GLOBAL CHANGE AND ECOSYSTEMS
6th Framework Programme No 515234

IASON:International Action for the Sustainability of the Mediterranean and Black Sea Environment

Coordinator: Hellenic Centre for Marine Research, Greece

Management Policies in the Mediterranean and Black Seas (WP5)

An Assessment of the Projected Socio-economic Impact of the Various Hazards and Threats on the Stability/Sustainability of the System *(D5.2)*

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Project no.: 515234
Project acronym: IASON

Project title: **I**nternational **A**ction for **S**ustainability of the Mediterranean and Black Sea Envir**O**nme**N**t

Instrument: Specific Support Action

Thematic Priority: 6.3 GLOBAL CHANGE AND ECOSYSTEMS

Deliverable 5.2
An Assessment of the Projected Socio-Economic Impact of the Various Hazards and Threats on the Stability/Sustainability of the System

Due date of deliverable: April 2006
Actual submission date: August 2006

Start date of project: 1st January 2005 Duration 18 months

Organisation name of lead contractor for this deliverable: Hellenic Centre for Marine Research (HCMR)

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	**X**
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Introduction

The Deliverable D 5.2 entitled “An Assessment of the Projected Socio-Economic Impact of the Various Hazards and Threats on the Stability/Sustainability of the System” is a defined output from WP5: “Management Policies in the Mediterranean and Black Seas”.

In order to formulate interventions to address threats to the marine environment a systematic analysis of the causes of environmental degradation is necessary, including social and economic aspects. This type of analysis is effectively carried out using the Driver-Pressure-State-Impact-Response (DPSIR) framework (Turner and Salomons, 1999) (see Figure 1).

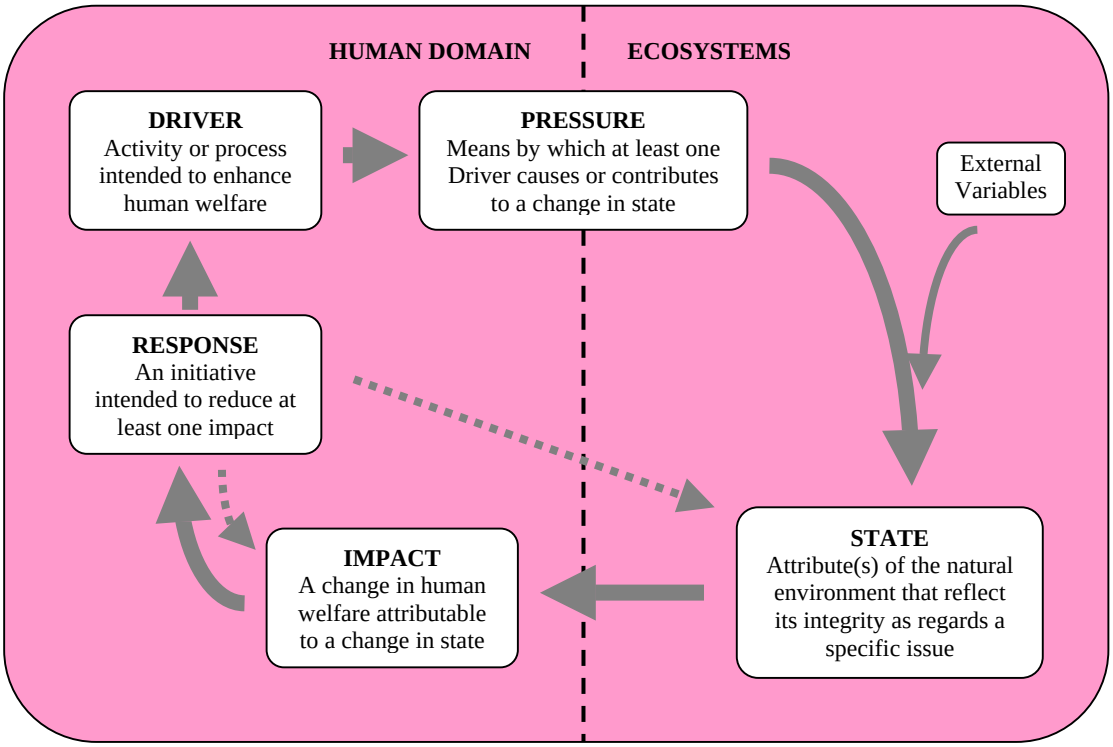

Figure 1. Diagrammatic representation of the DPSIR framework

This framework has been widely used not least by the GEF in their International Waters projects throughout the world, including the Mediterranean and the Black Sea (GEF, 2006). It has the advantage of being conceptually valid at a range of spatial scales and therefore is well suited to marine and coastal issues.

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Aims

To collect, review and assess the hazards and threats to the ecosystem and resource availability.

Identify and prioritise potential human intervention.

Methodology

Outputs from the other work packages, specifically D2.2, D 3.2 and D 4.2 (as well as the first draft of Deliverables for Tasks 2.4, 3.4 and 4.4.) were analysed to identify the main hazards and threats as well as their underlying causes and socio-economic impacts. This information was used to construct preliminary and conceptual causal matrices which described some of the links in the causal hierarchy. Whilst quantitative data describing the relationships between the various nodes in the causal matrix undoubtedly exists, many of these datasets are not easily accessed or available in the appropriate format. Within the constraints of this project a more qualitative approach was deemed appropriate which involved using expert opinion to assess the significance of various issues, their causes and solutions.

The causal matrices provided the framework for the 'Delphi' exercise (Adler and Ziglio, 1996; Helmer, 1977). Due to the time constraints and the availability of participants it was neither appropriate nor feasible to conduct a true Delphi exercise but important elements of the process were incorporated into a discussion forum for a group of experts representing all the work packages and both sea areas.

Following a brief introductory presentation (IASON, 2006) the main issues were discussed focussing on (1) Socio-economic impacts, (2) Associated drivers, and (3) The potential for human intervention. Pressures and state changes had been thoroughly addressed through the other WP reports. At a suitable juncture each of the three aspects were scored by individual participants for their relative importance/significance. The ratings were based on a five-point scale (1-5) with '1' representing the least important or significant and '5' representing the most important or significant. The output from the discussion and subsequent scoring exercise are shown in the tables (Appendix) and discussed below.

Key Hazards and Threats

The outputs produced by the work packages (WP 2, WP3 and WP4) had identified the most significant hazards and threats to the ecosystem and resource availability. These were:

Eutrophication

Pollution

Overfishing

Coastal erosion

Invasive species

Global warming

With the exception of global warming, all the other hazards and threats can be analysed within the DPSIR framework at the scale of this project. Global warming is, by definition beyond the regional scope of the study and there is still uncertainty concerning the anthropogenic component and consequently in this case is considered an external variable. Responses to global warming within the scale of the two sea areas is essentially limited to adaptation since policy drivers which address the root cause of global warming require a global initiative. For the purposes of the Task 5.2 the analysis focussed on the other five issues.

Eutrophication (See Table 1, Appendix)

The major socio-economic impacts were perceived as being loss of recreational and landscape value caused by the aesthetic degradation of the coastal waters (colour, turbidity, foam) that deterred bathers and led to displacement of activity from the affected area. The same problem leads to the loss of tourism income which is seen as more significant than the secondary effects on fishing. The aesthetic loss rather than the more tangible impact of potential illness through consumption of contaminated seafood or contracting waterborne diseases was viewed as being of more importance. Although there are clearly observable negative impacts from eutrophication, there is also some debate over the potential benefits of increasing nutrient flows to oligotrophic systems such as the Mediterranean because it can result in increasing productivity for enhanced fisheries.

Regarding the drivers responsible for the problems there was a clear consensus that unsustainable agricultural practices such as over-application of fertiliser and poor manure

management together with inadequate treatment of municipal sewage were primarily responsible. Accordingly the appropriate responses were seen as addressing these failures through regulation of farming practices and investment in infrastructure respectively.

For countries that are part of the EU the eutrophication issue has been partly addressed through the Nitrates Directive but there is plenty of evidence to show that failure by a number of states to properly implement the Directive has led to continuing problems. There is a similar pattern with sewage treatment which should be subject to the provisions of the Urban Waste Water Treatment Directive (UWWTD) but a significant proportion of large settlements do not currently treat their waste but discharge it untreated into coastal waters. Financial constraints inhibit the installation of the collection and treatment infrastructure required to reduce the nutrient load. For states that are not part of the EU there is generally less regulation to control nutrients.

Pollution (See Table 2, Appendix)

As in the case of Eutrophication, loss of recreational and landscape value was seen as a major impact arising from pollution and the potential effects on human health were also of major concern. There is a wider range of driver sectors for this issue compared with eutrophication with the main contributors identified as agriculture, urbanisation, shipping and industry but none being dominant and a more even spread. This is to be expected as pollutants comprise a broad range of chemical species as well as biological pathogens. Their sources are equally diverse and effective interventions are consequently difficult to target. Responses that were envisaged as being appropriate were controlling application of pesticides, hormones and anti-biotics in agriculture (and aquaculture), better collection and treatment of municipal sewage, tighter regulation of shipping practices and better regulation of discharges from industry.

EU chemicals regulation such as the established IPPC and the new REACH regime should help to reduce the point and diffuse discharges of chemicals into coastal waters but non-EU states will not be subject to these regimes.

Overfishing (See Table 3, Appendix)

Two clearly dominant impacts were identified – loss of income and employment for fishers and the increase in price of fish to consumers as a result of scarcity. There was one dominant driver for this issue, which was not the lack of regulation, nor the need for better-designed regulations but the lack of enforcement of existing regulation which produces poor

compliance. The most effective responses to this problem were identified as more efficient regulation to control fishing effort and improved assessment using the ecosystem approach. There are a number of existing global agreements, such as the FAO Code of Conduct for Responsible Fisheries (1999) and the UNCLOS Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks (2001) but the majority of states in the region have not signed up to either of them. There is clearly a need to encourage all states to sign up to and ratify (and subsequently enforce) these agreements. There are some international efforts to tackle specific problems. For example the International Convention on the Conservation of Atlantic Tuna (ICCAT) was established in 1966 to manage, amongst other species, Blue Fin Tuna fisheries but there is growing evidence that stocks are now on the brink of collapse. This is yet another example of the problems endemic in fisheries management – inaccurate estimate of stocks, management complacency and weak enforcement of controls.

Other responses include establishing protected areas, which should be addressed following the WSSD, and influencing consumer demand through education using ecolabelling something that is frequently achieved through a coalition between environmental groups and retailers. However, given the underdeveloped nature of both of these sectors in many countries in the Mediterranean and Black sea regions this type of intervention is unlikely to be of short-term significance.

The expansion of aquaculture to feed the growing demand in the region is not seen as a solution but more of an exacerbation of the problem as it invariably involves unsustainable harvesting of feedstock fish, which is inefficient and associated with the ecological problems of fishing down the food chain. This issue provides more justification for adopting the ecosystem approach to fisheries management.

Coastal erosion (See Table 4, Appendix)

Dominant socio-economic impacts related to loss of tourism income property and landscape value as well as the increasing demand for capital investment. The driver sectors scored as dominant were urbanisation, the construction of ports and harbours and the canalisation and damming of rivers. Responses include establishing a clear Integrated Coastal Zone Management (ICZM) framework to manage the development of the coastal areas utilising a range of regulatory tools, designing soft coastal defences all of which requires significant

financial investment. The latter response could have the additional benefit of recreating wetlands lost to development and/or sea level rise.

Invasive species (See Table 5, Appendix)

The chain of causality is relatively straightforward in this case with accidental releases, predominantly from maritime shipping operations, being the dominant factor and the loss of income and employment by fishers being the dominant impact. Tighter regulation to control the discharge of ballast water is likely to be the most effective response and this will be addressed through the Global Ballast Water Regulations (IMO, 2006) that are likely to enter force in the not-too-distant future.

Conclusion

Although the issues above have been analysed separately there is extensive overlapping of some elements of the causal matrices especially at the Driver, Response and Impact levels. Common impacts such as the loss of recreational and landscape value, loss of income by fishers and loss of tourism income are realised through a number of the issues. Similarly there are driver sectors that contribute to multiple pressures across a range of issues; unsustainable agricultural and fishing practices; inadequate collection and treatment of sewage; emissions from transport and industry and maritime shipping operations.

A number of these sectors are subject to existing or emerging legislation but common to all is a lack of enforcement and compliance, an issue that was highlighted in the Deliverable D5.1. Although some of the responses are specific to certain issues many, such as improving compliance, are generic in nature. There is an overarching requirement to implement in full all existing global, regional and national legislation. This necessitates improved compliance and trend monitoring which in turn requires the strengthening of institutional structures and capacity, particularly at national level. In order to realise this there is a need for financial support to the less developed states and a general increase in the level of political commitment.

The more integrated approach being realised through ICZM, catchment management and the ecosystem approach needs to be implemented throughout the Mediterranean and Black Sea

regions. This joined-up approach should overcome the fragmented governance of coastal and marine environments and produce more appropriate and effective responses.

Future scenarios for the Mediterranean and Black sea regions (Benoit, G. and Comeau, A., 2005) show that the dominant driver sectors discussed above are likely to increase in activity fuelled by economic growth and increasing personal wealth. Coastal populations (both permanent and transient) are projected to increase substantially and this will require infrastructure developments to mitigate the impacts. Although regulation can play an important role in helping to achieve sustainable development by compensating for market failures there needs to be a more fundamental assessment of the underlying social drivers which currently manifest as profligate and unsustainable consumption patterns. This is a challenge for governments in the region as it necessitates a re-appraisal of individual and collective priorities in the development of more sustainable lifestyles.

References

Adler, M., and Ziglio, E. (1996). *Gazing into the Oracle.* Jessica Kingsley Publishers: Bristol, PA

Benoit, G. and Comeau, A. (2005). A *Sustainable Future for the Mediterranean.* Earthscan, London

GEF (2006). Global Environment Facility Projects. Available at: http://www.gefweb.org/Projects/focal_areas/focal_areas.html

Helmer, O. (1977). Problems in futures research: Delphi and causal cross-impact analysis. *Futures*, February, 17-31.

IASON (2006). IASON *Task 5.2 Workshop, Athens 21st June 2006.* Briefing presentation. Available at: http://www.iasonnet.gr/restricted/modules/dms/file_retrieve.php?function=view&obj_id=130#1

IMO (2006). Global Ballast Water Convention. Available at: http://globallast.imo.org/index.asp?page=mepc.htm

Turner, R. K. and Salomons, W. (1999). Coasytal management principles and practice; introduction and overview. In: *Perspectives on Integrated Coastal Zone Management*, eds. Salomons, W., Turner, R.K., de Lacerda, L.D. and Ramachandran, S., pp.1-10. Springer, Berlin.

APPENDIX

Causal Matrices for:

Eutrophication
Pollution
Overfishing
Coastal erosion
Invasive species

Table 1. Eutrophication

Response	Regulation restricting fertilizer application	Regulation regarding manure and slurry application and storage	Improved sewage collection and treatment	Regulation to control transport emissions	Control of nutrient flow from aquaculture	Tighter regulation of atmospheric emissions from industry
Driver	Unsustainable agricultural practice		Inadequate treatment of sewage	Transport	Unsustainable Aquaculture practices	Industry and energy generation
Pressure	Input of nutrients from agricultural land run-off Input of nutrients from sewage outfalls Atmospheric inputs of N Riverine inputs of N and P compounds (Global warming)					
State	Elevated N and P concentrations in costal waters Harmful algal bloom Contaminated shellfish Disruption of ecosystem functioning Unsightly algal growth Increased turbidity					
Impact	Loss of income and employment by fishers, aquaculture and shellfish growers					
	Illness through consumption of contaminated seafood or contact with water (waterborne diseases)					
	Loss of income from commercial macro algal species					
	Loss of tourism income and jobs					
	Loss of recreational and landscape value					

Key to colour shading:

Negligible	Minor	Moderate	Major	Dominant

Table 2. Pollution

Response	Regulation restricting pesticides application	Regulation to restrict use of pesticides, anti-biotics etc.	Regulation of sewage collection and treatment	Tighter restrictions on emissions from transport	Regulation to emissions, losses and discharges from shipping activities	Regulation to control industrial emissions to all media
Driver	Unsustainable agricultural practice	Aquaculture	Urbanisation	Transport	Shipping	Industry and energy generation
Pressure	Input of pesticides from agricultural land run-off Input of pesticides, antibiotics, hormones etc from aquaculture Input of pollutants from sewage outfalls Atmospheric inputs of PAH Input of oil and related HCs from shipping					
State	Elevated POPs and trace metal concentrations in coastal waters and sediments Impaired health and reproductive capacity in marine fauna Disruption of ecosystem functioning					
Impact	Loss of income and employment by aquaculture and shellfish growers					
	Illness through consumption of contaminated seafood					
	Illness through contact with waterborne bacteria/viruses					
	Loss of tourism income and jobs					
	Loss of recreational and landscape value					

Key to colour shading:

Negligible	Minor	Moderate	Major	Dominant

Table 3. Overfishing

Response	More efficient regulation to control fishing effort				Appropriate subsidies	Expand aquaculture as alternative	Education of consumer (ecolabelling)	Protected areas (NTZs)
	Assessment of fish stock / real ecosystem approach							Artificial reefs
								Restocking
Driver	Lack of enforcement and compliance	Lack of regulation	Technology	Poorly designed regulation	Subsidies that encourage unsustainable fishing	Demand		
Pressure	Fishing effort Illegal and unreported fishing Loss of habitats (Eutrophication) (Chemical pollution) (Global warming)							
State	Reduction in size and health of stocks of target species Reduction in size and health of stocks of non-target species Disruption of ecosystem functioning (mean trophic level)							
Impact	Loss of income and employment for fishers and related activities							
	Increase in price of fish to consumer							
	Reduction in consumer choice							
	Loss of tourism income and jobs							
	Loss of recreational angling							

Key to colour shading:

Negligible	Minor	Moderate	Major	Dominant

Table 4. Coastal Erosion

Response	Implement ICZM					
	Regulation to control littoral and riparian development			Supply finance for coastal defence works (new and maintain)	Regulation to control capital and maintenance dredging	Soft coastal defence works
Driver	Urbanisation	Coastal tourism development	Ports and harbour construction	Maritime shipping	Construction and building industry	Canalisation and damming of rivers
Pressure	Construction of littoral structures Inappropriate dredging practices Decreasing sediment supply (Global warming Sea level rise Changing meteorological regime Wave energy regime)					
State	Loss of beaches Loss of low-lying land Frequent flooding Loss of habitat					
Impact	Loss of tourism related income and employment					
	Loss of property, income and employment					
	Loss of landscape value					
	Increased demand for capital investment for coastal protection					

Key to colour shading:

Negligible	Minor	Moderate	Major	Dominant

Table 5. Invasive species

Response	Regulation to control releases of ballast water	Tighter regulation on cultivation of alien species and control of escapees	Improve management procedures at aquaria
Driver	Maritime shipping	Aquaculture	Aquarium accidents
Pressure	Release of organisms in ballast water discharges Deliberate introduction of alien species Changing spatial distributions of certain species (Global warming) Accidental release		
State	Reduction or loss of established species Disruption of ecosystem function Change of biodiversity Change in habitats		
Impact	Loss of income and employment by fishers		
	Loss of tourism income		
	Loss of recreational value and landscape		

Key to colour shading:

Negligible	Minor	Moderate	Major	Dominant