



PRIORITY
ACTIONS
PROGRAMME



Climate Change in Coastal Zones of the Mediterranean

Position Paper



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Acronyms

ACCCA	Advancing Capacity to support Climate Change Adaptation
ADB	Asian Development Bank
ALM	Adaptation Learning Mechanism
AR4	Fourth Assessment Report
ASLR	Accelerated Sea Level Rise
AWG-LCA	Ad-hoc Working Group on Long-Term Co-operative Action
BD	Biodiversity
CAM	Coastal Area Management
CAMP	Coastal Area Management Programme
CAP	Common Agricultural Policy
CARICOM	Caribbean planning for Adaptation to Global Climate Change
CBAMPIC	Capacity Building for the Development of Adaptation Measures in Pacific Island Countries Project
CCA	Climate Change Adaptation
CIRCE	Climate change and impact research: the Mediterranean environment
CMCC	Centro euro-Mediterraneo per i Cambiamenti Climatici (Euro-Mediterranean Centre for Climate Change)
CNR	Consiglio Nazionale delle Ricerche (Italian National Research Council)
CO	Carbon monoxide
CO ₂	Carbon dioxide
COP	Conference of the Parties
CP	Contracting Party
EC	European Commission
EEA	European Environment Agency
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
ENEA	Italian National Agency for New Technologies, Energy and Sustainable Economic Development
ENPI	European Neighbourhood and Partnership Instrument
EPOCA	European Project on Ocean Acidification
EU	European Union
EUCC	European Union for Coastal Conservation
FEDER	Fundo Europea De Desenvolvimento Regional (European Regional Development Fund - ERDF)
FISR	Fondo Integrativo Speciale per la Ricerca
GCCA	Global Climate Change Alliance
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GEF	Global Environment Facility
GOCE	Gravity Field and Steady-State Ocean Circulation Explorer
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Corporation)
IASG	Impact and Adaptation Steering Group
ICARM	Integrated Coastal Area and River Basin Management
ICM	Integrated Coastal Management
ICZM	Integrated Coastal Zone Management
IADB	Inter American Development Bank
IMEP	Israel Ministry for Environmental Protection
IMELS	Italian Ministry for the Environment, Land and Sea
IPA	Instrument for Pre-Accession
INC	Initial National Communication
INTERREG	European Union INTERREGional Co-operation Programme
IPCC	Intergovernmental Panel on Climate Change
IUCN	World Conservation Union (International Union for the Conservation of Nature and Natural Resources)

IWRM	Integrated Water Resource Management
JRC-IES	EC Joint Research Centre
LDC	Least Developed Countries
MA	Millennium Ecosystem Assessment
MAAP	Mediterranean Adaptation Action Plan
MAP	Mediterranean Action Plan
MATTM	Ministero dell'Ambiente e della Tutela del Territorio e del Mare (Italian Ministry for the Environment, Land and Sea - IMELS)
MDGs	Millennium Development Goals
MEDA	Euro-Mediterranean Partnership
MEEDDM	Ministère de l'Écologie, de l'Énergie, du Développement durable et de la Mer (French Department of Ecology, Energy, Sustainable Development and the Sea)
MFF	Mangroves for the Future
MIPAAF	Ministero delle Politiche Agricole, Alimentari e Forestali (Italian Ministry of Agricultural, Food and Forestry Policies)
MPA	Marine Protected Area
MSSD	Mediterranean Strategy for Sustainable Development
MUR	Ministero dell'Università e della Ricerca
NAO	North Atlantic Oscillation
NAPA	National Adaptation Programmes of Action
NAS	National Adaptation Strategy
NGO	Non-Governmental Organisation
NOA	National Observatory of Athens
ODA	Official Development Assistance
OECC	Oficina Española de Cambio Climático (Spanish office for Climate Change)
OECD	Organisation for Economic Co-operation and Development
ONERC	Observatoire National sur les effets du réchauffement climatique (French National Observatory on the effects of global warming)
PAP/RAC	Priority Actions Programme / Regional Activity Centre
PESETA	Projection of Economic impacts of climate change in Sectors of the European Union based on bottom-up Analysis
PICs	Pacific Island Countries
PoW	Programme of Work
ReCAF	Regional Coastal Adaptation Framework
RENA	Regional Environmental Network for Accession countries
REReP	Regional Environmental Reconstruction Programme
SBI	Subsidiary Body for Implementation
SBSTA	Subsidiary Body for Scientific and Technological Advice
SIDS	Small Island Developing State or States
SLR	Sea Level Rise
SNC	Second National Communication
SPA	Specially Protected Area
SRES	Special Report on Emission Scenarios
SST	Sea Surface Temperature
TACIS	Technical Aid to the Commonwealth of Independent States
UKCIP	United Kingdom Climate Impacts Programme
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USAID	United States Agency for International Development
V&A	Vulnerability and Adaptation
WGs	Working Groups

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Executive Summary

The science of global climate change has been the focus of an extensive international research effort, particularly over the last 20 years. The results of this research indicate that the climate of the earth is changing and will continue to change through the coming century. Projections for change include an increase in global air temperatures and sea surface temperatures, changes in precipitation patterns and a rise in mean sea level. These changes in climate will occur irrespective of whether global greenhouse emissions are curbed – and to a much greater degree if future emissions are not significantly reduced.

Coastal environments and the societies that rely on them will face important challenges as a result of projected changes in climate. This is due to the inherent physical sensitivity of the coastal ecosystem and the traditional socio-economic, cultural and amenity values which humans place on the coastal zone.

The Mediterranean coastal zone: a case for climate change adaptation?

The Mediterranean coastal zone is densely populated and highly urbanized, with 40% of land used for human activity and, although the socio-economic costs of climate change have not yet been fully assessed, major sectors such as agriculture and tourism are predicted to suffer decline from drought, water shortage and increased occurrence of storms. Sea level rise impacts on ports and other coastal infrastructure as well as the coastal erosion are also a concern while recent episodes of human health affected by undesirable organisms such as algal blooming and jellyfish may further multiply as a consequence of higher temperatures.

The need for some form of adaptation to climate changes is now a consensus view in light of the inevitability of impacts on already pressurised coastal zones.

The Role of the PAP/RAC: impetus for a Position Paper

PAP/RAC plays a critical role in coordination and support of ICZM, which encompasses climate change adaptation. In recognition of this, climate change adaptation has become an important new mandate¹ of the PAP/RAC and has recently been adopted into its proposed five-year Programme of Work of UNEP/MAP. The key tool for implementation of adaptation initiatives within the Mediterranean Region under the UNEP/MAP structure will be ICZM Protocol. In this context, the challenge that now faces MAP and in particular the PAP/RAC is the building of adaptive capacity throughout the region within the existing framework of this Protocol to allow effective mainstreaming at a range of temporal and spatial scales.

Before detailed planning in this regard can be undertaken, it is necessary to gain an understanding of the range of climate change impacts to which the region is subject and the policies and strategies and projects and programmes employed to address these impacts at a range of temporal and spatial scales. Additionally, a consideration of climate change vulnerability and adaptation assessment practice at a global scale will provide MAP with an overview of 'best practice' to inform future initiatives. In this context, the current Position Paper is built on a review of the current status of, and experience in, climate change adaptation initiatives both regionally and globally to provide a set of recommendations for PAP/RAC. These recommendations are intended to build on lessons learned to provide important support for future climate change adaptation initiatives in the Mediterranean region.

¹ During the 16th Meeting of the Contracting Parties to the Barcelona Convention and its Protocols held in Marrakesh in November 2009, adaptation to climate change in the Mediterranean coastal and marine environments was identified as a priority issue requiring attention. Accordingly, climate change adaptation in the coastal zone has been incorporated into the "Marrakesh Declaration" on Adaptation to Climate Change (UNEP(DEPI)/MED IG.19/8 Annex I).

Review Findings

Climate change drivers: a hotter, drier climate grading north/south and west/east

An analysis of model predictions for the 21st century finds a continuing decrease in precipitation that extends throughout the Mediterranean region and reaches values as high as 20% less than the current mean precipitation by the end of the century. In the Mediterranean region overall, summer temperatures will increase most to the east during summer and to the south-west during autumn. Precipitation decreases will generally be insignificant in the northwest while the southwest will experience decreases of up to 5% during summer. In the southwest winter rainfall averages are expected to decrease by around 20% with this number increasing to 30% during winter months.

Considering north/south changes in precipitation across the basin, countries to the south will be subject to much greater decreases (around 27% reduction) than those to the north (approximately 4% reduction). While it is difficult to give accurate projections for sea level rise across the basin due to the importance of local affects, relative sea level rise will be greatest to the east and least to the west.

Regional Impacts: influenced by physical, ecological & socio-economic diversity

The impacts of climate change will be felt in natural and human systems. Initial assessments agree that the resulting impacts in the Mediterranean will include increased extreme water-related phenomena like floods and persistent droughts, enhanced water scarcity and increased desertification, the loss of – or shift in – vegetation zones, threatened food production as a result of increased irrigation demands and more numerous incidents of plant diseases. In marine and coastal areas water scarcity would lead to further salt water intrusion and insufficient freshwater flushing in estuaries. Researchers have also become increasingly concerned about ocean acidification linked with the absorption of carbon dioxide in seawater.

The range of physical, ecological and socio-economic conditions in the Mediterranean means that the impacts of climate change will be varied. While general trends in impacts can be inferred - for example low-lying sandy coasts with high population densities will be subject to greater impact than high relief rocky coasts with low population density - details on the relative scale and severity of impacts across the Mediterranean and at a country specific scale are currently unavailable. This is due in part to the lack of a regionally consistent approach to evaluating such impacts.

Regional adaptation activities: establishing adaptation maturity

A range of coastal adaptation projects, programmes and initiatives has been undertaken throughout the Mediterranean region. Each varies in scale and focus from regional, *versus* local and sector specific *versus* theme specific. Overall, few of the research programmes assessing the implications of potential climate change impacts or support of adaptation planning are 1) coastal or 2) Mediterranean specific. In addition:

- The range of projects currently underway demonstrates the lack of a co-ordinated approach to climate change action in the region.
- Implementation of adaptation action appears to have occurred based on regional directives (for example through the EU) or countries proactively sourcing funding.
- There are a number of useful existing research activities that PAP/RAC can build upon and potential leverage as they move towards co-ordinated adaptation planning on a region-wide basis.
- A key gap is a regional programme of works that can pull together the disparate activities and highlight key areas of focus for the PAP/RAC programme.

Following on from these observations, largely related to “gaps” in current knowledge, a series of specific recommendations for future action may be made:

- The five Non-Annex I countries yet to complete their Initial National Communications should do so as a priority.
- The seven Non-Annex I countries yet to submit their Second National Communications should focus attention to this task and provide an indicative timeframe for completion.
- The two Annex I countries yet to submit their 5th National Communication should provide a status update.
- Turkey should be supported in completion of its Second National Communication (as the only Annex I country yet to do so).
- All countries yet to produce specific climate change adaptation plans or strategies should do so as a priority or, at a minimum, timetable these activities into their upcoming programmes of work.

Adaptation maturity at a regional scale

The information gained in the review of adaptation activity in the region was used to infer a level of adaptation maturity associated with each of the MAP Contracting Parties (CPs). That is, the level of adaptation action currently underway for each CP in terms of plans, strategies, projects and programmes was considered as a surrogate for “current capacity”.

Categorisation of countries by level of vulnerability (incorporates a consideration of capacity to adapt and exposure to projected climate changes)

Prioritisation ID *	Grouping	Description
1	EU Annex 1 countries	These countries have developed national adaptation strategies and/or completed a number of National Communications. They possess a heightened understanding of their vulnerability to climate change. While Monaco is not currently a member of the EU, its status in terms of vulnerability and capacity necessitate its inclusion in this group.
2	Annex 1 non EU countries	Croatia and Turkey are Annex 1 countries, but are assigned special considerations. They are also candidate countries of the EU, and are therefore aligning themselves to EU policies and strategies. Consequently, EU CCA developments, such as the EU policy of CCA, have relevance to these countries, in more of a way than other non-EU countries.
3	Non Annex 1 EU countries	These countries are highly sensitive to the projected impacts of climate change. While they are EU countries, their geographical nature disposes them to high impacts of climate change (they are small island nations). In addition, the countries have existing coastal management issues (such as erosion and water shortages) that are likely to be exacerbated by climate change. Finally, they are also very dependent upon tourism, which is likely to be highly affected by climate change.
4	Non EU Balkan countries	These countries have not completed an initial national communication. Therefore, the understanding of their vulnerability to the projected impacts of climate change is not as well understood as other Mediterranean countries.
5	Middle East countries	Countries are grouped, but on the recognition that Syria has not completed a national communication.
6	North African	Whilst these countries are grouped together, Morocco is slightly less vulnerable to climate change because it has an active funded coastal adaptation project in the coastal zone and is also less physically susceptible to climate change due to geographic nature of the coast. Tunisia is very sensitive. All countries have issues of drought and desertification on top of all the other issues they have to deal with. The countries differ from European countries in that adaptation efforts are more development focused.

*Prioritisation is presented from highest adaptive capacity (1) to lowest adaptive capacity (6).

It is clear that the EU countries (Annex I Parties to the UN Framework Convention on Climate Change – UNFCCC) have the most established adaptation “architecture” of all CPs under consideration. Conversely, the UNFCCC non-Annex I Mediterranean Balkan countries and Middle Eastern Mediterranean countries have a much lower number of

projects, programmes, policies and strategies pertaining to climate change adaptation in the coastal zone.

It is important to remember that the presence/absence of a project in a region cannot be directly translated into a measure of capacity. For example, Albania may only have one active project, but this project is extensive and is serving to build capacity both at regional and national levels. Rather, an appreciation of the existence of specific policy and programme initiatives in conjunction with their overriding aims and objectives was used to create the groupings of countries in terms of their capacities to adapt to coastal climate change:

1. EU Annex I countries (France, Italy, Spain, Greece, Slovenia and Monaco*)
2. Annex 1 non EU countries (Croatia and Turkey)
3. Non-Annex I EU countries (Malta and Cyprus)
4. Non-EU Balkan countries (Bosnia and Herzegovina, Montenegro and Albania)
5. Middle East countries (Syria, Lebanon and Israel)
6. North African countries (Egypt, Libya, Tunisia, Algeria and Morocco)

Global adaptation activities

Key lessons learned from the review of adaptation activities at a global scale may be summarised as follows:

- Adaptation must be encompassed within a comprehensive management framework. From a coastal perspective, a strong approach to ICZM in which climate change adaptation can be mainstreamed is required.
- Most effective projects are focused, based on the realisation that climate change adaptation is a long-term process.
- A national framework is useful in ensuring a consistent approach to adaptation. However, whilst it is very valuable to set a national framework, there must be caution in applying a “one-size fits all” approach.
- There is no need to “reinvent the wheel”, existing frameworks and approaches should be utilised where possible.
- The key to effective pilot projects is knowledge management and dissemination to ensure that lessons learned in the pilot project can be widely shared to promote uptake beyond the pilot site. The components of knowledge transfer fit within two adaptation options: (i) Create Information; and (ii) Supportive social systems.
- Capacity building and climate change mainstreaming are widely advocated as tools to support effective climate change adaptation. However, the ability of a project to achieve increased capacity and climate change mainstreaming is not widely explored.
- Adaptation at the local level is useful in countries that do not have the required facilities to implement a top-down approach. Any approach to adaptation should combine top-down and bottom-up approaches if at all possible.
- Effectiveness of local scale adaptation projects is enhanced through decentralisation of project management and delivery.
- There is a need for proactive adaptation. Some adaptation issues will be difficult to face. Therefore, good practice necessitates that “stepping stones” be implemented immediately, to support broader transition into the future in keeping with the changing climate.

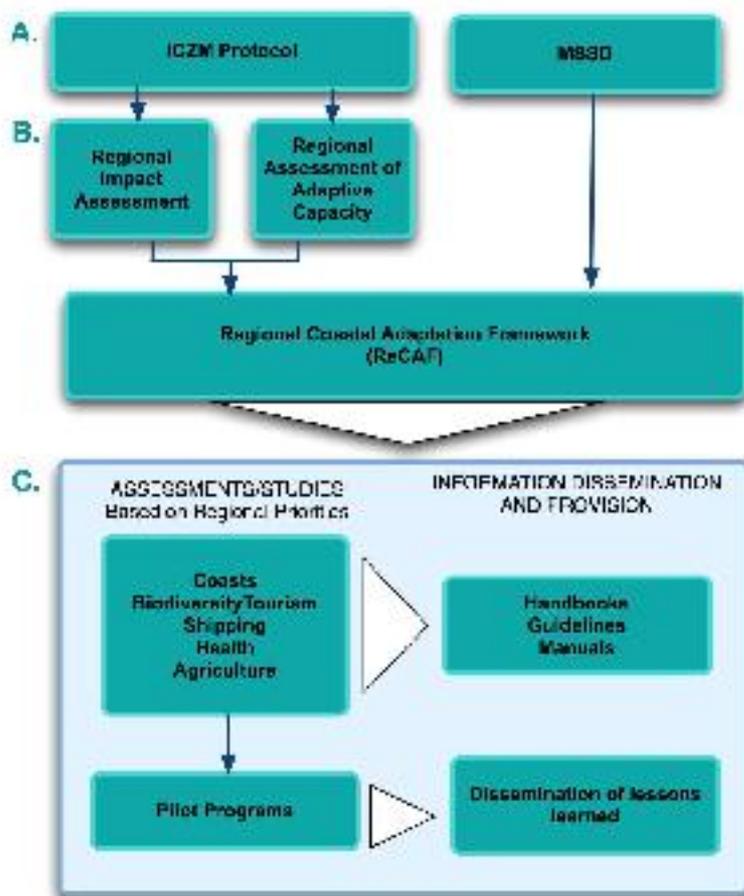
Recommendations for PAP/RAC

The information compiled through the foregoing review components was collated to inform a series of recommendations to assist PAP/RAC in supporting effective climate change adaptation activities throughout the Mediterranean coastal zone. These recommendations are summarised in the Table that follows under a series of categories: General Recommendations (G01-06); Recommendations pertaining to Co-operation (C01-02); Financing (F01-F05); Regional Priorities (R01-03); and Information (I01-I05).

ID	Description
G01	Promote ratification of the ICZM Protocol.
G02	Increase the awareness of CPs and other key stakeholders of the links between ICZM and climate change, as outlined in the ICZM Protocol.
G03	Support mainstreaming of climate change adaptation into the MSSD.
G04	Provide support to CPs on how mainstreaming adaptation is applicable in the coastal context. It will be important to demonstrate climate change mainstreaming across a variety of tiers, from regional (ICZM Protocol and MSSD), to national and local (guidelines, etc.).
G05	Support capacity building in key areas, i.e. climate change mainstreaming.
G06	Ensure that when the ICZM Protocol is reviewed, the important and intertwined nature of climate change in ensuring an integrated approach to coastal zone management in the Mediterranean is recognised.
C01	Demonstrate leadership in climate change adaptation by promoting a co-ordinated approach to climate change adaptation in the Mediterranean through the development of a Regional Coastal Adaptation Framework (ReCAF).
C02	Strengthen existing regional ICZM co-operation mechanisms to enhance the flow/support for information dissemination.
F01	Ensure up-to-date knowledge of the funding landscape for climate change adaptation and coastal management. Identify potential funding opportunities and disseminate this information to CPs as appropriate.
F02	Develop and/or support the development of targeted funding requests. Funding requests should be based on established understanding of regional priorities and local development objectives (as would be established through development of the ReCAF).
F03	Ensure collaboration in the development of any Regional Coastal Adaptation Framework (ReCAF). Whilst this is not a direct financial action, it provides the operational framework for financial activities, as finances should be targeted based on an understanding of regional priorities.
F04	Investigate opportunities to improve the uptake of adaptation action by Contracting Parties through better use of available financial resources and instruments and/or a combination of policy measures (i.e. funding measures, market-based instruments, guidelines and public-private partnerships).
F05	Encourage public-private partnerships with a view to sharing investment, risk, reward and responsibilities between the public and private sector in the delivery of adaptation actions.
R01	Commission an assessment of the relative impacts of climate change, and associated vulnerability, in the Mediterranean.
R02	Commission an assessment of the adaptive capacity of Mediterranean countries, to highlight focus areas for capacity building programmes.
R03	Apply the outputs from R01 (vulnerability assessment) and R02 (adaptive capacity assessment) into the Regional Coastal Adaptation Framework (ReCAF).
I01	Establish a well-coordinated coastal monitoring programme to ensure that the signal of coastal change driven by climate change can be detected and evaluated with respect to broader anthropogenic changes to the coast. This would require leadership from PAP/RAC to establish a Mediterranean wide agreement on the definition of key climate change indicators and the promotion of improved monitoring and reporting mechanisms.
I02	Support the development of climate information – downscaling climate projections and developing standardised approach to regional comparison of impacts. This recommendation aligns to recommendation R01.
I03	Lead innovation and development of good practices through implementation of local adaptation projects. It would be important to ensure that the local adaptation projects are selected based on regional prioritisation (see recommendation C01).
I04	Provide a facility for enhanced co-operation for climate change adaptation across the Mediterranean (North-South or from Annex1 countries to others).
I05	Application or development of new and innovative adaptation methodologies to the specificities of the Mediterranean coast including: the adaptation approach, measures, options and actions.

A Regional Coastal Adaptation Framework (ReCAF)

The ICZM Protocol and the MSSD (A below), in which climate change will be mainstreamed, will guide the development of a Regional Coastal Adaptation Framework (ReCAF). Additional components that are required to inform the development of the ReCAF include a regional impact assessment and a regional assessment of adaptive capacity (B). The assessments align to the PAC/RAC mandate and actions. Subsequently, the ReCAF will guide the implementation of sector or issue specific programmes in key vulnerable areas. These may be undertaken as pilot projects that will lead to lessons learned that can be disseminated throughout the region. In addition, PAP/RAC may create tools, guidelines and manuals in line with the key sector/issues to be addressed (as identified in the impact and capacity assessment). The key to Section C (below) is the creation and dissemination of information based on regional priorities, which link to national and local scale development objectives.



Conceptual framework guiding the development of PAP/RAC recommendations

The recommendations outlined here have been aligned to the PAP/RAC objective/mission and fields of action to demonstrate alignment between recommendations and the current Mandate of the PAP/RAC.

Alignment between PAP/RAC Mandate and Recommendation

Mandate	Associated Recommendations
Objective and Mission	
Provide assistance to Mediterranean countries in the implementation of Article 4(i) of the Barcelona Convention, meeting their obligations under the ICZM Protocol and implement the Mediterranean Strategy for Sustainable Development (MSSD), 2005;	G01, G02, G06, G03:
Carry out, in particular, the tasks assigned to it in Article 32 of the ICZM Protocol, 2008, as follows:	
1. Assist the Parties to define a common regional framework for integrated coastal zone management in the Mediterranean pursuant to Article 17;	C01, R03
2. Prepare a regular report on the state and development of integrated coastal zone management in the Mediterranean Sea with a view to facilitating implementation of the Protocol;	I01
3. Exchange information and carry out activities of common interest pursuant to Article 27;	I03, I04
4. Upon request, to assist the Parties: To participate in a Mediterranean coastal zone network pursuant to Article 16; To prepare and implement their national strategies for integrated coastal zone management pursuant to Article 18; To co-operate in training activities and in scientific and technical research programmes pursuant to Article 25; To co-ordinate, when appropriate, the management of transboundary coastal zones pursuant to Article 28;	R01, R02, F02
Fields of Action	
Formulating and implementing national strategies for action plans under the ICZM Protocol;	C01
Assisting countries in the region in strengthening their capacities with a view of facilitating the sustainable development of coastal zones by ensuring that environment and landscapes are taken into account in harmony with economic, social and cultural development; preserving coastal zones and their integrity; ensuring the sustainable use of coastal natural resources; and achieving coherence between public and private initiatives and between all decisions by the public authorities at all levels that impact the coastal zones;	F03, F04, F05:
Assisting countries in the implementation of demonstration/pilot coastal management projects in selected local Mediterranean coastal areas to demonstrate the application of ICZM as a major tool, with a view to implementing specifically the ICZM Protocol;	I05
Developing regional co-operation in the field of capacity building and awareness raising of the importance of the integrated management of coastal zones through the organisation of training, education and awareness-raising activities, networking, publications and the dissemination of information;	G04, G05, F01, F04, I02, I04:
Developing ICZM methodologies and tools as well as addressing specific sectoral issues with a coastal focus in the framework of ICZM, such as urban development, natural resources management, sustainable tourism, landscape and heritage protection, coastal and soil erosion, infrastructure and transport, pollution and waste, climate change, and specific coastal ecosystems.	I01:

Programme of Work (2010-2015)

The PAP/RAC Five-Year Programme of Work (PoW) builds on 6 themes: Governance, Integrated Coastal Zone Management, Biodiversity, Pollution Prevention and Control, Sustainable Consumption and Production and Climate Change.

Of particular relevance to the Climate Change theme and the recommendations proposed in this Position Paper are the undertakings to: strengthen and reinforce UNEP/MAP internal coherence with a view to ensuring integrated action and avoiding sectoral approaches; render the reporting and compliance system more effective; enhance partnerships and co-operation; prepare a sound basis for the implementation of the ICZM Protocol; enhance knowledge about the impact of climate change in the Mediterranean marine and coastal

areas and ensure their integration in adaptation strategies and overall National Sustainable Development policies.

Whilst the status of programme implementation is unknown, the outputs and indicative activities provide an insight into the committed funds that may support implementation of the recommendations outlined herein. The PoW and the recommendations are aligned in the Table below. The objective is to demonstrate the available resources (human and financial) committed to addressing the impacts of climate change. Whilst the description of the “specific activities” committed to in the PoW may not align directly to each recommendation, there is alignment between the intended outcomes of both activities. For example, Specific Activity 6.2.2 (Assist countries in elaborating strategies and funding requests regarding climate change and biodiversity) aligns to the recommendations F01 and F02.

There are a number of sectoral specific activities currently underway or planned to commence, as outlined in the PoW. However, a current gap is an overarching framework in which the activities are couched. For example, while activities such as: 6.2.1 *Vulnerability analysis of tourism in a selected area* and 6.2.3 *Analysis of the adaptation to climate change of the Water/Energy sectors*, will provide integral support to CPs in addressing the impacts of climate change, it is important that the alignment of such activities to the overall objectives of Regional Adaptation is clear. In other words, the alignment of sector specific analyses should be couched within a broader understanding of regional vulnerability. A Regional Adaptation Framework (recommendation C01) could provide this clarity.

Outputs and Activities in the PoW and recommendations

Output	Indicative Activities	Associated Recommendations
Output I Mediterranean region able to face climate change challenges through a better understanding of potential ecological impacts and vulnerabilities	<p><i>Better understanding/awareness of climate change impacts on the Mediterranean environment and natural resources:</i></p> <p>Contribute to assessing the impact of Climate Change on Marine and coastal biodiversity (identify the most vulnerable habitats and species to climate change), natural resources (soil, forests, water);</p> <p>Development of impact indicators tailored to the Mediterranean marine and coastal environment;</p> <p>Assessment of impacts on water quality and pollution risks as a result of climate change, particularly desertification, erosion, salinisation, flooding and sea level rise;</p>	R01 and I01
Output II Reduced socio-economic vulnerability	<p><i>Better understanding of the challenges of CC for the Mediterranean economy and societies:</i> through an analysis of socio-economic impact of CC (focused on coastal zone and maritime activities);</p> <p><i>Facilitate adaptation planning/processes that address and reduce vulnerability through supporting the development of the Marine and coastal dimensions of regional/national strategies on adaptation.</i></p>	R02, F01, F02, G05, and G04

Output	Indicative Activities	Associated Recommendations
	<i>Promotion of low carbon production and consumption in the context of the MSDD implementation</i>	
Output III Assess and provide information to reduce adverse environmental impacts of mitigation and adaptation strategies & technologies	<p>Assessment of environmental impact of CO2 sequestration</p> <p>Assessment of coast and marine physical alteration due to mitigation strategies and technologies</p> <p>Integration of environmentally sound desalination and waste water re-use in IWRM</p>	I05

Summary

The review undertaken towards production of this Position Paper highlights the complexity of the climate change adaptation issue. For example, an adaptation measure for one element (such as water supply in urban areas) can have adverse effects on other elements (such as water availability for agriculture or tourism). In light of this, the ecosystem approach, or holistic/comprehensive approach to dealing with adaptation measures is the only viable way forward. Priority areas for action must be selected according to an accurate assessment of the regional situation. This must include an awareness of socio-economic factors as well as physical change and ecosystems impacts. A major issue to be dealt with in the face of the “coastal squeeze” will be the displacement of populations and resulting climate refugees (for example in the Nile Delta).

Recommendations to assist PAP/RAC in the development and support of future adaptation activities within the Mediterranean coastal zone have been presented and aligned to the PAP/RAC mandate in addition to the requirements of the ICZM Protocol. These recommendations focus on the information needs to support the delivery of technical assistance to countries as well as actions that can be taken to build capacity of relevant stakeholders at regional, national and local levels. The activities of PAP/RAC will, by necessity, be pro-active and include, for example:

- Application or development of new and innovative adaptation methodologies to the specificities of the Mediterranean coast including: adaptation approach, measures, options and actions.
- Definition of how “mainstreaming” adaptation can be applied in the coastal context.
- Innovation and development of good practices through local adaptation projects.
- Review of the ICZM Protocol as knowledge and awareness of climate change impacts emerges and changes.
- Leading the development of climate change capacity in coastal awareness.
- Provision of a facility for North-South co-operation across the Mediterranean (or from Annex1 countries to others).

Developing a Mediterranean Coastal Adaptation Framework is seen as a key priority. This will encompass the need for sharing experiences and tools for adaptation, which is increasingly important at the regional level as work develops in the field. Although vulnerability and adaptive capacity to climate change varies widely depending on the

context, as do the initiatives to be undertaken, the need to share experiences and build capacity encourages the issue to be put on the regional agenda.

Overall, climate change brings with it a whole range of new governance and management techniques; economic and financial mechanisms, and community action needs. MAP and specifically PAP/RAC are ideally placed to play an active mentoring and leadership role as the countries of the Mediterranean move towards adapting to the large-scale issues arising from climate change. Ultimately, the effectiveness of this role will be shaped by political will within the region that should be cognizant of the need for foresight. This will be essential to mitigate the potential for even greater expenditure of resources in the future should effective and “adaptive” adaptation not be instigated as a pressing concern.

1. Introduction

The coastal zone is the interface between the marine and terrestrial environment. It is a physically complex and dynamic margin characterised by rocky shores, sandy beaches, reefs, lagoons, swamps, estuaries and deltas. This wide range of habitats is home to a diverse and unique variety of plants and animals. Additionally, the coastal zone is a confluence of industrial, recreational, residential and commercial pursuits making it a vital part of economic and cultural life.

The importance of the coastal zone, and its associated long history of human usage, inevitably leads to a wide range of pressures on the natural environment. This is particularly true in environmentally complex and densely populated coastal reaches like the Mediterranean (Figure 1; Table 1) where the coastal zone has been intrinsically tied to the development and sustenance of civilisations since early times.

It is estimated that 50-70% of the population in Mediterranean countries live within 60 km of the coast (Caffyn et al., 2002) with this proportion continuing to increase. In addition to high population density, the coastal zone has been subject to intensification of fisheries, industry, agriculture and tourism and the introduction of alien species (Grenon & Batisse, 1989; Di Castri et al., 1990). This has resulted in impacts that threaten the coastal zone. In particular, the future threat of greenhouse-gas induced climate change and sea level rise mean that the coastal zone is likely to be subject to accelerated long-term and cyclic erosion into the next century.

Impacts of climate change will be superimposed on a dynamic natural system that has been subject to a concerted management effort, especially with the evolution of Integrated Coastal Zone Management over the past two decades. In this respect, the challenge that faces coastal managers and decision makers into the future will be the effective mainstreaming of climate change adaptation into existing coastal management practices.

Table 1: Summary of geographic, biodiversity and socio-economic elements of the Mediterranean Coastal Zone (Data Source: UNEP/MAP-Plan Bleu, 2009)

Attribute	Details
Geography	<ul style="list-style-type: none"> • Semi-enclosed seas covering an area of 2,542,000 km², 46,000 kilometres long, with nearly 19,000 kilometres of island coastline • Coastal geography is diverse incorporating sandy shores (46%) and rocky cliffs (54%) with vast area of low-lying coastal land
Biodiversity	<ul style="list-style-type: none"> • 60% flora endemic • 30% fauna endemic • 7% of all the marine species known world-wide • Nearly 19% of assessed species to date are considered threatened with extinction
Socio/Economic	<ul style="list-style-type: none"> • 7% of the world's population with 460 million inhabitants • 31% of international tourism, with 275 million visitors and every year • 30% of international maritime freight traffic and some 20 to 25% of maritime oil transport transits the Mediterranean Sea • 60% of the population of the world's "water-poor" countries

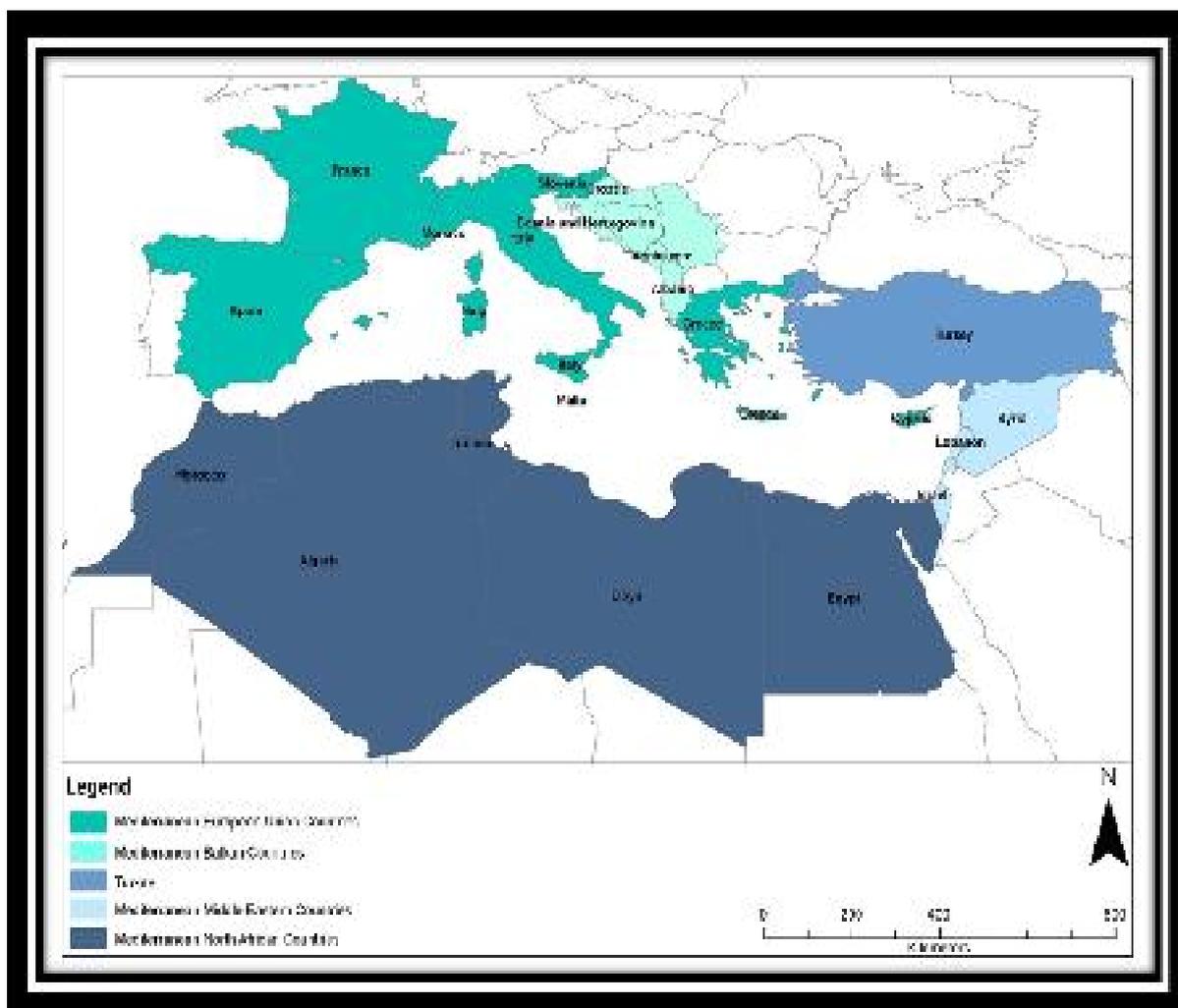


Figure 1: The Mediterranean region

1.1. Climate Change Adaptation and the Mediterranean Action Plan

The Mediterranean Action Plan (MAP) was the first Regional Seas Programme established by UNEP in 1975. It has 22 Contracting Parties² (CPs) with vested interest in the Mediterranean coastal zone and is governed by the Barcelona Convention. On its creation the main objectives of the MAP were to assist the Mediterranean countries to assess and control marine pollution, to formulate their national environment policies, to improve the ability of governments to identify better options for alternative patterns of development, and to optimize the choices for allocation of resources.

Although the initial focus of the MAP was on marine pollution control, experience confirmed that socio-economic trends, combined with inadequate development planning and management, were the root of many environmental problems. Consequently, the focus of MAP gradually shifted to include integrated coastal zone planning and management as the key tool through which solutions are being sought.

² The CPs are, in alphabetical order: Albania, Algeria, Bosnia and Herzegovina, Croatia, Cyprus, Egypt, the European Union, France, Greece, Israel, Italy, Lebanon, Libya, Malta, Monaco, Montenegro, Morocco, Slovenia, Spain, Syria, Tunisia and Turkey.

Within the MAP umbrella, the specific objective of the Priority Actions Programme/Regional Activity Centre (PAP/RAC) is to contribute to sustainable development of coastal zones and sustainable use of their natural resources (Figure 2). In this respect, PAP/RAC's mission is to carry out the tasks assigned to it in Article 32 of the Protocol on Integrated Coastal Zone Management in the Mediterranean (2008).

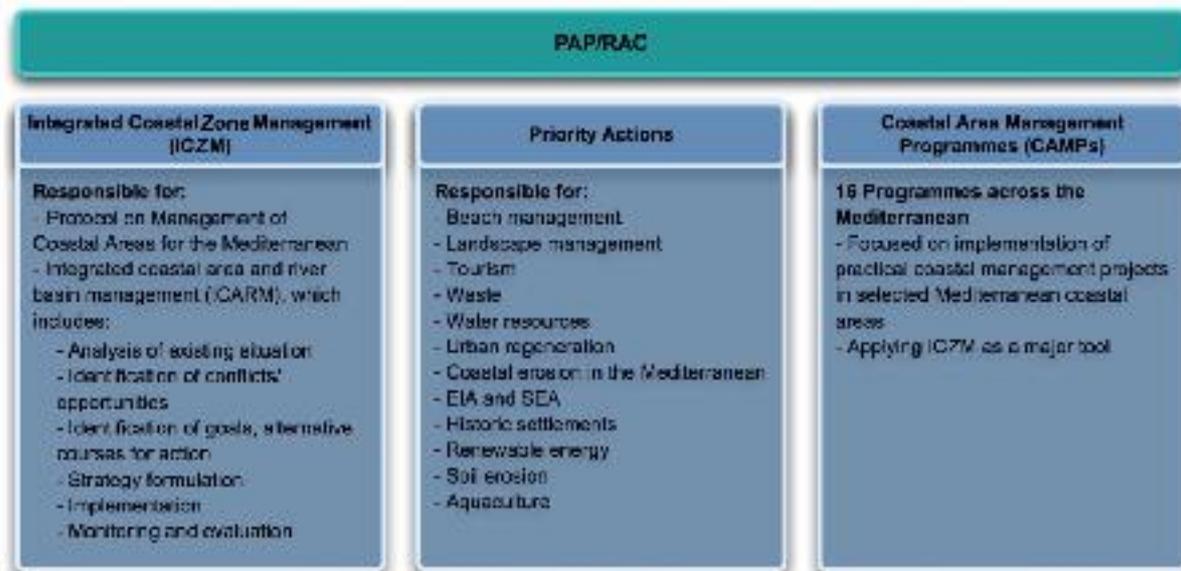


Figure 2: Fields of action of PAP/RAC

The ICZM Protocol was developed in response to increasing pressure in the Mediterranean coastal zone and the lack of legally binding commitments that would support progress in coastal management. The existing guidelines, recommendations, action plans and white papers developed to support coastal management were not binding, and there was recognition that without such binding commitments, on-ground progress in ICZM would be limited.

Following extensive consultation the resultant ICZM Protocol was signed in January 2008. It became the 7th Protocol in the framework of the Barcelona Convention. The Protocol was viewed as a crucial milestone that would allow countries to better manage their coastal zones and deal with emerging coastal environmental challenges, such as climate change (PAP/RAC, 2009) (Figure 3). PAP/RAC will, in turn, be responsible for the implementation of the Protocol across the 22 MAP Contracting Parties.

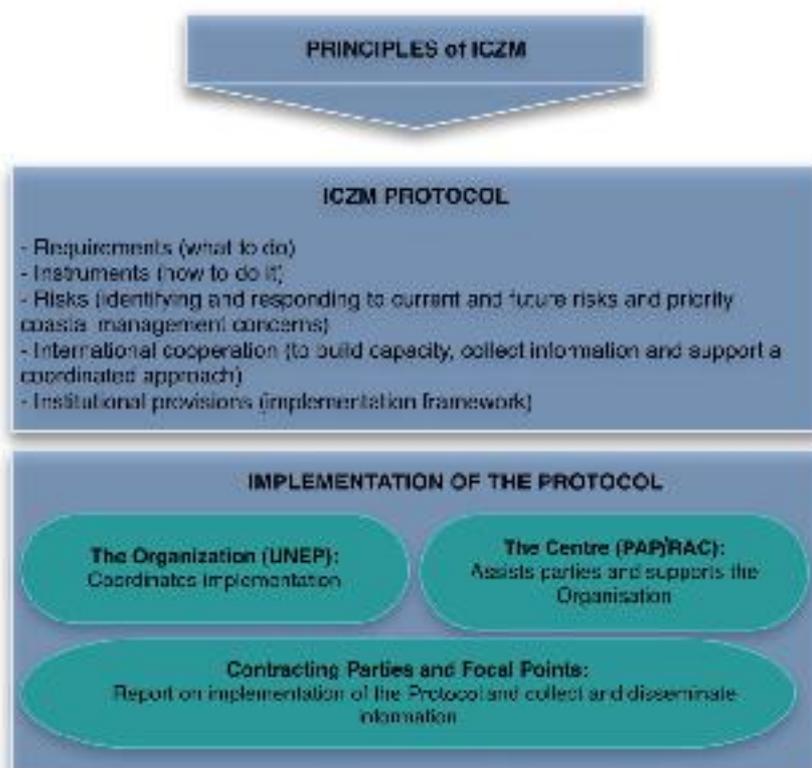


Figure 3: The ICZM Protocol, components and implementation framework

In addition to its well-established role in supporting Integrated Coastal Zone Management in conjunction with Contracting Parties, the MAP is aware of the pressing need to address the impending impacts of changes in coastal climate and their implications for ongoing coastal resilience. In light of this, climate change adaptation has become an important new mandate³ of the PAP/RAC and has recently been adopted into its proposed five-year Programme of Work of UNEP/MAP (UNEP(DEPI)/MED IG.19/8 Annex III).

It is widely accepted that the key tool for implementation of adaptation initiatives within the Mediterranean Region under the UNEP/MAP structure will be the ICZM Protocol. In this context, the challenge that now faces MAP and in particular the PAP/RAC is the building of adaptive capacity throughout the region within the existing framework of this Protocol to allow effective mainstreaming at a range of temporal and spatial scales.

1.2. Aims & Objectives

Before MAP can commence with detailed planning of its upcoming initiatives to support vulnerability and adaptation, it is necessary to undertake a review exercise to determine the policies and strategies and projects and programmes active in the region at a range of temporal and spatial scales. This is the key aim of the current **Position Paper**⁴.

³ During the 16th Meeting of the Contracting Parties to the Barcelona Convention and its Protocols held in Marrakesh in November 2009, adaptation to climate change in the Mediterranean coastal and marine environments was identified as a priority issue requiring attention. Accordingly, climate change adaptation in the coastal zone has been incorporated into the "Marrakesh Declaration" on Adaptation to Climate Change (UNEP(DEPI)/MED IG.19/8 Annex I).

⁴ The Position Paper is intended as a summary document to provide an overview of current initiatives within the region and recommendations for future action by PAP/RAC with specific reference to international best practice.

The objectives required to achieve this aim are summarised in Table 2 and include provision of an overview of impacts, threats and consequences of coastal climate change in the Mediterranean with a summary of the status of coastal adaptation initiatives around the globe to highlight best practice.

Review activities to support the production of this **Position Paper** were carried out between December 2009 and February 2010. Information contained in this document was collated through desktop review, focused on publicly available information. While the executive of the PAP/RAC was consulted through the formulation of the report, direct contact with Contracting Parties to MAP was beyond the scope of the investigation. This will be a key next step to build on the preliminary findings presented here. Further background information collated during the production of this Position Paper is presented in an accompanying **Background Paper**⁵.

Table 2: Key Objectives per Section

Objective	Details	Section
1	Overview at a strategic level the main threats/impacts/consequences of climate change to Mediterranean coastal areas	Section 2
2	Profile the coast; climate change vulnerability assessment and adaptation initiatives already undertaken or in progress by the Mediterranean countries using existing published information	Section 3
3	Summarise the status of the experience from other regions/countries to this respect	Section 4
4	Summarise the potential adaptation actions that could be undertaken by the Mediterranean countries in coastal zones	Section 5.1
5	Develop options on how to link the ICZM Protocol and potential adaptations measures	Section 5.2
6	Provide suggestions on the sort of technical assistance of the Mediterranean Action Plan and in particular PAP/RAC to countries to adapt to climate change in coastal zones	Section 5.3

⁵ The Background Paper was produced as a supplementary document to this Position Paper. It contains additional details and background material that have supported the development of recommendations presented here.

2. Impacts of climate change in the Mediterranean

The fourth report from the Intergovernmental Panel on Climate Change (IPCC) published in 2007, stressed that the globe is likely to be affected by climate change in the course of this century. Projections for 2100 suggest that temperature and sea level will have risen and a greater frequency and intensity of extreme weather events are expected. Even if emissions of greenhouse gases stop today, these changes would continue for many decades and, in the case of sea level, for centuries. This is due to the historical build up of the gases in the atmosphere and time lags in the response of climatic and oceanic systems to changes in the atmospheric concentration of greenhouse gases.

The widespread consensus on likely changes in climate at a broad scale has fostered a more recent consideration of scenarios for regional and sub-regional change. For example, recent initiatives have been concerned with “downscaling” climate predictions to make them more locally relevant (e.g. Hallegatte et al., 2007; Klein & Lichter, 2005; Klein & Lichter, 2009; Giannakopoulos et al., 2009; Van Grunderbeeck and Tourre, 2008). Downscaling of global models to the regional scale allows global climate change processes to be taken into account in estimating potential regional scale changes. On these scientific bases, and keeping in mind the inherent uncertainties in projecting future changes, three main components of the ocean/atmosphere system are vulnerable to major future climate evolutions: temperatures (air and sea), precipitation regimes, and sea level.

A summary of climate change projections relevant to the Mediterranean and likely associated impacts is presented here and can be supplemented with information contained in the associated **Background Paper**.

2.1. Climate Drivers

2.1.1. Temperature (Air and SST)

Increases in average annual temperature at a Mediterranean basin scale are likely to be slightly higher than at a world level (Hallegatte et al., 2007; Van Grunderbeeck and Tourre, 2008). This increase is estimated at approximately 2°C and 6.5°C by the end of the century (compared with a global mean increase between 1.1°C and 6.4°C). The probability of temperatures rising by between 3 and 4°C is estimated at 50% (Figure 4).

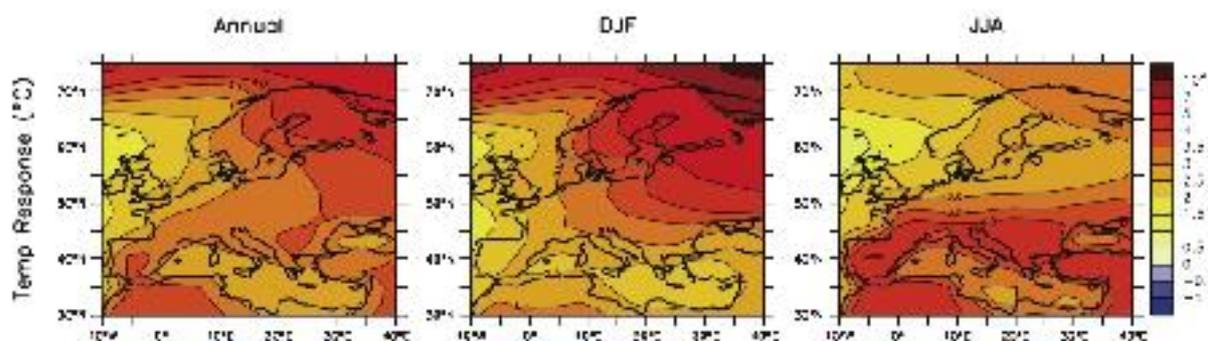


Figure 4: Temperature changes over Europe (A1B scenario) between 1980 to 1999 and 2080 to 2099 (Christensen et al., 2007)

Seasonal variations will remain significant, even if temperature increases are more marked in winter than summer. Infra-regional variations must also be considered: for example, in autumn, the western Mediterranean basin is likely to be characterised by a temperature elevation that is slightly higher than for the rest of the basin, whereas over the summer this trend is likely to be inversed, effecting southern and eastern countries.

Projections for average annual sea surface temperature suggest that the Mediterranean could be 1.1°C warmer by the period 2030-39, rising to 3.6°C by 2090-99 (Brochier & Ramieri, 2001) or +2°C to +4°C by the last quarter of the 21st century (Hertig and Jacobeit, 2007; Somot et al., 2007, based on the A2 scenario) (Figure 5). This will increase thermal expansion of seawater, causing further sea level rise. According to the AR4 and a number of local models, the temperature will continue to grow in the Mediterranean region at the speed higher than the average in Europe. For instance, Albania is likely to experience a mean annual temperature increase in the range of 0.8-1.1 degrees by 2025, and 1.7 to 2.3 degrees by the year 2050. On the seasonal scale the biggest increase is expected in winter.

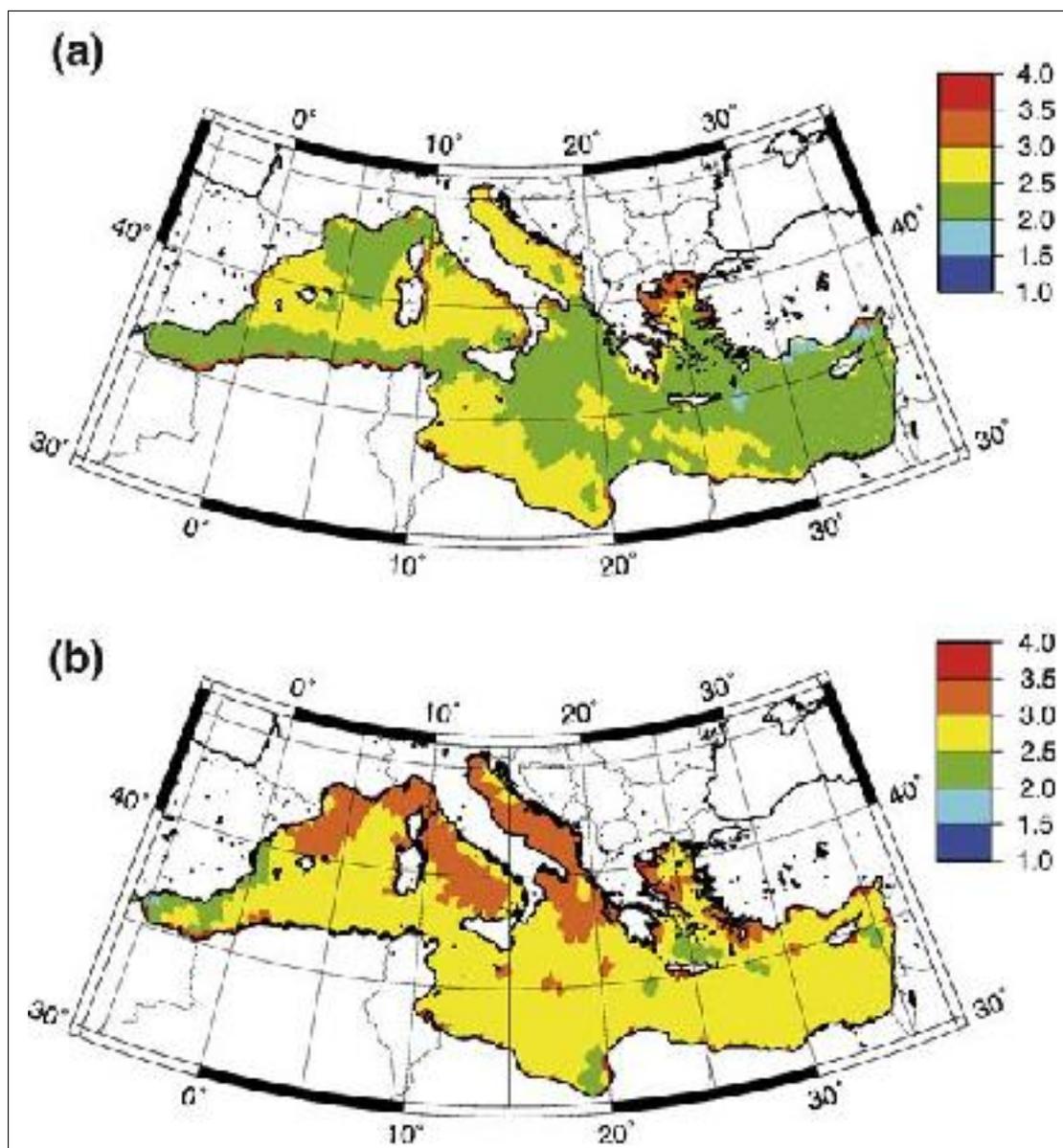


Figure 5: Foreseeable changes in sea surface temperature in winter (a) and summer (b) from 2070 to 2099 compared to 1961 to 1990 (Source: Somot et al., 2007)

2.1.2. Precipitation

Regional projections of the precipitation regimes for the different SRES scenarios⁶ are difficult to ascertain. This is largely due to the fact that they depend on specific conditions in the Mediterranean basin to an even greater degree than temperature. Despite this, model projections indicate 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 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).

Projections suggest that there will be a reduction in regional average precipitation, within the range of -4 % on the northern coasts, to -27 % on the southern coasts (scenarios A1B) (Christensen et al., 2007). However, the decrease is not expected to be homogenous throughout the whole year with the summer period from June to August being more effected than the winter period from December to February (Table 3). As a result, the risk of summer drought is heightened for the whole of the basin: indeed it is estimated that by 2080 to 2099, almost one year out of two could be considered as dry.

Table 3: Summary of Climate Change Projections for Mediterranean Region

Attribute	Details	Source
Air Temperature	<ul style="list-style-type: none"> • Average Temperature increase between 2 – 6.5°C by 2100 (over all SRES scenarios) • Seasonal variations remain significant • Infra-regional variations also important: W basin likely to have greater rise in autumnal temperature than elsewhere; while rise in temperature will be greatest in S and E of Basin in summer 	Hallegatte et al., 2007; Van Grunderbeeck and Tourre, 2008 Christensen et al., 2007
Sea Surface Temperature (SST)	<ul style="list-style-type: none"> • 1.1°C increase by 2030 (A2 Scenario) • 3.6°C increase by 2100 (A2 Scenario) • Increased thermal expansion will lead to further sea level rise • SST will continue to grow at faster rate in the Mediterranean region than elsewhere in Europe • Largest temperature increase expected in winter 	Hertig and Jacobeit, 2007; Somot et al., 2007.
Precipitation	<ul style="list-style-type: none"> • 4% reduction in rain on northern coasts by 2030 (A1B Scenario) • 27% reduction in rain on southern coasts by 2030 (A1B Scenario) • Summer: -5% in SE & -30% W and NW • Winter: -20% in SW & slight increase in NW • Potential for one year out of two to be “dry” by 2100 • Fewer rainy days • Longest periods without rain extending • More water in winter • Less in spring and summer • Increased flooding associated with storm events 	Christensen et al., 2007
Sea Level Rise	<ul style="list-style-type: none"> • IPCC figures of 0.18 – 0.59 m by 2100 excluding small ice sheet melt (+0.2m) • Mediterranean specific projections are complicated by local subsidence effects, especially in deltas and coastal cities 	Hansen, 2007; Rahmstorf et al., 2007 Hallegatte et al., 2007

⁶Climate projections are established based on emission scenarios and socio-economic scenarios, applied to model the future evolution of the greenhouse effect at the global scale. The IPCC uses “standard” scenarios to simplify the comparison of results from different climate models (defined in Nakicenovic and Swart, 2000), known as the “SRES scenarios” (Special Report on Emissions Scenarios). See IPCC (2000) for further details.

Attribute	Details	Source
	<ul style="list-style-type: none"> • Infra-regional differences are apparent – more significant SLR in the East than to the West 	

Figure 6 shows that major spatial variations will operate at infra-regional scales. For instance, while the reduction of precipitation will affect all the countries of the Mediterranean basin in summer, a north/south gradation occurs in winter, with the north of the basin being less affected. At an even finer scale, these variations will probably be accentuated or attenuated due to the influence of topography and microclimatic phenomena. The exact nature of these effects has yet to be elucidated.

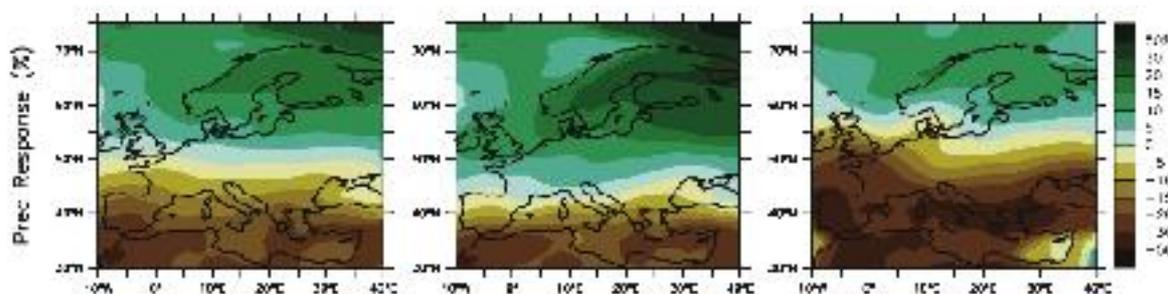


Figure 6: Precipitation changes over Europe (A1B scenario) between 1980 to 1999 and 2080 to 2099. Percent change in precipitation (i) annual, (ii) DJF and (iii) JJA (Source: Christensen et al., 2007)

2.1.3. Sea Level

The IPCC global models project rises in future mean sea level ranging between 18 cm and 59 cm by 2100 depending on the level of GHG emissions. These figures do not factor in potential impacts of small ice sheet melt, which could add an additional 20cm of sea-level rise. A number of studies published since the IPCC report suggest that future sea level rise at the global scale of more than one metre during the current century may be possible, and up to tens of metres over longer time scales (Hansen, 2007; Rahmstorf et al., 2007).

Local changes in sea level depart from the global mean trend due to regional variations in oceanic level change and geological uplift/subsidence. For example, coasts that are subsiding due to natural or human-induced causes will experience larger relative rises in sea level, especially significant in locations such as deltas and coastal cities. Although no solid projections for relative sea level rise specific to the Mediterranean Basin as a whole are currently available (Hallegatte et al., 2007), it is important to consider the existing information on infra-regional differences to enable a consideration of relative distribution of sea level rises throughout the basin:

Tsimplis's (2007) study suggested 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 7).

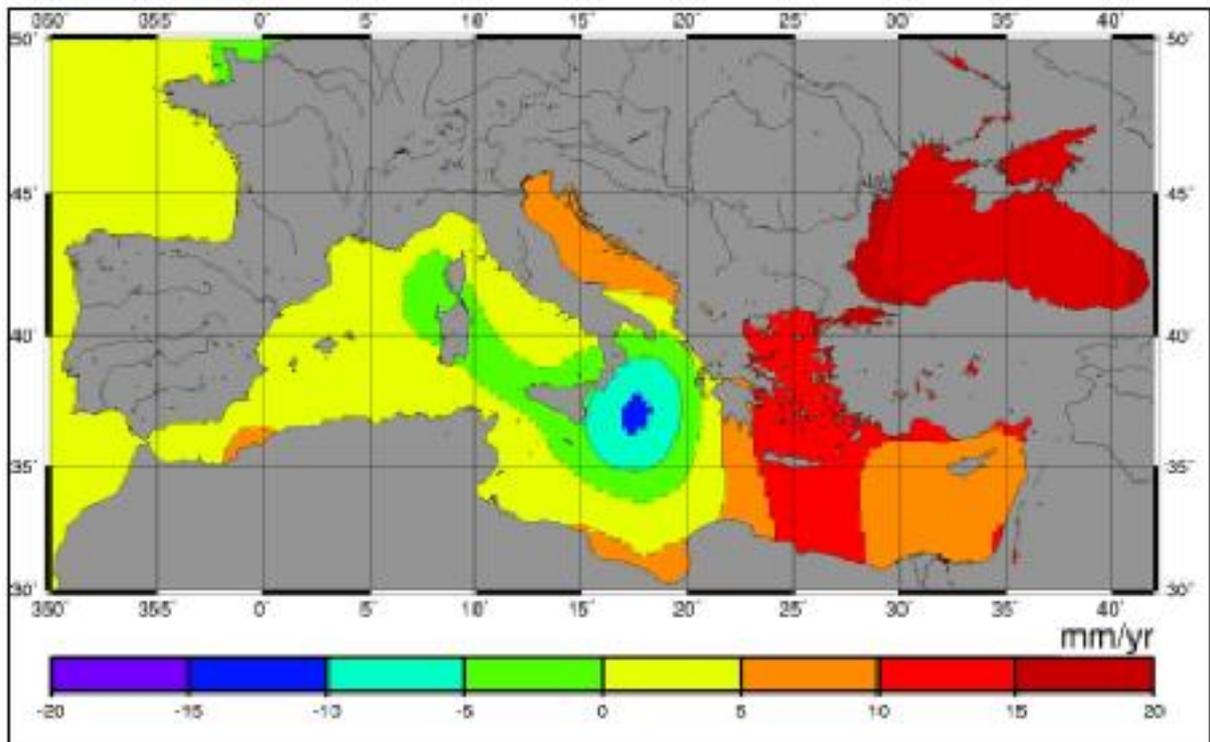


Figure 7: Sea level variations observed between 1992 and 1998 by the TOPEX/Poseidon programme (Source: LEGOS-GRGS-CNES)

Additionally, characteristics that are specific to the Mediterranean Sea, which will also be affected by climate evolution, lead to modification of the general conditions and therefore to changes in volume. Factors of particular importance include: salinity, the action of atmospheric pressure, water balance (evapotranspiration, water input from rivers, exchanges with the Atlantic) or the influence of dominant currents (Hallegatte et al., 2007).

2.2. Associated Impacts

The issue of *how* climate change will affect the marine and coastal environment has become a major concern at an international level (e.g. IPCC AR4) and is particularly relevant in the case of the Mediterranean. A generic summary of the projected impacts of climate change in the coastal zone is presented in Table 4 with specific implications for the region discussed further below.

Table 4: Impacts of climate change in the coastal zone (adapted from Abuodha and Woodroffe, 2006)

Climate Change Impacts	Effects on the Coastal Environment
<p>Higher sea levels Higher sea temperatures Changes in precipitation patterns and coastal runoff Changed oceanic conditions Changes in storm tracks, frequencies and intensities</p>	<p>Bio-geophysical effects</p> <ul style="list-style-type: none"> ● Displacement of coastal lowlands and wetlands ● Increased coastal erosion ● Increased flooding ● Salinisation of surface and groundwaters <p>Socio-economic impacts associated with climate change include:</p> <ul style="list-style-type: none"> ● Loss of property and land ● Increased flood risk/loss of life ● Damage to coastal protection works and other infrastructure ● Loss of renewable and subsistence resources ● Loss of tourism, recreation, and coastal habitats ● Impacts on agriculture and aquaculture through decline in soil and water quality <p>Secondary impacts of accelerated sea level rise:</p> <ul style="list-style-type: none"> ● Impact on livelihoods and human health ● Decline in health/living standards as a result of decline in drinking water quality ● Threat to housing quality <p>Impacts on infrastructure and economic activity:</p> <ul style="list-style-type: none"> ● Diversion of resources to adaptation responses to sea level rise impacts ● Increasing protection costs ● Increasing insurance premiums ● Political and institutional instability, and social unrest ● Threats to particular cultures and ways of life

Sea level rise as a result of climate change will have a number of different physical and ecological effects on coastal systems including direct inundation, flood and storm damage, loss of wetlands, erosion, saltwater intrusion, and rising water tables. Other effects of climate change, such as higher sea water temperatures, changes in precipitation patterns, and changes in storm tracks, frequency, and intensity, will also affect coastal systems, both directly and through interactions with sea level rise. Rising surface water temperatures, for example, are likely to cause increased coral bleaching and the migration of coastal species toward higher latitudes. Changes in precipitation and storm patterns will alter the risks of flooding and storm damage. These may also be enhanced by increased acidification of the oceans due to higher levels of CO₂ absorbed from the atmosphere.

These bio-geophysical effects will, in turn, have direct and indirect socio-economic impacts on tourism, human settlements, agriculture, freshwater supply and quality, fisheries, financial services, and human health in the coastal zone (McLean et al., 2001; Nicholls, 2004). In this respect, it is important to consider "chains of impacts", i.e. sequences of repercussions from climate impacts to human activities (Figure 8). The view proposed in Figure 8 is not exhaustive as the complexity of the chains of impact is considerable, and often poorly understood. However, it does provide an overview of this complexity showing the indirect

affects climate change may have within a few key sectors of the Mediterranean economy. This serves to highlight the issue of socio-economic inequalities over the basin as a whole, as well as within discrete countries in the area.

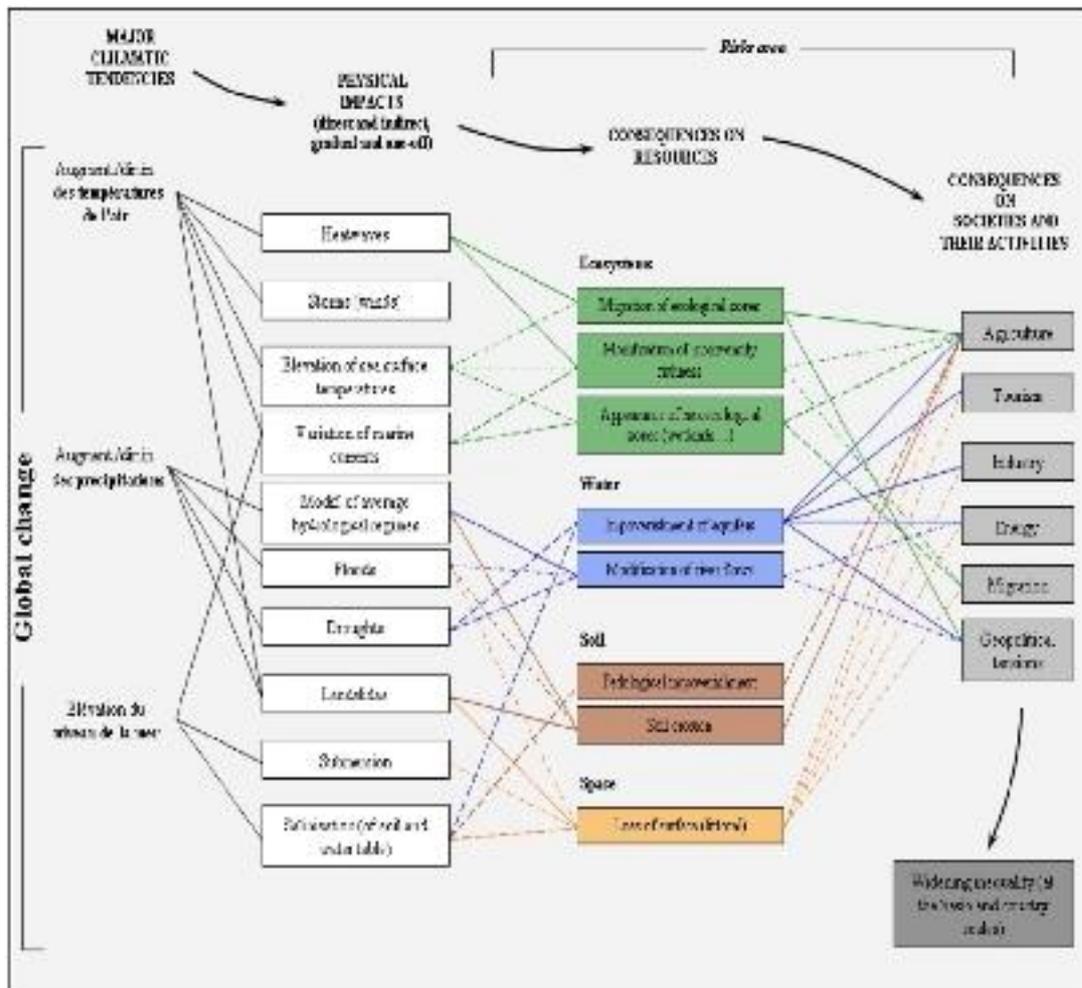


Figure 8: Some examples of "chains of impacts" that explain the effects of major climatic changes on future human activities (Nicholls et al., 2007)

2.2.1. Regional Impacts

The key impacts of climate change within the Mediterranean region are similar to those likely to be experienced at a global scale (discussed above) and are summarised in Table 5.

Overall, the priority impacts of climate change in the Mediterranean coastal region are freshwater shortage and sea level rise. Sea level rise is likely to affect parts of the coastline situated below 5m elevations, resulting in a risk of coastal flooding. Under an IPCC high scenario (A1FI) up to an additional 1.6 million people each year in the Mediterranean, Northern and Western Europe, might experience coastal flooding by 2080 (Nicholls, 2004). In addition, it is likely that large areas of coastal land will be affected by saltwater intrusion. This will have further implications for the availability of freshwater given that "dry" periods in the region are projected to increase in length and frequency.

Table 5: Climate change impacts in the Mediterranean (following UNEP/MAP-Plan Bleu 2009)

Attribute	Details
Physical	Shoreline erosion, flooding, unstable shorelines (rock and sandstone cliffs).
Ecosystems and biodiversity	Observed temperature rises and changes in precipitation patterns already affect various aspects of the Mediterranean's natural systems. Projected climate change is expected to lead to considerable losses of species and habitats throughout the region.
Livelihoods	<p><i>Social:</i> Changes in frequency and intensity of extreme weather and climate events could pose a serious threat to human health. These threats may either be direct, such as heat waves and flooding, or indirect, for example, by the spread of tick-borne diseases. Particularly vulnerable sections of the population are elderly people with limited access to health care services. There are already major <u>Water Source Shortages</u> in some areas, and these will increase due to climate change (rainfall and runoff decreases, SLR, saline intrusion of groundwater) as well as population increases. A growing share of water demand is being met through the over-exploitation of groundwater, prompting seawater seepage (which, among other problems, leads to soil salination problems when this water is used for irrigation). This problem will be exacerbated with SLR.</p> <p><i>Economic:</i> <u>Fisheries</u> - 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 rely on them. <u>Forestry</u> - increased risk of forest fires and parasites (forest production, and impacts of fires on people and economy and environment). <u>Tourism</u> - 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. Further, biodiversity and quality of natural environment are strong attractors of tourism, and these may be negatively effected by climate change. Economy-wise the most vulnerable sectors are beach tourism and fisheries.</p>

As much as 30% of the coastline is likely to be affected by erosion with knock-on impacts on ecosystems functions and livelihoods. Marine ecosystems already under pressure from pollution and overfishing will also be affected by warmer temperatures and acidification, with changes in species reproduction, changes in distributions of marine organisms, more frequent algae blooms and shifts in plankton communities.

Key sectors impacted in the Mediterranean coastal zone will include:

- **Fisheries and aquaculture** – sea-level rise, glacier melting, ocean acidification and changes in precipitation, groundwater and river flows will affect the quality and productivity of coastal and offshore waters with repercussions for the viability of fisheries and aquaculture.
- **Infrastructure and building** - intense precipitation events, increased flood risk, and sea level rise may increase the risk of infrastructure damage. The greatest impact on transportation systems will be flooding of roads, railways and transit systems. Critical coastal infrastructure, communities situated close to the coast as well as seaports will be exposed to coastal flooding, and storms may provoke impacts on maritime transport and related infrastructure.

- **Tourism** - problems of water supply are becoming increasingly common in Mediterranean tourist areas. The island of Cyprus for example has suffered from a chronic shortage of water for a number of years where rising demand and dwindling rainfall has put pressure on limited water resources. Coastal tourism will also be affected as a consequence of accelerated coastal erosion and changes in the marine environment and marine water quality, with less fish and more frequent jellyfish and algae blooms.
- **Water supply and sanitation services** - climate change affects the function and operation of existing water infrastructure, including hydropower, structural flood defences, drainage and irrigation systems, as well as water management practices.

2.2.2. Country Specific Vulnerability

The concept of “vulnerability” proposed by the IPCC combines the assessment of exposure to specific social/environmental stresses (e.g. climate change projections), associated sensitivity (e.g. population growth) and related adaptive capacity (e.g. technological options for coastal defence) (IPCC, 2007). Overall, the vulnerability of discrete marine and nearshore waters and coastal zones is crucially dependent on local factors (Smith et al., 2000; EEA, 2004b; Swift et al., 2007; Arnell et al., 2004).

Consequently, impacts of climate change will not affect all the regions of the Mediterranean, and not in the same way or with the same intensity. Within the region, there are several key factors that determine the range and severity of impacts including the characteristics of:

- Natural Systems;
- Socio-Economic Systems; and
- Government Systems in each of the MAP Contracting Parties.

In order to determine locally relevant assessments of vulnerability at discrete temporal and spatial scales the complex interaction between socio-economic systems, government systems, and natural systems must be taken into account (Table 6; Figure 9).

At present, in the Mediterranean context, general trends in impacts can be inferred. For example, in areas of coastal subsidence or high tectonic activity, as in the low tidal range Mediterranean and Black Sea regions, many coastal areas are increasingly being drawn within the range of influence of sea-level rise (Smith et al., 2000). Such areas are, in turn, more likely to suffer potential damage from storm surges and tsunamis (Gregory et al., 2001). Further, tectonic phenomena, may work to raise certain coasts (e.g. in Algeria, Italy, Greece and Turkey), which in turn will tend to locally mitigate the consequences of sea level rise.

Erosion as a result of increases in mean sea level will lead to the inland migration of the beaches of the Mediterranean over time with soft sedimentary coasts more susceptible to change than “harder” rocky coastlines (Sánchez-Arcilla et al., 2000; Stone and Orford, 2004; Hall et al., 2007). Deltas are particularly vulnerable to the impacts of erosion and inundation due to their particular topography, which means that they are only just above sea-level and are scattered with ponds and lagoons. 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.).

While this type of general information is a useful first step towards vulnerability assessment, details on the relative scale and severity of impacts at a country specific scale are currently unavailable. This is due in part to the lack of a regionally consistent approach to evaluating such impacts.

In Europe, PESETA (Projection of Economic impacts of climate change in Sectors of the European Union based on bottom-up Analysis) is contributing to a better understanding of the possible physical and economic effects of climate change in Europe over the 21st century. The assessment provides country level impact data (erosion, flood risk, coastal wetland loss/change, and salinisation) for European countries, enabling relative impacts to be assessed. Such analysis provides a valuable tool to support climate change adaptation, where activities can be focussed in the most vulnerable areas. Unfortunately, paralleled information for the non-European MAP Contracting Parties is not readily available at this time.

In light of this, for the purposes of the current Position Paper, supplementary information on projected climate impacts by country was sought through a review of information available in National Communications prepared in fulfilment of country responsibilities as Parties to the United Nations Framework Convention on Climate Change⁷ (See Section 3.1) (Results of this review are summarised in Appendix A;). The review was limited in its scope and did not involve consultation with MAP Contracting Parties. As such, it is constrained by significant gaps in information.

⁷ Parties to the Convention must submit national reports on implementation of the Convention to the Conference of the Parties (COP). The core elements of the national communications for both Annex I and non-Annex I Parties are information on emissions and removals of greenhouse gases (GHGs) and details of the activities a Party has undertaken to implement the Convention. National communications usually contain information on national circumstances, **vulnerability assessment**, financial resources and transfer of technology, and education, training and public awareness; but the ones from Annex I Parties additionally contain information on policies and measures. http://unfccc.int/national_reports/items/1408.php

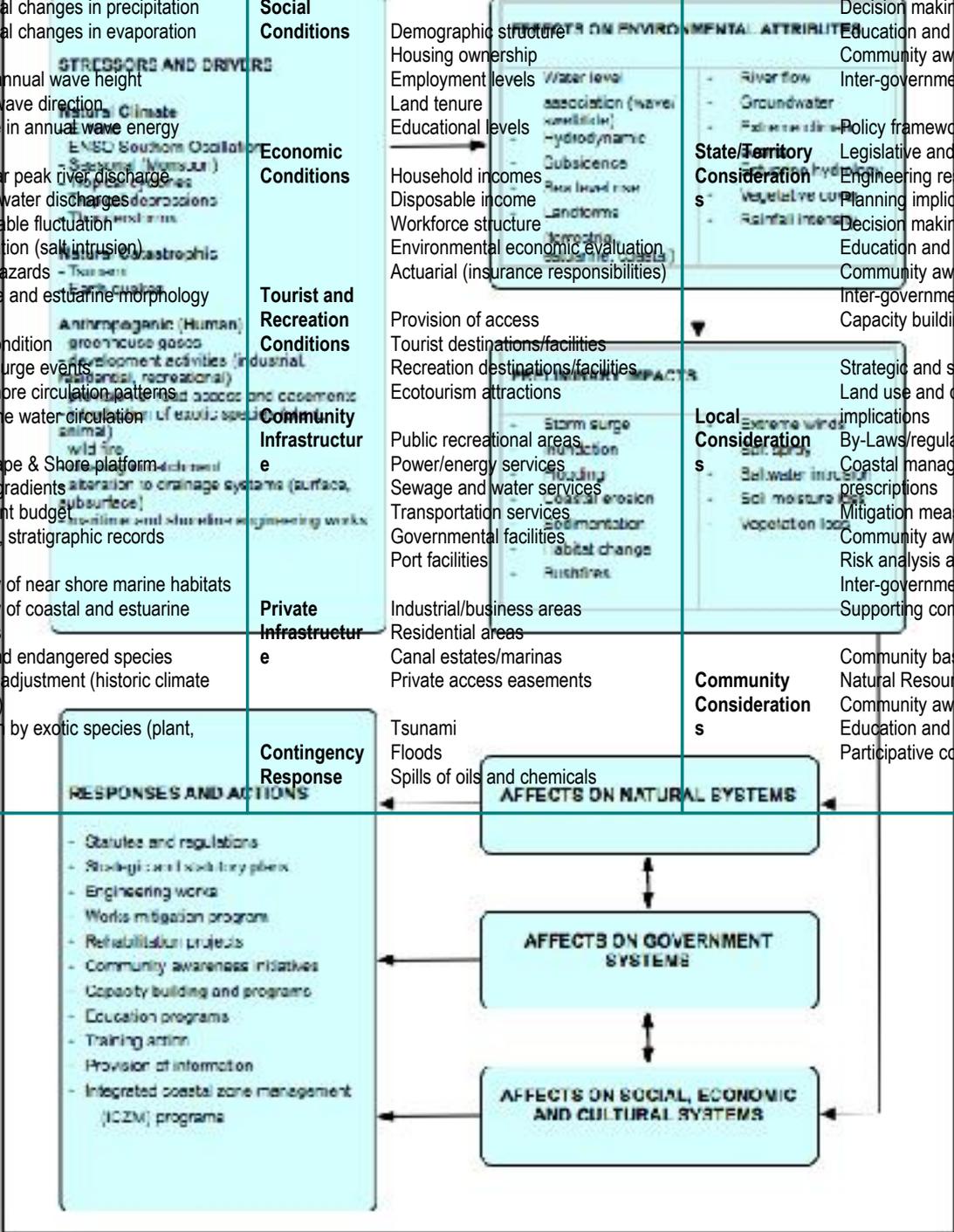
Table 6: Factors Affecting Coastal Vulnerability

NATURAL SYSTEMS

SOCIO-ECONOMIC & CULTURAL SYSTEMS

GOVERNMENT SYSTEMS

Climate Conditions	Storm frequency and intensity Extreme wind events Cyclone events Seasonal changes in temperature Seasonal changes in precipitation Seasonal changes in evaporation	Cultural and Heritage Conditions	Moveable heritage items Natural heritage areas Sites of scientific and related interest	Regional Considerations	International obligations Policy frameworks Legislative frameworks Cultural/heritage considerations Decision making networks Education and training Community awareness Inter-governmental liaison
Wave Climate	Modal annual wave height Modal wave direction Change in annual wave energy	Social Conditions	Demographic structure Housing ownership Employment levels Land tenure Educational levels	State/Territory Considerations	Policy frameworks Legislative and regulatory frameworks Engineering responses Planning implications Decision making networks Education and training Community awareness raising Inter-governmental liaison Capacity building
Hydrological Conditions	Ten year peak river discharge Groundwater discharges Water table fluctuation Salinisation (salt intrusion) Flood hazards Riverine and estuarine morphology	Economic Conditions	Household incomes Disposable income Workforce structure Environmental economic evaluation Actuarial (insurance responsibilities)	Local Considerations	Strategic and statutory planning frameworks Land use and development control implications By-Laws/regulations Coastal management programmes and prescriptions Mitigation measures Community awareness Risk analysis and risk sharing Inter-governmental liaison Supporting community initiatives
Water Level Oscillation	Tidal condition Storm surge events Near shore circulation patterns Estuarine water circulation	Tourist and Recreation Conditions	Provision of access Tourist destinations/facilities Recreation destinations/facilities Ecotourism attractions	Community Considerations	Community based projects Natural Resource Management Community awareness-raising projects Education and training projects Participative consultations
Shoreline Conditions	Bay shape & Shore platform Beach gradients Sediment budget Historic, stratigraphic records	Community Infrastructure	Public recreational areas Power/energy services Sewage and water services Transportation services Governmental facilities Port facilities	Private Infrastructure	Industrial/business areas Residential areas Canal estates/marinas Private access easements
Biological Conditions	Stability of near shore marine habitats Stability of coastal and estuarine habitats Rare and endangered species Habitat adjustment (historic climate change) Invasion by exotic species (plant, animal)	Contingency Response	Tsunami Floods Spills of oils and chemicals	Contingency Response	



The exercise demonstrated a crude indicative outline of the variable nature of climate change impacts across MAP Contracting Parties. However, the most interesting finding of the review was the extremely variable levels of “**availability**” of pertinent information on climate change vulnerability and impacts for each of the 22 CPs considered. While some countries have completed analytical evaluation of impacts, others have undertaken a qualitative impact assessment. Further, those that apply quantitative approaches do not necessarily apply the same models, timeframes or scenarios, making regional comparison impossible. Effective climate change adaptation, as discussed further in Chapter 4, requires such information in order to prioritise the implementation of adaptation actions, to know where actions should be focussed and identify those which are considered a priority.

2.3. Summary

An analysis of model predictions for the 21st century finds a continuing decrease in precipitation that extends throughout the Mediterranean region and reaches values as high as 20% less than the current mean precipitation by the end of the century.

Overall, summer temperatures will increase most to the east during summer and to the south west during autumn. Precipitation decreases will generally be insignificant in the northwest while in south west will experience decreases of up to 5% during summer. In the southwest winter rainfall averages are expected to decrease by around 20% with this number increasing to 30% during winter months. Considering north/south changes in precipitation across the basin, countries to the south will be subject to much greater decreases (around 27% reduction) than those to the north (approximately -4%). While it is difficult to give accurate projections for sea level rise across the basin due to the importance of local affects, relative sea level rise will be greatest to the east and least to the west.

The impacts of climate change will be felt in natural and human systems. Initial assessments agree that the resulting impacts will include increased extreme water-related phenomena like floods and persistent droughts, enhanced water scarcity and increased desertification, the loss of – or shift in – vegetation zones, threatened food production as a result of increased irrigation demands and more numerous incidents of plant diseases. In marine and coastal areas water scarcity would lead to further salt water intrusion and insufficient freshwater flushing in estuaries. Researchers have also become increasingly concerned about ocean acidification linked with the absorption of carbon dioxide in seawater.

The range of physical, ecological and socio-economic conditions in the Mediterranean means that the impacts of climate change will be varied. While general trends in impacts can be inferred details on the relative scale and severity of impacts across the Mediterranean and at a country specific scale are currently unavailable, due in part to the lack of a regionally consistent approach to evaluating such impacts.

3. Status of V&A in the Mediterranean

An informed, effective programme of work for PAP/RAC with respect to climate change adaptation in the Mediterranean must combine an appreciation of the range of potential climate change impacts to which the coastal zone may be subject (discussed in Chapter 2) with an overview of climate change vulnerability assessment and adaptation initiatives already undertaken or in progress by countries in the region (under discussion in the current chapter).

Specifically, this chapter focuses on Institutional Arrangements (e.g. Policy, Plans and Strategies) and Projects and Programmes in place within the region to provide a critical evaluation of these initiatives in order to derive lessons and gaps for future attention⁸. The review summarised here covered a range of spatial scales from regional (related to all MAP Contracting Parties); sub-regional (discrete group of MAP CPs (e.g. EU countries); national (whole of country scale); sub-national (regional within country)⁹.

3.1. Regional and Sub-Regional Institutional Arrangements

On a global stage, all Contracting Parties to MAP are signatories of the UNFCCC and have ratified the Kyoto Protocol. As such, they have indicated their commitment to combating climate change and have accepted an associated suite of obligations, the extent of which is dictated by their respective Status (Table 7). That is, the UNFCCC divides countries into three main groups according to differing commitments: Annex I Parties include the industrialized countries that were members of the OECD (Organisation for Economic Co-operation and Development) in 1992, plus countries with economies in transition (the EIT Parties), Non-Annex I Parties are mostly developing countries and are recognized by the Convention as being especially vulnerable to the adverse impacts of climate change, including countries with low-lying coastal areas and those prone to desertification and drought.

Parties to the Convention must submit national reports on implementation of the Convention to the Conference of the Parties (COP). The required contents of national communications and the timetable for their submission are different for Annex I and non-Annex I Parties. This is in accordance with the principle of "common but differentiated responsibilities". National communications for both Annex I and non-Annex I Parties are information on national circumstances, vulnerability assessment, financial resources and transfer of technology, and education, training and public awareness.

Of the 22 CPs under consideration here, 13 are Non-Annex I Parties and 8 are Annex I parties. The European Union also has Annex-I status. Five MAP CPs with non-Annex I status have yet to submit their initial national communication (Cyprus, Bosnia and Herzegovina, Montenegro, Syria and Libya). The remaining Annex I Contracting Parties have all submitted an initial national communication (INC) between 1999 and 2002 with the exception of Malta, whose INC was not completed until 2004. Albania is the only non-Annex I MAP CP to have currently submitted its Second National Communication (SNC). Five of the eight Annex I Contracting Parties have recently submitted their fifth communication to the

⁸ Numerous initiatives focused on climate change adaptation have been developed at a range of scales throughout the Mediterranean in recent years. Various stakeholders including international organizations, governments, research institutions and local communities have instigated these initiatives. However, this assessment is focussed solely on those concerned with the coastal zone. It is also important to remember that as parties to the Barcelona Convention, each of the 22 MAP CPs have associated aims and objectives that relate indirectly to their ability to adapt to future climate change; and with the planned amendment of the Mediterranean Strategy for Sustainable Development to include climate change adaptation, this will become a more direct focus.

⁹ The broad scope of the current review precluded an examination of community based adaptation projects within the region.

Convention (Spain, Greece, France, Croatia and the EU). Of the remaining three Annex I CPs, Italy and Slovenia have submitted their 4th national communication in 2007 and 2006, respectively. While Turkey has only submitted one national communication (2007), it has been granted special consideration under the Convention.

Table 7: UNFCCC Country Status

Country	Country Status								
	UNFCCC		Kyoto Protocol		National Communications				
	Signature	Entry into force	Signature	Entry into force	NC1	NC2	NC3	NC4	NC5
EU Countries									
Spain	1992	1994	1998	2005		1997	2002	2006	2009
France	1992	1994	1998	2005	1994	1997	2001	2006	2009
Italy	1992	1994	1998	2005	1995	1999	2003	2007	
Malta	1992	1994	1998	2005	2004				
Greece	1992	1994	1998	2005	1995	1997	2003	2006	2010
Cyprus	1992	1998	-	2005					
Slovenia	1992	1996	1998	2005	2002	2004	2004	2006	
Monaco	1992	1994	1998	2006	1994	1997	2001	2006	
Mediterranean Balkan Countries									
Croatia*	1992	1996	1999	2007	2002	2007	2007	2007	2010
Bosnia and Herzegovina	-	2000	-	2007					
Montenegro	-	2007	-	2007					
Albania	-	1995	-	2005	2002	2009			
Turkey**	-	2004	-	2009	2007				
Middle East									
Syria	-	1996	-	2006					
Lebanon	1992	1995	-	2007	1999				
Israel	1992	1996	1998	2005	2000				
Mediterranean North African Countries									
Egypt	1992	1995	1999	2005	1999				
Libya	1992	1999	-	2006					
Tunisia	1992	1994	-	2005	2001				
Algeria	1992	1994	-	2005	2001				
Morocco	1992	1996	-	2005	2001				

At a sub-regional level, seven Mediterranean countries belong to the EU (France, Spain, Italy, Greece, Cyprus, Malta and Slovenia) with a further two (Turkey and Croatia) currently

under consideration for admission. As members of the EU, countries are also impacted by a range of policies relating to the environment and, more recently, climate change.

Over the last few years, the EU has made significant progress in incorporating climate change adaptation in development policy and programmes and has taken action to integrate climate change adaptation into development co-operation with the adoption of the EU Action Plan on Climate Change and Development (2004 to 2008). The aim of the Action Plan was to assist “EU Partner countries” (including the remaining MAP CPs who are not members of the EU) meet the challenges posed by climate change through supporting them to implement the UNFCCC and the Kyoto Protocol.

The General Affairs and External Relations Council adopted the Action Plan in November 2004. In 2007 a review of the progress of the Action Plan concluded that European Union (EU) donors had not yet adequately addressed integrating climate change systematically in the context of development co-operation and that enhanced efforts were necessary to make progress in this area. With the launch in 2007 of the Global Climate Change Alliance the European Commission (EC) renewed its commitment to integrate climate change into its co-operation programmes with developing countries. The implementation of the Action Plan has been given new impetus by the creation of the GCCA of which it forms a core element.

Since the IPCC Fourth Assessment Report in 2007, the EU has adopted a more co-ordinated approach on adaptation policy development and has published a White Paper on adaptation to climate change to define the policy direction of the EC in the forthcoming years. The EC is currently working on the design of an Adaptation Framework to reduce the EU's vulnerability to the impacts of climate change. This framework will complement and strengthen the actions taken by the EU Member States. The White Paper states that climate change adaptation will be integrated into all EU policies, and clearly reflected in its foreign policy in the future. This has important implications, both for the nine MAP CPs under consideration in the current review and the remainder of MAP CPs who wish to co-operate and co-ordinate their environmental management and subsequent development within the region.

In many EU member countries adaptation measures are either planned or taking place at a national level. Those that have been identified are discussed further from a National Perspective below. However, in its recent 5th national communication to the UNFCCC the EU recognized that an increased effort is required to reduce the vulnerability of different regions of the EU and mainstream adaptation in EC policies. Several projects and programmes are currently underway to support this process and are discussed further in Section 3.3 below.

While several other regional alliances exist between groups of MAP CPs with common issues, overriding objectives and geographies these are not accompanied by supporting policy or strategies to deal with adaptation to climate change at present and are thus not considered further in this review of existing initiatives in the region.

3.2. National Adaptation Plans and Strategies

At the time of production of this report, only three of the MAP CPs had adopted national adaptation plans or strategies (Spain, France and Tunisia)¹⁰. While it is recognised that several CPs may be in the process of formulating their National Adaptation Strategies, a review of “pipeline” activities was beyond the scope of this strategic, desktop study.

3.3. Regional/Sub-Regional Projects and Programmes

A summary of the Projects and Programmes relating to coastal climate change in the Mediterranean is presented in Table 8 that follows. Overall, at a regional level, few of the research programmes assessing the implications of potential climate change impacts or support of adaptation planning are coastal or Mediterranean specific¹¹.

Consideration of the range of projects in the region provides an overview of the diversity of issues that require attention. For example, future climate change, current climate variability, but also other environmental stresses (deterioration of biodiversity) and human stresses (unsustainable paths of development) (IDDRI, 2009). While a wide range of projects and programmes has been launched in the region, interestingly, these initiatives are not all conducted from a common basis with divergent sectoral, intersectoral and territorial actions carried out.

The information gained in the review of adaptation activity in the region has been used to infer a level of adaptation maturity associated with each of the MAP CPs under consideration for the purposes of the current report. That is, the level of adaptation action currently underway for each CP in terms of plans, strategies, projects and programmes was considered as a surrogate for “current capacity”. A further level of information used to inform this exercise was an appraisal of the coastal-specific legislative maturity within each CP. This was carried out due to the fact that, in the absence of discrete climate change adaptation strategies and protocols, the key instruments to enable adaptation will be these legal frameworks.

It is clear that the Annex I EU countries have the most established adaptation “architecture” of all CPs under consideration (Table 9). Conversely, the non-Annex I Mediterranean Balkan countries and Middle Eastern Mediterranean countries have a much lower number of projects, programmes, policies and strategies pertaining to climate change adaptation in the coastal zone. It is important to remember that the presence/absence of a project in a region cannot be directly translated into a measure of capacity. For example, Albania may only have one active project, but this project is extensive and is serving to build capacity both at regional and national levels. Rather, an appreciation of the existence of specific policy and programme initiatives in conjunction with their overriding aims and objectives has been used here to create the following groupings of countries in terms of their capacities to adapt to coastal climate change (Table 10):

1. EU Annex I countries (France, Italy, Spain, Greece, Slovenia and Monaco+);
2. Annex 1 non EU countries (Croatia and Turkey);
3. Non Annex I EU countries (Malta and Cyprus);
4. Non EU Balkan countries (Bosnia and Herzegovina, Montenegro and Albania)
5. Middle East countries (Syria, Lebanon and Israel); and
6. North African countries (Egypt, Libya, Tunisia, Algeria and Morocco).

¹⁰ See Background Paper for further details on the selected National Adaptation Plans and Strategies.

¹¹ Further detail on the projects funded by the EU to identify and assess the bio-physical impacts of climate change is provided in the Background Paper.

Table 8: Example of coastal V&A projects and programmes in the Mediterranean region

Title	Area	Timeframe	Focus	Funder	Comments
PESETA - Projections of Economic Impacts of Climate Change in Sectors of Europe Based on Bottom-up Analysis	Regional	2006-2007	Cross Sectoral	EC's Joint Research Centre (JRC)	Impacts of climate change on coastal systems, energy demand, human health, agriculture, tourism, and floods, and costs of climate change, based on bottom-up or sectoral physical assessments, given the state-of-the-art of today's methods and knowledge on the physical impacts of climate change. Web site: http://peseta.jrc.es/index.htm
CIRCE: Climate Change and Impact Research: the Mediterranean Environment	Regional	April 2007 to March 2011	Cross Sectoral; Case studies in coastal zones of Algeria, Spain, Egypt and Tunisia (see below for details)	CIRCE funded by Commission of the European Union (Contract No 036961 GOCE)	Focus of research: climate change and climate change impacts in the Mediterranean area. Aim: to develop for the first time an assessment of the climate change impacts in the Mediterranean area. In particular: to predict and to quantify physical impacts of climate change in the Mediterranean area; to evaluate the consequences of climate change for the society and the economy of the populations located in the Mediterranean area; to develop an integrated approach to understand combined effects of climate change; to identify adaptation and mitigation strategies in collaboration with regional stakeholders. Lead Institution: INGV, Italy Web site: http://www.circeproject.eu/
CIRCE Coastal Case Study – Gulf of Valencia	Spain		Coastal area; biodiversity – sensitive marine ecosystem	CIRCE funded by Commission of the European Union	Within the Gulf of Valencia (Spain), the Ebro Delta and Cullera bay are presented as examples of coastal features subject to a range of environmental pressures and vulnerable to the impacts of climate change.
CIRCE Coastal Case Study: The Gulf of Gabes	Tunisia		Coastal area; biodiversity – sensitive marine ecosystem	CIRCE funded by Commission of the European Union	The Gulf has extensive marine habitats and is highly biologically productive; as a consequence it is home to a fishing industry of national importance. However, the marine ecosystem faces threats on two fronts: industrial discharge, and atmospheric warming resulting in raised seawater temperatures and changes in circulation. The region is primed for rapid expansion in tourism activities, but the low-lying coastline and islands are extremely vulnerable to coastal erosion and inundation from even a moderate rise in sea level.
CIRCE Coastal Case Study: The Gulf of Oran	Algeria	2008-	Coastal area; biodiversity – sensitive marine ecosystem	CIRCE funded by Commission of the European Union	Key research issues related to climate change include accelerated coastal zone degradation and marine system modification, and the availability and quality of water resources http://www.circeproject.eu/
CIRCLE: Climate Impact Research Co-ordination for a Larger Europe	Regional	October 2005 to September 2009	Cross Sectoral	Most projects financed by the European Framework Programme(s) (FP4/5/6 and	Co-ordination and co-operation of research activities carried out at national or regional level. Focus of research: national programmes and initiatives on climate change impacts assessment, vulnerability, adaptation. Aim: to co-ordinate European research on climate change impact assessment and adaptation to facilitate the research needed by European and national decision makers to design effective yet economically efficient and feasible adaptation strategies. Web

Title	Area	Timeframe	Focus	Funder	Comments
				now FP7)	site: http://www.circle-era.net
CANTICO: Climate and local Anthropogenic drivers and impacts for the Tunisian coastal area	Tunisia	2008-2010	Coastal Zone		Aim: To develop a pilot study to establish a conceptual model tool to integrate the complex interaction of climate and anthropogenic impacts on vulnerable Mediterranean coastal areas; Downscaling for the Gulf of Gabes.
CLIMBIOMEDNET Scientific assessment of Climate Change effects on lagoons ecosystem in comparison with man-induced changes	Med. Region	2008-2010	Ecosystems	MEEDDM CII Galicia	This project involves 5 partners, three from contributing countries, Italy, France and Spain (Galicia), and two from other Mediterranean countries, that will be considered as subcontractors, Albania and Tunisia, respectively from Italy and France. The duration of the project is of 24 months.
The impact of climate change on Mediterranean intertidal communities: losses in coastal ecosystem integrity and services	Italy Croatia Malta Israel	2008-2010	Ecosystems	IMEP IMELS	Scientific assessment of impacts of Climate Change on coastal ecosystem and socio-economic consequences.
Participatory design of adaptive groundwater management strategies and instruments in Mediterranean coastal water scarce areas as a response to climate change	Morocco Portugal France	2008-2010	Coastal water resources and livelihoods	FCT MEEDDM	Develop capacity building methods for water users to define and discuss possible strategies of adaptation to future changes including climate change; Support definition of ground water management strategies and practices through improved participation of irrigation farmers.
Climate change impacts in transitional water systems in the Mediterranean	Morocco France Spain	2008-2010	Coastal Ecosystems	MEEDDM IMELS	Scientific assessment of coastal ecosystems vulnerability to climate and anthropogenic modifications. Explore adaptation measures.
Inter ministerial working group for assessing impacts, adaptation and associated costs	France	2007-	Multi-sectoral	MEEDDM, with the aid of various ministerial departments	Impacts have been assessed by comparing climate models at horizons 2030, 2050 and 2100 (created by Météo-France and the Institut Pierre Simon Laplace).
The Strategic Programme for Sustainable Development and Climate Change (Programma strategico Sviluppo Sostenibile e Cambiamenti Climatici)	Italy	2006-	Multi-sectoral	Funded through the FISR by the MATTM, MUR and MIPAAF.	Vulnerability assessment research includes coastal areas and marine ecosystems - The managing organization of the National Programme is the MUR.
VECTOR: Vulnerabilities of Italian coastal areas and marine ecosystems and their role in the	Italy	2006-2009	Coastal areas; tourism, agriculture &	FISR - Fondo Integrativo Speciale per la	Possible future impacts scenarios for Italian coasts: Key considerations: changes in the length of coastal areas, morphology of emerged beaches, the structure of

Title	Area	Timeframe	Focus	Funder	Comments
oceanic organic carbon cycles			fisheries	Ricerca	the water column, long-shore transport, transport of aerosols from the sea to the coastal areas, and the relative impacts on structures and settlements areas on freshwater layer of coastal plains.
Euro-Mediterranean Centre for Climate Change (CMCC - Centro Euro-Mediterraneo per i Cambiamenti Climatici)	Italy	2005 - onward	Cross Sectoral	funded through the FISR by the MATTM, MUR and MIPAAF	The research activities developed by the CMCC divisions follow the following lines: - technologies, grid applications and operations; - evaluation and diagnostics of the impacts of climate change on agriculture; - numerical applications; - models and socio-economic scenarios; - impact evaluation and diagnostics; - special projects. Web site: http://www.cmcc.it
Sustainability of terrestrial and aquatic systems (Sostenibilità dei sistemi terrestri e acquatici)	Italy	2006 to 2008	Environmental Systems – Coastal zone sustainable management	Department Earth and Environment of the CNR	Aim: to define the functioning of environmental systems and their responses to human activities, in order to set up methods and standards allowing a sustainable management. Research lines including climate change issues are (3 of 8): - inner water sustainable management; - environmental modelling for sustainability; - coastal zone sustainable management. Status of Research: set up of innovative instruments for a sustainable use of marine resources and of databases for the hydrologic balance in the Mediterranean environment. http://www.cnr.it/commesse/dipartimenti-progetti/1/TA-P04.html
Valuing the costs of climate change in Italy: the case of Sangro, Abruzzo (Valutazione dei costi dei cambiamenti climatici in Italia: il caso di Sangro, Abruzzo)	Italy	May 2005 to May 2006	Coastal Zone	ENEA	Case study to test methodological approach for climate change cost assessment and climate change control policies in the Italian coastal area, the Sangro area, located in the Abruzzo Region. Status of Research: completed Web site: currently not available. Information is available at: http://www.feem.it/Feem/Pub/Programmes/Climate+Change/Activities/200601-ENEA.htm
National Observatory of Athens (NOA) Atmospheric Chemistry and Climate Change Modelling (http://www.meteo.noa.gr)	Greece	2010	All Sectors	UNFCCC	Future CC predictions and vulnerability and adaptation measures discussed for the coastal zone under headings of Sea Level Rise; Ecosystems, water availability and erosion and flooding. Ministry of Environment, Energy and Climate Change has planned, in the context of the National Strategic Reference Framework for the period 2007-2013, the following projects to be implemented: • Study of the vulnerability of the Greek coastal areas & proposals of appropriate adaptation policies and measures. • Study of the impacts of climate change per geographical prefecture.

Title	Area	Timeframe	Focus	Funder	Comments
Climate Change and the Mediterranean: Environmental & socio-economic Impacts of Climate Change and Sea-level Rise in the Mediterranean Region	Croatia	1990-1996	Coastal areas and infrastructure	UNEP	Croatian Adriatic coast: two pilot-projects for the Islands Cres and Lošinj (North Adriatic) and for the Kaštela Bay (Middle Dalmatia).
Adaptation of the Nile Delta to climate change through integrated coastal zone management	Egypt	Sept 2009 - June 2014	Coastal areas, all sectors	UNDP-GEF	Ministry of Water Resources and Irrigation
Vulnerability and adaptation project for the Maghreb region	Sub Regional Maghreb Region (Algeria, Morocco, Tunisia)	Proposed 3 year project		UNDP; GEF Medium size project <750k	Targeted 3-year vulnerability and adaptation project for the Maghreb region. The end-of-project situation will be an enhanced capability to implement adaptation strategies in the Maghreb region through institutional capacity strengthening, development of national adaptation plans, project portfolio and pilot project development and the deepening of public awareness of the risks of climate change.
Non Annex 1; INC 2001 Initial Communication was prepared simultaneously within the framework of two Global Environment Facility projects: the capacity building regional project (RAB/94/G31) and the enabling activities national project (MOR/99/G32	Morocco	2001	Multiple Sectors – focus on water and agriculture with reference to coastal zone	GEF	The first diagnosis of Morocco's vulnerability to the CC impacts highlighted a dozen adaptation projects in the sectors of water and agriculture as well as seven accompaniment projects. Research project will develop capacity for, and contribute to, policy and decision-making for strategic coastal land-use planning and management, to reduce the vulnerability of coastal communities to the impacts of sea level rise, coastal flooding, and related extreme weather events. The project will advance the science and technology that underpin preparations for, and responses to climate related events, and contribute to the information systems that guide policies of public protection.

Table 9: Summary of Adaptation Activities per country

Country	Global	Regional	National			KEY REGIONAL PROJECTS						Other Projects and Programmes			
	UNFCCC NC	EU	Coastal Specific Legal Framework	Specific Coastal Law	NAS	Beach Med	Beach Med e	Beach Med 3	CIRCE	CIRCLE MED	PESETA	Regional	National	Sub-national	Local
EU Countries															
Spain	5	X	x	x	x		x	x	x	o,p	x				
France	5	X	x	x	x	x	x	x	p	x,p	x		1		
Italy	4	X	x			x	x	x	p	x,p	x	1	2		2
Malta	1	X	x	x				x		o,p	x				
Greece	5	X	x	x	x	x	x	x	p	x	x		1		
Cyprus	0	X	x					x			x				
Monaco		X	x	x				x							
Slovenia	4	X	x					x			x				
Mediterranean Balkan Countries															
Croatia	5				x			x		p	x				2
Bosnia and Herzegovina	0							x							
Montenegro	0							x							
Albania	2							x						1	
Middle East															
Syria	0							x	p						
Lebanon	1			x				x							
Israel	1				x			x	p	x					
Mediterranean North African Countries															
Egypt	1							x	x, p					1	
Libya	0			x				x							
Tunisia	1			x	x			x	x, p	p					
Algeria	1			x				x	x, p						
Morocco	1							x		p				1	
Turkey															
Turkey	1							x		o					

Key: NAS = National Adaptation Strategy, X= Yes, O= observer, P= party

Table 10: Categorisation of countries by level of vulnerability (incorporates a consideration of capacity to adapt and exposure to projected climate changes)

Prioritisation ID *	Grouping	Description
1	EU Annex 1 countries	These countries have developed national adaptation strategies and/or completed a number of National Communications. They possess a heightened understanding of their vulnerability to climate change. +While Monaco is not currently a member of the EU, its status in terms of vulnerability and capacity necessitate its inclusion in this group.
2	Annex 1 non EU countries	Croatia and Turkey are Annex 1 countries, but are assigned special considerations. They are also candidate countries of the EU, and are therefore aligning themselves to EU policies and strategies. Consequently, EU CCA developments, such as the EU policy of CCA, have relevance to these countries, in more of a way than other non-EU countries.
3	Non Annex 1 EU countries	These countries are highly sensitive to the projected impacts of climate change. While they are EU countries, their geographical nature disposes them to high impacts of climate change (they are small island nations). In addition, the countries have existing coastal management issues (such as erosion and water shortages) that are likely to be exacerbated by climate change. Finally, they are also very dependent upon tourism, which is likely to be highly affected by climate change.
4	Non EU Balkan countries	These countries have not completed an initial national communication. Therefore, their vulnerability to the projected impacts of climate change is not as well understood as in other Mediterranean countries.
5	Middle east countries	Countries are grouped, but on the recognition that Syria has not completed a national communication.
6	North African	Whilst these countries are grouped together, Morocco is slightly less vulnerable to climate change because it has an active funded coastal adaptation project in the coastal zone and is also less physically susceptible to climate change due to geographic nature of the coast. Tunisia is very sensitive. All countries have issues of drought and desertification on top of all the other issues they have to deal with. The countries differ from European countries in that adaptation efforts are more development focused.

*Prioritisation is presented from highest adaptive capacity (1) to lowest adaptive capacity (6).

It is important to note that within these groupings there are subtleties in the categorization due to (i) the countries UN status and reporting position; and (ii) current projects underway in Country. For example, Albania and Egypt have large-scale GEF projects underway, which enhance their adaptive capacity, despite their grouping with other countries that do not have such projects. Further, Syria for example is more vulnerable than Lebanon and Israel due to its narrow coastal zone backed by mountain ranges, which inhibit landward ecosystem migration and migration of agriculture activities. Despite these subtleties, a rudimentary

understanding of the range of adaptive capacities in the region will help support the development of recommendations for action.

3.4. Summary

A range of coastal adaptation projects, programmes and initiatives has been undertaken throughout the Mediterranean region. Each varies in scale and focus, i.e. regional, *versus* local and sector specific *versus* theme specific. The review undertaken towards production of the current Position Paper has allowed a number of key observations on the status of vulnerability and adaptation assessment in the region to be made and may be summarised as the following series of points:

- The range of projects currently underway demonstrates the lack of a co-ordinated approach to climate change action in the region.
- Few regional projects or programmes are 1) coastal or 2) Mediterranean specific.
- Implementation of adaptation action appears to have occurred based on regional directives (for example through the European Union) or discrete countries proactively sourcing funding.
- The actions are not necessarily targeted based on immediate needs of the region.
- There are a number of useful existing research activities that PAP/RAC can build upon and potential leverage as they move towards co-ordinated adaptation planning on a region-wide basis.
- Key gaps include a regional programme of works that can pull together the disparate activities and highlight key areas of focus for the PAP/RAC programme.

Following on from these observations, largely related to “gaps” in current knowledge, a series of specific recommendations for future action may be made:

- The five Non-Annex I countries yet to complete their Initial National Communications should do so as a priority;
- The seven Non-Annex I countries yet to submit their Second National Communications should focus attention to this task and provide an indicative timeframe for completion;
- The two Annex I countries yet to submit their 5th National Communication should provide a status update;
- Turkey should be supported in completion of its Second National Communication (as the only Annex I country yet to do so);
- All countries yet to produce specific climate change adaptation plans or strategies should do so as a priority or, at a minimum, timetable these activities into their programmes of work.

4. Best Practice Adaptation: lessons learned from global applications

Following on from the consideration of regional initiatives provided in Chapter 3, a range of further adaptation programmes and initiatives from elsewhere in the world were reviewed to gain an overview of best practice and lessons learned globally. This information is summarised in the current Chapter.

The framework adopted for the review is outlined in detail in the supplementary **Background Paper**. A database of coastal adaptation projects covering a range of spatial scales, adaptation approaches, measures and options, was constructed. Next, a number of case studies that represented the different categories of adaptation were selected to evaluate how the complexity of coastal climate change adaptation had been addressed globally. The complexity of coastal climate change adaptation is captured in the principles of effective adaptation developed specifically to address the challenges of climate change on the Mediterranean coastal zone (Figure 10). These principles were used to draw lessons learned from each of the case study projects.

An overview of the selected case studies is presented in Table 11.

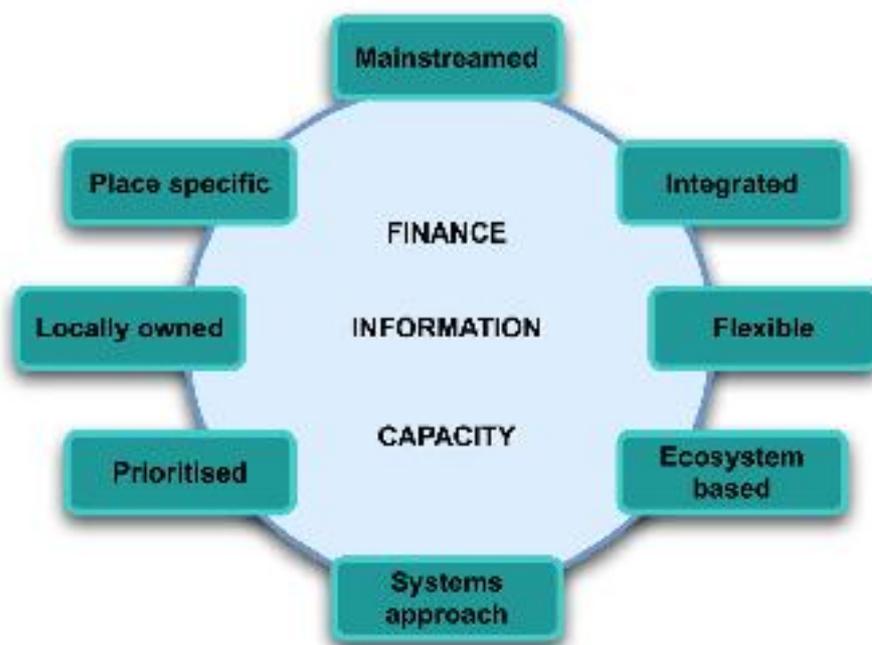


Figure 10: Principals of effective adaptation

Table 11: Featured Case Study Summaries

ID	Project Title	Description and Link
1	Adaptation to Climate Change: Responding to Shoreline Change and its human dimensions in West Africa through integrated coastal area management	<p>This project was selected as a case study due to its focus on mainstreaming climate change into an existing coastal management/planning system to manage the potential impacts of sea level rise. The project entails the collection of technical information to support policy formation. The focus is on creating capacity to ensure coastal planning is based on up-to-date technical information (i.e. change in mean sea level). This is innovative and may provide lessons learned for the Mediterranean region. In addition, the project incorporates pilot adaptation actions that are trialled in a local context, but apply a national and regional approach to manage shoreline change. In this way, the project ensures an integrated approach to coastal planning is achieved.</p> <p>http://www.gm.undp.org/projects_envIRON_accC.htm</p>
2	Australian National Climate Change Adaptation Initiative	<p>The case study showcases a national framework for climate change adaptation that incorporates a wide spectrum of sectors and issues. The framework is based on the recognition that climate change adaptation will require contributions from governments at all levels, businesses, communities and individuals and that governments play an important role in creating the appropriate framework and in providing information to support adaptation. The framework:</p> <ul style="list-style-type: none"> • Sets a national framework that incorporates action at local scales • Concentrates on knowledge generation to promote effective adaptation • Incorporates a national vulnerability assessment to prioritise areas for most immediate action <p>The framework is applied at the national level, but contains elements that guide and support localised adaptation planning. To this end, the framework is focussed on building understanding and adaptive capacity and reducing vulnerability in key sectors. The framework aims to ensure that local scale actions follow a “nationally” consistent approach.</p> <p>http://www.climatechange.gov.au/government/initiatives/climate-change-adaptation-program.aspx</p>
3	Implementing Pilot Climate Change Adaptation Measures in Coastal Areas of Uruguay	<p>Managing the potential impacts of sea level rise in the low-lying coastal environments, whilst maintaining biodiversity, through the promotion of local-level decision making within the context of national policy. The approach to facilitate local level decision-making is based on the incorporation of strategies of territorial zoning and climate risk management into municipal plans. The approach is piloted in priority coastal zones, and concentrates on implementation of adaptation measures necessary to preserve and restore coastal wetlands, and the sustainable use of coastal resources. Consultation and engagement is critical to promote change at the local level results. Efforts to engage stakeholders in the development of the proposed pilot adaptation projects target multiple levels of governance (local, municipal, and national). In addition, a four-step approach to support knowledge transfer is adopted to ensure dissemination of project outcomes beyond the Pilot sites.</p>

ID	Project Title	Description and Link
		http://www.adaptationlearning.net/project/implementing-pilot-climate-change-adaptation-measures-coastal-areas-uruguay
4	Caribbean Planning for Adaptation to Global Climate Change (CARICOM)	<p>The case study provides a good practice example of adaptation to sea level rise and demonstrates the long-term nature of climate change adaptation, particularly capacity building and climate change mainstreaming. Capacity building and climate change mainstreaming are widely advocated as tools to support effective climate change adaptation. However, the ability of projects to achieve increased capacity and climate change mainstreaming are not widely explored. In some cases, if climate change is incorporated in policy this is advocated as “mainstreamed” climate change. However, mainstreaming must move beyond “written” evidence, to practical evidence. How does incorporation of climate change “text” within policy translate to increase adaptation on ground? This project provides a practical example of the need for continued action to support capacity building and climate change mainstreaming. The initial actions are taken in Project 1, and these actions are expanded and consolidated through successive projects. In addition, the project activities cover the primary objectives of the Mediterranean ICZM Protocol and thus provide an example of how the ICZM Protocol can be implemented to achieve both ICZM and coastal climate change adaptation. For example, project activities include: monitoring; identifying vulnerable areas; training and institutional strengthening; and assessing policy options. http://www.caricom.org/jsp/projects/macc%20project/cpacc.jsp</p>
5	Mangroves for the Future Initiative	<p>The case study demonstrates an approach to incorporating climate change into an established initiative. The MFF initiative supports Countries impacted by the 2004 Tsunami to increase their resilience to climate variability through an integrated ocean wide approach to coastal zone management. At commencement, the initiative did not explicitly incorporate climate change within its Programme of Works. However, it was widely recognised that climate change will have potential impacts on the actions/projects funded through the initiative. Consequently, an approach to mainstream climate change into the initiative has been endorsed. This case study moves beyond project specific climate change adaptation and provides an example of programme/initiative wide climate change mainstreaming to support sustainability investments in ecosystem based coastal zone management. http://www.mangrovesforthefuture.org/</p>
6	Kiribati Adaptation Project	<p>The Kiribati Adaptation Project is the largest climate change adaptation project in the Pacific region. The project is in the final stage of its second phase of implementation and has a number of lessons learned drawn from the initial phases of the project. These include a strong consideration of project scope in project design; the need to move beyond mainstreaming of climate change into project documentation towards mainstreaming that supports on ground action; and the importance of ensuring the existence of strong environmental management and social management systems in which climate change adaptation can be incorporated. The lessons learned provide guidance to the development of future adaptation projects both in the Pacific and elsewhere. The three-phased approach has enabled a flexible approach to project implementation. For example, the scope of the project has been refined to target priority areas and ensure effective management of key deliverables. In</p>

ID	Project Title	Description and Link
		<p>addition, key areas of success can be built on in later phases of the project to ensure continued momentum in priority areas. http://www.adaptationlearning.net/project/kiribati-adaptation-project</p>
7	Community-led climate adaptation programme for Sustainable livelihoods in coastal areas of south Western Nigeria	<p>This study combines two approaches to climate change adaptation, (i) vulnerability approach and (ii) sustainable livelihood framework, to deliver a bottom-up approach that focuses on identifying and managing community-relevant vulnerability to climate change. Consultation and communication with local populace (through in-depth interviews, focus groups and other methods) is the primary tool to identify current coping strategies and how these may be adapted to support proactive adaptation to projected flood risks. In addition, the findings are communicated to key decision makers and planners to ensure community-level adaptation actions are aligned to, and supported by, national and local policy.</p> <p>http://www.acccaproject.org/evolution/modules/knowledgebox/external2/view.php?id=288&kbid=5</p>
8	Integration of Climate Change Risks into the Maldives Safer Island Development Programme	<p>This case study outlines an approach to implement the “deliver adaptation action” adaptation option, addressing the need for migration or movement of populations from high-risk areas. Population migration and re-settlement is an adaptation action that is not commonly addressed due to the political and social difficulties associated with implementation of this action and also to the time-lag before significant impacts will be felt. However, in many low lying nations where the potential impacts of sea level rise are significant, such adaptation action must be considered in a proactive and planned manner.</p> <p>http://www.adaptationlearning.net/project/integration-climate-change-risks-maldives-safer-island-development-programme</p>
9	Capacity Building for the Development of Adaptation Measures in Pacific Island Countries Project (CBAMPIC)	<p>This case study provides a practical example of “delivering adaptation action” at local scales. The project implemented an innovative approach to increase the resilience of 16 communities in four Pacific Island countries to the potential impacts of climate change. The project successfully applied a framework of action that fused top-down and bottom-up approaches to climate change vulnerability and adaptation assessment and action.</p> <p>The approach provides useful guidance to deliver adaptation action in communities where access to technical climate change information and data may be limited. It is focussed on community engagement and addressing the current vulnerabilities of communities to increase resilience to climate change. Adaptation actions include: construction of sea walls, population movement out of high-risk areas, and implementation of water harvesting infrastructure. The project is completed and provides detailed lessons learned that provide valuable guidance in the design and deliver of climate change adaptation projects in the Pacific and elsewhere.</p> <p>http://www.sprep.org/climate_change/cdbmpic.htm</p>
10	GEF Small Grants Programme	<p>The GEF small grants programme contains good practice examples of projects that deliver locally driven climate change adaptation within budget constraints. The effectiveness of the programme is in part attributed to</p>

ID	Project Title	Description and Link
		<p>the decentralised nature of project delivery, which promotes increased ownership and investment in project outcomes. The delivery of the small grants programme provides a good practice example of an approach to achieve the primary objectives of the adaptation, whilst also achieving broader environmental objectives, building capacity, and creating ownership.</p> <p>www.sgp.undp.org</p>
11	UK Climate Impacts Programme	<p>This case study provides an example of an adaptation support programme that has been implemented in an Annex 1 nation. The UK climate impacts programme is a national programme established to support climate change adaptation at national, regional and local levels in the United Kingdom. The programme focuses on providing the information and support tools required to support adaptation. As per Case Study 2, the National government plays a lead role in information provision and support to ensure cross sectoral engagement at all levels, including government, private and local entities, to ensure a holistic approach to climate change adaptation is achieved.</p> <p>http://www.ukcip.org.uk/</p>

Key factors contributing to effective adaptation projects across a range of spatial scales, as identified through the review, are summarised below:

- Adaptation must be encompassed within a sound management framework. From a coastal perspective, a strong approach to ICZM in which climate change adaptation can be mainstreamed is required. Without such a baseline, climate change adaptation may be viewed as an “additional” activity, rather than an integral component to achieving sustainable development objectives, i.e. Case Study 6.
- Adaptation projects commonly aim to achieve a broad range of adaptation objectives, for example, capacity building, information sharing and mainstreaming, among others. However, it is noted that the most effective projects are focussed, based on the realisation that climate change adaptation is a long-term process and it is unrealistic to achieve all objectives at the outset.
- A national framework is useful in ensuring a consistent approach to adaptation. However, whilst it is very valuable to set a national framework, there must be caution in applying a one-size fits all approach. For example, Case Study 2 applied a set “tool”, a risk assessment framework, which was not effective for all targeted stakeholders. A recommendation would be to support countries in identifying local (regional) needs and establishing more flexible frameworks.
- There is no need to “reinvent the wheel”, existing frameworks and approaches should be utilised where possible. Case Study 5 provides a good practice example of an approach to mainstream climate change into an ecosystem based coastal management initiative. In this case study, existing project management frameworks were updated to incorporate (mainstream) climate change.
- The key to effective Pilot projects is knowledge management and dissemination to ensure that lessons learned in the pilot project can be widely shared to promote uptake beyond the pilot site. Case Study 3 incorporates a four-step approach to support knowledge transfer, update and replication of successful experiences both within the project country and across the adaptation community of practice in general. The 4 components of knowledge transfer fit within two adaptation options: (i) Create Information; and (ii) Supportive social systems (Figure 11).
- Capacity building and climate change mainstreaming are widely advocated as tools to support effective climate change adaptation. However, the ability of a project to achieve increased capacity and climate change mainstreaming is not widely explored. In some cases, if climate change is incorporated in policy it is advocated as “mainstreamed” climate change. However, mainstreaming must move beyond “written” evidence, to practical evidence. How does incorporation of climate change “text” within policy translate to increase adaptation on ground? Case Study 4 provides a practical example of the need for continued action to support capacity building and climate change mainstreaming. It demonstrates that capacity building and climate change mainstreaming require long-term investments that extend beyond a single project. It has been successful in sustaining the momentum generated through project-based funding activities, to build the adaptive capacity of Caribbean communities.
- Adaptation at the local level is useful in countries that do not have the required facilities to implement a top-down approach. Any approach to adaptation should combine top-down and bottom-up approaches (Figure 12). Case study 9 developed a framework to fuse top-down and bottom-up approaches – the objective was to ensure local action could be undertaken immediately to increase

the resilience of communities in high risk areas, whilst climate change would also be mainstreamed at national level. The outcome was a focus on addressing current climate variability, and thus increasing resilience, couched within a framework that would ensure future climate change was incorporated within decision making at the national level.

- Effectiveness of local scale adaptation projects is enhanced through decentralisation of project management and delivery. Case Study 10 provides a funding delivery model for small-scale adaptation investments that promotes ownership and investment in project outcomes at the local level. All phases of project delivery and management are informed, owned and implemented by local people, from the National Steering Committee that oversees the funding programme, to the Non-Governmental Organisations that support implementation. The approach aligns to the principles of effective adaptation by ensuring adaptation is ecosystems based, locally owned and place specific.
- There is a need for proactive adaptation. Some adaptation issues will be difficult to face. Therefore, good practice necessitates that “stepping stones” be implemented immediately, to support broader transition into the future as climate changes. Case Study 8 provides an example of a model that supports adaptation to current climate variability, and that will also support long-term climate change adaptation. This case study provides a framework for addressing the potential impacts of sea level rise on high risk populations, by providing an approach to manage impacts that address current climatic variability (storms and inundation events) as well as setting preliminary action for addressing long-term climate change impacts. The two-phased approach, where, in the first instance, action is mainstreamed into existing policy to manage current climate variability, is valuable in that it can address both current and future impacts. The use of such an approach will facilitate transition to managing population migration and displacement on larger (and potentially more permanent) scales in the future.
- Case Study 10 and Case Study 5 provide good practice examples of achieving the primary objectives of adaptation, whilst also achieving broader environmental objectives, building capacity, and creating ownership.

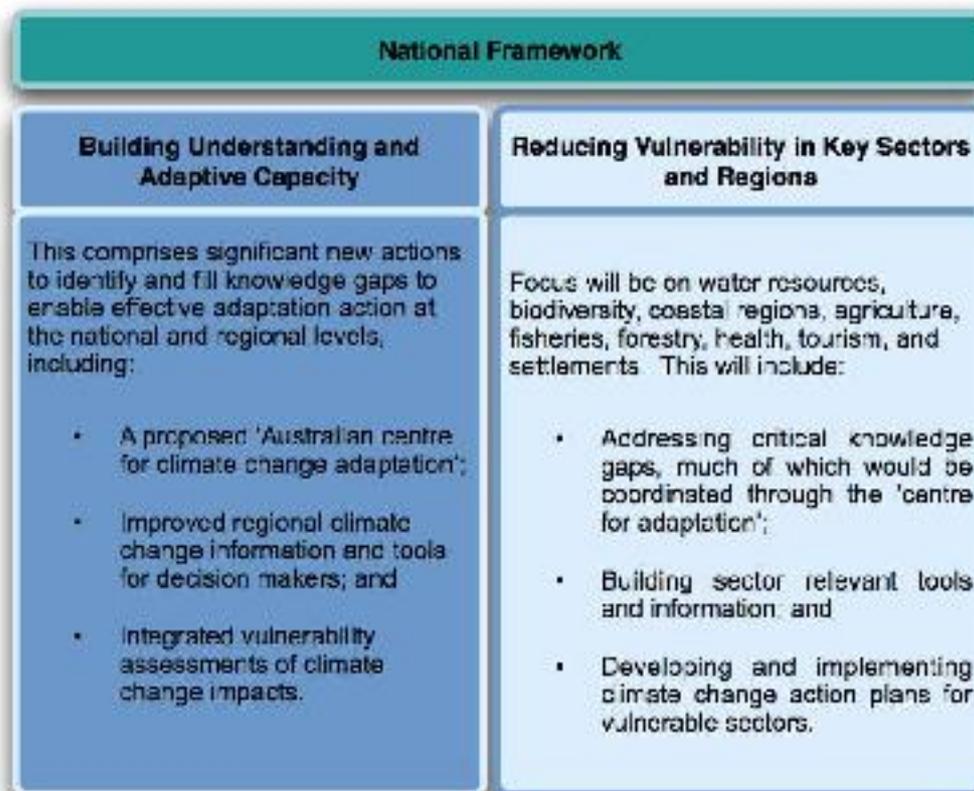


Figure 11: Components of the knowledge transfer, management and evaluation system applied in Case Study 3

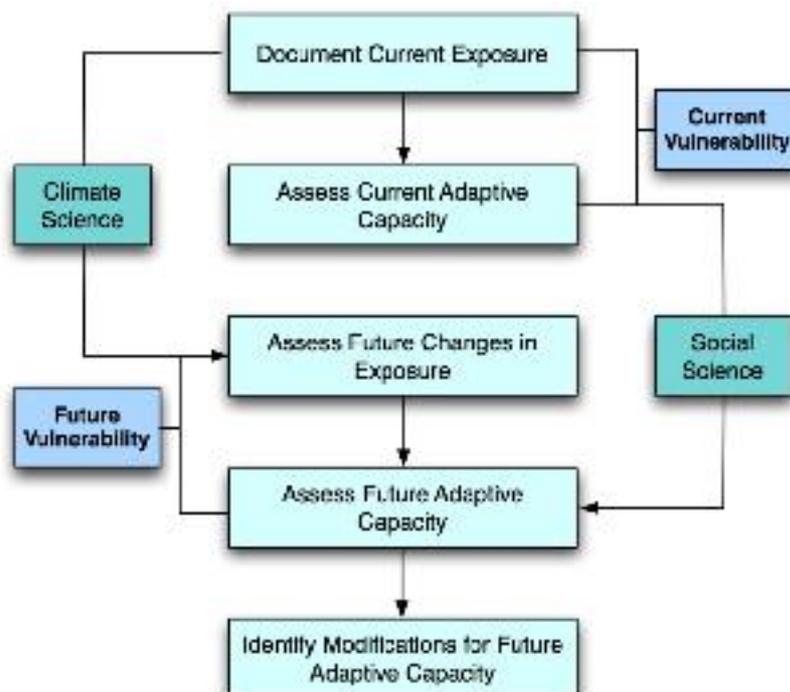


Figure 12: Components of the Climate Vulnerability and Adaptation Process applied in Case Study 9 (source: Nakalevu, 2006)

The adaptation activities undertaken differ based on situational context in which adaptation is undertaken. Whilst patterns in adaptation globally cannot be pulled from a strategic assessment such as this, we can highlight key issues and lessons learned from global adaptation projects to date. For example:

- Projects should be focused, aimed to achieve realistic goals;
- Adaptation is a long-term process that often exceeds project timeframes;
- Local ownership is critical; and
- Mainstreaming is essential to support implementation.

There is a clear trend in the type of adaptation activities undertaken and the adaptive capacity of the country in which the initiative is focussed. Whilst the subtleties of country characteristics for each of the case study projects have not been evaluated, their UNFCCC status provides a broad indication of their adaptive capacity. Non-Annex 1 parties to the Convention have less adaptive capacity than Annex 1 parties. Further SIDS and LDC have, by nature, lower adaptive capacity than Non-Annex 1 countries.

These broad classifications allow trends in adaptation type/objective and lessons learned to be gathered:

- Annex 1 countries, such as Australia and UK, focus on providing the information and tools to support a broad range of stakeholders in country, i.e. government and private organisations, adapt to the potential impacts of climate change. The focus is on information gathering and provision, and providing a framework that will promote a consistent approach to adaptation.
- Non-Annex 1 and SIDS/LDC: Case Study 3 is the only example of a Non-Annex 1 country focussed project. The other Case Studies that support Non-Annex 1 countries (i.e. Case Study 5 and 10) also support SIDS or LCDs. Therefore, trends in adaptation approach can not be drawn from this case study alone. Rather, it is clear that adaptation in Non-Annex 1 countries, SIDS and LDCs ranges from resilience building to managing the impacts of climate change. The adaptation approach appears to be governed by the level of financing rather than the location in which the project is implemented. Large financed projects (over \$1 million US) tackle a range of adaptation approaches from building adaptation capacity to delivering adaptation actions. Whilst smaller budget projects (<0.05\$US million) concentrate on the preliminary actions that will support adaptation (i.e. capacity building, and resilience building).
- Understanding the adaptive capacity of the location in which an adaptation action is to be implemented will provide guidance on the type of adaptation support that is required as a priority. In this regard, the lessons learned from a consideration of the case studies presented here will be considered in conjunction with the projected climate change impacts and adaptive capacity of MAP CPs, in order to inform recommendations for PAP/RAC in the Mediterranean region (Presented in Chapter 5).

5. Recommendations

The proceeding sections have highlighted a number of key issues and information gaps that inhibit a proactive and co-ordinated approach to climate change adaptation in the Mediterranean coastal zone. Recommendations for PAP/RAC to work to reduce the identified gaps and alleviate barriers to adaptation are made in this section.

The recommendations are discussed in relation to prospective implementation pathways by identifying their alignment to the PAP/RAC mandate and/or the 2010-2014 Programme of Works. Consequently, recommendations are noted as either aligning to the current Mandate, the current PoW or requiring support for targeted fundraising activities.

5.1. Recommendations

5.1.1. Governance

Mainstreaming climate change

ICZM should seek to integrate all key issues of critical importance to the management of coastal resources and resource use - including climate change adaptation. It is important that climate change is not seen as an issue outside of an ICZM framework. Rather, it is vital to understand that effective ICZM can only be achieved by ensuring that it is viewed through a climate change “lens”; thus climate change adaptation must be couched within an existing operational framework to facilitate implementation and ensure a coherent, transparent and long-term approach.

The ICZM Protocol provides the key tool to facilitate coastal climate change adaptation in the Mediterranean. The Protocol provides the legal framework for coastal management in the Mediterranean and was recognised by PAP/RAC as the key tool to enabling countries to deal with emerging coastal issues, including climate change.

The Protocol provides the framework to support climate change adaptation through the established “requirements” and “instruments” for ICZM. Climate change considerations have been aligned in this Position Paper to each section of the Protocol, as relevant, as a guide to highlight the alignment between recommended climate change actions and the existing ICZM framework (Table 12). The contents of Table 7 is not intended to amend the Protocol, rather it is a tool to highlight climate change elements within the existing Protocol “text”¹². PAP/RAC will play an important role in demonstrating leadership in climate change adaptation by promoting the alignment between climate change and the ICZM Protocol. In this way, PAP/RAC will demonstrate commitment to mainstream climate change across all coastal management activities.

Importantly, the majority of CPs has not ratified the ICZM Protocol¹³. Consequently, ratification by all CPs is a critical prerequisite to support climate change adaptation in the coastal zone. Without such ratification, the recognised limitations in achieving ICZM, which necessitated the production of the Protocol, are also likely to be experienced in coastal climate change adaptation. Consequently, PAP/RAC should ensure continued dialogue with CPs to: demonstrate the role of the Protocol in achieving sustainable development

¹² The Protocol should not be updated to incorporate climate change specific text at this stage, as it is an “intermediate Protocol” and does not contain specific detail.

¹³ Only France and Slovenia had ratified the Protocol at the time of report production (March 2010).

objectives; and garner additional commitment to ratify the Protocol to enhance coastal adaptation efficiency and long-term effectiveness.

The MSSD also provides a conduit for mainstreaming climate change to promote regional adaptation. Following the Marrakesh Declaration, it was planned that climate change adaptation would be integrated into the MSSD framework, to ensure that climate change can be mainstreamed into development policies at the regional level. While the MSSD adaptation strategy will be broader than the adaptation recommendations outlined here (which focus only on coastal adaptation) they will be critical inputs into the proposed MSSD adaptation strategy.

Further, to be effective, climate change adaptation must be embedded into policies at a regional level in order to reduce the long-term vulnerability of sensitive sectors such as agriculture, forests, biodiversity, energy, transport, water and health. This is already occurring within the EU where, for example, climate change will be one of the main drivers that shape European agriculture and the Common Agricultural Policy (CAP).

Importantly, the degree to which climate change has been mainstreamed into policies, plans and strategies at national and local scales has not been examined in detail. Whilst PAP/RAC can provide leadership and direction at the regional level through mainstreaming climate change into the ICZM Protocol and the MSSD, it will also be important for PAP/RAC to increase awareness of opportunities for mainstreaming at national and local scales through training and capacity building activities directed at CPs.

Overall, PAP/RAC's role in supporting the integration of climate change into coastal management policies and practises in the Mediterranean can be summarised as:

- G01: Promote ratification of the ICZM Protocol.
- G02: Increasing the awareness of CPs and other key stakeholders of the links between ICZM and climate change, as outlined in the ICZM Protocol (Table 7).
- G03: Support mainstreaming of climate change adaptation into the MSSD.
- G04: Provide support to CPs on how mainstreaming adaptation is applicable in the coastal context. It will be important to demonstrate climate change mainstreaming across a variety of tiers, from the regional (ICZM Protocol and MSSD), to National and Local (guidelines, etc.).
- G05: Support capacity building in key areas, i.e. climate change mainstreaming.
- G06: Ensure that when the ICZM Protocol is reviewed, the important and intertwined nature of climate change in ensuring an integrated approach to coastal zone management in the Mediterranean is recognised.

Partnerships and Co-operation

Continued co-operation between the MAP, EU, national, sub-national and municipal authorities will be a prerequisite for successful coastal adaptation. The number and diversity of regional stakeholders necessarily results in a range of ICZM policy and practice. Consequently, it is important to ensure active and ongoing dialogue to develop a shared adaptation agenda. The objective is not to decrease diversity in practice, but rather to ensure co-ordination of efforts, to reduce duplication and ensure efficient use of limited human and financial resources.

Table 12: Alignment of climate change adaptation to the ICZM Protocol

Part	Climate change adaptation considerations
Requirements	<p>Article 8: Climate change is a cross sectoral issue that will effect marine and land management. Consequently, climate change should be mainstreamed into coastal strategies, plans and programmes across all levels of operation. Criteria to monitor the potential impacts of climate change, and the effectiveness of adaptation strategies to mitigate the potential impacts of climate change, should be incorporated within national legal instruments. While general criteria can be outlined, all criteria must be place-based. Climate change criteria are under development internationally. This is a new area of research and therefore consultation and collaboration with international partners will be vital to ensuring robust criteria area developed.</p> <p>Article 9: Climate change will impact economic activities in the region. The potential impacts of climate change on economic activities in the coastal zone must be clearly understood to support effective management of such activities. For example, approaches to manage agriculture or tourism activities in the coastal zone may differ under an altered climate regime.</p> <p>Articles 10 & 11 & 12 & 13: Measures to protect coastal ecosystems, landscapes and socio-economic elements (i.e. cultural heritage) should be based on an understanding of how they may change under projected climate changes. Such an approach will ensure that measures taken to protect the characteristics of specific coastal ecosystems, landscapes and socio-economic elements are sustainable despite a changing change. Islands are particularly susceptible to the potential impacts of climate change, namely rise in mean sea level. The impacts of climate change on islands must be considered.</p> <p>Articles 14 & 15: Awareness raising activities, training programmes and research into ICZM must incorporate climate change. Climate change adaptation is a core component of an integrated approach to coastal management, and the potential impacts of climate change must be understood to ensure ICZM can be achieved. For example, training in vulnerability and adaptation assessments and research into the potential impacts of climate change on the social, economic and environment elements of the coastal zone, are priority areas of information collection.</p>
Instruments	<p>Article 16: Climate change should be monitored and observed through existing, or new, mechanisms. The outputs should be maintained within national inventories that capture information mean sea level, storm events, etc, following an agreed format and process for data collection. In addition, experience in climate change adaptation should be shared through participation in coastal networks (such as the Mediterranean coastal network and the Adaptation Learning Mechanism).</p> <p>Article 17: Climate change adaptation is incorporated within the Mediterranean Strategy for Sustainable Development (MSSD). The MSSD should be taken into account to define a common regional framework for ICZM in which climate change is mainstreamed. Subsequently, climate change should also be mainstreamed into ICZM implementation tools, such as regional action plans, national strategies and other operational instruments.</p> <p>Article 18: As per Article 17, climate change should be mainstreamed into national coastal strategies and coastal implementation plans and programmes. The national coastal strategy should contain summary of existing situation (including a climate change vulnerability assessment), rationale for management priorities, and schedule of measures to be taken and implementation details (cost, institutional structures). Indicators to evaluate effectiveness of strategies (adaptation strategies and broader environmental strategies), plans, and programmes and progress of implementation of the Protocol are required. Refer to Article 8 for information on climate change criteria that may be used to as indicators for inclusion in strategies, plans and programmes.</p> <p>Article 19: Environmental impact assessments consider the sensitivity of the environment to projected impacts of climate change and the inter-relationships between marine and terrestrial parts of the coastal zone and the cumulative impacts on the coastal zone in respect to coastal carrying capacities.</p> <p>Article 20: Adopt land policy instruments and measures (i.e. planning, acquisition, cession, donation, or transfer of land) to ensure sustainable management of public and private land of the coastal zones under a changing climate. For example, development set backs should be established, which incorporate projections for rise in mean sea level.</p>

Part	Climate change adaptation considerations
	<p>Article 21: Adopt financial, economic or fiscal instruments to support implementation of national coastal strategies, plans and programmes. Financial instruments to support climate change adaptation may include UNFCCC sources, GEF sources + other sources of funding. In addition, opportunities to establish a climate change trust fund may be investigated.</p>
Risks	<p>Article 22: Undertake vulnerability and hazard assessments to take preventive, mitigation and adaptive measures to address the effects of natural disasters, in particular climate change.</p> <p>Article 23: To prevent or mitigate the negative impacts of coastal erosion adopt the necessary measures to maintain or restore the natural capacity of the coast to adapt to change, including rise in sea levels. The effect of climate change on local and regional sediment budgets should be assessed. Such information will support the development of coastal or marine structures that take into account the potential negative effects on coastal erosion and the direct and indirect costs that may result. In addition, scientific data to improve knowledge on state, development and impacts of coastal erosion under changing climate should be shared.</p> <p>Article 24: Climate change is expected to increase the intensity (and potentially the frequency) of extreme events. Consequently, it is important to ensure that action is taken to build response capacity. International co-operation to co-ordinate the use of equipment for detection, warning, and communication is important in this regard.</p>
International Cooperation	<p>Article 25: Training in the field of ICZM (which incorporates climate change - as per Article 15) should be undertaken to strengthen capacity, develop scientific and technical research, promote centres specialised in ICZM, and promote training programmes for local professionals.</p> <p>Articles 26 & 27: Co-operate for the provision of scientific and technical assistance in climate change adaptation, including access to adaptation technologies and their transfer. Co-operate in the exchange of information on best practice climate change adaptation; in particular: establish and mainstream vulnerability and adaptations assessments; define adaptation strategies for application in the coastal zone; identify indicators to monitor the effectiveness adaptation action; and carry out activities of common interest, such as demonstration projects.</p> <p>Articles 28 & 29: Ensure climate change is a core component in all co-ordinated national coastal strategies, plans and programmes related to contiguous coastal zones. Co-operate through notification, exchange of information and consultation in assessing the environmental impacts (which incorporates an understanding of climate change) of plans, programmes and projects, prior to authorisation. To this end, co-operate in the formulation and adoption of guidelines to establish procedures to support notification, exchange of information and consultation at all stages of plan, programme and project formulation.</p>
Institutional provisions	<p>Following the descriptions above, climate change adaptation is an integral component to ICZM. It is not an additional activity or action to be undertaken. Therefore, the institutional provisions remain as per the Protocol and do not need to be individually specified here.</p>

To promote co-operation on adaptation the EC has proposed setting up a consultative forum known as the Impact and Adaptation Steering Group (IASG) where EU Member States will play a role in developing the four key areas of the proposed EC adaptation framework. It is suggested that this type of forum be adopted for MAP Contracting Parties so as to align with the overriding objectives of the EC's framework and expand their application to MAP CPs as a whole. Developing a Regional Coastal Adaptation Framework (ReCAF) will be an important step in ensuring a co-ordinated approach to adaptation in the coastal zone.

PAP/RAC's role:

- C01: Demonstrate leadership in climate change adaptation by promoting a co-ordinated approach to CCA in the Mediterranean through the development of a Regional Coastal Adaptation Framework (ReCAF) – see recommendation F03 for further details.
- C02: Strengthen existing regional ICZM co-operation mechanisms to enhance the flow/support of information through focal points to national and local decision makers.

Financing

The financial costs of adaptation, and thus financial needs, are high. It is unlikely that many CPs will be able to meet these additional costs without substantial external support. UNFCCC Annex 1 countries have pledged to provide financial support for adaptation (Article 4 of the Convention, Article 11 of the Kyoto Protocol, Marrakesh Agreements) and should be encouraged to do so through well-coordinated, cost-effective regional initiatives.

The establishment of such financial mechanisms, discussed globally within the framework of UNFCCC negotiations, requires in the Mediterranean region a continuous and informed dialogue, in line with regional and local specificities, and related needs. Bilateral and multilateral development agencies will be critical in this regard. Their role is all the more important as fundamental synergies exist between development (through the Millennium Development Goals) and effective adaptation. These synergies are such that it is often difficult, and with limited practical meaning, to concretely distinguish between development-led and adaptation-led initiatives. The key issue is that a focus remains on coastal climate change adaptation initiatives with clear and concrete development co-benefits (and *vice versa*) leading to “win-win” outcomes.

Consequently, it will be critical to align on-ground projects in targeted locations to the regional priorities of the Mediterranean ensuring that local and individual projects are contributing to the key objectives of a regional strategy. Development of a Regional Coastal Adaptation Framework (ReCARF) (as outlined in recommendation ID C01) would provide leadership and direction to national and local governments on the key issues that not only address development objectives at the local scale but also contribute to regional objectives. It will be important to engage national and local stakeholders in the development of any ReCAF to promote ownership and uptake at the local scale.

Finally, it is widely recognised that global financing needs will outstrip the available funds provided through such mechanisms as the UNFCCC. Consequently, there is a need to further consider a combination of policy measures and examine the potential use of funding measures, market-based instruments, guidelines and public-private partnerships to ensure effective delivery of adaptation. There is a scope for improving the uptake of adaptation

action by Contracting Parties and for targeting better the use of available financial resources and instruments to encourage this.

PAP/RAC's role in supporting financing may include:

- F01: Ensure up-to-date knowledge of the funding landscape for climate change adaptation and coastal management. Identify potential funding opportunities and disseminate this information to CPs as appropriate.
- F02: Develop and/or support the development of targeted funding requests. Funding requests should be based on established understanding of regional priorities and local development objectives (as would be established through implementation of recommendations R01 to R03).
- F03: Ensure collaboration in the development of any Regional Coastal Adaptation Framework (ReCAF). Whilst this is not a direct financial action, it provides the operational framework for financial activities, as finances should be targeted based on an understanding of regional priorities.
- F04: Investigate opportunities to improve the uptake of adaptation action by Contracting Parties through better use of available financial resources and instruments and/or a combination of policy measures (i.e. funding measures, market-based instruments, guidelines and public-private partnerships).
- F05: Encourage public-private partnerships with a view to sharing investment, risk, reward and responsibilities between the public and private sector in the delivery of adaptation actions.

5.1.2. A regional perspective to the potential impacts of climate change and adaptation strategies

The effects of climate change will not stop at national borders – therefore, it is most effective to adopt a regional approach to addressing the issue. However, the physical, social and ecological complexity of the Mediterranean region makes this a challenging process. Countries within the region have differential priorities and it is unrealistic to assume that a “one-size-fits all” approach to addressing ICZM, of which climate change adaptation is an integral component, will be successful. Fortunately, there is an opportunity to find regional synergies and to tap into the wealth of information that is available across the region to enhance the management of the potential impacts of climate change.

The recommended ReCAF will require comprehensive input data and information to prioritise investments, to identify the key impacts and the most vulnerable areas or in other words, accurately determine the scale and severity of the impacts of climate change in the Mediterranean. Such information is currently unavailable. Whilst national assessments of the potential impacts of climate change have been undertaken, a regionally consistent approach has not been applied. Consequently, relative impacts across the region cannot be established at present.

Prioritising investments or action based on an understanding of relative vulnerability to the impacts of climate change is a complex process. A number of similar assessments have been carried out at the global scale to prioritise adaptation assistance from the global adaptation fund. Such assessments apply indicators to establish relative vulnerability (Esty et al., 2005; IADB 2005; Vincent 2004; UNDP 2004; and Adger et al. 2004). Whilst there are recognised challenges in establishing indicators of vulnerability, such assessments continue as they provide a targeted and transparent approach to identifying adaptation priorities at the different scales, i.e. global, regional and/or national. The PAP/RAC should investigate such

approaches to guide implementation of the Programme of Works in relation to climate change adaptation. The PESETA project may provide a framework for such assessment.

Countries in the Mediterranean are at different stages in understanding and taking action on the potential impacts of climate change (as outlined in Section 3). This differential capacity to adapt is not well understood, i.e. no analysis of the adaptive capacity of Mediterranean countries has been undertaken. However, the level of adaptive capacity of a target country has a large influence on their ability to implement any tools/strategies/recommendations developed by the PAP/RAC in support of a regionally consistent approach to coastal adaptation. Consequently, understanding differential adaptive capacity and targeting assistance to build capacity is a vital step in supporting regional action on climate change. Whilst preliminary recommendations in this regard outlined could be made this would be based solely on an understanding of information requirements for climate change adaptation (i.e. policies, plans, strategies and projects) and does not consider other vitally important components of adaptive capacity such as socio-economic and biophysical capacity. Such information will provide PAP/RAC with the knowledge to identify interventions that will be a key component in reducing vulnerability throughout the Mediterranean.

PAP/RAC could fill this gap through:

- R01: Commission an assessment of the relative impacts of climate change, and associated vulnerability, in the Mediterranean.
- R02: Commission an assessment of the adaptive capacity of Mediterranean countries, to highlight focus areas for capacity building programmes.
- R03: Apply the outputs from R01 (vulnerability assessment) and R02 (adaptive capacity assessment) into the Regional Coastal Adaptation Plan (ReCAF).

Through completion of activities R01 to R03, regional priorities will be identified. Consequently, PAP/RAC may support the development of targeted tools for adaptation based on an understanding of the relative vulnerability and adaptive capacity of the Mediterranean region. Activities may range from the provision of information to support more detailed assessments of the impacts of climate change; to the development of handbooks or guides to adaptation in differing coastal environments. Further, PAP/RAC will play an important role in information sharing.

Access to information differs considerably across regions and insight into the costs and benefits of different adaptation options and information on good coastal adaptation practice is limited. This results in disparity between the understanding of the potential impacts of climate change and understanding of the options available to treat any identified risks. The role of PAP/RAC in alleviating such gaps could include establishing information sharing mechanisms to, *inter alia*: promote collection, storage and dissemination of climate information and to share lessons learned from climate change adaptation across the region.

Effective adaptation decision-making for coastal zones in the Mediterranean will necessarily involve a range of spatial scales from Med-wide to local, site-specific decisions. Advocating a blended approach for bottom-up (local level) and top-down (Med-wide) adaptation (with spatial scales in between) will be the key to successful adaptation. It will be crucial for MAP to build on existing partnerships, frameworks and institutional arrangements within the region to facilitate this process. There a number of existing or proposed initiatives in the Mediterranean that can provide insight into regional approaches at varying scales of implementation (for example, CIRCE, Beachmed 3 and CIR2CLE¹⁴). PAP/RAC should co-ordinate their efforts with such existing or proposed initiatives.

¹⁴ See the *Background Paper* for further information on these initiatives.

PAP/RAC's recommended role in facilitating information provision and sharing across the region may include:

Information Provision

- I01: Establish a well-coordinated coastal monitoring programme to ensure that the signal of coastal change driven by climate change can be detected and evaluated with respect to broader anthropogenic changes to the coast. This would require leadership from PAP/RAC to establish a Mediterranean-wide agreement on the definition of key climate change indicators and the promotion of improved monitoring and reporting mechanisms.
- I02: Support the development of climate information – downscaling climate projections and developing standardised approach to regional comparison of impacts. Such information is available for the EU but is not available for the entire Mediterranean region. This recommendation aligns to recommendation R01.

Information Sharing

- I03: Lead innovation and development of good practices through implementation of local adaptation projects. It would be important to ensure that the local adaptation projects are selected based on regional prioritisation (see recommendation ID C01).
- I04: Provide a facility for enhanced co-operation for climate change adaptation across the Mediterranean (North-South or from Annex1 countries to others). As outlined in Section 4, some countries are more advanced in addressing the climate change issue than others. This differential capacity not only leads to different climate change adaptation priorities but can also be utilised to share lessons learned and practical experience between Countries. PAP/RAC could provide a vital information network through the already established CP Focal Points. In addition, a Clearinghouse mechanism to share climate relevant information could be developed. This may be an extension of the MAP online resources to include climate change, or new information sharing platform.
- I05: Application or development of new and innovative adaptation methodologies to the specificities of the Mediterranean coast including: the adaptation approach, measures, options and actions.

5.2. Overview of Recommendations

Recommendations to reduce the vulnerability of the Mediterranean coastal zone to the projected impacts of climate change have been identified and are summarised in Table 13.

The framework guiding the production of the recommendations is shown in Figure 13. The framework is based on an understanding that adaptation strategies can address both climate change impacts (that result from system exposure to climate changes and the physical sensitivity of the system) and adaptive capacity (that result from socio-economic and institutional capacity to adapt and willingness to adapt). Knowledge gaps to inform adaptation in these two areas have been identified and recommendations to address these gaps have been presented (Section B in Figure 11).

The ICZM Protocol and the MSSD, in which climate change will be mainstreamed, will guide the development of a Regional Coastal Adaptation Framework (ReCAF) (Section A, Figure 11). Additional components that are required to inform the development of the Regional Coastal Adaptation Framework include a regional impact assessment and a regional assessment of adaptive capacity. The assessments align to the PAC/RAC mandate and

actions. Subsequently, the ReCAF will guide the implementation of sector or issue specific programmes in key vulnerable areas. These may be undertaken as pilot projects that will lead to lessons learned that can be disseminated throughout the region. In addition, PAP/RAC may create tools, guidelines and manuals in line with the key sector/issues to be addressed (as identified in the impact and capacity assessment). The key to Section C (Figure 13) is the creation and dissemination of information based on regional priorities, which link to national and local scale development objectives.

Table 13: Recommendations for PAP/RAC

ID	Description
G01	Promote ratification of the ICZM Protocol.
G02	Increase the awareness of CPs and other key stakeholders of the links between ICZM and climate change, as outlined in the ICZM Protocol (Table 12).
G03	Support mainstreaming of climate change adaptation into the MSSD.
G04	Provide support to CPs on how mainstreaming adaptation is applicable in the coastal context. It will be important to demonstrate climate change mainstreaming across a variety of tiers, from regional (ICZM Protocol and MSSD), to national and local (guidelines, etc.).
G05	Support capacity building in key areas, i.e. climate change mainstreaming.
G06	Ensure that when the ICZM Protocol is reviewed, the important and intertwined nature of climate change in ensuring an integrated approach to coastal zone management in the Mediterranean is recognised.
C01	Demonstrate leadership in climate change adaptation by promoting a co-ordinated approach to climate change adaptation in the Mediterranean through the development of a Regional Coastal Adaptation Framework (ReCAF).
C02	Strengthen existing regional ICZM co-operation mechanisms to enhance the flow/support for information dissemination, etc.
F01	Ensure up-to-date knowledge of the funding landscape for climate change adaptation and coastal management. Identify potential funding opportunities and disseminate this information to CPs as appropriate.
F02	Develop and/or support the development of targeted funding requests. Funding requests should be based on established understanding of regional priorities and local development objectives (as would be established through development of the ReCAF).
F03	Ensure collaboration in the development of any Regional Coastal Adaptation Framework (ReCAF). Whilst this is not a direct financial action, it provides the operational framework for financial activities, as finances should be targeted based on an understanding of regional priorities.
F04	Investigate opportunities to improve the uptake of adaptation action by Contracting Parties through better use of available financial resources and instruments and/or a combination of policy measures (i.e. funding measures, market-based instruments, guidelines and public-private partnerships).
F05	Encourage public-private partnerships with a view to sharing investment, risk, reward and responsibilities between the public and private sector in the delivery of adaptation actions.
R01	Commission an assessment of the relative impacts of climate change, and associated vulnerability, in the Mediterranean.
R02	Commission an assessment of the adaptive capacity of Mediterranean countries, to highlight focus areas for capacity building programmes.

ID	Description
R03	Apply the outputs from R01 (vulnerability assessment) and R02 (adaptive capacity assessment) into the Regional Coastal Adaptation Framework (ReCAF).
I01	Establish a well-coordinated coastal monitoring programme to ensure that the signal of coastal change driven by climate change can be detected and evaluated with respect to broader anthropogenic changes to the coast. This would require leadership from PAP/RAC to establish a Mediterranean-wide agreement on the definition of key climate change indicators and the promotion of improved monitoring and reporting mechanisms.
I02	Support the development of climate information – downscaling climate projections and developing standardised approach to regional comparison of impacts. This recommendation aligns to recommendation R01.
I03	Lead innovation and development of good practices through implementation of local adaptation projects. It would be important to ensure that the local adaptation projects are selected based on regional prioritisation (see recommendation C01).
I04	Provide a facility for enhanced co-operation for climate change adaptation across the Mediterranean (North-South or from Annex1 countries to others).
I05	Application or development of new and innovative adaptation methodologies to the specificities of the Mediterranean coast including: the adaptation approach, measures, options and actions.

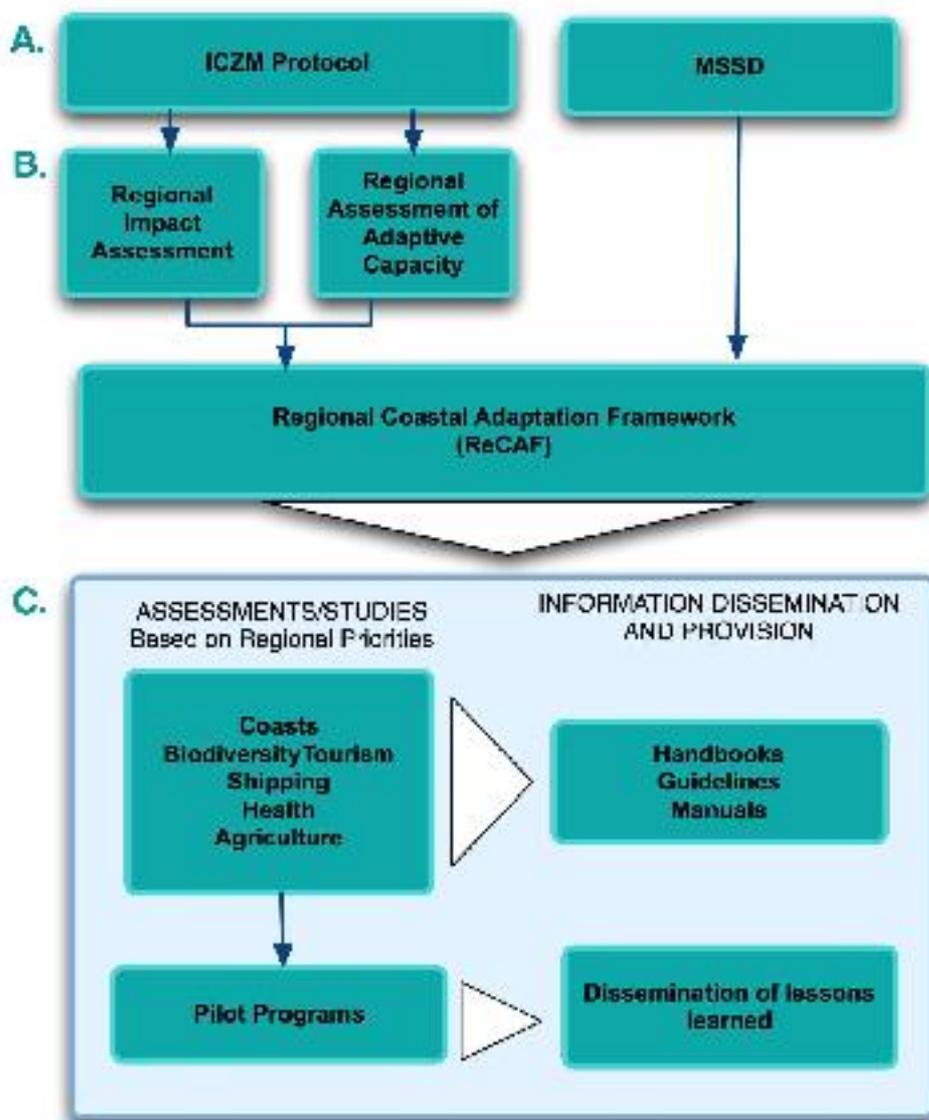


Figure 13: Conceptual framework guiding the development of PAP/RAC recommendations

5.3. Implementation Pathways

5.3.1. PAP/RAC Mandate

The specific objective of PAP/RAC is to contribute to sustainable development of coastal zones and sustainable use of their natural resources. In this respect, PAP/RAC's mission is to provide assistance to Mediterranean countries in the implementation of Article 4(i) of the Barcelona Convention, meeting their obligations under the ICZM Protocol and implement the Mediterranean Strategy for Sustainable Development (MSSD), 2005, and by carrying out, in particular, the tasks assigned to it in Article 32 of the ICZM Protocol, 2008.

In addition, the main fields of action for the achievement of sustainable development of coastal zones consist of:

1. Assisting the Contracting Parties in formulating and implementing national strategies for action plans under the ICZM Protocol;

2. Assisting countries in the region in strengthening their capacities with a view of facilitating the sustainable development of coastal zones by ensuring that environment and landscapes are taken into account in harmony with economic, social and cultural development; preserving coastal zones and their integrity; ensuring the sustainable use of coastal natural resources; and achieving coherence between public and private initiatives and between all decisions by the public authorities at all levels that impact the coastal zones;
3. Assisting countries in the implementation of demonstration/pilot coastal management projects (such as Coastal Area Management Programme - CAMP) in selected local Mediterranean coastal areas to demonstrate the application of ICZM as a major tool, with a view to implementing specifically the ICZM Protocol. CAMP projects have the goal to develop relevant implementation instruments and procedures for sustainable development in project areas; to identify and apply relevant methodologies and tools; to contribute to capacity building at the local, national and regional levels; and to secure the broad use of the results achieved;
4. Developing regional co-operation in the field of capacity building and awareness raising of the importance of the integrated management of coastal zones through the organisation of training, education and awareness-raising activities, networking, publications and the dissemination of information;
5. Developing ICZM methodologies and tools as well as addressing specific sectoral issues with a coastal focus in the framework of ICZM, such as urban development, natural resources management, sustainable tourism, landscape and heritage protection, coastal and soil erosion, infrastructure and transport, pollution and waste, climate change, and specific coastal ecosystems.

The recommendations outlined here have been aligned to the PAP/RAC objective/mission and fields of action (Table 14) to demonstrate alignment between recommendations and the current Mandate of the PAP/RAC.

Table 14: Alignment between PAP/RAC Mandate and Recommendations

Mandate	Associated Recommendations
Objective and Mission	
Provide assistance to Mediterranean countries in the implementation of Article 4(i) of the Barcelona Convention, meeting their obligations under the ICZM Protocol and implement the Mediterranean Strategy for Sustainable Development (MSSD), 2005;	G01, G02, G06, G03:
Carry out, in particular, the tasks assigned to it in Article 32 of the ICZM Protocol, 2008, as follows:	
1. Assist the Parties to define a common regional framework for integrated coastal zone management in the Mediterranean pursuant to Article 17;	C01, R03
2. Prepare a regular report on the state and development of integrated coastal zone management in the Mediterranean Sea with a view to facilitating implementation of the Protocol;	I01

3. Exchange information and carry out activities of common interest pursuant to Article 27;	I03, I04
4. Upon request, to assist the Parties: To participate in a Mediterranean coastal zone network pursuant to Article 16; To prepare and implement their national strategies for integrated coastal zone management pursuant to Article 18; To co-operate in training activities and in scientific and technical research programmes pursuant to Article 25; To co-ordinate, when appropriate, the management of transboundary coastal zones pursuant to Article 28;	R01, R02, F02
Fields of Action	
Formulating and implementing national strategies for action plans under the ICZM Protocol;	C01
Assisting countries in the region in strengthening their capacities with a view of facilitating the sustainable development of coastal zones by ensuring that environment and landscapes are taken into account in harmony with economic, social and cultural development; preserving coastal zones and their integrity; ensuring the sustainable use of coastal natural resources; and achieving coherence between public and private initiatives and between all decisions by the public authorities at all levels that impact the coastal zones;	F03, F04, F05:
Assisting countries in the implementation of demonstration/pilot coastal management projects in selected local Mediterranean coastal areas to demonstrate the application of ICZM as a major tool, with a view to implementing specifically the ICZM Protocol;	I05
Developing regional co-operation in the field of capacity building and awareness raising of the importance of the integrated management of coastal zones through the organisation of training, education and awareness-raising activities, networking, publications and the dissemination of information;	G04, G05, F01, F04, I02, I04:
Developing ICZM methodologies and tools as well as addressing specific sectoral issues with a coastal focus in the framework of ICZM, such as urban development, natural resources management, sustainable tourism, landscape and heritage protection, coastal and soil erosion, infrastructure and transport, pollution and waste, climate change, and specific coastal ecosystems.	I01:

5.3.2. Programme of Works (2010-2015)

The PAP/RAC Five-Year Programme of Work (PoW) builds on 6 themes: Governance, Integrated Coastal Zone Management, Biodiversity, Pollution Prevention and Control, Sustainable Consumption and Production and Climate Change.

The proposed activities, of relevance to the theme of ICZM and Climate Change, aim at strengthening and reinforcing UNEP/MAP internal coherence with a view to ensuring integrated action and avoiding sectoral approaches; rendering the reporting and compliance system more effective; enhancing partnerships and co-operation; preparing a sound basis for the implementation of the ICZM Protocol; enhancing knowledge about the impact of climate change in the Mediterranean marine and coastal areas and ensuring their integration in adaptation strategies and overall National Sustainable Development policies.

Whilst the status or programme implementation is unknown, the outputs and indicative activities provide an insight into the committed funds that may support implementation of the recommendations outlined herein. Consequently, the alignment between the PoW and the recommendations are presented in Table 15. The objective is to demonstrate the available resources (human and financial) committed to addressing the impacts of climate change. Whilst the description of the “specific activities” committed to in the PoW may not align directly to each recommendation, there is alignment between the intended outcomes of both

activities. For example, Specific Activity 6.2.2 (Assist countries in elaborating strategies and funding requests regarding climate change and biodiversity) aligns to the recommendations F01 and F02.

There are a number of sectoral specific activities currently underway or planned to commence, as outlined in the PoW. However, a current gap is an overarching framework in which the activities are couched. For example, while activities such as: *6.2.1 Vulnerability analysis of tourism in a selected area* and *6.2.3 Analysis of the adaptation to climate change of the Water/Energy sectors*, will provide integral support to CPs in addressing the impacts of climate change, it is important that the alignment of such activities to the overall objectives of Regional Adaptation is clear. In other words, the alignment of sector specific analyses should be couched within a broader understanding of regional vulnerability. A Regional Adaptation Framework (recommendation C01) could provide this clarity.

Table 15: Outputs and Activities in the PoW and recommendations

Output	Indicative Activities	Associated Recommendations
<p>Output I Mediterranean region able to face climate change challenges through a better understanding of potential ecological impacts and vulnerabilities</p>	<p><i>Better understanding/awareness of climate change impacts on the Mediterranean environment and natural resources:</i></p> <p>Contribute to assessing the impact of Climate Change on Marine and coastal biodiversity (identify the most vulnerable habitats and species to climate change), natural resources (soil, forests, water)</p> <p>Development of impact indicators tailored to the Mediterranean marine and coastal environment</p> <p>Assessment of impacts on water quality and pollution risks as a result of climate change, particularly desertification, erosion, salinisation flooding and sea level rise</p>	<p>R01 and I01</p>
<p>Output II Reduced socio-economic vulnerability</p>	<p><i>Better understanding of the challenges of CC for the Mediterranean economy and societies:</i> through an analysis of socio-economic impact of CC (focused on coastal zone and maritime activities)</p> <p><i>Facilitate adaptation planning/processes that address and reduce vulnerability through supporting the development of the marine and coastal dimensions of regional/national strategies on adaptation</i></p> <p><i>Promotion of low carbon production and consumption in the context of the MSDD implementation</i></p>	<p>R02, F01, F02, G05, and G04</p>
<p>Output III Assess and provide information to reduce adverse environmental impacts of mitigation and adaptation strategies & technologies</p>	<p>Assessment of environmental impact of CO₂ sequestration</p> <p>Assessment of coast and marine physical alteration due to mitigation strategies and technologies</p> <p>Integration of environmentally sound desalination and waste water re-use in IWRM</p>	<p>I05</p>

6. Summary

This Position Paper provides PAP/RAC with an overview of the situation related to climate change in the Mediterranean and proposed activities to be undertaken by PAP/RAC with the aim to adapt to climate change impacts in coastal zones. The activities align to the PAP/RAC mandate and to the requirements of the ICZM Protocol, and focus on the information needs to support the delivery of technical assistance to countries as well actions that can be taken to build capacity of relevant stakeholders at regional, national and local levels.

Developing a Mediterranean Coastal Adaptation Framework is seen as a key priority. This will encompass the need for sharing experiences and tools for adaptation, which is increasingly important at the regional level as work develops in the field. Although vulnerability and adaptive capacity to climate change varies widely depending on the context, as do the initiatives to be undertaken, the need to share experiences and build capacity encourages the issue to be put on the regional agenda.

Overall, climate change brings with it a whole range of new governance and management techniques; economic and financial mechanisms, and community action needs. MAP and specifically PAP/RAC are ideally placed to play an active mentoring and leadership role as the countries of the Mediterranean move towards adapting to the large-scale issues arising from climate change. Ultimately, the effectiveness of this role will be shaped by political will within the region that should be cognizant of the need for foresight. This will be essential to mitigate the potential for even greater expenditure of resources in the future should effective and “adaptive” adaptation not be instigated as a pressing concern.

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Appendix A: Additional information on country specific vulnerability derived from National Communications Review

Country	Impacts
Spain	<ul style="list-style-type: none"> • Heterogeneous coast with mixture of eroding rocky cliffs and soft shorelines – some soft eroding cliff lines along Algarve coast and sandy beaches with sediment deficits. Sea level rise will cause flooding and permanent inundation of some coastal areas and exacerbate erosion • Loss of biodiversity in highly developed coastal zone already susceptible to climate variability; no buffer for inland migration of wetlands; current over-exploitation exacerbated by impacts of climate change. • Big problems in terms of impacts of climate change on tourism in the coastal zone. Planning and development has occurred in an <i>ad-hoc</i> manner resulting in development situated in high-risk locations. Erosion and land loss are major coastal climate change issues for Spain.
France	<ul style="list-style-type: none"> • Sea level rise is likely to have an impact on road network due to the extensive distribution along France's coast. Exacerbated impacts on areas of coast currently subject to erosion (approximately 40% of total coastline including Atlantic seaboard). • Mixture of rocks/hard cliffs, developed beaches and some cliffs subject to erosion. • Main impacts outlined in national communications concern forestry. Heterogeneous Mediterranean ecosystems will be pressurised due to sea level rise and erosion, and in many places issues will be related to the fact that there is no scope for landward migration of process boundaries due to highly developed nature of many coastal areas. • The largest impact of climate change in the coastal zone will be impacts on the tourism industry.
Italy	<ul style="list-style-type: none"> • 4,500 square kilometres of coastal areas and plains at risk of sea flooding; floods likely to be frequent and distributed over all Italian coasts. • Coastal zone is largely low lying with low tidal range; highly fragmented and instability will increase under projected rises in mean sea level. • The eastern coastline is more susceptible to the impacts of climate change than the west coast. • Reduction in the number of stable plant species in 2100 of between 60-80% in the Mediterranean area. Valuable endemic species (i.e. posidonia) are situated in the region. • 40% of tourists visit during summer and will be impacted extreme hot conditions, especially among the elderly and those who are affected by chronic diseases. However, conditions in spring and autumn will improve. The availability of water supply could become a major constraint and the quantity and quality of water available may not be sufficient to satisfy future tourist demand.
Malta	<ul style="list-style-type: none"> • Inundation of low-lying coastal areas including all sandy beaches and the gently sloping rocky coasts mostly along the north-eastern shoreline. • Apart from the actual loss of land area, these locations also support rare and localised habitats containing highly specialised organisms. Ecosystems spread over the Maltese islands will be affected in a number of ways. Most of the bays and the north-eastern shores are expected to experience submergence, shifting zone patterns landward. Specialised and rare habitats such as wetlands will be mostly under threat, some of which will be facing complete obliteration. • Existing infrastructure may serve to reduce the extent of inundation, but can also restrain the inland transfer of the threatened habitats. • Moderate to high economic vulnerability; impacts on fish stocks will decrease the viability of fisheries and tourism may also experience negative impacts which has implications for the service industries.
Greece	<ul style="list-style-type: none"> • Far reaching impacts given the geomorphology of the country and the high percentage of population living in coastal areas. • Coastline over 16,500km in length (including islands), the largest coastline in the Mediterranean region. The potential impacts include accelerated erosion of susceptible areas of coast and inundation of low lying areas due to sea level rise and flooding. The current rate of

Country	Impacts
	<p>coastal erosion is estimated at 1.2mm <i>per annum</i>.</p> <ul style="list-style-type: none"> • Growth, abundance, distribution, composition, diversity and recruitment success of Mediterranean species will be impacted – e.g. anchovy (<i>Engraulis encrasicolus</i>) or sardine (<i>Sardinella aurita</i> and <i>Sardina pilchardus</i>). • The coastal zone is home to 80% of industrial activity, 90% of tourism activity and 35% of agricultural and productive land. • The increased temperatures during summer can lead to the gradual decrease of summer tourism in the Mediterranean, but increase during spring and autumn. Studies have shown that climate change will lead to the prolongation of the touristic period in Greece and Spain up to 2030 with arrival of tourists allocated more homogenously, decreasing the intensity of the water scarcity and energy consumption issues in the islands during summer. Attica and Heraclio (Crete) will experience the higher rate of water change that might result to shortages that would affect touristic activities, while the islands of the Aegean, and especially the Cyclades, seem to keep their cool climate, indicating that the impact of the sea is very important in the moderation of increased temperatures. • Tourism in Greece is largely nature based and is therefore highly vulnerable to climate change.
Cyprus	<ul style="list-style-type: none"> • 50% of population live along the coastline hosting 60% of GDP and 90% of tourism. Several developments along the coast that could potentially be under threat, for e.g. airport, ports desalination centre refinery station, energy plants, industries and archaeological sites. The main pressures on the coast are intense urbanisation, and uncontrolled development of tourist activities. • Exacerbation of erosion on already problematic coastline; impacts on coastal defence structures and degradation of illegally built and often sub-standard structures. • Livelihoods: Big problems of very severe socio-economic and environmental impacts. Lack of water resources is the primary climate change issue – this will affect economic and environmental impacts, agriculture, forests, tourism and energy.
Slovenia	<ul style="list-style-type: none"> • Very small coast line, 46 km in length. Consequently, coastal management is not a priority in terms of climate change adaptation for the region. Despite this, some broad generalisations regarding potential impacts of climate change in the coastal zone have been made. It is noted that a rise in sea levels and sea temperature will threaten coastal areas. • Higher temperatures, different water balance and more frequent extreme weather events increased stress, will threaten biodiversity. • The threat of floods will increase and there will be problems ensuring the supply of drinking water.
Croatia	<ul style="list-style-type: none"> • Croatian Adriatic coast mainly consists of rocks and is at high elevation, therefore, not seriously endangered by the rising of sea level. However, inundation will be an issue in lowlying coastal areas covered with alluvial or flish deposits and sandy beaches. Projections indicate that over 100 km² of the mainland will be flooded due to rising sea levels. • Changes in oceanographic and hydrological characteristics will influence the composition of Adriatic ichthyofauna. The number of immigrant thermophilous fish species in the Adriatic is increasing and the findings of the Red Sea and Indo-Pacific species are increasingly frequent. Some of the immigrant fish species represent an alternative for exploitation in commercial fishing and mariculture. Changes in spawning sites and in distribution of fish populations affect the fishing industry considerably. • Sea flooding in shallow and densely populated areas will impact residential and harbour buildings, roads, energy and telecommunication cables and sewage systems. Infiltration of salt water could increase salinity of the freshwaters in the coastal zone. Rise in temperature extends the tourist season in the coastal zone from the present three to five months.
Bosnia & Herzegovina	<ul style="list-style-type: none"> • Small coastal zone. Most climate change issues are associated with agriculture, limited examination of the projected impacts of coastal climate change. • No information available. • No information available.
Montenegro	<ul style="list-style-type: none"> • Coast stretches from the entrance to the Bay of Kotor, Boka Kotorska to the mouth of the Bojana River. The coast is relatively short and narrow, because of the steep, high mountains in the immediate hinterlands. • No information available.

Country	Impacts
	<ul style="list-style-type: none"> No information available [Tourism Key focus in coastal zone].
Albania	<ul style="list-style-type: none"> SLR will result in likely decrease in coastal forest area (Lezha coast) is likely from 1.14 to around 1 km² by 2100. Beach erosion at Shengjin and inundation of coastal cities in areas where dwellings were built on low-lying swamps. Likely enlargement of lagoons will increase holding capacity for migratory birds and change the species present. Change in water fauna and flora in favour of species that like more warmth and salinity is also likely. The expected climate change and sea level rise will largely influence the geographical distribution of the residence areas, population, their economic activity in general and tourism in particular. Along the coastal areas of the valley of “Drini i Bashkuar” river (from Kukesi to “Vau i Dejes”) likely changes are: (i) increase in temperature from 2.8 to 5.6 °C during summertime; (ii) increase in surface air temperature and humidity - these increases are projected to be largest mainly in the low lying areas and are likely to influence especially the health conditions of population; (iii) increased frequency of extraordinary events (heavy rains, strong winds, droughts, flooding); and (iv) coastal tourism is expected to suffer consequences of sea level rise. At the beach of Shengjin the tourism constructions are all threatened by sea level rise in the coming 50–100 years. Areas within coastal cities, particularly those in the state properties of the ex-swamps which were drained in the period 1950–1960, are situated close to sea level or sometimes below sea level, and are continuously threatened by flooding due to sea level increase or rivers overflowing.
Turkey	<ul style="list-style-type: none"> Coastal erosion, flooding and inundation along Turkish shorelines are problems of national significance, particularly in the middle and eastern Black Sea, the northern Aegean Sea and eastern Mediterranean. A majority of the coastline is “hard” coast, however, the coast of the Northern Aegean and Eastern Mediterranean are subject to erosion and inundation. The increased risk of drought is likely to be the biggest climate change impact felt by Turkey which will exacerbate loss of biodiversity in coastal ecosystems already under pressure due to other climate-related factors. Tourist and coastal cities are particularly under threat. Many “flagship” cultural sites would also be damaged or destroyed by Accelerated Sea Level Rise (ASLR) like ancient cities such as Phaselis and Patara on the south-western coasts of Turkey. Some of them could be destroyed by increased wave activity, whereas burial by more active sand dunes is also possible (e.g. the ancient city of Pompeipolis [Viransehir] on the Mediterranean coast has recently been covered by sand dunes). Because of the large number of ruins, relocation is impossible in practical terms, and it may change their character and context, as well.
Syria	<ul style="list-style-type: none"> A narrow coastal plain runs from the Turkish border to Lebanon. A 250 km-long Jebel Ansariyya mountain range that runs along its entire length squeezed between the highland and the sea is a narrow coastal strip that widens towards the south. This area will be susceptible to accelerated erosion and flooding and inundation as a result of sea level rise and an increase in wave height and extreme events. Narrow coastal strip is extremely fertile and agriculturally rich; no space for landward migration of ecosystems with sea level rise due to existence of backing high mountain range. 67% of population lives in urban regions due to internal migration from remote areas to major cities such as Damascus, Homs, Hama, Aleppo and other cities along the coastal strip. The main sea port at Lattakia is under threat and there are associated impacts on livelihoods. Tourism is also a high source of revenue in this area with beach resorts and ruined ancient city of Ugarit (Ras Shamra).
Lebanon	<ul style="list-style-type: none"> The major pressures on coastal zones will be related to development rather than the direct result of climate change. Erosion in the coastal zone will be exacerbated and areas already under pressure due to intensive sand extraction are likely to be most negatively impacted. Changes in water temperature will potentially impact Phytoplankton populations, for example, the phytoplankton populations in Jounieh Bay, species responsible for bloom at late winter and at the beginning of spring like <i>Skeletonema costatum</i>, <i>Nitzschia spp.</i>, <i>Leptocylindrus denicus</i> and <i>L. minimus</i> and others could start earlier; both density and timing of spring blooms will be altered in some regions. The

Country	Impacts
	<p>taxonomic composition of the phyto- and zooplankton may change influenced by the change of ocean structure. <i>Clupeidae</i> which is very sensitive to the gradient of temperature will reproduce also earlier. Changes in plankton productivity associated with greater temperature and greater stratification of the water column may favour pelagic as opposed to demersal fish communities.</p>
Israel	<ul style="list-style-type: none"> • Dominated by a flat, sandy coastal zone, with sandstone coastal cliffs. Vermetid reefs, found in several rocky beaches are expected to mitigate coastal erosion by decreasing the direct impact of waves on the shoreline. • 300-500 km northward shift of Mediterranean Biomes will mean that the Negev ecosystems may be expected to replace Mediterranean ecosystems in Israel. Habitat fragmentation and natural limitations on migration may lead to a loss of natural populations or even species. Sensitive ecosystems in Israel include the coral reefs of the Red Sea and the coastal wetlands, and isolate mountain ecosystems such as the Hermonn, Mron and Carmel mountains. The most dramatic changes in ecosystem structure and composition are likely to occur in the semi-arid region of Israel, the non-desert/desert ecotone. Plant and animal communities will not be able to migrate or expand eastward due to lack of suitable habitats. Aquatic ecosystems within rivers as well as terrestrial ecosystems along the coastline will be endangered by sea level rise and by seawater infiltration of ephemeral river basins. • Sea level rise may erode coastal structures, adversely affect harbour and other coastal structures and lead to collapse of the coastal beach cliff in the central sector of Isreal's shoreline. Increase in storm frequency and changes in wind directions may enhance coastline erosion and retreat. Isreal's heavily populated coastal plain is most vulnerable to coastal erosion. Sea level rise may lead to the loss of valuable lands, buildings and tourist facilities in close proximity to the sandstone coastal cliffs.
Egypt	<ul style="list-style-type: none"> • The coastal zone of the Nile Delta in Egypt is perceived as vulnerable to the impacts of climate change, not only because of the impact of sea level rise (SLR), but also because of the impacts of climate change on water resources, agricultural resources, tourism and human settlements. Several studies were undertaken, to assess climate change impacts on low land areas in Alexandria, Beheira, Port-Said and Damietta governorates. For Alexandria, a scenario involving a sea level rise of between 0.5 m and 1.0 m over the next century is assumed, if no action is taken, an area of about 30% of the city will be lost due to inundation. • The Nile delta covers 5.5% of Egypt's land area, but contains 95% of the country's population. For Rosetta city, the expected economic loss as a result of an estimated 0.5 m sea level rise show that 1/3 of the employment in the city will be affected and a loss of about \$2.9 billion is expected over the next century. The most affected sectors are expected to the industrial, transportation and urban sectors. Agriculture in non-coastal areas is not projected to be highly affected because it is mainly found in the suburbs and thus will not be affected by sea level rise. However, it is noted that SLR will have a significant impact on human habitat and settlements with a projection of at least two million people migrating from the Delta coastal areas due to the inundation and loss of fertile land. Careful assessments are required to examine the socio-economic impact of this migration and determine the costs of resettlement, finding new jobs, new habitats, etc.
Libya	<ul style="list-style-type: none"> • High risk of erosion and sea level rise along low lying coastal plains where most of population are concentrated. • Mangroves and currently endangered species at risk from climate change. • High concentration of population in coastal zone due to population movement from rural areas to the capital city. • There is a high area of land close to the coastline that is situated below sea level and therefore highly vulnerable to the sea level rise. • 90% of the population is in the coastal zone. Agriculture is only supported in the coastal zone, due to the reliance on rainfall (no irrigation systems) and cannot locate further inland due to the harsh arid environments. Saltwater intrusion due to sea level rise is also a major issue.
Tunisia	<ul style="list-style-type: none"> • The coast is vey fragile and low-lying islands are at particularly high risk. Sea level rise would damage the aquifer coastal formations and other underground water reserves where anthropogenic pressure is already very high. Most vulnerable coastal areas are likely to be lagoons, sebkhas, and lowest coastal marshes, which will be in inundated by rising sea levels. Erosion of the shoreline along lagoon coasts is also likely. Water resources are projected to decline by 28% where the loss of groundwater reserves in particular will be problematic. Loss of land to sea water, particularly on some islands (KerKenna Islands) and swamps (Maritime swamps and Sebkhass). • The findings, which were presented in a report published in February 2007, illustrate the dramatic effects of climate change in Tunisia,

Country	Impacts
	<p>including 50% loss of non-irrigated forested areas in southern Tunisia; drastically increased risk of forest fires; and substantial increase in the vulnerability of ecosystems.</p> <ul style="list-style-type: none"> • The expected sea level rise will put not only agriculture but also tourism – a major economic sector in Tunisia – at risk. 60% of the population live within the coastal zone; and 70% of the economy is based in the coastal region, including over 90% of tourist accommodation and agriculture. There is projection of a 20% loss in arable cropland by 2030.
Algeria	<ul style="list-style-type: none"> • Coastal zone not dealt with specifically in National Communication. • Two thirds of population live along coastline – problems with waste dumped into the sea with no prior treatment and industrial activities concentrated along the coast. • Tourist activity is extremely important along the Mediterranean coast and is already degrading the quality of coastal waters. The degradation of natural resources in the region is reaching its limits. Due to climate changes, the risks of natural resource degradation are increasing.
Morocco	<ul style="list-style-type: none"> • In Morocco, the examination of the last three decades (1970-2000) show revealing signs of climate change: the frequency and intensity of droughts, unusually devastating floods, the decrease in the snow cover period on the peaks of the Rif and the Atlas mountains, the modification of spatial-temporal rainfall distribution, changes of itinerary and passage dates of migrating birds, the appearance of certain species of birds in the Rabat region that only used to be seen in the south of Marrakech. • Ecosystem destruction and pollution are current management issues, likely to worsen under a changing climate. • A key climate change impact in the coastal zone is erosion and marginalization due to the harsh inland environment. Development in the coastal strip has been largely <i>ad-hoc</i> increasing the potential susceptibility to the impacts of climate change.