



# **Mediterranean coastal areas at risk between conservation and development – the WADI project as an effort of integration**

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## **Abstract**

The WADI project (INCO-CT2005-015226) analyses a number of fresh and transitional water bodies in Mediterranean coastal areas suffering from scarcity and/or bad quality of water. Holistic multidisciplinary approaches have been adopted to highlight impacts on the ecological and socio-economic systems depending on these water bodies. The ultimate goal of the project is to mitigate existing conflicts among stakeholders for water use, addressing the needs of the local people, particularly the weak or underrepresented part of the population. Efforts have been made to facilitate communication between the various contendents. The lessons learnt and difficulties encountered in the various contexts are discussed in this paper.

## **The context in the Mediterranean coastal zones**

The Mediterranean coastal zones are facing increasing challenges of development and integration. In this region integrated water management mainly concerns fresh water demand for domestic, agricultural and industrial uses in a context of water scarcity. Conflicts may also arise between the coastal and inland zones over the use of natural resources, pollution and/or depletion, with a consequent scarce supply of poor quality water.

Mismanagement of surface water may affect regions far from the source of pollution. This is evident when long rivers flow across several countries and various regions. Even small river basins are often interconnected through systems of canalization. Generally, problems are perceived as such when it is already too late for mitigation. It may be impossible to recover the systems at that point. So awareness of the possible impacts of water managements at various levels of integration is fundamental if we wish to develop efficacious long term strategies.

On the northern coast of the Mediterranean Sea, the arid and semi-arid coastal zones suffer from irregular rainfall and polluted water supply from the rivers, which are often exploited by economically active inland regions, as in the cases of eastern Spain and western Italy. The Segura River flows to the Alicante province from the Castile region, where its water is used intensively to irrigate crops, leaving the coastal zone a scarce supply of bad quality fresh water. In northern Tuscany, the Arno River flows to the coast severely polluted by the industrial activities in the plain. The polluted water vapour of the coastal waters has caused the death of the pine trees lining the coast in the formerly royal reserve of San Rossore (now a regional natural park).

In north Africa, the water supply in the coastal regions is irregular and gives origin to the typical wadis (non permanent flows of water in the arid regions). This water is also used to develop agriculture in the arid inland areas and a network of dams and channels has been constructed to collect and transport water from one place to another. In most cases this has ecological and socioeconomic impact on the coastal zone. The management of rivers may reduce the flow of sediments and consequently facilitate the erosion of the beaches by the sea, indirectly affecting the development of beach holiday tourism. The sediment accumulated in the dunes represents an important buffer or reservoir and protects the coastline against erosion (McLachlan 2006). Beach-dune ecosystems are under threat of disappearance all around the Mediterranean (Oueslati 2004).

Increasing urbanization is the most relevant issue in the Mediterranean coastal zone, as it is all over the world. Human population growth is the underlying force that drives a "coastal squeeze" (Schlacher et al. 2006). Here the coastal zones are trapped between burgeoning urbanization from the terrestrial side and various marine stressors, also caused by climate change (Nordstrom 2000). These pressures are likely to increase at different tempos, with urbanization expanding more rapidly than long-term climate changes. The latter may affect water supply from rainfall in an unpredictable way, becoming a constraint for a rational distribution of fresh water resources.

In water management there is a tendency to implement measures that were already used somewhere else, without considering their possible impacts along the river basins and throughout time or the unique nature of the systems. Rarely are past lessons taken into account in decision making. On the contrary, solutions for which the technology already exists are favoured. The models, generally used in engineering projects, rarely take into account the complexity of the problems and tend to focus exclusively on a particular sector, e.g. crop irrigation, the distribution of drinking water or the conservation of wetlands as a reservoir of biodiversity, etc. When decisions are taken centrally (at a national level), issues are generally oversimplified and the solutions proposed are those technically feasible, no matter if and how the local communities are affected by the management. On the other hand, when decisions are taken locally (at a sub-political level), the decision makers are well aware of the complexity of the problem, which receives due consideration, reducing possible risks (Beck 1986). At this level, various indicators can be perceived and management can be adaptive.

As pointed out by Swallow et al. (2001) "For the purpose of research, it is usually important to be able to draw broadly applicable conclusions from impact assessment. This argues for selecting 'representative' sites. Yet in the case of watersheds, where site specificity may limit the ability to extrapolate results from one site to another, selection of research sites might better focus more on important or extreme circumstances whose results could provide insights into specific aspects of watershed management. A combination of methods, including quantitative and qualitative approaches, may be called for."

But the risk remains of subordinating the interests of many (the local communities) to those of few (the local policy makers). Moreover, the scientific community is rarely consulted and hardly understood, when political decisions have to be taken. The tempos of the social impact of scientific results and decision making processes are different, the latter depending on the length of the mandates. There is an urgency to speed up the process of communication with the scientific community and scientists should be considered as key players (stakeholders) at a supranational level, representing the interests of underrepresented social and environmental components.

## The WADI<sup>1</sup> project approach

The WADI project analyses the socioeconomic and ecological impacts of water management upstream on the water reserves downstream in the coastal areas, which sustain development and the highest level of urbanisation, but also contain the most threatened water ecosystems, at highest risk of disruption, given their peculiar no-land/no-water status. The acronym WADI – WAter Demand Integration – suggests the temporary and unpredictable water flows in the southern Mediterranean region. Fresh water is the most important natural resource for the local communities, as well as a source of wealth for the countries where scarcity of water dominates. The project focuses on fresh and transitional water bodies and the benefits the local population derives when using this water. The objective of proposing scenarios of equal water distribution to all stakeholders, including the less powerful components of the society, is ambitious and clearly maximal. In the framework of WADI we have adopted a case study approach and encouraged interactions between researchers and stakeholders on different levels, local, intermediate, national and international, and ultimately communication between the scientific community and society. A dialogue with the stakeholders was initiated from the beginning of the project by means of focal meetings held at the study sites. During the meetings various stakeholders, who in some cases had come together around the same table for the first time, were asked to explain their problems, hopes and suggestions regarding water management. The outcomes of these meetings are now driving ecological and socioeconomic field research at the sites, focusing on real problems and continuing the exchange of information with all parties involved. Contextualization (Beck 1997) and adaptability are key concepts of this strategy.

The study sites chosen along the Mediterranean coasts cover a range of issues common in the region, and, at the same time, each site has a specificity derived from physical, climatic as well as socioeconomic conditions. A number of gradients can be drawn by comparing the case studies chosen by the WADI project: north – south, developed – under development – in transition, intensively – sparsely urbanized, developed – recently discovered tourism. The study sites were chosen in sub-humid (Italy), semi-arid

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<sup>1</sup> The project “Sustainable management of Mediterranean coastal fresh and transitional water bodies, through a socioeconomic and environmental analysis of changes and trends, to enhance and sustain stakeholder benefits”, funded by the EC, 6<sup>o</sup> Framework Programme, contract INCO-CT2005-015226-WADI, began in 2005 and is still ongoing. Details on the project can be viewed on the web site: [www.wadi.unifi.it](http://www.wadi.unifi.it).

(Morocco and Tunisia) to arid areas (Spain and Egypt). Standards of living vary considerably among sites from relative wealth at the European ones (varying according to stakeholders) to poverty in some situations analysed in north Africa (Abdrabo 2006). The fragility of the systems and unpredictability of ecological and socioeconomic changes are common traits of all WADI case studies.

### **The Egyptian case study**

In Egypt, in the eastern part of the Nile Delta, the beautiful historical city of Alexandria is backed by Lake Maryut, a coastal fresh water lagoon that belongs to a network of coastal lakes and collects water from the Nile, buffering the floods thereof. The lake also has a high landscape value given its geographical position. However, water flow into the lake has decreased as a consequence of upstream managements of the Nile River. Lake Maryut also collects discharge and waste waters from agriculture, urban and industrial uses. Its pollution has been aggravated by the recent development of the city of Alexandria and has dramatically increased since the deviation of its discharge channels from the Mediterranean Sea to the lake, so as to keep the coastal waters of tourist resorts clean. From that moment on the situation of the lake has become worse with a sudden decline in fish catches. The lake supports a numerous population of fishermen (around 5000 households, but this number is only an estimate as people continuously migrate from one place to another). This population is getting poorer and poorer as fish stocks in the lake decline. From a holistic point of view we should also consider the effect of increased nutrient discharge from agriculture to be a consequence of decreased fresh water supply from the Nile (McNeill 2000). Income generating activities around the lake are also the sorting of solid urban wastes and the cutting of reeds in the lake for several uses, e.g. building. Women and children participate in these activities. The solutions proposed by the local administration include the filling up of the lake to gain ground for buildings and their infrastructures. Such measures will hardly favour the local population around the lake, the “lagoon people”. A large amount of money from the World Bank has been earmarked to analyse the current situation, without showing a real willingness to improve it in favour of the local people.

### **The Tunisian case study**

In Tunisia WADI participants have chosen an area located on the northern coast of the country, including the low basin of Oued Mejerda and

Ghar El Melh lagoon. This area is of high economic, environmental, landscape value, although threatened by floods and droughts, coastal erosion and silting up of the lagoon and its outlets. The risks are aggravated by the recent construction of a highway, the development of intensive agriculture, urbanisation and management of irrigation water to supply agriculture in the arid central regions of Tunisia. These activities are in many cases managed by international enterprises, which act sectorially with scarce consideration of the local needs. Also, intervention in one sector (e.g. tourism) may have negative effects on another (e.g. agriculture). Coastal management projects are being developed to enhance tourism activities in the region, while the needs of the lagoon population who depend on fishing and traditional agriculture are scarcely taken into account by the intermediate and national level decision makers.

### **The Moroccan case study**

The north-western Mediterranean coast of Morocco is currently developing its tourism and infrastructures, such as the construction of the new harbour of Tangier and the coastal highway. This is in apparent contrast with the rural mountain environment where the settlements are mostly sparse douars administered by rural municipalities, around the historical city of Chefchaouen. The high altitude natural forests conserve endemic arboreal species as well as a rich diversity of fauna and flora. Both are threatened by an intense use of ground for traditional agricultural practices and the illegal kif crop (Ater & Hmimsa 2006). The latter represents an important source of income for the resident rural population integrating the money sent by the emigrants to the cities and Europe. The site is therefore in an unstable equilibrium between a traditional way of living and rapid developments. Problems are perceived as such only when they concern the short term, and the local people have apparently no interest in future developments. Regarding water, there is a deterioration of water quality from upstream to the coast caused by the absence of any regulation in waste discharge (El Alami et al. 2006).

### **The Spanish case study**

In Spain WADI has focused on El Hondo lagoon (Alicante province), an artificial water reserve for irrigation needs, recently developed into a natural reserve. When water supply is scarce, as happens throughout most of the year and was especially severe during the recent years of drought, the stakeholders' water demands come into conflict. The association of irriga-

tors owns the water, the farmers are the users and pay for the water, and the environment is represented by the regional environmental agency. The economic, cultural and natural values of the area are unquestionable and all stakeholders claim their own part in the exploitation of the water body. The WADI participants organised joint meetings of the various stakeholders, including the least represented such as rural women and school teachers, and set up a discussion table on El Hondo. The local and regional press participated in this process of promoting awareness of the El Hondo problems along with the area's value, as well as people's expectations of the project (Martín Cantarino 2006).

### **The Italian case study**

In Italy our chosen case study was the lower the Ombrone River valley in southern Tuscany where we tried to increase awareness on the issues related to water use and abuse. As surface water becomes scarce during the dry Mediterranean summer and its quality consequently worsens, ground water is increasingly used to irrigate crops. In the coastal zone the water table is generally near the surface and the exploitation of wells for domestic use and irrigation of small landholdings is easier and more economic than the management of a canalization from the river. The consequence of this practice by the local farmers is a lowering of the water table, which aggravates the effect of droughts. The intense use of fresh water from the wells for crop irrigation has also deteriorated the quality of ground water and increased soil salinity. The lowering of the water table in the coastal zone may cause an intrusion of marine water with a consequent increase in the salinity of ground water. This has had a dramatic impact on the viability and growth of pine trees and on biodiversity within the natural park, which is part of the area and represents an additional value for the region (Scapini and Nardi 2007). There is a demand for new tools to monitor the impacts of climatic change and come to grips with the problems of increasing soil salinity as well as coastal erosion.

### **Providing useful tools for environmental management**

During the second phase of our WADI project we collected first hand information with particular emphasis on the gaps, generally relative to sectors neglected by the powerful stakeholders. The neglected sectors may be the poor fringes of the population (e.g. in the Egyptian and Moroccan cases) and the natural component of the ecosystems (e.g. the two European

cases). The picture has not only become more complete, but the focus has changed, observing the issues from different points of view. Therefore the issue of communicating scientific results has become urgent. In many cases we want to communicate messages that are unwelcome to powerful stakeholders and this may represent a “political” problem.

This issue was particularly evident in the Italian case study, where conflicts exist among various sectors: ecosystem protection, agriculture and tourism, each using water resources. As long as the discussions about environmental protection and the management of natural resources were kept within the meetings among managers and scientists, no problems arose. However, when the scientific results clearly contrasted with existing local management plans, the conflicts of interest became apparent. In the case analysed engineering measures had been planned to contrast beach erosion, threatening the protected natural beach-dune system within the natural park. Both hard (armouring) and soft (nourishment) interventions have impact on the natural ecosystems. WADI researchers had collected the data to show these threats, but had not been asked for such data during the development of the plans. Only after a long and difficult negotiation the plans for coastal stabilisation were changed giving consideration to ecosystem protection within the natural park.

WADI participants decided to publish the contrasting scientific results in an illustrated book on the natural park to be sold in book shops at a low price (Scapini and Nardi 2007). The book was aimed at enhancing public awareness not only of the environmental values, but also on the difficulties of their management. In particular, the last chapter of the book regarded the management of the natural park. Local policy makers and park managers considered this politically dangerous and have made efforts to have this chapter removed from the book and conceal the threats of mismanagements from the lay public, practically to block the flow of communication from science to society in this respect. According to this logic, science should stay in its world of “universals”, separated from political issues, and only communicate their contrasting results to managers and policy makers, without involving the public.

## **Lessons learnt**

I’m not going to describe the work in progress aimed at developing scenarios for the study sites here. At the moment we can summarise the lesson learnt from the WADI experience up to now.

- 1) A holistic approach has proven very useful for an adaptive management of environmental resources, including fresh water.
- 2) The management should consider all the sectors and stakeholders as well as the links between them and the relations between the various sectors.
- 3) The conflicts among stakeholders should be analysed prior to any management, and the parts listened to. Otherwise there is the risk of neglecting the weak social sectors and starting vicious circles of environmental degradation and poverty.
- 4) The points indicated above can be fulfilled only at the local level. However issues can never be entirely localized and impacts often derive from changes occurring elsewhere. The concept of open systems is a key concept in this respect.

However, the issue remains of communicating messages to those generally powerful stakeholders who do not welcome them. We are well aware that most of the powerful stakeholders already have precise ideas on what they want to do using their power. We are also aware of the difficulty of intercultural and interdisciplinary communication. But we feel that scientists have a duty of transparency with respect to the public, who pay taxes to support scientific research.

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