PRIORITY ACTIONS PROGRAMME

Strategic Partnership for the Mediterranean Large Marine Ecosystem

MedPartnership

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Integrating climate change into the ICZM planning process

Contribution to the Integrative Methodological Framework for coastal, river basin, aquifer and groundwater management

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Professor Markandya has worked extensively on climate change, energy and environmental issues and has received a number of awards. He was a lead author for Chapters of the 3rd and 4th IPCC Assessment Reports on Climate Change. He was one of the core team that drafted the IPCC 4th Assessment that was awarded the Nobel Peace Prize in 2007. He was also the author of a paper on climate regulation that was awarded 2nd Prize at the World Energy Council in Rome in November 2007.

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Introduction

This document provides some guidance on the steps to be taken in including climate change related issues into the ICZM process. It is based on the view that climate adaptation measures should be an integral part of the process and not an add-on or a separate component. The structure adopted is that used by the Integrative Methodological Framework for coastal, river basin and aquifer management and by the Guidelines for the preparation of National ICZM strategies [1] (henceforth referred to as the IMF document), which identify the following key steps:

I. ESTABLISHMENT: Aim & Objectives
- Establishing coordination mechanisms
- Defining territorial scope
- Defining governance context
- Scoping
- Engaging Stakeholders
- Proposing the vision
- Decision on Strategic Environmental Assessment

II. ANALYSIS & FUTURES: Aim and Objectives
- Building the evidence
- Identifying futures

III. SETTING THE VISION: Aim & Objectives
- Building consensus
- Setting the direction
- Measuring success

IV. DESIGNING THE FUTURE: Aim & Objectives
- Formulating ICZM Strategies, Plans or Programmes
- Establishing Management structure
- Embedding

V. REALISING THE VISION: Aims and Objectives
- Implementing
- Investment and Infrastructure
- Acting
- Monitoring and Review

The IMF document notes that actions related to climate change need to be integrated in the respective frameworks. The present report goes through each of the stages listed above and indicates how the climate change dimension should be addressed, both at the strategy stage as well as in the preparation of the coastal plans at both the national and local levels. In both cases the context is the Mediterranean.

[1] The ICZM process has been presented in the three related documents prepared by the Priority Actions Programme: "Towards Converging Management Approaches for Mediterranean Coastal Zones: An Integrated Methodological Framework for coastal, river basin and aquifer management", April, 2012; "Guidelines for the preparation of National ICZM Strategies required by the Integrated Coastal Zone Management (ICZM) Protocol for the Mediterranean", June, 2011; and "ICZM Process" (PEGASO Platform).

Five stages of the ICZM process

1. Establishment

This is an important stage of the ICZM process. The aim is to set out an operational foundation for the subsequent preparation of the strategy or plan and its implementation, to begin the process of understanding the challenges facing the area and the differing perceptions of those challenges, and to begin building a constituency of support for the strategy or plan.

Establishment starts with the initiation, which sets out the ICZM strategy and plans within the context of the Protocol on Integrated Coastal Zone Management in the Mediterranean. The assumption is that both the strategy and the plans should be, inter alia, **comprehensive** - covering all issues crucial for coastal environment and its protection in the 21st century – and i**ntegrated** - ensuring institutional co-ordination, co-ordination of national, regional and local authorities, involvement of non-governmental organisations and other competent organisations, as well as the integrity of sea and land areas. All partners should agree on the final status of the Plan at this Initiation stage, particularly where this Plan is being used to meet the statutory purposes of one or more sectors.

As far a climate change is concerned, the main concern is to ensure that there is institutional coordination with bodies responsible for climate adaptation and mitigation strategies and plans. All countries have an obligation to produce a communication to the United National Framework Convention on Climate Change, detailing greenhouse gas emissions (GHGs), as well as vulnerability assessments and some actions to adapt to climatic changes[2]. Thus from the outset any actions on climate change under the ICZM should be coordinated with the National Communication Office of the country. In addition, local authorities in many coastal zones are already planning to introduce measures to respond to some of the expected impacts of climate change. It is essential that these authorities and their plans and procedures be brought into the ICZM process at this initiation stage.

These climate issues should be noted in the strategy and the national plan for ICZM should ensure that they conditions are met. This plan should identify the key partners that each local plan needs to coordinate its actions with.

The scoping report, which is the output of this stage when preparing the plan, should cover the following areas: coordination mechanisms, boundary definition, governance context, drivers and pressures, key problems and issues, risk identification, stakeholder analysis, vision proposal, decision on Strategic Environmental Assessment and the work plan.

As for the work plan, A GANTT chart is a key tool, which provides: the plan process stages expressed as work packages, the major outputs in the form of reports and plans, key meeting, event dates, critical milestones centred on key meetings or events, key financial reporting requirements and the subsequent schedule of implementation.

In the next chapters individual steps within the Establishment Stage are considered in turn from the viewpoint of climate change.

[2] For details see: http://unfccc.int/national_reports/items/1408.php. Annex One countries (i.e. those that have a target reduction of GHGs under the Kyoto Protocol) also have to provide information on polices and measures that have been introduced.

1.1.Establishing coordination mechanisms

The IMF document identified three groups that constitute the governance structure for the ICZM: the steering group, the technical group and the consultative group. As far as climate change is concerned, its mainstreaming requires the following:

a. At least one representative from national government or the higher-level competent local administration(s) should have familiarity with climate issues, possibly because s/he is involved in one of the other bodies dealing with this topic.
b. The technical group needs at least one person with working knowledge of adaptation to climate change
c. The consultative group should include someone from the National Communication Office as well as representative from all sectors where climate issues have been assessed as being important at stage 1.4 Scoping

The governance structure is decided during the preparation of the national ICZM strategy and implemented in drawing up the national and local plans.

1.2.Defining territorial scope

Climatic changes will have impacts on areas that do not respect the boundaries of a coastal zone as defined in the ICZM. Sea level rise, for example may well affect areas outside the defined zone, and extreme events could impact on areas that extend beyond the defined boundaries, yet are part of an integrated area that includes the coastal zones.

As the IMF document states, it is necessary to be practical in defining the territorial scope of the areas to be covered under the plan. The 'competent' coastal units should be reconciled with the ecosystem, economic, social and political criteria as appropriate. This also applies to maritime zones, where the economic and social criteria should be applied, including coastal tourism, culture, agriculture and economic uses, but also includes patterns of transport and accessibility and urbanisation. In general it makes sense to retain the use of administrative boundaries where possible to maintain the integrity of stakeholder accountability and recognition, policy conformity and statistical information. A pragmatic compromise of ecosystem and administration is required.

The issue of boundary definitions is something to be brought up during the preparation of the national ICZM strategy, with, in our opinion, a pragmatic view as outlined above being the recommended approach. When the national plan is being prepared more details should be provided on how to deal with conflicts between administrative definitions and ecological, economic, social and political zones. Some resolution of these conflicts should be proposed in the National Plan. The local plans should then work with the agreed boundary definitions.

1.3.Defining governance context

As noted at the outset, the institutional context for climate change planning is already well established. In addition to the National Communication Office, and local and regional governments that are considering actions to adapt to climate change, several line ministries and departments have some involvement. These include:

- Ministry of Agriculture, for possible impacts in terms of crop yields

- Ministry of Environment, especially the Department dealing with water management and ecosystem health
- Ministry of Health, dealing with consequences of heat waves, vector and water borne diseases and increased risks of food contamination with higher temperatures
- Departments responsible for land classification (local and central).
- Ministry of Tourism

In addition one must not forget that the private sector is actively engaged in the coastal areas. Individuals and enterprises with significant investments will be well aware of the increased climate risks and will be planning to take some measures. These measures, however, will depend very much on what policies the government is putting in place and there is a strong inter-linkage between actions by the two sets of actors. It is critical that the ICZM be aware of the private sector's plans and provide it with the right framework and incentives so it can make a cost effective contribution to adapting to climate change.

The actions needed to address climate change will involve all these and many of them they will be giving some thought to developing policies to address the problems that are likely to arise. The ICZM needs to liaise with all of them to understand their positions and, ideally, play the role of coordinating their efforts for the effective management of the coastal zones. This can only be done if the ICZM has buy in at the highest level and recognition for its capacity to play this coordinating role.

The identification of the key institutional aspects of the ICZM should be done in the national ICZM strategy, including those relating to addressing climate change. In the national and local plans these linkages should be implemented, ensuring that all the important stakeholders are included in the process of preparing the plan.

1.4.Scoping

The *main problems* arising from climate change have been broadly identified under the following headings: damage to infrastructure from sea level rise and flooding, declines in agricultural yields, health risks from heat waves, risks to human life from extreme weather events, possible declines in tourism in the high season and possible increases in the shoulder seasons due to changes in climate, shortages of water due to changes in precipitation and possible saline contamination of groundwater, damages to ecosystems from changes in temperature and water availability.
These are the general set of problems that should be noted in the ICZM strategy but not all will apply in all coastal zones. It is at the stage of preparing the ICZM local coastal plans that the ones most relevant to the respective areas need to be identified.

The main drivers and pressures from climate change include the following: sea level rise, changes in precipitation (causing declines in water availability in some areas and during some seasons and causing floods in other areas and other seasons), increased frequency of extreme events (hurricanes, floods etc., heat waves) and possible increases in risks of vector and water borne diseases. At this stage an identification of these pressures, and an idea of where and when they are likely to be most serious, is required. As noted in the IMF document, the pressures will depend, among other things, on future plans for land use, which is a key determinant of the impacts that result from the climate-related factors just identified. The climate drivers will also depend on policies for water and land management that are in place or likely to be introduced.

The national ICZM strategy should note the important climatic drivers and pressures. It is at the national plan stage that national level data will be collected and at the local plan stage that further relevant data will be assembles. There are data sources that provide information at some degree of spatial disaggregation (see the websites listed at the end of this report). For further information on the likely pressures, a downscaling exercise may be needed, but this can be undertaken, if required, at a later stage in the process.

The scoping stage, including also *risk identification*, is primarily a desk exercise in conjunction with key stakeholders and technical experts from relevant sectors. As noted in the IMF document risk vulnerability is conventionally categorised according to the:

- **Nature** of the risk and its consequence
- **Magnitude** of the possible adverse consequences from each risk
- **Probability** of occurrence of each risk

In the case of climate change, objective probabilities cannot be defined in most cases. However, broad probability categories based on modelling and expert judgment are available for some pressures and impacts. These define, for example, when an event such as an increase in temperature is 'likely' if the probability of it being exceeded is less than 50%; or unlikely if the probability of it being exceeded is less 10%. At this stage the exercise should see which of the key impacts identified in the previous stage have some probabilistic information. This is likely to be available for extreme events, sea level rise, temperature increase and possibly change in precipitation. Together with the data on key problems such information will help at the later stage when the analysis of options is carried out.

The nature of the risk identification and its relevance for the ICZM should be noted during the preparation of the national ICZM strategy. The collection of probabilistic data at the national level should be collected for the national ICZM plan and at the local level for the local plans. The last of these, however, may require some downscaling of the models that predict the impacts.

1.5.Engaging the stakeholders

Stakeholder participation at several stages of the strategy and plan preparation is essential. As far as climate change is concerned key groups need to be informed about the major climate changes in the area of interest, the likely consequences of these changes and the increased risks they represent. This can be done without providing too much technical detail. The groups who need to be involved will include local communities, government agencies, NGOs, business, media and opinion formers etc., providers of tourism services, private developers, and those engaged in agriculture and fisheries. Based on these consultations options for action will be drawn up.

The same groups need to be consulted once these options have been evaluated technically to get their feedback. The final plan will be based on a consensus that includes opinions from these key stakeholders.

As the IMF document recommends, a simple communication strategy should be produced during or shortly after the establishment stage outlining how these different participatory activities will be carried out and what other, wider, communications will be undertaken.

The national ICZM strategy will include the preparation of the broad communication strategy and identification of key stakeholders. The details of the communication strategy and groups or individuals to be invited will be spelt out in the national and local plans.

1.6.Proposing the vision

The vision is prepared at this stage with the objective of ensure the smooth running of the project and a common understanding of the time constraints, and to allocate resources efficiently over the plan period. There is not much special to add here about integrating climate change into the vision. It will give rise to specific actions and activities, which form part of the whole structure. Some of the analytical measures identified in may give rise to outsourcing studies that provide technical material which has to be integrated into the main planning framework. This may also be the case with some other components of the ICZM. All such subcontracts have to be seen as part of the overall input into the preparation of the plan and there has to be enough capacity within the core team to be able to understand the results of these studies and to use them in drawing up the main integrated coastal zone management plan.

1.7.Decision on Strategic Environmental Assessment

As defined in the IMF document, a strategic environmental assessment is: *" a systematic process for evaluating the environmental consequences of proposed policy, plan or programme initiatives in order to ensure that they are fully included and appropriately addressed at the earliest stage of decision-making, on a par with economic and social considerations."*[3]
A number of countries have a statutory requirement to carry out an SEA when a major project or policy change is being considered. The tool can be useful when there are actions being proposed across a number of sectors, or where actions in one sector are likely to have impacts across several sectors. It can also be useful when the time frames for different actions are different – for example some land use measures in the short term may conflict with climate adaptation objectives in the long term.

If a decision is taken to carry out an SEA for the whole ICZM, then this will include of course any policies and measures for the climate component. At the outset it has to be noted that the exercise is a complicated one: to examine a combination of policies across a range of sectors for their impacts on the environmental resources. It can only really be done at of the ICZM and will require considerable resources and time. At the end of the day it is a decision that the steering group has to take in the light of national policies concerning SEAs.

In any event, if a SEA is not done, some assessment of the cross effects of the different policies will be needed. Development programmes that expand land use in coastal areas have to be undertaken with the consequences for future climate costs in mind. Expansion of tourism that does not take account of the impacts of climate change on visitors or of changes in water availability on the water balance could result in failure. Hence such cross effects should be accounted for at the analytical stage, whether it is through a SEA or through other more *ad hoc* methods, which may prove easier to carry out.

The decision on an SEA has to be taken at the strategy stage. Its application will be within the national plan (it is unlikely that the local plans will have the resource to prepare an SEA).

3 Evaluating Socio Economic Development, SOURCEBOOK 2: Methods & Techniques. Strategic environmental impact assessment. EU Regional Policy, INFOREGIO, December 2009

2. Analysis and futures

2.1.Building the evidence

The aim of this stage is to establish an operational foundation for the subsequent preparation of the plan and its implementation. From a climate viewpoint the key tasks are to:

(a) Identify the main elements of climate variability and change in the short- (10-20 years), mid- (30-40 years), and long-term (60+ years) periods.
(b) The impacts of this variability on key sectors and the risks associated with them.

The work described below is part of the preparation of the plan, although the strategy should describes the broad structure of the climatic data that needs to be collected and analysed and the tools to be used for this purpose.

Table 1: Possible climate related Indicators that complement other indicators for the ICZM

		Climate related indicators for selected years					
		Popn. at flood risk	Popn. at heatwave risk	Property at risk	Water balance	Ecosystems under stress	Tourist Visitor Nos.
Broad Indicator	Sub Objectives						
A Health and Productive Economy	Maximising economic development	X		X	X		X
	Increase employment						X
	Foster diversification						X
A Healthy and Productive Environment	Minimize habitat destruction					X	X
	Reduce volume of all pollutants					X	X
Public Health and Safety	Protect human life and public and private property	X	X	X			
Social Cohesion	Maintain a sense of equity and social justice						

Note: Each indicator will need further clarification refinement before it can be estimated.

Elements of Climate Variability and Change
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 between 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%.

These and other broad estimates of climate impacts in the region are a strong indication of the magnitude of the impacts that need to be taken into account in any future ICZM plans. In doing, however, it is important to avoid duplication of effort and to draw on existing work that has been undertaken at the national, regional and global levels. The best point of departure is the National Communication by the country the UNFCC, which should provide at least national level estimates of the main impacts in terms of temperature increase, sea level rise,

precipitation and extreme events. By the very nature of the problem[4], such data cannot consist of point estimates, but must be provided in the form of ranges. Thus they will take a form that makes it appropriate to adopt a risk based assessment at future stages of the process. Box 1 provides a description of the kind of data available for a mature economy such as the United Kingdom. Tables 2 and 3 describe the data that is typically provided. Other countries may not have quite the same level of geographical detail; if the impacts are likely to be significant it may be worth asking a specialised agency such as the UK Met Office or the Danish Climate centre to customise projections for specific coastal regions. This is likely to involve some outlays, which may be recoverable from international institutions supporting the preparation of the programme.

Box1: Impacts data Available for Coastal Zones in the UK

Data are available for a range of future socio-economic scenarios and allowing for different probabilities of climatic outcomes. For example, in the UK the following kinds of data are available for 25x25km grids on a probabilistic basis. The 20 variables for which date are given are listed in Table 1. Projections are averaged for each of seven future overlapping 30 year time periods: 2010-2039; 2020-2049; 2030-2059; 2040-2069: 2050-2079; 2060-2089; 2070-2099. All changes are expressed relative to a modeled 30-yr baseline period of 1961-1990.

Some information is also available in probabilistic terms, which provides a **central estimate** (e.g. 50% probability of not being more than a given increase in temperature), and **very unlikely events** (e.g. a 10% probability of being less than a given increase in mean temperature value or more than a given increase in mean temperature). These are based on 3 emissions scenarios plus other uncertain parameters.
For marine areas the information available includes, as noted in Table 1, the sea level rise (with the probabilistic information as indicated above for mean temperature rise). In addition the marine projections include information on projected storm surges. The last gives the projected elevation of the projected high tide under different return levels (e.g. 50 year return levels). Figures are available with different confidence intervals.
A third piece of climate information that is projected is changes in offshore waves. This gives changes in winter mean wave height but uncertainties in this variable cannot be expressed in probabilistic terms.

Impacts of Climate Variability and Change

The data on climate variability and change is used to assess the impacts in the key sectors of interest and to assess the risks involved. In coastal zones the key sectors are likely to be the following:

- Impacts on agriculture
- Coastal infrastructure (housing, public buildings, roads etc.)
- Impacts of extreme events (heat waves, floods etc.)
- Sea level rise
- Availability of freshwater
- Impacts on tourism
- Loss of ecosystem services through low river flows, flooding etc.
- Supply and demand for energy

[4] One important reason is that future emissions and concentrations of greenhouse gases are not known and depend on what policies are adopted to control them. But other sources of uncertainty also exist.

Table 2: Data Provided on a Downscaled Basis for Making a Risk Assessment

Variables Over Land Areas	**Units**	**Temporal Averaging**
Mean Temperature	ºC	Month, season, year
Mean daily maximum temperature	ºC	Month, season, year
Mean daily minimum temperature	ºC	Month, season, year
Warmest day of the season	ºC	Season
Coolest day of the season	ºC	Season
Warmest night of the season	ºC	Season
Coldest night of the season	ºC	Season
Precipitation rate	mm/day	Month, season, year
Wettest day of the season	mm/day	Season
Specific humidity	g/kg	Month, season, year
Relative humidity	%	Month, season, year
Total cloud	Fraction	Month, season, year
Net surface long wave flux[1]	W/m^{-2}	Month, season, year
Net surface short wave flux[2]	W/m^{-2}	Month, season, year
Total downward short wave flux[3]	W/m^{-2}	Month, season, year
Mean sea level pressure	hPa	Month, season, year
Variables Over Marine Areas		
Mean air temperature	ºC	Month, season, year
Precipitation Rate	Mm/day	Month, season, year
Total cloud	Fraction	Month, season, year
Mean sea level pressure	hPa	Month, season, year

Source: UK Climate Projections Briefing Report, 2009.

Note:

1. **Net surface long wave flux is a measure of the total amount of long wave radiation that flows through a unit area per unit time at the Earth's surface.**
2. **Net surface short wave flux is a measure of the total amount of shortwave radiation that flows through a unit area per unit time at the Earth's surface.**
3. **Total downward surface shortwave flux is a measure of the amount of shortwave radiation received by a unit area per unit time at the Earth's surface.**

Table 3: Typical Data Reported from the Climate Models
Projections for SW England in the 2050s

Climate Variable	Very likely to be *more than*	Central estimate	Very unlikely to be *more than*
Mean annual temperature	+1.7ºC	+2.7ºC	+4.0ºC
Mean summer temperature	+1.4ºC	+3.1ºC	+5.1ºC
Mean annual precipitation	-6%	0%	+6%
Mean summer precipitation	+8%	-20%	-45%
Mean winter precipitation	+3%	+18%	+41%
Relative sea level	+13cm	+27cm	+41cm

Note: Comparisons are relative to the 1960-1990 climate average
Source: UK Climate Projections Briefing Report, 2009.

The main sources of data linking climate variability and change to impacts by sector and the main assessed impacts for the Mediterranean region are summarised in Table 4.

Table 4: Main Impacts of Climate Variability and Change and Sources of Data

Impact	Estimate of Impact	Sources of Data
Agriculture	The average percentage change in crop yield for the Mediterranean North region in the PESETA study for the A2 2011-2040 scenario is -2% with a standard deviation of 13%. Some estimates also for individual countries but rarely for coastal zones.	The PESETA project (Ciscar, 2010) looked at the impacts of climate change on agricultural productivity of crops in different regions of Europe (Iglesias et al., 2009). Other key studies are Cline (2007, 2008), Mendelsohn and Schlesinger, 1999 which also look further forward. Issues of water availability need to be accounted for and carbon fertilization effect is uncertain. Some detailed studies also exist for individual countries, taking account on more factors.
Health	The potential health impacts of climate change include temperature related changes in mortality and morbidity, higher frequency of food-, water- and vector-borne diseases due to temperature increases as well as an increase in the incidence of other diseases such as tick-borne diseases.	The cCASHh project provides functions relating climate variability to health impacts. These can be applied with local variability data. See (Menne and Ebi, 2006), Kovats et al. (2006), (Ciscar, 2009). Dessai (2003). The PESETA study quantifies health impacts for all of the EU-27 countries for two climate change scenarios namely A2 2011-2040 and 2071-2100 (A2 and B2). (Ciscar, 2010).
Extreme Events	The PESETA study estimates the physical impacts of river floods in terms of the additional expected population affected to be about 49,000 people per year for Southern Europe for the A2, 3.9˚C temperature increase during 2071-2100 scenario from the baseline period (1961-1990). ABI (2005) note that a 20 percent increase in the frequency of top 5% of storms wind speed increases average annual total financial losses by 35% for Europe.	Estimates can be obtained from IPCC, 2007; Pollner et al., 2008; the Peseta study (Ciscar et al., 2010); Leckebusch and Ulbrich (2004) on wind speed changes.
Sea Level Rise SLR	Estimates are available from National Communications in most countries. Specific projections are complicated by local subsidence, especially in deltas and coastal cities.	IPCC, 2007; Hallegatte et al. 2007. The PESETA study (Ciscar, 2009) estimates of the number of people who are expected to be affected by coastal floods due to sea level rise are presented for different regions in Europe for different climate change scenarios.
Freshwater	The North Western tip of South East Europe will see an increase of rainfall by 5 percent in 2071-2100 relative to 1961-1990 (Pollner et al. 2008) However, the rest of the Adriatic coastline and Western Balkans region annual mean precipitation is expected to decrease by 10-20 percent over the same period (European Commission, 2007). Lehner et al. (2006) project a significant increase in drought in S and SE Europe and by the 2070s the drought that currently occurs 1:100 years could have a return period of less than 10 years.	Pollner et al. 2008; European Commission, 2007; Lehner et al. 2006;Lopez- Francos (ed.), 2010 provides a number of papers that look at climate change and drought in an economic context. IPCC, 2007, forecasts reductions by 2030 for different coasts. Specific impacts for different river basins are needed to make more accurate projections. These may be available from the National Communications to the UNFCCC or from other country specific research.
Tourism	Changes in temperature and precipitation will affect attractiveness of coastal areas for tourism. For a survey see Fisher, 2007.	Ciscar, 2010. Detailed estimates of changes in demand for visits are available for different regions.
Ecosystems	Low river flows will change supply of ecosystem services and some species will be at risk. Impacts are very location specific.	Country specific studies are needed to identify where ecosystems are at risk. See outputs from the CIRCE project and National Communications to the UNFCCC.

The main lessons to be learnt from this are the following:

(a) Many of the predictions are for a wider area than just a coastal zone, and certainly wider than the part of a coastal zone likely to be of interest to the drawing up of an ICZM strategy. Thus more downscaled estimates may well be needed, which will necessitate (a) downscaled climate projections and (b) response functions that link impacts to climate variability and change;

(c) The projections that are available have a high level of uncertainty. This is not fully reflected in the Table but the studies either give ranges of estimates or put in a lot of qualifications indicating why we have to be aware of the level of uncertainty. This makes taking a risk assessment approach important; the timing of the impacts is important. Several are long term (over 60 years) and therefore less relevant to the current plans for many but not all activities. Areas where such impacts are a matter of concern include investments in infrastructure, roads, land use planning and some energy supply systems. On the other hand long term agricultural and health projections are not so important for current plans. Cases where shorter term impacts are important include water, flood protection, tourism and agriculture.

(d) The table refers to impacts at the sector level but what matters for policy purposes is often the number of people affected, or the damage to property, crops or other economic activities. This will require some further work on the part of the team drawing up the ICZM, but even in this case local studies on the 'downstream' consequences of the impacts may be available. A thorough literature research is recommended.

Risk Assessment

The data collected on the impacts should be presented in a form that can be fed into the drawing up of the policies and priorities in the ICZM. Given the high level of uncertainty the recommended approach is to provide a 'central' estimate of impacts, qualified with a 'low risk' figure and a 'high risk' figure. These estimates can take two forms: a monetary value of the damages or benefits and physical estimates. The former will require some further work, in which some of the physical losses shown in Table 4 can be converted into money values.

Again there is research on this; see for example, Ciscar, 2010 and more widely the results of the PESETA project and the more recent Climate Costs project[5]. The estimates can be presented as shown in Table 5.

Table 5: Risk and Damage Representation

Risk	Low Risk	Central Estimate	High Risk
Damages Monetary	€	€€	€€€
Damages Not Included in Monetary Total	P	PP	PPP

Monetary damage estimates can be made for coastal and other infrastructure, health, some ecosystem services, changes in availability of freshwater, changes in tourism and changes in agriculture. Both monetary and physical impacts data will be relevant to the next stage of the ICZM.

[5] For Climate costs see: http://www.climatecost.cc/reportsandpublications.html. For the PESETA project see http://peseta.jrc.ec.europa.eu/results.html. In some cases it may be possible to give probabilities for the different outcomes. Where it can be provided it should, but this is not usually possible.

2.2.Identifying futures

Policies and priorities for action will be taken based on all three pillars of sustainable development: economic, environmental and social. The climate change factors to be discussed are of varying importance, depending on which sector or area of policy is under consideration. In this section we present those policy areas where the climatic factors have an important role. The range of policies and options will be identified in the strategy, along with possible pilot actions action sources of funding. The selection of the actual policies options will be done when drawing up the national and local plans (depending on whether the policies and options are local or national). At this stage the elaboration of the pilot actions and sources of funding will be elaborated.

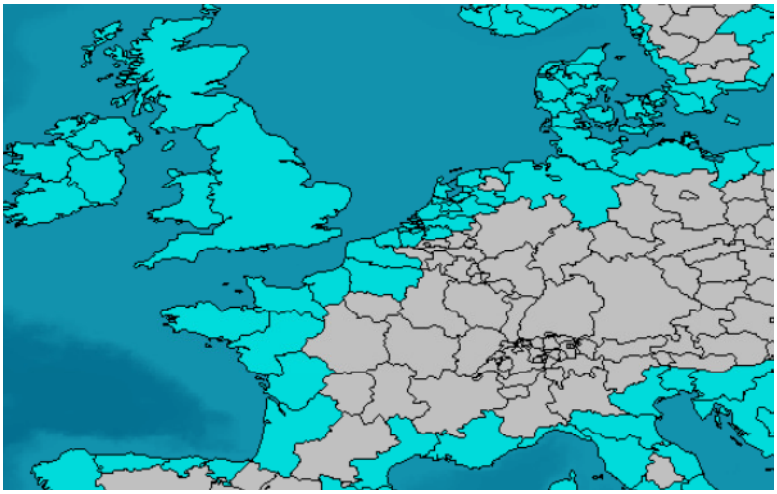
Agriculture

The impacts on agriculture are likely to be of wider interest and relevance than just to the coastal community. Adaptation measures undertaken will include research and development on crop varieties better suited to the new climate, improved irrigation where appropriate and extension and other support to farmers to assist them to adapt to climatic changes. In coastal zones where water is already at a premium appropriate adaptation plants may different from other areas and it is probably best that those responsible for the ICZM participate actively in national agricultural adaptation programmes as well as in the planning for water allocation and management.

Infrastructure

Sea level rise and changes in extreme events have a direct bearing on coastal infrastructure. Fortunately this is an area that is most developed in terms of tools for the assessment of appropriate responses. In particular the DIVA model has been used to estimate the required investment in coastal protection for different parts of the European coastline (Richards and Nicholls, 2009). The model looks at the direct impacts on erosion, (ii) increased flood risk and inundation, (iii) coastal wetland loss and change, and (iv) salinisation. It estimates the best responses on the basis of their costs and benefits. The responses considered include flood defences and beach nourishment but not all the softer options such as insurance. The model has been applied to most of the European coastline, including the Mediterranean, but not to the Mediterranean countries of North Africa, the Middle East and parts of the Balkans. Figure 1 gives the coasts that have been assessed.

Figure 1: Coasts Covered under the DIVA Model



Probably the most effective action would be to run the DIVA model for the other regions of the Mediterranean. This could be done singly by country or as part of an internationally supported study for all countries. In the absence of that, a single country could undertake an assessment itself, based on the same data that is used in DIVA, namely: projections of SLR based on different scenarios, ranges of impacts derived from the scenarios and costs of different interventions for different stretches of the coastline.

A factor not considered by the DIVA model is changes land use planning, as it assumes current practices will be maintained in the future. Yet an important tool of adaptation is precisely to limit land use in areas likely to be inundated. This aspect can be built into the adaptation strategy by providing the DIVA model with data on populations in different locations in the future. Funding for the application of DIVA may be available from global funds.

Health

As with agriculture, this is a wider issue than just for coastal zones, although the latter could be specially impacted if there is an increase in vector borne diseases. Impacts of climate on health through contaminated food and water will require stricter controls on vendors of products to the public. The ICZM needs to review its regulations and look at ways of improving health safety where required.

Water

Adaptation to changes in water supply will take the form of reductions in demand (measures that promote more efficient use, increases in water charges) as well as increases in storage and available supply. The latter could involve building of reservoirs, increasing capacity to manage runoff, plans for water allocation in periods of drought and even the transfer of water from surplus to deficit areas. There is also the option of building desalinisation facilities to meet water deficits. In coastal areas all of these could be relevant and need to be considered in the context of the ICZM, including the demands for water created by any plans to increase activities such as tourism.

Extreme Events

Increased risks of flooding and damages from heavy rains, winds etc., should have been identified in the stage 2.1 Building the evidence. Appropriate actions will include land use changes, improved flood and hurricane protection, as well as better insurance to provide coverage against damages. Many of these actions will also be considered at the national level, so plans should be drawn up in collaboration with the national authorities. Current thinking on this issue for coastal zones in developing countries is summarized in the Box 2 below. (Yves Henocque, 2011). It is worth nothing that as a response to the Cairo overarching principle, the coastal setback zones stipulated under Article 8-2 of the Mediterranean ICZM Protocol is part of the “broader goal of preventing natural risks and adapting to climate change, and is a major tool to achieve this goal”.

Box: Extreme Events and Climate Change in Coastal Zones

In the aftermath of the 2004 tsunami in the Indian Ocean, UNEP/GPA (Global Programme of Action for the Protection of the Marine Environment from Land-based Activities) convened a meeting in February 2005 in Cairo (Egypt) to discuss post-tsunami reconstruction and coastal zone rehabilitation and management in affected countries. The meeting adopted 12 guiding principles which were initially drafted by integrated coastal management practitioners and, to a large extent, encapsulate the approaches that seek to reduce coastal areas vulnerability to both man-made and natural hazards. In the end, these principles were endorsed by senior government officials from tsunami-affected countries, representatives from UNEP Regional Seas Programmes, and other UN agencies including FAO and IOC-UNESCO, as well as by international institutions such as IUCN, the World Bank and the WWF.

The 12 principles are:

1. Overarching principle: Reduce the vulnerability of coastal communities to natural hazards by establishing a regional early warning system, applying construction setbacks, greenbelts and other no-build areas in each nation, founded on a scientifically mapped "reference line".
2. Promote early resettlement with provision for safe housing; debris clearance; potable water; sanitation and drainage services; and access to sustainable livelihood options.
3. Enhance the ability of the natural system to act as a "bioshield" to protect people and their livelihoods by conserving, managing and restoring wetlands, mangroves, spawning areas, seagrass beds and coral reefs; and by seeking alternative sustainable sources of building materials, with the aim of keeping coastal sand, coral, mangroves and rock in place.
4. Promote design that is cost-effective, appropriate and consistent with best practice and placement of infrastructure away from hazard and resource areas, favouring innovative and soft engineering solutions to coastal erosion control.
5. Respect traditional public access and uses of the shoreline, and protect religious and cultural sites.
6. Adopt ecosystem-based management measures; promote sustainable fisheries management in over-fished areas, and encourage low-impact aquaculture.
7. Promote sustainable tourism that respects setback lines and carrying capacity, benefits local communities and applies adequate management practices.
8. Secure commitments from governments and international organizations to abide to these *Principles* and build on and strengthen existing institutional arrangements where possible.
9. Ensure public participation through capacity building and the effective utilization of all means of communication to achieve outcomes that meet the needs and realities of each situation.
10. Make full use of tools such as strategic environmental assessment, spatial planning and environmental impact assessment, to identify tradeoffs and options for a sustainable future.
11. Develop mechanisms and tools to monitor and periodically communicate the outcomes of the reconstruction through indicators that reflect socio-economic change and ecosystem health.
12. Widely disseminate good practices and lessons learnt as they emerge

Tourism

For most coastal zones tourism is a key sector and the impacts of climate change on visitor numbers is critical information in the planning and management of the areas. Studies have now been conducted on this topic; for a useful survey of the literature see Fischer, 2007. The studies provide estimates of changes in numbers under different scenarios. For the Mediterranean the summary appears to be that the region will be too hot during summer, but the climatic conditions will improve during spring and autumn. Considering the improving summer temperatures in northern Europe, it is likely that the Mediterranean and its related tourism industry will encounter a decrease (dramatic decrease in Spain) in international tourist arrivals in summer and an increase during the shoulder periods (spring and autumn), especially in Spain, Greece and Turkey, and the winter season will become more attractive in North Africa. More detailed figures are available in the references cited in this survey article.

In terms of planning the data will determine the nature of the facilities offered as well as the volumes of visitors that can be expected. It will be a direct input into strategies for the kind of developments that are appropriate for each coastal zone.

Ecosystems

As noted, the impacts on ecosystems are very location specific. Studies under the CIRCE project identify low flows in rivers as an important impact, but there are also expected consequences on marine systems and fisheries. This is an area where those responsible for the ICZM should undertake a local assessment, drawing of course on the existing literature. Information collected at the analysis stage will influence the measures that need to be introduced. Some downscaling of impact assessment using models will probably be required ad funding for this may be available from global funds[6]. For rivers, low flow alleviation may be required to avoid loss of recreation services as well as risks of species. For marine areas, protection of new areas may be advisable and some measures may be needed to protect fisheries.

[6] For the choice of downscaling methods for this and other impacts see Sunyer et al. 2011.

3. Setting the vision

The aim of this stage is to engage the stakeholders in setting the priorities and agreeing on the key policies and measures that should be considered in the analysis stage.

3.1. Building consensus

The point of departure for this stage is the scoping report, which was prepared at the establishment stage and which identified the drivers and pressures and risks associated with the different areas of concern. This report is discussed with stakeholders and amended in the light of their reactions. In addition the stakeholder consultations are used to determine the priorities.
In the area of climate change priorities will have to drawn from a range of possible actions. These can be classified as follows:

Low regret or No-regrets measures: These are measures that can be introduced now to adapt to climate change, incurring no or little cost and generating a range of benefits. Examples include improvement in efficiency of water use, development of early warning systems that inform affected parties of extreme weather events, improved monitoring of climate data to better predict impacts under higher temperatures and changes in rainfall patterns. Also included in this category are measures to address the "adaptation deficit"[7]. An adaptation deficit arises when the current infrastructure is inadequate to cope with the present climatic variations (e.g. present flood defences are inadequate to cope with present flooding). Action to correct this situation can possibly be justified even without reference to future climate change (although it may still not be the top priority).

Action Vs Postponement: The literature on adaptation notes the benefits in some cases of postponing decisions on, for example, the height of a sea defence, until more information is available on the likely risks. This can be done through an analytical method known as Real Options Analysis[8].

Hard vs Soft Options: Too often adaptation to climate change is thought of in terms of engineering solutions. Yet these may not be the most effective and certainly not the least costly. Examples are restoration of wetlands which can be less costly and as effective in protecting some coastal areas and sea walls; or demand management measures for water which can be less costly then building additional reservoirs. These soft measures are often ignored because they involve policy changes requiring administrative coordination across different departments.

Long term vs Short term: many climate impacts are relatively long term, involving actions now to protect coastal areas and their inhabitants ten or more years down the line. These impacts, however, can be exacerbated by short to medium term measures introduced for other reasons (e.g. economic expansion and growth). For example, allowing settlement in an area that may be more prone to flooding may yield benefits now but will impose heavy costs later.

The different options should be laid out for each of the areas where some action is required and the pros and cons of each discussed with stakeholders. The aim at this stage is not to

[7] For further discussion on the adaptation deficit see Parry et al. (2009).
[8] For an example of Real Options analysis see the assessment for the Thames defences, summarised in Ranger et al. (2010).

make a final selection but to indicate broad priorities from which sets of options can be drawn and evaluated in Stage 4. Designing the future.

The national ICZM strategy should describe how the key problems will be analysed and how priorities will be set. For climate change it should note some of the choices that are open to the policy makers (as outlined above). It will be at the stage of preparing the national and local plans that the options will be elaborated further and priorities among them determined.

3.2.Setting the direction

The vision statement, which is the aim of this sub-section, is a general statement that defines the broad priorities. As the Main Guideline report notes, the objectives that arise from the vision statement can be complex, consisting of High Level Objectives (or Goals) and clusters of Sub-Objectives. Additionally some objectives will be predetermined in existing international, national and sub-national policies, such as 'Horizon 20-20', the Water Framework Directive and other water quality standards.

On the climate front a clear statement is needed of the importance given to adaptation to climate change as a high level objective. This can be followed by a list of the areas where action is seen as required, and the cross sectoral priorities (e.g. adaptation to climate versus short term development imperatives).

The vision statement has to be made at the strategy stage and carried over to the Plans (both national and local).

3.3.Measuring success

The IMF document sets out a fairly detailed description of the indicators that will track whether the Plan's interventions are achieving their intended objectives. Consequently they need to be aligned with these objectives and, more precisely, they have to be linked to the output or outcome being measured.

The structure that is offered in these Guidelines proposes three kinds of indicators: S**ustainability Indicators** that seek to show how the Plan's purpose is realised; **Impact Indicators that seek to** measure how well the Plan's outputs are being achieved; and **Performance Indicators that** measure how well the project activities are being implemented. In addition a distinction is made between Headline Indicators that provide information to the general public and specific indicators that are designed to assist in the technical monitoring of the Plan. An indicator matrix is offered, which provides a link between the broad objectives (see Section 2.1) and possible indicators that inform us of progress regarding these objectives.

From the climate change perspective the broad objectives of relevance are likely to be sustainable development of the region; protection of human life and natural and physical capital in the face of climate change. Each of these is likely to be affected by climate change. The problem with developing indicators in this context is that the relevant threat from climate change is in the future and an assessment has to be made of the magnitude, given plans for development etc. **Hence the relevant climate indicators will need considerable analytical to be estimated.** This can be done and will require regular monitoring over the life of the ICZM, but it is worth the effort as it keeps this dimension of the problem in the public's mind.

Attached is a list of possible climate indicators, using the same broad categories of indicators that are provided in the IMF document (Table 1).

The structure of the indicators is laid out in the strategy, with the criteria they should fulfil. The selection of the specific indicators is done during the preparation of the national plan. Ideally the same indicators should be sued for local plans to allow for some comparability, but exceptionally a local plan may include some other indicators, or leave out ones that do not apply at all.

4. Designing the future

4.1.Formulating ICZM strategies, Plans and Programmes

At this stage, plans, strategies and programmes will now have specific climate related elements. These will include measures related to sea level rise, such as sea defences, changes in land use regulations etc., as well as measures derived in the areas of agriculture, health, water and ecosystems, mostly in conjunction with national policies in these areas. Specific to climate change will be issues relating to funding. External funds should be available from the Global Adaptation Fund, which is being set up and which will set out some guidelines for the documentation that needs to be provided for projects that are requesting funding. Much of the information recommended here to be collected as part of the ICZM should be of great value in preparing such proposals, although further data may be required.

As the term indicates, this is an activity for the plan stage, although the strategy will have identified the preferred "trajectory", along with the elements that have to be included within it.

4.2.Establishing Management structure

This stage consist in setting up the inter-sectoral management, facilitation and consultation structures for the long-term, post-plan period, ultimately having impact on the coastal governance performance. Solutions developed since the Stage 1.3. Defining the governance context through the strategy or plan formulation now should be reconsidered in a view of long-term, permanent solutions for the integration over sectors.

4.3.Embedding

At this stage the indicators identified in Section 3.3 have to be estimated and the first set provided. Then as the plan is implemented, changes in the indicators need to be estimated as well. This need not be done too frequently, as the indicators will not change that easily. For the climate indicators, calculations at 5 year intervals should be acceptable.

The estimation of the indicators is carried out as part of the implementation of the plan.

5. Realising the vision

5.1. Implementing

ICZM involves a wide range of instruments to implement the strategy. A central pillar is land use regulation and the limitation on the use of certain areas on environmental grounds. But also important is adoption of standards for building, energy and other sectors that provide goods and services. In addition it is increasing important to use fiscal instruments to promote certain actions that are considered desirable. The use of such instruments serves a number of purposes. First, it is more flexible than direct physical controls for the person whose actions are being affected. Second, if the instrument takes the form of a charge it allows the authorities to raise much needed financial resources that can be put to use to provide the essential public goods. Third, as long as the charge is in place it provides a continued incentive towards greater efficiency, which is not the case when only physical controls that have to be complied with.

Areas where fiscal instruments could be used, specifically to address some of the climate change impacts that have been discussed are:

- Transferable development rights, where an individual whose rights have been taken away in one location can have them reallocated in another location. These make the introduction of new regulations easier and allow a market in such rights to develop (Markandya et al, 2008).

- The use of charges that better reflect the cost of services, particularly related to water.

- Development of insurance markets to provide cover against risks of flooding etc. To the extent that they bear at least part of the costs this encourages the private sector and individuals to modify their behaviour and not take excessive risks, as they tend to do when all damage costs are covered through public funds.

- Charges on tourists to cover the additional burden of the public services they demand, as a source of finance for improved environmental protection.

The range of instruments to be used in the ICZM should be identified in the strategy, along with some priorities indicating which ones are preferred from a national viewpoint. The actual selection, however, will be made at the plan stage, national or local as appropriate.

5.2. Investment and Infrastructure

Some of a climate related actions will involve investment in protective infrastructure, such as sea walls, dykes and desalinisation facilities. As noted, the ICZM should not give priority to such solutions, but look in the first instance for lower cost options which involve early warning systems, use of fiscal and other incentives etc. However, some investments will be needed, and some investments that are part of the development plan will need to be modified in the light of climate change. Examples of these include measures in buildings to withstand increased impacts from extreme weather events, transport systems that have to take account of increased risks of subsidence etc. Some of these investments will be in the public sector and some will be in the private sector.

The ICZM should provide guidance to the private sector on how to address the additional climate risks. There are various sources for this, such as the World Bank (see e.g. World Bank, 1997). In the case of public sector investments, a key aspect is funding. Some funds may be available from the Global Adaptation Fund or other international sources. These will require careful and detailed assessment of the costs and benefits of the outlays. Some guidance on how to prepare these has been provided in this report, but further examples and information can be found in Nicholls, 2007, Ranger et al. 2010, UKCIP, 2003.

The issues discussed above should be noted in the strategy, which should identify possible sources of funding and the need for support for capacity building. The national and local plans would then elaborate some of these requirements as they apply in their respective contexts.

5.3.Acting

Lessons learnt from the early attempts should be shared across the ICZM community and used to improve future plans. This applies specially in the climate area, where there is not much experience with the implementation of actual policies and measures and lessons are being learnt all the time.

A dissemination and replication strategy is defined at the strategy stage and elaborated in the national plan.

5.4.Monitoring and Review

It is critical that the planners continue to track information on climate impacts as new data are coming out all the time. These may affect the proposed adaptation actions, which should be revisited periodically, as new knowledge is gained.

In addition, as for all aspects of ICZM it is important to monitor how successful the actions that have been taken have been in achieving the goals they were set for, and what have been the related impacts of introducing the relevant measures. There is nothing specific from climate change here, except of course that that the climate related actions are subject to the same monitoring and evaluation.

These critical steps in the implementation of the plans are noted as described in the strategy.

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(Websites)
Major European and other projects on climate change impacts and adaptation can best be accessed from their websites. The main ones of relevance here are:

http://www.circeproject.eu/
The CIRCE Integrated Project, funded under the European Commission's Sixth Framework Programme, aims to reach this objective, highlighting impacts and possible adaptation actions of the climate change in the Mediterranean region that includes Europe, North Africa and Middle East.

http://www.climatecost.cc/reportsandpublications.html
Using detailed disaggregated, bottom-up approaches, combined with top-down aggregated analysis, this project aims to provide a comprehensive and consistent analysis of the full costs of climate change. It covers the member states of the EU as well as India and China.

http://peseta.jrc.ec.europa.eu/results.html
The objective of the PESETA project (Projection of Economic impacts of climate change in Sectors of the European Union based on bottom-up Analysis) is to make a multi-sectoral assessment of the impacts of climate change in Europe for the 2011-2040 and 2071-2100 time horizons.

http://ec.europa.eu/research/environment/pdf/env_health_projects/climate_change/cl-ccashh.pdf
The cCASHh project is a combination of impact and adaptation assessment for four climate-related health outcomes: *health effects of heat and cold; *health effects of extreme weather events; *infectious diseases transmitted by insects and ticks, e.g. tick-borne encephalitis, malaria (vector borne and rodent borne diseases);

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