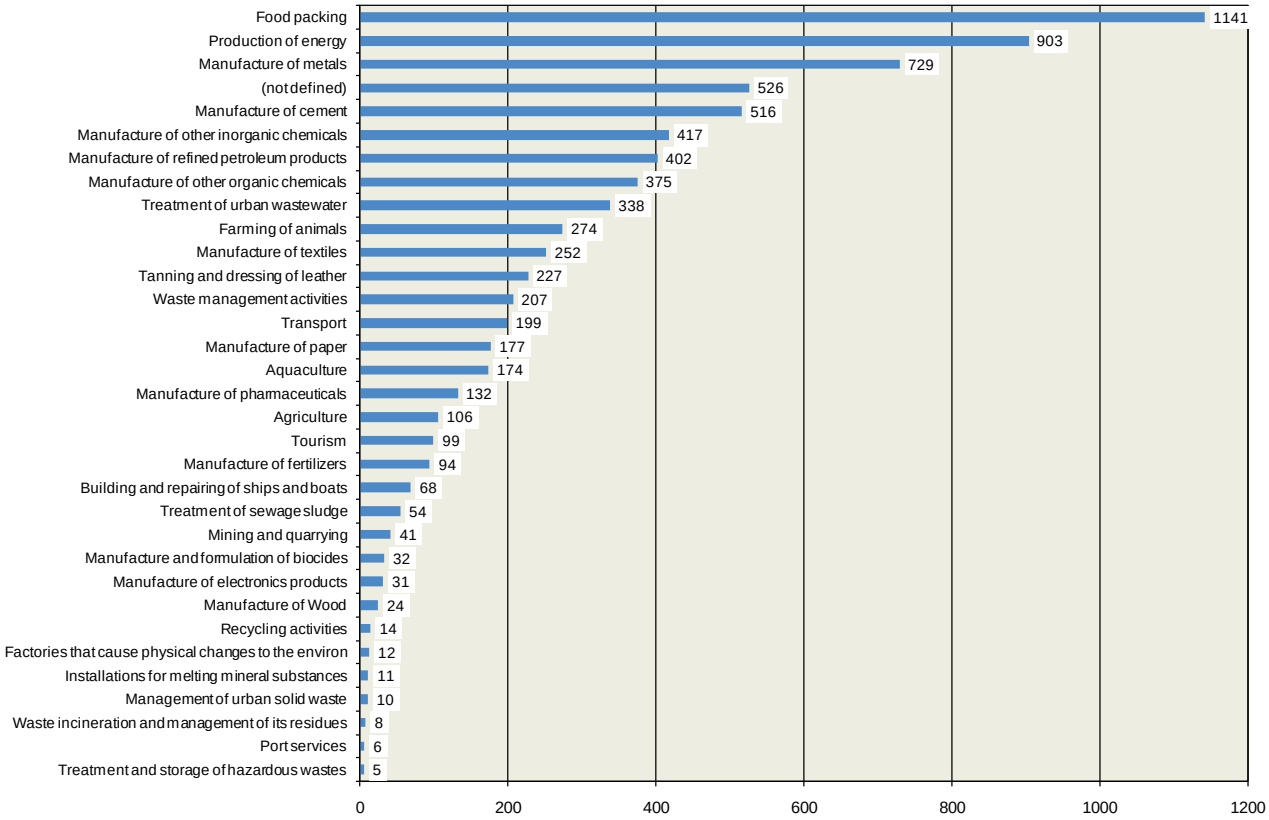
The highest number of records for the discharge of different pollutants is from the food packing industry that accounts for 15% of records, followed by production of energy (12%), manufacture of metals (10%), manufacture of cement (7%), inorganic chemicals, oil refining and organic chemicals (5%) (*Figure 2*).

These sectors with the highest number or records are often present in all countries (e.g. food industry, energy production, metal industry), or are composed of many industrial facilities in which the measurement of the BOD is standard procedure (e.g. BOD in food industry). In other cases, it may concern fewer but large industrial facilities for which data and emission factors are well established and available (e.g. energy production, cement, oil refining) or, as in the chemical industry, may be composed of many different substances

The qualification and ranking of the hazardous profile of each sector according to the number of substances of concern reported by each industrial sector shows some significant variations.

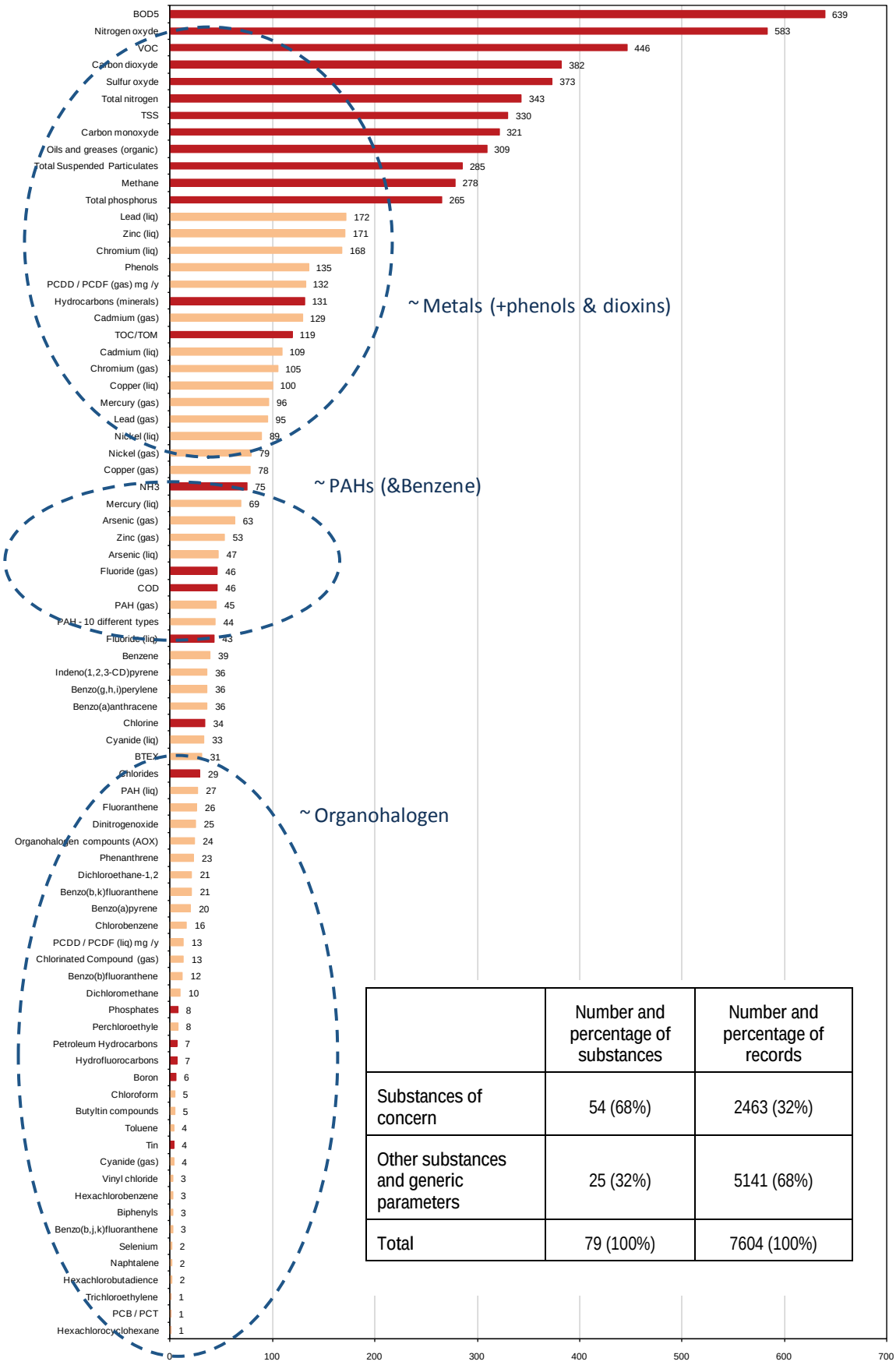
Not surprisingly several industrial sectors related to waste and wastewater management activities, which concentrate pollution, appear to have high proportions of records of substances of concern. While the 'hazardous profile's of the food industry is one of the lowest (*Figure 4*).

Figure 2 Number of records by sector, 2003



Source: MED POL NBB

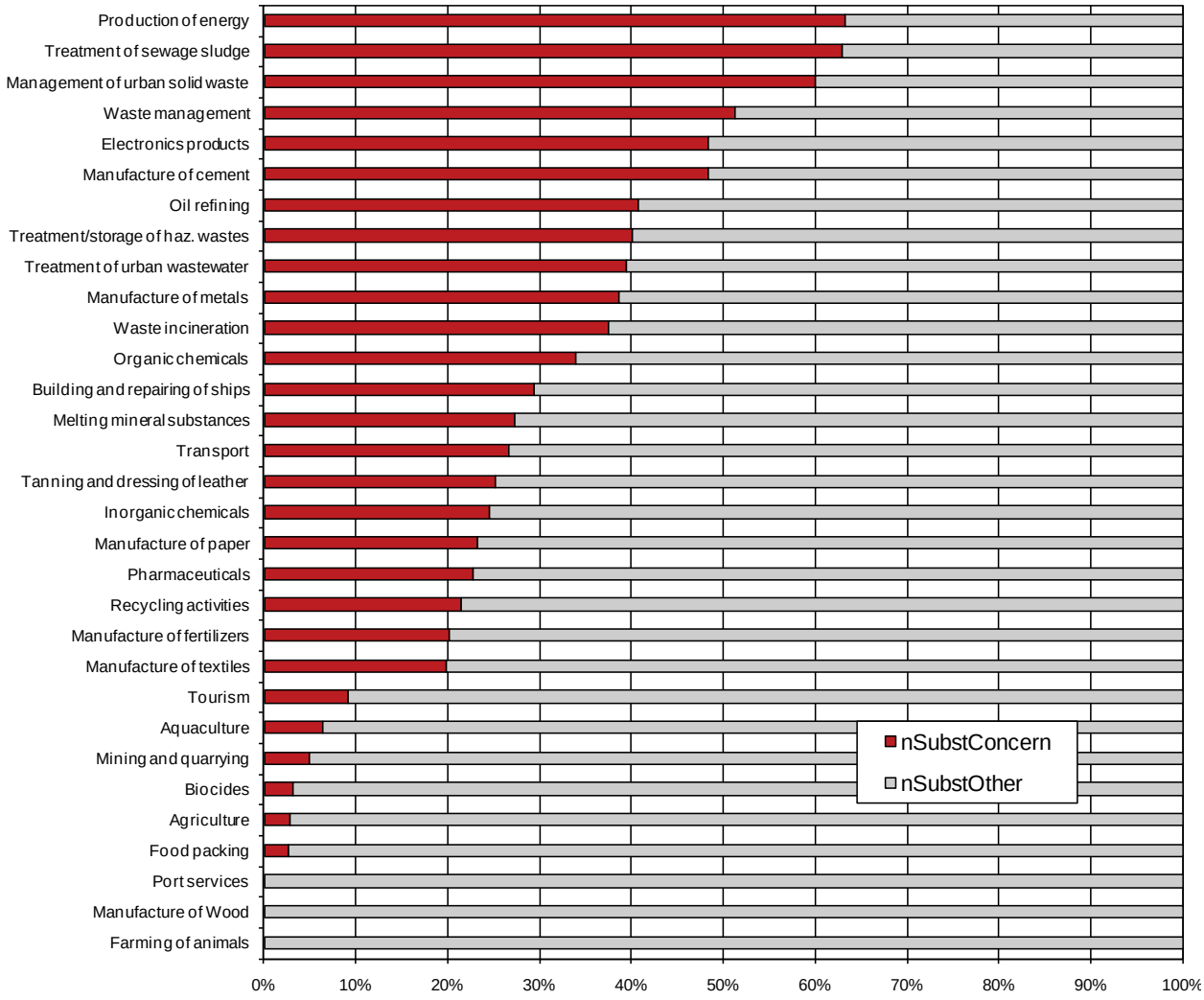
Figure 3 Number of records per substance, 2003



	Number and percentage of substances	Number and percentage of records
Substances of concern	54 (68%)	2463 (32%)
Other substances and generic parameters	25 (32%)	5141 (68%)
Total	79 (100%)	7604 (100%)

Source : MED POL NBB

Figure 4 Number of records per sector and type of substance ('hazardous profile'), 2003



Source: MED POL NBB

When combining the total data available with the sector 'hazard profile' (e.g. sectors with more that 20% of the records including substances of concern), energy production appears as the greatest polluter among the 10 most hazardous sectors (sorted by the number of Substances of Concern discharged):

- Production of energy
- Manufacture of metals
- Manufacture of cement
- Oil refining
- Treatment of urban wastewater
- Organic chemicals
- Waste management
- Inorganic chemicals
- Tanning and dressing of leather
- Transport

Which sectors are responsible for heavy metal, organic and nutrients discharge into the Mediterranean sea?

This analysis is focused on some selected pollutants according to the following criteria: a) compounds are common priority substances of concern; b) a minimum number of 25 records have been reported in the database; and c) the substance's emissions have been reported by at least 5 sectors from the 30 surveyed.

Accordingly, the metal industry accounts for major emissions of several heavy metals, such as air emissions of cadmium, lead, or chromium and emissions to water of cadmium, nickel and zinc.

The manufacture of fertilizers accounts for the majority of emissions to water of lead and mercury, while air emissions to air of mercury are produced by the cement, energy, and metal industry.

Chromium to water is mainly emitted by oil refining, followed by the fertilizers and tanning industry. The majority of reported emissions to air of nickel is produced by the energy sector.

Accordingly, the metal industry, manufacture of fertilizers, production of energy, oil refining, and cement industry are significant sources of heavy metals.

Concerning organic pollutants, the manufacture of metals is also responsible for PAHs and benzene releases. Oil refining accounts for the majority of phenols emissions, and is also relevant for benzene and PAH emissions (to water). Transport accounts for significant air emissions of PAH and dioxins (*Figure 5*).

The situation for emissions of nutrients is as follows: for nitrogen (N), the largest emitters are urban waste water treatment (31%), livestock farming (19%) and metal industry (11%); for Phosphorous, the manufacture of fertilizers accounts for the majority of Phosphorus emissions (63%), followed by the livestock farming (20%) and urban waste water treatment (8%).

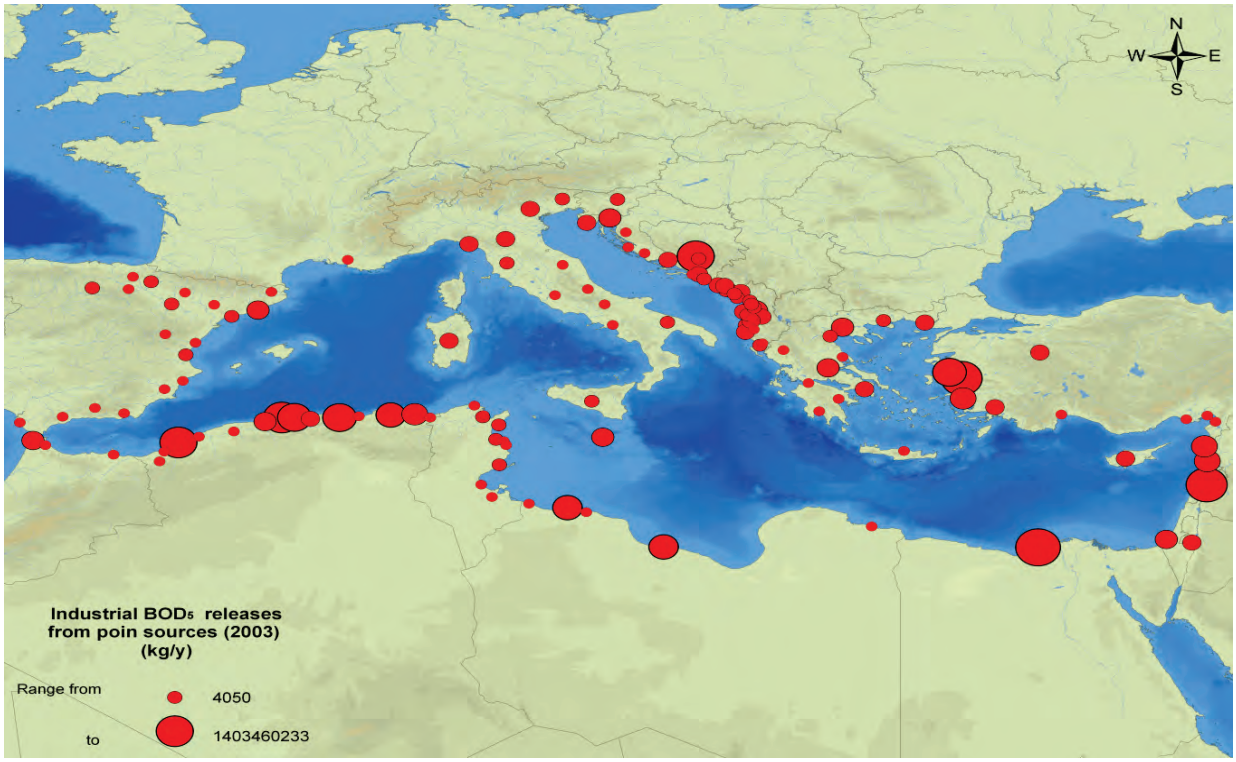
It is worth noting, that the NBB inventory only considers point sources. Diffuse pollution from uses of fertilizers in agriculture is by far the greatest emitter of nutrients. One can nonetheless observe that a limited number of sectors account for the majority of releases of nutrients in the Mediterranean region. This is also the case for other generic parameters of pollution, like BOD or suspended solids, where the food packing industry is an important sector in both cases (*Figures 5, 6, 7 and 8*).

Figure 5 Main activity sectors discharging BOD, nutrients and suspended solids in the Mediterranean region, 2003

Parameters	Sectors	% of total emission in the Med region
BOD	Oil refining	87 %
	Food packing	
	Farming of animals	
TSS	Food packing	72 %
	Manufacture of textiles	
	Treatment of urban wastewater	
Total P	Manufacture of fertilizers	91 %
	Livestock farming	
	Treatment of urban wastewater	
Total N	Treatment of urban wastewater	61 %
	Livestock farming	
	Manufacture of metals	

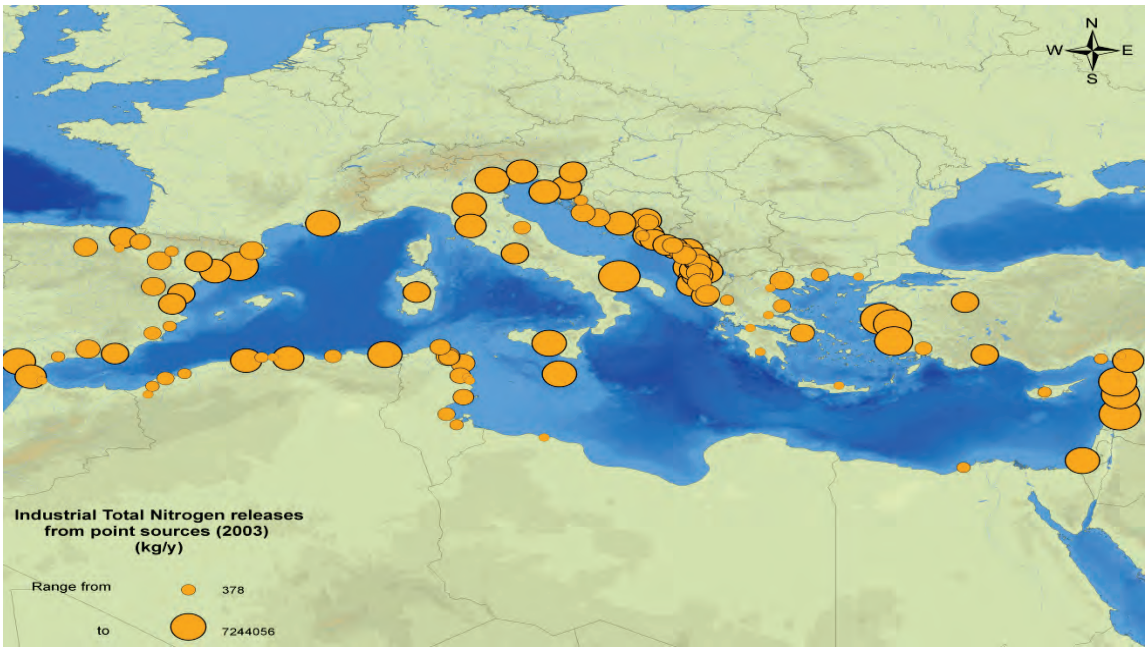
Source: MED POL NBB

Figure 6 Distribution of releases of BOD from points sources in the Mediterranean region, 2003 (kg/year)



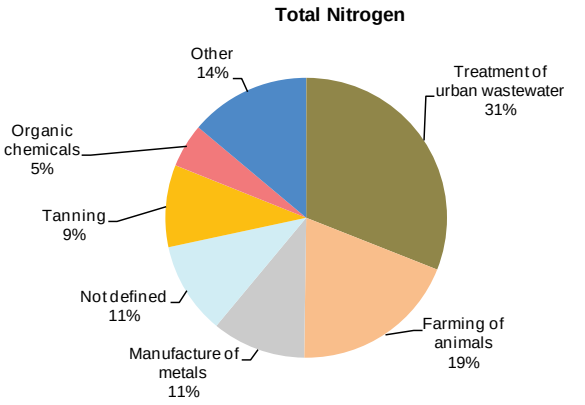
Source: MED POL NBB

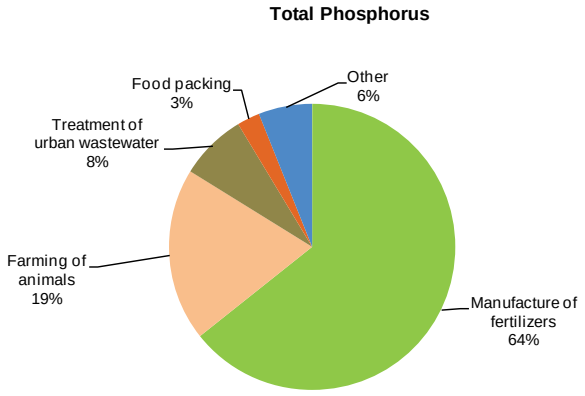
Figure 7 Distribution of releases of total nitrogen from points sources in the Mediterranean region, 2003 (kg/year)



Source: MED POL NBB

Figure 8 Total loads of nitrogen and phosphorus by sector, 2003 (%)





Source: MED POL NBB

Is there progress in the reduction of pollution from industrial activities?

The preliminary results from the National Action Plans which address LBS of pollution in the Mediterranean point to concrete reductions of inputs of pollution from industrial activities since 2003, the reference year. *Figure 9* shows the numbers for some countries.

Figure 9 Percentage of pollution reduction for some pollutants and industrial sectors between 2003-2008 in selected Mediterranean countries

Countries	Sector	Pollutant	% reduction between 2003-2008	% increase between 2003-2008
Malta	Energy Production	BOD	36	
		Nickel	86	
	Oil & Fuel terminal	BOD	36	
		Nickel	38	
Morocco	Overall(Tanger)	BOD	32	
		Total nitrogen		30
		Total phosphorus		40,5
Croatia	Overall release	BOD	19	
Slovenia	Dairy Industry	BOD	22	
	Farming	BOD	62	
	Fish processing	BOD	75,5	
	Cement	Lead(Pb)	98	
	Electronic	VOC	35	
	Organic Chemicals	VOC	97	

Source : MED POL NBB

How do the major land-based pollution sources affect the concentrations of hazardous substances in the Mediterranean marine coastal environment?

Heavy metals and persistent organic compounds enter the Mediterranean from urban and industrial wastewater discharges, run-off from urban/industrial areas and heavy metal contaminated sites, as well as through atmospheric transport. In the marine environment, metals and Persistent Organic Pollutants (POPs) tend to precipitate with settling particles, accumulate in the sediments and ener the food chain.

Based on the available data, it is evident that large cities are critical sources of pollution, since most of the hazardous substances "hot spots" are located in their neighbouring sediments (Alexandria, Algiers, Athens, Barcelona, Genoa, Marseilles, Naplesi, Oran, Port Said, Thessaloniki, Toulon). Also, high concentrations of hazardous substances are found in sediments located in river mouths and estuaries of major Mediterranean rivers (Ebro, Nile, Po and Rhone) and lagoons (Venice lagooon in Italy, lake Manzala in Egypt, Canet, Berre, Thau and Vaccares in France). For other pollutants such as PAHs, atmospheric deposition may be more significant in the transfer of pollution to the open sea (*Figure 10*).

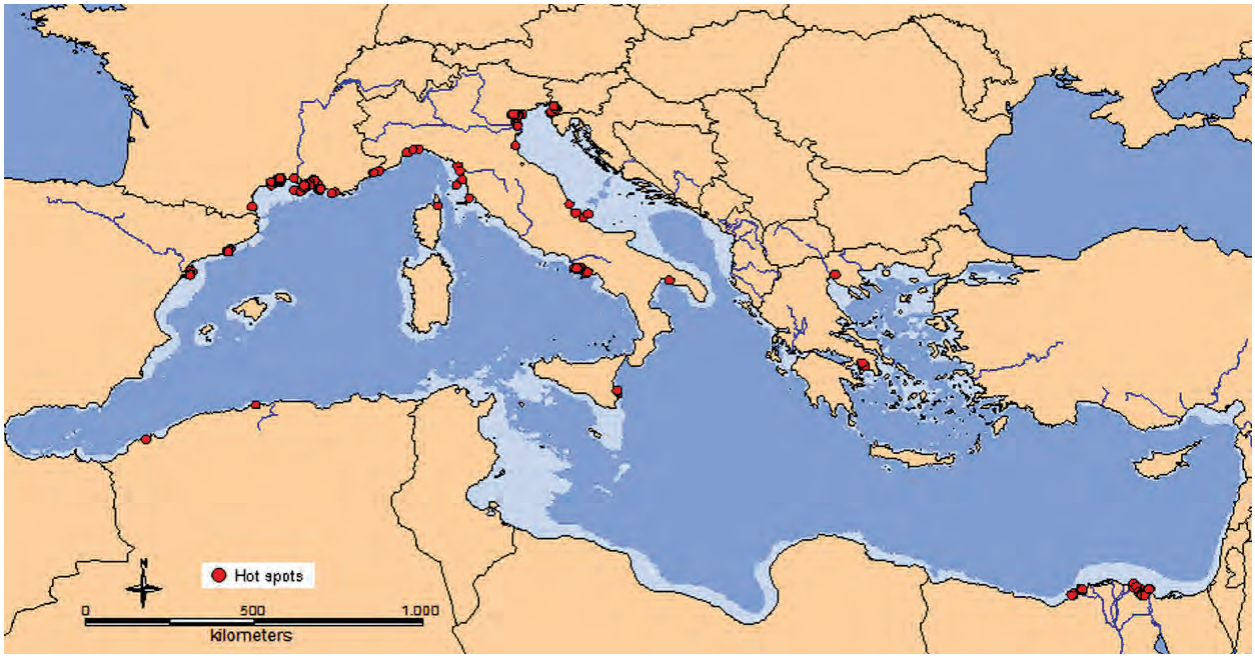
Figure 10 Ranges of PCBs, DDTs and HCB concentrations in sediments (< 10 Km) close from the principal Mediterranean urban centres (> 100,000 inhabitants)

Urban area	Sub-bassin	PCBs (Arochlor, ng/g)	DDTs (ng/g)	HCB (ng/g)
Venice (Italy)	Adriatic	6 – 5600	1 - 43	2 – 2400
Napoli (Italy)	Western Med	2 – 3200	1 - 312	0.2 – 1.3
Barcelona (Spain)	Western Med	6 - 2224	2 - 225	0.2
Pireaus (Greece)	Eastern Med	1 - 775	0.3 - 1406	0.1 – 5.2
Thessaloniki (Greece)	Eastern Med	1 - 299	0.3 - 33	0.1 – 1.3
Alexandria (Egypt)	Eastern Med	0.1 - 96	0.7 - 299	5 - 60
Oran (Algeria)	Western Med	323	-	-
Algiers (Algeria)	Westen Med	-	40	-

Source : MED POL from Gomez-Gutierrez et al, 2007

For example, PCB concentrations in sediments of the Rhone and Ebro deltas ranged from 1 to 472ng/g dw and from 6 to 200ng/g dw, respectively, while in the Po River in the Adriatic, lower concentrations were recorded (13 to 129ng/g dw). Higher PCBs levels were also reported in the River Nile sediments, in the South Eastern Basin (53 - 1500ng/g dw) (*Figure 11*).

Figure 11 Identified hot spots for the concentrations of PCBs, DDTs and HCB [4]in the Mediterranean surficial sediments, 2007



Source : MED POL from Gomez-Gutierrez et al, 2007

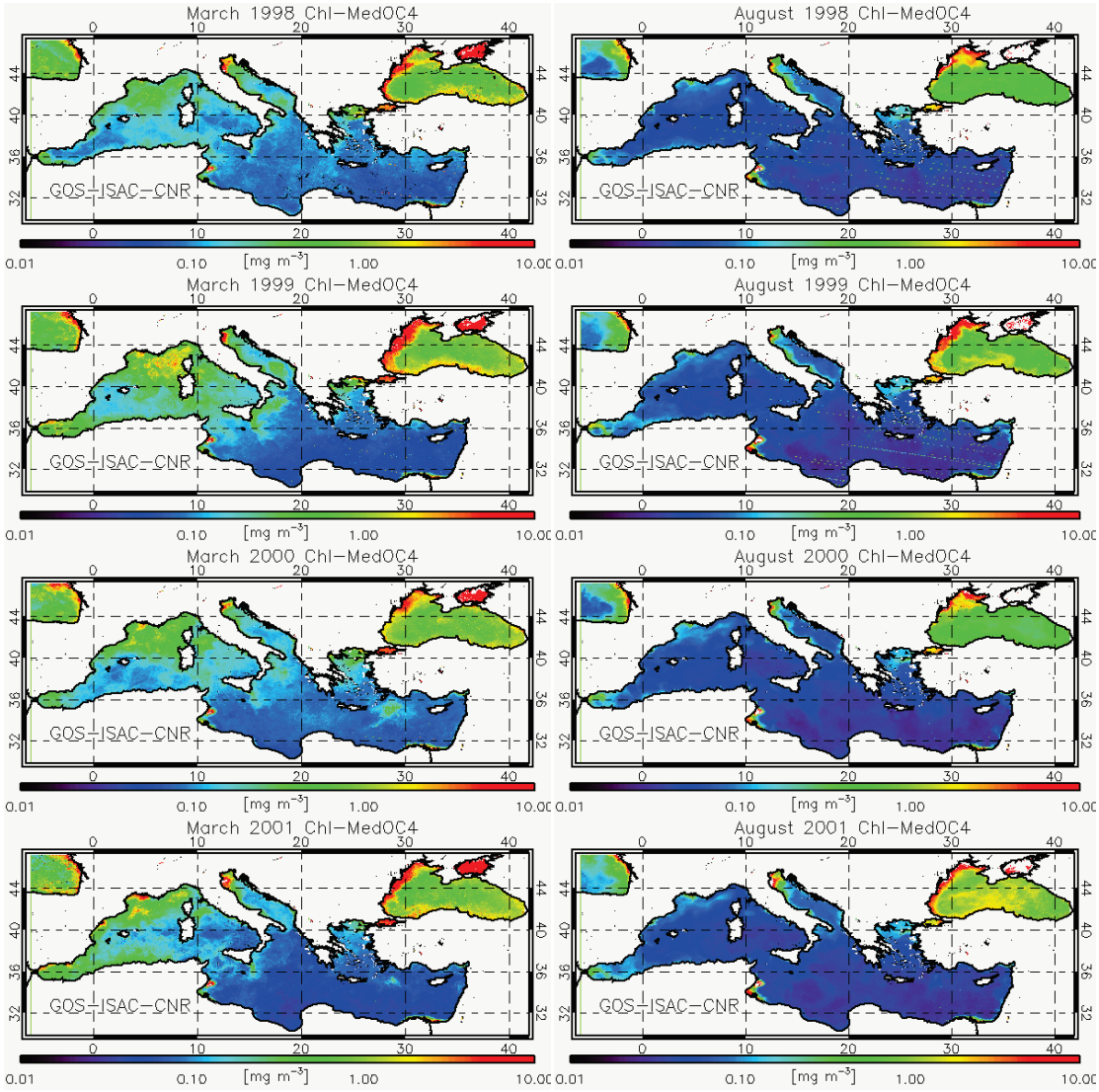
Is eutrophication in the Mediterranean Sea significant?

The Mediterranean basin is characterised by low primary production and low phytoplankton biomass, resulting to high transparency and deep light penetration into the water column. The most eutrophic waters in Mediterranean are more numerous along the northern coastline such as the Adriatic Sea, but areas, such as the Nile Delta are also eutrophic and this problem has been increasing gradually over the last decades.

The eastern part of the Mediterranean is less productive than the western part. However, over the last few decades, the Mediterranean ecosystem has experienced changes in biodiversity due to climatic and environmental change or to accidental inputs of exotic species. But the plankton community, which is the base of the food chain and remains only partly described, is also probably experiencing a drastic change. Observed changes in nutrient concentrations and ratios in the deep waters of the western Mediterranean, as well as differences between the eastern and western Mediterranean, suggest that shifts have occurred in the relative distribution of nutrients and therefore probably phytoplankton species over the whole sea.

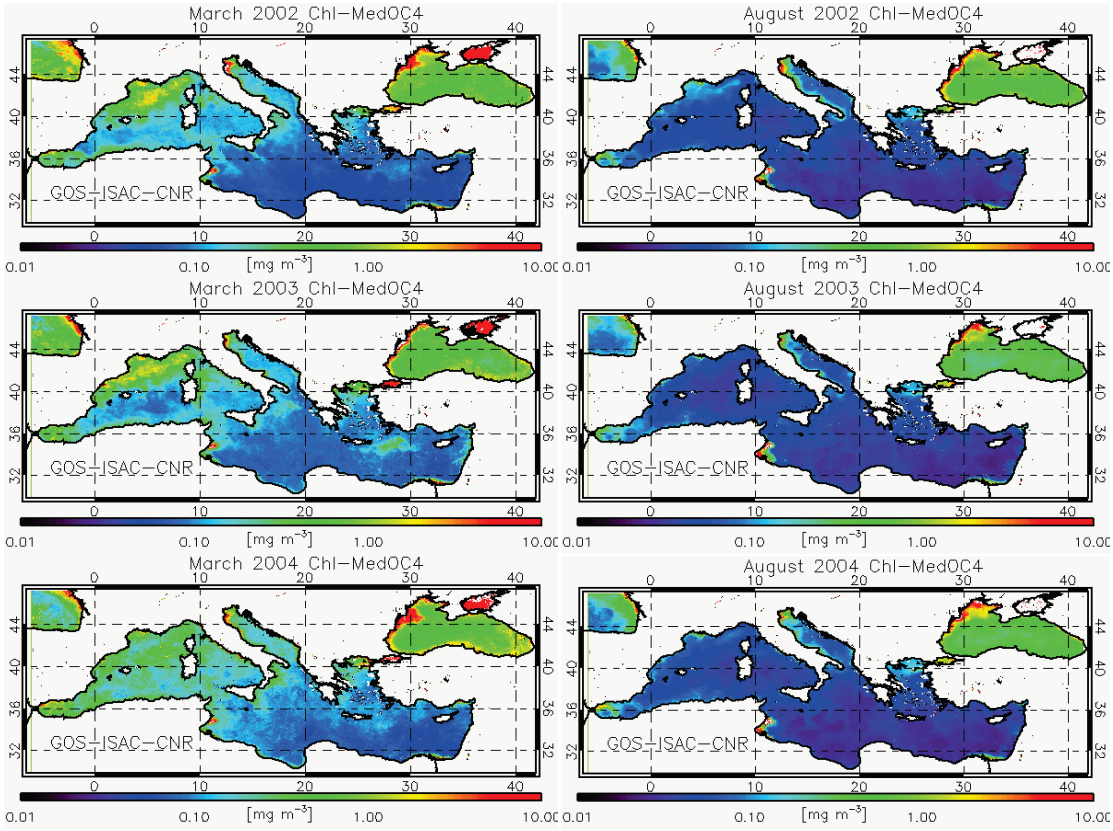
A shift from a diatom-dominated ecosystem to a non-siliceous one (as already observed in some coastal areas, with increasing algal blooms and eutrophication events) may involve the whole Mediterranean Sea and have consequences for fishery and tourism activities.

Figure 12 Chlorophyll-like pigments concentrations in Mediterranean Sea, 1998-2001



Source: Volpe *et al.*, 2005

Figure 13 Chlorophyll-like pigments concentrations in Mediterranean Sea, 2002-2004



Source: Volpe *et al.*, 2005

Satellite images of the Mediterranean show chlorophyll variations in surface waters. The highest levels correspond to the areas close to river deltas or those off large urban agglomerations. Conversely, the open seawaters of the Mediterranean are generally close to oligotrophy except for cases caused by the upwelling of deep waters rich in nutrients. A series of maps (*Figures 12 and 13*) of chlorophyll-like pigments concentrations in the Mediterranean Sea are shown above, corresponding to the spring blooming period (March) and the lowest productive one (August) for each year. These maps are derived from SeaWiFS satellite images and show monthly mean concentrations from October 1997 to December 2004.

What are the concentrations and and trends in hazardous substances concentrations in the Mediterranean marine environment?

Metal concentrations in the flesh of mussels (*Mytillus galloprovincialis)* are often used as an indicator for marine pollution, because bivalves accumulate pollutants in their tissues at elevated levels in relation to pollutant biological availability in the marine environment.

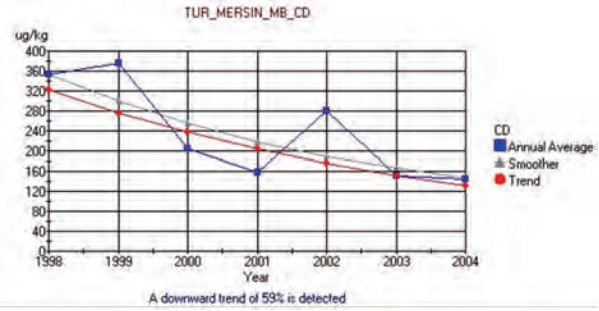
In general, Cadmium (Cd), Lead (Pb) and Mercury (Hg) concentrations in mussels are relatively elevated in the vicinity of urban and industrial areas, compared to those collected far removed from anthropogenic sources of pollution (*figure 14*).

Figure 14 Trace metal concentrations in the blue mussel (*Mytillus galloprovincialis*) in different areas from the Mediterranean Sea

Location	Sampling year	Concentration	References
Mali Ston Bay (Eastern Adriatic)	1998-2005	Cd: 1.15 µg/g dw Hg: 0.15 µg/g dw Pb: 1.09 µg/g dw	Kljatovic-Gaspic et al. 2007
Gulf of Taranto	1999-2000	Cd: 0.23 - 0.77 µg/g dw Pb: 1.19 - 4.29 µg/g dw	Cardelicchio et al. 2008
Turkish-Aegean Sea	2002-2003	Cd: 0.04 - 0.52 µg/g ww Pb: 0.49 – 1.72 µg/g ww	Sunlu 2006
Tyrrhenian Sea	2000	Cd: 0.23 - 0.77 µg/g dw Pb: 1.19 - 4.29 µg/g dw	Conti and Cecchetti 2003
Venice Lagoon	1993	Cd: 0.05 - 4.64 µg/g dw Pb: 6.18 - 80.26 µg/g dw	Conti and Cecchetti 2003

A monitoring programme, will deliver results by the end of 2009. Preliminary results show, in some cases, a downward trend in metal concentrations, which can be interpreted as an improvement of the quality of the marine coastal environment (*Figure 15*).

Figure 15 Cadmium concentration in blue mussels (*Mytilus galloprovincialis) in* Mersin, Turkey (µg/kg)



Source: MED POL NBB

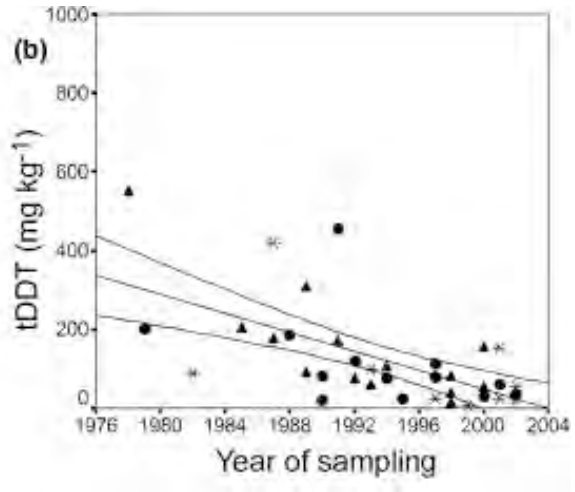
Data collected in the frame of national/sub-regional monitoring programmes point to decreasing concentrations of chemicals (DDT, PCBs), banned for several decades, but in some cases concentrations still remain relatively elevated. This downward trend is usually consistent with the chemical's history of use. For example, DDT was widely used after the 1950s and its production increased exponentially up until the 1970s. Manufacture ceased in Europe in the 70s following legislation which restricted and banned its manufacture and use. Such regulations are applicable to most countries bordering the Mediterranean Sea. In the mussel *Mytilus galloprovincialis*, in the Northwest Basin the total DDT concentrations dropped from 18 – 668ng/g wet weight (average of 146ng/g ww) in 1973-1974 to 4 - 126ng/g ww (mean 26ng/g ww) in 1988–1989.

More recently, an analysis of DDT concentrations in bottlenose dolphins blubber between 1978 and 2002 in different areas from the Western Mediterranean coasts allowed to observe a declining temporal trend between 1978 and 2002 for total DDT concentrations, which decreased by a factor of 23.7 (*Figure 16*).

Similar decreasing trends have also been observed in the concentrations of PAHs in biota using data from RNO (France)[5] and SIDIMAR (Italy). According to the RNO set of data, in French Mediterranean coasts the overall median concentrations of PAH16 in mussels have decreased from 157ng/g dw in 1994 to 73ng/g dw in 2006. Measured levels after the year 2000 are in general lower than those detected in the 90s. In Italian coasts the range of measured levels is very wide, and no clear trend is observed from SIDIMAR data.

Although these results are presenting a positive sign for the quality of the marine environment, they are not conclusive, because they are using small amount of data in geographically restricted regions. More coordinated effort is needed to close temporal and geographical gaps in order to provide a more robust answer to the question whether the Mediterranean marine environment is improving or not.

Figure 16 Decreasing trend in total DDT concentration in bottlenose dolphin blubber from 1978 to 2002, in the Western Mediterranean (mg/kg)



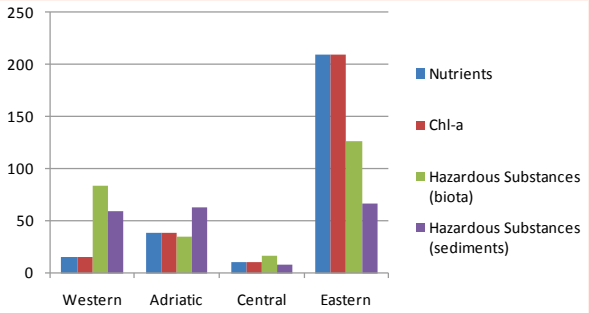
Source: Borrell and Aguilar, 2007

Box 1 MED POL monitoring activities

National marine monitoring programmes generating data and reposting in the frame of MED POL Phase IV Programme

The MED POL monitoring and assessment program started in the mid-1970s and is actually in its Phase IV (2005-2013). MED POL Phase III (1996-2204) and Phase IV monitoring programmes have been designed to cover two different types of marine sites; hot spots and coastal/reference areas. The mandatory monitoring matrices are biota and sediment and the mandatory contaminants Mercury (Hg), Cadmium (Cd), selected halogenated hydrocarbons, pesticides and polyaromatic hydrocarbons. However, some countries include more substances/toxic element in their national programmes. During Phase III and IV of MED POL (1996-today), nutrients and Chlorophyl a (Chl-a) data in seawater have been collected from 275 stations, while data on hazardous substances concentrations in marine organisms (*Mytilus galloprovincialis* and/or *Mullus barbatus*) have been collected form 263 stations. Data on hazardous substances in marine sediments have been collected from 190 stations in the Mediterranean Region (*Figure 17*). However, data are not reported regularly in many cases, leading to important temporal gaps in the time series of data.

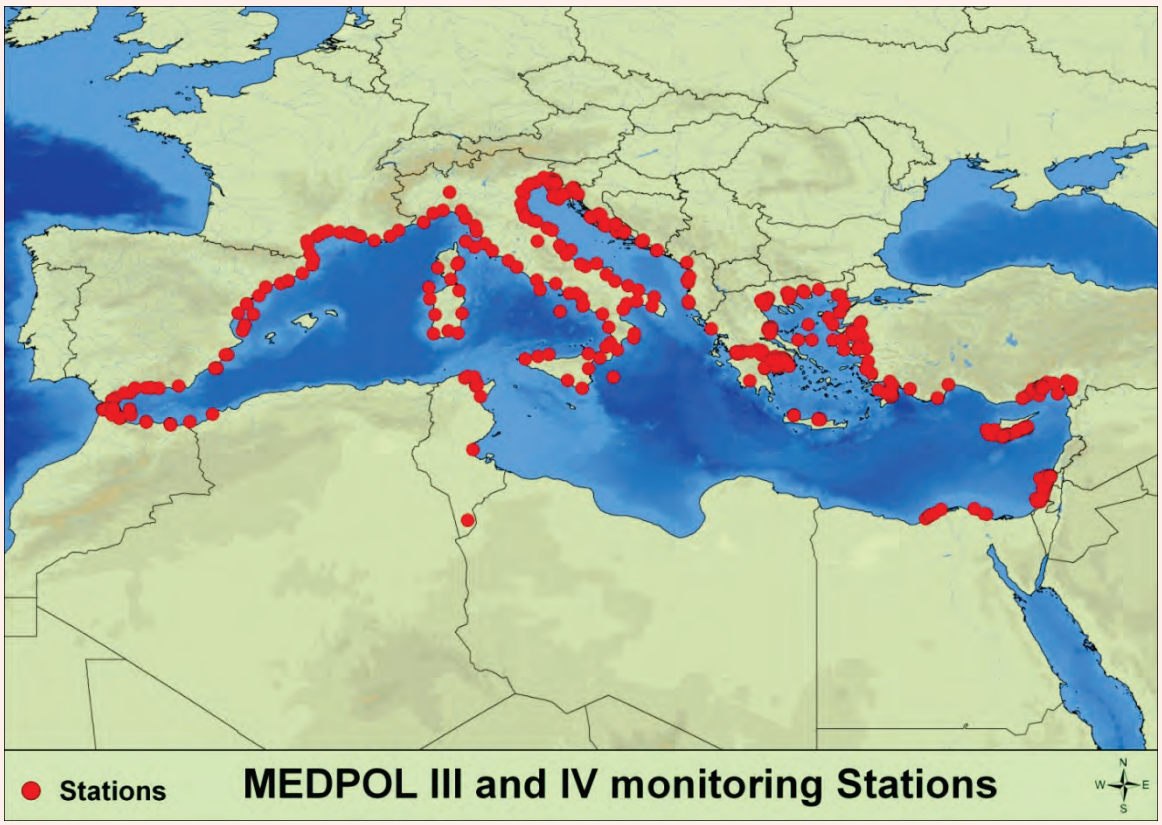
Figure 17 Number of monitoring stations with data uploaded in MED POL database (1996-2008)



Source: MED POL

On the other hand, the geographical coverage of the marine monitoring stations is good in the Adriatic, the northern coasts of the Mediterranean, while extended spatial gaps occur in the north African coast, and in some areas of the Middle Eastern countries (*figure 18*).

Figure 18 MED POL III and IV Monitoring Stations



Source: MED POL

Box 2 The Horizon 2020 initiative to reduce the pollution of the Mediterranean Sea by 2020

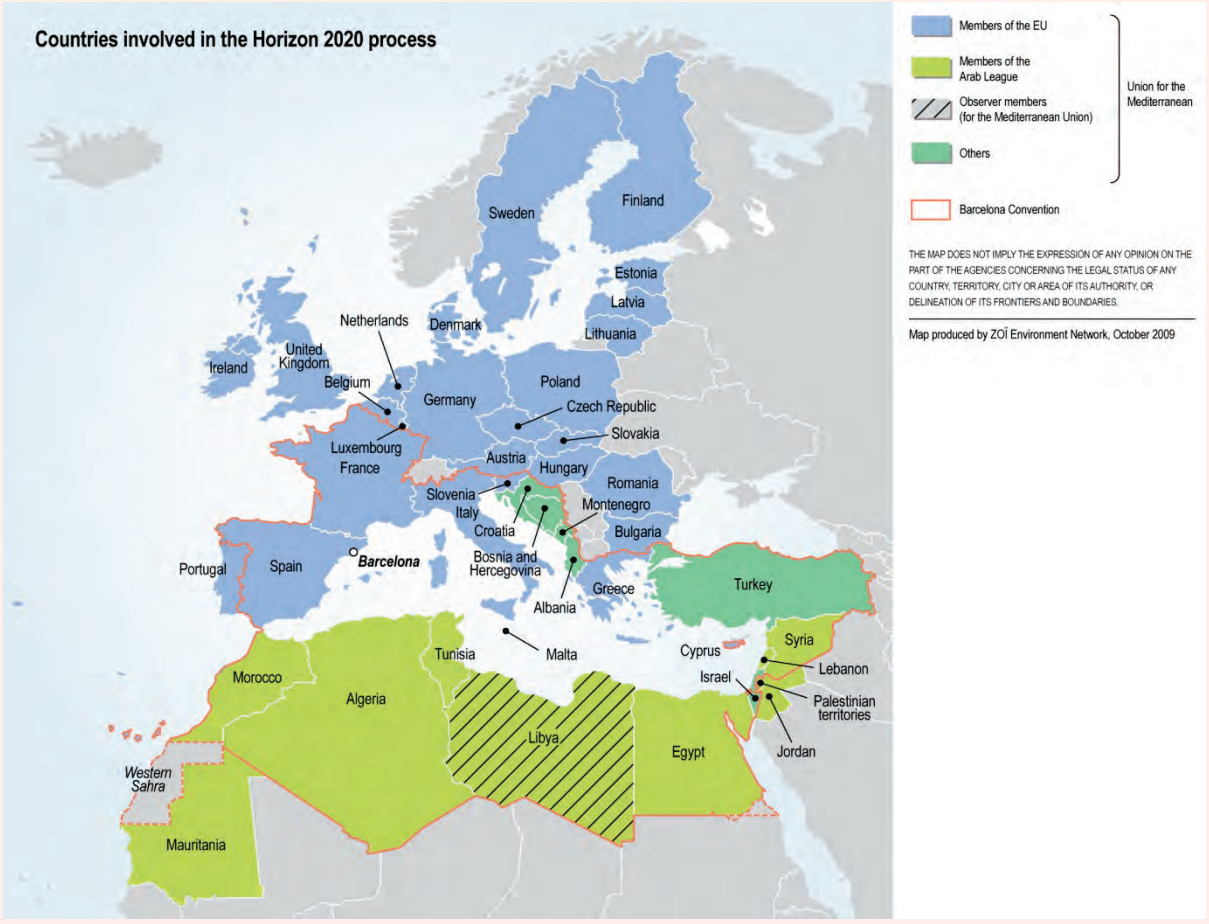
Back in 2005, at the 10th Anniversary Summit of the Euro-Mediterranean Process, leaders of the partnership endorsed the idea of a new push to protect the Mediterranean from the threat of pollution. This initiative has now become known as Horizon 2020. One year later, in November 2006, the Cairo meeting of Euro-Mediterranean Environment Ministers was an important milestone for regional environmental cooperation. The Cairo ministerial agreed on a timetable of concrete actions (Cairo Road-map) covering the period to 2013. In a declaration the ministers agreed to meet in 2009 to review progress.

Horizon 2020[6] is an Union for the Mediterranean initiative that aims at increasing efforts to reduce the pollution of the Mediterranean Sea by 2020.The main objective of the initiative is to accelerate ongoing activities to de-pollute the Mediterranean reduce the most significant pollution sources focusing on industrial emissions, municipal waste and urban waste water, responsible for up to 80% of pollution in the Mediterranean Sea.

A consultative H2020 Steering Group (SG), with a wide membership, was established in 2007. National Contact Points were identified from a wide range of other stakeholders, including international organisations, and financial institutions, as well as representative networks of cities, local authorities, NGOs, business organisations etc.

Within the steering group, three thematic sub-groups were established, to oversee the implementation of the initiative in all its pillars:

- Pollution reduction (EIB leader): to support the identification, prioritisation and implementation of the most significant pollution reduction projects tackling major priority sources of pollution;
- Capacity building (DG Environment leader): to support to the implementation of the Horizon 2020 Initiative identifying key gaps and promoting capacity building actions at regional, national and local levels as appropriate;
- Review, Monitoring and Research (EEA leader): to monitor progress of the implementation of the Horizon 2020 initiative, particularly through appropriate information sharing systems easily accessible to all Mediterranean partners, in cooperation with all partner organizations.



The initiative was considerably strengthened in 2008 when the Euro-Mediterranean Partnership, formerly known as the Barcelona Process, was re-launched as the "Union for the Mediterranean", reinforcing the political dimension of de-polluting the Mediterranean and facilitating the financial leverage for pollution reduction investments, and capacity building projects.

A considerable improvement was also the expansion of the geographical membership of the Euro-Mediterranean Process[7] to include the coastal states of South East Europe (SEE), giving coherence between the geographical coverage of the Euro-Mediterranean Process, in which Horizon 2020 lies and the key multilateral framework for environmental cooperation in the region, the Barcelona Convention. In line with the expansion to cover South Eastern Europe contact points have been requested for these additional countries and H2020 meetings can now be held in this region.

Inbox elaborated by the EEA

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Notes

[1] The Protocol on Land-Based Sources (the LBS Protocol) was adopted on 17 May 1980 by the conference of Plenipotentiaries of the Coastal States of the Mediterranean Region for the Protection of the Mediterranean Sea Against Pollution from Land-based Sources, held in Athens. The Protocol entered into force on 17 June 1983.

The original Protocol was modified by amendments adopted on 7 March 1996 by the Conference of Plenipotentiaries on the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources, held in Syracuse on 6 and 7 March 1996 (UNEP(OCA)/MED IG.7/4). The amended Protocol, recorded as "Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities", entered into force on May 11, 2008.

[2] The Strategic Action Programme (SAP MED) is an action-oriented initiative of the MED POL Programme identifying priority target categories of polluting substances and activities to be eliminated or controlled by the Mediterranean countries through a planned timetable (up to the year 2025) for the implementation of specific pollution reduction measures and interventions.

[3] PAHs are chemical compounds, and occur in oil, coal, and tar deposits, and are produced as byproducts of fuel burning (whether fossil fuel or biomass).

[4] PCBs : Polychlorinated biphenyls are a class of organic compounds; DDT: dichlorodiphenyltrichloroethane is one of the most well-known synthetic pesticides; HCB : Hexachlorobenzene, it is a fungicide formerly used as a seed treatment, especially on wheat to control the fungal disease bunt. It has been banned globally under the Stockholm Convention on persistent organic pollutants.

[5] RNO (French National Monitoring Network) and SIDIMAR (Programma di Monitoraggio dell Ámbiente Marino) are national monitoring programmes.

[6] COM(2006) 475 final "Establishing an Environment Strategy for the Mediterranean".

[7] The Initiative was originally open to all Member States of the European Union and Euro-Mediterranean Countries covered by the European Neighbourhood Policy.

Waste

Oliver Keserue (Plan Bleu)

Closely connected with the economic development of countries the quantity of waste keeps increasing with growing and changing consumption and production. Since the mid-1970s, waste management has become a major concern for Mediterranean countries which have invested massively in collection, treatment and disposal and more recently prevention, control and recycling.

Solid waste pose innumerable direct and indirect risks to both man and the environment in the form of pollution of ground waters and surface waters, contamination of the soil, degradation of natural ecosystems; emissions of greenhouse gases or more harmful dioxins. Malodorous, they can pose a serious nuisance to neighbourhoods while landfills scar landscapes.

What is a waste?

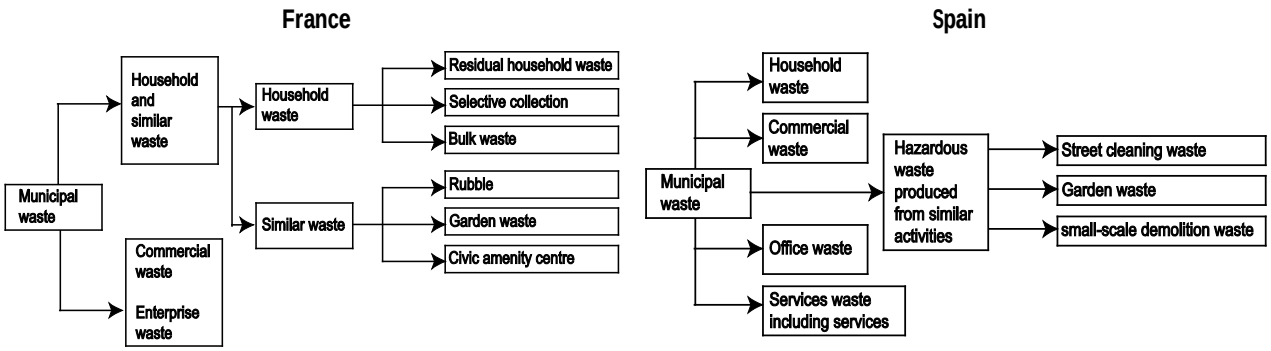
Waste may be generated by extractive and agricultural activities, as by-products of their processing into intermediate or finished products which, once consumed by economic actors and households, lose their usefulness and become waste (*Figure 1*).

The term waste is fairly elastic, and its meaning varies particularly according to whether we approach it from the perspective of a developed or of a developing country; its scope being closely connected to the place that the management of their risks has been granted in policy and law. Nevertheless, for purposes of harmonisation it is commonly accepted internationally that "waste" concerns any substance or object that its holder disposes of or is obliged to dispose of.

While there is general consensus on the definitions of industrial and hazardous waste, that of municipal waste varies greatly between countries, and there is no common definition in the Mediterranean for "municipal waste".

The term "municipal waste" is less elusive when related it to the role of municipalities as guarantor of public health at the origin of municipal services (of public utility) such as waste collection. What is collected, however, may vary considerably but generally consists of waste from households and similar waste generated by high street commerce, private and municipal services, schools and hospitals, workshops and enterprises and sometimes industry. It may also contain spoil earth from street cleaning, while industrial waste is generally collected by parallel collection channels. In the Mediterranean, such a framework typifies Northern Mediterranean Countries (NMCs) and Turkey. In Morocco and Tunisia, for instance, the regulations distinguish between hazardous and non hazardous waste, but the waste generated by small crafts and industrial enterprises, and those generated by markets, are often mixed with domestic waste in most major cities.

Figure 1 Definition of waste in France and Spain



Source: Chalmin

The definition of the term "treatment" is even more difficult to pin down. In the Southern Mediterranean countries, priority is given to clearing urban streets from the hazards that waste pose in terms of vectors of infectious diseases and treatment consists of disposing the waste in largely uncontrolled waste dumps in the outskirts of cities. While uncontrolled in terms of management and containment, in most SMCs, such sites are clearly identified and dedicated by the local authorities to receive waste.

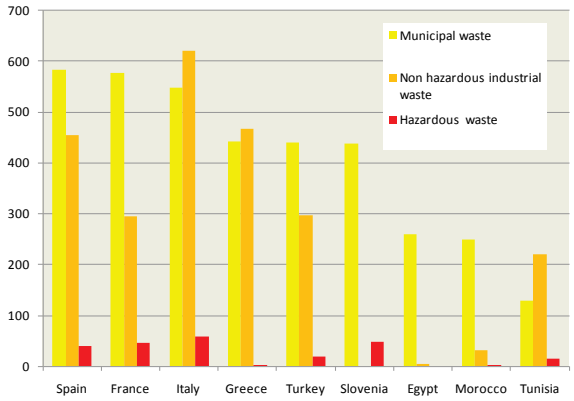
Although significant progress has been made to harmonise definitions, wide variations still prevail which also reflect in the data acquisition methods (declaration, surveys, estimates). Statistics advanced by countries must be interpreted with caution. Thus, collection rates ranging from 70 to 98%, or even 100%, often refer to a specific geographical coverage or to the rates observed within areas served by waste collection services. A high collection rate is also no necessarily guarantee of environmental performance. In Tunisia, for instance, the waste collection rate is estimated at 85% in urban environment, but only 40% of the 2 million tonnes of urban waste produced annually are conveyed to controlled landfills, while 60% are disposed of in 400 unauthorized waste dumps. In Morocco, this concerns 90% of urban waste.

Do Mediterranean inhabitants produce more and more waste?

In the NMCs, the evolution of the waste volumes produced over the period 2000-2005 was of 19% (NMCs-EU), against an evolution by 19% of GDP (constant PPP 2005). This confirms the strong correlation between the evolution of household expenditure and waste production. However, on a per capita basis, the evolution of the waste volumes produced (for countries where time-series are available) over the period 2000-2007 reveals a stabilisation, if not an increase between 2004 and 2007 which corresponds to an economic growth period. The economic crisis of 2009 has also caused a decline by 5 to 10% of the waste quantities in France, but again confirms the strong link of waste generation to economic cycles.

In the SMCs, the situation is similar. In Tunisia, the annual growth of waste volumes is estimated at 3%. According to the World Bank, the annual production of 2 million tons could reach 4.9 million tons by 2030. In Morocco, the annual 5 million tons could reach 6.2 million tons by 2020 (*Figure 2*).

Figure 2 Waste generated per inhabitant in 2006, (kg/inhab/year)



Note: Municipal waste in Egypt refers only to the Governorate of Alexandria
Sources : Eurostat, Chalmin and national sources

The volumes of non hazardous industrial waste production, of manufacturing origin, is similar to that of municipal waste (455 kg/inhab/year, as against 583 kg/inhab/year, for Spain; 220 kg/inhab/year, as against 130/kg/inhab/year, for Tunisia). These volumes reflect the structure of the industrial fabric. Thus, France generates the equivalent of 296 kg/inhab/year of industrial waste. This fairly low level is probably due to the relocation of heavy industrial processes with a high waste intensity, and keeping on its national territory high value added assembly processes which generate only little waste. In Tunisia, almost 700 MT/year of waste, that is, 70 tons/inhab/year, are generated by phosphate mining for the manufacture of fertilizers intended largely for export markets. In Algeria, one million tons of mercury waste have been accumulated over twenty years in temporary storage facilities.

Another sign of the transboundary effects of solid waste concerns the phenomenon of marine litter.

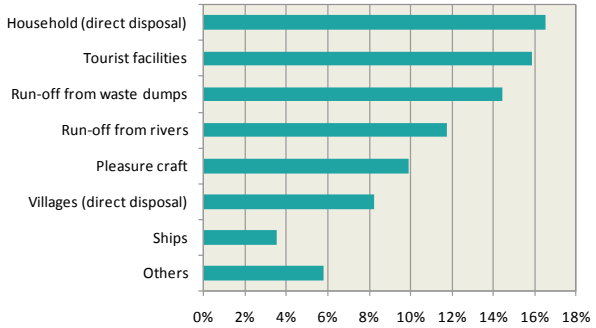
A recent bibliographical study conducted by MED POL on the phenomenon in the Mediterranean concluded that, between 2002 and 2006, the situation had hardly changed.

Marine litter, found in the sea and on the coastline, originate mainly from coastal urban centres. These wastes are generated by direct disposal of domestic waste, tourism infrastructure waste, flows from landfills and rivers (*Figure 3*) and waste from maritime traffic. MED POL observes, in particular, that the management of solid waste in coastal areas is generally not covered by national environmental policies, but by health policies, and that there is

generally no municipal policy of management of solid waste: municipal strategies being geared, above all, to meeting basic standards of public hygiene. For technical and economic reasons, it seems that the sea is still considered as the easiest waste disposal site and that, consequently, the disposal of solid waste into the sea is still common practice for small and medium size towns.

National, regional and international NGOs are active in Mediterranean beach cleaning campaigns. The International Coastal Cleanup (ICC) observes that, in the Mediterranean, the heavy fraction (big household appliances) is on the decrease[1] and that the average weight of waste found in the sea has dropped from 511 g to 258 g. As regards the light fraction, the number of plastic bags, caps and plastic bottles is also on the decrease; the share of plastic found in the sea dominates and composes 75% of collected items. The analysis of the data available indicates that coastal and recreation activities account for 52% of the waste found on beaches.

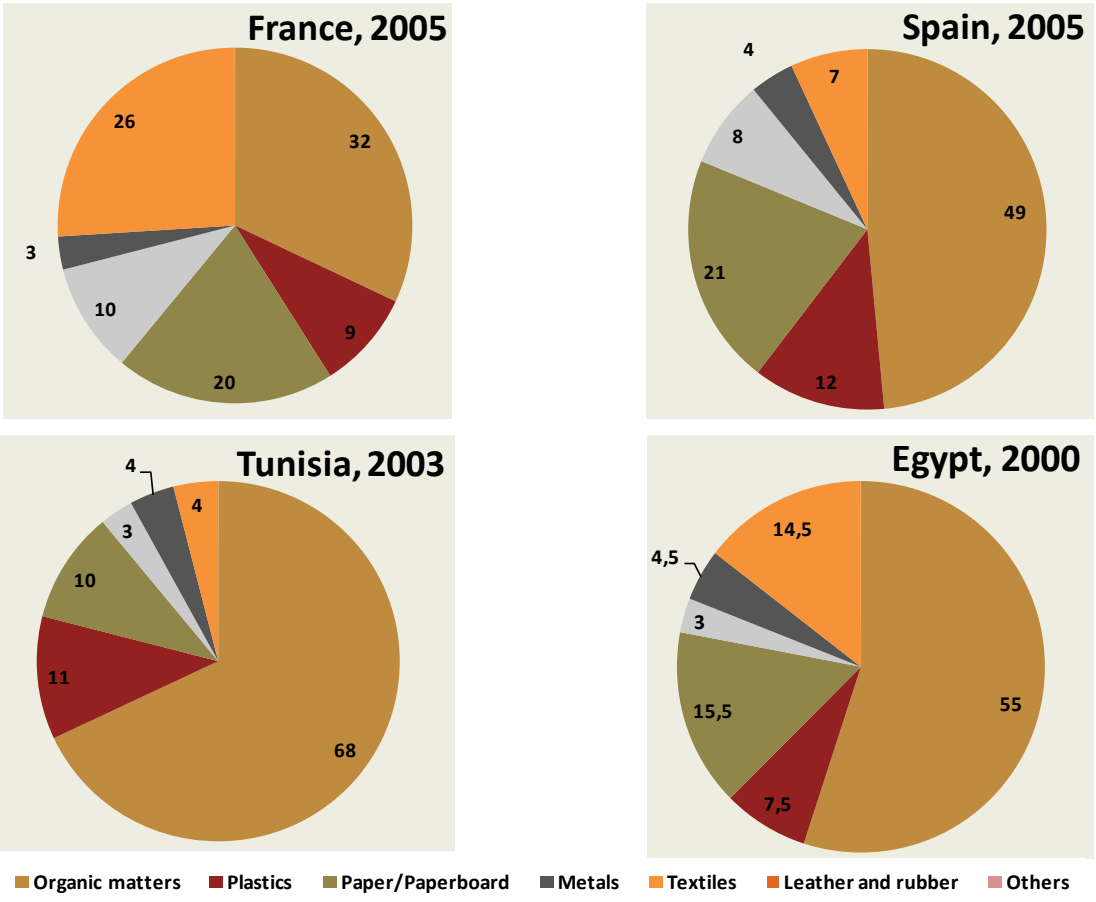
Figure 3 Origin of marine litters in the Mediterranean



Sources: MED POL

MEDPOL is tackling these issues today and has recently published a set of guidelines for coastal cities designed which address the management of municipal waste

Figure 4 Composition of municipal waste in some Mediterranean countries



Sources: Eurostat, World Development Indicators ; OECD, ANGED

Is waste in the Mediterranean more and more hazardous?

With regard to the composition and hazardous character of waste, the recent domestic waste characterisation campaign, MODECOM, in France has noted a qualitative improvement in residual waste since 1993, related in particular to content in chlorinated substances and heavy metals. It is likely that kerbside separate collection or voluntary drop-off at civic amenity centres are significant factors of such an improvement, as well as the lower incidence of industrial waste from small enterprises in municipal waste, or, still, the technological effect which has helped reduce, if not substitute, certain substances (*Figure 5*).

Yet, a whole range of other hazardous substances are now targeted because of the health risks that they represent; and attest to the increasing complexity of the composition of consumer products, most notably of which small electrical household appliances, for which specialised treatment methods are lacking.

Figure 5 Evolution of chemical composition of residual waste in France

Element	Unit	1993	2007
Chlorine	mg/kg	14 000	2878
Fluorine	mg/kg	58	100
Copper	mg/kg	1 048	56
Cadmium	mg/kg	4	1,3
Chromium	mg/kg	183	87
Nickel	mg/kg	48	20
Zinc	mg/kg	1000	301
Mercury	mg/kg	3	0,1
Arsenic	mg/kg	5	2,5
Selenium	mg/kg	0,02	0,22

Source: ADEME

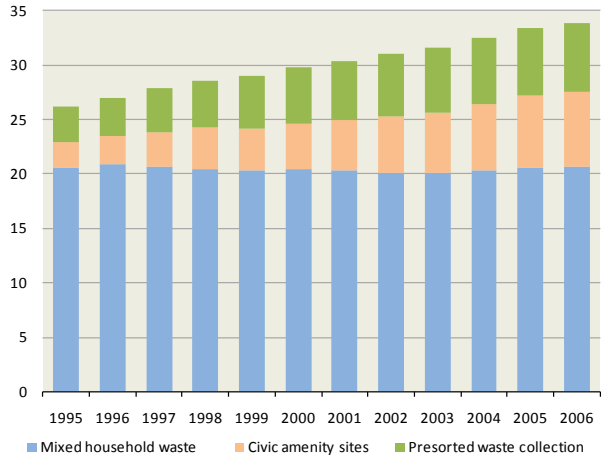
Economic development also induces a very rapid evolution of the composition of waste. While the most visible change relates to a reduction of the organic fraction, with the rise in household income (68% in Tunisia, 49% in Spain, 32% in France), there has been a quite significant growth in the other fractions (paper/cardboard, glass, plastic, textiles/other) with a high calorific value, linked to the changing consumption patterns oriented towards highly packaged products. The Turkish Ministry of the Environment and Forestry, for example, estimates the share of packaging as 38% of domestic waste, that is, 9.5 million tons country-wide. This evolution is also accompanied by an increasing presence of hazardous compounds in bottles (paint and solvents), or batteries in small household appliances (*Figure 4*).

How do Mediterranean inhabitants relate to their waste?

The growing awareness about waste-related environmental issues causes both Mediterranean citizens and the relevant local authorities to contemplate the gaping inadequacy and/or unsustainability of current treatment capacities. The city councils/municipalities, both in the NMCs and in the SEMCs, in their capacity as guarantors of public interest, find themselves having to revisit the scope of services under their control. In the SEMCs, the issue of waste is evolving from a service focused on urban cleanness largely limited to street-sweeping and waste collection, into an integrated service which includes downstream management (treatment and disposal). This requires the closing down, remediation, or upgrading of uncontrolled waste dumps, and the channelling of the waste to engineered landfills, a first step towards a sustainable scenario. In Morocco, such a transition is set out in the new legislation (28-00) on waste. The World Bank estimates that this would require doubling the annual investments to 2.2 billion Moroccan Dirhams[2], that is, a 14% annual increase of municipal budgets. The municipalities would incur an increase in cost estimated as 300 billion Dirhams[3]/year over the next 3 to 5 years. The World Bank stated, back in 2000, that the expenditure for a quite partial collection already claimed up to 50% of the municipal budget for the municipalities of developing countries.

In NMCs, the municipalities are pursuing the process of qualitative upgrading of the treatment sectors not only to cleaner, but also more resource-saving, methods. This transition from dependence on waste landfill to more virtuous treatment technologies, such as material recycling and recovery, comes at a price. In France, for instance, the waste collection and treatment expenditure over the period 1995-2006, expressed in share of GDP, increased from 0.55% to 0.73% of GDP. Translated on a cost per tonne this represents a rise from 249 to 340 € per tonne. In Italy, the cost per tonne in 2005 stood at 217 €.

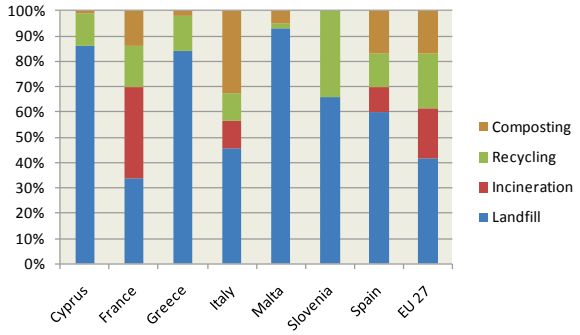
Figure 6 Waste collected by the municipalities in France, 1995-2006 (millions of tons)



Notes: Provisionnal data in 2006; Dom included.
Sources: ADEME- SOeS, 2008

In the NMCs, the trend shows an increase in recycling (the Waste Framework Directive 2008/98/EC, sets a target of 50% by 2020), with an increasing share in participation by households in separate collection or voluntary drop-off to civic amenity centres (+8.6% between 2001 and 2005 in France, *Figure 6*). While such developments may well have contributed to stabilise the residual fraction of waste, the quantities flowing through French households (which will ultimately be recycled, recovered or eliminated) have nonetheless continued to grow exposing the limits of the current legal arsenal to address the fundamental need dematerializing consumption.

Figure 7 Municipal solid waste treatment: distribution between the different recycling and recovery channels, 2005 (%)



Note : In Slovenia, composting is included in recycling.
Source : Eurostat

A consequence of this duality between the 50% recycling objective and the constant increase in volumes is that the treatment methods and capacities prevailing in NMCS do not match the objectives concerning the preservation of resources spearheaded by the European Union (*Figure 7*). This reuse and recycling deficit makes NMCs strongly dependent on international markets to meet their obligations, thus generating transboundary waste flows. Such movements must rely on a strict normative framework to prevent the transfer of waste and hazards to countries that are unaware of the intrinsic risks to which they are exposed.

How to address the issue of informal waste management?

In the SEMCs, the informal sector provides an undeniable service in the management of waste, intervening across all levels of the value chain: from kerbside collection, through to sorting on waste dumps, both as middlemen and as wholesalers. It is a whole self-supporting system, supplementing in part the absence of public services short of public finance to provide them. Though operating in often difficult conditions, an economic activity in its own right is taking shape. Over 10 000 rag pickers have been inventoried in Morocco, according to the Moroccan Social Development Agency, with embryonic syndicates (such as the Association of Cardboard Recovery Workers - ARPC) mainly driven by economic rather than environmental motives. This illustrates one of the paradoxes observed in several emerging countries: rag pickers fear to be taxed if their activity is recognised, while the authorities are reluctant to recognize the public service they provide and which could justify the allocation of public funds.

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Notes

[1] The high cost of conducting measurement campaigns in the seabed tends to overestimate the light fraction more likely to be brought out on land.

[2] ~193 million EUR

[3] ~26 billion EUR

Sanitation

Mohammed Blinda (Plan Bleu)
Georges Kamisoulis (MED POL/WHO)

Inextricable from drinking water supply, sanitation and wastewater treatment have a twofold objective in protecting public health and the environment: it removes wastewater from homes and neighbourhoods, and channels it for treatment before its release to surface waters and the natural environment. In the Mediterranean, access to sanitation and wastewater treatment is still lagging compared to access to drinking water but is above the world average. Since the 1990s, with regional development assistance, significant investments have been made in South and East Mediterranean Countries (SEMCs), which are progressing towards the access to sanitation objectives of the Millennium Development Goals (MDGs).

As for the Northern Mediterranean Countries (NMCs), the servicing of the population in wastewater treatment plants has increased significantly over the past two decades largely due to the European Directive of 1991 on urban wastewater.

What are the characteristics of municipal wastewater in the Mediterranean region?

Municipal wastewater is discharged directly in coastal areas or in rivers flowing into the Mediterranean, either untreated (raw), or having undergone various treatment processes. In certain cases, it reaches the sea by infiltration, following leaks in sewers. In the Mediterranean, municipal wastewater is composed of a mix of domestic wastewater (generated mainly by households) and industrial wastewater. Industrial wastewater is either collected by sewerage systems, or directly discharged into wastewater treatment plants, with or without preliminary treatment. Sewers also collect groundwater and storm water which occur when the discharge pipes are located below the hydrostatic level (*Box 1*).

The wastewater quantity entering the sewerage network depends on a number of factors. For the Mediterranean region, especially in the NMCs, water consumption is in the order of 250 to 350°litres per person per day, this figure is lower in the South and in the East. Between 70 and 80% of the total water quantity distributed reaches the sewerage network (excluding industrial effluent), the remainder infiltrates into the soil (garden watering). The wastewater flow depends both on climate and the size of the community. In coastal communities, seasonal variations may be shaped by tourism. The composition of wastewater depends, therefore, on factors connected with standards of living, weather conditions, water supply systems, water quantities available and composition of industrial wastes.

Box 1 Parameters for analysing wastewater

The key parameters for the analysis of municipal wastewater are: i) the organic load evaluated based on BOD5 (biochemical oxygen demand during 5 days at 20°C) and on COD (chemical oxygen demand), ii) suspended solids (SS), iii) nutrients (nitrogen N, phosphorus P) and iv) pathogens.

The concentration of each substance in wastewater depends on the water consumption per inhabitant per day. In the SEMCs, due to limited water quantities, expressed in low daily consumption, higher concentrations may be expected in domestic wastewater. On the other hand, the NMCs, where industrial activity is intense, are affected by the presence of other substances, such as total dissolved solids, ions (such as sodium, calcium, magnesium, bore), organic compounds (such as phenols, pesticides, chlorinated hydrocarbons) and metals (cadmium, zinc, nickel, and mercury, etc). These substances are particularly worrying in view of their toxicity and their resistance to conventional wastewater treatment methods. Finally, the presence of pathogenic micro-organisms (coliforms, faecal streptococcus, salmonella, etc) in municipal wastewater in the Mediterranean depends on the population's health conditions.

Regarding treatment, there are three levels. Primary treatment helps remove from the wastewater such bodies as coarse wastes, sand and grit, oils and floating matter. Secondary treatment helps eliminate organic pollutants via physical-chemical and biological processes. In general, wastewater treatment plants provide at least these two treatment levels. Tertiary treatment reduces the levels of nitrogen and phosphorus. In certain bathing areas or areas where fishing is practiced on foot, no discharge of wastewater is permitted. Concerning the discharge at sea, the length of the outfall pipe will be calculated so as to guarantee that there will be no effect of pathogenic micro-organisms to human health on the shore.

Is access to sanitation for all achieved in the Mediterranean region?

In 2006, around 47 million rural inhabitants did not have access to basic sanitation. In Egypt 66% of the population is connected while in most NMCs everybody is served. In North Africa, 76% of the population had access to basic sanitation.

The average rate of urban population with access to a sanitation system is around 96%, except for Morocco (85%), Egypt (85%) and the Palestinian Territories (84%).

The disparities between urban and rural areas remain significant and may reach as much as 30% in certain Southern Mediterranean countries: access rates in rural areas are below 70% in Egypt, in Morocco, in Tunisia and in the Palestinian Territories.

Reliance on autonomous wastewater treatment systems (of which septic tanks) remains high in Tunisia (with 32% of the population), Cyprus (65%) and the Palestinian Territories (55%).

Significant progress has been made since 1990. An additional 77 million people have access to enhanced sanitation (*Figure 1*) in large part made possible by investments from regional and international cooperation.

Improving access to these services remains politically challenging due to rural/urban inequalities and the emergence of "pockets" of urban poverty. The urban population is likely to increase by 50 % by 2025 on the Southern and Eastern Mediterranean rims; ensuring access to sanitation services in unregulated peripheral quarters and in medium and small-sized towns is, therefore, a major social challenge in these developing regions. Donors, such as the French Development Agency (AFD), have contributed to the design and implementation of policies destined to develop drinking water services in rural areas in Morocco and Tunisia since 1995. The focus has now shifted to sanitation services in rural areas and the urban periphery (*Box 2*).

Box 2 French commitment for sanitation in Maghreb

National Programme for the Sanitation of Low-Income Quarters in Tunisia

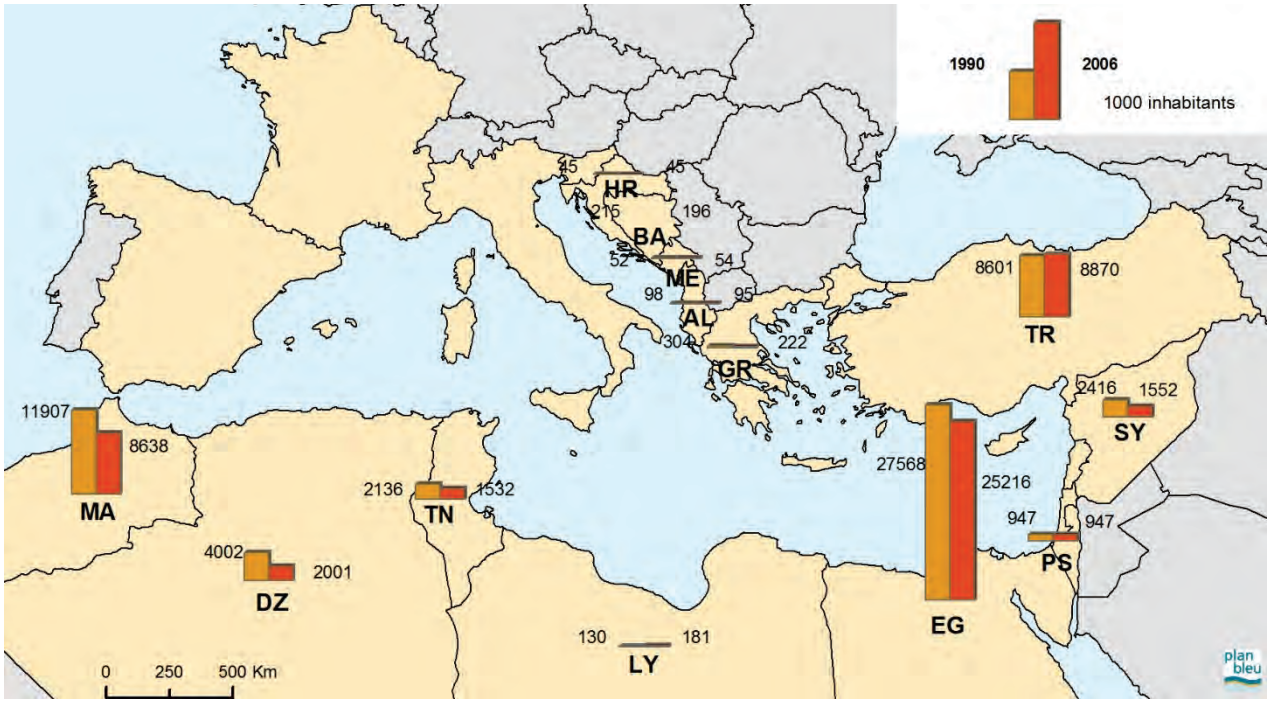
Since 1998, the French Development Agency (AFD) committed 174 million € in support of sanitation in Tunisia. The funding of the National Sanitation Utility (ONAS) has helped it connect 155 000 households, via 1 900 km of sewers, that is, 11 % of total ONAS connections and 14 % of its sewerage network length. In about 20 % of the cases, these works had preceded a housing upgrade operation conducted by the public authorities.

Public service under State control in Figuig (Morocco 2003-2011)

Sanitation is a priority of the cooperation protocol signed in 2000 between the municipality of Figuig, an oasis of 12 000 inhabitants in the Moroccan desert, and the Department of Seine-Saint-Denis. In 2003, it developed into a multi-stakeholder initiative between the Department of Seine-Saint-Denis, the town of Figuig, the Syndicat intercommunal pour l'assainissement de l'agglomération parisienne/ Greater Paris Sanitation Authority (SIAAP), and the Fédération des associations de Figuig/ Federation of the Associations of Figuig in France. Its scope: the construction of a sanitation network and of oxidation basins for the reuse of treated wastewater for agricultural purposes, public awareness-raising and set-up of a municipal sanitation service.

Sources: AFD, 2008, ARENE- Ps EAU – SIAAP, 2009

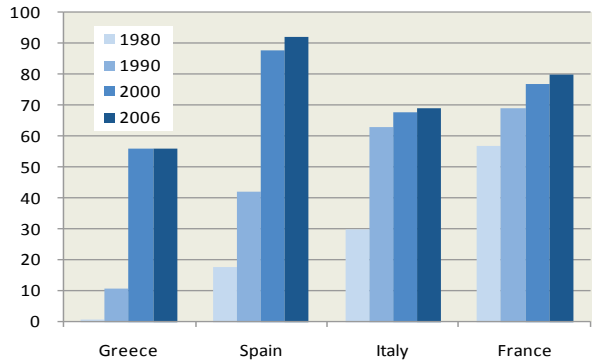
Figure 1 Population without access to sanitation, 1990, 2006 (thousand of inhabitants)



Source : UNSD

In the NMCs, where 100% of the population has access to sanitation, the focus of investments is now on wastewater treatment plants (*Figure 2*). In France, half of its sewerage network is being equipped with a split system (storm water, wastewater), thus allowing better optimisation of wastewater treatment plants.

Figure 2 Trend in the share of the population connected to waste water treatment plants - North Mediterranean Countries, 1980-2006 (%)



Source : OECD

Is all collected wastewater treated?

Not all collected wastewater is treated. In the Mediterranean, the rate of wastewater collected and treated by public sanitation ranges from 7% to 90%. A significant portion of the collected wastewater is, therefore, discharged either into internal waterways or into the sea without prior treatment. Except in Morocco, where the equipment rate is high (80% in 1999), other SEMCs are not or, when these do exist, they rarely use advanced treatment technologies (of the tertiary type)

Nevertheless, over the past few years, countries that experience a certain delay in terms of servicing in wastewater treatment plants have developed strategies with objectives and programmes to address all forms of pollution (*Box 3*).

Effluent from industry is often discharged to public sanitation networks without pre-treatment or to surface waters with devastating consequences to the receiving environment. Its direct discharge in public sanitation networks, normally designed to receive domestic effluent, may also inhibit the bacterial activity essential for the good functioning of the wastewater treatment plants. Nonetheless, the share of on-site treatment of industrial wastewater is far from being generalized. Data is sparse, but those available show rather low rates for on-site treatment (50% in Cyprus, 36% in Turkey and 35% in Israel).

Box 3 The innovative Depollution Plan of the Lagoon of Nador (Morocco)

In 2007, the French Development Agency (AFD) granted a loan to the Moroccan National Drinking Water Utility (ONEP) to overhaul of the sanitation network and the construction of a new wastewater treatment plant in Nador, a town located alongside the largest lagoon of the Mediterranean coastline, a remarkable natural site. A lagoon clean up and protection plan, inspired by the model of "bay contracts" (« contrats de baie ») in France, is intended to harmonise public urban policies to achieve the common objective of safeguarding the lagoon. Serving as a tool for consultation among the various stakeholders (elected representatives, utility managers, estate developers, entrepreneurs, fishermen, civil society, etc), this plan will be implemented with the financial assistance of the FFEM (French Global Environment Facility), in partnership with the Mohammed VI Foundation for Environment Protection.

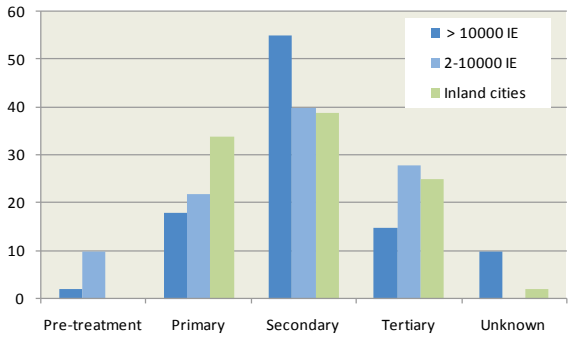
Source: AFD, 2008

Are Mediterranean coastal cities equipped with wastewater treatment plants?

Wastewater discharge into the sea is particularly regulated in EU countries through the Directive 91/271/EC on the treatment of urban wastewater. This prescribes as a minimum the secondary treatment for urban areas in excess 10,000°inhabitants.

The results of a MEDPOL survey, conducted over 10 years on the state of sanitation of coastal cities and of inland cities discharging their effluent into rivers[1], reveal a diversity of situations.

Figure 3 Degree of treatment process of waste water treatment plants in coastal and inland cities, 2004 (%)



Note : IE = Inhabitant Equivalent

Source : MED POL

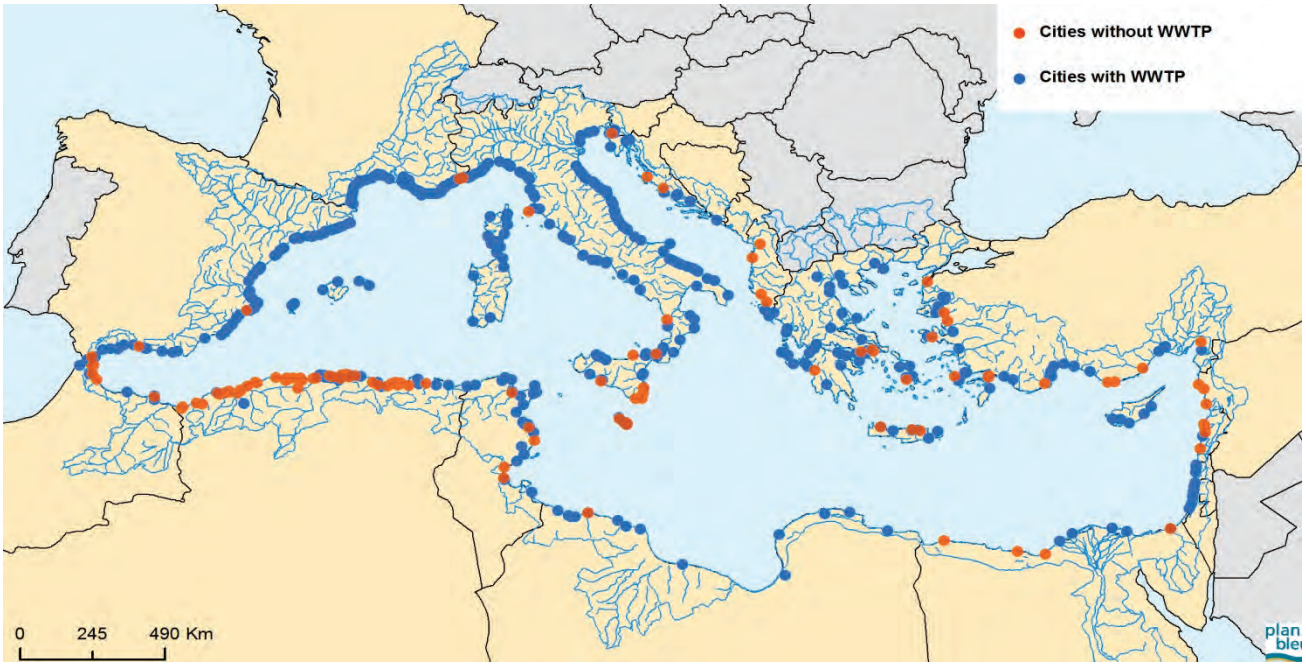
On a regional scale, 40% of municipalities with over 2,000 inhabitants (673 cities out of 1699) are not served by wastewater treatment plants. That is

19%°of the population or 14 million inhabitants (2004) of the Region. A breakdown by type of urban area and level of access to sanitation shows the disparities by type of urbanity: 69% of coastal cities of over 10 000 inhabitants; 49% for smaller municipalities (2000-10,000 inhabitants); and 62% of inland municipalities, the latter discharging directly into rivers.

On a sub-regional scale: in NMCs only 11% of the coastal cities of over 10 000 inhabitants (39 out of the 365 cities) are not equipped; the figure is of 44%°for South and the East (100 cities out of 228) (*Figure 4*).

Wastewater treatment plants involve various processes that are used as stand-alone, or in series, in order to obtain the requisite effluent quality. The most common treatment level is secondary treatment, 55% of the coastal cities of over 10 000°inhabitants, with tertiary treatment still not extensively developed, albeit proportionally more in small cities: 28% and 25% for non coastal cities and 15% in large coastal cities (*Figure 3*).

Figure 4 Localisation of waste water treatment plants on the coast



Sources : MED POL, Plan Bleu

Does the lack sanitation have impacts on the quality of water resources?

A global, or even regional, quantification of the impacts resulting from poor access to sanitation and treatment on the quality of natural water is not straightforward and cannot be solely attributable to water misuse by communities, industry or agriculture, and hence to the behaviour of the users. Poor management of wastewater or inadequate service quality is equally important. For example, Algeria, according to the World Bank, benefits from a rate of connection to the sanitation networks of 80%, but the service quality remains poor, with several sewers being clogged or are inadequate to cope with the population's needs. Besides, most of the 49 wastewater treatment plants of the country are not working. The wastewater collected is thus released untreated in waterways and the sea posing a hazard to public health and the environment.

It is also difficult to quantify in volume terms the loss of water resources resulting from pollution, as this result in increasing treatment costs rather than its outright removal from the stock of available water resources.

The incidence of pollution on the production and quality of drinking water includes: a decrease in the level of water quality achievable; higher costs of production of drinking water or change in supply source; increased inequalities in access to drinking water – particularly true for nitrate pollution.

In 1991, 96 communities (754,000 inhabitants) in Spain were supplied with water with nitrate levels above the legal threshold of 50 mg/l and for 193,000°inhabitants this exceeded 100 mg/l. In France, a report by the Directorate General for Health (2008) found that, in the Department of Eure-et-Loire, 28 % of drinking water was distributed with nitrate contents above the legal threshold of 50°mg/l, that is, slightly less than 50,000 people concerned. Similarly, in 2007, non-conformity to the authorised limit for pesticides in water was reported in 1398 water distribution facilities.

The adoption of comprehensive and integrated approaches to drinking water and sanitation services: A course of action towards a more sustainable management?

The investment backlog for sanitation and particularly in wastewater treatment, compared to drinking water supply equipment, is considerable and impacts on the quality of the resource. This in turn compounds water supply and creates "tensions" between the two "services". It is from the perspective of health protection and the conservation of water resources that the sanitation and wastewater treatment situation must be examined.

In Egypt, the low wastewater prices and low cost recovery have led to the neglect and sometimes abandonment of wastewater treatment plants. In 2004, the government engaged a reform of the drinking water and sanitation sectors which led to the creation of independent commercial operators in an attempt to ensure recovery of the costs of operation, depreciation and capital investments. These new enterprises (Holding Companies) have the dual responsibility for drinking water and sanitation. While the Egyptian Water Regulatory Agency (EWRA) has maintained a supervisory role, reviewing and monitoring all water and wastewater sector activities.

The lack of financial and human resources often constitutes an obstacle to water management. While delivering considerable medium-term savings, in infrastructure and the impact avoidance, sustainable water management requires considerable investment: purchase of sanitation and water treatment equipment. To bridge this investment gap, and access to all in South and East Mediterranean Countries, regional and international cooperation and development aid must be put to task.

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Notes

[1] These are cities of over 2000 inhabitants located alongside major rivers flowing into the Mediterranean (in Albania, Algeria, Croatia, France, Greece, Italy, Morocco, Spain, and Turkey).

Health issues

George Kamizoulis (MEDPOL/WHO)

Throughout the centuries and long before the start of the industrial revolution, men have been using the sea as the most convenient place for the disposal of solid and liquid wastes resulting from human activities. The sea's self-purification ability has been largely over used. Dumping of domestic, industrial, and radioactive wastes, as well as the run-off from agricultural products have not only created considerable hazards to human health but have also endangered the marine environment.

The direct discharge of untreated wastewater into aquatic environment is one of the predominant reasons for the microbial pollution and deterioration of the marine environment. The presence of pathogenic micro-organisms in the marine environment may result to impacts on public health, through direct contact with polluted seawater and/or sand and through consumption of contaminated seafood.

Which are the health risks in bathing waters and shellfish growing areas?

In both coastal and freshwaters the point sources of pollution that cause most health concern are those due to domestic sewage discharges. Diffuse outputs and catchments aggregates of such pollution sources are more difficult to predict. Discharge of sewage to coastal and riverine waters exerts a variable polluting effect that is dependent on the quantity and composition of the effluent and on the capacity of the receiving waters to accept that effluent. Thus enclosed, low volume, slowly-flushed water systems will be affected by sewage discharges more readily than will water bodies that are subject to rapid change and recharge.

Recreational waters generally contain a mixture of pathogenic and non-pathogenic micro-organisms. These micro-organisms may be derived from sewage effluents, the recreational population using the water, livestock, industrial processes, farming activities, domestic animals and wildlife. In addition, recreational waters may also contain free-living pathogenic micro-organisms. These sources can include pathogenic organisms that cause gastrointestinal infections following ingestion or infections of the upper respiratory tract, ears, eyes, nasal cavity and skin.

The principal burden of disease is via the faecal-oral route. The number of micro-organisms that may cause disease or infection depends upon the specific pathogen, the form in which it is encountered, the conditions of exposure and the host's susceptibility and immune status. For viral and parasitic protozoan illnesses, this dose may be very few viable organisms.

The types and numbers of pathogens in sewage will vary depending on the incidence of disease in the contributing human and animal populations and the seasonality of infections. Numbers will therefore vary across the Mediterranean region and will be different from northern Europe and other parts of the world. As a tourist destination, the tourist population on the one hand may influence the pathogen numbers in the sewage and on the other hand be susceptible to local pollution.

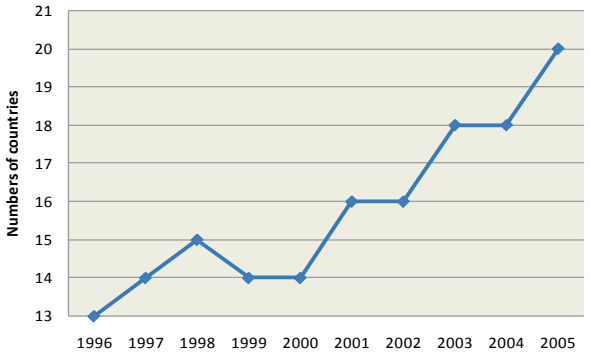
Seafood – and particularly molluscs normally eaten uncooked – is a commonly implicated vehicle for the transmission of infectious diseases caused by enteric micro-organisms (including bacteria and viruses) that enter the marine environment through the disposal of urban/domestic wastewater. Pathogenic bacteria can remain viable in the sea for days to weeks, and viruses can survive in the marine environment or in the tissues of fish and seafood for months. Filter-feeding shellfish – whose breeding areas are often placed near sources of nutrients, such as wastewater outfalls or polluted estuaries – are highly prone to concentrating high levels of pathogens.

Numerous problems contribute to shellfish-associated infections. These problems regard handling the growth beds and storing, processing, labelling, and shipping the product—as well as lack of education. To reduce the risk of contaminated shellfish reaching restaurants, the European Union have recently established legislative standards that focus on the number of micro organisms per 100 g of shellfish flesh.

How many Mediterranean countries provide data on the microbiological quality of coastal waters?

Since mid nineties regular monitoring of microbiological quality of coastal waters is developed in the Mediterranean countries. The number of participating countries has grown from 13 to 20 in 2005 with a slight downturn between 1998 and 1999, the overall number of sampling points has risen steadily indicating that more extensive areas of the Mediterranean are being monitored (*Figure 1*).

Figure 1 Number of countries submitting data on the microbiological quality of coastal waters, 1996-2005



Source: MED POL

Are bathing waters in the Mediterranean coastline safe to be used for recreation?

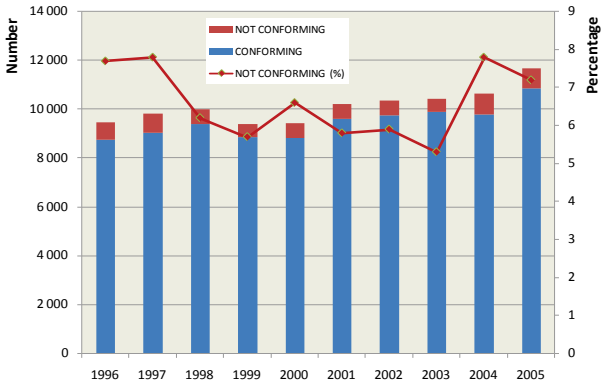
During the period 1996-2005, there has been a near stagnation in the percentage of bathing waters conforming to national standards (from 92.3% to 92.8%), with fluctuations during the period (*Figure 2*). Quality of those areas where monitoring takes place appears to have steadily increased until 2003 and then a slight worsening of quality are seen in 2004. A slight improvement is seen between 2004 and 2005. It should be noted that data only refers to waters that are officially monitored and there may be a number of bathing areas which are used for recreation that are not monitored.

The positive trend for bathing water is also noticed in the number of sampling points, where samples were collected for analysis. In fact, following a minor decrease in 1999-2000, the number of sampling points was increased from 9,500 to 11,600 sampling points per year. The results confirm that every year more and more countries with an increasing number of sampling points implemented monitoring programmes.

Although there is no real trend evident during the sampling period it can be seen that, 50% of the countries submitting data for 2005 achieved over 90% compliance with national standards for bathing water quality. Malta, Cyprus, Greece, Turkey and Monaco all achieved 100% compliance with their national standards by 2005.

It should be noted that different countries have participated each year in the survey and national legislation differs slightly from country to country. However, there is a geographical imbalance in the distribution of the sampling points, the northern and western parts of the region submitting data from a greater number of sampling points than the east and the south).

Figure 2 Number and percentage of bathing water areas complying and non-complying with the national legislation per year, 1996–2005



Source: MED POL

Can the situation be improved?

Although in the recent years, a lot of improvement was noticed either in implementing monitoring programmes or providing compliance data, there is still more to be done particularly in the Eastern and Southern parts of the Mediterranean. In general terms, the amount of microbiological data on seawater for bathing purposes has increased in comparison with the 1984-1994 decade; however no substantial growth was noted for the shellfish growing waters.

Regulatory schemes for the microbial quality of recreational water have been largely based on percentage compliance with faecal index organism counts. Management actions are retrospective and can be deployed only after human exposure to the hazard. In many situations, the risk to health is primarily from human excreta, yet the traditional indices of faecal pollution are also derived from other sources.

The response to non-compliance, however, typically concentrates on sewage treatment or outfall management. Beaches are classified as either safe or unsafe, although there is, in fact, a gradient of increasing variety and frequency of health effects with increasing faecal pollution of human and animal origin.

In addition to microbiological state of coastal waters, system for beach evaluation has been developed since 2001 (BARE – the Bathing Area Registration and Evaluation system) and applied ever since mainly in the Mediterranean region. The system evaluates beaches, based on their water quality, but also on their nature values, safety facilities, scenery and litter (See Chapter on *Coastal Zones*).

As mentioned previously, around 93% of bathing waters conform to the legislation, showing that the general situation remains unchanged, even with the increase of sampling stations and number of data. There is still a lot to be done for achieving a compliance percentage of about 97-99%, which will provide better degree of safety to the bathers. However, a better look at the national compliance data shows that in some countries including those of the EU, the data conforming to the legislation are in the range of 98-100%.

As regard the protection of shellfish waters, the European Council adopted early in 1979, a Directive (79/923/EEC) to protect and improve the quality of shellfish waters, and was applicable to the four Mediterranean Member States (France, Greece, Italy and Spain). The aim of defining quality objectives for shellfish waters was to protect the development of shellfish populations from the principal sources of pollution. The Directive stresses that it cannot, by itself, ensure protection of consumers of shellfish products, and that it is therefore necessary to take other measures to this effect. With this in mind, the Council adopted in 1991, the Directive 91/492/EEC, which lays down the health conditions for the production and the placing on the market of live bivalve molluscs.

As noticed in a survey conducted between 1983 and 1994, the lack of monitoring data on shellfish growing waters precludes an assessment, both on the current situation and on any progress effected since. Only a limited number of countries provide compliance monitoring data, even in the EU countries. However, the general situation should be viewed in the light of incidence of gastrointestinal diseases and disorders, both among coastal populations and tourists. Admittedly, overall morbidity statistics in themselves are insufficient, as practically all disease caused by pathogens are capable of being contracted through media other than the marine environment and most in fact, are probably so caused. However, this deficiency is offset in many countries by the strict quality

standards imposed on shellfish destined for human consumption through public health and related legislation that also includes surveillance and early warning systems in the EU countries.

Box 1 Health issues related to consumption patterns

Are food consumption patterns sustainable in the Mediterranean region?

According to FAO, global studies highlight that both in developed and developing countries largely plant based diets have been swiftly replaced by high-fat, energy-dense diets with a substantial content of animal-based foods whose excessive consumption leads to excessive intakes of fat.

In the Mediterranean region, dietary changes in countries like Egypt have been associated with increasing proportions of energy-dense foods and saturated fat. In that country, food patterns have changed towards increasing intakes of fats and oils, high-fat products, sugar, meat and refined carbohydrates, and decreasing cereal consumption. In 2000, cereals' contribution had declined to 52%, while animal protein's had increased to 20%.

Due to the generalization of bad nutrition habits, obesity and its related health problems as heart disease, hypertension, stroke, and diabetes, are becoming a problem for both developed and developing countries.

In the Mediterranean, obesity increase rates are especially worrying in EU Med countries as France, where child cases of obesity are increasing by 17% annually (by 2020 France might reach the U.S. obesity and overweight rate of more than 65%) and Spain where one out of two adult persons is overweight and about 14% are obese. Nevertheless, overweight and obesity is becoming also a major health problem in Med developing countries as Morocco, Tunis or Lebanon. For example a disturbing increase in the prevalence of overweight among children has taken place over the past 20 years in Tunisia while in Morocco obesity increased from 4% in 1984 to 10% in 1998. Half of all women in both countries are overweight or obese. In Lebanon, studies reckon that the adult Lebanese population is at increased risk of cardiovascular diseases, obesity and other non-communicable diseases due to the rather high contribution of fat to daily energy intake, the low intake of fish and the relatively high percentage of people consuming less than the recommended amount of fruits and vegetables.

What are the key messages to promote the shift to sustainable patterns of food consumption?

According to FAO, the broad parameters for a dialogue with the food industries are: less saturated fat; more fruits and vegetables; effective food labelling; and incentives for the marketing and production of healthier products. Likewise, in working with advertising, media and entertainment partners, there is a need to stress the importance of clear and unambiguous messages to children and youths. Global "health and nutrition literacy" requires a vast increase in attention and resources.

In the Mediterranean, the protection and promotion of the so-called "Mediterranean diet" has demonstrated to be a key element in the development of both healthy and sustainable lifestyles in the region. In this respect, the MSSD states the need to "create a conducive regional environment to help countries develop policies and efficient procedures for the labelling and quality certification of Mediterranean food products and to promote the Mediterranean diet".

Source: Magali Outters from CP/RAC

There is still much to be done in terms of improving bathing water quality and shellfish waters in the Mediterranean, particularly in the south and eastern part of the region. It is likely that bathing water quality will need to be further improved as legislation is tightened. The EC bathing water Directive for example has been revised and will require higher standards of quality. It will be difficult for improvements to be made if there is not a better understanding of the sources of pollution, and in particular the balance between point source and diffuse sources.

Identification of sources of indicator organisms forms an important part of water quality management allowing targeted risk management and remediation to improve water quality and protect public health. Improvements will also need continuous training courses and intercalibration exercise in microbiological methods (including data quality assurance and updating of the relevant procedures for the implementation of the legislation). In addition, capacity building assistance should be provided for sampling methods, microbiological methods of seawater analysis, good laboratory practice and the assessment and control of health risks deriving from swimming, or from consuming of shellfish.

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Marine Biological Invasions

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Biological invasions in marine habitats represent a recognized worldwide threat to the integrity of native communities, to economy and even to human health. Invasive species are believed to accelerate the decline of native populations already under environmental stress, leading to population losses and extinctions on a local scale, but not globally. The extent of the impact has been so severe that invasive species are regarded as the second biggest cause of biodiversity loss after habitat destruction, constituting one of the four greatest threats to the world's oceans on local, regional and global scales.

What is an alien? Who are they?

A species, subspecies or lower taxon, introduced outside its natural past or present distribution; includes any part, gametes, seeds, eggs, or propagules of such species that might survive and subsequently reproduce[1].

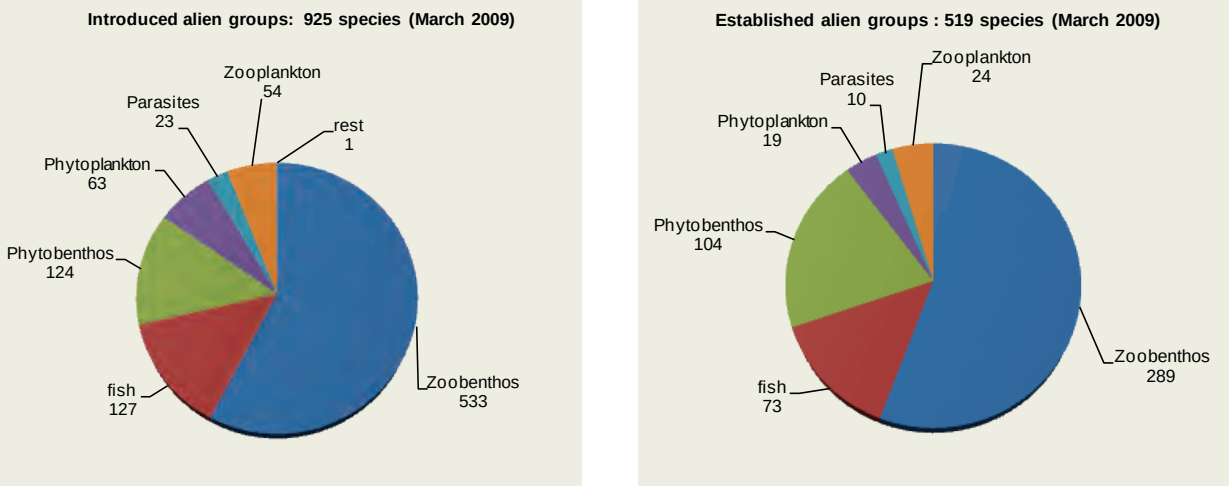
There are currently 925 alien species of which 56% (519 species on the 12 000 known) have established durable populations and are spreading[2]. The bulk of the alien species recorded in the Mediterranean are seabed living animals (zoobenthos), plants (phytobenthos) and fish (*Figure 1*) living in the littoral and sub-littoral zones. Among the seabed animals the dominant group is the molluscs (216 species) followed by crustaceans (106 species) and sea worms (80 species).

How did they arrive?

A classification according to the means of introduction shows that the majority of aliens in the Mediterranean entered through the Suez Canal (47%), followed by vessels (28%) and aquaculture (10%). The majority of aliens in the Eastern Mediterranean entered through the Suez Canal, whereas Aquaculture and shipping are powerful means of introduction in the North-Western Mediterranean and in the Adriatic Sea (*Figure 2*).

The increase in vessel-transported aliens may be attributed to the increase in shipping volume throughout the region, due to the development of the Middle Eastern oil fields and later, the ascendance of the South-East Asian economies. Similarly, the increase in intentional and unintentional commercial introductions (primarily mariculture, but also ornamental, bait and edible species) follows the rise of shellfish production.

Figure 1 Distribution of alien taxa in the Mediterranean, March 2009



Note: The updated list includes all alien species found in the Mediterranean biogeographic area, rectifies previous errors (Zenetos *et al.*, 2006, 2008) and provides new records reported until March 2009.

Source : Hellenic Centre for Marine Research database

Figure 2 Mode of introduction of aliens (last available data)

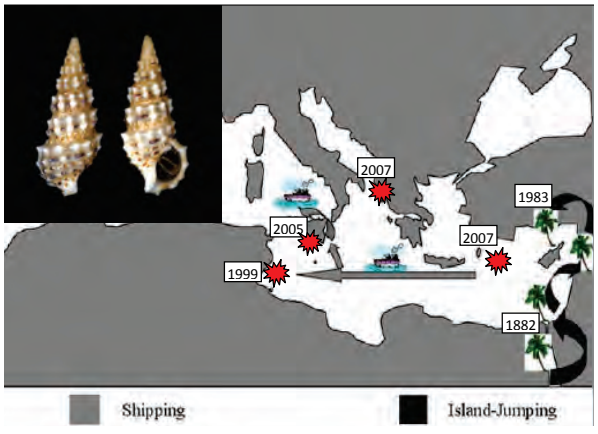
	South-Eastern Mediterranean	Western Mediterranean	Average in the Mediterranean
Suez Canal	81%		47%
Shipping	13%	34%	28%
Aquaculture	3%	42%	10%
Aquaculture/Shipping		9%	

Sources : Galil, SPA/RAC

It has been assumed that the progressive penetration of Indo-Pacific species through the Suez Canal and along the coasts of the Levant is a result of ''natural'' dispersal (the so-called Lessepsian migration). Indeed, a temporal succession of «island jumping» records from the Red Sea, the Suez Canal, and along the coasts of the Levant confirms a species status as a naturally dispersing alien[3].

However, vessel-transported dispersal is feasible as well. It is well known that ships have in more than one instance dispersed marine organisms from one part of the world to another. A good example is illustrated in the dispersal mechanism of the Indo-Pacific mollusc species *Cerithium scabridum* (*Figure 3*).

Figure 3 Interpretation of the mechanism of dispersion of an Indo-Pacific mollusc species Cerithium scabridum



Note: Years indicate first sighting/collection dates, grey arrows indicate shipping, black arrows indicate island-jumping

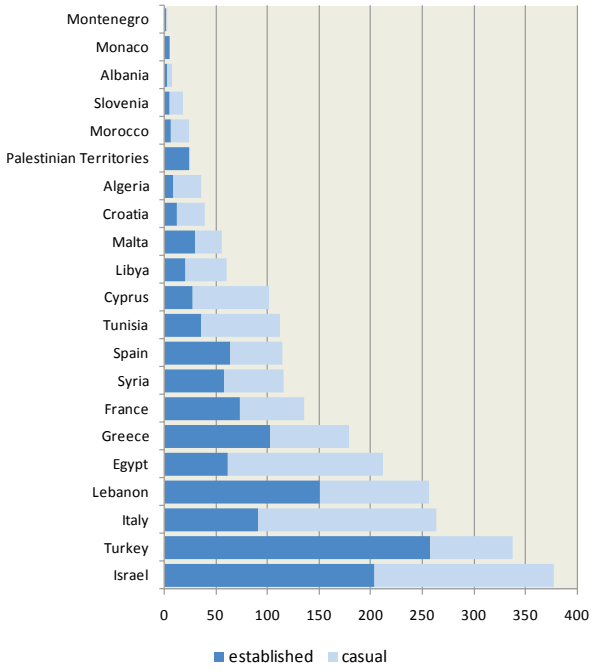
Source: Modified from Garilli & Caruso, 2004 with data from Zenetos *et al.*, 2009; Crocetta *et al.* 2008.

Who studies them?

The study of biological invasions in the marine environment has grown over the past three decades, as it has been widely recognized that the littoral and infra-littoral biota in many regions had undergone rapid and profound changes caused by the introduction of alien species. New records encountered in the frame of research programmes as well as record reported by amateurs as for example on crabs, molluscs, fish are immediately published.

The realization that ports may become focal points of biotic invasion have induced researchers to pay attention to alien taxa. The Mediterranean Science Commission (CIESM) has published an illustrated atlas of alien species providing a comprehensive inventory for the Mediterranean: four volumes (Fish, Decapod & Stomatopod crustaceans, Molluscs and Macroalgae) appear in digital format. Review papers/websites on a country basis are available for Israel, Turkey, Malta, Italy and Greece and in preparation for Tunisia, Spain. Data on a country level and sub-regional level is archived at a Hellenic Centre for Marine Research (HCMR) database. Many have established durable populations and extended their range: 157 alien species have been recorded from five or more countries.

Figure 4 Number of established[4] (dark blue) and casual[5] (light blue) records of marine aliens per country, March 2009



Note: Numbers for Palestinian territories (not reported after 1950), and Monaco (reported with France) are underestimates.

Source : Hellenic Centre for Marine Research database

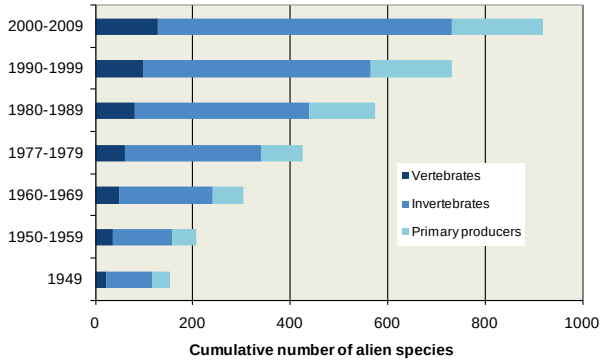
Considering that the main doorway for aliens is the Suez Canal, it is not surprising that Israel and Turkey occupy the first places in Figure 4, with more than 350 alien biota. It is worth mentioning

that Lebanon, with a limited coastline, has invested a lot in international collaborations investigating the topic and the results are impressive. The high number reported in Italy may be attributed to major harbours such as Trieste, Otranto, Naples, that are exposed to a strong inflow of ship-borne aliens as well as lagoons (e.g. Venice) used for aquaculture which may serve as foci for primary introductions and for secondary ship mediated dispersal within the Mediterranean.

Is the trend in new introductions declining?

By mid 90s, about 150 alien species were known as introduced in the Mediterranean. Of the 770 species sighted in the 1950-2009 period, invertebrates are the most dominant group (515 species).

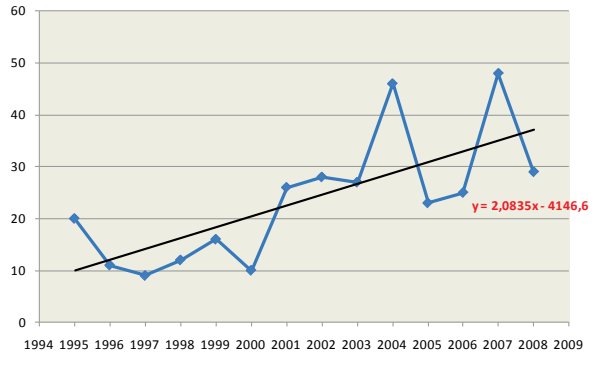
Figure 5 Trend in alien species after 1950



Note: Dates correspond to the year the species were first sighted

Source: Hellenic Centre for Marine Research database

Figure 6 Rate of new aliens reported over the last 15 years



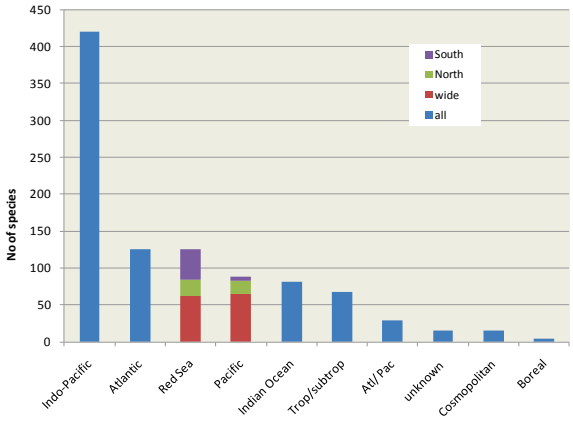
Source: Hellenic Centre for Marine Research database

Figure 5 shows that the numbers of alien species which have been recorded in the Mediterranean each decade over the past 60 years, have increased in recent decades with 187 species discovered and reported since 2000. The temporal records of the alien species reflect political crises, economic development and scientific interest in studying the phenomenon. An increasing rate is clearly seen after 1995. On average the rate of introductions has increased from one new species reported every 4.5°weeks to 1 species every 1.3 weeks (*Figure 6*). Bearing in mind that some 2008 issues are delayed, it is obvious this is an underestimate.

Where do they come from?

The majority of aliens are warm-water species originating from the Indo-Pacific, Red Sea or Indian Oceans (*Figure 7*).

Figure 7 Origin of alien species



Source: Hellenic Centre for Marine Research database

The origin differs greatly among the basins of the Mediterranean. The native ranges of the Western Mediterranean aliens are spread over 'the seven seas', while the Levantine aliens mostly originate in the tropical Indo-Pacific or parts thereof (Indo-Pacific 46%, Indian Ocean 23%, Red Sea 13%).

What causes the phenomenon?

The possible causes for the epic scale of invasion in the Mediterranean Sea may be explained as the synergetic effect of multiple stressors - pollution, eutrophication, destruction and fragmentation of habitats, fast-expanding mariculture , enlargement of the Suez Canal, increase in maritime traffic , and climate change. According to European Environment Agency, in the Western and Eastern Mediterranean, the average increase in Sea surface temperature (SST) has been 2.2 and 2.6 °C between 1982 and 2003 respectively (*Figure 8*). The present-day Mediterranean marine biodiversity is undergoing rapid alteration. Because of the increased occurrence of warm-water biota, it has been said that the Mediterranean is under a process

of "tropicalization" or more exactly as a meridionalization.

Why do we care? Impact

The impacts of introduced alien species have been extensively reported and many cases of their ecological, economic and health threats have been recorded. It is argued that alien species have increased the biodiversity of the Eastern Mediterranean.

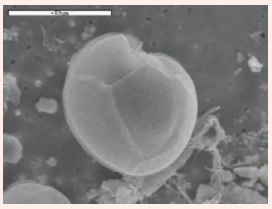
Box 1 Selected cases of well established aliens extending their geographic range

- The tropical seagrass *Halophila stipulacea*, one of the first lesseptian species in the Levantine Basin, was reported in within the harbour of Palinuro (Salerno, Central Tyrrhenian Sea, Italy) in 2006.
- The comb-jelly species, *Beroe ovata*, and *Mnemiopsis leydyi*, (one of the 100 world worst invasive species) that was present in the Eastern Mediterranean since 1990, were detected in the north most part of the Adriatic.
- The killer algae, *Caulerpa taxifolia* (one of the 100 world worst invasive species), restricted in the Western Mediterranean, has invaded the Levantine Sea: reported from Iskenderun Bay in 2006.
- The bluespotted cornet-fish, *Fistularia commersonii*, one of the most recent invaders in the Levantine Basin, was spotted as west as Spain and Algeria.

By definition, alien species have a negative impact on biodiversity. Though no extinction of a native species is known, sudden decline in abundance, and even local extirpations, concurrent with proliferation of aliens, have been recorded. For example, in Izmir the alien bivalve *Anadara demiri* is making up 93% of the biomass at one site. The marine flora of the Thau Lagoon includes 58 macrophytes (25% of the total flora). Local population losses and niche contraction of native species may not induce immediate extirpation, but they augur reduction of genetic diversity, loss of functions, processes, and habitat structure, increase the risk of decline and extinction, and lead to biotic homogenization. Indeed species traditionally restricted in one basin are expanding their distribution range (*Box 1*). Thus, globalization seems to be a reality.

Box 2 Is human health threatened?

Potential impacts on public health, such as those arising from the documented records of harmful algal blooms (HAB) of alien microscopic algae, are obviously of high concern to the public. The presence of the toxic dinoflagellate *Ostreopsis ovata* in various areas such as North Aegean raises concern as it was found to produce a toxin, analog of palytoxin (putative palytoxin, p-PLT). The detection of *Gambierdiscus* sp. cells on the west coasts of Crete in September and October 2007 is the first record of the causative agent of ciguatera in the Mediterranean Sea.

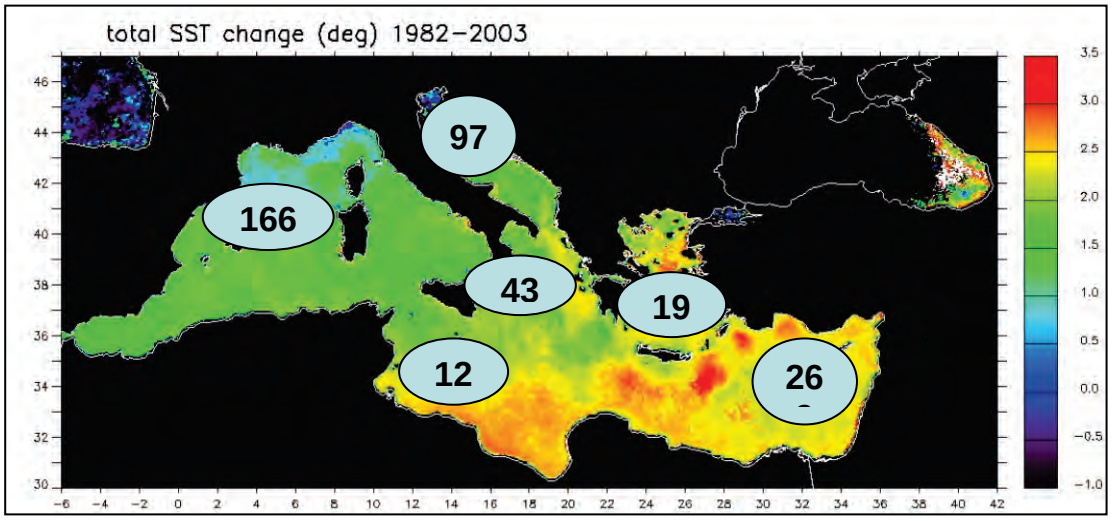


Gambierdiscus
Credit K. Aligizaki

Lagocephalus sceleratus
Credit de S. Kalogirou

The silverstripe blaasop *Lagocephalus sceleratus*, a toxic fish of the Indo-Pacific living on sandy and muddy substrates of shallow coasts, has dramatically spread in the eastern Mediterranean. First discovered in 2003 (Southern Turkey) has spread rapidly in the Levantine Sea reaching also the north Aegean . The species contains tetrodotoxin that may cause food poisoning . During 2005-2008, thirteen patients aged 26-70 years were hospitalised in Israel after consuming *L. sceleratus*.

Figure 8 Sea surface temperature (SST) change in the Mediterranean 1982-2003



Note: Numbers indicated new alien species reported after 1982
Sources: EEA 2006a, SPA/RAC

Everyone is worried: EU, CBD, IMO, GEF, MAP

The introduction of alien species into Mediterranean coastal waters has recently increased, and many of these species have proved to be invasive. Whether intentional or non-intentional, alien species represent a growing problem due to the unexpected and harmful impacts they cause to the environment (biodiversity changes), economy (e.g. fouling organisms) and human health (Harmful Algal Blooms introduced via shipping and/or Aquaculture) (*Box 2*).

Alien species is of high relevance to:

a) the Barcelona Convention;

b) the Common Fisheries Policy (introductions from aquaculture and accidentally introduced species with them);

c) the Bern Convention on the Conservation of European Wildlife and Natural Habitats which offers specific advice to countries and international organizations on measures to combat the threat of bio-invasions;

d) the International Maritime Organization (IMO) Convention for the Control and Management of Ship's Ballast Water and Sediments;

e) the EC Water Framework Directive (WFD): work is in progress focusing on how to evaluate impact of alien species for the assessment of ecological status as well as on how to take them in account when setting reference conditions for biological quality elements.

The Bern and the Barcelona conventions are showing concern and so is the IMO, the Global Environment Facility, the European Union through the Common Fisheries Policy, the WFD and the Marine Strategy Directive and their activities reflect this.

Within the Mediterranean Action Plan (MAP), both UNEP/MAP and the Regional Activity Centre for Specially Protected Areas (RAC/SPA) are now active in multiple ways. European and Mediterranean activities towards inventorying, monitoring preventing and mitigating the phenomenon since 2003 are summarized in Box 3.

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Box 3 European and Mediterranean activities towards inventorying, monitoring preventing and mitigating marine biological invasions since 2003

At EU Level	At Mediterranean Level
2003: The Convention on the Conservation of European Wildlife and Natural Habitats'' adopted in 2003 a ''European Strategy on Invasive Alien Species'' (http://www.coe.int/).	2003: Elaboration of the "Guidelines for the development of Ecological Status and Stress Reduction Indicators".
2004-2006: EU funded the DAISIE programme (SSPI-CT-2003-511202). Inventory of alien species, including list of 100 worst invasive. 23 occur in the Mediterranean.	2003: Adoption of the "Action Plan concerning species introductions and invasive species in the Mediterranean Sea".
2004-ongoing: EEA: "SEBI2010 WG5" Trends in alien species. Includes a list of worst invasive aliens, 41 of which occur in the Mediterranean (EEA 2007 and SEBI2010).	2004: Elaboration of "Fact sheets on marine Pollution Indicators including alien species as a biological indicator".
2006: Council Directive 2006/88/EC of 24 October 2006 on animal health requirements for aquaculture animals and products thereof, and on the prevention and control of certain diseases in aquatic animals	2005: RAC/SPA convened a regional workshop to identify the most important taxonomic and geographic data gaps, and to propose guidelines for the prevention of biodiversity loss caused by vessel and mariculture-introduced alien species (Rome, 6-7 December 2005).
2006: EEA and UNEP/MAP: Report on Priority Issues in the Mediterranean. Alien species as one of the six Key Issues.	
	2007: UNEP/MAP through its regional activity centres REMPEC and RAC/SPA is participation to the IMO/GEF/UNDP GloBallast Partnerships Project, which overall aim is to reduce the risks and impacts of marine bio-invasions caused by international shipping.
2008: European Marine Strategy Framework Directive (2008/56/EC).	2008: Presentation to the Contracting Parties to the Barcelona Convention of the "Guidelines for controlling the vector of introduction of non-indigenous species and invasive marine species" (UNEP/MAP-RAC/SPA, 2008a) and "Guide for risk analysis assessing the impacts of the introduction of non-indigenous species" 2009: Fact sheets (UNEP/MAP/ Plan Bleu)

Some steps are already being taken in these directions, more are needed.

These are well described in the Action Plan concerning species introductions and invasive species in the Mediterranean Sea. The most important step to be undertaken at present, is the setting-up of a regional mechanism for collecting, compiling and circulating information on invasive non-indigenous species.

In addition, some urge is required to the Mediterranean countries to ratify the IMO Convention for the Control and Management of Ships' Ballast Water and Sediments. By May 2009, only five Mediterranean countries, Albania, Egypt, France, Spain and Syria, have signed the Convention

Box 4 Caulerpa taxifolia – The history and monitoring of a biological invasion

Caulerpa taxifolia is a macrophyte, which was introduced into the Mediterranean by accident. First spotted covering a 1 m² patch close to Monaco's oceanographic museum in 1984, it was to proliferate rapidly. By 1989 it had colonised an area of 1°hectare along the French coast, which grew to 3 hectares by 1991.

Faced with such a rapid spread, the national and subsequently the international authorities took action and set about eradicating the species. Various approaches were tested, some more scientific than others: pulling up the plant manually or mechanically (suction dredges, grabs...), using underwater canvas sheets to block photosynthesis, use of chemical substances (salt, copper, dry ice, chlorine) intended to kill off the plant. Despite their variable effectiveness, none of these techniques was to prove capable of halting the spread of the species, all the more so given its marked ability to colonise through fragmentation of the thallus and the fact that its spread is encouraged by human activity (particularly anchoring).

The year 2000 marked a new stage, with more than 13°000°hectares having been colonised, sightings in 6 Mediterranean countries (Croatia, Spain, France, Italy, Monaco, Tunisia) and over 190 km of coast affected (3 100 hectares and 70 km of coastline for the French coasts alone), but more particularly with colonies being spotted outside the Mediterranean, in California and Australia.

The spread of *Caulerpa taxifolia* is still on-going , with a further Mediterranean country (Turkey) having been affected since 2006 and the affected area continuing to rise, with 8,600 hectares having been colonised by late 2007, affecting over 136km of coastline (for France alone). It is currently proving impossible to eradicate the species, apart from in highly localised sectors. Thus, the California site was targeted by a successful chemical eradication campaign (chlorine discs) over 5 years and to the tune of 3,34 million dollars. Given the cost of such operations, only some of the sites affected have introduced systems to monitor the spread of the species, public information and awareness-raising campaigns and eradication procedures intended purely to protect a limited geographical scope (some 3 000 € per year for about one kilometre of coast in the PACA region).

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Notes

[1] http://www.cbd.int/invasive/terms.shtml.

[2] Data on a country level and sub-regional level is archived at a HCMR database (updated for March 2009). Sources for the full list and details on species distribution are: published research papers, review papers on a country basis, (available for Israel, Malta, Italy and Greece) and two relevant papers (Zenetos et al., 2006; 2008) on alien species that are the result of a collaboration of experts across the Mediterranean, who have co-authored these publications or have acted as consultants to the Hellenic Centre for Marine Research database.

[3] In fact, there is a progression from one to another species of exotic species from the Red Sea to the Mediterranean which is why the species has spread naturally (and still do) towards the mainstream when the man opened one lane of traffic between two entities originally isolated (Red Sea and the Mediterranean).

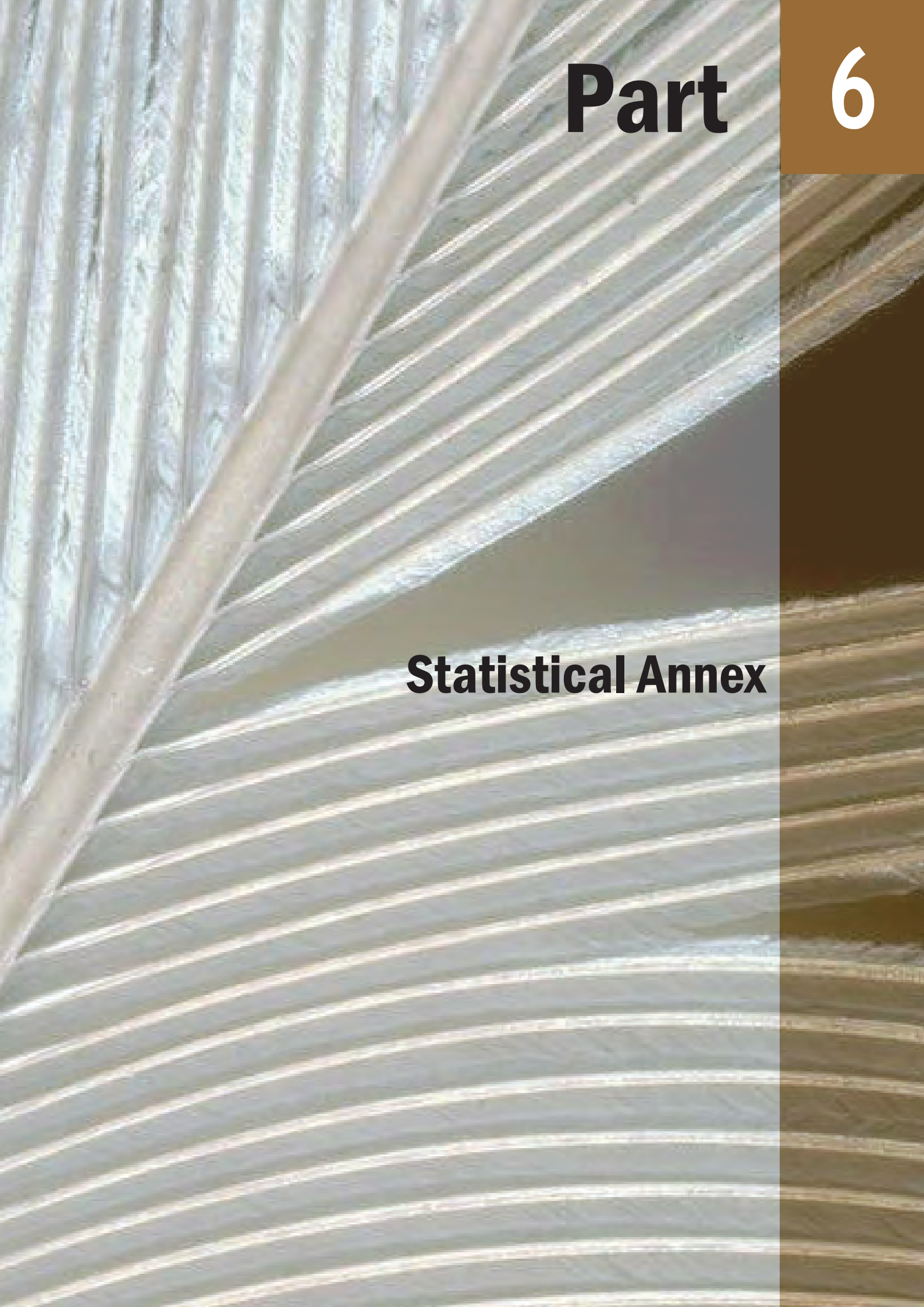
[4] Established: Introduced or feral population of species established in the wild with free-living, self-maintaining and self-perpetuating populations unsupported by and independent of humans. As established here are also classified species with at least two records spread over time and space in the sense of CIESM atlas series. Synonym: Naturalized.

[5] Casual species are identified those having been recorded only once (no more than twice for fishes) in the scientific literature: they are presumed to be non-established in the basin. In this paper casual is used in the same sense as alien in the CIESM atlas series.

In Conclusion

The report highlights the sharp contrasts of the Mediterranean, by showing that despite undeniable progress over recent years in matters of marine pollution and of ecosystem conservation, considerable efforts are still required to anticipate the impacts of climate change, to more parsimoniously manage rare natural resources, such as water and energy, to curb biodiversity loss, to preserve such coveted landscapes as coastal zones and to promote more sustainable modes of production and consumption. But these chapters also reveal that the Mediterranean is in need of further study, as current trend analyses and descriptions are weakened by the lack of data, of reliable information, comparable over time and space, to point to the realities of the pressures on the environment and its present state, the effects of responses to the stakes at hand. It is therefore a necessity to strengthen knowledge and to allocate the required means to this end. The issues under analysis also reveal the Mediterranean as a locus for regional cooperation, in view of the fact that while such issues as wiser water management and waste treatment can be covered by local initiatives, it is regionally, i.e. collectively, that Mediterranean countries will find the solutions to their specific challenges. Whether the issues are adaptation to climate change, fisheries management, marine and coastal ecosystems protection, risk and pollution control, individual efforts will succeed all the more that they benefit from a consistent, shared and regularly upgraded framework. It is precisely to develop this framework that the Mediterranean Action Plan has, since 1975, spared no efforts, through its legal instrument, the Barcelona Convention on the Protection of the Mediterranean Marine and Coastal Environment and through its Regional Activity Centers. The Union for the Mediterranean initiative has confirmed the validity of its actions and will certainly reinforce its foundations.

If the 2009 report, of which a more detailed and updated version will be presented in 2011, persuades its readers to establish the Mediterranean as an example of environmental protection and sustainable development promotion, it will have reached its goal.



Part 6

Statistical Annex

List of tables

Jean-Pierre GIRAUD (Plan Bleu)

Table 1 Geographical framework

presentation rank	ISO 2 Code	Countries / Entities	Mediterranean shores		European countries	Euromed Countries	EEA Members
1	ES	Spain	NMC	NORTH	EU		EEA
2	FR	France	NMC	NORTH	EU		EEA
3	IT	Italy	NMC	NORTH	EU		EEA
4	GR	Greece	NMC	NORTH	EU		EEA
5	MC	Monaco	NMC	NORTH	(*)	Euromed	EEA
6	MT	Malta	NMC	NORTH	EU		EEA
7	CY	Cyprus	NMC	NORTH	EU		EEA
8	SI	Slovenia	NMC	NORTH	EU		EEA
9	HR	Croatia	NMC	NORTH	Candidate	Euromed	EEA Associated
10	BA	Bosnia-Herzegovina	NMC	NORTH	Potential candidate	Euromed	EEA Associated
11	ME	Montenegro	NMC	NORTH	Potential candidate	Euromed	EEA Associated
12	AL	Albania	NMC	NORTH	Potential candidate	Euromed	EEA Associated
13	TR	Turkey	SEMC	EAST	Candidate	Euromed	EEA
14	SY	Syria	SEMC	EAST		Euromed	
15	LB	Lebanon	SEMC	EAST		Euromed	
16	IL	Israel	SEMC	EAST		Euromed	
17	PS	Palestinian Territories	SEMC	EAST		Euromed	
18	EG	Egypt	SEMC	SOUTH		Euromed	
19	LY	Libya	SEMC	SOUTH		Euromed	
20	TN	Tunisia	SEMC	SOUTH		Euromed	
21	DZ	Algeria	SEMC	SOUTH		Euromed	
22	MA	Morocco	SEMC	SOUTH		Euromed	

Note: *Through its specific relationship with France, Monaco participates directly in some Community policies.

Table 2 Mediterranean countries specificities in 2006

Countries	Total area (km^2)	Land area (km^2)	Population (inhabitants)	Population Growth rate 2000-2006 (%)	Population density (inhab/km^2)	Urban population (habitants)	Urbanisation rate (%)
Spain	505 370	499 190	44 121 300	1.54	88	33 902 807	77
France	551 500	550 100	61 256 600	0.66	111	47 118 577	77
Italy	301 340	294 110	58 842 800	0.55	200	39 871 881	68
Greece	131 960	128 900	11 147 100	0.35	86	6 592 395	59
Monaco	2	1.95	32 600		16 718	32 600	100
Malta	320	320	406 000	0.67	1 269	387 892	96
Cyprus	9 250	9 240	771 200	1.77	83	535 984	70
Slovenia	20 270	20 140	2 006 800	0.15	100	1 027 080	51
Croatia	56 540	55 920	4 441 300	-0.23	79	2 520 882	57
Bosnia-Herzegovina	51 210	51 200	3 926 406	0.60	77	1 817 141	46
Montenegro	14 026	13 812	601 022	-1.80	44		
Albania	28 750	27 400	3 172 155	0.49	116	1 463 632	46
Turkey	783 560	769 630	72 975 000	1.33	95	49 447 860	68
Syria	185 180	183 780	19 407 558	2.73	106	9 862 921	51
Lebanon	10 400	10 230	4 055 301	1.21	396	3 516 757	87
Israel	22 070	21 640	7 048 600	1.92	326	6 457 927	92
Palestinian Territories	6 020	6 020	3 774 671	4.10	627	2 706 439	72
Egypt	1 001 450	995 450	74 166 496	1.83	75	31 876 760	43
Libya	1 759 540	1 759 540	6 038 643	2.05	3	5 138 885	85
Tunisia	163 610	155 360	10 128 100	0.96	65	6 652 136	66
Algeria	2 381 740	2 381 740	33 351 137	1.50	14	21 324 717	64
Morocco	446 550	446 300	30 496 553	1.16	68	18 096 655	59
Total/Average							
North Shore	1 670 538	1 650 334	190 725 283	0.77	116	135 270 871	71
South and East Shore	6 760 120	6 729 690	261 442 059	1.62	39	155 081 057	59
Mediterranean	8 430 658	8 380 024	452 167 342	1.26	54	290 351 929	64
World	133 945 751	129 644 587	6 538 082 878	1.23	50	3 197 735 145	49
Ratio							
North Shore / Mediterranean	20%	20%	42%		214%	47%	110
South & East Shore / Mediterranean	80%	80%	58%		72%	53%	92
Mediterranean/World	6.3%	6.5%	6.9%		107.0%	9.1%	131

Source: WDI 2008 and Plan Bleu computations

Table 3 Specificities of the Mediterranean countries economy in 2006

Countries	Gross Domestic Product (Purchase Power Parity)		Gross Domestic Product per capita (Purchase Power Parity)		Gross National Income (Purchase Power Parity)	
	(Millions of constant 2005 $)	Growth rate 2000 – 2006 (%)	(constant 2005 $)	Growth rate 2000 – 2006 (%)	(Millions of current $)	(current $ per capita)
Spain	1 225 020	3.34	27 765	1.77	1 244 175	28 199
France	1 899 238	1.69	31 005	1.02	1 974 931	32 240
Italy	1 656 767	0.89	28 156	0.34	1 704 894	28 974
Greece	339 017	4.33	30 413	3.97	344 082	30 867
Malta	8 546	1.24	21 049	0.57	8 523	20 993
Cyprus	19 344	3.36	25 083	1.56	19 328	25 062
Slovenia	47 368	3.73	23 604	3.58	48 106	23 971
Croatia	61 588	4.78	13 867	5.02	61 502	13 848
Bosnia-Herzegovina	24 688	5.13	6 288	4.50	26 639	6 785
Montenegro	5 262	4.55	8 755	6.46	5 366	8 929
Albania	18 096	5.33	5 705	4.81	19 033	6 000
Turkey	595 293	4.62	8 157	3.25	613 685	8 410
Syria	79 466	4.36	4 095	1.59	79 703	4 107
Lebanon	38 284	3.36	9 441	2.12	38 922	9 598
Israel	164 603	2.47	23 353	0.54	168 063	23 843
Palestinian Territories	13 187	-1.19	3 493	-5.08	14 048	3 722
Egypt	356 023	4.21	4 800	2.34	366 459	4 941
Libya	68 015	3.61	11 263	1.53	70 244	11 632
Tunisia	67 328	4.59	6 648	3.60	65 717	6 489
Algeria	205 146	4.61	6 151	3.06	198 023	5 938
Morocco	115 711	5.41	3 794	4.21	117 695	3 859
Total/average						
North Shore	5 304 933	2.03	27 819	1.25	5 456 579	28 615
South and East Shore	1 703 057	4.23	6 514	2.56	1 732 559	6 627
Mediterranean	7 007 990	2.54	15 499	1.26	7 189 137	15 899
World	58 639 125	3.34	8 969	1.77	60 209 862	9 209
Ratio						
North Shore / Mediterranean	76%				76%	180%
South and East Shore / Mediterranean	24%				24%	42%
Mediterranean /World	12.0%				11.9%	173%

Note: Purchase Power Parities (PPPs) are the rates of currency conversion that equalise the purchasing power of different currencies by eliminating the differences in price levels between countries. In their simplest form, PPPs are simply price relatives which show the ratio of the prices in national currencies of the same good or service in different countries. (See the website *www.worldbank.org/data/icp* of the International Comparison Program for more details)

Sources: WDI 2008 and Plan Bleu computations

Table 4 Population of the Mediterranean countries

Countries	1980	1985	1990	1995	2000	2005	2006
Spain	37 386	38 408	38 836	39 387	40 263	43 398	44 121
France	53 880	55 170	56 735	57 844	58 896	60 873	61 257
Italy	56 434	56 593	56 719	56 846	56 949	58 607	58 843
Greece	9 643	9 934	10 161	10 634	10 918	11 104	11 147
Monaco						33	33
Malta	364	344	360	378	390	404	406
Cyprus	513	542	580	651	694	758	771
Slovenia	1 901	1 973	1 998	1 990	1 989	2 001	2 007
Croatia	4 588	4 701	4 780	4 670	4 503	4 443	4 441
Bosnia-Herzegovina	3 914	4 122	4 308	3 421	3 787	3 915	3 926
Montenegro	576	576	587	623	670	608	601
Albania	2 671	2 957	3 289	3 150	3 080	3 154	3 172
Turkey	44 484	50 286	56 154	61 737	67 420	72 065	72 975
Syria	8 971	10 815	12 721	14 610	16 511	18 894	19 408
Lebanon	2 785	2 891	2 974	3 491	3 772	4 011	4 055
Israel	3 878	4 233	4 660	5 545	6 289	6 924	7 049
Palestinian Territories			1 970	2 396	2 966	3 626	3 775
Egypt	43 674	49 186	55 137	60 648	66 529	72 850	74 166
Libya	3 063	3 850	4 364	4 833	5 346	5 918	6 039
Tunisia	6 384	7 260	8 154	8 958	9 564	10 029	10 128
Algeria	18 811	22 097	25 283	28 265	30 506	32 854	33 351
Morocco	19 380	21 779	24 167	26 435	28 466	30 143	30 497
Total							
North Shore	171 870	175 320	178 354	179 594	182 138	189 297	190 725
South and East Shore	151 429	172 398	195 584	216 917	237 368	257 313	261 442
Mediterranean	323 299	347 718	373 938	396 512	419 505	446 610	452 167
World	4 431 033	4 823 325	5 263 924	5 676 845	6 076 654	6 461 660	6 538 083
Ratio							
North Shore / Mediterranean	53%	50%	48%	45%	43%	42%	42%
South and East Shore / Mediterranean	47%	50%	52%	55%	57%	58%	58%
Mediterranean / World	7.3%	7.2%	7.1%	7.0%	6.9%	6.9%	6.9%

Sources: WDI 2008 and Plan Bleu computations

Table 5 Proportion of population using an improved drinking water source (%)

Countries	Total			Urban			Rural		
	1990	2000	2006	1990	2000	2006	1990	2000	2006
Spain	100	100	100	100	100	100	100	100	100
France	100	100	100	100	100	100	100	100	100
Italy				100	100	100			
Greece	96	99	100	99	100	100	91	97	99
Malta	100	100	100	100	100	100	100	100	100
Cyprus	100	100	100	100	100	100	100	100	100
Croatia	99	99	99	100	100	100	98	98	98
Bosnia-Herzegovina	97	97	99	99	99	100	96	96	98
Serbia-Montenegro			98			100			96
Albania	96	97	97	100	100	97	93	94	97
Turkey	85	93	97	92	96	98	74	87	95
Syria	83	86	89	96	95	95	70	77	83
Lebanon	100	100	100	100	100	100	100	100	100
Israel	100	100	100	100	100	100	100	100	100
Palestinian Territories	96	93	89		95	90	90	89	88
Egypt	94	97	98	97	99	99	92	95	98
Libya	71	71		72	72		68	68	
Tunisia	82	90	94	95	98	99	62	76	84
Algeria	94	89	85	99	93	87	88	84	81
Morocco	75	80	83	94	98	100	58	58	58

Notes:

– 1990 data for France, Albania and Palestinian Territories refer to 1995.

– The proportion of the population with sustainable access to an improved water source, urban and rural, is the percentage of the population who use any of the following types of water supply for drinking: piped water, public taps, public boreholes, protected wells and springs or rainwater. Improved water sources do not include vendor-provided water, bottled water, tanker trucks and unprotected wells and springs.

Source: UNSD, WHO, UNICEF

Table 6 Proportion of population using improved sanitation, (%) (H2020 indicator)

Countries	Total			Urban			Rural		
	1990	2000	2006	1990	2000	2006	1990	2000	2006
Spain	100	100	100	100	100	100	100	100	100
Greece	97	98	98	100	99	99	93	96	97
Malta				100	100	100			
Cyprus	100	100	100	100	100	100	100	100	100
Croatia	99	99	99	99	99	99	98	98	98
Bosnia-Herzegovina	96	96	95	99	99	99	94	93	92
Serbia-Montenegro			91			96			86
Albania	86	89	97	97	97	98	79	83	97
Turkey	85	87	88	96	96	96	69	71	72
Syria	81	87	92	94	95	96	69	79	88
Lebanon	98	98		100	100	100	87	87	
Israel				100	100	100			
Palestinian Territories	80	80	80	84	84	84	69	69	69
Egypt	50	61	66	68	79	85	37	47	52
Libya	97	97	97	97	97	97	96	96	96
Tunisia	74	81	85	95	95	96	44	57	64
Algeria	88	92	94	99	99	98	77	82	87
Morocco	52	65	72	80	83	85	25	43	54

Notes:

– France, Albania, Lebanon and Palestinian Territories in 1990: 1995 data.

– Proportion of the urban and rural population with access to improved sanitation refers to the percentage of the population with access to facilities that hygienically separate human excreta from human, animal and insect contact. Facilities such as sewers or septic tanks, poor-flush latrines and simple pit or ventilated improved pit latrines are assumed to be adequate, provided that they are not public, according to the World Health Organization and United Nations Children's Fund's Global Water Supply and Sanitation Assessment 2000 Report. To be effective, facilities must be correctly constructed and properly maintained.

Source: UNSD, WHO, UNICEF

Table 7 Proportion of urban population living in slums

Countries	Urban population living in slums (inhabitants)			Proportion of urban population living in slums (%)		
	1990	2001	2005	1990	2001	2005
Turkey	7 997 492	8 011 145	7 634 645	23.3	17.9	15.5
Syria	628 609	891 523	981 945			
Lebanon	1 142 000	1 601 500	1 756 720	50.0	50.0	53.1
Palestinian Territories		1 333 289			60.0	
Egypt	14 086 925	11 761 704	5 405 326	57.5	39.9	17.1
Libya	1 241 856	1 674 464		35.2	35.2	
Tunisia	425 340	234 173		9.0	3.7	
Algeria	1 507 568	2 100 518		11.8	11.8	
Morocco	4 456 958	5 579 166	2 422 062	37.4	32.7	13.1

Note: UN-HABITAT defines a slum household as a group of individuals living under the same roof who lack one or more (in some cities, two or more) of the following conditions: security of tenure, structural quality and durability of dwellings, access to safe water, access to sanitation facilities and sufficient living area.

Source: UNSD, UN-HABITAT

Table 8 Greenhouse gas emissions (1 000 tonnes CO_2 equivalent)

Countries	Base year (Climate Convention)	1995	2000	2005	2006	2007	Change from base year to latest reported year (%)
Spain	288 135	319 166	385 768	441 150	433 070	442 322	53.5
France	565 495	559 607	560 581	558 445	546 371	535 772	-5.3
Italy	516 318	529 686	549 509	573 685	562 982	552 771	7.1
Greece	105 562	110 184	127 126	131 831	128 089	131 854	24.9
Slovenia	20 340	18 714	18 912	20 377	20 570	20 722	1.9
Croatia	31 374	22 865	25 955	30 433	30 769	32 385	3.2
Monaco	108	115	120	104	93	98	-9.3
Turkey	170 059	220 719	279 956	312 420	332 675	372 638	119.1
EU27	5 776 676	5 237 183	5 080 090	5 141 693	5 136 864	5 078 788	-12.1
United States	6 084 490	6 447 084	6 975 180	7 082 213	7 006 049	7 107 162	16.8

Note: This table do not include the emissions from Land Use, Land-Use Change and Forestry (LULUCF)

Source: UNFCCC

Table 9 CO_2 emissions (1 000 tonnes CO_2 equivalent)

Countries	Base year (Climate Convention)	1995	2000	2005	2006	2007	Change from base year to latest reported year (%)
Spain	228 447	255 256	307 692	367 997	358 418	366 366	60.4
France	398 005	396 049	409 466	420 538	410 948	401 007	0.8
Italy	434 688	445 401	462 715	490 056	485 754	475 302	9.3
Greece	83 150	86 752	103 439	111 047	109 625	113 566	36.6
Slovenia	16 293	15 007	15 211	16 671	16 854	16 989	4.3
Croatia	23 105	16 930	19 955	23 424	23 528	24 865	7.6
Monaco	105	112	113	99	89	92	-12.6
Turkey	139 594	171 854	223 806	256 434	273 705	304 475	118.1
EU27	4 973 620	4 825 079	4 621 128	4 753 408	4 754 814	4 730 142	-12.1
United States	5 068 576	5 399 817	5 946 409	6 081 905	6 006 104	6 094 390	20.2

Note: This table do not include the emissions from Land Use, Land-Use Change and Forestry (LULUCF)

Source: UNFCCC

Table 10 Distribution of CO_2 emissions from energy use per sector (2005)

Countries	CO2 emissions from energy use per sector (1000 tonnes CO_2 equivalent)					CO2 emissions from energy use per sector (%)				
	Electricity, heating (1)	Manufacturing construction (2)	Transport (3)	Other fuel combustion (4)	Fugitive emissions (5)	(1)	(2)	(3)	(4)	(5)
Spain	129 394	64 557	110 761	37 287	0	38	19	32	11	0
France	72 002	78 237	134 558	103 856	0	19	20	35	27	0
Italy	161 037	84 211	119 197	89 885	0	35	19	26	20	0
Greece	50 086	9 417	22 076	14 150	0	52	10	23	15	0
Malta	2 001	0	540	100	0	76	0	20	4	0
Cyprus	3 473	1 001	2 031	550	0	49	14	29	8	0
Slovenia	5 894	2 772	4 353	2 492	0	38	18	28	16	0
Croatia	7 085	4 173	5 654	3 873	0	34	20	27	19	0
Bosnia-Herzegovina	9 317	1 471	2 572	2 592	0	58	9	16	16	0
Serbia-Montenegro	32 674	7 806	6 515	3 412	0	65	15	13	7	0
Albania	330	600	2 422	1 261	0	7	13	52	27	0
Turkey	81 129	57 122	37 918	42 941	5	37	26	17	20	0
Syria	22 316	9 787	11 749	3 943	469	46	20	24	8	1
Lebanon	6 765	3 192	3 973	1 891	0	43	20	25	12	0
Israel	40 299	1 811	9 867	7 916	35	67	3	16	13	0
Egypt	61 605	37 437	31 613	17 042	1 457	41	25	21	11	1
Libya	23 617	7 315	11 729	2 772	1 640	50	16	25	6	3
Tunisia	6 785	3 853	4 543	4 113	715	34	19	23	21	4
Algeria	35 616	11 188	17 793	19 764	6 864	39	12	20	22	8
Morocco	18 043	7 165	1 821	14 350	0	44	17	4	35	0
Total										
North Shore	473 294	254 245	410 679	259 459	0	34	18	29	19	0
South and East Shore	296 506	139 471	133 427	115 994	11 184	43	20	19	17	2
Mediterranean	769 800	393 716	544 106	375 453	11 184	37	19	26	18	1
EU27	1 617 697	661 871	954 474	744 712	3 506	41	17	24	19	0
World	12 316 197	5 187 813	5 381 874	3 310 468	194 389	47	20	20	13	1

Source: WRI-CAIT (version 6.0)

Table 11 Water resources and demand (total and per inhabitant), exploitation index, period 2000-2005

Countries	Natural renewable water resources NRWR (a)	Natural renewable and exploitable water resources NREW	Total demand	Withdrawals in the renewable natural water (b)	Exploitation index	Per capita NRWR	Per capita NREW	Total demand per capita	Drinking water demand per capita
		(km^3/year)			(b)/(a)			(m^3/inhabitant)	
Spain	111.5	46.3	37.070	37.070	33.2	2 612	1 085	868	96
France	200.0	100.0	34.960	34.950	17.5	3 312	1 656	579	103
Italy	191.3	110.0	41.982	41.983	21.9	3 323	1 911	729	138
Greece	74.3	29.0	7.800	7.800	10.5	6 715	2 713	705	113
Malta	0.0	0.0	0.058	0.032	97.0	82	50	145	77
Cyprus	0.8	0.5	0.253	0.220	27.5	944	654	306	81
Slovenia	31.9	15.0	0.894	0.894	2.8	15 959	7 511	448	94
Croatia	71.4	20.0	0.375	0.375	0.5	16 073	4 502	84	71
Bosnia-Herzegovina	37.5	15.0	0.930	0.930	2.5	9 592	3 837	238	59
Montenegro	15.7	7.0	0.050	0.050	0.3	25 000	7 962	80	80
Albania	41.7	13.0	1.700	1.700	4.1	13 401	4 178	546	148
Turkey	213.6	112.0	40.100	40.100	18.8	2 977	1 561	559	84
Syria	18.2	16.0	16.690	16.700	91.8	980	861	898	77
Lebanon	4.4	1.8	1.400	1.400	31.8	1 246	494	395	127
Israel	1.9	1.6	1.950	1.724	90.7	274	230	287	104
Palestinian Territories	0.8	0.7	0.280	0.220	27.5	214	202	80	36
Egypt	56.8	50.0	70.430	55.500	97.7	782	688	970	66
Libya	0.6	0.5	4.260	0.500	83.3	105	87	742	105
Tunisia	4.2	3.2	2.457	1.730	41.2	403	313	247	41
Algeria	11.7	6.0	6.270	4.490	38.4	361	185	194	41
Morocco	20.7	11.9	9.488	9.415	45.5	694	399	318	29
Total/Average									
North Shore	740.0	359.0	126.072	111.574	15.1	3 957	1 920	674	111
South and East Shore	342.0	214.0	153.325	133.479	39.0	1 327	830	595	66
Mediterranean	1082.0	572.0	279.397	245.052	22.6	2 433	1 286	628	85
Ratio									
North Shore / Mediterranean	68%	63%	45%	46%		163%	149%	107%	130%
South and East Shore / Mediterranean	32%	37%	55%	54%		55%	65%	95%	78%

Note: Water resources are calculated by sub-regions without double counting (due to water exchanges between neighbouring Mediterranean countries)

Source: Plan Bleu, from national sources

Table 12 Water demand, total and per sector, period 2000-2005

Countries	Total demand	Drinking water	Irrigation	Industry	Energy	Drinking water	Irrigation	Industry	Energy
	(km^3/year)		(km^3/year)			(%)			
Spain	37.070	5.300	24.160	1.440	6.170	14.3	65.2	3.9	16.6
France	34.960	6.200	4.100	3.380	21.280	17.7	11.7	9.7	60.9
Italy	41.982	7.940	20.136	7.986	5.919	18.9	48.0	19.0	14.1
Greece	7.800	1.250	6.300	0.130	0.120	16.0	80.8	1.7	1.5
Malta	0.058	0.031	0.024	0.003		53.4	41.4	5.2	
Cyprus	0.253	0.067	0.182	0.004		26.5	71.9	1.4	
Slovenia	0.894	0.187	0.007	0.080	0.620	20.9	0.8	8.9	69.4
Croatia	0.375	0.314	0.001	0.050	0.010	83.7	0.3	13.3	2.7
Bosnia-Herzegovina	0.930	0.230	0.600	0.100		24.7	64.5	10.8	
Montenegro	0.050	0.050				100.0			
Albania	1.700	0.460	1.050	0.190		27.1	61.8	11.2	
Turkey	40.100	6.000	30.100	4.000		15.0	75.1	10.0	
Syria	16.690	1.426	14.669	0.595		8.5	87.9	3.6	
Lebanon	1.400	0.450	0.940	0.010		32.1	67.1	0.7	
Israel	1.950	0.712	1.129	0.113		36.5	57.9	5.8	
Palestinian Territories	0.280	0.125	0.155			44.6	55.4		
Egypt	70.430	4.760	58.800	2.200	4.670	6.8	83.5	3.1	6.6
Libya	4.260	0.600	3.540	0.120		14.1	83.1	2.8	
Tunisia	2.457	0.406	1.918	0.133		16.5	78.1	5.4	
Algeria	6.270	1.330	3.940	0.800	0.200	21.2	62.8	12.8	3.2
Morocco	9.488	0.855	8.475	0.158		9.0	89.3	1.7	
Total/Average									
North Shore	126.072	22.029	56.560	13.363	34.119	17.5	44.9	10.6	27.1
South and East Shore	153.325	16.664	123.666	8.129	4.870	10.9	80.7	5.3	3.2
Mediterranean	279.397	38.693	180.226	21.492	38.989	13.8	64.5	7.7	14.0
Ratio									
North Shore / Mediterranean	45%	57%	31%	62%	88%				
South and East Shore / Mediterranean	55%	43%	69%	38%	12%				

Notes:

- Total water demand corresponds to the sum of water directly abstracted, including losses in transport and use, and the production of non-conventional water
- Drinking water demand refers to water directly abstracted and water issued from desalination of sea water and brackish water for supplying the households, public services, commercial establishments and deserved industries.
- Water demand for irrigation refers to water directly abstracted and non-conventional production (desalination, clean wastewater reuse, drainage, etc.) for irrigated agriculture production.
- Water demand for industry refers to water directly abstracted for the industries not deserved by the public drinking water network.
- Water demand for energy refers only to the thermal power plant cooling.

Sources: Plan Bleu, from national sources

Table 13 Energy intensity and total primary energy supply per capita

Countries	Energy intensity (koe/ $ 2000 PPP)					Total primary energy supply per capita (koe/inhab)				
	1990	1995	2000	2005	2007	1990	1995	2000	2005	2007
Spain	138	144	142	141	133	2 309	2 560	3 029	3 268	3 208
France	178	178	165	163	152	3 859	3 995	4 168	4 320	4 148
Italy	118	120	117	120	113	2 586	2 801	2 997	3 120	3 003
Greece	135	134	135	123	120	2 074	2 133	2 480	2 725	2 876
Malta	164	128	98	120	112	1 931	1 876	1 733	2 131	2 120
Cyprus	151	155	158	140	141	2 347	2 682	3 079	2 929	3 097
Slovenia	197	216	186	177	157	2 835	3 018	3 227	3 646	3 632
Croatia	188	203	190	172	163	1 884	1 510	1 730	2 003	2 100
Bosnia-Herzegovina	1 233	249	212	193	191	1 627	460	1 179	1 335	1 485
Serbia-Montenegro*	515	370	364	353	327	1 948	1 250	1 626	2 020	2 140
Albania	268	152	155	156	132	809	420	575	733	683
Turkey	128	128	130	115	122	939	998	1 132	1 171	1 353
Syria	352	296	328	268	268	895	961	1 055	926	987
Lebanon	278	300	304	274	198	755	1 238	1 307	1 355	975
Israel	130	128	119	119	115	2 486	2 822	2 933	2 956	3 062
Egypt	204	192	190	216	208	577	582	679	835	891
Libya	280	366	354	294	264	2 596	3 268	3 100	2 967	2 895
Tunisia	131	127	122	110	106	607	648	764	821	862
Algeria	162	173	167	157	170	878	853	886	984	1 089
Morocco	78	93	92	92	91	287	325	360	435	465
Total										
North Shore	153	151	145	144	135	2 789	2 885	3 184	3 375	3 292
South and East Shore	155	158	156	148	149	801	864	953	1 024	1 111
Mediterranean	153	153	148	145	139	1 784	1 817	1 956	2 055	2 059
European Union (27)	191	179	159	153	142	3 462	3 421	3 491	3 616	3 546
World	263	244	220	207	196	1 666	1 626	1 650	1 769	1 820

Note: * 2005 and 2007 data refer to Serbia

Source: EIA

Table 14 Burnt areas (ha)

	Spain	France	Italy	Greece	Croatia	Slovenia	Cyprus	Turkey
1980	263 017	22 176	143 919	32 965				
1981	298 288	27 711	229 850	81 417				
1982	152 903	55 145	130 456	27 372				
1983	108 100	53 729	212 678	19 613				
1984	165 119	27 202	75 272	33 655				
1985	484 476	57 368	190 640	105 450				
1986	264 887	51 860	86 420	24 514				
1987	146 662	14 108	120 697	46 315				
1988	137 734	6 701	186 405	110 501				
1989	426 693	75 566	95 161	42 363				
1990	203 032	72 625	195 319	38 594				
1991	260 318	10 130	99 860	13 046				
1992	105 277	16 593	105 692	71 410				
1993	89 267	16 698	203 749	54049				
1994	437 635	24 995	136 334	57 908				
1995	143 484	18 137	48 884	27 202				
1996	59 814	11 400	57 988	25 310				
1997	98 503	21 581	111 230	52 373				
1998	133 643	19 282	155 553	92 901				6 764
1999	82 217	15 906	71 117	8 289				5 804
2000	188 586	24 078	114 648	145 033	129 883	8 034		26 353
2001	93 297	20 642	76 427	18 221	27 251	4 830		7 394
2002	107 464	30 160	40 791	6 013	74 945	2 196	161	8 513
2003	148 172	73 278	91 805	3 517	77 359	2 349	2100	6644
2004	134 193	13 711	60 176	10 267	8 988	1 218	138	4 876
2005	188 697	22 135	47 575	6 437	21 407	1 838	280	2 821
2006	148 827	7 844	39 946	12 661	18 782	1 160	1420	7 762
2007	82 048	8 570	227 729	225 734	63 719	4 483	128	11 664

Source: European Forest Fire Information System (EFFIS)

	1995	2000	2001	2002	2003	2004	2005	2006	2007
Syria		0		0	0	0	0		
Lebanon		408		0	0	585	440	875	4 031
Israel		1 500	1 100	900	700	700	1 000	2 000	800
Algeria	32 157	38 462	55 782	14 378	11 194	11 998	31 676		
Tunisia	60	1 375	2 275	231	371	189	355	150	457
Morocco		412	182	60	60	0	0		

Source: Eurostat

Table 15 Distribution of wooded land, agriculture land and pastures, 1990 and 2005

Countries	1990						
	Arable land and permanent crops (1000 ha)	Forest and wooded land (1000 ha)	Meadows and pastures (1000 ha)	Total (1000 ha)	Arable land and permanent crops (% of total)	Forest and wooded land (% of total)	Meadows and pastures (% of total)
Spain	20 172	25 926	10 300	56 398	36	46	18
France	19 190	16 625	11 380	47 195	41	35	24
Italy	11 972	9 263	4 868	26 103	46	35	19
Greece	3 967	6 511	5 255	15 733	25	41	33
Malta	13	0.3	0	13.3	98	2	0
Cyprus	157	161	5	323	49	50	2
Slovenia	200	1 242	328	1 770	11	70	19
Croatia	1 212	2 440	1 079	4 731	26	52	23
Bosnia-Herzegovina	850	2 705	1 200	4 755	18	57	25
Serbia-Montenegro	3 720	3 397	2 920	10 037	37	34	29
Albania	704	1 045	417	2 166	33	48	19
Turkey	27 677	20 585	12 000	60 262	46	34	20
Lebanon	305	121	300	726	42	17	41
Israel	431	170	148	749	58	23	20
Egypt	2 648	64	0	2 712	98	2	0
Libya	2 155	547	13 300	16 002	13	3	83
Tunisia	5 735	971	3 793	10 499	55	9	36
Algeria	7 635	3 638	31 041	42 315	18	9	73
Morocco	9 443	4 696	20 900	35 039	27	13	60

Source: FAO

Countries	2005						
	Arable land and permanent crops (1000 ha)	Forest and wooded land (1000 ha)	Meadows and pastures (1000 ha)	Total (1000 ha)	Arable land and permanent crops (% of total)	Forest and wooded land (% of total)	Meadows and pastures (% of total)
Spain	17 844	28 214	11 320	57 378	31	49	20
France	19 643	17 262	9 907	46 812	42	37	21
Italy	10 334	11 026	4 402	25 762	40	43	17
Greece	3 734	6 532	4 600	14 866	25	44	31
Malta	9.3	0.3	0	9.6	97	3	0
Cyprus	166	388	1	555	30	70	0
Slovenia	205	1 308	305	1 818	11	72	17
Croatia	927	2 481	265	3 673	25	68	7
Bosnia-Herzegovina	1 120	2 734	1 037	4 891	23	56	21
Serbia-Montenegro	3 822	3 514	1 768	9 104	42	39	19
Albania	659	1 055	418	2 132	31	49	20
Turkey	26 606	20 864	14 617	62 087	43	34	24
Lebanon	283	243	370	896	32	27	41
Israel	381	256	125	762	50	34	16
Egypt	3 523	87	0	3 610	98	2	0
Libya	2 085	547	13 500	16 132	13	3	84
Tunisia	4 896	1 226	4 928	11 050	44	11	45
Algeria	8 363	3 872	32 848	45 083	19	9	73
Morocco	8 989	4770	21 000	34 759	26	14	60

Source: FAO

Table 16 Urban population and urbanisation rate

Countries	Urban population (thousands)				Urbanisation rate (%)			
	1980	1990	2000	2006	1980	1990	2000	2006
Spain	27 217	29 282	30 721	33 903	72.8	75.4	76.3	76.8
France	39 494	42 041	44 643	47 119	73.3	74.1	75.8	76.9
Italy	37 585	37 832	38 269	39 872	66.6	66.7	67.2	67.8
Greece	5 564	5 975	6 419	6 592	57.7	58.8	58.8	59.1
Malta	327	325	364	388	89.8	90.4	93.4	95.5
Cyprus	300	387	476	536	58.6	66.8	68.6	69.5
Slovenia	913	1 007	1 010	1 027	48.0	50.4	50.8	51.2
Croatia	2 299	2 581	2 503	2 521	50.1	54.0	55.6	56.8
Bosnia-Herzegovina	1 389	1 689	1 636	1 817	35.5	39.2	43.2	46.3
Albania	900	1 197	1 287	1 464	33.7	36.4	41.8	46.1
Turkey	19 484	33 243	43 621	49 448	43.8	59.2	64.7	67.8
Syria	4 190	6 221	8 272	9 863	46.7	48.9	50.1	50.8
Lebanon	2 052	2 472	3 244	3 517	73.7	83.1	86.0	86.7
Israel	3 436	4 213	5 748	6 458	88.6	90.4	91.4	91.6
Palestinian Territories		1 338	2 121	2 706	62.4	67.9	71.5	71.7
Egypt	19 173	23 985	28 275	31 877	43.9	43.5	42.5	43.0
Libya	2 080	3 430	4 442	5 139	67.9	78.6	83.1	85.1
Tunisia	3 288	4 860	6 063	6 652	51.5	59.6	63.4	65.7
Algeria	8 183	13 172	18 243	21 325	43.5	52.1	59.8	63.9
Morocco	8 004	11 697	15 685	18 097	41.3	48.4	55.1	59.3
Total/Average								
North Shore	115 988	122 316	127 330	135 271	67.7	68.8	70.2	71.1
South and East Shore	69 889	104 629	135 713	155 081	46.2	53.5	57.2	59.3
Mediterranean	185 877	226 946	263 043	290 352	57.6	60.8	62.8	64.3
World	1 724 084	2 250 720	2 826 484	3 197 735	39.1	43.0	46.7	49.1
Ratio								
North Shore / Mediterranean	62%	54%	48%	47%				
South and East Shore / Mediterranean	38%	46%	52%	53%				
Mediterranean / World	11%	10%	9%	9%				

Sources: WDI 2008 and Plan Bleu computations

Table 17 Number of cities and population distribution by size classes, 2005 (H2020 indicator)

Countries	Number of cities					Population distribution (%)					Urban Population
	500 000 to 1 million	1 to 5 million	5 to 10 million	10 million or more	Total	Fewer than 500 000	500 000 to 1 million	1 to 5 million	5 to 10 million	10 million or more	(1000 inhab)
Spain	4	1	1		6	61	8	14	16		33 295
France	6	3	1	0	10	62	9	8	21	0	46 781
Italy	12	4			16	55	19	26			39 652
Greece	1	1			2	40	12	48			6 700
Malta						100					377
Cyprus						100					580
Slovenia						100					990
Croatia	1				1	73	27				2 570
Montenegro						100					372
Albania	0				0	100	0				1 413
Turkey	7	4	1	0	12	52	10	18	20	0	49 097
Syria	2	2			4	37	14	49			10 049
Lebanon	0	1			1	49	0	51			3 473
Israel	2	1			3	23	28	49			6 131
Palestinian Territories	0				0	100	0				2 693
Egypt	2	1	0	1	4	47	3	13	0	37	31 062
Libya	0	2			2	30	0	70			4 557
Tunisia	1				1	89	11				6 603
Algeria	1	1			2	81	4	15			20 805
Morocco	5	2			7	49	22	29			16 763
Total											
North Shore	24	9	2	0	35	60	12	17	12	0	132 730
South and East Shore	20	14	1	1	36	54	9	22	6	8	151 233
Mediterranean	44	23	3	1	71	57	11	20	9	4	283 963
World	446	361	31	18	856	52	10	22	7	8	3 164 635

Source: UN-World Urbanisation Prospects, 2007

Table 18 Agricultural population

Countries	Agricultural population (thousand)					Agricultural population (percentage of the rural population)				
	1990	1995	2000	2005	2006	1990	1995	2000	2005	2006
Spain	4 580	3 667	2 940	2 482	2 389	48	39	31	25	24
France	3 112	2 496	1 979	1 589	1 520	21	17	14	11	11
Italy	4 879	3 884	3 069	2 439	2 327	26	20	16	13	12
Greece	1 902	1 695	1 477	1 254	1 213	45	39	33	29	28
Malta	9	8	6	5	5	26	24	20	19	20
Cyprus	92	79	68	57	55	41	34	28	22	21
Slovenia		64	38	22	20		7	4	2	2
Croatia		547	382	277	259		26	19	14	13
Bosnia-Herzegovina		263	196	135	125		13	9	6	6
Montenegro					92					39
Albania	1 796	1 622	1 488	1 420	1 408	86	84	83	82	81
Turkey	21 383	21 265	20 961	20 223	20 056	91	89	87	85	84
Syria	4 245	4 452	4 610	4 863	4 917	65	61	58	55	54
Lebanon	216	182	140	106	100	43	34	27	20	19
Israel	186	179	164	146	143	43	36	31	26	25
Palestinian Territories	328	348	370	381	382	47	45	41	36	35
Egypt	24 245	24 483	24 482	24 189	24 102	78	71	64	58	57
Libya	474	387	317	257	246	45	33	25	19	18
Tunisia	2 316	2 377	2 356	2 300	2 288	67	69	67	66	65
Algeria	6 526	7 097	7 336	7 435	7 444	54	57	60	62	62
Morocco	11 208	11 013	10 618	10 136	10 043	88	85	79	74	73

Source: FAO

Table 19 Rural population

Countries	Rural population (thousands)					Rural population (percentage of the total population)				
	1990	1995	2000	2005	2006	1990	1995	2000	2005	2006
Spain	9 576	9 510	9 550	10 103	10 165	25	24	24	23	23
France	14 719	14 602	14 349	14 210	14 162	26	25	24	23	23
Italy	18 873	18 954	18 910	18 995	18 967	33	33	33	32	32
Greece	4 182	4 338	4 419	4 400	4 389	41	41	40	40	39
Malta	35	34	30	26	25	10	9	8	6	6
Cyprus	226	234	247	257	258	33	32	31	31	30
Slovenia		970	977	1 009	1 018		49	49	50	51
Croatia		2 106	2 001	1 982	1 973		45	44	44	43
Bosnia-Herzegovina		2 016	2 150	2 124	2 109		59	57	54	54
Montenegro					236					39
Albania	2 091	1 924	1 794	1 741	1 731	64	61	58	55	55
Turkey	23 395	23 763	24 032	23 872	23 826	41	38	35	33	32
Syria	6 496	7 297	7 987	8 845	9 025	51	50	48	47	47
Lebanon	502	530	528	537	538	17	15	14	13	13
Israel	435	491	521	561	570	10	9	9	8	8
Palestinian Territories	692	774	898	1 069	1 102	32	30	29	28	28
Egypt	31 165	34 682	38 165	41 787	42 542	57	57	57	57	57
Libya	1 059	1 160	1 263	1 361	1 379	24	24	24	23	23
Tunisia	3 456	3 458	3 497	3 501	3 500	42	39	37	35	34
Algeria	12 114	12 438	12 260	12 050	12 011	48	44	40	37	36
Morocco	12 803	13 019	13 452	13 732	13 789	52	48	47	45	45

Source: FAO

Table 20 Arable land areas

Countries	Arable land (1000 hectares)				Arable land per capita (hectares/inhabitant)			
	1990	1995	2000	2005	1990	1995	2000	2005
Spain	15 335	14 045	13 400	13 700	0.395	0.357	0.333	0.316
France	17 999	18 310	18 440	18 507	0.317	0.317	0.313	0.304
Italy	9 012	8 283	8 479	7 744	0.159	0.146	0.149	0.132
Greece	2 899	2 821	2 741	2 627	0.285	0.265	0.251	0.237
Malta	12	10	8	9	0.033	0.026	0.021	0.022
Cyprus	106	99	98	120	0.183	0.152	0.141	0.158
Slovenia		196	173	176		0.098	0.087	0.088
Croatia		1 117	1 458	1 110		0.239	0.324	0.250
Bosnia-Herzegovina		850	1 000	1 000		0.248	0.264	0.255
Albania	579	577	578	578	0.176	0.183	0.188	0.183
Turkey	24 647	24 654	23 826	23 830	0.439	0.399	0.353	0.331
Syria	4 885	4 799	4 542	4 873	0.384	0.328	0.275	0.258
Lebanon	183	180	190	186	0.062	0.052	0.050	0.046
Israel	343	345	338	317	0.074	0.062	0.054	0.046
Palestinian Territories	111	116	106	107	0.056	0.048	0.036	0.030
Egypt	2 284	2 817	2 801	3 000	0.041	0.046	0.042	0.041
Libya	1 805	1 870	1 815	1 750	0.414	0.387	0.340	0.296
Tunisia	2 909	2 842	2 864	2 729	0.357	0.317	0.299	0.272
Algeria	7 081	7 519	7 662	7 450	0.280	0.266	0.251	0.227
Morocco	8 707	8 921	8 767	8 480	0.360	0.337	0.308	0.281
Total/Average								
North Shore	45 942	46 308	46 375	45 571	0.258	0.259	0.256	0.242
South and East Shore	52 955	54 063	52 911	52 722	0.271	0.249	0.223	0.205
Mediterranean	98 897	100 371	99 286	98 293	0.265	0.254	0.237	0.220

Sources: WDI 2008, FAOSTAT

Table 21 Irrigated land areas (1000 hectares)

Countries	Areas equipped for irrigation						Agriculture area Irrigated	Permanent crops Irrigated	Temporary crops Irrigated
	1990	1995	2000	2005	2006	2007	2006	2006	2006
Spain	3 402	3 527	3 735	3 858	3 840	3 840	3 320	1 179	
France	1 970	2 510	2 634	2 678	2 690	2 706	1 593		
Italy	2 711	2 698	3 887	3 973	3 973	3 973	2 613		
Greece	1 195	1 383	1 451	1 479	1 500	1 594	1 330	408	
Malta	1	1	2	3	3	3.2	2.4	0.7	2
Cyprus	36	40	42	45	46	46	33	22	11
Slovenia		2	3	5	5	9	3	1	2
Croatia		3	3	16	16	16	4		4
Bosnia-Herzegovina		2	3	3	3	3			
Montenegro					2.2	2.2			
Albania	423	340	340	362	365	365	835		
Turkey	4 071	4 186	4 745	5 215	5 215	5 215	5 215		
Syria	693	1 089	1 211	1 428	1 402	1 396	1 402	173	1 229
Lebanon	86	105	104	104	104	104	142	55	54
Israel	206	194	198	220	225	225			
Palestinian Territories	18	17	17	16	17	17	17	7	10
Egypt	2 648	3 283	3 291	3 422	3 530	3 530			
Libya	470	470	470	470	470	470			
Tunisia	300	361	394	418	418	418	356	177	
Algeria	455	558	568	569	570	570			
Morocco	1 258	1 258	1 443	1 484	1 484	1 484			

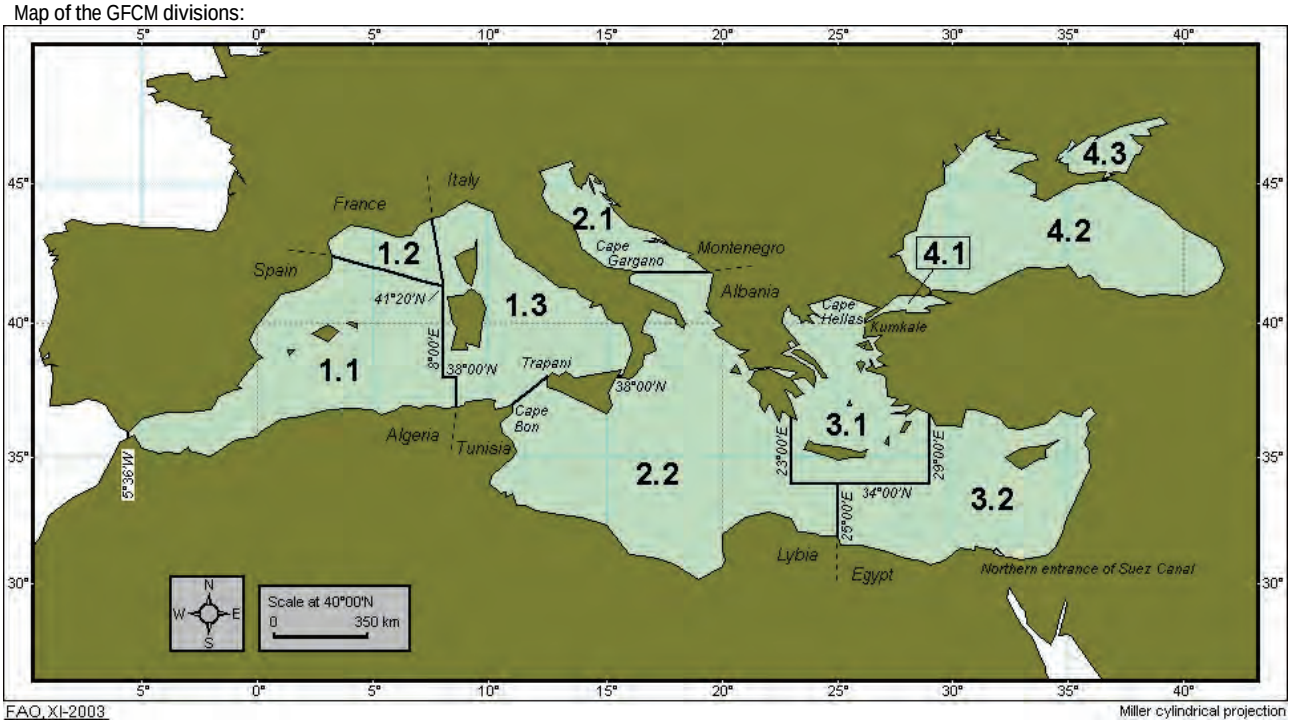
Source: FAOSTAT

Table 22 Catches in the Mediterranean sea (Black sea, Azov sea and Marmara sea excluded) (tonnes)

Statistical divisions	1970	1975	1980	1985	1990	1995	2000	2005
1.1 Balearic	128 668	190 507	218 758	232 823	249 853	277 625	261 373	258 282
1.2 Gulf of Lions	40 971	35 514	34 983	36 381	40 790	30 636	41 635	25 035
1.3 Sardinia	149 436	93 647	75 917	102 997	59 386	84 740	77 902	86 122
2.1 Adriatic	144 516	195 378	216 896	220 359	149 686	144 563	155 271	147 298
2.2 Ionian	83 884	147 059	156 256	245 860	242 003	273 841	199 617	220 731
3.1 Aegean	44 043	62 866	91 392	109 236	133 430	172 663	114 551	114 217
3.2 Levant	22 265	21 241	34 141	37 789	70 668	79 153	80 915	84 334
Not known (CGFM area)	-	-	-	-	-	24	-	5 879
Tunas (CGFM area)	34 093	26 924	44 998	66 568	69 233	75 459	71 577	129 097
Total	647 876	773 136	873 342	1 052 012	1 015 049	1 138 702	1 002 841	1 070 993

Source: General Fisheries Commission for the Mediterranean (GFCM)

Map of the GFCM divisions:



37 1 - WESTERN subarea
- 37 1 1 - Balearic
- 37 1 2 - Gulf of Lions
- 37 1 3 - Sardinia

37 2 - CENTRAL subarea
- 37 2 1 - Adriatic
- 37 2 2 - Ionian

37 3 - EASTERN subarea
- 37 3 1 - Aegean
- 37 3 2 - Levant

37 4 - BLACK SEA subarea
- 37 4 1 - Marmara Sea
- 37 4 2 - Black Sea (proper)
- 37 4 3 - Azov Sea

Tuna catches are not allocated according to GFCM statistical divisions and are grouped together into a division named "Tunas"(37 0 0). Another division, named "Not known" (37 9 0), contains all the catches for which the statistical division is not known.

Table 23 Aquaculture production (tonnes) (H2020 indicator)

	1995	2000	2001	2002	2003	2004
Marine water	579 281	631 690	752 685	773 807	805 462	690 834
Fish	40 305	142 766	140 645	149 131	170 821	182 223
Molluscs	537 870	486 957	609 970	622 579	632 505	506 338
Crustaceans	1 106	1 967	2 070	2 097	2 136	2 273
Brackish water	138 191	307 666	357 538	404 944	471 375	637 805
Fish	78 191	307 665	302 538	349 944	446 375	472 805
Molluscs	60 000	1	55 000	55 000	25 000	165 000
Marine and brackish waters	717 472	939 356	1 110 223	1 178 751	1 276 837	1 328 639
Fish	118 496	450 431	443 183	499 075	617 196	655 028
Molluscs	597 870	486 958	664 970	677 579	657 505	671 338
Crustaceans	1 106	1 967	2 070	2 097	2 136	2 273
Fresh water	157 961	220 106	200 674	181 781	188 663	211 312
Fish	156 961	220 024	200 577	181 611	188 603	210 498
Crustaceans	1 000	82	97	170	60	814
Total	875 433	1 159 462	1 310 897	1 360 532	1 465 500	1 539 951
Fish	275 457	670 455	643 760	680 686	805 799	865 526
Molluscs	597 870	486 958	664 970	677 579	657 505	671 338
Crustaceans	2 106	2 049	2 167	2 267	2 196	3 087

Sources: SIPAM, SPA/RAC, synthesis Hadj-Ali

Table 24 International tourists arrivals (thousand)

Countries	1995	2000	2001	2002	2003	2004	2005	2006	2007
Spain	34 920	47 898	50 094	52 327	50 854	52 430	55 914	58 190	59 193
France	60 033	77 190	75 202	77 012	75 048	75 121	75 908	79 083	81 900
Italy	31 052	41 181	39 563	39 799	39 604	37 071	36 513	41 058	43 654
Greece	10 130	13 096	14 057	14 180	13 969	13 313	14 765	16 039	17 518
Monaco	233	300	270	263	235	250	286	313	328
Malta	1 116	1 216	1 180	1 134	1 127	1 156	1 171	1 124	1 244
Cyprus	2 100	2 686	2 697	2 418	2 303	2 349	2 470	2 401	2 416
Slovenia	732	1 090	1 219	1 302	1 373	1 499	1 555	1 617	1 750
Croatia	1 324	5 831	6 544	6 944	7 409	7 912	8 467	8 659	9 307
Bosnia-Herzegovina	37	171	139	160	165	190	217	256	306
Montenegro	228	239	351	136	142	188	272	378	984
Albania	40	32	34	36	41	32	48	60	57
Turkey	7 083	9 586	10 783	12 790	13 341	16 826	20 273	18 916	22 248
Syria	815	1 416	1 801	2 186	2 085	3 033	3 368	4 422	4 566
Lebanon	450	742	837	956	1 016	1 278	1 140	1 063	1 017
Israel	2 215	2 417	1 196	862	1 063	1 505	1 903	1 825	2 268
Palestinian Territories		330	43	33	37	56	88	123	264
Egypt	2 871	5 116	4 357	4 906	5 746	7 795	8 244	8 646	10 610
Libya	56	174	169	135	142	149			
Tunisia	4 120	5 058	5 387	5 064	5 114	5 998	6 378	6 550	6 762
Algeria	520	866	901	988	1 166	1 234	1 443	1 638	1 743
Morocco	2 602	4 278	4 380	4 453	4 761	5 477	5 843	6 558	7 408
Total									
North Shore	141 945	190 930	191 350	195 711	192 270	191 511	197 586	209 178	218 657
South and East Shore	20 732	29 983	29 854	32 373	34 471	43 351	48 680	49 741	56 886
Mediterranean	162 677	220 913	221 204	228 084	226 741	234 862	246 266	258 919	275 543
World	540 000	687 000	688 000	709 000	694 000	764 000	805 000	850 000	908 000
Ratio									
North Shore / Mediterranean	87	86	87	86	85	82	80	81	79
South and East Shore / Mediterranean	13	14	13	14	15	18	20	19	21
Mediterranean / World	30.1	32.2	32.2	32.2	32.7	30.7	30.6	30.5	30.3

Note: 1995, 2000 and 2001 data for Montenegro refer to the Serbia-Montenegro

Source: UN-WTO, Plan Bleu computations

Table 25 Arrivals of international tourists per transport mode (thousand)

Countries	1996				2006			
	Air	Road	Rail	Sea	Air	Road	Rail	Sea
Spain	24 658	9 369	379	1 815	42 445	13 819	281	1 646
France	9 136	44 660	4 082	4 527	17 718	48 755	4 880	7 730
Italy	8 415	43 794	3 080	1 961	21 520	41 032	1 900	1 901
Greece	9 136	943	28	1 127	11 509	3 441	79	2 255
Monaco					222			91
Malta	973			81	1 104			20
Cyprus	1 744			344	2 408			221
Slovenia	75	739	17	1	310	1 256	48	2
Croatia	522	18 077	377	109	1 825	44 560	312	1 036
Albania	52	160		44	151	645		141
Turkey	6 240	1 360	92	922	14 085	4 206	72	1 457
Syria	325	2 101		9	686	5 313		11
Israel	1 612	471		17	1 568	255		2
Egypt	2 579	801		516	7 610	812		660
Libya		1 225		51				
Tunisia	2 674	1 155		55	4 144	2 305		101
Algeria	370	63		172				
Morocco	1 277	395		1 021	3 549	1 072		1 937

Source: UN-WTO, Plan Bleu computations

Table 26 Rate of motorisation and number of passenger cars

Countries	Number of passenger cars (per 1000 inhabitants)				Total number of passenger cars (1000)			
	2000	2003	2004	2005	2000	2003	2004	2005
Spain	431	445			17 353	18 692		
France	476	492	494	494	28 034	29 596	29 897	30 071
Italy	545		590	595	31 037		34 323	34 871
Greece	293	348	368	388	3 199	3 836	4 071	4 308
Malta	485	520	523		189	207	210	
Cyprus	340	371	406	550	236	268	300	417
Slovenia	426	446	456	471	847	890	911	942
Croatia	257	291	301	312	1 157	1 293	1 337	1 386
Albania	37		61		114		191	
Turkey	66	66	75	80	4 450	4 667	5 336	5 765
Syria	8	11	12		132	197	221	
Lebanon	403				1 520			
Israel	226	231	234	239	1 421	1 545	1 592	1 655
Palestinian Territories		23	27	29		77	95	105
Egypt	25	26	27		163	1 827	1 932	
Libya				232				1 373
Tunisia	54		83		516		824	
Algeria	56	56	57	58	1 708	1 786	1 845	1 906
Morocco	44	46			1 252	1 358		
World	104	118			634 643	744 407		

Source : WDI, IRF

Table 27 Length of rail and road networks

Countries	Rail (km)			Road (km)			Paved road (%of the road network)		
	1995	2000	2005	1995	2000	2005	1995	2000	2005
Spain	12 280	13 866	14 484		664 024	666 292	99	99	99
France	31 939	32 515	29 286	892 700	894 000	950 985		100	100
Italy	16 003	16 499	16 225	315 000	479 688	484 688	100	100	100
Greece	2 850	2 299	2 576	117 000	116 470	117 533	92	92	
Malta				2 000	2 213	2 254	95	88	88
Cyprus				10 150	11 141	12 060	57	61	63
Slovenia	1 201	1 202	1 228	14 836	38 403	38 485	80	100	100
Croatia	2 296	2 727	2 726		28 123	28 472		85	84
Bosnia-Herzegovina		1 032	1 000	21 826	21 826	21 846	52	52	52
Albania	674	440	447	18 000	18 000		39	39	
Turkey	8 549	8 671	8 697	381 300	385 960	426 914	23	34	
Syria	1 525	1 771		37 059		94 890	25		20
Lebanon			401	6 359	7 300	6 970	95	85	
Israel	610	676	899	14 751	16 449	17 589	100	100	100
Palestinian Territories						4 996			100
Egypt	4 810	5 024	5 150	58 000	64 000	92 370	78	78	
Libya			2 757	81 600	83 200		57	57	
Tunisia	1 860	2 260	1 909	22 500	18 997	19 232	79	68	66
Algeria	4 290	3 793	3 572	102 424	104 000	108 302	69	69	70
Morocco	1 907	1 907	1 907	60 559	57 626	57 626	50	56	62

Notes:

- Data for Road in Bosnia-Herzegovina and Palestinian Territories in 2000 refer to 2001
- Data for Road in Malta, Cyprus, Syria, Egypt, Tunisia and Algeria en 2005 refer to 2004
- Data for Paved road in Syria in 2000 refers to 2001
- Data for Paved road in Malta, Cyprus, Syria, Egypt, Tunisia and Algeria en 2005 refer to 2004

Sources: WDI, IRF, World Bank

Table 28 Waste water treatment plans in the Mediterranean coastal cities, 2004 (H2020 indicator)

Countries	Number of cities					Number of inhabitants (1000)				
	Total	With WWTP	Stopped/ in maintenance	In project/ Under construction	Without WWTP	Total	With WWTP	Stopped/ in maintenance	In project/ Under construction	Without WWTP
Spain	73	69	0	0	4	6 413	6 221			192
France	70	68	0	0	2	5 098	5 052			46
Italy	120	100	0	12	8	8 003	7 443		413	147
Greece	64	52	3	0	9	7 207	6 776	127		304
Malta	1	1	0	0		35	35			
Cyprus	15	7	0	0	8	214	104			109
Slovenia	4	4	0	0		330	330			
Croatia	3	2	0	0	1	76	63			13
Albania	10	8	0	0	2	797	649			148
Turkey	4		0	0	4	300				300
Syria	34	22	0	0	12	4 784	4 279			506
Lebanon	6		0	0	6	604				604
Israel	7	1	0	0	6	2 256	1 200			1 056
Palestinian Territories	9	9	0	0		3 640	3 640			
Egypt	13	6	0	2	5	5 161	4 762		224	175
Libya	17	6	6	4	1	4 062	721	2 476	785	80
Tunisia	32	21	0	7	4	3 983	3 197		693	93
Algeria	98	30	6	4	58	4 290	1 374	323	118	2 475
Morocco	12	2	0	2	8	1 473	264		973	237
Total										
North Shore	364	311	3	12	38	28 473	26 674	127	413	1 259
South and East Shore	228	97	12	19	100	30 254	19 437	2 799	2 793	5 226
Mediterranean	592	408	15	31	138	58 727	46 111	2 926	3 206	6 484

Notes:

- WWTP : Waste Water Treatment Plants
- This table do not include the cities discharging into rivers

Source: MEDPOL

Table 29 Waste water treatment plans in the Mediterranean coastal cities, 2004 (%) (H2020 indicator)

Countries	Number of cities				Number of inhabitants			
	With WWTP	Stopped/ in maintenance	In project/ Under construction	Without WWTP	With WWTP	Stopped/ in maintenance	In project/ Under construction	Without WWTP
Spain	95	0	0	5	97			3
France	97	0	0	3	99			1
Italy	83	0	10	7	93		5	2
Greece	81	5	0	14	94	2		4
Malta	100	0	0	0	100			0
Cyprus	47	0	0	53	49			51
Slovenia	100	0	0	0	100			0
Croatia	67	0	0	33	83			17
Albania	80	0	0	20	81			19
Turkey	0	0	0	100	0			100
Syria	65	0	0	35	89			11
Lebanon	0	0	0	100	0			100
Israel	14	0	0	86	53			47
Palestinian Territories	100	0	0	0	100			0
Egypt	46	0	15	38	92		4	3
Libya	35	35	24	6	18	61	19	2
Tunisia	66	0	22	13	80		17	2
Algeria	31	6	4	59	32	8	3	58
Morocco	17	0	17	67	18		66	16
Total								
North Shore	85	1	3	10	94		1	4
South and East Shore	43	5	8	44	64	9	9	17
Mediterranean	69	3	5	23	79	5	5	11

Notes:

- WWTP : Waste Water Treatment Plants
- This table do not include the cities discharging into rivers

Source: MEDPOL

Table 30 The Mediterranean marine ecosystems

Countries	Mediterranean coastline	Georeferenced Magnoliophytes and corallogenic reefs		Number of protected species*		Specially protected areas	
	(km)	(km)	Percentage	2002	2007	Number	Protected area (km²)
Spain	2 580	1 600	62	61	61	355	23 720
France	1 703	1 300	76	47	47	293	5 072
Italy	7 375	5 000	68	104	104	26	2 868
Monaco	4	0		19	19	3	1
Greece	15 021	3 800	25	0	54	12	2 667
Malta	180	175	97	47	96	6	12
Cyprus	782	67	9	54	54	8	2 076
Slovenia	47	8	17	25	36	8	16
Croatia	5 835	5 600	96	20	66	12	3 147
Bosnia-Herzegovina	23	0				2	80
Montenegro	294	2	1	0	43	23	
Albania	418	6	1	5	26	12	1 500
Turkey	5 191	51	1	0	30	13	9 581
Syria	183	0				3	50
Lebanon	225	0		18	18	2	13
Israel	179	0		0	81	29	27
Palestinian Territories	55	0					
Egypt	955	0		0	31	4	1 586
Libya	1 770	75	4	18	18	13	3 184
Tunisia	1 298	380	29	0	19	8	240
Algeria	1 200	70	6	0	13	8	1 054
Morocco	512	0		0	19	1	485
Total							
North Shore	34 261	17 558	51			760	41 159
South and East Shore	9 638	576	6			81	16 219
Mediterranean	43 899	18 134	41			841	57 378

Note: *Number of species of the annex II of the SPA/BD protocol protected in the countries

Sources: SPA/RAC and Plan Bleu, from national sources and reports

Table 31 Waste production and waste disposals (H2020 indicator)

Countries	Year	Waste production (1000 t)				Number of controlled landfills for non-hazardous waste
		Total amount generated	Hazardous waste	Industrial waste	Municipal waste	
Spain	2006	160 947	4 028	22 427	26 209	482
France	2006	445 865	9 622	22 973	33 879	769
Italy	2006	155 025	7 465	39 997	32 508	557
Greece	2006	51 325	275	5 285	4 927	1 440
Malta	2006	2 861	51	50	253	12
Cyprus	2006	1 870	80	413	571	54
Slovenia	2006	6 036	116	2 385	866	53
Turkey	2004	58 820		15 389	29 225	2 420
Syria	2004		42 e		7 500 e	4
Lebanon	2001	1 449 e	108	260 (1)	1 440	3 (2)
Israel	2006	5 527 (3)	340 (4)			22
Palestinian Territories	2006	2 053	15	984	1 166 (5)	0
Egypt	2000	67 871		5 000 e	29 000	1 (4)
Tunisia	2004		150 (6)	7 500 (7)	2 025	5 (2)
Algeria	2003	11 100	325 (8)	1 030	8 500 (9)	13 (10)
Morocco	2000	7 500 (2)	131	974	6 500	6 (2)

Notes:
(1) 2000 Data.
(2) 2006 Data.
(3) 2003 Data, refers to collected waste.
(4) 2004 Data, refers only to hazardous waste treated.
(5) 2005 Data.
(6) 2002 Data.
(7) 2003 Data.
(8) Refers only to hazardous industrial waste.
(9) of which 1,5 million tonnes of similar industrial waste.
(10) 2004 Data.
e: estimations

Source: Eurostat, from national sources

Table 32 Composition of municipal waste (%) (H2020 indicator)

Countries	Year	Organic waste	Papers and cardboard	Textiles	Plastics	Glass	Metals	Others wastes
Spain	2006	11.1	4.1	0.0	0.7	5.6	2.1	76.4
France	2006	10.1	7.8	0.2	1.4	3.8	1.0	75.6
Italy	2006	0.3	3.4	0.0	0.5	2.3	0.2	93.3
Malta	2006	2.1	1.2	0.0	0.2	0.5	0.1	96.0
Cyprus	2006	0.0	3.8	9.0	16.3	1.6	3.1	66.2
Slovenia	2006	3.2	2.4	0.2	0.9	1.1	1.2	91.0
Syria	2004 e	60.0	10.0	2.5	12.0	2.5	4.0	9.0
Lebanon	2001 e	51.0	17.0	3.0	10.0	9.0	3.0	7.0
Israel	2006 (1) e	40.0	25.0	4.0	13.0	3.0	3.0	12.0
Palestinian Territories	2006 (2)	86.0	2.7	0.0	0.0	0.0	0.0	11.3
Egypt	2000	55.0	15.5	3.5	7.5	3.0	4.5	11.0
Tunisia	2004	68.0	10.0	2.0	11.0	3.0	4.0	2.0
Algeria	2003	10.1	2.1	2.7	1.1	2.9	76.5	4.7
Morocco	2000	68.5	19.0	2.0	4.0	4.0	2.5	0.0

Notes:
(1) refers to collected waste. Since 205, data include recycled materials collected within the municipality
(2) refers to the collected household's waste
e: estimations

Source: Eurostat, from national sources

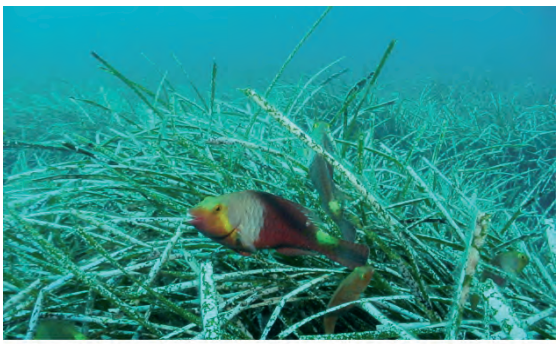
Acronyms and Abbreviations

AAGR	Average annual growth rate
ADEME	French Environment and Energy Management Agency
AFD	Agence française de développement
AFS	Anti-Fouling System
ARENE	Agence régionale de l'environnement et des nouvelles énergies (France)
ARPC	Association des récupérateurs de papier carton (Morocco)
BAMM	Bathing Area Management Model
BARE	Bathing Area Registration and Evaluation system
Bcm =Gm3	billion cubic meters = Giga cubic meter
BOD	Biochemical Oxygen Demand
BOD_5	Biochemical oxygen demand during 5 days
BWM	Ballast Water Management Convention
CAIT	Climate Analysis Indicators Tool
CAMP	Coastal Area Management Programme
CBD	Convention on Biological Diversity
Cd	Cadmium
CDM	Clean Development Mechanism
CESD	Centre for Environmentally Sustainable Development (Bosnia-Herzegovina)
CHM	Clearing House Mechanism
CIESIN	Centre for International Earth Science Information Network
CIESM	International Commission for the Scientific Exploration of the Mediterranean Sea
CIHEAM	International Centre for Advanced Mediterranean Agronomic Studies
CITET	Centre international des Technologies de l'environnement de Tunis
CMPP	Centre marocain de production propre
CNES	Centre national d'études spatiales (France)
CNTPP	Centre national des technologies de production plus propre (Algérie)
CO	Carbon monoxide
CO_2	Carbon dioxide
COD	Chemical oxygen demand
CP/RAC	Cleaner Production Regional Activity Centre
DDT	Dichlorodiphenyltrichloroethane
dw	Dry weight
DWT	Deadweight Tonnage
EC	European Council
ECAP	Ecosystem Approach
ECC	European Cruise Council
EE	Energy Efficiency
EEA	European Environment Agency
EEZ	Exclusive Economic Zone
EI	Energy Intensity
EIB	European Investment Bank
EIC	European Information Centre
EMSC	European-Mediterranean Seismological Centre

ENCPC	Egypt National Cleaner Production Centre
EU	European Union
EWRA	Egyptian Water Regulatory Agency
FAO	Food and Agriculture Organisation of the United Nations
FFEM	French Global Environment Facility
FRA	Fisheries Restricted Areas
GDP	Gross Domestic Product
GEF	Global Environment Facility
GFCM	General Fisheries Commission for the Mediterranean
GHG	Greenhouse gas
Gm^3	Giga cubic meter
GPP	Green Public Procurement
GW	Giga watt
GWh	Gigawatt per hour
H2020	Horizon 2020 initiative
HAB	Harmful Algal Bloom
HCB	Hexachlorobenzene
HCMR	Hellenic Centre for Marine Research
HCWW	Holding Company for Water and Wastewater (Egypt)
Hg	Mercury
HNS	Hazardous and Noxious substances
ICC	International Coastal Cleanup
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICZM	Integrated Coastal Zone Management
IEA	International Energy Agency
ILO	International Labour Organization
IMO	International Maritime Organisation
IOAC	International Civil Aviation Organization
IPCC	Intergovernmental Panel on Climate Change
IPIECA	International Petroleum Industry Environment Conservation Association
IRF	International Road Federation
IUCN	World Conservation Union
IUU	Illegal, unregulated and unreported fishing
JRC	European Joint Research Centre
K	Potassium
Km^2	Square kilometre
Km^3	Cubic kilometre
koe	Kilo of oil equivalent
LA21	Local Agenda 21
LBS	Land-Based Sources
LDCF	Least Developed Country Fund
LEGOS	Laboratoire d'études en géophysique et océanographie (France)
LPG	Liquefied Petroleum Gas
m/c	Marine and coastal
MA	Millennium Ecosystems Assessment

MAP	Mediterranean Action Plan
MARPOL	International Convention for the Prevention of Pollution from ships
MATE	Ministère de l'Aménagement du Territoire et de l'Environnement (Algérie)
MDG	Millennium Developments Goals
MED	Mediterranean region
MED POL	Programme for the Assessment and Control of Marine Pollution in the Mediterranean Region
MEDWET	Mediterranean Wetlands Initiative
MENA	Middle East and North Africa
METAP	Mediterranean Environment Technical Assistance Programme
MIDIV	Monitoring Illicit Discharges from Vessels
MOIG	Mediterranean Oil Industry Group
MSSD	Mediterranean Strategy for Sustainable Development
Mtoe	Million tonnes of oil equivalent
MWe	Megawatt electric
MWO	Mediterranean Wetlands Observatory
N	Nitrogen
NAPA	National Adaptation Programme of Action
NBB	National Baseline Budget
ng/g	Nano gram per gram
µg/g dw	Microgramme per gramme of dry weight
µg/g ww	Microgramme per gramme of wet weight
NGO	Non-governmental organisation
NGV	Natural Gas Vehicle
NKP	Nitrogen, Potassium and Phosphate
NMC	Northern Mediterranean Countries
NOAA	National Oceanic and Atmospheric Administration (US)
NOx	Nitrogen oxide
OECD	Organisation for Economic Cooperation and Development
OGJ	Oil and Gas Journal
OME	Mediterranean Energy Observatory
ONAS	National Sanitation Utility (Tunisia)
ONEP	Moroccan National Drinking Water Utility
ONERC	Observatoire national des effets du changement climatique (France)
OPRC	Convention on Oil Pollution Preparedness, Response and Cooperation
P	Phosphorus
PACA	Provence Alpes Côte d'Azur (French region)
PAH	Polycyclic Aromatic Hydrocarbons
PAP/RAC	Priority Action Programme Regional Activity Centre
Pb	Lead
PCB	Polychlorinated Biphenyls
PM	Particulates matters
POP	Persistent Organic Pollutants
PPP	Purchasing Power Parity
REMPEC	Regional Marine Pollution Emergency response Centre for the Mediterranean Sea
RNO	Réseau National d'Observation de la qualité du milieu marin (France)

ROV	Remote Operated Vehicle
SAP MED	Strategic Action Programme
SCCF	Special Climate Change Fund
SEBI 2010	Streamlining European 2010 Biodiversity Indicators
SEE	South East Europe
SEMC	Southern and Eastern Mediterranean Countries
SIAAP	Syndicat interdépartemental pour l'assainissement de l'agglomération parisienne (France)
SIDIMAR	Programma di Monitoraggio dell Ámbiente Marino / national Italian monitoring programmes
SIPAM	Information system for the promotion of aquaculture in the Mediterranean
SMAP	Short and Medium Term Action Programme for the Environment (EU-MEDA)
SNCPC	Syrian National Cleaner Production Centre
SO_2	Sulfur dioxide
SPA funds	Strategic Priority on Adaptation funds
SPA	Specially Protected Areas
SPA RAC	Regional Activity Centre for Specially Protected Areas
SPA/BD Protocol	Specially Protected Areas and Biodiversity Protocol
SST	Sea surface temperature
TCI	Tourism Comfort Index
TEU	Twenty foot Equivalent Unit
Toe	Tonne of oil equivalent
TSS	Total Suspended Solid
TWh	Terawatt hour
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UN-Habitat	United Nations – Habitat (housing)
UNICEF	United Nations Children's Fund
UNIDO	United Nations Industrial Development Organization
VMS	Vessel Monitoring System
VOC	Volatile Organic Compound
WDI	World Development Indicators
WDM	Water Resources Management
WEC	World Energy Council
WFD	Water Framework Directive
WRI	World Resources Institute
WTO	World Travel Organisation
WTTC	World Travel and Tourism Council
WWF	World Wide Fund for nature
WWTP	Waste Water Treatment Plant



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