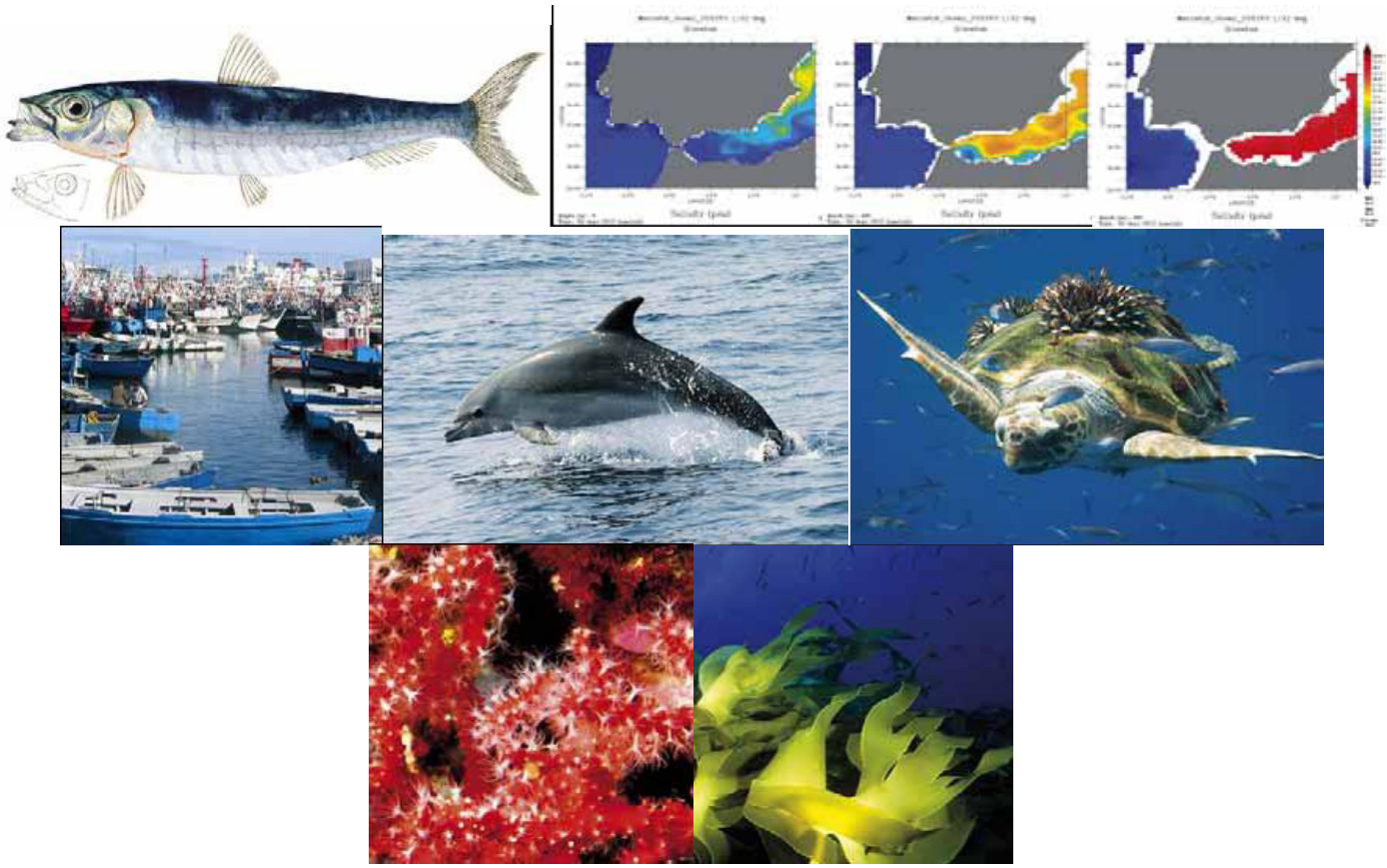
Conservation and sustainable development of the Alboran Sea



UNIÓN INTERNACIONAL
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Las actividades del Centro de Cooperación del Mediterráneo están financiadas principalmente por:

GOBIERNO DE ESPAÑA
MINISTERIO DE MEDIO AMBIENTE Y MEDIO RURAL Y MARINO

JUNTA DE ANDALUCIA
CONSEJERÍA DE MEDIO AMBIENTE

málaga.es diputación
medio ambiente y articulación territorial

Cover photographs:

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The publication of this document has been made possible thanks to the financial support of the Malaga Provincial Council.

Published by:
IUCN, Gland, Switzerland and Malaga, Spain.

Citation:
Robles, R. (2010). *Conservation and sustainable development of the Sea of Alborán / Conservación y desarrollo sostenible del mar de Alborán / Conservation et développement durable de la mer d'Alboran.* Gland, Switzerland and Malaga, Spain: IUCN.

ISBN:
978-2-8317-1254-3

Layout and printing:
Multiprint, MC 98000 Monaco.

Produced by:
IUCN-Mediterranean Cooperation Centre

Available from:
IUCN-Mediterranean Cooperation Centre
c/ Marie Curie 22
29590 Campanillas, Malaga, Spain
Tel: +34 952 028430
Fax: +34 952 028145
http://www.iucn.org/Mediterranean

Or

IUCN (International Union for the Conservation of Nature).
Publication Service
Rue Mauverney 28
1196 Gland, Switzerland
Tel: +41 22 999 0000
Fax: +41 22 999 0020

books@iucn.org
www.iucn.org/publications

There is a catalogue of IUCN publications.

This book is printed on ecological paper.

malaga.es diputación
environment and territorial planning

Conservation and sustainable development of the Alboran Sea

Strategic elements for its future management

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May 2010

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ABOUT THE IUCN

The International Union for the Conservation of Nature (IUCN) helps to find pragmatic solutions worldwide to the problems and challenges of the environment and development.

The IUCN works in the field of biodiversity, climate change, energy, human development and the green economy with the support of scientific research, projects on the ground all over the world and with the involvement of governments, NGOs, the United Nations and the private sector for the implementation of policies, laws and good practices.

The IUCN is the world's largest, most experienced environmental organisation and its members include over 1,000 governments and NGOs, as well as 11,000 expert volunteers in more than 160 countries. The work of the IUCN is backed up by over 1,000 employees in 60 offices and hundreds of partners in the public and private sectors and NGOs all over the world.

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The document that you have in your hands is a process, a scientific, social and environmental journey of cooperation through the Sea of Alborán. The cooperation that led to this report has been going on for almost three years and the new proposals, ideas and projects have enriched the final product, the process and all of the participants.

This process commenced in 2007, when a number of Spanish and Moroccan experts, institutions and organisations (joined later by Algeria), began to prepare this document, "Conservation and sustainable development of the Sea of Alborán", which has been refined and updated with the information contributed. We hope that it will bring us closer to identifying strategic elements for the future management of this eco-region.

This book, produced in May 2010, is not intended as a closed, final document. On the contrary, it aims to establish visions, experiences and actions which we today believe to be essential and which will be enriched by all of those involved in the day-to-day work in this environmental hotspot of the planet.

If your organisation, activities or projects are included, we are grateful and it is thanks to the joint north-south cooperation of the many experts who have been involved. If not, we apologise, and we would ask you please to send us information about your experiences through the channels provided.

We should like to thank each one of the participants for their valuable contributions and collaboration, especially Oceana and Arnitak for the photography, Maurizio Würst for his drawings and the Natural History Museum of Nice for the Fossat watercolours.

Lastly, this book would not have been possible without the support of the Malaga Provincial Council.

An electronic version of the document, complete with annexes, can be found at:

http://www.iucn.org/es/sobre/union/secretaria/oficinas/med/iniciativas/alboran/

Contents

FOREWORD

In 2006, the International Union for the Conservation of Nature (IUCN) decided to start an initiative with the aim of achieving better conservation and sustainable development in the Sea of Alborán. The long term objective of this analysis is to create the conditions and to construct the basis required for the establishment of co-ordinated management in the Sea of Alborán in the future.

The Malaga Provincial Council adopted the idea and gave strong support, contributing funds both for the performance of the most complete analysis possible of current knowledge about and the actions being taken in the Sea of Alborán and also in order to organise the necessary working meetings on the subject. The *Agence de Développement de l'Oriental* joined in these endeavours.

The Malaga Oceanography Centre, part of the Spanish Institute of Oceanography (IEO) and the National Fisheries Research Institute (INRH) soon joined the initiative, contributing their knowledge and long experience in the field.

The consultant who was considered most appropriate for the task was hired to draft the basic document with an analysis of the current situation in the Sea of Alborán, with two fundamental, immediate objectives:

a) To produce an initial document that would gather all of the available information from Spain, Morocco and Algeria, which is not abundant and is very dispersed. This document would identify the players involved in the sustainable development of the Sea of Alborán and its environment, and also the projects of interest for international cooperation currently under way (analysing their degree of development, objectives and managers). In addition, as far as possible, an attempt was to be made to evaluate the status of the implementation of the recommendations made in the different projects. It was also agreed that the bibliography would merely be indicative.

b) On the basis of said document, meetings were to be organised between specialists and managers in order to carry out a critical analysis of the situation today in the Sea of Alborán and its environment in the form of a proposal for improvements for the future and to submit an action plan to achieve those improvements to the IUCN and other stakeholders.

A small coordination group was created among the parties involved in order to ensure regular monitoring of the work[1]. The result is this document, which was offered for discussion and improvement at the 1st International Meeting on the Conservation and Sustainable Development of the Sea of Alborán held in Malaga in November 2007, with the participation of all the stakeholders (administrations, scientists, NGOs, the fisheries sector, etc).

Since that 1st Meeting, a summary leaflet has been produced and submitted to the world conference of the IUCN (Barcelona, October 2008) and a 2nd Meeting was held in Morocco (Oujda, April 2009), whose purpose was to progress:
- In the exchange of data between the players and stakeholders in the Sea of Alborán,
- In the identification of the most urgent problems and possible solutions at regional level,
- In the identification and debate of the priorities to be followed in order to improve management and governance of the zone,
- In considering the possible launch of an Alborán Action Plan which would include the measures to be taken, especially the creation of an Observatory, all of which is included in the Oujda Declaration.

[1] The group consisted of: François Simard and Andrés Alcántara (IUCN), Juan Antonio Camiñas (IEO), Saturnino Moreno (Malaga Provincial Council), Mohamed Najih and Abdellatif Berraho (INRH) and Rafael Robles (consultant)

DECLARATION OF OUJDA, ON THE CONSERVATION AND SUSTAINABLE DEVELOPMENT OF THE REGION OF THE ALBORAN SEA AND ITS COASTAL AREA (18 APRIL 2009)

The participants at the 2nd International Meeting on the Conservation and Sustainable Development in the region of the Alboran Sea, held in Oujda from 16 to 18 April 2009, from Algeria, Spain, Morocco and international organisations, jointly organised by the IUCN and the INRH, with the support of the Agence de Développement de l'Oriental and the Malaga Provincial Council:

Recalling the 1st Alborán Meeting, held in Malaga in November 2007;

Underlining the specificity of the Alborán region as a land and marine space which requires integrated treatment;

Recalling the leading role of the Sea of Alborán for all of the Mediterranean and its influence in the Atlantic zone;

Bearing in mind the biological diversity and wealth of the Alborán region, and its vulnerability;

Aware that the wealth and diversity of the cultural heritage of the region, the social, economic and political diversity and differences in the region of the Alborán;

Aware also of the social and economic importance of the activities which take place in the region of the Sea of Alborán and its coastal areas for its development;

Considering the importance of communication, the exchange of information and knowledge and the visualisation of actions as essential aspects of sustainable development in the region;

Considering the aspects of governance related to conservation and sustainable development of the Alborán region at regional and international level and wishing to increase collaboration and coordination with national and international organisations active in the Mediterranean;

Convinced of the need to ensure sustainable development in the Alborán region on the basis of an the ecosystem approach and considering the environmental services which it provides, this represents an opportunity for the conception of appropriate, innovative projects which take into account the protection of the environment and of biodiversity;

Convinced of the importance of education, and awareness regarding conservation and economically viable, socially equitable and environmentally acceptable development in the Alborán region, through educational projects at regional level;

The participants in the Second Meeting on Conservation and Sustainable Development in the Sea of Alborán

RECOMMEND

- the improvement of the integration and visibility of the Sea of Alborán in the processes of governance in the Mediterranean, in particular, as regards the Convention for the Protection of the Marine Environment and of the Coastal Region of the Mediterranean (Barcelona Convention);
- To bring into operation, a system for the regular, reliable exchange of information, which includes all of the relevant indicators on the use of the marine and coastal environment;
- The development and harmonisation of appropriate methodology for the integrated management of coastal zones, on the basis of an ecosystem approach, taking into account the characteristics of the Alborán and previous experience in this field in coastal regions;
- The consolidation of the existing network of protected areas in coastal and marine zones; the identification and creation of new protected areas; the restoration of habitats, in order to protect the integrity of the Alborán region and in order to the sustainability of human activities carried out in it;

- The promotion and reinforcement of cooperation at all levels for the conservation and sustainable development of the Alborán region;
- The creation of a focus of research and knowledge on marine biodiversity, including cutting-edge projects based on research, conservation, ecosystem management, information, education and awareness on the basis of the integration of experience in different countries;
- The creation of multidisciplinary working groups on priority aspects related to the conservation and sustainable development of the region and the preparation of an Action Plan for the Alborán;
- The creation of the "Alborán Sustainable Development Network" to support a permanent surveillance system in the form of an observatory of conservation and sustainable development in the Alborán region.

The Oujda meeting was made possible thanks to the support of the Agence de Développement de l'Oriental of Morocco.

In view of the foregoing, the participants at the 2nd Alborán Meeting

INVITE

The competent national and international organisations to consider specific initiatives which promote the above strategic actions for the conservation of the ecological values and the sustainable economic exploitation of the resources of the region of the Sea of Alborán and its coastal zones.

The existing Organisation and Coordination Committee led by the IUCN was also enlarged[2], with the aim of facilitating contact between decision-makers, capturing funds for the planned activities, ensuring good communication and external visibility, creating a website, etc. Some of the specific working groups have already been set up and the publication of a hard copy of the first document has been decided.

The first working groups created are:

- Biodiversity: development and conservation,
- Exploitation of sand and integrated coastal zone management,
- Mitigation of risks for cetaceans and other protected pelagic marine species,

Fisheries and Aquaculture were considered issues to be addressed at a later stage.

[2] The organisers were joined by: Alain Jeudy de Grissac and María del Mar Otero (IUCN), Jaime Rodríguez (UMA), Ricardo Sagarmínaga (Alnitak), M'Hamed El Ahdal (INRH), Youssef Bahetta (Agence Oriental), Driss Nachite (University of Tetouan), Larbi Sbaï (DPM) and Ignacio Fernández (consultant)

All of the aspects related to the updating of the information used until now, particularly that related to legislation, were considered a transversal issue which should be applied in all of the working groups.

In the period between the two Meetings (2007-2009), and as conceptual support for this document, Professor Jaime Rodriguez and his collaborators (University of Malaga) proposed the preparation of an ecosystem approach to the conservation and sustainable development of the Sea of Alborán. The document reflects that conceptual model, which can be summarised as follows:

"Today it is widely accepted that regional policies for the protection and conservation of the environment should be based on an ecosystem approach. This approach contemplates the structural and functional integrity of ecosystems as a framework for the conservation of biodiversity and for the production of the goods and services generated therein. In order to consider this level of ecosystemic organisation, the main compartments and processes that characterise the structure and operation of the ecosystem in question, in this case, the Sea of Alborán, must be identified. In this article, those compartments and processes are organised around the four fundamental components of all marine ecosystems: physical forces, chemical forces, ecological processes of material and energy flows and flows of species or biodiversity. In coherence with the principle of sustainability which is the objective of this article, each sub-model includes the anthropogenic processes (driving forces or impacts), which affect the natural compartments or processes. The conceptual model resulting from the coupling of these components could be a useful tool for the development of conservation, protection and sustainable development initiatives on a regional scale".

1. Introduction

The Sea of Alborán is a unique marine space: it is the entry and exit to the Mediterranean Sea and the point of contact between Africa and Europe. It is also an obligatory route of passage for numerous migratory land and marine animals and the sea route for maritime transport between the Atlantic and the Mediterranean. There is no doubt that it is a very important area from the geopolitical, strategic and scientific point of view. Furthermore, given the importance of its ecosystems and its biodiversity, it can be considered the dynamic motor of biodiversity in the western Mediterranean. For all of these reasons, it is a zone which deserves special protection and good management.

To ensure the conservation of biodiversity and the sustainable use of its resources, it is necessary to draw up and put into practice a management plan coordinated between the countries on its shores, that is, Spain, Morocco and Algeria, which should include key elements such as Integrated Coastal Zone Management (ICZM) and Protected Marine Areas (PMAs) for the conservation of species and resources.

2. Context of the Alboran Sea in the Mediterranean

2.1 FEATURES OF THE ALBORAN ECO-REGION

a) Natural characteristics

There are some generally accepted limits[3] to the Sea of Alborán, which are the Straits of Gibraltar (Tarifa) and a line from Cabo de Gata (in Almería, Spain) to Cape Fegalo in Oran (Algeria). Altogether, the stretch of coast on the northern shore (from Gibraltar to Cabo de Gata) is some 570 km long. In the south, the coastal strip in Morocco (from Tangiers to the Algerian border) is 540 km long, to which must be added some 120 km of the Algerian coast as far as Cape Fegalo, plus the islands and islets (Isle of Alborán, Chafarinas Islands, etc). The total surface area is of the order of 57,000 square kilometres. It is the ante-room or the transition between the Mediterranean Sea and the Atlantic Ocean, where oceanic masses of water of different salinity and temperature meet. It can be considered the hydrological motor of the western Mediterranean. The shallowness of the Straits of Gibraltar, less than 300 m in the Camarinal Sill, is a fundamental topographical feature in the functioning of the marine ecosystem of the Alborán Sea.

The microplate, or Alborán Plate, has a very thin cortex due to the different processes of extension, which have led to igneous manifestations and gave rise to volcanic processes in the zone.

The continental shelf is narrow, marked by submarine canyons and a rocky bottom. It is crossed by a dorsal mountain range in a south-west to north-east direction of some 150 km in length (between Al-Hoceima and Cabo de Gata), creating a western basin and a southern basin from which the Isle of Alborán emerges. The Cabo de Gata mountains (Almería), which are volcanic, are a distinctive element which, together with the rest of the volcanic features of south-east Spain, are intimately related in their origins to the Alpine fold and the formation of the Alborán Plate.

Box 1

Context of the Sea of Alborán in the Mediterranean

The Mediterranean is essentially a relic of the great Sea of Tethys, which, from about 135 to 50 million years ago, separated Laurasia in the north (the Eurasian and North American tectonic plates) from Gondwana in the south (African and South American tectonic plates). The Sea of Thetys was an equatorial sea which circled the planets and which communicated what are today the Atlantic and Indian Oceans. The northward movement of the African plate and its collision with the Eurasian plate gradually closed off part of the Sea of Thetys, finally creating the Mediterranean Sea, in the Miocene (some 10 million years ago). In reality, the Mediterranean Sea, as we know it today, was not formed until the Messinian salinity crisis was overcome and the Straits of Gibraltar opened, allowing water and life from the Atlantic to flow in during the Pliocene, (some 5 million years ago), culminating in the elevation of the Rock of Gibraltar (about 1 million years ago), giving rise to the current circulation system.

The role of the tectonic plates, together with climate change, has been fundamental in determining the biodiversity of the Mediterranean. The main physical consequences of the collision of the African and Eurasian plates, causing the African plate to be subducted beneath the European plate, were:

- the creation of a virtually closed sea, the Mediterranean, with a total surface area of some 3 million km², connected to the Atlantic Ocean by the Straits of Gibraltar, some 15 km wide and with a maximum depth of

[3] Taking into account the complex, variable hydrology of the Sea of Alborán, these limits very over time and space depending on the wind and currents, the Exchange between deep and surface waters and the mix of Atlantic and Mediterranean waters.

350 m, with temperate deep waters (around 13° below 200 m in depth), characterised by its high salinity and high oxygen content.

- the elevation of mountains along the northern coast (Sierra Nevada in Spain, the Pyrenees between Spain and France, the Alps in France, Switzerland, Austria, Italy and Slovenia, the Apennines in Italy, the Dinaric Alps in Croatia and Bosnia-Herzegovina, the Taurus Mountains in Turkey) and on the southern shore (the Atlas range in western North Africa)

- The creation of a relatively narrow continental shelf (in the western Mediterranean, the Gulfs of Lyon, Valencia and Gabès are notable, but limited, exceptions).

- The creation of marine basins of considerable depth (the average depth is 1,500 m, reaching a maximum of 5,100 m in the Matapan Trench in Italy)

- The high level of volcanic and seismic activity

- The damping of the tidal regime

- Its very specific wind regime

- The slow renewal of its water (approximately every 97 years), with annual evaporation of some 3000 Km^3 of water
- Its volume is around 3.7 million Km^3, with a negative water balance, compensated by the significant inputs of water from the Atlantic (35,000 Km^3) and the smaller input from the Black Sea (200 Km^3)

Bio-geographical aspects

The Sea of Alborán is the confluence of three regions: the Lusitanian (temperate-cold), the Mauritian (warm) and the Mediterranean itself, and so its marine fauna and flora include species belonging to the temperate fauna of the European Atlantic, others typical of the Mediterranean and others which are subtropical, from north-west Africa, which are joined by different endemic species. All of this makes these coasts home to the greatest diversity of species in Europe's seas. The river basins which flow into the Alborán are made up of small rivers, especially torrential rivers (on the north coast, the Guadalfeo, Guadalhorce, Palmones and Guadiaro and, in the south, the Moulouya –the only river which forms an estuary-, Martil, Laou, Ghiss, Nkor and Kert)

Box 2

Meadows of marine phanerogams

At ecosystem level, they supply oxygen and nutrients, they trap sediments, thereby preventing the loss of beaches and erosion of the coast, and they are an important focus of biodiversity (e.g. *Pinna nobilis*) with some species that are important to the fishing industry (octopus, cuttlefish). In the Sea of Alborán, four autochthonous species are known: *Zostera marina*, *Zostera noltii*, *Posidonia oceanica* and *Cymodocea nodosa*. The current state of the meadows on the northern shore of the Sea of Alborán is not fully known but they are clearly in regression, with the exception of some areas (the Marine Reserve of the Cabo de Gata-Níjar Natural Park). The meadows of *Posidonia oceanica*, which are endemic to the Mediterranean, are the most important, complex and extensive marine ecosystem of this sea and it is considered a priority species for conservation under EU directives. The distribution limits of other species, such as *Zostera marina*, is limited to the Sea of Alborán, appearing in some very restricted zones of the Mediterranean, such as inland lagoons and the northern zones of the Adriatic and the Aegean Sea. The pressure of human activity, especially illegal trawling, the extraction of sand for the regeneration of beaches, the construction

of coastal infrastructure and the dredging of ports are the main causes of the degradation of many meadows.

In the northern part, the great importance of the meadows of marine phanerogams is worthy of note (*Posidonia, Zostera, Cymodocea*) (Box 2). On the Isle of Alborán, there are also important kelp forests, dominated by brown and red seaweed. The meadows of green algae, *Caulerpa prolifera*, and maërl beds (nodules of calcareous algae) are considered one of the most ecologically dynamic of all habitats with the greatest wealth of species.

Oceanographic aspects[4]

This is the last basin for the relatively dense Mediterranean waters leaving the Mediterranean (at depth) and the first basin which is occupied by the lighter incoming Atlantic waters (at the surface) in their long process of transformation into Mediterranean waters in this sea. The different densities of the two types of water is a determining factor in the hydrodynamic processes which take place in the Sea of Alborán, a unique, peculiar basin, which has the most intense oceanographic fronts known anywhere on the planet. One of these is known as the Almería-Oran front which stretches along a line between these two towns and which is the eastern limit of the Sea of Alborán. This front sees geostrophic speeds of an intensity of over 1 m/s.

The average surface circulation is conditioned by the presence of two warm-core gyres, which occupy the western and eastern sub-basins, and which accumulate light Atlantic waters. These two gyres are separated by the 3ºW meridian which runs through the prominent Three Forks Cape and whose presence is, in all probability, the cause of the warm-core gyre in the eastern sub-basin. The dimensions of the gyres are variable, although when they are fully developed, they cover the entire breadth of the basin. Their depth is related to their size, and can exceed 150-200 m at the centre when the gyre is fully formed. The first study, based on infrared thermal images, concluded that the gyres are in permanent evolution, and that their absence could be one stage of that evolution. Other, more recent studies have indicated a certain seasonality in these surface structures, the winter being the time of year when the gyres are likely to disappear and the summer being the time when they are fully developed. Recently, a curious phenomenon has been reported, and that is the possibility that the Alborán basin is occupied by three warm-core gyres, the two better-known ones in the eastern and western sub-basins and a third between the two. The part of the north-western sector where the continental shelf is wider, off the provinces of Cadiz and Malaga, has characteristics of its own which are conditioned by the dynamics of the large warm-core gyres, specifically the western gyre, and by the proximity of the Straits of Gibraltar, which means that it is a region suitable for upwelling.

Productive aspects

As a consequence of the oceanographic characteristics described above, the Sea of Alborán has a different distribution and nutrient load (nitrates and phosphates, above all) which is higher than the average in the Mediterranean. The distribution of nutritive salts during the summer, at a depth of between 10 and 100 m, confirms that the greatest concentrations are found between the Atlantic stream and the Spanish coast, in the upwelling areas. The abundance of chlorophyll in the Sea of Alborán shows a great disparity between the two shores, the northern part being much richer.

The production of plankton is highly dynamic due to these changes in the hydrological structure, which leads to high values of phytoplanktonic and zooplanktonic biomass (above the Mediterranean average) on the Almeria-Oran front and in the provinces of Cadiz and Malaga, which in turn makes this an ideal spawning area for the sardine (*Sardina pilchardus*) and the European anchovy (*Engraulis engrasicolus*). In particular, the Bay of Malaga is very important for many species at the alevin stage, especially the European anchovy, which spends its entire life cycle in the zone (eggs, larvae, juveniles and adults),

[4] Updated information provided by J. García Lafuente (University of Malaga).

being found there all year round, with the spawning period (summer) coinciding with large quantities of larvae of species which are virtual competitors, such as the boarfish (*Capros ape*) (to the west of 4° longitude), and the round sardinella (*Sardinella aurita*) (to the east of the same meridian).

The differences in temperature found at intermediate depths indicate the parallel 36° N as the latitudinal dividing line for larvae of certain mesopelagic species, with Arctic-boreal species dominating to the north and temperate-subtropical species to the south.

The benthos are also affected by this dynamic in the water and there is information about both the Atlantic or Mediterranean algal flora (macroalgae on the Malaga coast) and also the fauna, with Atlantic species of tropical origin present on the Malaga coast, which in some cases are not found in the more easterly zone.

b) The importance of its biodiversity

The Mediterranean, in general, is one of the largest reserves of marine and coastal biodiversity, with 28% of its species being endemic and with 7.5% of the marine fauna and 18% of the marine flora to be found in the world. The scientific literature has described exceptional biological communities, characterised by a high rate of endemism, a great variety of taxa in deep waters, associated with submarine mountains, cold-water coral reefs and hypersaline basins. The Sea of Alborán can be considered one of the most attractive maritime zones for certain marine species, especially turtles, cetaceans and large pelagic species. Likewise, the presence of red coral (*Corallium rubrum*), particularly in the immediate surroundings of the Isle of Alborán, in the submarine area of Tofiño, which is today considered a rare species, and certain bivalves such as the date shell (*Lithophaga lithophaga*) which is classified as being in a state of extinction, bear witness to the ecological value of these waters. The submarine canyons, typical of the Alborán, are the essential habitats for the life cycle of some species which are found in great density and also, in some cases, high indices of recruitment for macro and mega-fauna, as in the case of the blue and red shrimp (*Aristeus antennatus*) in some cases. Furthermore, they are also areas with a high level of endemism (e.g., *Medusae*). All of these habitats are true hotspots of biodiversity and they host fragile ecosystems.

c) Vulnerability of its natural resources. Climate change.

Elements which significantly affect the vulnerability of the Alborán Sea are:

i) Excessive urban development (62% of the north shore, and up to 69% on the Malaga Coast[5]). In one decade, urban development in Morocco multiplied by 3.5. This avalanche towards the coast has been translated into rapid, uncontrolled urban development with a high incidence of real estate speculation, as well as conflicts for the occupation of land.

ii) The pollution produced by different agents, especially discharges of all types.

iii) Desertification (shortage of water and salinization of aquifers, wind and water erosion, deforestation, drought, degradation of pastureland and farmland).

iv) Fragility and shortage of water resources in the region.

v) Invasion by alien species.

vi) The decline of agriculture (an increase in the artificial use of the land, drought).

vii) Forest fires (arson and accidental fires).

viii) The fragility of the meadows of marine phanerogams.

[5] Data from the Spanish Sustainability Observatory (2005).

ix) The destruction of coastal wetlands and dune systems.

x) Volcanic and seismic activity, since this is an area where the Eurasian and African tectonic plates meet. Although of low intensity in general, it does undoubtedly represent a certain risk.

xi) The effect of human activity on the landscape.

The existence of an increasingly large and increasingly globalised market and the rising standard of living foreseeable in Morocco, with the increase of the territorial and environmental impacts that this implies are, undoubtedly, an important cause of this vulnerability, contributing to:

i) A reduction in the number of farmers.

ii) The rapid urbanisation of the coast.

iii) An increase in the volume of goods transported.

iv) An increase in the number of private cars and the generation of domestic waste.

v) Increased energy consumption and the consequent emission of greenhouse gases.

Only by heeding the lessons learned from national and international experience, and also through international cooperation, can these foreseeable impacts be attenuated and addressed.

Climate change is causing increasing alarm and is in continuous progress. It is due mainly to global warming and, today, it is without doubt the element that is most beginning to affect the vulnerability of the planet in general. Current forecasts predict that the effect will be particularly acute in the Mediterranean zone. It is already giving rise to a number of effects which are of crucial importance, such as the accelerated drought, erosion and desertification processes, floods, storms, rising temperatures of sea water and on land, currents of salinity, the gradual rise in the sea level, and the reduction of biodiversity.

d) Some macroeconomic data: north-south differences

Purely as an illustration, the following data is of interest: the minimum wage in Spain is three times higher than in Morocco; the average annual expenditure per person is nine times higher on the northern shore; illiteracy rates are very high on the Moroccan side (an average rate of 43% among the population over 10 years of age). Some of the most important inequalities between the two shores are:

i) *Economic growth* (the standard of living is eight times lower in the south than the north).

ii) *Industrialisation* (much higher in the north).

iii) *Consumption, and waste, of energy per capita, and the greenhouse effect* (much higher in the north).

iv) *Tourism* (highly developed on the Andalusian coast, which should serve as an example for the Moroccan Mediterranean coast, where, hopefully, the serious errors committed in Spain can be avoided).

v) *Excessive urban development* (together with the development of tourism and the increasing demand for a second holiday home as an investment on the northern shore, which is now taking off in the south).

vi) *Maritime and land transport* (which is increasing rapidly on both shores, though at a much higher rate in the north).

vii) *The deficit in the development of infrastructure and planning in the south* (where the Andalusian Mediterranean coastline cannot be taken as a paradigm).

viii) *The shortage of drinking water* (and the increasing per capita demand, which is much higher in the north, though also increasing in the south), which will increasingly be a limiting factor for sustainable development in the zone.

In the period between the drafting of this document until today (2007-2009), an extremely acute financial crisis has affected the world economy, and this has very important implications for the construction industry, particularly in Spain, leading to a generalised paralysation of excessive urban development.

e) Environmental awareness

We may speak of a certain historical respect in the Mediterranean for the use and conservation of certain natural resources (the rational use of water, a fishing industry almost entirely restricted to coastal waters, although the capture of undersized fish also goes back a long way). However, unfettered development and urban overcrowding in the second half of the 20th century brought with it great environmental insensitivity at all levels and in almost all sectors of society. Slowly, gradually, over the last few years, there has been greater awareness of the increasingly urgent need to protect the environment[6].

It is possible that, today, we can begin to say that the protection of the environment is one of the three pillars of sustainable development, together with economic and social growth. It is even beginning to be accepted that the protection of the environment is an important vehicle of development and prosperity (tourism itself depends increasingly on the quality of the environment, especially on the coast).

f) The historical and cultural context

Many of the greatest civilisations that the world has seen have been established or developed on the Mediterranean, for example, the Egyptian, the Minoan, the Greek (Mycenaean and Hellenic), the Etruscan, the Phoenician, the Roman, the Arab and the Ottomans civilisations. The same can be said of the main religions (in chronological order of appearance): Judaism, Christianity and Islam. These civilisations, many of which were based on empires, have considerably modified the initial environment in a similar way, in fact, in the same way as today: the growth of cities and ports, agriculture, the use of fresh water, industry and leisure activities, including tourism. They have also left us a great architectural legacy, which today forms part of the World Heritage established by UNESCO, and a common history in the north and south, whose influence is still with us today and which will, perhaps, survive in coming centuries.

g) The legal and institutional situation

The Sea of Alborán is subject to international legislation affecting the Mediterranean in general, as well as the relevant national legislation including, in the case of Spain, that of the Andalusian Regional Government which has competence over a small coastal strip (inshore or "cape-to-cape" waters) which is, nevertheless, of great environmental importance.

In the Mediterranean area, the Intergovernmental Conference on the Protection of the Mediterranean, at which the participants approved the Mediterranean Action Plan (MAP) (Box 3) is relevant.

In addition to the above, the United Nations Environment Plan (UNEP), the United Nations Food and Agriculture Organisation (FAO) and European Union regulations (Box 4) are also applicable.

[6] This has been helped by some ecological disasters which have had significant media impact (the bursting of the tailings pond at the Aznalcollar mines in Andalusia and the sinking of the *Prestige* in the sea off the coast of Galicia) and whose consequences, particularly of the *Prestige*, generated an enormous "tidal wave" of national and international solidarity.

Box 3

In 1975, 16 Mediterranean countries and the European Economic Community (EEC) adopted the Mediterranean Action Plan (MAP), the first ever Regional Seas Programme under UNEP's umbrella.

In 1976, these same countries adopted the Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona Convention). Seven Protocols addressing specific aspects of Mediterranean environmental conservation complete the MAP legal framework:

- Dumping Protocol (from ships and aircraft)

- Prevention and Emergency Protocol (pollution from ships and emergency situations)

- Land-based Sources and Activities Protocol

- Specially Protected Areas and Biological Diversity Protocol

- Offshore Protocol (pollution from exploration and exploitation)

- Hazardous Wastes Protocol

- Protocol on Integrated Coastal Zone Management (ICZM)

Although MAP's initial focus was aimed at marine pollution control, over the years, its mandate gradually widened to include the conservation of biodiversity and integrated coastal zone management.

In 1995, the Action Plan for the Protection of the Marine Environment and the Sustainable Development of the Coastal Areas of the Mediterranean (MAP Phase II) was adopted by the Contracting Parties to replace the Mediterranean Action Plan of 1975.

At the same time, (1995), the Contracting Parties adopted an amended version of the Barcelona Convention of 1976, renamed the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean.

Today, over 30 years later, the Barcelona Convention and MAP are more active than ever. The Contracting Parties are now 22, and they are determined to protect the Mediterranean marine and coastal environment while boosting regional and national plans to achieve sustainable development. The activities funded by the Regional Activity Centres (RAC) are: RAC of the Blue Plan (RAC/BP), RAC for Specially Protected Areas (RAC/SPA), RAC for Emergency Marine Contamination Situations in the Mediterranean Sea (RAC/SEC) and the RAC of the Priority Actions Program (RAC/PAP) for integrated coastal zone management.

As well as the above, the Mediterranean has the status of Biosphere Reserve where the Convention for Biological Diversity is applicable.

For its part, in 1949, the FAO created the General Fisheries Council for the Mediterranean (today, the Commission, GFCM), and in 1975, the International Commission for the Conservation of Atlantic Tuna (ICCAT), which includes the Mediterranean, was established.

In 1996, the Bonn Convention included the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic Area (ACCOBAMS) within its framework.

Box 4

International framework

Although the United Nations Organisation was created in 1945, issues related to the sea and its resources, were not given international attention until the 1960s, with the UN Conferences on the Law of the Sea (1958, 1960) and the creation of the Fisheries Committee within the Food and Agriculture Organisation (FAO) en 1965.

Later, in 1972, the United Nations Conference on the Human Environment got under way, and in the Declaration of Stockholm, marine aspects were included, culminating in 1982 in the fundamental United Nations Convention on the Law of the Sea (**UNCLOS**), and its associated instruments. Under UNCLOS, the Agreement on the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks was formalised in 1995. The process, which derived from UNCLOS, continued with the gradual incorporation of new signatory countries and the review of the Exclusive Economic Zone (EEZ) in order to register their interests in the natural resources contained in those zones.

In 1992, building on the Stockholm Conference of 1972 and supported by the Bruntland Report, also known as Our Common Future (1987) –in turn, derived from the meetings of the World Commission on Environment and Development-, the United Nations organised its Conference on the Environment and Development (**UNCED**) in Rio de Janeiro in 1992, better known as the Earth Summit, which, in the Rio Declaration, the Convention on Biological Diversity and Agenda 21, includes aspects related to the seas. Among a series of Instruments associated with this Summit, we would highlight the Commission for Sustainable Development and the Global Environmental Facility (GEF). Ten years on, UNCED organised another World Summit on Sustainable Development (Johannesburg, 2002) which included marine issues in the Johannesburg Declaration.

Today, the United Nations, through its Environment Programme (UNEP), which was created in 1972, its Development Programme (UNDP), its Sustainable Development Commission (UNSDC) and UNESCO, has continued working with countries, in particular through the successive Conferences held by the Parties, on the decisions derived from the Convention on Biological Diversity, the Rio Declaration, Agenda 21, the Climate Change Convention and the Johannesburg Declaration.

For its part, in 1993, the FAO adopted the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas. Later, in 1995, there was unanimous agreement to launch the Code of Conduct for Responsible Fisheries, though as guidelines, rather than obligatory regulations. Many aspects of this Code of Conduct embrace concepts of sustainable exploitation which is respectful of the environment, derived from UNCED. In 2001, the FAO organised the Reykjavik Conference on Responsible Fishing in the Marine Ecosystem which very explicitly placed environmental aspects at the core of fishery management. Today, the FAO continues to lead international fishery policy with the establishment of Action Plans aimed at managing the fishing capacity, reducing illegal and undeclared catches, preventing the accidental death of sea birds and conserving the shark population. Logically, all of the above is applicable to all seas, including the Mediterranean.

In 1979, the Bonn Convention for the conservation of migratory species of wildlife and the Bern Convention for the conservation of natural habitats and wildlife in Europe were launched. In 1973, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was signed.

For its part, the EU, with the Birds Directive and, especially, the Habitats Directive, brought into force two important legal instruments whose annexes list numerous marine species which are protected in EU territory.

In June 2008, the EU adopted the Framework Directive on Marine Strategy, whose purpose is to protect more efficiently the European marine environment, seeking good environmental conditions in Europe's marine waters by 2020 and to protect the marine resources upon which many social and economic activities depend. The Framework Directive is a vital environmental component of the future marine policy of the Union, designed to allow maximum development of the economic potential of the oceans and seas in harmony with the marine environment.

This Directive establishes European Marine Regions based on environmental and geographical criteria. Each Member State, co-operating within each Marine Region with other Member States and non-EU countries, is required to develop strategies for its marine waters.

2.2. EXPLOITATION OF RESOURCES AND THE ORIGIN OF THE MAIN ENVIRONMENTAL PRESSURES

a) Fishing and aquaculture

On the Moroccan coast of the Sea of Alborán, fishing is one of the main socio-economic activities in some provinces, making a fundamental contribution to food security in the zone (the average production in recent years has been some 31,000 tons per annum, with a value at the first sale of some €26 billion in 2005). A large proportion of the fish landed in Moroccan ports is exported. On the Spanish coast, fishing as an economic activity does not carry the same relative weight as in Morocco, despite tripling its catch and exceeding its economic value by five (the electronic version of this document includes data on the fleet and fish landed).

Artisanal fisheries, which fish very close to the coast, involve more than 2,000 boats on the Spanish side, although not all are always active or working full-time. They use more than 200 different types of fishing gear (a large number of them are very similar, having only small local differences based on the type of boat, the fishing grounds and the time of year at which they are used), and it is estimated that some 5,000 fishers are permanently employed in artisanal fisheries.

More recent data from the Andalusian Regional Government gives considerably lower figures, though it is possible that this data does not include those fishing boats which only work sporadically.

In the Moroccan zone, it is estimated that some 2,500 artisanal fishing boats of less than 6 m in length are working, though they are not always active or working full-time. They use numerous different types of fishing gear and employ some 7,800 persons [about 2 per boat, although in the Tangiers zone, the average is 4], with some 90 landing places, half of which are isolated and do not usually have any fishery infrastructure or means of valorising the catch. For these reasons, the amount of fish landed is practically unknown. The 510-kilometre Mediterranean highway currently being built, which will connect Saidia in the east with the city of Tangiers in the west, will reinforce the road network, allowing access to more than 200 km of beaches, coves and tourist resorts. This should also lead to a valorisation of the fishing industry.

ArtFiMed[7] (Sustainable Development of Artisanal Fishing in Morocco and Tunisia) is an FAO pilot project co-ordinated by COPEMED II. Funded by the Spanish Agency for International Development Cooperation (AECID), its purpose is to contribute to the reduction of poverty in artisanal fishing communities by improving their means of earning a living, seeking sustainability, respecting ecosystems and supporting the integration of artisanal fishing communities into the dynamics which directly affect them, in particular, fishery management and the development of the coastal zone.

The target communities are: in Tunisia, Ghannouch, an extensive beach where more than 500 fishers use different types of gear, mainly gillnets, in a zone with intense industrial activity, and El Akarit, where more than 500 women catch shellfish on foot at low tide in the Gulf of Gabès; in Morocco, Dikky, on the Straits of Gibraltar, where there is no port infrastructure and where more than 300 fishers use hook and line gear from small boats to fish for bluefin tuna and other species with a high market value.

The ArtFiMed project aims to obtain results and learn lessons at three levels: i) the fishing communities where the project is being run; ii) in the two countries, Tunisia and Morocco, in collaboration with the administrations and other national and international initiatives, and iii) the Mediterranean region,

[7] http://www.faoartfimed.org

reinforcing the information and visualisation of artisanal fisheries and communicating the results and lessons learned in the project to the GFCM.

Fishing for small, surface pelagic species is carried out by the Moroccan and Spanish seine fleets (some 140 and 110 boats, respectively) which mainly catch sardine (*Sardina pilchardus*) and anchovy (*Engraulis enchrasicholus*), horse mackerel *(Trachurus sp.*), mackerel (*Scomber scombrus*) and, to a lesser extent, bogue (*Boops boops*), which can substitute those mentioned previously in the case of scarcity or are complementary to the two main catches. The round sardinella, (*Sardinella aurita*), a more temperate species which has become more abundant in the western Mediterranean over recent years, is important in some ports and at certain times of the year, mainly in Algeria and Morocco. Fishing usually takes place at night, using lights, taking advantage of the tendency of the target species to group together and rise to the surface.

The Spanish fleet prefers the anchovy, while the Moroccan fleet catches more sardine. Small pelagic resources oscillate widely year on year, causing sudden collapses and recuperations of the population, which is why it is necessary directly to evaluate the resources every year. On the northern shore, anchovy catches have shown a downward trend over recent decades, with minimum catches in the 1990s (of the order of 400-500 tonnes), though in 2002 there was an isolated peak, with the catch exceeding 3,000 tonnes (the highest figure in the last 10 years), thanks to exceptional recruitment in 2001. More recently, (2006 data), resources have been in a critical situation, subject only to the influence of the environment, and without the minimum stability required for their operation.

A study of socio-economic indicators of the Spanish and Moroccan seine fleets performed as part of the FAO-COPEMED project in 1999-2000 and published by the GFCM, classified the seine fleets in both countries, revealing that most of the indicators used for the two fleets (productivity by boat, productivity per person, etc), did not differ greatly. The study revealed, for example, that, as regards fish landed by each segment of the fleet, "the differences between ports are more significant than the differences between countries".

The seine fishing sector on the southern shore, and perhaps to a lesser extent in the north, has for years been facing the problem of attacks on its gear by some cetaceans, especially the bottlenose dolphin (*Turciops truncatus*), which is translated into a loss of the catch and the increased supplementary expenses of the repair of damaged fishing gear. This is producing losses to the sector which could exceed 10%.

Demersal fishing is carried out by the trawler fleets for bottom-dwelling fish on the continental shelf and continental slope. In the Spanish zone, there is, firstly, a large inshore dredge fleet of small shellfishing boats (almost 300), which capture bivalve molluscs, especially the tuberculate cockle (*Acanthocardia tuberculata*), the hard clam (*Callista chione*), the striped Venus clam (*Chamelea gallina*), the wedge shell (*Donax trunculus*) and the king scallop (*Pecten maximus*) and, secondly, the trawler fleet (around 160 boats) working the continental shelf and slope, which catch more than a hundred species and which discards a high percentage of its catch as it has no commercial value. This represents a serious problem. The trawler fleet generates a large number of direct jobs and catches well over fifty commercial species[8].

In Moroccan waters, these fish are caught by the trawler fleet (some 144 boats) and some of the so-called mixed-gear boats (an undetermined number of the existing 66). Official Moroccan statistics include the

[8] The most important species are: among fish, the hake (*Merlucius merlucius*), whiting (*Micromesistius poutassou*), different *Sparidae* (*Pagellus spp., Diplodus spp., Dentex spp.*), mullet (Mullus spp.); among the crustaceans, the blue and red shrimp (*Aristeus antennatus*), the deep-water rose shrimp (*Parapenaeus longirostris*) and the Norway lobster (*Nephrops norvegicus*); among molluscs, the common octopus (*Octopus vulgaris*), common squid (*Alloteuthis spp.*), cuttlefish *(Sepia officinalis)* and the European squid *(Lolligo vulgaris).* The order of importance varies on the southern shore, where more *Sparidae* are landed, followed by red mullet, deep-water rose shrimp and hake.

sardine fleet with the inshore fishing fleet (the mixed-gear statistics also include sardine boats which change their activity over the year), thus complicating the gathering of data referring strictly to the bottom-fishing fleet. Demersal fisheries generate 15,000 direct jobs.

Ocean fishing for tuna and a similar species takes place mainly in international waters except for trap netting (*"almadraba"*), which has a long historical tradition and is still practiced in areas of the Straits of Gibraltar. This gear also captures a number of associated species, especially sharks, and some marine mammals and turtles, which could produce an impact on the ecosystem (Box 5).

Commercial fishing in the Spanish zone is carried out by a small number of large seine fisheries, more than 25 active surface longliners (there are another fifty in the ports to the north of Cabo de Gata), and handliners.

There are also an undetermined number of seine boats which catch small bluefin tuna and other lesser members of the tuna family. In the Moroccan zone, drift gillnets are still used under specific regulations for swordfish (prohibited by the EU, GFCM, and the ICCAT) and handlines for bluefin tuna. The most important species in the area of study are the bluefin tuna (*Thunnus thynnus*), the albacore (*Thunnus alalunga*) and smaller tunas such as the bullet tuna (*Auxis sp.*), Atlantic bonito (*Sarda sarda*), little tunny (*Euthynnus alletteratus*) and, occasionally, the skipjack tuna (*Katsuwonus pelamis*). Among the related species, the swordfish (*Xiphias gladius*) stands out. The average annual catch of all tuna and related species in the Sea of Alborán and the region of the Straits of Gibraltar (1998-2004), caught with all of the different fishing gears by Spain and Morocco came to some 6,300 tonnes (40% caught by the Spanish fleet and 60% by Morocco).

Box 5

Fishing for large pelagic species in the Sea of Alborán[9]

BLUEFIN TUNA FISHERY

Trap nets

Trap nets are a type of fixed fishing gear which are laid from the coast and stretch several kilometres offshore to intercept bluefin tuna and other members of the tuna family on their annual migration. Spain has four trap net sites on the Atlantic coast and two on the Mediterranean (Ceuta on the Sea of Alborán and La Azohía in Murcia, to the north of Cabo de Gata). Morocco used to have four trap nets on the Atlantic, though in recent years, this number has increased. In the Mediterranean, it has one working trap net (Príncipe, on the Sea of Alborán).

The Atlantic trap nets catch large reproducing tuna of age group +6, while the catch of Mediterranean trap nets (Alborán) is currently very low and is made up of young fish and small tuna. The average annual catch of bluefin tuna by Spanish and Moroccan trap nets in the Atlantic (1998-2004), came to 2,822 tonnes (ICCAT SCRS-2006), equally shared between the two countries. It is believed that, together with the fall in population due to overfishing, there are other factors which could affect catches of these species (for example, pollution).

Handlines

This activity commenced in the 1996 in the waters of the Straits of Gibraltar. It takes place during the months of July and August and is undertaken by Spanish and Moroccan boats.

The Spanish fleet is made up of some 30-40 boats using artisanal gear, typically with a gross registered tonnage of 10 tonnes, 75 hp and 10 m in length. The fishing grounds are in the centre of the Straits on the sea floor between 500 and 800 m in depth.

[9] Information provided by Jose Miguel de la Serna (IEO, Malaga)

The gear is composed of a 3.5 mm twisted plastic and nylon mother line of between 100 and 500 m in length. A 2-mm nylon, single-filament fishing line is attached to the end of the mother line, with a large baited hook (shank of 12 cm and bend of 5 cm). Atlantic horse mackerel, of 25-30 cm in length is used as bait.

The Moroccan fleet is made up of 200 boats using artisanal gear, which are usually less than 6 m in length, 2-3 GRT, and 15-20 hp. This fleet operates from the Ksar Sghir region and fishes in the Straits of Gibraltar, at depths of over 300 m, using gear similar to that described for the Spanish fishery.

The average annual catch of bluefin tuna by the Moroccan fleet using hand lines (1998-2004) came to 331 tonnes, with the fishing season lasting from July until October. The catch of the Spanish fleet is significantly lower, amounting to 65 tonnes. The tuna caught are large specimens.

Pole lines with live bait

The Spanish fleet which fishes with live bait in the area of the Straits of Gibraltar is made up of 12 boats based in Tarifa (Cádiz) and 17 in Algeciras (Cádiz), with an average GRT of 15 tonnes, 150 hp and a length of 14 m. Another 15 larger boat from ports in the north of Spain also fish temporarily in the area. The average annual catch in recent years has been 323 tonnes, with significant oscillations due to the variability of environmental and meteorological conditions in the area, which affects yield.

The range of sizes is very wide (80-250 cm in length) due to the long fishing season, which runs from August to March of the following year. The boats use seine gear to supply themselves with bait, the most widely-used bait being the round sardinella and the Atlantic horse mackerel.

Targeted surface longlines

During the months of May to June, a number of Spanish swordfish longline boats change their gear and fish for bluefin tuna with Japanese longlines in certain areas of the Sea of Alborán off Cabo de Gata. Seven of these boats are based in the port of Motril (Granada) and others in Carboneras (Almería), which fish in the Seco de los Olivos area. Their catches consist of bluefin tuna of an average weight of 70 kg, the average annual catch being 20 tonnes.

SWORDFISH FISHERY

Drift gillnets

Morocco has a fleet of almost 370 boats which fish for swordfish using this gear in the Moroccan Mediterranean and the area of the Straits of Gibraltar. The ports of Tangiers and Nador, with 247 and 36 boats, respectively, represent 67% and 10% of the total fleet. These boats have a GRT of between 5 and 20 tonnes and an average of between 50 and 150 hp, according to registered data from 2002. The gear is between 1,500 m and 3,000 m long in the area of the Straits and the near Atlantic and is considerably longer in the Mediterranean, depending on the fishing grounds, due to the different oceanographic and meteorological conditions. The mesh measures 40 mm and the height of the net is between 18 m and 30 m.

Fishing for swordfish with drift gillnets in the area of the Straits is a seasonal activity, beginning in March and ending in October. In the Sea of Alborán, this activity takes place all year round, though catches are lower and of smaller specimens than in the Atlantic area close to the Straits of Gibraltar. The average annual catch in recent years has been 3,500 tonnes, of which 91% is from the Gibraltar area. In the area of the Straits of Gibraltar, the swordfish caught are predominantly adults. Fishing in the Mediterranean contributes 91% of the total catch of this species in Morocco. With an average annual production of 3,500 tonnes, Morocco is the Mediterranean's second biggest producer of swordfish, after Italy.

Drifting surface longlines

The Spanish fleet which fishes for swordfish with surface longlines in the Sea of Alborán at certain times of the year consists of boats from the ports of Motril (5 boats), Adra (1), Roquetas de Mar (2) and Almería (1), plus a variable number of boats from Carboneras. This is just a fraction of the longline fleet fishing for swordfish in the Mediterranean, which is made up of 75 boats, to which must be added others with temporary permits. Fishing for swordfish in the Sea of Alborán has two distinct periods, May-June

in areas situated between the Spanish coast and the Isle of Alborán and October-November, between the Isle and Morocco. The average catch of swordfish is around 15% (some 200 tonnes) of the total captured by the fleet, whose average annual catch (1998-2004) was around 1,300 tonnes.

Fishing for swordfish in the Sea of Alborán is characterised by a smaller proportion of juveniles and a higher catch of elasmobranchs, especially the blue shark (*Prionace glauca*, Fig. 34). Surface longline gear is subject to regulation, fishing being permitted with a maximum of 2,000 hooks and 60 km of line, a specified minimum distance between snoods and minimum hook sizes, in the case of Spain.

ALBACORE FISHERY
In the 1970s and '80s, considerable quantities of albacore were caught in the Sea of Alborán by a fleet of boats from the north of Spain that fished with live bait. Today, albacore is fished with surface longlines in the areas of the Isle of Alborán and Canal, with a small number of boats from Murcia and Almería.

The average albacore catch by the Spanish fleet in the Sea of Alborán represents 25% (some 50 tonnes) of the total catch of this species by the Spanish fleet as a whole in the Mediterranean, which can be as much as 200 tonnes per year.

SMALL TUNA FISHERY
Small tuna are caught on the Spanish and Moroccan coast with trap nets, or *almadrabas***,** both by the Atlantic trap nets on the outward leg of their annual migration and by the Mediterranean trap nets (Alborán) on the return leg. Today, the Mediterranean trap nets in the Sea of Alborán (Príncipe and Ceuta) capture a higher proportion of small tuna. The bullet tuna is also caught, in season, by surrounding nets targeted at *Clupeidae* and by driftnets (targeted at bonito and bullet tuna) recently prohibited by the EU. Catches of small tuna in the Sea of Alborán and the Straits region average 553 tonnes, mainly bullet tuna and little tunny.

Sport or recreational fishery includes a number of different types of gear (mainly handlines and hooks) both from the shore and from leisure boats, and it is clearly becoming more popular. It generates and supports a significant amount of industry and services and creates many jobs. Its social importance is based both on the leisure afforded to the fishers and the economic development that it induces. From an environmental point of view, it causes environmental damage and mortality among fish stocks which are significantly lower than that caused by commercial fishing. Unfortunately, very little is known and there has been very little control over this type of fishing, though in recent years an effort is being made to quantify and regulate it.

Recently, in September 2006, Spain hosted the 1st Mediterranean Conference on recreational sea fishing under a new, reasonably conservationist perspective, whose general objectives were: i) to dignify the activity and to define, economic, social and environmental identifiers; ii) to analyse the place of this type of fishing in sustainable, high-quality tourism and to inform the commercial fishing sector of possible alternatives; iii) to study measures for standardising Mediterranean regulations and possible self-regulation measures; iv) to promote the conservation of fishery resources and responsible fishing. From the papers read at the Conference, it can be seen that the real importance of leisure fishing is much greater than may be imagined[10].

With respect to Aquaculture, production in the Sea of Alborán is not significant today, with total production figures, for both shores, of the order of only a few thousand tonnes. The situation, then, is very far from the spectacular boom seen in other Mediterranean zones, especially since the late 1980s, when the 1985 production level of 220,000 tonnes rose to the 400,000 tonnes produced today (if we include only fish production, this increase is much more significant, since, in the same period, production rose from 1,000 tonnes to almost 100,000 tonnes produced today)[11].

[10] Information available at: www.mediterranea-fpr.org/pdfs

[11] This can be explained by the large deficit of seafood products in European Mediterranean countries, since demand has been outstripping supply. However, it appears to be reaching a ceiling due to the

On the northern shore, the Andalusian Regional Government is making significant efforts to promote aquaculture[12]. Tests have been carried out on the cultivation of the common scallop (*Pecten jacobeus*) and the queen scallop (*Chlamys opercularis*) in floating baskets in the open sea, but these have not been commercially successful due to the persistence of toxicity caused by red tides. Today, there are a little over 20 aquaculture facilities currently operating on land and at sea (rafts, floating cages, longlines), as well as a company specialised in the cultivation of lyophilised microalgae. It should be noted that, recently, the cultivation of mussels on longlines (4) and rafts (10) has begun in the province of Malaga, with plans for 400 units. Initial results are very promising, since the mussel reaches commercial size in even less time than in Galician waters, indicating that production could be significant in a few years time. A centre for the purification of molluscs has also been established in Malaga.

On the southern shore, aquaculture has still not taken off as there are still strong doubts about its real potential and its possible advantages. This situation of long-term uncertainty and risk inhibits private initiative. This has even meant that there has been a gradual reduction in aquaculture over the years. The only fish farming company that is still active is experiencing technical, economic and, above all, commercial difficulties. In contrast, companies which cultivate molluscs, basically, mussels and oysters, have begun to locate here.

In the 1990s, the National Fisheries Research Institute (INRH) and the Overseas Fishery Cooperation Foundation (OFCF) of Japan set up a plant in M'Diq, basically to farm bluefin tuna. The results have not been sufficiently encouraging. Today, the INRH is carrying out fish-farming tests with new species such as the red porgy (*Pagrus pagrus*), the common dentex (*Dentex dentex*), groupers (*Epinephelus alexandrinus, Epinephelus marginatus*) and the meagre (*Argyrosomus regius*). Recently, the M'Diq Centre (together with the Institut Vétérinaire Hassan of Rabat and the companies, Aqua M'Diq, an aquaculture company, and Aquamed, a food producer), also carried out tests on the production of food for sea fish using locally produced ingredients.

Both fisheries and aquaculture exert significant pressure on the surrounding environment, producing a series of negative effects detailed in point 2.4.c. In turn, environmental conditions also exert a considerable influence, particularly on pelagic species with a short lifespan. Likewise, discharges of all types have a negative influence on the commercial species which come into most direct contact with them, especially molluscs which inhabit the coastal zone.

b) Hydrocarbons and gas

Prospection in the Sea of Alborán has, to date, not discovered any commercial deposits of hydrocarbons, and so the possible existence of crude oil in the basin can be ruled out.

In 2005, the SIROCO project was launched to search for natural gas (the indications found in previous prospection were only of dry gas) (Box 6).

Box 6

problems which exist in the market (which is in the hands of the multinationals), the lack of suitable sites, production costs, pathological aspects and the shortage of skilled workers.

[12] A study has been made of the ideal locations for aquaculture in order to identify potential zones, promote communication and coordination between administrations, improve administrative processes and facilitate access by promoters. The concession of a large number of facilities for floating mussel production is being processed. At national level, the national Aquaculture Observatory has also been set up with the objectives of: i) increasing R&D&I activities, ii) facilitating the exchange of information between researchers, administrations, public and private bodies and companies, and iii) making aquaculture more accessible to interested parties.

Hydrocarbons and gas

Seismic acquisition (2D) and the drilling of exploration wells have taken place in the Sea of Alborán for over 30 years, in the case of seismic acquisition, and since the 1980s in the case of the three exploration wells drilled to date. This involves the reprocessing of 2,000 Km of the old seismic 2D lines registered by the companies which had previously explored the area, a 3D seismic acquisition campaign (to the west of the Malaga meridian) and, in the event that it is decided to continue with the exploration, the drilling of a borehole[13].

After years of fruitless prospecting along the Andalusian coast line, in early 2007, it was decided to move on to the next exploratory period with the purpose of drilling a borehole in 2010 (the prospections carried out in waters of the Sea of Alborán were given with the names SIROCO: A, B and C)[14].

Recently, large deposits of clathrate hydrates have been discovered in the Sea of Alborán, mainly methane hydrate. This is an important source of hydrocarbons, which is already being exploited in experimental deposits in Alaska and Siberia, and which could become one of the main sources of energy in the long-term if economically viable techniques can be developed to extract the methane.

The authorisation of research permits must include, in all cases, the following studies and plans: the appropriate environmental impact study to identify and qualify all of the possible impacts which could be caused by the operations to be carried out; an Environmental Management Plan containing the preventive and corrective measures proposed with regard to the impacts identified; an Environmental Contingency Plan containing the corrective measures to be taken in the case of significant environmental contingencies, including measures against contamination caused by hydrocarbon spills.

The Spanish Institute of Oceanography (IEO) has drawn up a geographic map of the sea floor in the Sea of Alborán and has identified morphological features unknown until now. The topobathymetric relief map of the Sea of Alborán and the Straits of Gibraltar reproduces the sea bed with great precision, similar to aerial photographs, and this has allowed the identification of possible superficial indications of deposits of hydrocarbons and gas.

c) Alternative energies

The exhaustion of traditional sources of energy, together with the need to reduce greenhouse gas emissions in order to meet the requirements of the Kyoto Protocol and to achieve sustainable development, make it necessary to increase the proportion of renewable energy in the total mix of energy consumed.

[13] In the case of a positive result (after drilling another borehole for confirmation nearby), a land connection with a small treatment plant would have to be established by means of a small submarine gas pipe, similar to those which already exist in the case of the gas deposits in the Gulf of Cadiz, in which all of the operations involving the submarine wellheads are controlled from land at a small base in Mazagón (Huelva), there being no floating elements in the water column above the deposits.

[14] Repsol Investigaciones Petrolíferas, Sociedad Anónima, a Spanish oil company, has concluded the first stage of gas exploration in the marine subsoil of Malaga, with "very positive results". Seismic prospection covered an area of 307 square kilometres between Marbella and Benalmádena, and was performed from a boat which emitted seismic waves which were then recorded with hydrophones. The company is currently working on "Siroco-D" in the Mediterranean Sea off the coast of Malaga (Royal Decree 59/2008). In the "Siroco-D" area, which covers 13,784 hectares, natural gas prospection is expected to begin in early 2011, some 10 km off the coast. Recently, the Spanish Government has approved Order ITC/456/2010, which allows the term of the research permits of "Siroco A, B and C" to be extended until 20 November 2010.

Among renewable energies, *wind energy* is that which has grown most in recent decades. The most recent projects locate wind farms on the continental shelf, which gives rise to a new type of physical occupation of the marine zone, which until now had only been used for aquaculture plants, oil wells and navigation routes. For this reason, the establishment of offshore wind farms must be addressed from a responsible, integrating perspective. Currently, and until the advantages and disadvantages can be defined, the possible concession of permits in the zone is in suspension.

In this sense[15], and bearing in mind the special nature of the procedure for the authorisation of offshore generation projects, the number of administrations involved and the diversity of the regulations applicable in these cases, as well as the investment required for these projects, the Spanish Government decided to approve a regulation, Royal Decree 1028/2007, of 20 July, on the administrative procedure for processing applications for the authorisation of generation facilities in territorial waters. The regulation had the dual purpose of giving guidance to private initiative as regards the administrative treatment of applications for authorisation, and at the same time to allow the Spanish Administration to participate in the implementation of these facilities, safeguarding the physical spaces where they are to be installed against possible environmental impacts and rationalising the applicable administrative procedure.

Although the title of the regulation may suggest that the establishment of offshore wind farms is restricted to "territorial waters", it should be clarified that the authorisation procedure for the establishment of energy generation facilities regulated in the Decree is also applicable to marine wind farms to be located in the "contiguous zone" or the "exclusive economic zone".

In accordance with the third additional provision of said Royal Decree 1028/2007, on 16 April 2009, the Strategic Environmental Study of the Spanish coast for the installation of offshore wind farms was published. The purpose of this study was to determine the zones of the maritime-terrestrial public domain which, from an environmental point of view only, are suitable for the establishment of offshore wind farms. For these purposes, exclusion zones and suitable zones have been defined. For the latter, a scale of suitability has been established which depends on environmental conditioning factors, in such a way that once an application for the reservation of a zone is approved, the offshore wind farm can only be constructed within the limits of the suitable zones.

For illustrative purposes, some of the criteria for the declaration of exclusion zones for the installation of wind farms in Spanish waters are as follows:

- The areas currently included in the Natura 2000 network (Special Protection Areas and Sites of Community Interest).

- Other types of natural spaces in the marine environment which are protected under international, European, Spanish or regional legislation.

- Marine areas which may be declared a National Park in the future, in accordance with the study carried out by the National Parks Authority.

- Priority or community interest habitats or other marine habitats of high environmental value or which are vulnerable to these facilities, which generally coincide with habitats of high conservation value for fishery resources: marine phanerogam meadows, coralligenous sea beds and macroalgae formations.

- A six-mile protection and buffer strip along the coastline around internationally important Ramsar coastal wetlands (also classified as Special Protection Areas) which are essential for the conservation of the main migratory routes on the coast.

- Areas of exceptional importance for the migration of birds and other biological groups, such as the Straits of Gibraltar.

[15] Information provided by Javier Pantoja.

- Areas occupied by species included in the Spanish Catalogue of Endangered Species or in the applicable regional catalogues.

The main problem for the development of offshore wind farms in the Sea of Alborán is that the continental shelf is very narrow, and this makes it difficult safely to anchor the wind turbines to the sea floor due to the great depth of the water. Today, experimental projects are being carried out with floating offshore wind farms which overcome these difficulties.

Wave energy and tidal energy, although less widespread than wind energy, also represent a new potential use of the coastal zone in some areas, and so their implications and consequences must be considered in order to integrate them adequately with the rest of the uses of the sea.

d) Desalination plants

Among the urgent actions planned under the Ministry of the Environment's Water Programme (Law 11/2006), the construction and enlargement of desalination plants in Mediterranean river basins has been approved and this is undoubtedly going to be a new source of pressure on the coastal zone which is being addressed through a Strategic Environmental Assessment (SEA), an environmental sustainability report already having been drawn up to consider the impact on the coast. See the map of desalination plants in Spain (2007).

e) Extraction of aggregate

In Spain, the situation has improved over the years and, today, aggregate is extracted from deposits which have previously been studied in order to minimise the effect on communities and ecosystems. The Directorate General of Coasts includes environmental impact assessments on the deposits of sand to be extracted in all regeneration projects.

Some of the beaches which have been destabilised by coastal construction have been artificially regenerated through costly operations to extract aggregate from banks or deposits of sand of a certain diameter from nearby sea beds. This process, if it is not carried out correctly, can cause serious damage to biodiversity, including habitats. Furthermore, since the coastline construction that caused the disappearance of the beach remains, these "regenerated" beaches suffer losses of sand, and the regular replenishment of sand, with the consequent environmental impact, is necessary in order to maintain them.

In Morocco, it has been found that, at least until a few years ago, the extraction of sand was uncontrolled and illegal, particularly in the region of M'Diq and the Bay of Al Hoceima. Studies carried out by the INRH in the Wilaya (administrative district) of Tetouan on the impact on the fishery resources in the region have identified the negative effects of aggregate extraction on the pre-recruitment phase in fish (icthyo-plankton –eggs and larvae-) and on benthonic fauna and flora. Today, the INRH sits on an interministerial commission to offer scientific advice on the environmental impact of sand extraction.

f) Marine biotechnology

This "blue biotechnology" includes a whole series of new products which can be obtained from the wealth of marine biodiversity in general and, in particular, that of the Mediterranean. It has significant long-term potential, as it is estimated that 80% of the living organisms in the world are to be found in aquatic ecosystems. Marine biotechnology will in the future contribute to a growing number of industrial sectors, from health to aquaculture, cosmetics and food products.

g) Coastal urbanisation (demographic growth and tourism)

There is general unanimity that the origin of the main environmental problems facing all areas of the Mediterranean lies basically in the excessive, unplanned urban development of the coastline. This is due, above all, to demographic growth and tourism, which wastes limited resources (water being the paradigmatic example), discharges (urban, industrial and agricultural) and maritime traffic, with all of the

dangers that go with it. We have already commented on the environmental impact of fishing and aquaculture and we have already indicated the tremendous problems that could be generated by the galloping evolution of climate change.

The singular conditions of the Sea of Alborán have meant that the coastal zone must withstand heavy human pressure, due above all to demographic growth and tourism. Tourism is the main economic driving force and this zone is home to over 7 million inhabitants, a figure which doubles each year with the arrival of the tourists. There are, therefore, some 14-15 million people who use it every year.

- Demographic growth

If we take the average number of inhabitants per square kilometre as an indicator, we find that, while the average is some 80 persons per km^2 on the Mediterranean in Spain as a whole, in Andalusia, the figure is 119 and on the coast of Malaga, 267 inhabitants per km^2. Taking both shores together, the average is 128 inhabitants per km^2. These concentrations are considerably higher in the western than the eastern part (on both shores).

The birth rate has been significantly higher in the south than the north, though in recent years there has been a fall in the fertility rate in the countries of the south in general and a considerable increase in the north, thanks mainly to immigration.

- Tourism

Over the last 50 years, the number of tourists has multiplied exponentially in the Mediterranean, which is today the leading tourist destination of the entire planet. According to the World Tourism Organisation, the four most important segments of the tourism markets in Mediterranean countries are sun and sand tourism, cruises, nautical tourism and cultural tourism.

The northern area of the Alborán, particularly the Costa del Sol in Malaga, has for many years been one of the most important tourist destinations in the whole Mediterranean. The boom in tourism brought with it a huge rise in construction and unfettered, uncontrolled urban growth. The first large-scale urban developments arose in the 1960s on the western Costa del Sol and these were later joined by many more, both on the coast and inland. Concentration on the coastal strip is a phenomenon which is associated with intensive urbanisation and indiscriminate occupation of the land.

Emerging tourist destinations, such as Morocco, are those which are today under the strongest pressure. New tourist promotions are being developed at these destinations, increasing environmental pressure on the area as a whole. Close collaboration between the different agents (public administrations, international organisations, companies, experts, NGOs and civil society in general) is fundamental in order to guarantee that tourism on the Sea of Alborán is sustainable.

h) Industrial, agricultural and urban waste discharge

The most significant discharges in Andalusian waters (Atlantic and Mediterranean) are sewage (around 60%), industrial discharges –oil and petroleum products above all- (around 30%) and, in proportions of less than 5%, agricultural waste and radioactive compounds (in the Atlantic zone). This is a reflection of the low level of industrial development and the effects produced by urban conglomerations.

On the southern shore, the most significant problems originate from urban discharges, with four areas which can be considered hotspots, the urban areas of Tangiers, Al Hoceima, Nador and Tetouan/Martil (whose waste water treatment plants do not cover the real demand).

i) Maritime traffic

The flow of maritime traffic is characterised by the high volume of traffic which passes through the Sea of Alborán without calling into port, although increasing numbers of container ships are docking in the

Spanish ports of Algeciras and Malaga. On the southern shore, the termination of the TangerMed port will lead to an increase in the number of ships docking.

According to the Mediterranean Action Plan (2006), something over 25% of world cargo shipping (some 60,000 ships a year[16]) pass through the Sea of Alborán (including oil tankers and bulk container carriers with cereals, chemical products, gas, coal, cement, sand, oils, etc.[17]). This represents a significant, permanent risk of potentially contaminant accidents, especially by hydrocarbons.

The incidents which have occurred off the Moroccan coast, in particular the accident involving the "Sea Spirit" which, in August 1990, collided with a ship carrying methane, the "Hispiris", off the coast at Al Hoceima, contributed to raising the awareness among Moroccan public opinion of the risks which threatened the coastline.

Neither should we forget the existence of a large port like Algeciras-Gibraltar and its impact on the surrounding environment.

2.3. CURRENT ENVIRONMENTAL SITUATION: MAIN IMPACTS ON THE ECOSYSTEM AND BIODIVERSITY

Having identified the origin of the environmental pressures and threats affecting the Sea of Alborán, it is appropriate now to indicate the impact caused by these pressures and threats. We have included those which are due to the destruction of coastal habitats, pollution, eutrophication (including red tides), fisheries and aquaculture, the invasion of alien species and, of course, climate change.

a) Modification and alteration of the coastal habitat

- Excessive coastal development and the conflicts this causes. Coastal erosion.

On the entire coastline of the Sea of Alborán, though to a significantly higher degree in the north than the south, the coastal areas are being abused through: i) indiscriminate construction; ii) the extraction of sand (to regenerate beaches, for construction, cultivation in sand in greenhouses); iii) the construction of coastal infrastructure (ports, piers) which could interrupt coastal drift[18]; iv) the reduction of deposits of sediment from rivers on the coast (dams, channelling of river mouths); v) excessive agricultural and urban consumption of water.

Furthermore, coastal erosion undoubtedly causes a loss of forest cover and degradation (progressive salination) of the soil. These phenomena are altering coastal dynamics and causing a progressive breakdown of the coastal balance.

- Water shortage

We have already commented on how vital water is to the zone, both for the preservation of ecosystems and for human development, and we have also mentioned the shortage, fragility and poor quality of water resources in the region. For these reasons, there is no doubt that water shortage could become a limiting factor as regards future development. An indicative fact is that, in the case of the Moroccan Mediterranean shore (2004 figures), only 53% of dwellings enjoyed a drinking water supply (maximum of 77% in Tangiers-Assilah and a minimum of 15% in the province of Chefchaouen). Agricultural

[16] If ferries are included, this figure exceeds 90,000 ships per year.

[17] The Port of Algeciras is the biggest in Spain and the seventh biggest in Europe for cargo traffic.

[18] The gradual movement of sand and other sediments along the coast under the effect of waves and coastal currents.

practice is still a significant, diffuse source of progressive contamination (salination) and losses of water in the zone.

The tremendous increase in the number of golf courses opened in recent years (today, there are about 80 in Andalusia) plus the planned expansion (almost 100 new courses in Andalusia as well as several more under construction in Morocco), makes it essential that all of the Administrations with responsibility in the field, as well as the promoters themselves, take the necessary measures to avoid overexploitation of aquifers. The reuse of water and other associated measures to diminish the impact of golf are required.

b) Pollution[19]

As from the second half of the 20th century, thanks to rising concern for the matter and the growing technological capacity to detect its influence, human action has significantly magnified the natural effects influencing Mediterranean geochemistry (soil erosion, water run-off, volcanic activity, atmospheric transport, such as rain containing red sand from the Sahara). Trace metals (lead, cadmium, mercury, copper and zinc) have been found throughout the whole water column, as have a series of substances linked exclusively with human activity, such as pesticides, anti-scaling agents, Freon, artificial radionuclides and waste of all types. This growing difference between natural effects and artificial effects is the origin of marine contamination.

Thanks to the different control programmes (MEDPOL) run under the Mediterranean Action Plan of the United Nations Environment Programme (UNEP) and the Barcelona Convention, the previous upward trend has been stabilised and even reversed in certain zones, but there are still significant deficiencies in data gathering and in a lack of consistency in data relating to trends over time. There is still a lack of information, organisation, resources and results in a significant number of countries[20].

The main contaminants studied are heavy metals, organochlorines (persistent organic chemicals such as PCBs and DDTs), crude and petroleum hydrocarbons and microbiological agents.

- Heavy metals

Mercury, lead and cadmium are toxic and persistent. They are bio-accumulable in the tissues of fish and filtering molluscs (for example, mussels and oysters), and they may be passed on to human beings, creating serious health problems especially when these species are consumed frequently and copiously. Species at the top of the food chain (dolphins, tuna and swordfish) biomagnify the levels of metals (they show higher concentrations than those found in the fish they eat). To date, heavy metals have not been found at levels to cause concern in the zone.

- Organochlorines

Since the 1940s, organochlorines have been widely used in agriculture (*DDTs*) and in industry (polychlorinated biphenyls, *PCBs*). Since the 1970s, their production and marketing has been prohibited in many countries, but they are still considered important pollutants of the marine environment. Their toxicity has led them to be classified as Persistent Organic Pollutants (POPs) by the Stockholm Convention.

PCBs: concentrations detected are at a medium level with some peaks in more industrialised areas. Studies of the levels of PCBs in the common dolphin (*Delphinus delphis*) in the Sea of Alborán show

[19] Summary of the information provided by José Benedicto (IEO, Mar Menor-Murcia).

[20] In the case of the Sea of Alborán, on the northern shore, regular research (since 1991) has been done by the Murcia CO of the Spanish Institute of Oceanography (IEO) and on the southern shore by the Nador Centre of the INRH (in more recent years).

concentrations which are double those found in this species in the Atlantic and are close to levels which could cause adverse effects (failure of the immunological system and reproduction).

DDTs: concentrations found in the Spanish zone are low. The large differences in levels between the common dolphins in the Mediterranean and the Atlantic reflect a certain degree of isolation of the Mediterranean population of this species.

- Crude and petroleum hydrocarbons

Discharges (due to leaks, cleaning of bilges, leaks from refineries or accidents) alter the composition and function of the surface microlayers, which could affect the balance of the coastal ecosystem in question and the lives of birds, marine mammals and benthonic species in the surrounding area. Almost 30% of world oil transport by tanker passes through the Straits of Gibraltar. The lack of adequate port facilities and the existence of crude oil refineries and storage tanks explain why, in this area (around ports and refineries), hydrocarbon concentrations have been found at levels higher than those found in the Atlantic.

- Microbiological agents

The most immediate and persistent source of contamination by pathogens, as well as the greatest health risk, is waste water. Its treatment has improved considerably in recent years in the northern zone. The same cannot be said of the south.

c) Eutrophication, including harmful algal bloom

Eutrophication is another type of contamination caused by untreated or insufficiently treated urban or agricultural effluent which contains a very high nutrient load (especially nitrogen and phosphorus) and material in suspension (degradable or inert) which contribute significantly to the accumulation of deposits which are rich in organic material (which are often also contaminated by metals and other pollutants). This phenomenon is common in ports and bays which are more or less closed, especially those close to coastal cities and at the mouths of rivers. It can also give rise to the appearance of large quantities of mucilage and to the increase of multicellular algae which invade beaches and foul fishing gear[21]. In excessive quantity and under particular conditions (Black Sea), a more or less generalised situation of anoxia may arise.

Eutrophication, together with particular oceanographic conditions, can encourage the proliferation of a number of microscopic algae, some of which may be toxic and can cause the phenomenon known as “red tides”. Bivalve molluscs are filtering species which feed on small particles which float in the water. Their diet includes numerous species of these microscopic algae, which means that the bivalves accumulate certain substances which are toxic to human beings. The presence of high concentrations of these toxins has led the authorities to prohibit the capture and/or sale of molluscs. On the Spanish side, the appearance of red tides has produced negative effects on bivalve mollusc fishing on the Andalusian coast since 1989, with intermittent suspensions of shellfishing and, on occasions, the complete closure of bivalve mollusc fishing grounds in order to prevent the capture of shellfish with toxicity exceeding the legal limits. There has existed, for some time, regular control of the different dinoflagellate species, which are mainly responsible for the red tides, and of the health problems which they cause: PSP (Paralytic Shellfish Poisoning), DSP (Diarrhetic Shellfish Poisoning), NSP (Neurotoxic Shellfish Poisoning) and ASP (Amnesic Shellfish Poisoning).

[21] Jellyfish are also increasingly common on the beaches and this may be at least partly due to the increase in nutrients. However, the influence of currents, the increase in the temperature of the water and the fall in the number of predators must also, without doubt, have an influence.

d) Fishing and aquaculture

It is well known that overfishing, in breach of the regulations and when it affects the lower levels of the food chain, has consequences for the ecosystem as a whole. In the Mediterranean in general (including the Sea of Alborán), over the last 50 years, the trophic level of catches has fallen, which in turn has meant a significant loss of large predators in the ecosystem (FAO data). Moreover, massive catches of young specimens and the high level of discards of non-target species by trawlers, together with the physical damage caused in marine phanerogam meadows, can eventually cause the loss of biodiversity, since the structure of fish stocks is altered.

Even though aquaculture in the Sea of Alborán is not highly developed, measures to minimise the possible impact[22] should be contemplated.

e) The introduction of alien species

The introduction of species occurs, above all, in the eastern part of the Mediterranean, especially through the Suez Canal (known as lessepsian migration), although the sediment and ballast water of ships in transit, encrusted organisms and aquaculture (through importation) also lead to the introduction of alien species (some of these species can become invasive and can endanger the local fauna and flora or change the balance of the ecosystem). The phenomenon of introduced species is also seen as one of the processes derived from global change, and global concern about its possible effects is increasing. These effects could include:

- The introduction or spread of pathogens or parasites;

- The modification of the physical characteristics of natural ecosystems and the alteration of ecological conditions (for example, lack of oxygen);

- The modification of the existing balance as regards competition for resources (food, space, spawning grounds);

- The appearance of imbalances in the food chain with the introduction of species which are potentially dangerous and which may displace, reduce or extinguish native species (genetic effects on those species);

- The production, in certain cases, of unwanted economic effects due to the greater encrustation on ships, in water tanks and drainage systems;

- Economic losses in tourism and leisure activities.

f) Climate change

The serious impact being caused by climate change, as well as the impact that may foreseeably occur in a future which is much nearer than one may think, is already causing changes in the wind system, the sea-atmosphere interaction (evaporation, precipitation, exchange of gases –especially carbon dioxide and oxygen- and salts) and in the mean sea level and marine currents. There are indications that the

[22] Due to the use and subsequent presence in the surrounding marine environment of a series of products frequently used in aquaculture (hormones, antibiotics, steroids and similar substances, including phytoestrogens, as well as the significant amount of uneaten food and excrement in the case of floating cages), which, in aquaculture zones, could cause changes in the abundance and diversity as well as the biomass of the macro-fauna and flora and in the diversity of organisms which live in the sediment in those zones.

Mediterranean (and the Sea of Alborán in particular) may be particularly sensitive to this type of change[23], with a rise in the sea level of around 50 cm between now and 2050.

The latest EU forecasts already speak of an extremely alarming situation, as it is accepted that within a period much shorter than that initially estimated (of just 15-20 years), there may be an increase in the sea level that will flood, among others, large areas of the Mediterranean coast.

According to the report of Working Group II of the 4th Report of the Intergovernmental Panel on Climate Change (IPCC), for the first time, a wide spectrum of impacts caused by recent changes in the current climate has been documented. The Report notes that the climate-based risks will increase, although the type of change will vary from one zone to another. And so, for the Mediterranean region, drought will be more frequent and prolonged, the forest fire season will be longer and the risk will be higher, and the flow of water in some rivers could drop by up to 80% in summer. As well as this, the rise in the sea level will probably give rise to a migration inland from the beaches, with losses of up to 20% of coastal wetlands. This will also reduce the availability of wetlands for many species which reproduce or feed in low-lying coastal areas. Many ephemeral aquatic ecosystems will disappear and permanent ecosystems will become smaller. The higher temperature of the sea could cause infective mortality on a large scale among Mediterranean dolphins, as well as an increase in salinity and eutrophication of coastal waters.

The capacity to examine the impact on marine ecosystems is still limited, but these impacts will be substantial in highly dependent communities, since long-term variability in the climate is a determining factor in fishery production at regional level.

Strategies to adapt to climate change must be mainstreamed into comprehensive integrated management plans for coastal zones and in the creation of new protected marine areas.

2.4 CONSERVATION OF THE NATURAL AND CULTURAL HERITAGE TO ENSURE SUSTAINABLE USE

The accumulation of impacts of all kinds (physical, chemical, biological, geological, socio-economic, cultural and aesthetic), which are making the Alborán zone increasingly fragile and vulnerable, require a response from society, beginning with the governments, which is becoming increasingly urgent. The sustainability measures which, after long, arduous discussion, have been taken by the international organisations involved and which have then been gradually and slowly adapted at national level, must assess the threat affecting the zone and protect its natural and cultural heritage. To do so, it is essential to take the preventive measures necessary to avoid those threats. Such measures are, firstly, those related to the risks originated by human action: i) maximise control of the consumption of natural resources (water, land, fish, energy); ii) minimise the loss of biodiversity and the increase in pollution; iii) control unrestrained, poorly-planned urban development, preventing construction in high-risk zones; iv) ensure compatibility between tourism and the environment; v) maximise control of forest fires and of the loss of coastal wetlands (Box 7) and plant cover, and secondly, measures related to the prediction and maximum attenuation of natural risks.

The key elements in order to guarantee the conservation and sustainable use of the natural and cultural heritage are the integrated management of marine and coastal zones, the creation of protected marine areas and the conservation of species, as well as the sustainable management of resources.

[23] A detailed study of the period 1992-2001 has shown that there has been a sharp increase in the water temperature on the continental shelf of the Sea of Alborán on the coast of Malaga. The rate of increase is of the order of 0.01°C per year, which is greater than the increase seen in the deep waters of the Mediterranean. Likewise, the number of species of "Mauritanian" origin in the area has also increased. The population of the round sardinella (*Sardinella aurita*) has increased over the last decade, especially in the waters of the northern half of the Spanish Mediterranean coast.

a) The integrated management of marine and coastal zones

The strategic importance of the coastline is undeniable (Box 8) and, precisely for that reason, it faces a number of problems among which we would highlight: i) the lack of foresight in coastal management; ii) the existence of numerous policies and sectoral plans with copious sectoral regulations, but which are dispersed and unequal (with conflicts of responsibilities between administrations); iii) the lack of political support for local initiatives in matters affecting the coast; iv) the absence of professional profiles adapted to the needs of integrated, multidisciplinary management; v) the lack of public awareness regarding the coastal environment.

In order to address these problems, the concept of Integrated Coastal Zone Management (ICZM) was defined, especially at scientific level, several decades ago. It refers to a process of governance which consists of the legal and institutional framework necessary in order to guarantee that coastal management and development plans include integrated environmental objectives and that they are drawn up with the participation of all of the sectors and/or stakeholders affected.

Box 7

Coastal wetlands

Transitional spaces between the land and the water, wetlands are true biological reserves which constitute a remarkable natural heritage due to their biological wealth and the important natural functions that they perform. On the one hand, they provide a habitat for numerous bird populations and offer a space for the reproduction of many species of fish. On the other, they also contribute to the regularisation of the water regime, allowing the replenishment of subterranean waters, preventing flooding, stabilising the coastline and allowing the self-purification of watercourses. They are, then, an extraordinarily productive system. Unfortunately, down the years, this situation has deteriorated enormously due to the actions of man. Though there are few coastal wetlands on the Sea of Alborán, despite their scarcity, they represent ecosystems of great interest and diversity. At international level, the Ramsar Convention is an intergovernmental treaty on the conservation and rational use of wetlands of international importance established in 1971 in order to address these matters, though its success has been very limited.

The wetlands in the Alborán Region which are covered by different regional protection measures are:

In Spain

- Cabo de Gata Salt Flats, Almeria, two wetlands (437.5 hectares in total). Ramsar Site
- Punta Entinas-Sabinar, Almeria, three wetlands (804.4 hectares in total). Ramsar Site, 1,948 hectares
- Albufera Honda (15 hectares), Almeria
- Albufera Nueva (32 hectares), Almeria
- River Palmones Marshes (58 hectares), Cadiz
- Mouth of the River Guadiaro (27 hectares), Malaga
- Mouth of the River Guadalhorce (67 hectares), Malaga
- Mouth of the River Vélez (12.18 hectares), Malaga
- Charca de Suárez (13.78 hectares), Granada

In Morocco (Ramsar Sites)

- Moulouya Estuary (3,000 hectares)
- Nador Lagoon (Sebkha Bou Areg) 14,000 hectares (also known as Mar Chica)
- Three Forks Cape 5,000 hectares

In Algeria (Ramsar Sites)

- Marais de la Macta (Oran), 44,500 hectares

Box 8

Strategic importance of the coastline

i) An increasing percentage of the population and of the economic activities which generate wealth and well-being are located in these zones;
ii) They are a fundamental link for transport and trade;
iii) They have some of the most valuable habitats from the point of view of their contribution to biodiversity and geodiversity;
iv) At the same time, they are a priority resource for tourism, one of the world's leading economic activities.

In Recommendation 2002/413/EC, the European Parliament and Council and the Protocol for the Mediterranean of the Barcelona Convention called on Member States to adopt a strategic approach to ICZM based on the following objectives (to be achieved in the period 2002-2006):

- The protection of the coastal environment in terms of ecosystems;

- Recognition of the threat posed by climate change;

- Ecologically responsible protection measures, including protection of coastal settlements and their cultural heritage;

- Sustainable economic opportunities and employment options;

- A functioning social and cultural system;

- Accessible land for recreational purposes and aesthetic reasons;

- The cohesion of remote coastal communities;

- Improved coordination of measures.

The Protocol on Integrated Coastal Zone Management in the Mediterranean, under the umbrella of the Barcelona Convention, was signed in Madrid on 21 June 2008, after six years of consultations and negotiation. It is the Seventh Protocol of the Convention, due to come into force in 2010 or 2011, and represents the will of the Mediterranean countries to improve the management of the sea-land interface.

b) The protection of marine and coastal areas and the conservation of species

PROTECTED MARINE AREAS (PMAs)

The establishment of PMAs, in the form of small reserves or parks, as a conservation/protection measure is already quite old. More recently[24], it has been suggested that they be used as a complementary tool for the management and protection of living resources, habitats and in the restoration of degraded ecosystems. Whatever the main objective of their creation, (whether for the protection of the biological and ecological diversity of waters or for fishing interests), the management of protected marine areas should be convergent, laying down shared objectives in order to ensure the protection of biodiversity and the sustainable use of resources.

The IUCN defines Protected Marine Areas as "*any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment*" (IUCN, 1999).

Spain's Law on the Natural Heritage and Biodiversity (Law 42/2007, of 13 December), establishes Protected Marine Areas as those zones designated for the protection of ecosystems, communities or

[24] Article 6.8 of the FAO Code of Conduct for Responsible Fisheries (1995) advocates the establishment of PMAs as a best practice, especially for developing and small-scale fisheries. The 1995 Barcelona Convention also recommends Mediterranean countries to take measures for the conservation of marine biodiversity in the Mediterranean, contemplating the establishment of cross-border and high-sea PMAs.

biological or geological elements of the marine environment, including intertidal and subtidal areas which, due to their rarity, fragility, importance or singularity, deserve special protection.

At the same time, PMAs, if they are well managed, can contribute to the re-establishment of fish stocks, thereby increasing production in neighbouring zones and improving the economic situation of local communities.

Marine Reserves of interest to fisheries are zones established in order to improve fishery management (target species, areas, seasons, fishing methods, etc) and where, as a side effect of their establishment, certain species or habitats which are not the target of fishing may be protected (through the reduction of the fishing effort or the permanent closure of certain zones). A protected marine area aimed at fishing implies a total or partial prohibition of fishery activity, which may be by means of closing areas to fishing if there are no other means of managing the area (fishery protection zones, closed areas -in space and/or time-, exclusive fishing zones, marine management zones, natural marine refuges, fishery refuges), that is to say, by means of fishery reserves, also known as marine reserves or marine reserves of fishery interest which have some kind of planning, such as zoning or rotation of uses. In all events, it is essential to guarantee their management and their continued existence so that they can really fulfil their function of protection and conservation. The specific objectives of the fishery reserves[25] are:

i) The protection of spawning and/or alevin stocking areas[26];

ii) The increase of the reproductive potential which comes with the increase in the number of large specimens[27] and the export of biomass, both eggs and larvae, as well as adult individuals;

iii) The reduction of mortality due to fishing in the fraction of the population which occupies that specific area, thereby facilitating the conservation of the demographic structure;

iv) The maintenance of genetic diversity, since the impact of fishing on biodiversity is eliminated and zones would be available for comparison in order to study said impacts;

v) The limitation of other activities which could have a significant impact on the target species or ecosystem;

vi) The reduction of conflict between fishers (suspension/prohibition of the use of certain types of fishing gear).

CONSERVATION OF SPECIES

Some marine species are particularly threatened due to the alteration of their habitat or overfishing. The fall in the stocks of these species in recent years is a clear example of the effect of human action on the marine environment. Cetaceans, turtles, phanerogam meadows, kelp forests and maërl beds are just a few fairly paradigmatic examples of this need for conservation.

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[25] See Reports and Studies Nº 4 of COPEMED on "Protected marine areas as tools for fishery management in the Mediterranean", March 2004.

[26] Furthermore, the prohibition of the more destructive fishing gear, such as trawling, can also help to increase the complexity of the habitats through the possible recuperation of those key species which help to structure the space which had previously been affected by destructive fishing gear (such as marine phanerogam meadows, maërl beds and sessile invertebrates). This would contribute, in turn, to a greater availability of refuge and of trophic resources.

[27] The effect would depend on the biology of the species and their dispersion rate, on the distance from the boundaries of the protected area, the duration of the larval stage in the life cycle and the oceanographic conditions of the zone.

- The relevance of the region for cetaceans[28]

The most common species in the Alborán zone are the common dolphin (*Delphinus delphis*), the striped dolphin (*Stenella coeruleoalba*) and the common bottlenose dolphin (*Tursiops truncatus*), together with the long-finned pilot whale (*Globicephala melas*). Less common are the Risso's dolphin (*Grampus griseus*), sperm whale (*Physeter macrocephalus*), fin whale (*Balaenoptera physalus*), Cuvier's beaked whale (*Ziphius cavirostris*) and, more occasionally, the bottlenose whale (*Hyperoodon ampullatus*). The occasional presence of other species has also been reported (Minke whale, humpback whale, orca, false orca, etc).

- The three species of dolphin have a high population density (of the order of one specimen per square kilometre for the common dolphin in coastal waters, and for the striped dolphin in deeper waters), while the common bottlenose dolphin is found in the largest groups (4-5 times larger) found in Europe. The common dolphins of the Sea of Alborán are genetically different from those of the eastern Mediterranean and are more closely related to those of the north-east Atlantic.

- The long-finned pilot whale is a resident in the zone in the highest densities found anywhere in the western Mediterranean. The Risso's dolphin prefers the deep waters to the south of Almería, where it meets with the same animals over a period of several years.

- The Cuvier's beaked whale is found almost exclusively in the deep waters to the south of Almería (at more than 900 m in depth).

-the sperm whale is not very common (just a few dozen residents), and is found above all in the Straits of Gibraltar and in the deep waters to the south of Almería.

- The fin whale uses the Sea of Alborán as a migratory route between the Mediterranean and the Atlantic.

- Groups of orcas (*Orcinus orca*) can also be found in the area of the Straits of Gibraltar between the months of March and October.

Legal instruments have been created in Spain for the conservation of cetaceans, such as Royal Decree 1727/2007 or the 2006 Royal Decree which distanced maritime traffic from the Cabo de Gata zone. These two instruments are described in the section on Cetaceans.

- The importance of the region to turtles[29]

Five species of turtles have been observed in the Sea of Alborán, the most common being the loggerhead sea turtle (*Caretta caretta*), which is found throughout the year. Another species which is frequently found in these waters, mainly close to the Straits of Gibraltar, is the leatherback turtle (*Dermochelys coriacea*). The green turtle *(Chelonia mydas),* Kemp's Ridley *(Lepidochelys kempii)* and the hawksbill turtle *(Eretmochelys imbricata*) are found here sporadically. None of these species usually reproduces on Spanish or Moroccan beaches, although the nesting of a loggerhead sea turtle has been recorded on the beach at Vera (Almería) in 2001 and another two in Catalonia and Valencia in 2006. The leatherback turtle also visits the zone regularly while the Mediterranean population of the green turtle is in a critical state.

[28] Information summarised from that provided by Ana Cañadas (ALNITAK), the pioneering NGO in the study of the north-eastern zone of the Sea of Alborán and the Gulf of Vera (since 1992). Another NGO, CIRCE, began a monitoring programme in the waters of the Straits of Gibraltar in 1999. Both organisations work in close cooperation with each other and with the Spanish Cetacean Society.

[29] Summary of the information provided by Ricardo Sagarminaga (ALNITAK) and J. A. Camiñas (IEO, Málaga).

Fishing with drifting surface longlines is the main threat to sea turtles in the western Mediterranean, with annual catches in the entire Mediterranean basin being estimated at 60,000 individuals. The loggerhead sea turtle is the species which has most been studied in the Sea of Alborán, both because of its abundance and its beachings in Spanish and Moroccan waters and because of the significant conservation problems caused by its accidental capture with surface longlines and driftnets, mainly in the area of the Straits of Gibraltar and the contiguous zone of the Sea of Alborán, where up to 150 boats using drift gillnets have been counted, which could catch large numbers of *Caretta*. The relevance of the Sea of Alborán as a migratory and feeding habitat should also be underlined, for both the Mediterranean and Atlantic populations of the loggerhead sea turtle and the leatherback turtle.

Factors which influenced the death and/or beaching of specimens in the zone:

- Accidental entanglement in fishing gear;

- The ingestion of solid waste, mainly plastics;

- Impregnation with tar and oil;

- Collisions with boats;

- Chronic parasitic hepatic illness or reproductive disorders – the accumulation of toxic substances (heavy metals and pesticides) in bodily tissues.

As regards the state of conservation, the population of the loggerhead sea turtle is in regression worldwide[30].

- Relevance of the region to marine flora

MARINE PHANEROGAM MEADOWS

These are one of the most interesting and richest ecosystems to be found on the sandy bed of the Sea of Alborán, though they are little known. As we have already mentioned (see point 2.1.a), these marine plants are very important primary producers and diversifiers of the space they occupy. This means that a large number of marine species find their food, refuge and a suitable place for reproduction in these meadows. Marine phanerogams are distributed from the low tide line down to 15/60 m (the lower photophile limit). The maximum depth at which we find phanerogam meadows depends on the transparency of the water and the intensity of the light. On the coasts of the Sea of Alborán, there are four autochthonous species of phanerogam: *Posidonia oceanica*, *Cymodocea nodosa*, *Zostera marina* and *Zostera noltii*.

Most of the marine meadows on the coast of the Sea of Alborán (except those at Cabo de Gata) are currently in regression due to the alteration of environmental factors such as:

- The amount of suspended solids (the discharge of waste water limits the penetration of light),

- Physical destruction by trawl gear (in waters where this is prohibited, <50 m in depth), by fishing gear used to capture molluscs[31] and by the anchors of boats,

[30] Included on the IUCN Red List of endangered species (2001), in Annexe 1 of CITES and the Bonn Convention. In the EU, it is catalogued as a species of community interest (1997) and in Spain as a species of special interest (1990). The Atlas and Red List of Amphibians and Reptiles of Spain catalogues it as "endangered".

[31] It has been estimated that one hour of trawling on a meadow of *Posidonia oceanica* can uproot between 100,000 and 360,000 plants, which could cause the regression or even disappearance of the meadow

- discharges by seawater desalination plants (*Posidonia oceanica* does not tolerate sharp variations in salinity).

The zones of the Sea of Alborán where marine phanerogam meadows have been located are:

Spain

- Cabo de Gata (*Posidonia oceanica* and *Cymodocea nodosa*). The only zone where, thanks to the protection afforded to them, the Posidonia meadows are clearly expanding. Almería.
- Torregarcía to Cerrillos, Bay of Almería (*Posidonia oceanica).*
- Punta del Sabinar and Punta Entinas (Almería) to Guardas Viejas (*Posidonia oceanica).* Extensive, sparse meadows.
- Roquetas de Mar (Almería) (*Cymodocea nodosa*, *Posidonia oceanica* and *Zoostera noltii*). At risk of disappearing.
- Castell de Ferro (*Posidonia oceanica*). Just a few isolated meadows.
- Castillo de Baños and Punta Negra (Granada) with *Posidonia oceanica* and *Cymodocea nodosa.*
- Entre Salobreña and Motril (Granada), *Zostera marina.*
- Maro-Cerro Gordo (*Posidonia oceanica*, *Zostera marina* and *Cymodocea nodosa*), Málaga.
- Torre del Mar (*Zostera marina*) (probably disappeared).
- Rincón de la Victoria, Chilches and Benajarafe (*Zostera marina*), probably degraded.
- From Punta Calaburra to Marbella (*Posidonia oceanica*), just a few isolated meadows (Málaga).
- Bay of Estepona (Málaga) (*Posidonia oceanica* and *Cymodocea nodosa*).
- Mouth of the River Palmones, Cádiz (*Zostera noltii*).
- Torreguadiaro, Cádiz, *Cymodocea nodosa.*
- Between Tarifa and Algeciras, three large meadows of *Cymodocea nodosa.*
- Bay of Algeciras (*Zostera marina*).
- Punta Chullera-Cala Sardina, Cádiz, *Posidonia oceanica.*

Morocco

There are meadows of *Zostera marina* in Nador Lagoon at depths of 3.5 m, below which *Posidonia* is predominant. They can also be found at the westerly limit of Three Forks Cape.

Algeria

- *Posidonia oceanica* is to be found from the coast at Oran to the Moroccan frontier, although few studies have been made.

On the southern shore in general, of these four species of marine phanerogams, *Zostera* is relatively abundant although it is found in very localised areas, whereas *Posidonia*, as a species which is endemic to the Mediterranean, is rarer in areas with a greater influence of Atlantic waters. The meadows around the Chafarinas Islands are one of the western limits of their distribution on the African coast.

KELP FORESTS

Kelp forests are very rich environments given the spatial variety of habitats and micro-habitats that they provide. On the northern shore of the Sea of Alborán, there are four species of kelp: *Laminaria ochroleuca*, *Phyllariopsis brevipes*, *Phyllariopsis purpurascens* and *Saccorhiza polyschides.* They are only found between Tarifa and Estepona, off the coast opposite the castle at Guardias Viejas (Almería) and on the Isle of Alborán. On the Moroccan and Algerian coasts as far as the Straits of Mesina, *L. ochroleuca* is found from 25 m down to 70 m, *S. polyschides* from 12-14 m down to 25 m and the two *Phyllariopsis* species are found below 25 m. Kelp forests in the Sea of Alborán, formed by *Laminaria ochroleuca* and *Saccorhiza polyschides,* are the largest to be found in Spanish waters, with specimens of

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when the trawling is repeated in the same zone. It is estimated that meadows affected in this way can take around 100 years to recover.

up to 4 m, while *Phyllariopsis* forms the undergrowth. The physical variety and the singularity generated by these habitats in Alborán give rise to a very rich associated flora and fauna. *Laminaria ochroleuca* is included in Annexe I of the Bonn Convention as a strictly protected species of flora.

MAËRL BEDS

Maërl beds formed of living and dead calcareous algae, mainly free, articulated rhodophytes of the *Corallinaceae* and *Peyssonneliaceae* families, are home to very diverse flora and fauna which are just as important as the phanerogam meadows or kelp forests. In the maërl communities studied in the Mediterranean, more than 300 plant and 700 animal species have been recorded, and new species are constantly being discovered. Furthermore, they make up an important zone for the spawning and rearing of many species of economic importance, such as bivalves, cephalopods and fish. Their calcareous structure, their need for good quality water and their low growth rate make these communities very sensitive to changes and anthropogenic pressure. Due largely to the taxonomic complexity of algae and a general lack of knowledge about their importance, few studies have been made of this habitat. Around the Isle of Alborán, maërl appears at depths of between 30 and 80 m, overlapping with the kelp forests. The distribution on the rest of the northern shore is little known, though it is believed that extensive areas are to be found especially in Cabo de Gata-Níjar (Almería) and the Straits.

- Relevance of the region to the Mediterranean monk seal (*Monachus monachus*)

The observations of Moroccan fishers indicated that the Mediterranean monk seal was relatively common (several colonies) in the Al Hoceima-Ras Kebdana region. Investigation by a team from INRH-Nador in October 2004 at the different sites where it was thought the seal was to be found identified the only existing specimen, in the Chamlalla zone. This specimen subsequently disappeared, and the fishers revealed that it had been found beached at Imhiyaten (some 2 km to the west of Three Forks Cape), although its body was never recovered. It was not spotted on the Moroccan coast in 2007, nor was it observed on the Algerian coast in a mission in 2006.

c) The sustainable management of resources

A series of specific characteristics of fisheries in the Mediterranean (including the Alborán Sea) can be defined. Among the positive characteristics, we could highlight:

- Many artisanal fisheries which provide employment and support specific coastal communities which conserve historical local traditions;

- There are populations of fish and molluscs, generally of high economic value (high market demand), which are local, confined to the coastal strip and not shared between countries;

- Narrow coastal shelves which fall rapidly down to the deeper waters of the continental slope guarantee the protection of some stocks in some zones;

- In general, industrial fisheries are less developed than in other zones, while the existence of fishers' Guilds and/or Associations could facilitate their participation in shared management with the national and regional Administrations concerned. This could allow the application of flexible management systems which are adapted to local circumstances;

- At international level, especially through the FAO-COPEMED project funded by the Spanish Agency for International Development Cooperation (AECID), significant efforts have been made in recent years both to reinforce knowledge of fisheries and also to encourage north-south and south-south scientific collaboration, all under the umbrella of the GFCM in order thereby to facilitate the management of shared resources.

The negative elements include:

- The inability in practical terms to apply conservation measures which tend to limit fishery mortality (measures affecting the fishing effort or catches, including minimum sizes, the regulation of mesh size, closed areas and close seasons, restrictions on the use of certain types of fishing gear), probably due to the diversity of fisheries, the high number of fishing ports and the existence of a market for undersized fish, leading to overfishing of some pelagic species and many demersal species.

- The unreliability of existing statistics;

- The limited information about the biology and status of stocks (they have been few evaluations, and it has not been possible to define reference limits or to apply the precautionary principle);

- The high fishery pressure in coastal waters, with a high proportion of discards and the massive catch of juveniles (trawling);

- The lack of scientific knowledge and lack of control over sporting or recreational fishing;

- The scarcity of information available to evaluate the real degree of dependence on fisheries in the different coastal communities, in order to provide a guide for future development;

- The unwise use of community subsidies for the modernisation of fishing fleets, which has led to a race to acquire ever bigger and more powerful boats in order to fish more. In practice, this has led to an increase in the fishing effort, thereby diminishing the sustainability of resources;

- The notable lack of involvement of the different stakeholders (Box 9) in the management of resources (little interaction between administrations, scientists and, above all, artisanal fishers);

- The practical non-existence of common fisheries in Alborán (except for large pelagics in the Straits zone, managed by the ICCAT), which has meant that there has been no need to establish a common resource management policy between the countries.

A chronic problem of Mediterranean fisheries (including the Alborán) has been and still is the lack of a sustainable management policy for its resources at all levels, which has led to an undoubted crisis of governance.

Box 9

Stakeholders and resource management

The stakeholders, in the widest sense, are:

- All of the direct users of resources with significant investment in the fisheries system, including fishers/fishing boat owners, processors, boat builders, net makers, consumers of fish and derived products, as well as those responsible for food safety
- Those interested in the environment, its habitats, flora and fauna
- Scientists and experts in the different disciplines
- Regional and local Administrations with responsibilities for social, economic and environmental issues
- Central governments, which are obliged to take a wider view of the problems at national and international level
- In Europe, the EU, as the body with the highest responsibility for the shared management of resources

In order to achieve the sustainable management of fisheries, it is essential to have updated information about the exploitation of the resources. Let us review the current situation.

There is known overfishing of the anchovy in Spanish waters, however, there is no information about its status in the Sea of Alborán as a whole, since there has never been a joint north-south evaluation. As regards the sardine, although there has been a growth in catches landed and in the CPUE since 1998, there

are, to date, no recommendations to limit the fishing effort targeted at this species, although such recommendations do exist in the Moroccan zone.

Small pelagic fish stocks are highly dependent on the prevailing environmental conditions. These conditions are not uniform in the Sea of Alborán and there are significant differences between the north and south of the basin, and between the east and the west. Therefore, if it were possible to carry out a Pilot Plan for the management of small pelagic fish, as is the intention of the COPEMED project, this should be done with multidisciplinary research. This would require studies of the physical environments and the food chain in all of the area of distribution of the stocks which are being exploited. Joint management of small pelagic fish resources in the Alborán would also allow the resources which are not exploited by one country to be exploited by another within the framework of stable commercial and political agreements, providing that there is mutual interest and a consensual management system.

From the analysis of the data gathered in the MEDITS_ES campaigns studying demersal trawling in all of the Spanish Mediterranean over a period of 10 years (1994-2003), it is possible to identify, overall, a slight downward trend in the abundance of the 33 species studied over this period. An Atlas with the results of these studies is to be published shortly by the University of Alicante.

Among fish, the results in all sectors indicate that the hake (*Merluccius merluccius smiridus*), black-bellied angler (*Lophius budegassa*), red mullet (*Mullus barbatus*), blackbelly rosefish (*Helicolenus dactylopterus*), greater forkbeard (*Phycis blennoides*), spotted flounder (*Citharus linguatula*), grey gurnard (*Chelidonichthys gurnardus*) and the blackspot seabream (*Pagellus bogaraveo*) are clearly overfished[32]. As regards their geographical distribution, latitudinal trends have been found in most species. Some species such as the blackbelly rosefish, surmullet, axillary seabream, blackspot seabream, greater forkbeard and picarel tend to diminish in numbers with the latitude, and are therefore more abundant in the Alborán sector than the rest of the Spanish Mediterranean, while others are very few in number, increasing their presence towards the north (as is the case of the Atlantic horse mackerel, grey gurnard, rays, small-spotted catshark, blackmouth catshark, monkfish, red mullet, hake, poor cod and blue whiting). However, the annual trends in biomass indices are similar in all sectors.

Box 10

Small pelagic fish

For the monitoring and evaluation of small pelagic resources, the IEO undertakes an annual assessment campaign of small pelagics using acoustic methods in winter (November-December) from the Gulf of Lyon to the Straits of Gibraltar. The annual assessments began in 1983, though it has not always been possible to perform the assessment every year in the Sea of Alborán. It also undertakes regular monitoring of the sizes of fish landed at the different ports in the region. The IEO has also carried out quarterly campaigns in the north of Alborán since 1992 to study the spawning and rearing grounds (concentration of juveniles), larval growth and conditions, environmental parameters and the biological cycles of phytoplankton and zooplankton. In the assessments regularly submitted to the countries of the Scientific Advisory Committee of the GFCM, recommendations are made regarding the measures which are considered most appropriate in order to ensure the most rational possible management. In the recommendations presented by the IEO in 2004 on the European anchovy for the North Alborán geographical sub area, the SAC recommended that the fishing effort should not be increased.

In Morocco, the INRH has an efficient sampling network for the regular gathering of bio-statistical data. The most recent assessments of the sardine in the South Alborán geographical sub-area submitted by the INRH to the GFCM are for the year 2001 and the results found, on the basis of data collected only in the port of Al Hoceima, are considered very representative of this fishery. In the period 1990-2000, it shows a reduction of biomass throughout the decade, a consequence of the increased mortality due to fishing,

[32] In other species (axillary seabream, blue whiting, Atlantic horse mackerel, picarel, blackmouth catshark and small-spotted catshark), overfishing has not been detected, while for the rest it is not possible to establish conclusions due to the low numbers found in samples or the instability of trends.

which targets, above all, breeding specimens. The stock is considered to be overfished, since the current fishing effort exceeds the theoretical optimum level by 40%. In order to correct this situation, a reduction of the fishing effort was recommended, particularly by means of the introduction of a biological rest period of a certain duration, to be chosen during the sardine spawning period (October-January). Currently, the Ministry of Sea Fishing is examining management plans of the main national fisheries, in particular of small pelagic fisheries.

Among **crustaceans**, the blue and red shrimp (*Aristeus antennatus*) is on the limits of overfishing and a reduction in the fishing effort is therefore recommended for this species. No overfishing has been detected for the deep-water rose shrimp (*Parapenaeus longirostris*) whose annual fluctuations depend heavily on recruitment, nor for the Norway lobster (*Nephrops norvegicus*) (which does however appear to be overfished on the Tramontana sector on the coast of Catalonia).

Among **cephalopods**, no symptoms of overfishing have been detected, although a careful analysis of the evolution of the situation is necessary. Indicators of the abundance of the main species (octopus - *Octopus vulgaris, Eledone cirrhosa, Eledone moschata*- and the common cuttlefish -*Sepia officinalis*-) have fallen slightly in recent years. Squid (*Loligo vulgaris* and *Illex coindeti*) have shown a slight recovery since the year 2000. All of the cephalopods studied, except *Eledone cirrhosa,* are abundant in the Sea of Alborán and diminish towards the north, though annual trends in the biomass indices are the same in all sectors.

Large pelagic species

The bluefin tuna (Eastern Atlantic-Mediterranean) has been overfished for a long time, which has obliged the ICCAT to set in motion long-term recuperation plans. The situation is increasingly alarming, with an ever-lower breeding biomass, increasing numbers of juveniles being caught and, in general, a very high level of mortality caused by fishing.

3. Conservation policy in the Sea of Alborán. Recommendations and proposals by the different stakeholders

Despite the undoubted progress achieved, political and social mobilisation with respect to the environment and sustainable development is still insufficient and must be improved. This situation is probably due to:

i) The difficulty in correctly understanding the concept of sustainable development;

ii) The difficulty in avoiding the predominance of short-term interests and acquired rights;

iii) The use of unsustainable consumption and production models;

iv) The excessive use of natural resources;

v) The excessive weight of debt in developing countries;

vi) The difficulties in finding solutions to funding issues and rational environmental technology transfer.

For these reasons, increasing efforts must be made to promote conservationist policies. To achieve this, the main stakeholders (institutions and players) must first be identified, in this case, those related to the Sea of Alborán. A list of stakeholders is included in the electronic version of this document, which also includes an important number of current international cooperation projects and programmes, in which we have tried to include the objectives pursued and the results and recommendations produced.

Among the general weaknesses to be corrected, we would highlight:

Regulation measures and the enforcement of existing legislation must be improved. This continues to prevent the appropriate management of environmental issues and compliance is, without doubt, one of the essential priorities to be achieved.

A large part of the growth being seen on the southern shore is being achieved at the expense of the environment. However, there are still insufficient human, technical and financial resources available in order to comply with and enforce national and international regulations. On the northern shore, although there has been a significant improvement in many aspects in recent years, greater political will is still needed in order to achieve the rigorous enforcement of the already abundant environmental legislation.

The consequences of climate change must not be ignored and should be taken into account in all planning and actions taken.

3.1 EXISTING MANAGEMENT MEASURES RELATED TO COASTAL ZONES AND THEIR INTEGRATED MANAGEMENT

In Spain, the strategy for Integrated Coastal Zone Management (ICZM)[33], required by the EU of all its Member States, which, in its second stage (planning and organisation, 2006/2007), defined the following specific objects to be achieved as from 2008:

[33] Which touches on aspects related to tourism and urban development, climate change, maritime traffic, fisheries and aquaculture, agriculture, industrialisation (with all of the associated problems of pollution, eutrophication, coastal erosion and water shortage), as well as urgent intervention plans.

i) Sustainable management of the interaction between natural physical processes and the occupation of the coastal strip, including the application of urban development regulations;

ii) Protection and recuperation of coastal ecosystems;

iii) Optimisation of the use of natural resources (including living resources, mineral resources and sources of renewable energies, respecting the load capacity of the system);

iv) Safety with regard to the risk of environmental accidents and natural catastrophes on the coast;

v) Improvement of public facilities and the accessibility of the coast, under sustainable criteria;

vi) Recuperation and promotion of the cultural heritage related to the coast;

vii) Effective, systematic integration into the decision-making process of environmental information and knowledge;

viii) Coordination between the different administrative levels in order to facilitate territorial cohesion and coherence in defence of the public interest;

ix) Transparency in the management process and effective participation in the planning of actions;

x) Financial consolidation which guarantees the availability of the necessary technical and economic resources.

The initiatives, measures and instruments to be established in order to achieve these objectives are:

i) The Master Plan for Coastal Sustainability;

ii) The Sustainability Observatory of the Spanish coast;

iii) Agreements with the authorities of the coastal regions of Spain;

iv) The National Coastal Council;

v) The purchase of land for protection and restoration;

vi) Support for R&D&I in coastal areas;

vii) Education, ongoing training and skill-building for coastal managers.

The costs involved in the execution of such an ambitious project are not included in the document. It does, however, indicate that there must first be a complex evaluation of the cost of each of the planned actions and the economic and social costs of the new scenarios generated when the entire strategy is really and effectively implemented. Likewise, it also contemplates an evaluation of the effects of the implementation of the Strategy, with the positive and negative impacts that it is expected to produce.

Similarly, the Andalusian Regional Government decided to promote a change in the organisations which manage the coast, in order to encourage the implementation of an ongoing administrative process characterised by co-operation between the administrations, decentralisation, efficiency and public participation. A fruit of this participatory process has been the drafting of the Proposed Andalusian Strategy for Integrated Coastal Zone Management (Proposed AS-ICZM) which would provide the basis for the forthcoming approval of the Andalusian Strategy for Integrated Coastal Zone Management during the 7th regional legislature (2008-2012).

The Proposed AS-ICZM includes the following elements:

i) An analysis of the Andalusian coast, which includes:

- The geographical scope of ICZM
- Other dimensions of coastal areas, with a view to governance
- Natural processes and resources on the Andalusian coast
- Social uses and economic activities
- Scenarios of trends and operative objectives

ii) A strategic diagnosis:

- Institutional perspective of the Andalusian coast
- Integrated Coastal Zone Management and public policies of the Andalusian Regional Government
- Regulation for the management of the coast and its resources
- The distribution of responsibility for the management of the Andalusian coast
- Andalusian institutions responsible for the management of coastal zones
- Coastal management instruments in Andalusia
- Economic aspects of the management of coastal zones
- Training and skill-building for administrators
- Public information and technical-scientific knowledge
- Education and awareness for the sustainability of the Andalusian coast
- Public participation and institutional co-operation in coastal management in Andalusia
- Synthesis of the Strategic Diagnosis: SWOT matrix for ICZM in Andalusia

iii) Strategic options and approach for ICZM in Andalusia:

- Efforts to improve coastal management in Andalusia
- The challenges still facing Integrated Coast Zone Management in Andalusia
- Strategic approach: CAME matrix (a specific ICZM matrix) in Andalusia
- The strategic objectives and goals of ICZM in Andalusia. Criteria for the establishment of strategic actions
- Policy and the institutions involved. Search for synergies and the need for leadership
- Strategic options for Integrated Coastal Zone Management in Andalusia

iv) An analysis of the participatory process of the Strategy, paying special attention to:

- The objectives and conditioning factors of the process, the methodology developed, targets, materials used, provincial meetings, organisation
- Procedure, results and conclusions

There is no doubt that ICZM will only be successful if the experience and knowledge available are used optimally and budgets are allocated preferentially to projects with an overarching environmental perspective (Box 11).

Box 11

Integrated Coastal Zone Management

With respect to ICZM in the Mediterranean, an interesting workshop held by the EU over a decade ago (1996), which enjoyed significant participation by specially selected experts from both shores, classified the three aspects which way are considered to be essential for integrated coastal management, namely:

- Problems associated with the use of coastal zones (particularly the use and conservation of living resources, the impact of human activities and the influence of natural processes)
- Problems associated with spatial interactions (particularly between the open sea and the coastal zone, between land and the coastal zone and between the different activities and users of the coast)
- Problems associated with the necessary political and operative initiatives (particularly in terms of skill-building, joint research priorities, knowledge and technology transfer)

Among the conclusions and recommendations of the three working groups created at the workshop which could be applicable to the Sea of Alborán, we would highlight the following:

A. On the coastal zone

- The launch of specific pilot projects on coastal and lagoon management
- The analysis of the consequences of urban development and construction on the coast
- The preparation of a practical, informative manual for managers and planners
- In-depth studies of coastal erosion, restoration, protection and rates of change (in space and over time)
- Creation of a map of natural processes in the Mediterranean and their risks

B. On spatial interactions and related natural resources

- Treatment of fisheries in a much wider context, as a "fishery system" which includes not only fisheries, but also the ecosystem as a whole in which all of the different parties interact (which was later to be called the "Ecosystem approach to fisheries")
- Improved knowledge of the interaction between the flows of pollutants and their impacts
- Mapping and assessment of biodiversity and the sensitivity of the ecosystem

C. Socio-cultural considerations

- Analysis of the consequences of all kinds derived from the dramatic increase of tourism in the zone
- The systematic incorporation of socio-economic analysis into Euro-Mediterranean cooperation programmes
- Comparative studies at regional level of legislation related to the environment in the widest sense in the different countries
- Increased public interest and participation in these issues.

D. Methodological capacity and Research and Development

- Improvement of existing databases and strengthening of communication networks
- Development of a GIS specifically adapted to the management of coastal fisheries
- Creation of a co-ordinated peri-Mediterranean network of marine biology experts
- Creation of a bottom-up Euro-Mediterranean political model for marine issues

E. Education, Training and Technology Transfer

- Improvement of the human and material resources available for marine research
- Joint, coordinated use of research ships
- Organisation of a Euro-Mediterranean Master's degree in the management of coastal zones
- Specialised short courses
- Assessment of the needs and opportunities of work in this field
- Good interdisciplinary research and knowledge transfer

Overall, it was recognized that the great challenges we face were rooted in the need to communicate the idea that the management of renewable coastal resources was not just socio-economically important, but that it was even profitable in the long term.

It was also recognised that in order to achieve a coherent policy based on serious, ongoing regional cooperation and the performance of co-ordinated actions in this field, it was necessary to combine the four Ps, that is, Political considerations must be taken into account (in maritime policy-making), actions must be Practical (in terms of administration and their launch), they must benefit from Professional advice (with research-based information, data and theories) and they must ensure the Public Participation of the targets of government action.

Apart from this approach, which is theoretical for the moment and whose results will appear only gradually given its complexity and cost in practical terms, all that exists today is what has just been launched under the Protocol for ICZM in the Mediterranean of the Barcelona Convention with regard to some pilot Coastal Area Management Programmes (CAMPs). Among these, there is a specific programme for the Levante area in Almeria, within the Alborán zone, which, since it is a pioneer programme, will shed a lot of light on the practical application of the planned actions.

In Morocco, the Master Plan for Protected Areas (AEFCS, 1996) identified 10 Mediterranean coastal zones as Sites of Biological and Ecological Interest (SIBES), including the proposed National Park of Al Hoceima. In turn, the Moroccan Economic and Social Plan contemplated four main measures: (1) the definition of an overall planning and protection strategy for the coastal environment; (2) the improvement of the institutional framework of integrated coastal management; (3) the reinforcement and improvement of surveillance programmes; (4) the elaboration of pilot projects for the integrated planning and conservation of coastal zones in Morocco.

The creation by the INRH of a Coastal Health Monitoring Network is one of the expressions of national policy at local level as regards the protection of the marine environment, the coast and the consumer. It consists of three stations distributed in accordance with the specific nature of the different marine sectors (Nador, M'Diq and Tangiers). This network serves to create a database and it has a role in an alarm system for cases of accidental pollution or the appearance of phenomena which perturb the coastal

ecosystem (red tides -the proliferation of toxic algae- or the introduction of invasive species such as *Caulerpa taxifolia*).

As regards coastal zones, the main efforts are directed at laws and proposed laws on maritime fisheries, the preservation of marine ecosystems, coastal protection, the protection and development of the environment and impact studies.

Let us now analyse the situation of each of the different aspects covered by ICZM, reviewing the existing management measures, together with a succinct critical analysis of the results achieved by them and including some of the weaknesses which still have to be corrected.

a) Tourism (Box 12)

Main management measures proposed:

- To prevent additional degradation;
- To reduce social and environmental impacts by rehabilitating existing infrastructure and developing alternative solutions in order to limit pressure on the coast;
- To plan adequately, thinking not only in terms of short-term profit, which would avoid many problems. The proposals for changes to convert tourism into a driving force of sustainable development in the Mediterranean are an invitation to take action to reverse the current trend and make tourism an ally of environmental development.

Critical analysis of the current situation

Although tourism is still a motor of economic growth, its contribution to local economies and sustainable development in the region is still insufficient. Its excessive localisation in coastal zones, the power of the tour operators and competition between countries is leading to a tendency to standardise the products offered, with the subsequent fall in the spend per tourist (of which only a small proportion remains in the local economy).

Box 12

Tourism

The RED Report (Rapport Environnement-Developpement) of the Blue Plan for the Mediterranean, referring to the 2025 horizon, indicated that, today, tourism is centred on the coastal resort model and is characterised by fierce competition, without sufficiently valuing the cultural and environmental potential of the region. There is little control of its evolution (with explosive growth in the supply and demand from the moment that the destinations are put on the market), with a risk of economic transience (poor distribution of profits, an unfavourable currency balance for national and local economies and dependence caused by the fact that the economy is dominated by a single industry, tourism) and adverse social effects (precarious, poorly paid, unskilled jobs), together with increased environmental risks.

The report goes on to comment that the tourist sector is too deeply rooted in market logic, that it generally lacks a long-term view and it is tremendously subordinated to the interests of large, foreign-owned tour operators. In many cases, it is in the hands of financiers and business people whose sole objective is to earn a rapid return on their investments. Although there are some Mediterranean countries which have implemented sectorial policies, those policies, while there are no relevant indicators, usually only serve private interests and so the profits generated are in many cases repatriated to the country of origin. These large tour operators reinforce the single economic activity of the area, increasing the fragility of other sectors.

In this context, the development strategies of Mediterranean countries are characterised more by a spirit

of competition than of co-operation. Market logic places hotel complexes at the centre of tourist activity and contributes to a certain standardisation and banalisation of the supply (the services offered and arguments used to attract customers being very similar, and the price being, in the end, the deciding factor). The specific characteristics of the different destinations are not sufficiently valued. At the end of the day, competitiveness is based on low prices and this inhibits the development of a quality tourist offer. On the Mediterranean coast, tourism is almost synonymous with hotel management. There is a risk that ferocious competition between countries and regions will be reinforced by a further considerable increase in tourist flows (637 million tourists were foreseen for the year 2025 –half of them in coastal regions-, in comparison with 364 million in the year 2000, half of whom also visited the coast) and an uneven distribution in space and time.

The report concludes by saying that the irreversible destruction of the environment (artificialisation of the land, coast and wetlands, deterioration of the landscape, etc) and the degradation and/or waste of natural resources (water, energy) undoubtedly constitute an unsustainable trend in tourist activity.

Likewise, the increase in the production of solid and liquid waste, atmospheric emissions related to the increase in transport and noise pollution without doubt threaten the sustainability of the eco-region. The report also notes that, in the *consolidated tourist destinations* (such as on the northern shore of the Sea of Alborán), competition and standardisation of the tourist product has led to a diversification of activities, almost always identical in the different resorts (golf, thalassotherapy, water parks, etc), which are always close to the coast. Furthermore, these activities are not always adapted to the resources available in the area (the rehabilitation of the coast that would be necessary is not usually undertaken, due to its cost).

In *developing tourist destinations* (the case in one part of the southern shore of the Sea of Alborán), the growth of the coastal resort tourism model is difficult to control. The profits from tourism are usually insufficient at the local level to finance the fight against pollution and other damage. Given the strong seasonality of the model, the infrastructure created is usually oversized. The proliferation of second homes can also complicate the problems even more.

In *emerging or potential tourist destinations* (in the other part of the southern shore of the Sea of Alborán), the most desirable coastal spaces are the prey of investors, who exercise pressure of all kinds in order to take possession and develop them. Thus, "foreign enclaves" are often developed, the profits of which are never seen by the local population.

The negative repercussions of low-spending, mass tourism can generate economic problems (fall in revenue, deterioration of buildings, excessive construction of infrastructure due to concentration in the summer months, etc), environmental problems (further losses of natural spaces, the reduction or disappearance of species, urban pollution, more transport, more cement, more desalination plants and power stations, more consumption and energy dependency, etc) and socio-cultural problems (changes in the traditional urban landscape, loss of cultural identity, temporary, unskilled jobs, an increase in illegal activities, etc).

b) Physical alterations

Main management measures proposed

i) Control and management of the development of the coast;

ii) Recover the land;

iii) Control and management of the exploitation of underground waters

iv) Perfect the organisational and legal instruments, including instruments affecting the market.

In the northern zone of the Sea of Alborán, the Regional Ministry of the Environment of the Regional Government of Andalusia[34] has, in recent years, begun to implement an active policy for the protection of the coast (36% is now protected) and has mapped the entire region, including the coastal zones. This will be of great use, even though access is restricted. The foreseen entry into force (2008-2012) of a planned, controlled policy for the integrated management of the coastal zone could significantly improve this situation.

On the southern shore, the draft law on coastal protection, which is expected to enter into force shortly, contemplates:

- The implementation of integrated management of the coast for its protection against all types of pollution and degradation, whatever their origin;
- The establishment of a balance between the need for economic and social development and the need for the protection of the coast in order to conserve its wealth for future generations;
- The mainstreaming of the coastal environment dimension into state sectorial development policies;
- Partnership with local groups, environmental protection organisations and the private sector in the decision-making process affecting the coast;
- The rehabilitation of coastal zones and areas suffering deterioration or contamination;
- The application of the principle of free access to the seashore.

Critical analysis of the current situation

As well as monitoring the application of the proposed management measures, at a more immediate, practical level, it will be necessary to monitor and attenuate, in the northern zone, and prevent the foreseen increase in the southern zone of the destruction of habitats due to coastal erosion, the shortage of fresh water and the salination of aquifers, deforestation –forest fires-, drought, the degradation of pasture and farmland and the extraction of aggregate.

It will also be necessary to ensure adequate urban planning which respects the environment and existing resources much more, particularly water, avoiding illegal construction.

The accelerated desertification process which is still occurring is a key weakness which must be controlled as far as possible.

As regards urban development, local authorities must have sufficient resources to respond to the growing demand for infrastructure and services so as to avoid the problems of all kinds which have arisen on the northern shore.

c) Pollution

Main management measures proposed

i) Compliance by countries with the recommendations of MEDPOL for the standardisation of monitoring methods, parameters and substances to be measured;

ii) Launch of quality assurance programmes which cover sampling and analysis;

[34] As the Regional Ministry responsible for the quality of coastal waters, the conservation of the environment, protected spaces and public use, the management of public facilities, water management and environmental awareness.

iii) Assessment of current conditions;

iv) Cooperation in studies on the biological effects of pollutants;

v) Control, vigilance and monitoring of existing regulations and their connection with sustainable development issues (by means of the acceleration of clean production processes and the promotion of clean technology transfer from north to south).

In Andalusia, a significant effort has been made in recent years, with up to 75 new waste water treatment plants (WWTPs) coming into service, progressing from primary treatment to secondary and tertiary treatment in 2005, treating a load equivalent to almost 4 million inhabitants.

The Regional Ministry for Government (Civil Protection) of the Andalusian Regional Government has already carried out a risk analysis of pollution caused by discharges on the coast. This laid down the methodological bases for the analysis of vulnerability and it revealed the need to carry out this type of study on a more detailed scale. In 1996, Morocco launched a National Emergency Plan (NEP) against accidental contamination by hydrocarbons, which was further developed in 2003, and which involves several different Ministries and institutions.

Critical analysis of the current situation

Despite the undeniable improvements achieved thanks to the work of MEDPOL-MAP, pollution is still one of the most serious threats, both that derived from excessive urban development and insufficient treatment of the solid and liquid urban waste and also that produced through discharges of petroleum products and industrial activities, particularly pollution caused by the accumulation of hazardous substances and old or discarded chemical products (especially in the southern zone).

High concentrations of hydrocarbons have been found, especially in areas near ports and refineries in the northern zone; there is no data for the south. These concentrations are of an order of magnitude greater than those found in the Atlantic. Furthermore, the high concentration of PCBs and DDTs found in the population of the common dolphin is another very worrying indicator.

In the southern zone, there is still an almost complete lack of modern waste water treatment plants[35], for which reason it is recommended that they urgently be brought into service.

The recently created Coastal Discharge Pollution Risk Analysis Plan in Spain, mentioned above, and the Moroccan National Emergency Plan against accidental pollution by hydrocarbons are elements which, if they operate effectively and smoothly, could do much to facilitate the struggle against pollution in a planned, coordinated manner.

A weakness to be corrected is the failure adequately to implement the recommendations of MEDPOL in the different countries (especially in the southern zone), for which the main deficiencies in MEDPOL itself would have to be addressed[36].

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[35] The only waste water treatment plant currently in service is in Al Hoceima, which was brought into service in 1996; however, its solid waste is discharged at Sid-El-Abid, on a 140 m cliff which gives directly onto the Sea of Alborán.

[36] Especially those related to the fact that most of its work has concentrated on: i) in the analysis of a relatively short list of chemical substances; ii) only a few abiotic compartments (sea water and sediments -especially coastal sediments- and, to a much lesser extent, particles in suspension, marine aerosols, interstitial water and the water-atmosphere surface layer); iii) just a few biological species (mussels and red mullet in particular, though more fish, plankton and some benthonic species have gradually been included). Very little is known about the destination and transformation of the pollutants that are already being monitored or about other emerging pollutants.

As regards blooms of harmful algae (red tides), prediction is constantly improving, and there has also been progress in the control of their effects through the prohibition of the marketing of the bivalve species affected. However, the virtual impossibility of eradicating them, at least in the short term, is an important weakness.

d) Maritime traffic

Main management measures proposed

The International Maritime Organisation (IMO) has created the figure of Particularly Sensitive Sea Areas (PSSAs). These areas are not protected marine areas but they are, however, a useful tool for the spatial management of ships. Appropriate handling can, without doubt, be of great use in order to avoid the real or potential threats posed by boats to resources of ecological, social, cultural, economic, scientific or educational interest.

Critical analysis of the current situation

More guarantees are required to prevent accidents and to ensure better control of compliance with existing regulations. PSSA status should be sought for the Sea of Alborán, as WWF Spain has already requested of the IMO in 2002 and of the Barcelona Convention in 2003.

Despite being a key element in the Sea of Alborán, given that they are a source of significant pollution risk, an important weakness in the zone is the lack of adequate port facilities.

e) The introduction of alien invasive species

Main management measures proposed

The Barcelona Convention, in accordance with Article 8 of the Convention on Biological Diversity, establishes that each of the signatory parties of the Convention should prevent the introduction and control or eradicate all of those alien species which threaten the ecosystems, habitats or species.

On the northern shore, some progress has been made in this direction and attempts are being made to control the entry of alien species and to monitor them.

Analysis of the current situation

The phenomenon of alien species is considered to be one of the processes of global change and its possible effects are arousing increasing concern worldwide. It could continue to produce changes in biodiversity, which are difficult to evaluate at the moment. Since this phenomenon is favoured by climate change and the deterioration of ecosystems, it is difficult to predict its evolution. Compliance with the preventive measures must be ensured, since they are fundamental in order to avoid the introduction or reintroduction of alien species.

An important weakness which needs to be corrected is the adaptation to the Mediterranean-Alborán of a code of conduct based on the Code of Practice (1995) of the International Council for the Exploration of the Sea, the guidelines (1994) of the International Maritime Organisation on ballast water and incrustations and the Precautionary Focus (1996) of the FAO.

3.2. PROPOSED MANAGEMENT MEASURES RELATED TO RESOURCES (FISHING AND AQUACULTURE) AND THEIR SUSTAINABLE MANAGEMENT (ECOSYSTEM APPROACH)

a) Fishing

The conservation and management of fishery resources in the Sea of Alborán, which have for some time been in a worrying situation[37], with overfishing of some key species (the anchovy and bluefin tuna, in particular), is the responsibility of the Member States, which are members of the Regional Fisheries Organisations (RFOs) of the Mediterranean (GFCM and ICCAT).

Main management measures proposed

The GFCM, faced with this situation and given the specific characteristics of Mediterranean fisheries, both as regards the large number of different species caught and the peculiarities of the fleets, has for several years been advocating resource management based on the control of the fishing effort instead of controlling catches through TACs and quotas, as is the case in the Atlantic.

The ICCAT, which manages tuna resources and related species in the Atlantic and Mediterranean, uses planning measures to protect the reproductive biomass and reduce catches of juveniles through:

i) The reduction of mortality by setting Total Allowable Catches (TACs) per country and/or party to the Agreement (the case of the European Union);

ii) Setting minimum sizes (weights) which are continuously increased (in 2006, they were 30 kg for bluefin tuna and 25 kg for swordfish);

iii) Establishing closed areas and close seasons for fishing, in space and time.

The results achieved to date are not very encouraging, despite the implementation of important control measures, which are perhaps a little complex. The recent launch of long-term recuperation plans for the bluefin tuna (2007-2022) and the swordfish (2000-2009)[38], brings some hope of improvement in the medium term, if the proposed recommendations are really applied.

In 2006, the EU introduced new regulations on technical measures for the Mediterranean to substitute those of June 1994, with results which were not as expected but which could also bring about improvements if they were enforced.

There is general agreement that the management measures to be implemented should:

i) not increase the fishing effort, adapting it to the capacity of the resources;

ii) prevent the use of trawl gear at a depth of less than 50 m;

iii) prevent the use of fishing gear with a mesh size less than that which is permitted;

iv) prohibit all use of drift gillnets;

v) rigorously control all fishery activities;

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[37] Apart from endangering the medium and long-term survival of the stocks most affected, overfishing could also be affecting the biodiversity of the marine food chain (especially due to discards). At a more local level, there could be an impact on the ecosystem due to the effect on certain sensitive habitats (*Posidonia* meadows, coral beds, etc).

[38] These plans can be found on the ICCAT website (www.iccat.int/Documents/Recs/Compendiopdf-s/2006-05-s.pdf)

vi) encourage artisanal fisheries and their increased involvement in Integrated Coastal Zone Management;

vii)Gradually apply the ecosystem approach in fisheries.

In the case of the Sea of Alborán, both Spain and Morocco have a fairly extensive body of management measures. Of note is Spain's recently established (January 2006) Management Plan for the Conservation of Fishery Resources in the Mediterranean, a two-year plan that includes a number of very important protection measures which, if enforced, would undoubtedly bring about a substantial improvement in the current situation.

The case of drift gillnets is worthy of note. They were prohibited by the EU (basically because of the by-catch of mammals, turtles and birds) and are no longer used in Spain (the same cannot be said of France and Italy), but which were previously exported to Morocco (1989). There, they are still used to catch swordfish and the regulation which prohibits net lengths of over 2.5 km is not observed. In 2004, Morocco launched an Action Plan to end the use of this gear. The plan included awareness programmes, conversion to longlines and training for the fishers who use them. The fisheries administration plans to prohibit their use totally as from 31 December 2011. Likewise, to contribute to the conservation of juveniles, Morocco declared a prohibition of trawling at depths of under 80 m to the west of Al Hoceima and up to 3 miles to the east of this region.

Analysis of the current situation

It is necessary to improve and to progress in the management of fishery resources, given that there are still significant areas where there is insufficient information and insufficient effort or interest in achieving improvements at national level. Efforts to enforce national management measures and international recommendations must be improved.

The unanimous opinion in all forums is that the situation of fisheries has not improved in recent years, just the opposite in fact, although there seems to have been a slight reduction of the fishing effort, or in the number of boats at least. It remains to be seen whether this reduction has also been translated into a real reduction in the total fishing capacity of existing boats, though the indications are that it has not.

The recent new status of the GFCM, which has taken 10 years to achieve (1995/2005) and which has given it greater independence and resources, could and should allow improvements in common fisheries management in the Mediterranean, although historical inertia and the low level of real commitment of the countries does not make us very optimistic.

The new management measures recently implemented in the Mediterranean by Spain (2006-2008), if fully enforced, could represent good progress. The planned prohibition of the use of driftnets by Morocco in late 2008, if applied, could also be a significant improvement, both for the swordfish which these nets catch and for the conservation of turtles and cetaceans which get trapped in their mesh.

Following the guidelines laid down by the RFOs, as well as those produced by the different scientific institutions and international co-operation projects, the main weaknesses to be corrected in order to improve the current situation of Mediterranean fisheries (including the Alborán), are:

- The lack of political will and support in order to ensure the enforcement of regulatory measures and the control of the growth of fleets. Priority should be given to the award of subsidies for conservation measures, avoiding subsidies which bring about an increase of the fishing effort, whose control is considered an essential measure in order to achieve the better management of available resources;

- The failure to consolidate the function of scientific advisors, which would allow the standardisation of methodology for the evaluation of stocks and socio-economic analysis;

- The lack of international harmonisation in the application of management measures and instruments;

- The half-hearted commitment of the different stakeholders in the management of resources and the consequences which lead to the failure to integrate co-management schemes at all levels (national, regional and, especially, at the more local level);

- The low level of protection and real representativeness of artisanal fisheries, whose social and economic role is considered crucial;

- The low level of importance attached until now to the conservation aspects of management (protection of biodiversity, restoration of habitats, consideration of interactions between species);

- The lack of training in the field of resource conservation of all of the parties related to fisheries, from workers to executives;

- The failure to strengthen, in practical terms, the measures which may lead to the improvement of information flows of all types, ensuring the better dissemination and exchange of the data obtained (which would allow a real improvement in the relationships between scientists, fishers and fishing communities through better communication of scientific concepts, using appropriate language, as well as the incorporation of the experience and traditional knowledge of fishers);

- The failure to apply an adaptive management strategy based on an efficient management structure with well-defined objectives and sufficient, ongoing funding;

- Seek and encourage the necessary political will to launch a pilot plan based on co-management schemes with the use of indicators to inform decision-making and control (which could start with an Alborán Fishery System Pilot Plan, under the auspices of the GFCM, and which could even have its own Scientific-Technical Committee, with a Coordination and Management Office);

- The low level of knowledge about ecosystems and the ecosystem approach. In this context, priority should be given to research on a series of issues which are currently not highly developed, such as those which appear in Box 13.

Box 13

Some currently underdeveloped areas of research into fisheries and ecosystems

- Identification of indices, base levels and limits of ecologically important parameters
- Biology and life cycles of species of interest and interactions between them in order to improve knowledge of the ecosystem
- The effects of climate change on stocks and fisheries
- The population structure of fish species, in order to examine the relationship between coastal stocks and deep-water stocks and to define appropriate biological management units
- The integration of the knowledge of fishers into advisory and management processes
- The development of management strategies for complex, uncertain ecological systems, multi-species models and bio-economic models
- The development of alternative stock evaluation methods based on data which is independent of the fisheries and on groups of species
- The determination of the impact of fisheries (trawling in particular) on the environment, on non-target species and on ecosystems in general
- Conservation benefits and the economic cost of technical measures and other management instruments, including closed areas and areas of cooperative research between scientists, socio-economists and fishers
- Bio-economic simulation models and other methods aimed at ascertaining the factors which influence the distribution of effort and the behaviour of investors
- The identification of operative units and management units
- The implications of the possible extension of jurisdictional waters
- Right of use systems
- The development of methods to allocate intrinsic and economic values to marine ecosystems, habitats and species

- The role of governments in the management of fisheries: identification and analysis of motivational behaviour, political orientation and the impact of political change
- The quest for fishing gear and methods which are more selective and environmentally sound
- The energy efficiency of fishing boats
- Improvements in preservation and processing techniques in order to improve the quality of the products

To sum up, the fundamental weakness, which prevents any improvement in the situation, is the failure to enforce a significant number of existing regulations, both nationally and internationally, together with the failure to integrate co-management schemes at all levels (national, regional and, especially, at the more local level).

b) Aquaculture

Main management measures proposed

Given the precarious situation of Mediterranean fisheries, aquaculture is the sector which should offer a response to the generalised, growing demand for fishery products, and it is already responding to that demand, particularly on the northern shore. The measures recommended by the GFCM, IUCN and other scientific forums in order to address the general problems faced are:

i) To take advantage of existing experience in similar fields (which requires special efforts in international cooperation and coordination);

ii) Efforts to involve the aquaculture sector in Integrated Coastal Zone Management;

iii) The reorientation of research towards subjects such as:

- The diversification of species,
- The search for quality criteria and the perfection of alevin production technologies for restocking in both wetlands and coastal areas;
- The improvement of extensive or semi-intensive techniques;
- The perfection of open sea or deep sea technologies;
- The improvement of closed-circuit techniques;
- The encouragement of studies related to marketing strategies which allow greater cohesion of the aquaculture industry.

This desirable reorientation of research should not imply that other lines of basic research (genetics, physiology, pathology, etc) or those related to the integration of aquaculture into the surrounding coastal environment, from which it receives and where it produces impacts of many kinds, should be abandoned. The above should, at all times, respect the basic principles of sustainable aquaculture, that is, it must be ecologically acceptable, socially fair and economically viable.

Critical analysis of the current situation

Since it is relatively undeveloped in the Sea of Alborán, its negative impact is irrelevant for the moment.

3.3. BIODIVERSITY PROTECTION STRATEGIES AND EXISTING MANAGEMENT MEASURES RELATED TO THE CONSERVATION AND PROTECTION OF CERTAIN SPECIES

a) Strategies for the protection of biodiversity

Main management measures proposed

The IUCN's Mediterranean marine strategy proposes the following actions as conservation measures to ensure biodiversity:

i) The identification of priorities for the conservation and recuperation of threatened marine species, including the necessary legal instruments;

ii) The prevention, control and eradication of alien invasive marine species;

iii) The evaluation of the role of bio-prospection for natural marine products, with the launch of a guide to share access to and benefits of the products;

iv) The sustainability of fisheries, ensuring the conservation of diversity at genetic, species and ecosystem level, through: a) the development of responsible aquaculture that does not damage the coastal environment or stocks of wild species; b) the widest possible application of the ecosystem approach in fisheries management; c) the promotion of the establishment of Protected Marine Areas, including closed zones.

For its part, the Ministry of the Environment, Rural and Marine Affairs[39], through its Directorate General of Marine and Coastal Sustainability, has taken many actions for the conservation of marine biodiversity. We would highlight the following actions taken in 2008 and 2009:

i) The 2008 and 2009 Jellyfish Campaigns;

ii) Basic document for maritime spatial planning in Spain;

iii) Technical instructions for the environmental management of marine extractions (to obtain sand);

iv) Observance of the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention);

v) Leadership in the production of UNEP/LC guides for the installation of artificial reefs (approved in October 2008);

vi) Respect the EC Committee on the Marine Strategy Framework Directive;

vii) Publication of the book, *Los Mares de España* ("The Seas of Spain");

viii) Publication of the book, *Actividades Humanas en los Mares de España* ("Human Activities in the Seas of Spain");

ix) Environmental processing of projects subject to environmental impact assessment;

x) Environmental processing of plans or programmes subject to strategic environmental assessment;

xi) Observance of the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic Area (ACCOBAMS);

xii) Monitoring and formulation of Strategies and Plans for the conservation of marine species included in the Spanish Catalogue of Endangered Species (*Patella ferruginea*, loggerhead sea turtle);

xiii) Monitoring of proposals of marine species to be included in the Convention on the Conservation of Migratory Species of Wild Animals and the CITES Convention;

[39] Information provided by Javier Pantoja.

xiv) Monitoring of issues related to marine biodiversity under the Convention on Biological Diversity;

xv) Support and monitoring of meetings of the International Whaling Commission;

xvi) Monitoring of the ad hoc Working Group of the General Assembly of the United Nations on the protection of biodiversity in international waters.

In 2003-2005, the Andalusian Regional Government, as a development of the actions foreseen under Agenda 21 (Rio Summit), took the following actions related to the conservation of species, habitats and marine biodiversity:

- The inspection of the condition of the sea bed and its benthonic communities;
- Bionomic mapping of the seabed, especially the phanerogam meadows;
- Inventory of invertebrate marine species suitable for cataloguing;
- Conservation and monitoring of the populations of endangered species and the regeneration of stocks of molluscs which are not of interest to the fisheries sector;
- Monitoring of the populations of seabirds;
- Monitoring of artificial reefs in protected natural spaces;
- Study of Andalusian phycological flora;
- Building work in the recuperation centres for marine species in Almería;
- Identification of appropriate locations for the installation of artificial reefs and the sinking of wooden vessels;
- Inventory of endemic species;
- Dissemination programmes.

On the southern shore, in recent years, special attention has been paid to the direct and indirect protection and the safeguarding of marine biodiversity. The main measures taken by Morocco include:

- The creation of a National Park at Al Hoceima;
- The project to totally prohibit the use of drift gillnets, scheduled for December 2011;
- The protection of areas of concentration of juveniles (prohibition of trawling);
- Control of the size of fish landed;
- Membership of ACCOBAMS for the protection of cetaceans;
- The prohibition of the use of harmful products in fishery activities, etc.

Critical analysis of the current situation

Although substantial progress has been seen in this field in recent years, there are still a number of significant deficiencies, both as regards knowledge of the real current situation and the enactment of the necessary legal instruments at all levels.

b) Conservation and protection of certain species and types of habitat (especially cetaceans, turtles and marine meadows)

The protection and conservation of species on the northern shore of the Alborán has seen significant progress in recent years. There is no specific list of endangered or threatened species in the Sea of Alborán, though the Mediterranean Action Plan, through the RAC-SPA, has published one for the Mediterranean which can be found in the electronic version of this document.

In Spain, the following species are included in the Spanish Catalogue of Endangered Species:

IN DANGER OF EXTINCTION:
Limpet (*Patella ferruginea*)
Sea lamprey (*Petromyzon marinus*)
Mediterranean monk seal (*Monachus monachus*)

SENSITIVE TO ALTERATIONS OF THE HABITAT
(Pending adaptation to Law 42/2007)
Eelgrass (*Zostera noltii*)
Sea star *(Asterina pancerii)*
Humpback whale *(Megaptera novaeangliae)* (peninsular Atlantic and Mediterranean population)

VULNERABLE
Noble pen shell *(Pinna nobilis)*
Triton *(Charonia lampas lampas)*
Worm snail (*Dendropoma petraeum)*
Orange coral *(Astroides calycularis)*
Fin whale *(Balaenoptera physalus)*
Blue whale *(Balaenoptera musculus)*
Sei whale *(Balaenoptera borealis)*
Sperm whale *(Physeter macrocephalus)*
Bottlenose dolphin *(Tursiops truncatus)*
Common dolphin *(Delphinus delphis),* Mediterranean population
Harbour porpoise *(Phocoena phocoena)*

OF SPECIAL INTEREST
(Pending adaptation to Law 42/2007)
Sea urchin *(Centrostephanus longispinus)*
Leatherback turtle *(Dermochelys coriacea)*
Loggerhead sea turtle *(Caretta caretta)*
Green turtle *(Chelonia mydas)*
Hawksbill turtle *(Eretmochelys imbricata)*
Short-finned pilot whale *(Globicephala macrorhynchus),* peninsular Atlantic and Mediterranean population
Orca *(Orcinus orca)*
Long-finned pilot whale *(Globicephala melas)*
Risso's dolphin *(Grampus griseus)*
Striped dolphin *(Stenella coeruleoalba)*

CETACEANS

Main management measures proposed

The ACCOBAMS general recommendations are:

i) To mitigate the interaction of cetaceans with fisheries (with the accidental capture of specimens leading directly, on occasions, to their death);

ii) To attenuate, as far as possible, toxic contamination (in the water and the food chain, as well as the danger posed by spillage of petroleum products and other toxic substances) and acoustic contamination (caused, above all, by military manoeuvres and seismic prospection with high power emissions, which cause particular problems to beaked whales);

iii) To prevent overexploitation of fishery resources (which reduces the availability of prey for cetaceans which feed on fish, especially the common dolphin and the bottlenose dolphin);

iv) To prevent collisions with vessels (especially sperm whales and particularly in the Straits of Gibraltar);

v) To prevent the degradation of the habitat and, especially, the physical destruction of the seabed (which is particularly important for the bottlenose dolphin).

In 2007, Royal Decree 1727/2007[40], which established measures for the protection of cetaceans, was passed. The purpose of the Decree was to adopt protection measures for cetaceans that would avoid or minimise the negative impact caused by certain activities, especially whale-watching, whether for tourism, scientific, recreational or educational purposes, or any other circumstances in which man comes into contact with cetaceans. In order to achieve this, the Decree established a "Mobile Cetacean Protection Space" around the animals, where all of the activities which affect their conservation are to be regulated, especially whale-watching.

Also of note are the management measures promoted to reduce the impact of maritime traffic on marine biodiversity in general and large cetaceans (sperm whales and rorquals) in particular. And so, in January 2007, the Navy Hydrographical Institute, part of the Spanish Ministry of Defence, published a Notice to Mariners which defined the safety zone in Spanish waters of the Straits of Gibraltar in the presence of sperm whales with the aim of reducing the risk of collisions in the area, and at the same time it established recommendations to all vessels passing through the area to limit maximum speed to 13 knots and to navigate with extreme caution. Another significant action was the relocation of the Cabo de Gata Traffic Separation Device from five to 20 nautical miles offshore as a consequence of the protection of the natural values and marine biodiversity found in the waters of the proposed "Almería South" Marine SCI (Tejedor, *et al*. 2008).

Taking the aerial (2008) and nautical (2004 to 2008) monitoring campaigns run by the Andalusian Regional Government together, with more than 12,000 nautical miles prospected, the number of sightings recorded in the aerial campaign was 201, while there were 76 sightings from boats (the presence of calves was recorded in 28 of the sightings (36.84%) from boats).

SPECIES	**Nº OF SIGHTINGS**	**%**
Common dolphin	27	9.7
Striped dolphin	36	13
Bottlenose dolphin	29	10.5
Small Delphinidae	136	49.1
Long-finned pilot whale	25	9
Risso's dolphin	19	6.9
Sperm whale	1	0.4
Cuvier's beaked whale	3	1.1
Large cetaceans	1	0.4
TOTAL	277	100

[40] Information provided by Javier Pantoja.

Critical analysis of the current situation

The experts recommend the activation of the Conservation Plans already drawn up for the bottlenose dolphin and the common dolphin[41], and the prioritisation of the application of ACCOBAMS resolutions, as a contribution to the Sea of Alborán Management Plan as a whole.

In 2007, for the first time, Spain asked the ships crossing the Straits of Gibraltar to reduce their speed and beware of the whales.

Main management measures proposed

Scientists have designed a Conservation Plan for the loggerhead sea turtle which lays down some lines of priority action for the mitigation of accidental catches in fishing gear, indicating also a number of elements which have a negative effect (degradation of the usual nesting grounds, ingestion of solid waste, collisions with vessels, diseases and disorders caused by pollution). The Spanish Ministry of the Environment and regional authorities have taken the initiative of drafting a National Strategy for the loggerhead sea turtle, which is now entering into force.

In late 2007, the Andalusian Regional Government initiated the monitoring of beached turtles, providing veterinary attention to the animals which were still alive in order, if possible, to save them and reintroduce them into their environment, and also to assess the causes of death of beached cetaceans.

In 2008, 139 beached turtles were recorded (as well as 194 cetaceans and one pinniped), the most common species being the loggerhead sea turtle. As regards the recuperation of the species, four loggerhead sea turtles have been received in the Centre for the Recuperation of Endangered Marine Species (CREMA), of which two died and the other two are still in the centre.

Critical analysis of the current situation

The changes which have occurred in the central Spanish administration with the new Ministry of the Environment, Rural and Marine Affairs and the necessary coordination between the different intra- and inter-administrative levels of the Spanish state mean that the effects of fishing on sea turtles which live in or pass through the Sea of Alborán still require the drafting and coordination of regulations and action plans. In this sense, it is essential to improve coordination between administrations and the development of such actions.

MARINE FLORA

Main management measures proposed for phanerogam meadows

The scientific studies carried out recommend the following:

i) Ensure the most transparent water possible (cleaning of the coast);

ii) Maximise control of illegal trawling and shellfishing on the seabed;

iii) Avoid large-scale anchoring of boats in phanerogam meadows;

iv) Mitigate, as far as possible, the alteration of coastal dynamics (which could bury the meadows and increase the turbidity of the water).

In Andalusia, though there is some knowledge of the general location of *Posidonia oceanica* meadows, it is only approximate and descriptive, and new in-depth studies are required using technologies that facilitate the integrated study of the natural environment. This type of study has already been initiated, to a certain extent, in some places such as the Cabo de Gata Natural Park, the Maro-Cerro Gordo Natural Site and a few other very specific coastal spaces which are generally related to environmental impact studies for maritime building projects. Less is known about other species of phanerogams.

[41] In 2004, ACCOBAMS, in coordination with the Cetacean Specialist Group of the IUCN, drew up a Consolation Plan for the common dolphin in which the Alborán region was identified as a "Possible Conservation Area".

Critical analysis of the current situation

Little progress has been achieved on the northern shore with regard to the conservation of marine flora, though the experience of the good condition in which they are to be found in the Cabo de Gata SPAMI shows the path to follow. New studies and projects are being proposed and undertaken with respect to the biodiversity of the region and these will help to gather more information for the identification of new sensitive habitats and species, their current condition and possible management plans.

The weaknesses to be corrected are: achieving the recuperation of endangered or declining habitats and species through the restocking of specific zones and the creation of new PMAs or other tools for the management of areas and resources that would contribute to the conservation of species.

CONSERVATION AND PROTECTION OF HABITATS

PROTECTED MARINE AREAS

Main management measures proposed

The environmental protection figures which exist today and which related to the coastal and marine zones of the Sea of Alborán are:

	International					Algeria	Spain						Morocco	
	Biosphere Reserve	SPAMI	SCI *	SCI		Natural Marine Reserve	Marine and Fishery Reserve	Nature Reserve	Natural Park	Natural Site	Natural Monument	Coastal Wetland	National Park	Site of Biological and Ecological Interest (SIBEs)
				SPA	RAMSAR									
Andalusian-Moroccan Intercontinental Reserve (Spain-Morocco)	X													
Cabo de Gata-Níjar (Almería)	X	X		X	X		X		X					
Isle of Alborán and surrounding sea beds (Almería) (Figs. 73 & 74)		X		X			X			X				
Levante sea bed, Almería		X												
Maro-Cerro Gordo Cliffs (Málaga-Granada)		X		X						X				
Punta Entinas-Sabinar (Almería)				X	X			X				X		
Albufera de Adra (Almería)				X	X			X				X		
La Gravera Lagoon (Almería)				X						X				
Salinas de Cerrillo (Almería)				X						X		X		
Chafarinas Islands								X						
Straits				X					X					
Los Alcornocales (Cádiz)									X					
Mouth of the River Guadalhorce (Málaga)										X				
Marshes of the River Palmones (Cádiz)				X						X				
Estuary of the River Guadiaro (Cádiz)				X						X				
Artola Dunes (Málaga)											X			
Peñón del Cuervo (Málaga)											X			
Levante sea bed, Almería (Terreros and Negra Islands)											X			
Posidonia Barrier Reef, Roquetas de Mar (Almería)											X			
Al Hoceima		X											X	
Cape Spartel														X
Jbel Moussa														X
Smir Lagoon (Bay of Tetouan)														X
Koudiet Taïfour														X
Côte Rhomara														X
El Jabha cove														X
Three Forks Cape					X									X
Sebkha Bou Areg (Nador Lagoon)					X									X
Jbel Gourougou														X
Mouth of the River Moulouya					X									X
Habibas Islands		X				X								

Critical analysis of the current situation

Raising awareness, both in the administration and society, of the importance of PMAs brought substantial progress in recent years on the northern shore, especially with the declaration of the 4 SPAMIs which exist today. On the other hand, the situation on the southern shore is highly deficient. There is only one marine Natural Park, at Al Hoceima. The lagoon at Nador (Box 14), the mouth of the River Moulouya (an estuary zone which receives protected migratory birds during certain times of the year) and the Three Forks Cape are clear examples of zones which require protection as soon as possible.

The effective application of Self-Protection Plans for protected natural spaces on the Andalusian coast would correct a significant weakness. In the southern zone, more resources and better organisation and control are required.

The different conservation measures planned, both for species and for habitats, have a very direct, real impact on the protection of biodiversity, even when the joint application of all of them is necessary to achieve serious progress in this direction.

Box 14

Nador Lagoon

This is a lagoon complex with a surface area of 115 Km² separated from the sea by a dune system which is some 25 km long and 300 to 400 m wide, reaching at some points over 20 m in height. From a functional point of view, the lagoon and its peripheral wetlands contribute to the physical and ecological balance of the coast as a whole, helping to stabilise it by protecting it from coastal erosion, and also playing a role in hydrological regulation by absorbing water when the rivers are in spate, preventing floods and allowing the replenishment of the water table. Furthermore, it also acts as a purifying filter, protecting the coast and guaranteeing better bacterian quality on nearby beaches. Moreover, the lagoon provides a good feeding zone for fish, crustaceans and molluscs, and also provides an exceptional place of refuge for birdlife. It has an artisanal fishing fleet consisting of some 320 boats, which use different types of gear (surface and deep water trammel nets, different types of longline, surrounding nets, etc.). There is also a certain amount of aquaculture and shellfish farming. There is also a notable stock of *Gracillaria sp.* algae which could potentially be exploited for the extraction of agar-agar.

4. Expectations and recommendations

4.1. IN THE INTERNATIONAL CONTEXT

The Mediterranean Action Plan (MAP), in a report produced in 2005, proposed general protection policies, which are in themselves a series of challenges to be met, based on:

- Foreseeing new social relationships and international eco-regional cooperation specifically aimed at managing the environment and sustainable development, strengthening the territorial focus and local sustainable development;

- Creating a realistic framework programme, avoiding the paradigm of the single development model;

- Coordinating more and better sectoral policies through appropriate decompartmentalisation and by mainstreaming the environment in economic policies: ensuring a strong political commitment with innovative funding and co-operation mechanisms; adapting the organisation, co-operation and coordination of the different Administrations to this end; achieving greater sustainability in the involvement of the EU in the Mediterranean;

- Incorporating the appropriate regulations, and ensuring their enforcement;

- Making Euro-Mediterranean cooperation a sustainable development laboratory (pilot plans). In the case of the Alborán, the Spanish-Moroccan-Algerian partnership would have to be relaunched and south-south (Morocco-Algeria) cooperation reinforced;

- Achieving a wider and better connection between the environment and social justice: i) protecting the natural and cultural heritage and preventing hazards; ii) making tourism compatible with the environment; iii) developing new methods to raise awareness and involve civil society more in this objective; iv) mobilising technological progress.

The Mediterranean Blue Plan, in its 2005 report, includes a number of general recommendations to improve governance and the knowledge and appreciation of the biological and cultural values of existing habitats.

All of these recommendations follow the same lines as those already described repeatedly, namely:

- Achieving the integrated management of the coastal zone;

- Ensuring the conservation of biodiversity and landscape;

- Improving water management (reinforcing water supply through demand management, in both the tourism and agricultural sectors);

- Supporting the conservation of the soil in agriculture;

- Making tourism compatible with the environment;

- Disconnecting economic growth from the pressures on the environment, making cities the prime candidates for that disconnection; making energy efficiency a strategic priority; breaking the current vicious circle of transport; minimising natural hazards.

The most important general challenges to be met, according to the document, are:

- And inadequate economy which requires innovation;

- The undervaluing and deterioration of the links between society and the environment;

- The lack of adaptation of public administrations to environmental issues;

- The need to strengthen international co-operation in the Mediterranean;

- Insufficient environmental awareness and information.

In line with these environmental protection policies, the United Nations Environment Programme (UNEP) and the European Environment Agency (EEA) (2006) also proposed lines of action to be followed (which are other challenges to be met, complementary to those of the MAP), in order to:

- Give maximum priority to the development of the necessary environmental legislation and to enforce it;

- Improve prevention, control and evaluation schemes to allow well-informed political action;

- Fill the existing gaps in knowledge about the environment, including quality information on: inventories and the management of ecosystems; coastal erosion; contaminant agents and loads; the impact of fisheries; the application of common criteria and rapid evaluation techniques, particularly regarding the species that are key to marine biodiversity; efficient information flows with the adequate use of the appropriate indicators; strengthening of the concept of the eco-region;

- Improve environmental management practices by means of an ecosystem approach, ensuring: the necessary socio-economic capacity (financial, technological, legal, with the involvement of civil society) in order to carry them out; stronger cooperation (north-south and south-south), taking advantage of the means and facilities provided by the Barcelona Convention;

- Undertake the necessary intervention (Box 15) in order to achieve true Integrated Coastal Zone Management: strict control of urban development; prevention of natural hazards and pollution; improvement of institutional and human skills; compatibility and coherence in external cooperation; sustainability of proposed measures, with guaranteed funding.

The recent EU Green Paper on Marine Policy also indicates a series of challenges to be met, derived from the need to launch, once and for all, a true European marine policy including, obviously, the Mediterranean. The overarching principles and main lines laid down for its development are based on constant support for the application of integrated management, the precautionary principle and sustainable development, by means of: the improvement of our knowledge of the oceans, the protection of the seas and coasts, protection against the sea, the promotion of a marine economy (leisure activities and maritime transport which respect the environment, rational exploitation of resources, appropriate development of marine industry and technologies).

The experience acquired has taught us that the current treatment of marine environmental issues, which is compartmentalised and which needs to increase coordination between the different Administrations involved (municipal, regional, national and international), can be improved[42].

From the analysis of all of the above, the pressing need to bring a new focus to marine management based on the ecosystem as a whole becomes increasingly obvious. In order to put that new management approach into practice, there must be an evaluation of environmental quality through the systematic analysis of the different natural and anthropic pressures affecting the environment. This analysis should be based on the relevant indicators and their evolution over time (at least over recent years), such as: EQS (Environmental Quality Standards), BRC (Background/Reference Concentrations), EAC

[42] In accordance with this, the Mediterranean Action Plan has attempted to begin applying this more holistic approach, integrating its different components in areas such as: the evaluation and control of pollution (using the relevant indicators), integrated coastal zone management, environment and development, biodiversity, ecological quality standards, etc.

(Ecotoxicological Assessment Criteria) and ERI (Ecological Reference Indices), which have hardly been developed at all in the Mediterranean.

In the face of the magnitude of the problems generated by climate change, particularly in the more vulnerable zones, such as the Mediterranean basin, there is increasing unanimity in calls for a worldwide reaction to minimise the tremendous consequences which could be produced in the relatively short term.

Apart from the inescapable need for general compliance worldwide with the Kyoto Protocol on CO_2 emissions, it is also essential to carry out multidisciplinary studies in order to assess the main environmental and socio-economic problems that could be produced as a result of the hazards derived from this (in order to distinguish between what could be due to natural fluctuations and the effects of anthropogenic activity) and to propose alternatives with adequate funding available.

4.2. AT NATIONAL LEVEL

All of the recommendations, proposals and challenges which we have just enumerated for the Mediterranean are also applicable to the Sea of Alborán. In the face of this situation, it appears appropriate to ask whether, in this specific case, the countries involved (starting with the different Administrations, but also including all of the stakeholders mentioned in Box 9) would be willing to continue giving increasing support, in both financial terms and in human endeavour, to the enormous efforts that are required at all levels (scientific, technological, ecological, socio-economic, management, governance, etc) which become even more complex if a real attempt is to be made to apply a management focus based on the ecosystem as a whole.

It is difficult to obtain a clear answer, though it must be acknowledged that, on the northern shore, the imminent application of ICZM by the Ministry of the Environment (2008-2012) and the current Andalusian Environment Plan (2004-2010) do, for the first time, take into account the crucial role of the coast and Andalusian coastal zones in sustainable development and they accept that the future prospects of the coast of the Sea of Alborán depend, to a large extent, on the sustainable use of natural resources and the maintenance of the wealth of the landscape.

On the southern shore, the publication by the Secretary of State responsible for the Environment (2004) of a National Action Plan and Strategy for the conservation and sustainable use of biological diversity brings hope of a significant improvement on the current situation, at least in the medium term.

Box 15

Development of the ICZM

The interventions that are needed in order to develop true ICZM should:

- Contain a realistic focus, making viable proposals which, although they take a long-term view, can really be applied in the short to medium term
- Include potential impacts and benefits at cross-border level
- Be harmonised with other past and present initiatives
- Be consistent with other objectives, strategies and programmes at different levels (global, national, regional, local), taking into account the content of: Agenda 21 (Med Agenda 21), PAM, GPA, GEF and the EU
- Ensure that the activities proposed are specific, oriented towards clear objectives which pursue practical results and help to mitigate, control and/or prevent possible cross-border problems in the present and the future
- Adopt a raft of common general and specific policies for the Sea of Alborán
- Guarantee that the essential political support is given.

Applying all of the above to the Sea of Alborán and taking into account the weaknesses that we have listed in point 4.1, the most appropriate way of addressing them would be to prioritise compliance with the following basic recommendations:

a) There must be a reconciliation between tourism and the environment with a change in direction towards environmental sustainability.

b) As regards pollution, the necessary technology, which already exists today, for the treatment of urban waste (especially in the southern zone), must be applied. The costs involved would be acceptable from the point of view of investment in health and the maintenance of ecosystems, and would prevent other economic losses.

   Harmful algal blooms will continue to cause health problems (and, consequently, commercial problems) as long as the problems of eutrophication persist. This is particularly so for the cultivation of molluscs on a large scale, as is intended on the Andalusian Mediterranean coast. Eutrophication must, therefore, be minimised.

c) As regards fisheries, with the failure of traditional management systems, given the historical failure to comply with the abundant, valid legislation which is in force in the field, all of the relevant forums agree that the basic priority is to ensure the real enforcement of existing regulations, using the appropriate means, with emphasis on the control of the fishing effort and greater attention to and protection of artisanal fishing, given its important social and economic role in the zone.

   To this end, it is essential to seek the cooperation of stakeholders and to launch complementary management systems based on the principles of:

   - The shared management by all of the stakeholders;
   - The ecosystem approach;
   - The FAO Code of Conduct for Responsible Fisheries;
   - The precautionary principle;
   - Integrated Coastal Zone Management, especially at local level;
   - The extension and consolidation of the concept of Protected Marine Areas.

   In one way or another, practically all of these principles are interrelated and there is today a tendency towards the application of an ecosystem approach to fisheries management. In this context, it seems more logical to speak of the more holistic concept of the “Fishery System” than of fishing as such.

d) As regards the protection and conservation of biodiversity (marine species and habitats) and the sustainable use of the Sea of Alborán, the MAP (Barcelona Convention), UNEP (United Nations) and the EEA (European Union) advocate:

   - The application of Integrated Coastal Zone Management to minimise the physical alterations which are occurring in those zones;
   - The improvement of scientific knowledge of natural marine resources and their interrelationships;
   - Minimising the discards of commercial fishing (improving the selectivity of fishing gear), preventing the use of trawl gear on marine phanerogam meadows (using, as well as control measures, dissuasive methods such as artificial reefs) and ensuring compliance with the GFCM recommendation not to allow trawling in deep waters;

- Creating new protected marine areas, at least in areas with phanerogam meadows on the Andalusian coast and in the Lagoon of Nador, the mouth of the River Moulouya and Three Forks Cape, as well as improving the situation of the National Park of Al Hoceima, on the Moroccan coast (Box 16). Given the hazards which exist and the vulnerability of its ecosystems, the comprehensive protection of the Sea of Alborán as a whole should be pursued;

- Control the introduction and/or reintroduction of alien invasive species, adopting a code of conduct for the Sea of Alborán which takes into account the provisions included in the Code of Practice (1995) of the International Council for the Exploration of the Sea, the guidelines (1994) laid down by the International Maritime Organisation regarding ballast water and incrustations and the Precautionary Approach (1996) of the FAO;

- Improvement and extension of specific alternatives (sustainable tourism) to mass sun and beach tourism, with the involvement of artisanal fishers for their know-how and experience;

- Greater awareness and environmental education;

- Conservation of the ethnographic values of the zone (customs, boats, fishing gear, language, etc, of the fishers and the local population).

Box 16

Proposed new marine areas for protection

Some research projects are making interesting new proposals for PMAs, though they have not yet been officially approved:

- Spain's National Parks Authority proposed the possible creation of a SPAMI in the Chafarinas Islands, where there is a large population of *Patella ferruginia* and an area which is suitable to be declared a National Park.

- The main objective of the EU-funded Life+ Indemares project (2009-2013) is to complete the inventory and designation of the Natura 2000 Network in the marine areas of Spain. To do so, the project is to gather the existing scientific information and evaluate the possible inclusion of 10 marine areas in the Natura 2000 Network, including two zones located in the Sea of Alborán, the Seco de Los Olivos zone and the volcanic mountains off the Isle of Alborán.

- The MedRas project, co-ordinated by IUCN-Med, which commenced in late 2008, has the objective of identifying the most representative priority areas and species for conservation in the Mediterranean Sea. To this end, the project plans, firstly, to elaborate the criteria for identifying and visually selecting the areas of ecological and biological importance to be protected and, secondly, through information gathering, to identify possible areas of the Sea of Alborán as a pilot project.

5. Elements to be taken into consideration in the elaboration of a strategy

As we have just established in the previous point, there is, by and large, agreement at all levels, nationally and internationally, on the path to follow. In accordance, in the elaboration of this strategy, our proposal would include the following elements:

5.1. Consider the Sea of Alborán as a single unit or entity of great environmental importance, making its conservation and sustainable use a priority.

To do so, it is essential to take the political decision to begin, straight away, organising the gathering and control of the essential specific basic information regularly and reliably. This would make it possible for those responsible for the management and planning of environmental policy to receive consistent, useful advice. With a view to adequate control and monitoring, this information would have to be incorporated into such indicators as are considered necessary.

The next steps to take would be those foreseen in documents produced by the EU which, for each marine region (the Mediterranean being one of them), propose a series of stages, which should begin with:

a) An initial evaluation, which should include a first analysis of the essential characteristics and ecological state, including, at least, the types of habitat, biological components, physical and chemical characteristics and hydro-morphology (the electronic version of this document includes a list of the characteristics which should be known in order to define a good ecological state);

b) An analysis of the main impacts and pressures which influence those characteristics and the ecological state, as well as any perceptible trends (the electronic version of this document lists those pressures and impacts);

c) Other economic and social analyses of the use of the marine environment, including the cost that its deterioration supposes.

We would add a fourth analysis of the practical applicability in the Sea of Alborán of a new approach based more on the ecosystem as a whole (including the complications and implications of all types that that would suppose).

5.2. Another essential premise to be fulfilled is that of adapting environmental regulations affecting the Sea of Alborán to its real current needs and uses, as well as emerging needs and uses, and guaranteeing enforcement, an area that still leaves much to be desired.

5.3. Decide, on the basis of the above, on a series of specific actions to be taken (out of those considered to be priorities and which are viable in the short, medium and long-term), determining the role to be played in those actions by the different stakeholders who really should and could become involved, on the basis of both the existing forecasts (mentioned in sections 3.1, 3.2 and 3.3) and on the series of recommendations that have been made by the different studies and projects undertaken up to now. An initial, provisional list of such actions could include the following:

a) The inclusion in official statistics of a specific section on the Sea of Alborán as a unit, thereby creating an exclusive database which can be expanded to include all other types of inventory, as deemed useful;

b) The compilation and publication of a specific monographic document which includes existing scientific information on the pressures and impacts which affect the Sea of Alborán (including those derived from climate change), as well as the proposed recommendations, and the activities to be undertaken in order to apply those recommendations, (which would require a multidisciplinary Working Group on uses, resources and the environment);

c) The definition of the different types of indicators considered essential in the fields of sustainability, biodiversity, the use of resources, social and economic issues, maritime traffic, etc, and the provision of the elements necessary to ensure their compilation (to be performed by the above-mentioned Working Group);

d) The compilation and publication of a comparative analysis of existing legislation on all aspects of the conservation and sustainable use of the Sea of Alborán in order to facilitate forthcoming joint regulation (this would require the creation of another Working Grouping on legislation[43]);

e) Real strengthening of international co-operation, particularly between the countries involved, including:

i) The joint programming and performance (or adaptation in cases where it already exists at a wider level) of a census and mapping of the different coastal habitats in all of the zone, as well as some specific activities of mutual interest (regular marine research campaigns, application of joint methodology, etc);

ii) The launch of a pilot project on key issues (for example, small pelagic fisheries or a conservation plan for species such as turtles) which demonstrates common political will and which also serves to demonstrate that if such political will exists in practice, then practical, useful results can be achieved in both socio-economic and environmental terms;

iii) The development of common rules and the performance of regular intercalibration exercises;

iv) An annual international symposium on different issues of interest in the Sea of Alborán.

f) Awareness-raising and environmental education campaigns about the need for conservation;

g) The creation of a Permanent Observatory which guarantees the maintenance and continuity of an "Alborán Network" that would guarantee compliance with all of the above points.

[43] In the case of fisheries, this task has already been done under the COPEMED project. The key problem here is the enforcement of existing regulations at both national and international level.

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Acronyms

ACCOBAMS
Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic Area

AECID
Spanish Agency for International Development Cooperation

AEFCS
Water, Forest and Land Conservation Administration (Morocco)

AMP / PMA
Protected Marine Area

ArtFiMed
Sustainable Development Project for artisanal fisheries in Morocco and Tunisia

ASP
Amnesic Shellfish poisoning

BRC
Background / Reference Concentrations

CAMP
Cpastal Area Management programme

CAR/RAC
Regional Activity Centre

CAR/ASP / RAC/SPA
Regional Activity Centre for Specially Protected Areas

CAR/PA / BP/RAC
Blue Plan Regional Activity Centre

CAR/PAP / RAC/PAP
Priority Actions Programme Regional Activity Centre

REMPEC
Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea

CDB / CBD
Convention on Biological Diversity

CE / EC
European Commission

CEE / EEC
European Economic Community

CGPM / GFCM
General Fisheries Commission for the Mediterranean

CITES
Convention on International Trade in Endangered Species of Wild Fauna and Flora

CMA / RME
Regional Ministry of the Environment (Andalusian Regional Government)

COPEMED
Co-ordination to Support Fisheries Management in the Western and Central Mediterranean

CPUE
Catch per unit effort

CREMA
Centre for the Recuperation of Endangered Marine Species

DDT
Dichlorodiphenyltrichloroethane

DPM
Department of Sea Fisheries (Morocco)

DSP
Diarrhetic Shellfish Poisoning

EAC
Ecotoxicological Assessment Criteria

EAE / SEA
Strategic Environmental Assessment

EA-GIZC / AS-ICZM
Andalusian Strategy for Integrated Coastal Zone Management

EDAR / WWTP
Waste Water Treatment Plant

EEA
European Environment Agency

EQS
Environmental Quality Standards

ERI
Ecological Reference Indices

FAO
United Nations Food and Agriculture Organisation

GEF
Global Environment Facility

GIZC / ICZM

Integrated Coastal Zone Management

GPA
Global Programme for Action for the Protection of the Marine Environment from Land-Based Activities

ICCAT / CICTA
International Commission for the Conservation of Atlantic Tuna

IEO
Spanish Institute of Oceanography

INRH
National Fisheries Research Institute (Morocco)

IPCC / GIEC
Intergovernmental Panel on Climate Change

LIC / SIG / SCI
Site of Community Importance

MEDPOL
Programme for the Assessment and Control of Pollution in the Mediterranean Region

NSP
Neurotoxic Shellfish Poisoning

OAPN
National Parks Authority (Spain)

OFCF
Overseas Fishery Cooperation Foundation

OMI / IMO
International Maritime Organisation

OMT / WTO
World Tourism Organisation

ONG / NGO
Non-Governmental Organisation

ORP / RFO
Regional Fisheries Organisation

PAM / MAP
Mediterranean Action Plan

PCB
Polychlorinated biphenyl

PNUD / UNDP
United Nations Development Programme

PNUMA / PNUE / UNEP
United Nations Environment Programme

POP
Persistent Organic Pollutant

PSP
Paralytic Shellfish Poisoning

PSSA
Particularly Sensitive Sea Area

PUN / NEP
National Emergency Plan (Morocco)

RAMSAR
Convention on Wetlands of International Importance

RED
Mediterranean Blue Plan Environment and Development Report

SIBE
Site of Biological and Ecological Interest

TAC
Total Allowable Catch

UE / EU
European Union

UICN / IUCN
International Union for the Conservation of Nature

UMA
University of Malaga

UNCED
United Nations Conference on Environment and Development

UNCLOS / CNUDM
United Nations Convention on the Law of the Sea

UNESCO
United Nations Educational, Scientific and Cultural Organisation

UNSDC
United Nations Sustainable Development Commission

ZEE / EEZ
Exclusive Economic Zone

ZEPA / SPA
Special Protection Area

ZEPIM / ASPIM / SPAMI
Specially Protected Areas of Mediterranean Importance