CT5050 ADDITIONAL MSc THESIS



# A Systematic Approach of Greek Coastal Zone Management

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#### PREFACE

This project has been accomplished by Anestis Lioutas and Vaia Tsimopoulou in the framework of their graduation work at Delft University of Technology. The idea of a project about the Greek coasts was initiated by ir. Ep van Hijum, former managing director of INFRAM, whose interest in the subject and his support has been motivating and is very much valued. The essential contribution of ir. Henk Jan Verhagen during all the project stages is also acknowledged and appreciated, together with the support of Prof. Marcel Stive, who is the main supervisor of this work.

#### ABSTRACT

Greece owns the most extensive coastline of all European countries. Greek economy relies on the protection and the development of the coast, where major economic activities take place and where about 60% of the population lives. Despite the crucial role of the coastal zone in Greece, there is no organized integrated act with regard to coastal zone management.

This project introduces the development and application of a database of all the Greek coasts. The main objective of this project is to take a first step towards an integrated coastal zone management, by developing a tool for primarily identifying any piece of Greek coast, and secondarily accomplishing a coastal classification with regard to physical characteristics and social-economic activities.

In order to decide about the content of the database and to come up with a proper structure, it was first necessary to define the main issues related to the Greek coasts, such as touristic development or environmental protection of a wetland, as well as to identify the possible users of the database and the kind of information that they would demand. The range of possible users has proved to be very wide, and therefore the range of information included in the database is wide too. The main data fields are the following:

- Type of coast: beach / rocky coast / wetland / port etc
- Geographical aspects: coordinates / province / prefecture
- Physical aspects: geological features/ beach length, width/ sediment grain size
- Hydraulic aspects: wind speed and direction / significant wave height
- Other general aspects: existence of fisheries / industry / urbanized areas etc.

The database has been developed with web-based software and is accessible via the internet in the address <u>www.greekcoasts.info</u>.

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#### **1. INTRODUCTION**

Since the ancient times, the sea and the coasts have always been a source of life for Greece. They offered natural resources, proximity to the sea and its benefits, favorable conditions for many vital human activities and prosperity, as well as a beautiful and harmonious environment with splendid landscapes that inspired many artists and cultural life.

The Greek coastline is considerably lengthy, and given the small size of the country, the coastal areas constitute a significant part of the Greek territory. The Greek economy depends greatly on the coasts, since the most vital economic activities for the country take place in the coastal zones. Moreover there is a continuous trend of urbanization and raise of population in the coastal zones. For this reason the rational and sustainable development of the coasts has always been of great importance for Greece.

The last three decades there is a continuous effort made by the Greek authorities for improvement of the coastal zone management. This effort has been intensified after 2002, when the Ministry of Environment, Physical Planning and Public Works supported the idea of the European Commission Recommendation on Integrated Coastal Zone Management (2002/413/EC). Numerous studies have been elaborated since then, and numerous decisions have been made concerning coastal management. The current coastal policy though has not proved sufficient yet, since the implementation of all actions that have been decided is slow and in many cases problematic.

This project refers to the development of a database which is determined to facilitate the Greek coastal management, not only in the stage of decision-making but also in the stage of implementation. It also comprises a handy tool that contributes to a rational approach of integrated management of the Greek coasts, which can be useful for many different parties, from common civilians to major stakeholders of the coasts. This database has been built-up and can be accessed online in the address www.greekcoasts.info. Its content is meant to be the totality of coasts that belong to the Greek territory, accompanied by some useful information about their physical and social-economic characteristics. At the moment only some indicative records exist in the database, since the populating procedure is out of the scope of this project. Its future expansion of records is necessary.

In order to gain insight into the state of the coastal zone and the current coastal management, and therefore a better understanding of the expediency of this project, an overview of the Greek coasts is presented in Chapter 2, while the national approach to the problem is described in Chapter 3. Chapter 4 is dedicated to the description of the database and its development. The report ends with Chapter 5, which contains a number of conclusions of the project.

#### 2. GREEK COASTS: OVERVIEW

#### 2.1 Introduction

Greece has a coastline of more than 16,500 kilometers which is the longest of any other Mediterranean or European country. Almost half of this coastline corresponds to the continental part of the country and a little more than half to the archipelagic complexes of the Aegean and Ionian Sea. There are about 3,000 islands, a few hundreds of which are inhabited. The Greek coastline represents, thus, about 25% of the coastline of the European Union with its current Member-States.

The coastal zone is of particular importance for Greece. Twelve out of the thirteen Regions of the country are coastal. Almost all the big urban centres of the country are located in the coastal zone, as well as 80% of the industrial activities, 90% of tourism and recreation, most of fisheries and aquaculture, 35% of agricultural land, which is often of high productivity, and an important part of infrastructure (harbours, airports, roads, electricity network, telecommunications etc).

#### 2.2 Coastal environment

The coastal and marine environment of Greece is characterised by its beautiful landscapes and important ecosystems with numerous rare species needing protection. At the same time it is vulnerable because of some natural hazards, such as erosion, as well as pressure due to some human activities and conflicting land uses (overexploitation of natural resources, urbanisation, pollution etc).

#### 2.2.1 Types of coasts

Three main types of coasts can be recognized throughout the whole country: beaches, rocky coasts and coastal wetlands (deltas, lagoons, etc), which are considered the most vulnerable types of coastal areas.

## • Beaches and sand-dunes

A variety of fauna and flora can be found along these areas. Due to their natural characteristics -both abiotic and biotic- they represent the areas were most of human activities are located. Sand-dunes constitute a particularly sensitive ecosystem, because they change easily under minor environmental pressure. Their value is ignored most of the times, which results in losses of many dunes in coastal zones that are nowadays overpopulated. Tourist growth puts a lot of pressure on dunes, and the same stands for recreation installations, road constructions for rapid access, urbanisation etc. Sand dunes in several cases have been destroyed. It is only during the last decade that the value of these ecosystems has been widely recognized. Still no significant measures for their protection have been adopted.

• Rocky coasts

They represent 70% of Greek coastline. The fauna and especially the flora of these areas are significantly different, but still appears to be of high biodiversity (Economidou, 1994).

Wetlands

Different types of wetlands can be found throughout the whole country. It should be noted that some of the wetlands can be considered as groups including other smaller wetlands. Many rare species of birdlife can be found there, such as the white-tailed eagle (Haliaeetus albicilla), the spotted eagle (Aquila clanga), and the dalmatian pelican (Pelecanus crispus). Along the coast numerous lagoons and marshes can be found. There also 8 large deltas. These ecosystems are exceptionally fragile and constitute the biotope of a big number of species.

# 2.2.2 Coastal ecosystems

The Greek coasts constitute a natural resource and a heritage of Mediterranean and international importance, which should be safeguarded for the present and future generations in a perspective of sustainability. The Greek coastal and marine ecosystems are characterized by high productivity, in particular the wetlands and sand-dunes, and they accommodate numerous species of fauna, the survival of which is particularly important for the conservation of biological diversity. Yet, some loss of biodiversity has been observed.

On an indicative basis one could mention that in Greece there are:

- More than 6,000 species of flora, considerable part of which is located in coastal zones and islands. 263 of them are considered rare and threatened (IUCN Red Book 1995);
- More than 670 species of vertebrates;
- 436 bird species, covering almost all those mentioned in the EC Directive 79/409;
- 81 specially protected areas for fauna in coastal areas out of 151 of the entire country, since small islands and rock formations constitute a valuable shelter and biotope for sea-birds.

The coastal zones often include coastal forests and bushes that create, in combination with the sea, a landscape of high aesthetic value, while they contribute at the same time to the minimization of floods, erosion and other natural hazards.

# 2.2.3 Bathing waters and beaches

Regarding bathing waters, Greece is monitoring its coastline in 40 prefectures and 343 municipalities in accordance to EC Directive 76/160, covering more than 1500 coasts. The clear conclusion of this programme is that the quality of bathing waters in Greece is very good and further improving every year, as indicated in the table below.

Year	% of Clean Coasts (Acceptable Values)
1998	98.70 %
1999	98.94 %
2000	98.80 %
2001	99.40 %
2002	99.90 %
2003	99.90 %
2004	99.90 %

Table 2.1: Percentage of clean coasts per year

Furthermore, Greece is awarded annually one of the highest numbers of blue flags for the quality of its organised beaches. The table below illustrates the progress during the last years.

Year	Blue Flags Awarded
1999	318
2000	319
2001	351
2002	354
2003	373
2004	378
2005	383
2006	411

Table 2.2: Number of blue flags per year

# 2.2.4 Environmental issues

## 2.2.4.1 Extinct species

Many species which can be found in the Greek coastal zones are under severe pressure due to basically tourism development. Such species include the Spur-winged plover (Hoplopterus spinosus), while three species of sea turtles, the best known being the Loggerhead sea turtle (Caretta caretta) nest in different areas. Another rare species is the Mediterranean monk seal (Monachus monachus) which is threatened with extinction.

## 2.2.4.2 Coastal forests

Coastal forests account for 60% of the Country's forests (H.Marchand, 1988). During the last decades successive fires, during summer, have destroyed large areas of forests or forest-like areas. A significant part of these areas is usually coastal areas. Since land regulation for forests and forest areas is not well coordinated and control mechanisms are quite diffused the burnt areas are occasionally converted to pasture land and become eventually built and urbanized. The lack of a systematic inventory of all the areas which are State property and lack of monitoring encourages the whole illegal process.

## 2.2.4.3 Islands

Islands comprise a particular case of coastal areas calling for a special management practice. With the exception of some large islands –Crete, Evvia, Lesvos, Chios- were other activities besides tourism are being developed, all other small islands depend on tourism for their future development. The main factors of attraction of the islands of Greece is their natural assets, most of which are connected with the coastal environment. A possible degradation or loss of such assets is certain to affect tourism itself and consequently the future of social and economic activity on the islands in an irreversible way. Islands, more than other localities depend on a delicate balance between environment, economy and society. They are particularly vulnerable to shifts in any of these factors due to their small scale and difficulty of access inducing higher transaction costs. Recovery costs are also much higher and restoration of balance tends to take much longer. To ensure a long lasting tourist activity it is necessary to plan for it in an integrated way in order to maximize its benefits and minimize its risks.

## 2.2.4.4 Coastal erosion

Greece suffers from a high rate of coastal erosion. 28.6% of the Greek coastline is estimated to be affected by erosion (EC data, 2004), which brings the country to the fourth highest rank among the coastal EU Member-States (after Poland, Cyprus and Latvia). This high rate is due to the strong winds and waves of the Aegean Sea and the fact that a big part of the Greek coastline is sandy. As expected, the erosion affects also the vulnerable coastal ecosystems and protected areas (including coastal wetlands), as well as port constructions and marinas. Impacts of coastal erosion on housing are very limited in Greece.

## 2.3 Coastal population

It is estimated that 57% of the country's population live in coastal areas. Four out of five prefectures are located on the coast, covering 76% of the total land. Greece with a total population of 10,964,020 (in 2001) is characterized by its high coastal concentration. In particular the population living on a relatively narrow strip of land 1-2 kilometres from the coast represents 33% of the total population. If one considers the population living in areas with access to the coast (45 minute drive or up to 50 km from the seashore) then the coastal population is estimated to be 85% of the total. The remainder 15% of the total population live in the interior of the country (CEU, 1995). The coastal density is 88 inhabitants per square kilometre while the average density for the country is 75, which indicates that the interior density is considerably lower.

Prospects suggest a modest population increase but geographic patterns vary widely from place to place. Coastal areas and tourist resorts are likely to experience significant population increases in parallel with wide fluctuations in numbers of residents from season to season. According to the Blue Plan Scenarios for Greece, coastal population is expected to increase in the mid- and long term (2025) although from a demographic

point of view two Scenarios foresee a slight decrease of population in the long term (University of the Aegean, 1993).

It is estimated that 62% of the total population live in urban areas while in 2025 urban population is expected to represent 79% of total (Lanquar, 1995). Urbanization has been strongly associated with urban concentration. Most of the large urban centres are located on the coast. The following table presents the first fifteen cities ranked according to their population size. Two out of three are located on the coast. Most of these cities are important harbours as well, with the exception of the city of Rhodes which is also an important tourist resort in Greece and the Mediterranean.

Cities	Population (1991)
Athens*	3.096.775
Thessaloniki*	377.951
Patra*	155.180
Iraklion*	117.167
Larisa	113.426
Volos*	77.907
Ioannina	56.907
Halkida*	51.482
Serres	50.875
Hania*	50.077
Trikala	48.810
Katerini	46.304
Lamia	43.898
Kalamata*	43.838
Rhodes*	43.619

Table 2.3 Population of major Greek cities

Prospects about coastal urbanization indicate a further increase in the mid and the long term (year 2025). In spite of an increase of both coastal population in general and of coastal urban population in particular, density will still remain low when compared to other Mediterranean countries. Compared to the rest of Europe, Greece will continue to demonstrate lower urbanization rates, although in the distant future the differences are expected to become less important.

Besides these high urban concentrations on the coast, the last few decades suggest also a strong tendency towards a sprawling of urbanisation along the coast, not necessarily in high densities. This process is encouraged by tourism development or an expanding construction of second homes. This suggests that in the long term urbanisation of the coast will continue with increasing densities as such areas are likely to be converted to prime residential areas, particularly those near the large urban centres. This is an anticipated outcome from the growing tendency of people to seek residences in "environmental amenity areas" and the coasts have a lot to offer in this context. As a result demands for adequate infrastructure in these areas will become more acute in the near future triggering further concentration of activities and people, boosting urban development along the coast.

#### 2.4 Economic activities

#### 2.4.1 Primary sector

## 2.4.1.1 Agriculture

Coastal zones often favour the existence of positive microclimates and the development of agriculture. This activity is particularly important for the islands that are geographically isolated, and need a boosting of their local economy. Coastal agricultural land covers 35% of the total coastal land, including some areas of high productivity. Even though the coastal environment is suitable for all kinds of cultivation due to its generally milder climate, the future of coastal agriculture is challenged. Conflicts over land use arise commonly between agriculture and tourism development. The lack of efficient agricultural land regulation combined with the large economic benefits arising from participation in tourism development has encouraged the abandonment of agricultural land and its gradual transformation. Agricultural areas located in the vicinity of large urban centres, appear to follow a gradual transformation process, where agricultural activities are replaced by activities of the secondary sector or become areas for second homes. This process is more acute in coastal areas.

Besides conflicts over land uses another cause for an expected future decline of this activity could be the implementation of Community Agricultural Policy and the realization of the Single European Market. In the long term it is possible that restructuring and modernization efforts could have a positive impact particularly in these areas which have large plains like Crete, South Peloponnisos, Thessalia and East Macedonia. However, in most cases unless particular measures are taken marginal agricultural activities will be replaced, causing an irreversible transformation of the environment, not always desirable. This is probably the most important problem for the smaller islands.

## 2.4.1.2 Cattle-breeding

Coastal zones include areas where the biomass is considerably high encouraging therefore the development of this activity. However in Greece most of breeding is mountain related (goat and sheep raising).

## 2.4.1.3 Fisheries

This sector is considered of high importance for the national economy, because, despite its small contribution to the GNP, it contributes to the social and economic cohesion of the coastal zones, which constitute an extended part of the country. About 40,000 people are occupied in this sector, with a fishing fleet of about 19,000 vessels, while the annual production in all categories (sea fisheries, aquaculture, lagoons etc) amounts in about 231,000 tons.

The aquaculture production is estimated to 258,000 €, which corresponds to 10% of the EU aquaculture production. Aquaculture installations can be found all around Greece in islands like Limnos, Lesvos, Crete, Leros, Cephalonia and Ithaki, but also along the

mainland coasts such as East Macedonia, Peloponnisos, Thrace, etc. In general the areas suitable for aquaculture are lagoons, river deltas and estuaries, which are from an environmental conservation perspective, areas of interest. Their positioning is subject to an administrative review procedure. However, in some cases there are strong conflicts of priorities in addition to occasional conflicts with local fishermen.

## 2.4.1.4 Saltpans and salt production

Salt production has been an important coastal lagoon activity in the past but gradually most sites have been abandoned due to negative economies of scale associated with small scale production. There are several saltpans throughout the country: Attica, Lesvos, Lefkada, Messolonghi, Zakinthos, Crete, Halkidiki, Pieria, Corfu, Milos, Thessaloniki, Xanthi, Samos, Halkida, Rodopi, etc. As salt production is strongly seasonal in character (summer) saltpans are widely used by migratory birds for wintering or intermediate stops. Recent experiences suggest a strong compatibility of salt production and environmental conservation (i.e. Messolonghi).

## 2.4.2 Secondary Sector

## 2.4.2.1 Mining and Industry

More than 80% of all industrial activities are located on the coast. Usually the industries that prefer coastal locations are only the ones which need water as part of their production process, or need water access for transportation purposes. In Greece though there has been a strong industrial concentration in coastal areas due to the coastal location of many major urban centres, the traditional role of shipping in transport of industrial products (i.e. mining raw materials, cement, etc.) but also due to the location pattern of the major road transport axis Patras-Athens-Thessaloniki, in the vicinity of the Greek coastline for geomorphologic reasons.

Mining locations are commonly near the coast causing serious conflicts in some areas with other activities, mostly tourism. Industrial locations have been in the past also a cause for environmental or land use conflicts in coastal sites mainly relating to the processing of raw materials (i.e. alumina plant, oil refining or gold smelting).

## 2.4.2.2 Marine transport

The importance of marine transport is particularly high in Greece because of the lengthy coastline and the existence of so many islands. The territorial and social cohesion depends directly on the existence of frequent and reliable coastal shipping services, which annually perform an extraordinary work of serving 94 islands and 36 million passengers. There are in total 20 ports with more than one million tones of cargo per year each.

Regarding general shipping activities the following facts can be mentioned:

• Greek interests control 3,338 vessels of various categories;

- The Greek-owned fleet registered under the Greek flag, comprised 969 ships in 2005;
- Internationally, Greek interests control around 9.1% of the world's total number of vessels in service and on order, and 18% of the world fleet dead weight, or 15.5% in gross tons;
- In terms of ships on order, Greek interests account for 7.8% of the total in number of vessels, 12.2% of the total DW, or 10.2% of the total GT.

It is known that marine transport is usually friendly to the environment and causes less environmental implications in comparison to other means of transportation. In principle the state of the environment in the areas adjacent to ports can be considered satisfactory. Nevertheless, the continuous increase of the transported volume has led to the saturation of a great number of ports. This fact combined with the lack of sufficient space and appropriate access, leads to an increase of potential negative effects to the marine environment, and the deterioration of urban areas around the port installations.

#### 2.4.3 Tourism

Tourism constitutes one of the main sources of national wealth for Greece, since it contributes annually to more than 18% of the GNP, generating approximately 700,000 jobs and contributing decisively to regional development. Tourist activities cover an important part of Greek coastal areas. In particular 90% of all tourist activities and recreation are located on the coast. This concentration is justified by the type of tourism developed in Greece, mass tourism related to sun, sea, sand, although usually linked to visits to cultural sites. A very small proportion of tourist installations can be found in other places. In the last few years the efforts of both policy makers and investors are oriented towards a broadening of tourist product and in the amelioration of services provided.

The areas that draw great profits from the rapid development of tourism are basically areas with a great coastal or island parts like Crete, Rhodes, Cos, Cyclades, Corfu, Halkidiki, Argolida, etc. There is still a strong potential for further tourist development in these and other areas which is gradually realized as new public investments allow for better access (i.e. roads, airports, marinas, etc.) or better services (i.e. waste water treatment, telecommunications etc.).

Besides economic profits, tourism development has caused a gradual deterioration of environmental quality through urbanization along the coast and a deterioration of the built environment particularly in traditional settlements. Although Greece is not characterized by large scale tourist installations, to an extent that other Mediterranean destinations have been developed, in several cases the impacts of tourism associated with urban development and sprawl have altered the scale and architectural character of traditional settlements, in spite of building and aesthetic control regulations. Such is often the case with the small human settlements in some islands which have been popular tourist resorts. Tourism related problems are not restricted to the control of urban development but also to functional problems for human settlements. Congestion of services and beach sites, drinking water delivery, liquid and solid waste disposal, noise and traffic congestion, etc., can be cited as typical problems of several tourist areas, often surpassing the organizational and financial capacity of local communities to deal with such issues. To a great extent such problems are caused by the strong seasonality of tourism in Greece. During summer population concentration is high, often exceeding the carrying capacity of both the natural ecosystem, the organizational structures (i.e. infrastructure and services), causing severe impacts.

## 2.4.4 Impact of economic activities

According to the above presentation of economic activities, the impact of human intervention to the coastal zones can be summarized in four types of problems:

- Concentration of population and activities in rather limited and sensitive space;
- Frequent conflicts of incompatible uses in the same or adjacent areas;
- Overexploitation of natural resources;
- Weaknesses in decision-making, policy implementation and in coordination of competent authorities.

#### **3. COASTAL POLICY**

#### 3.1 Introduction

The rational and sustainable use and management of coastal zones and the islands has always been a major priority for Greece, given its very lengthy coastline and the big number of its islands. Greece has participated in the demonstration projects phase launched by the European Commission with six projects in the '90s, and has supported the idea of agreeing in the European Commission Recommendation on Integrated Coastal Zone Management (2002). Furthermore Greece has participated in several related activities within the framework of the Mediterranean Action Plan of the United Nations' Environment Programme.

At national level, a considerable number of relevant studies have been carried out on the issue and management plans have been developed, covering coastal zones of different geographical areas of the country. A special report was also drafted in 2000 with the intension to launch and prepare a special framework for integrated coastal zone management, but this was never finalized for several reasons. The principles of the EC Recommendation were integrated instead in national and regional spatial plans. Therefore Greece has so far no national integrated coastal zone management strategy. However there is a continuous effort made towards this direction.

#### 3.2 Coastal Legislation

The coastal zone management in Greece is ruled by the following national laws, which have a direct reference to the coasts:

- Law 1337/1983, "Spatial and Urban Planning",
- Law 1650/1986, "Protection of the Environment",
- Law 2242/1994, "Urban Development of Secondary Housing in Zones of Urban Control and Environmental Protection",
- Law 2508/1997, "Sustainable Urban Development of Cities and Settlements of the Country",
- Joint Ministerial Decision 33318/3028/1998 Harmonization with Directive 92/43/EC, "Conservation of Natural Ecosystems and Wild Fauna and Flora",
- Law 2742/1999, "Spatial Planning and Sustainable Development",
- Law 2971/2001, "Seashore, Coasts and other Provisions",
- Law 3028/2002, "Protection of Antiquities and the Cultural Heritage in general",
- Law 3201/2003, "Re-establishment and Protection of the Natural and Built Environment on islands, as regards the competence of the Ministry of the Aegean".
- Law 3199/2003, "Protection and Management of Waters Harmonization with Directive 2000/60/EC (European Parliament and Council, October 2000),
- Laws 1515/1985 and 1561/1985, "Master Plans for Athens and Thessaloniki",

- All Ministerial Decisions approving the twelve Regional Spatial Plans announced in 2003,
- All Ministerial Decisions setting out the Zones of Land Development Control.

In addition to the above there are several presidential decrees, ministerial decisions or other laws that refer to other issues or sectors, and affect only indirectly the coastal zones. They refer to management of protected areas, organization of port facilities, shipping, industry, tourism, fisheries etc.

Furthermore, there are laws that ratify relevant international conventions, agreements or protocols. The most important of them are listed below:

- Decree 191/1974, ratifying the Ramsar Convention on Wetlands (1971),
- Law 855/1978 ratifying the UN Convention on the protection of the Mediterranean Sea (Barcelona, 1976), and its attached documents,
- Law 1335/1983, ratifying the Bern Convention on the conservation of wildlife and its natural environment in Europe (1979),
- Law 1634/1986, ratifying the Protocol on the Mediterranean Specifically Protected Area (1982),
- Law 2204/1994, ratifying the UN Convention on Biodiversity,
- Law 2321/1995, ratifying the Convention on the Law of the Sea (1982).

Regarding the coastal property regime, the Greek coasts are meant to be for common use. This is regulated with the following articles of the Greek Civil Code:

- Article 966 C.C.: Non-negotiable things are the commons, the things of common use and those serving state, regional, municipal and religious purposes.
- Article 967 C.C: Things of common use are particularly the waters with free and continuous flow, the roads, squares, coasts, harbors and bays, the banks of big rives, the big lakes and their banks.
- Article 968 C.C: The common things, provided that they do not belong to any municipality, or the law does not determine otherwise, belong to the state.
- Article 970 C.C: Some special private rights on things of common use can be allowed by the authorities and according to Law terms, provided that those rights do not impede the common use.
- Article 971 C.C: The non-negotiable things will lose this quality once their purpose stops being the common use or the service of state, municipal or religious purposes.

# **3.3** Decision-making bodies

Planning in Greece remains to a great extent within the competence of the central government. Although the main responsibility for spatial planning and protection of the environment lies to the Ministry of Environment, Physical planning and Public Works, the following bodies are also involved in the coastal zone management in the country:

National level

Apart from the Ministry of Environment, Physical planning and Public Works, the following seven ministries:

- Ministry of Development (covering also industry, energy and research),
- Ministry of Mercantile Marine,
- Ministry of Rural Development and Food,
- Ministry of the Aegean and Insular Policy,
- Ministry of Tourism,
- Ministry of Culture,
- Ministry of Economy and Finance
- Regional level
  12 out of 13 regional authorities
- Local level 451 coastal municipalities and 41 coastal prefectures.

An important role to the coastal region management and preservation is also played by non-governmental organizations, which usually represent universities, professional chambers, trade unions, or others mostly dealing with the environmental and cultural heritage.

The role of most of the above mentioned bodies is presented in the following paragraphs.

## 3.3.1 Ministry of Environment, Physical Planning and Public Works

The Ministry of Environment, Physical Planning and Public Works assumes responsibility for coastal zone management as well as for setting out the policy framework and priorities regarding the marine environment protection, including management of ecosystems and conservation of threatened species. This ministry bases its national policies to a great extent respectively on the EC Recommendation on Integrated Coastal Zone Management, the EC Directives 79/409 and 92/43 as well as on commitments undertaken within the Barcelona Convention and its related protocols. With the exception of the Dumping and the Emergency Protocols (pollution due to ships), the Ministry of Environment, Physical Planning and Public Works is the focal point for all activities covered by the Barcelona Convention system and the Mediterranean Action Plan. They have launched a programme of environmental studies for the most vulnerable NATURA and bird sites and has established already 27 protected areas with a management body, 13 of which are coastal and marine. There is close cooperation between the Ministry of Environment, Physical Planning and Public Works and the Ministry of Mercantile Marine for the control of possible illegal activities and the implementation of protection measures concerning these coastal and marine protected areas.

# 3.3.2 Ministry of Mercantile Marine

Government functions in respect to maritime transport in any sense have been assigned to the Ministry of Mercantile Marine. This Ministry is also responsible for safety of navigation issues and for monitoring the maritime traffic in the Greek seas. A VTMIS system is in operation covering a large part of the Greek waters, whereas its extension to the remaining sea areas is in progress. There is also a Hellenic Search and Rescue Centre (JRCC) operating in Piraeus, with personnel from the Hellenic Coast Guard, the Air Force and the Hellenic Navy.

In the field of the marine environment protection from pollution due to navigation, it is the Marine Environment Protection Directorate of the Hellenic Ministry of Mercantile Marine that has been nominated as the Greek operational focal point and, in this capacity, is entitled to act on behalf of Greece in relation to measures of mutual assistance and cooperation between parties in the framework of the implementation of the 2002 protocol concerning cooperation in preventing pollution from ships and, in case of emergency, in combating pollution of the Mediterranean Sea (Prevention and Emergency Protocol). Moreover, under the approved national organizational structure, the Hellenic Coast Guard performs the necessary government functions aimed at an effective marine environment control by using a modern fleet of air operational means (aircrafts and helicopters), which survey the Greek territorial waters for, among others, tracking down and preventing illegal discharges from ships. The Hellenic Coast Guard (HCG) has general duties for policing ships, either at sea or in ports, and enforcing the law not only in sea areas but also in land areas (coastal zones) of its competence.

# 3.3.3 Ministry of Rural Development and Food

The Ministry of Rural Development and Food is competent for the implementation of the common agriculture and fisheries policies in Greece, while the Ministry of Mercantile Marine through the Hellenic Coast Guard, conducts controls and inspections for preventing and combating if necessary, any illegal fishing activity.

# 3.3.4 Ministry of Culture

The ministry of culture has competence for the protection of coastal and marine archaeological sites and monuments.

# 3.3.5 Ministry of National Economy and Finance

The Ministry of National Economy and Finance is responsible for awarding permits for the use of beaches and seashores during the swimming period, or for broader investments. They are also responsible for carrying out all customs activities.

# 3.3.6 Regional and local authorities

The regional and local authorities maintain mainly a coordination and supervision role in regional and local level respectively, concerning the compliance of all authorities with the approved plans, when implementing their policies.

# 3.3.7 Non-Governmental Organizations (NGOs)

The non-governmental organizations contribute to the coastal management effort with different kinds of actions. They organize occasionally public awareness meetings or scientific workshops, they lead coastal cleaning campaigns or run small environmental management plans, express views on specific management problems, participate in networks as well as in public hearings in the context of issuing environmental permits, in particular in ecologically vulnerable areas. They also participate in the administrative councils of the management bodies of the 27 protected areas, 13 of which are coastal and marine. Some of them participate in related European networks and projects, such as the non-governmental organization "Mediterranean SOS". They participate in the Coastal Practice Network (CoPraNet), as well as in a LIFE project in cooperation with Eleusis Municipality, and in INTERREG IIIC activities together with the municipalities of Sifnos and Samothraki.

As part of the European platform for sharing knowledge and experience in coastal science, policy and practice (ENCORA), the Hellenic Network of Coastal Research (HENCORE) was created in 2005. This network is coordinated by the Aristotle University of Thessaloniki and its role can be summarized in the following:

- Integrate coastal zone research capacities and infrastructure across the country,
- Promote excellence throughout the country in knowledge, methodologies and education based on multidisciplinary coastal research,
- Promote application of knowledge and methodologies for integrated coastal zone management and sustainable use of the exclusive economic zone.

# 3.4 Coastal Management Development

As mentioned before, there is a continuous effort by the Greek authorities towards an effective coastal zone management, especially after the EC recommendation of 2002. Although the national integrated coastal zone management strategy is not completed yet, there has been a continuous progress made in different sectors, and some strategic future plans. The steps towards an integrated coastal zone management are presented below.

# 3.4.1 Preliminary actions

Greece has demonstrated an interest in the Community integrated coastal zone management activities since the '80s. This is indicated with some initiatives and actions taken the last three decades in order to implement the European policies, which are the following:

1. Over the period 1983-2005, the Ministry of Environment, Physical Planning and Public Works has developed plans that were approved and published in the Greek official Journal for 80 zones of land development control, more than 60 of which concern coastal areas;

- 2. During the same period, 30 special land use studies have been carried out, applying also to a great extent to coastal areas;
- 3. In the framework of ENVIREG programme, a number of projects have been realized covering mostly water treatment plants in a zone of 10 kilometers from the sea;
- 4. Since 1985 the Organizations of Athens and Thessaloniki for Master Plans of Environment protection have carried out a big number of plans for the land management in their respective areas of competence, covering also coastal zones.
- 5. Participation in activities within the framework of the Mediterranean Action Plan (MAP/UNEP), covering a wide range, from monitoring of the marine waters pollution and quality in general, to management plans for the protection of threatened marine species;
- Preparation of the "National Report of Greece on Coastal Zone Management" (2005), which was submitted to the European Commission in the context of the Recommendation on Integrated Coastal Zone Management (2002/413/EC), which summarizes the state of the Greek coasts and coastal policy until then;
- "Programme of Sustainable Development of Coastal Zones and Islands" (1997-99);
- 8. "Special Framework for the Sustainable Development of Coastal Zones" (2003),
- 9. "Special Framework for Coastal Zone Management", which was drafted before 2005, but not institutionalized yet.
- 10. Special frameworks for a national spatial plan and spatial plans for industry, renewable energy, tourism and coastal areas and islands (2008-2009).

The last three actions are part of the current national coastal strategy.

In addition to the above, six preliminary CZM studies were carried out in 1996, and concern six different coastal areas in the country. These studies cover the following issues:

- 1. "Programme for the Integrated Management of Coastal Areas in Cyclades" (LIFE project) by the Aegean University, Laboratory of Environmental Planning;
- "Awareness, cooperation and conditions for the sustainable development of coastal areas in Magnesia" (LIFE project) by the Development Company of Magnesia;
- 3. "Integrated Management of Coastal Areas in the Gulf of Strymonicos" (LIFE project) by the Greek Biotope and Wetland Centre;
- 4. "Integrated Management of Coasts in Sterea Ellada" (TERRA project) by the Province of Sterea Ellada;

- 5. "Strategies for the management and cooperation in the metropolitan and suburban coastal area of Saronicos Gulf" (TERRA project) by the Organization of Athens;
- 6. "Integrated Management of Coasts in Kavala" (TERRA project) by the Prefecture of Kavala.

# 3.4.2 Developments by sector

The following actions can be mentioned by sector, as an indication of progress towards integration of mainly environmental considerations in the policies sector.

## 3.4.2.1 Fisheries

The coastal ecosystems of the country are under important pressure due to coastal human activities, which results in reduction of the fish-stocks. For the protection and growth of the fishing resources near the coastal zones, some technical works have been constructed these last years, including artificial reefs.

Thus, in the framework of the operational programme "Fisheries" (E.P.AL. 1994-99), an artificial reef has been placed in the coastal waters of Vistonikos Gulf and a five-year monitoring period has started. At the same time, five feasibility studies have been financed for artificial reefs construction in the coastal waters of the island Kalymnos, the Gulf of lerissos, the Lagoon of Messolonghi, and the estuaries of Alfios, and Preveza. These studies were considered essential to identify the necessity and justify the possibility of construction of other additional artificial reefs for the protection and growth of fishing resources.

In the framework of E.P.AL. 2000-06, and particularly of the measure 3.1 for the protection and growth of fishing resources, the following objectives were identified:

- Protection and growth of fishing resources of 15-kilometre distance from the coast and the increase of local fishing production by 10% in the first five-year period;
- Increase of biodiversity and biomass in the areas of implementation;
- Maintenance of employment in the fisheries field in the areas of implementation beyond the five-year period too.

The achievement of the above objectives was attempted with actions mainly to the areas where the five feasibility studies for artificial reefs were carried out before.

Regarding aquaculture, Greece has a long tradition since the 1960's that was expanded in the '80s with extensive farming in lagoons. Yet, the considerable growth of the sector started after 1985, when the country promoted specific additional programmes making best use of the National and Community incentives policy, the ideal geological/climatic and environmental conditions, the high investment interest, the favorable conditions of the market, the improved related technologies, and the farming techniques. The aquaculture sector has contributed substantially to the reduction of fisheries deficit in Greece. It is of interest to note that aquaculture activities are in place even in regions where a demographic shrinking has been observed and no investment interest exist for other economic activities.

Operators that are interested in aquaculture investments are obliged to present an environmental impact study when applying for a permit, and they have to respect the environmental terms put by the competent authorities for the operation of their units. The current actions in the sector of aquaculture are oriented towards:

- the identification of aquaculture zones in order to minimize any problems due to incompatibility with other uses and activities;
- the promotion of appropriate environmental monitoring techniques, so that the aquatic resources will be protected, maintained, managed and developed in the most effective way and with full respect of the ecosystems;
- the maintenance of the economic and social prosperity of coastal aquaculture regions, as well as the promotion of products of fisheries and aquaculture;
- the maintenance and the increase of employment in coastal aquaculture areas through the support that is provided or the economic and social restructuring of areas that face social-economic difficulties because of changes in the sector of fisheries;
- the support and increase of collaboration between national and international coastal aquaculture regions;
- the local promotion of seafood;
- the reconstitution of the productivity potential in the sector of fisheries.

## 3.4.2.2 Marine transport

The development of a modern network of ports and marine transport system constitute a fundamental condition to ensure the social and economic cohesion of coastal areas. The progress made the last two decades is quite encouraging, since a continuous increase of both passengers and cargo is observed, which is due to the increase of international and domestic tourism, resulting from the economic growth of EU in general and Greece in particular.

Although marine transport is considered to have a smaller environmental impact under normal conditions, in case of an accident the rate of marine pollution can be very high. Before 2000, no harbor was equipped with the necessary installations to prevent and combat pollution. However the modernization and upgrade of the existing harbors, as indicated in the operational programme "Road Axes, Harbours and Urban Growth" (2000-06), included also the construction of the essential "port reception facilities" for oil residues and ballast waters. With the construction and operation of these facilities, the marine environment is considered protected, despite the increase of navigation. Some additional possibilities for the appropriate environmental management of the dangerous and polluting substances and waste, at the ports as well as along the marine transport corridors, are provided with:

- the extension and operation of a National Vessel Traffic Management Information System (VTMIS) and the equipment of ships in order to combat marine pollution,
- the building of infrastructure at Eleusis to store material and equipment for the combating of marine pollution caused by shipping,
- the creation of regional stations for the prevention and combating of pollution, with the essential equipment to this end.

# 3.4.2.3 Tourism

The tourist infrastructure in Greece is developed to an important extent, though it is still characterized by mass tourism as in the passed decades. In the National Strategic Development Plan for the period 2007-2013, part of tourist activities are focused on forms of alternative tourism and agro-tourism, in an effort to achieve the right balance.

The increase of tourist traveling numbers on an annual basis, over the last 20 years, has created new conditions for the management of the touristic development of the coastal regions. This increase combined with the predominance of a model of holidays, which seeks the sun and the sea during the summer period, has transformed many Greek coastal areas and islands into touristic zones. These zones have developed progressively a special type of production and environmental features; everything is directly or indirectly linked with, and even depending on tourism. Sometimes there are negative environmental implications that require high cost interventions and conflicts of land-uses are caused because of the high demand for expansion of tourist activities to new grounds. The high profits offered by tourism, however, attract more and more businessmen to this sector. It is not by chance that in many touristic zones serious efforts have been made in order to introduce a sustainable planning system, with the participation of the local stakeholders, which would take into account the special socio-economic, cultural and environmental features of each respective zone.

## 3.4.2.4 Industry

The last decades are characterized by an increase of the industrial production index and a concentration of industry in bigger units, with more workers and higher production, located mostly along the development axis Patras-Athens-Thessaloniki. This facilitates on one hand their accessibility to the markets, the human resources and the raw materials needed, and occasionally the sea front. On the other hand, in principle, it also allows adaptations to environmental requirements in an easier way.

There are on-going efforts these last years to improve the environmental performance of Greek industries, as reflected also in the National Strategic Plan for Development 2007-2013. Such improvement requires changes in the operation of enterprises at technical and organizational level, as well as at the level of planning of their production.

At the same time, institutional and other types of initiatives are necessary in order to activate appropriate environmentally friendly responses of the market, such as environmental rewards, voluntary agreements, systems of marketing of pollutants etc. The Special Framework for Spatial Planning of Industry pays particular attention to the above-mentioned issues.

#### 3.4.2.5 Environment

The Greek coasts are considered among the cleanest in Europe, as demonstrated by the rates of compliance to the Bathing Waters Directive and the Blue Flags awarded over the several last years (see Chapter 2).

With regard to the protection of marine species and ecosystems, one could recall that Greece has the second bigger biodiversity of superior plants among the EU countries and is characterized by a very high endemism. Furthermore, there is a very important diversity of biotopes and ecosystems, thanks to the rich combinations of marine, coastal and terrestrial habitats. In Greece, there have been identified 109 out of the 244 types of biotopes of the Directive 92/43/EC, 26 of them being of Community priority. It is estimated that the diversity of species has not presented considerable change over the past decade, despite the fact that some individual species face pressure on their population or their habitats. The percentage of threatened fauna species in Greece (22 %) is very close to that of Europe (25 %), while the corresponding percentage of flora species is lower (4 %).

The areas for protection included in the national catalogue of Greece as part of the Community network NATURA 2000 correspond approximately to the 16.5 % of the land surface of the country, a considerable part of which is coastal, while there are also some marine sites. The policy for these areas has favored mild human interventions that allow maintenance of the existing biodiversity. The objectives in this direction were as follows:

- Development and adoption of national strategies for the biodiversity, harmonized with the orientations of the related European strategy;
- Establishment and completion of a national system of management of the protected areas;
- Support to the operation of the first management bodies created for the protection of 27 priority areas, in order to ensure their long-term sustainability;
- Sustainable management of all protected areas and species, including those covered by the Birds Directive (EC Directive 79/409);
- Stopping the loss and protection of the biodiversity;
- Improvement of the state of conservation of ecosystems and of threatened populations presenting an ecological interest;
- Designation and maintenance of natural landscapes of high aesthetic value; Sustainable management of agricultural land and forests.

In accordance with the above objectives, the following actions have been taken:

- Establishment of 42 stations which provide on an annual basis data for the water quality with regard to sensitive aquatic organisms;
- Information actions, including seminars and awareness campaigns at regional level, concerning the protection of threatened species (e.g. Monachus monachus);
- Accounting for Natura 2000 areas, when selecting areas for aquaculture, as well as the potential impacts of the activity on them.

# **3.5 Current coastal strategy**

The problems and development potential of the coastal areas in Greece call for rational management in a perspective of strategic sustainable development. In this scope, the role of spatial planning is meant to be decisive in order to achieve coordination, compatibility of policies by sector, efficiency of infrastructures and at the same time protection of natural resources and ecosystems.

The coastal legislation includes many relevant laws and legal provisions; its sufficiency though is questionable because of its fragmentary approach. It becomes even less effective because of the big number of different services and institutions that are involved with overlapping roles in the planning and implementation of policies and measures concerning coastal areas.

Nevertheless the frameworks for spatial planning that were developed from 2003 to 2009 seem to have contributed to a clearer view of the needs and a more comprehensive approach of the required policies. In particular the ministerial decision for a "Special Framework of Spatial Planning and Sustainable Development of the Coastal Areas" is considered to be the current national strategy of the entire coastal space including both continental coasts and islands. The follow-up special frameworks for spatial planning of industry, renewable energy, tourism, and coastal space, and the regional spatial plans are considered part of an expansion effort and development of the existing strategy.

## 3.5.1 Objectives

The main idea of the Special Framework of Spatial Planning and Sustainable Development of the Coastal Areas was to develop a policy for coastal areas at three levels, national, regional and local.

- At national level there would be orientations and criteria for a further concretization of the policy at different lower-scale levels of management.
- At regional level there would be identification of geographical zones where the policy could be more effectively applied, with more concrete orientations and targets.
- At local level, within specific geographical zones there would be concrete master plans and regulatory measures for management of specific coastal zones,

providing for all relevant policies by sector and land use in a sustainable perspective.

Major purpose of this draft strategy was to identify mid-term actions and policies for inclusion in the national operational programme 2000-2006, so that the Greek coastal areas could be managed in a rational way, sustaining the population and the necessary development activities and protecting, at the same time, the natural resources and ecosystems.

# 3.5.2 Proposed actions

The following specific actions were identified and proposed for funding and implementation:

- 1. Elaboration of Sustainable Development Plans for coastal areas,
- 2. Protection of selected coastal areas as natural and cultural reserves,
- 3. Special actions in selected coastal areas,
- 4. Integrated management of islands
- 5. Pilot projects for the integrated management of coastal areas.

For the promotion of this policy there were two options: either issuing a Ministerial Decision for a Specific Framework on integrated coastal zone management, as mentioned above, or integrating the objectives related to coastal zone management into different policies by sector (i.e. tourism, urban planning, and infrastructure). For a number of reasons, finally the second option was followed. The planning instrument used to cover this need, together with many other objectives, was the set of 12 Regional Spatial Plans developed in the course of 2001-2003 and published after approval in 2003-2004.

Furthermore some priorities were indicated and proposed to be taken into account in the regional spatial plans. They are the following:

- 1. Rational management of coastal agricultural land of high productivity and coastal forest resources, as well as protection and effective management of marine resources;
- 2. Development and promotion of good practices and guidelines for coastal zones management.
- 3. In particular for islands:
  - a. Increase of accessibility,
  - b. Increase of employment opportunities,
  - c. Protection of their natural and cultural heritage;
- 4. Encouragement of "bottom-up" initiatives and active public participation in coastal zone management;
- 5. Establishment of appropriate follow-up mechanisms and monitoring, as well as dissemination of information to the stakeholders.
- 6. Development of training and education programmes covering integrated coastal zone management and marine environment protection.

- 7. Promotion of mechanisms for purchase of land with a long-term development perspective,
- 8. Promotion of agreements with coastal areas users, including industry,
- 9. Promotion of social, economic and fiscal incentives as well as mechanisms of regional cohesion.

As regards further concretisation of measures and more specific planning tools for the implementation of the policy targets, law 2742/1999 provides a number of plans with different scale or scope of application, as appropriate. Such specific planning tools have already been used in a number of cases.

# 3.5.3 Supervision mechanisms

The development of the current coastal strategy was elaborated under the supervision of the National Council of Spatial Planning and Sustainable Development. This council was foreseen by law 2742/1999 and was finally created as a body in 2001 after a ministerial decision. Many authorities and stakeholders are involved in it:

- 1. Different services of the Ministry of Environment, Physical Planning and Public Works,
- 2. Ministry of National Economy:
  - a. General Secretariat of Investments and Growth,
  - b. Directorate General of Public Investments, Regional Policy and Growth,
  - c. Directorate of Regional Policy,
- 3. Ministry of Mercantile Marine,
- 4. Ministry of Culture,
- 5. Ministry of Agriculture:
  - a. Directorate General of Fishery,
  - b. Directorate of Aquaculture,
- 6. Ministry of Development
  - a. Hotels Chamber of Greece,
  - b. Greek Organisation of Tourism,
- 7. Greek Tourist Enterprises,
- 8. Greek Centre of Biotopes and Wetlands (EKBY),
- 9. Association of Greek Urban and Regional Planners (SEPOH),
- 10. Greek Aquaculture Enterprises.

# 3.5.4 Expansion of coastal strategy

Although the Special Framework of Spatial Planning and Sustainable Development of the Coastal Areas was an important development in the field of coastal management, the need for an expansion of the coastal strategy arose soon. Experience implied the need for some actions that would facilitate the implementation of the new plans:

• Further coordination among competent authorities of different levels (ministries, central, regional and local government) and possible redefinition of roles when necessary,

- Use of a combination of means that would facilitate cohesion and integration of the integrated coastal zone management objectives in the policies by sector,
- Developing and use of mechanisms to facilitate implementation of the related provisions included in the Regional Plans,
- Strengthening of co-operation networks of major stakeholders.

In autumn 2005, the Ministry of Environment, Physical Planning and Public Works launched four follow-up spatial studies of national scale. This initiative was influenced by the fact that a national strategic development plan for the period 2007-2013 had started and all spatial plans would have to reflect the global policy options. They would have therefore more chances to be implemented. Those studies are listed below:

- General Framework for Spatial Planning and Sustainable Development (approved in 2008),
- Special Framework for Spatial Planning of Industry (approved in February 2009),
- Special Framework for Spatial Planning of Renewable Energy (approved in December 2008),
- Special Framework for Spatial Planning of Tourism (approved in June 2009).

Additionally to the above, another one study had been considered necessary, the "Special Framework for Spatial Planning and Sustainable Development of the Coastal Space and Islands". This study was just approved in August of 2009.

A great part of the objectives and targets for integrated coastal zone management, as mentioned in the European Commission reports are incorporated in these studies. However it is not known yet if these new legal instruments are sufficient, since they were approved very recently. A new discussion is now expected on possible need for an additional individual instrument for integrated coastal zone management.

## 3.6 Future prospects

The actions scheduled for the next years can be summarized in the following:

- Basic elements of the European Commission recommendation have already been incorporated in the 5 spatial frameworks. It is expected now that the related legislation will be finalized based on the new inserted elements.
- Emphasis is expected to be put on the creation of a Network of interested stakeholders to facilitate dialogue on policy options, consensus and later on implementation of the spatial plans. The Ministry of Environment, Physical Planning and Public Works is in regular contact with other competent Ministries, Regions, the scientists' network HENCORE and other non-governmental organizations to this end. Information meetings are organized on several occasions in order to better disseminate related information.
- Based on the outcome of the 5 spatial frameworks, the Ministry of Environmental, Physical Planning and Public Works will decide if there is necessity for:

- An update of the 12 regional plans,
- A specific framework plan for integrated coastal zone management,
- Special mechanisms to allow for more effective implementation of the coastal management provisions

#### 4. DATABASE DEVELOPMENT

#### 4.1 Database aspects

An important step in the building up of a database is the identification of the kind of information that will be contained in it. This information has to be directly connected with the needs of its users in order a high degree of utility to be ensured. It is therefore important to identify the possible users of such a database, and the coastal issues in which they would be interested. Given the role that this database is meant to serve, which is the contribution in the effort for an integrated coastal zone management in Greece, the most probable users are mainly members of the decision-making bodies, which are ministries, local and regional authorities, as well as non-governmental organizations. Other possible users are coastal researchers, consultants and contractors of coastal structures, different stakeholders with private interests in a particular coast, such as hotel owners, or other civilians interested from a tourist point of view.

#### 4.1.1 Coastal issues

As mentioned before, this database is determined to facilitate the processes that are required for the realization of integrated coastal zone management of the Greek coasts. For this reason its development needs to be based on the main issues that concern coastal management in Greece. As issues of priority for the coastal management are meant the vital economic activities that take place on the coasts, as well as the major coastal problems that are associated either with human activities or with physical phenomena.

The totality of those issues has been thoroughly presented in chapter 2. Not all of them though have been taken into account for the database set-up. A selection of issues has been made, based on their importance and consequently on their effect to the policies followed. The selected coastal issues are listed below:

- Tourism,
- Marine transport,
- Fisheries,
- Agriculture,
- Industry,
- Urbanization.

It is important to mention that the structure of the database should be flexible and functional enough to allow for future expansions also. This means that the information given has to be structured in a way that allows the insertion of more issues in the future, if necessary.

# 4.1.2 Coastal classification

In order to ensure the functionality of the database, a primary classification of the Greek coasts was necessary, which would indicate the special characteristics along the length of each coast. As coast in the database, is defined a piece of the Greek coastline, which has mutual physical and social-economic characteristics. For this reason the classification made is both physical and social-economic. Although it would seem more sensible the coasts to be classified separately for their physical and their social-economic characteristics, there is not such a distinction in the database, which proved to be more functional when only one classification is made, which determines the kind of coastal details that need to be specified in the very next step.

Thus the coast types that have been identified are the following:

- Beach fronting rock,
- Beach fronting soil,
- Rock coast,
- Soil coast,
- Port or marina,
- Wetlands.

In the four first coast types of the above classification there is information given for the existence or not of beach in combination with the background material. This combined information is important for the understanding of coastal processes that are taking place in the area of interest. Particularly the background material in a beach gives information about the erosion trends of the area, and the possible coastal protection solutions.

As mentioned before, this primary classification refers only to the characteristics along the coastline of interest, and therefore no information about the surrounding area is given. This information, which mainly concerns the surrounding human activities, is given in a later stage, since practice has proved that this way is more functional.

# 4.1.3 Coastal details

Every coast inserted in the database is accompanied by a number of coastal details. The information included in the coastal details can be categorized in the following fields:

- Basic information,
- Physical aspects,
- Hydraulic aspects,
- General aspects,
- Economic activities.

The majority of these details are common for all the coasts. There are though a number of details contained in the basic information and the physical aspects that vary in the different coast types. This is due to the differences by nature among some of the coast types. For instance it would be impossible to present the same aspects for a rocky coast and a marina.

The information that lies under each one of the above mentioned fields is presented in the following paragraphs.

## 4.1.3.1 Basic information

The basic coastal information consists of the following fields:

- *Coast id*: this is an increasing number that is given automatically to every new coast inserted in the database. This number is of high importance, because it is unique for each coast, and constitutes its identity. It gives therefore the possibility to discriminate any single coast, even if it has the same name with others.
- Coast name: the name that is commonly used for the referred coast,
- Municipality: the municipality in which the referred coast belongs,
- *Prefecture and Province*: the prefecture and the province in which the municipality of the relative coast belongs,
- Coordinates: the latitude and longitude of the referred coast,
- *Coast type*: this is the type of coast, as presented in the paragraph of coastal classification above,
- *Wetland type*: applicable only to wetlands,
- *Port type*: applicable only to ports.

## 4.1.3.2 Physical aspects

As mentioned before, the physical aspects vary slightly among the different coast types. The totality of physical aspects is presented below:

- Length: this is the main physical aspect, which is also common in all coast types,
- *Width*: applicable only to beaches,
- Grain size: applicable only to beaches.

## 4.1.3.3 Hydraulic aspects

The information contained in this field is mainly useful for hydraulic engineering matters in the area, or for navigation. The hydraulic aspects consist of the following fields:

- Wind speed: the maximum average wind speed in the area,
- Wind direction: the dominant wind direction of the area,
- *Wave height*: the significant wave height of the area.

## 4.1.3.4 General aspects

The information contained in the general aspects concerns the existence or not of some particular characteristics in the area that surrounds the coast of interest. The limits of the surrounding area of the coast are considered in the database identical with the limits of the dynamic coastal zone, as it is defined in the Special Framework for Spatial Planning of Coastal Areas and Islands that was approved in August 2009 (see figure 4.1). Since the general aspects concern the existence of particular characteristics, they are given only with "Yes/No" fields, except from the field of artificial protection where the type of the protection is also defined (if existing). They consist of three fields:

- *Urbanized areas*: existence or not of urbanized areas in the inland critical and dynamic zone,
- *Accessibility*: existence or not of connection by road of the coast with the inner land. This is mainly applicable to beaches and ports.
- Artificial protection: type of artificial coastal protection, if there is one.



Figure 4.1: Coastal zones and boarders of surroundings as defined in the database

# 4.1.3.5 Economic activities

Similarly to the general aspects, the field of economic activities concerns the existence or not of certain economic activities in the surrounding area of the coast of interest. The economic activities contained here are the following:

- Fishing,
- Industry,
- *Tourism*: existence or not of tourist infrastructure such as hotels and recreation areas in the surroundings,
- Aquaculture,
- Agriculture.

## 4.2 Database description

The database consists of two parts, an internal and a public one. The internal part can be used only by the database administrators, and it contains all the codes of which the database is structured, as well as the information that is already registered in the database. The public part is the online version of the database, which is accessible by anyone. These two parts are described in the following paragraphs.

## 4.2.1 Internal part

The two milestones in the development of the database are first the selection of the information that needs to be contained, and second the internal structure of the database. All the information given in the database has to be structured in a way that facilitates not only its regular use, but also the procedure of populating it, mostly in a sense that duplicate insertion of information is never needed. Furthermore, the internal structure has to be so that does not burden possible future expansion of the database.

In order the above requirements to be met, the structure has to provide the possibility of automatic insertion of information, and to minimize the need for manual insertion, which increases the probability of typing errors. This is achieved with the creation of smaller databases, or lists of data that can provide automatically their information to the coast database, since they contain standard information which can be considered fact and does not vary among the different coasts.

An example of smaller database that is used by the main database is the one that contains all the coastal municipalities of Greece. Every municipality has a municipality id in correspondence to the coast id of the main database. The data included in this database are only the prefecture and province in which the municipality belongs. This way, the only information that has to be given in the coast database is the municipality in which a coast belongs. Then the system knows automatically the prefecture and province of the coast. As for the lists of data, they are useful in the data fields that can only take certain values, such as the coast type that takes only six values or the artificial protection that takes only three values.



A diagram of the internal structure of the database, as it was made during its development can be seen below.

Figure 4.2: Internal structure of the database

## 4.2.2 Public part

The public part of the database consists of five online pages. Three of them are for the common use by anyone who is interested to the Greek coasts, while the rest is made for those who are going to update or correct the database. These pages are presented below.

## 4.2.2.1 Selection page

The selection page constitutes the home page of the database. It gives the possibility to users, either to print a list with all the coasts existing in the database, or to make an advanced selection and print only coasts with some mutual characteristics. The advanced selection can be done according to the following characteristics:

- Coast type,
- Prefecture of the coast,

- Province of the coast,
- Existence or not of fishing activities,
- Existence or not of industries,
- Existence or not of agriculture,
- Existence or not of aquaculture,
- Existence or not of tourist infrastructure and activities,
- Existence or not of urbanized areas.

A print of the selection page can be seen in the figure below.

Selectio	on page	of Greek TUDelft
Selectico Select your coast type: prefecture: province fishing: industrial: aquaculture tourism: urbanized:	an page	force to be additional of the prevention of the prime of the prima of the prime of the prime of the prime of the prime of the prim

Figure 4.3: Selection page

## 4.2.2.2 Overview page

This is the second page of the database. It opens when a selection is made in the home page and it gives an overview with all the coasts that obtain the selected characteristics. If no selections have been made in the home page, then an overview of all the coasts existing in the database is given. In every listed coast of this page there is a hyperlink that opens the coastal details page.

A print of this page with an overview of the totality of coasts can be seen in the following figure.

1    Kalamaria    Thessaloniki    solic cost      2    Eastoomi    Eparomi    Thessaloniki    beach fronting soil      3    Presa    Michaniona    Thessaloniki    port or marina      4    Presa    Michaniona    Thessaloniki    port or marina      5    Michaniona    Rethyno    beach fronting soil    fishing      6    Dammoni    Foinikas    Rethyno    beach fronting soil    marina      7    Suuda    Foinikas    Rethyno    beach fronting soil    marina      2    Achia Extenii    Arkadi    Rethyno    beach fronting soil    delta      2    Achia Extenii    Akida    Rethyno    beach fronting rock    delta      2    Achia Extenii    Akida    Rethyno    beach fronting rock    delta      2    Achia Extenii    Akida    Rethyno    beach fronting rock    delta      2    Achia Extenii    Akida    Rethyno    beach fronting rock    delta      2    Achia Extenii    Akida    Rethyno    beach fronting rock    delta      2    <	Image: section of the section of t	Kalamaria      Kalamaria      Thessaloniki      solito        Enonni      Epononi      Thessaloniki      beach fronting soil      http://www.solito.com//www.solito.co	ı İ	coastname	Municipality	Prefecture	Coast type	Port/wetland type
Epanomi    Epanomi    Thessaloniki    beach fronting soil      Prima    Mikra    Thessaloniki    beach fronting soil      Blakas    Foinikas    Rethyno    beach fronting soil      Damnoni    Foinikas    Rethyno    beach fronting soil      Souda    Foinikas    Rethyno    beach fronting soil      Abha fotsini    Arkadi    Rethyno    beach fronting rock      Abia fotsini    Arkadi    Rethyno    fibrabia arkadi arkadi arkadi arkadi arkadi arkadi	Epanomi Prima      Epanomi Mikra      Thessaloniki Thessaloniki beach fronting soil      Fight period pe	Epanomi Prena Michaniona      Epanomi Michaniona      Thessaloniki Michaniona      beach fronting soil        Alkas Michaniona      Michaniona      Thessaloniki Damoni      Denot or marina      fishing        Alkas Damoni      Foinikas      Rethyno      beach fronting soil      marina        Souda      Foinikas      Rethyno      beach fronting rock      marina        Ablas Totini      Arkadi      Rethyno      beach fronting rock      marina        Ablas Totini      Arkadi      Rethyno      beach fronting rock      deta		Kalamaria	Kalamaria	Thessaloniki	soil coast	
Persa      Mika      Thessaloniki      beach fronting soll        Michaniona      Michaniona      Thessaloniki      pott or marina      fishing        Plakias      Foinikas      Rethyno      beach fronting soll      marina        Qamnoni      Foinikas      Rethyno      beach fronting soll      marina        Souda      Foinikas      Rethyno      beach fronting soll      marina        Achai Soteini      Arkaid      Rethyno      beach fronting rock      delta	Persa      Mika      Thessaloniki      beach fronting soll        Michaelona      Michaelona      Thessaloniki      port or marina      fishing        Plakias      Foinikas      Rethyno      beach fronting soll      marina        Quannoni      Foinikas      Rethyno      beach fronting soll      marina        Social      Foinikas      Rethyno      beach fronting soll      marina        Actios      Rethyno      beach fronting soll      marina        Actios      Rethyno      beach fronting soll      marina        Actios      Rethyno      beach fronting soll      delta	Persa      Mitca      Thessaloniki      beach fronting soll        İhkaiso      Michaelona      Michaelona      Thessaloniki      port or maina      fishing        İhkaiso      Foinikas      Rethyno      beach fronting soll      maina <u>Damoni</u> Foinikas      Rethyno      beach fronting soll      maina <u>Socia</u> Foinikas      Rethyno      beach fronting soll      maina <u>Socia</u> Foinikas      Rethyno      beach fronting soll      maina <u>Achala Socia</u> Rethyno      beach fronting soll      maina <u>Achala Socia</u> Achala      Rethyno      beach fronting soll      maina		Epanomi	Epanomi	Thessaloniki	beach fronting soil	
Mitchanions  Mitchanions  Thessolick  pottor marina    Plakas  Folnikas  Rethyno  beach fronting soll    Damoni  Folnikas  Rethyno  beach fronting soll    South  South  Rethyno  beach fronting soll    Agbla forfilm  Arkadl  Rethyno  beach fronting rock    Agbla forfilm  Arkadl  Rethyno  beach fronting rock	Michaniona  Michaniona  Thesa Jonkia  pot or marina  fishing    Plakkas  Foinkas  Rethyno  beach fronting soil     Souda  Foinkas  Rethyno  beach fronting soil     Advis  Foinkas  Rethyno  beach fronting soil     Advis  Rethyno  beach fronting soil  marina    Advis  Advis  Rethyno  beach fronting rock	Michaniona  Michaniona  Thesa Jonkia  port or marina  fishing    Pikkias  Foinikas  Rethyno  beach fronting soil  interpretain		Perea	Mikra	Thessaloniki	beach fronting soil	
Pickas  Folnkas  Rethyno  beach fronting soil    Damonin  Folnikas  Rethyno  beach fronting soil    Souds  Folnikas  Rethyno  pot or marina  marina    Addital Folenitii  Arkadi  Rethyno  beach fronting rock    Adois  Rethyno  beach fronting rock  detta	Pickag  Folkag  Rethyno  beach fronting soil    Damonia  Folkag  Rethyno  beach fronting soil    Soutig  Folkag  Rethyno  pot or marina  marina    Agbita foteini  Arkad  Rethyno  beach fronting rock  deta	Pickas  Folkas  Rethyno  beach fronting soil    Damonia  Folkas  Rethyno  beach fronting soil    Souds  Folkas  Rethyno  pot or marina  marina    Action  Action  Rethyno  beach fronting rock  deta    Action  Action  Rethyno  beach forting rock  deta		Michaniona	Michaniona	Thessaloniki	port or marina	fishing
Damoni Sauda  Folnikas Folnikas  Rethyno Rethyno  Deach fronting soil port or mainal beach fronting rock    Aghla fotelini Cables  Arkos  Rethyno  beach fronting rock  dela	Damoni  Folnkas  Rethyno  beach fronting soll    Souds  Folnkas  Rethyno  port or marina  marina    Addia foliati  Addia  Rethyno  beach fronting rock  marina    Addia foliati  Addia  Rethyno  beach fronting rock  delta	Damoni  Foldwas  Rethyno  beach fronting soil    Suid State	( )	Plakias	Foinikas	Rethyno	beach fronting soil	
Souda  FolMas  Retro  pot or marina  marina    3  Adhie Extension  Akada  Retro  beach fronting rock  delta	Souda      FoldMas      Rethyno      pott or marina      marina        a Adhia Education      Addia State      Rethyno      beach fronting tock      addia        3      Axios      Thesseloniki      wetland      dela	Souds  Foldward  Retryno  pot or marina  marina    Addha Foldmini  Arkadi  Retryno  beach fronting rock  a    Addia  Addia  Thessaloniki  wetland  delta	3	Damnoni	Foinikas	Rethyno	beach fronting soil	
Aghin      Arkadi      Rethyno      beach fronting rock        Adios      Adios      Thessaloniki      wetland      delta	Agains      Arlandi      Rethyno      Beach fronting rock        Autos      Avios      Thessaloniki      wetland      delta	Aghin      Arkadi      Rethyno      Beach fronting rock        Adios      Avios      Thessaloniki      wetland      delta		Souda	Foinikas	Rethyno	port or marina	marina
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Figure 4.4: Overview page

#### 4.2.2.3 Details page

This is the third page of the database, and contains details about all the coasts registered in the database. The kind of information that is contained in this page has been presented in paragraph 4.1.3. In addition to that information, there is also a picture of the coast contained, as well as two hyperlinks. The first one, placed on the top of the page opens a Google map with the corresponding coast. The second one is placed on the bottom of the page and opens the references that have been used for filling in the information in the page. The references can be electronic sources, scientific papers etc.

A print of this page is given below.



Figure 4.5: Details page

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#### 4.2.2.4 Correction and update page

This page is used for the expansion, correction and generally update of the database. The index page of the section is shown below.

Correction page	of Greek TUDelft
Add a new record	Add new record
Data correction of record	Change database record
Add reference (url) to coast	Add urt
Add reference (file) to coast	Add file
Add picture to coast	
	Browse
This dictabase is prepared by Viona Tamopouk published by third parties and no responsibility	us and Anesis lixings as part of ther MCs asymmetric at TU Doffs. The distabase is usiger to regular spatiating as information becomes available, however the development and maintenance of this distabase relies primarily on information supplied or som be taken for the occurrery of data supplied.

Figure 4.6: Correction page

Firstly, it provides the opportunity to add a new coast record, filling all the relative fields. A number of fields can be filled with the use rolling lists. A view of this page is given below.

Input page		of Greak TUDelft
Input screen		
name:		
municipality:	unknown -	
type:	unknown	•
port type:	unknown -	
wetland type:	unknown -	
lattitude (degr.):		
longitude (degr.):		
scale factor:		
length (m):		
width (m):		
grain size (mm):		
wind direction:	unknown -	
wind speed (m/s):		
Hs (m):		
fishing:		
industrial:	-	
agriculture:		
aquaculture:	*	
tourism:		
urbanized:		
access:	· ·	
protection:	unknown -	
	Submit	
This database is prepa published by third part	red by Vana Tsimopoulou ties and no responsibility c	and Anestis Loutes as part of their AIS: assignment at TU Deff. The database is subject to regular updating as information becomes available, however the development and maintenance of this database relies primarily on information supplied or an be taken for the occurrocy of data supplied.

Figure 4.7: Input page

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Next, from the main correction page the user can modify an existing coast record with the help of the Data correction page which presents the current details and provides the possibility to change them. Next, a screenshot of such a page is presented.

Figure 4.8: Update page

Finally, from the main page of this section, the user has the possibility to enrich the database by adding references (url addresses or files) and pictures.

#### **5. CONCLUSIONS**

The conclusions coming up with this project can be summarized as follows:

- 1. Coastal zone management is of great importance for Greece mainly due to the vital economic activities that are allocated on the coastline. The Greek economy depends directly on the state of the national coast. Although there is a continuous effort towards a better coastal management, the current policies have not proved sufficient, while the new proposed policies seem to have difficulties in implementation. Moreover there is no national integrated coastal zone management. In order to facilitate the implementation of policies and to make a rational step towards integrated coastal zone management the development of a database of the Greek coasts is proposed.
- 2. A prerequisite for utility of the database tool is that its content is constituted by valuable data for the possible users, who can represent decision-making bodies, other stakeholders with private interests or common civilians. For this reason, the building-up of the database has to be based on the major coastal issues in Greece, which are both coastal problems related to environment or human activities, and the vital coastal economic activities.
- 3. It is essential that the internal structure of the database provides its functionality, in a sense that it facilitates:
  - the regular use by the public,
  - the enrichment of its records,
  - its possible future expansion.

This is achieved by the provision of automatism in the process of insertion of new data in the database.

- 4. At the moment only some indicative records are included in the database. Populating the database is out of the scope of this project. An online input page has been created instead, which allows this procedure to be elaborated in the future by other parties.
- 5. The role of this database is to operate as a coastal management tool for the Greek coasts. This role can merely be served once it has been populated and contains sufficient information for the majority of Greek coasts. It is therefore recommended that this task is undertaken in the near future.

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