Monitoring and Evaluation of Spatially Managed Areas

Deliverable 3.1-3.2

Selection procedure and description of the MESMA Case Studies

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Summary

Work package 3 aims to test the MESMA concepts, strategies and methodologies in a coherent way using newly developed case studies representing the different geographical regions of the EU marine waters, existing human pressures, spatial claims and representative habitats. The comparison of many human activities in the different regions will provide a better insight on the full scope of the methodologies required to enhance a good EU-policy instrument for the Monitoring and Evaluation of the Spatially Managed Areas. The case studies will further be used to assess how balanced governance can be achieved by an analysis of the potential of different incentives to address conflicts between top-down and bottom-up priorities.

The nine MESMA case studies will contribute to the general aim of identification of best practices in spatial management aimed at implementing ecosystem-based management and reducing the negative impacts of human activities. The case studies will help to evaluate the generic concept of preservation of habitat quality to sustain the multi-sectoral anthropogenic activities. The nine selected case studies are:

1) The Southern North Sea Case Study
2) The Pentland Firth and Orkney Waters Case Study
3) The Barents Sea Case Study
4) The Celtic Sea Case Study
5) The Basque country (SE Bay of Biscay) Continental Shelf Case Study
6) The Strait of Sicily Case Study
7) The Inner Ionian Archipelago – Patraikos and Korinthiakos Gulfs Case study
8) The Black Sea Case Study
9) The Baltic Sea Case Study

Since integrated (spatial) management often deals with a range of pressures that interact and interlink to a greater or lesser extent, it is important that the selected case studies do not have a strictly sectoral interest either. In order to find the right balance in this, it was chosen to have a first division into geographical encompassing regions: the North Sea region, the Atlantic region, the Mediterranean region, Baltic and the Black sea. Besides, one encompassing region was added through the Barents Sea case study (IMR, NO). In conclusion, six European encompassing regions are represented in the nine case studies. Some suggested case study areas have been lumped to stress the transnationality. This was done for Maltese and Sicilian waters, both operating in the 'Sicilian strait'. Several proposed areas in the North Sea were lumped together to one Southern North Sea case study area, including five different countries (and nine MESMA partners). Furthermore, the Baltic Sea encompasses two different regions (a Swedish part and a Polish part) and the Celtic Sea includes partners from UK and Ireland. In each of the encompassing regions, in order to avoid the mentioned and undesired sectoral approach, several human pressures will be investigated in a case study.

Based on the available data in each of these case studies, the generic concepts, guidelines, criteria and models to implement, evaluate and monitor the spatial management of the area will be tested. This overarching interregional approach will guarantee that essential topics for Marine SM in the EU waters are integrally addressed.

This deliverable reports on the selection procedure to come to a total of nine representative MESMA case studies together with a full description of these case study areas. The general applicability was tested during the selection period and has been elaborated in the description when the first ideas of the MESMA framework were developed (*cf.* WP2 and WP6). Descriptions refer to data-availability and framework applicability. Therefore, this WP3 report combines two deliverables being D3.1 (*Final listing and description (i.e. meta information) of case studies*) and D3.2 (*Evaluation of concept applicability*).

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1 Introduction

This WP3 report combines two deliverables being D3.1 (*Final listing and description (i.e. meta information) of case studies*) and D3.2 (*Evaluation of concept applicability*). The report includes the selection procedure to come to the nine representative MESMA case studies together with a full description of these case study areas. The general applicability was tested during the selection period and has been elaborated in the description when the first ideas of the MESMA framework were developed (*cf.* WP2 and WP6). Descriptions include performance indicators that refer to data-availability and framework applicability. Each identified case study has developed a full description of the issues that will be tackled. Note that the governance guidelines and WP2-framework manual were developed simultaneously with the selection and descriptions of the case studies. The current document needs therefore be considered as an important baseline document to start the analyses.

All contributors to this report are listed above. To increase transparency, the responsible author has been added at the beginning of each section.

2 Selection procedure

Coordination: Marijn Rabaut and Magda Vincx

The methodology to come to the final selection of case studies was based on (1) the MESMA-proposal, (2) the criteria suggested during the Kick off meeting (December 2009, Ijmuiden, The Netherlands), (3) Discussion during ExB Meeting (January 2010), (4) final selection through lumping of the candidate case studies and including new areas to cover European seas and (5) case studies presented and discussed during Ghent Workshop (27-28 May 2010; Milestone M3.1).

2.1 DoW criteria

The criteria found in the *Description of Work* (DoW) are:

"The MESMA project aims to provide tools to support integrated management plans for designated or planned sites with assessment methods based on European collaboration, therefore a **transnational approach** within the case-studies is essential. Since integrated (spatial) management often deals with a range of pressures that interact and interlink to a greater or lesser extent, it is important that **the selected case-studies do not have a strictly sectoral interest** either. In order to find the right balance in this, it is chosen to have a first division into geographical **encompassing regions**: the North Sea region, the Atlantic region, the Mediterranean region, Baltic and the Black sea. In each of these regions, in order to avoid the mentioned and undesired sectoral approach, several human pressures will be investigated in a case-study. Based on the **available data in each of these case studies, the generic concepts, guidelines, criteria and models** to implement, evaluate and monitor the spatial management of the area will be tested. **The different case studies will be compared**, especially when it concerns the same type of habitat with similar anthropogenic activities.

This approach makes it possible to compare pressures on an **inter-regional level** (e.g. Offshore wind farms in the North sea, Black sea and Baltic), or a **multi-pressure level** for a specific region (SMA in Fishing, Wind-energy, Geo-hazards and Tourism in the Black Sea).

To avoid a regional approach towards SMA's and to increase the inter comparability , the overall spatial component (and environmental services dependence) of **a number of human pressures** such as fisheries, renewable energy, shipping and aquaculture in the 5 investigated regions **will be evaluated throughout the case studies**."

2.2 Kick off meeting criteria

During the Kick off meeting, all DoW elements were used and a first list of human pressures were defined (i.e. Fisheries, oil and gas, shipping, wind farms, sand mining, gravel extraction, tourism, aquaculture, pipelines, cables).

2.3 First selection

Based on the defined criteria, all partners were invited to fill in a standardized form to map all aspects of ***candidate case studies*** (CCSs): Key human uses, number of conflicts, diversity in geography and spatial extent, data availability, transnational aspects, conservation issues, MSFD, level of spatial management today, participation of stakeholders, policy urgency for planning and commonalities in conflicts.

1. Key human uses for candidate case studies

Key human uses of the kick off meeting were included here and indication of availability of qualitative or qualitative data was asked for. More human uses/pressures were allowed to be added.

Table 1. Summary of key human pressures and data availability for some of the candidate case studies[1]

	Case Study 1	Case Study 2	Case Study 3	Case Study 4	Case Study 5	Case Study 6	Case Study 7	Case Study 8	Case Study 9
	Belgian North Sea	Offshore EEZ North Sea	Southern and central North Sea	Greek case study	Bay of Biscay	Sicily	Malta	Scottish case study	North Sea Sandeels
Fisheries	●	‡	●	●	‡	‡	●	‡	●
Oil/gas	o	‡	●	●	‡	●	●	‡	●
Shipping	‡	‡	●	‡	‡	‡	●	‡	●
Wind farms	‡	‡	●	o	o	o	●	‡	●
Sand mining	‡	‡	●	●	‡	o	o	o	●
Gravel extraction	o	o	●	●	o	o	o	o	●
Tourism	●	o	o	‡	‡	●	●	‡	o
Aquaculture	‡	o	o	‡	‡	‡	●	‡	o
Pipelines	‡	‡	●	o	‡	‡	●	‡	●
Cables	‡	‡	●	‡	‡	‡	●	‡	●

● qualitative

‡ quantitative

o No data or none existent pressure

[1] Not all candidate case studies are included here for practical reasons; see final selection and detailed case study descriptions below. The table is included to illustrate selection methodology.

2. Number of conflicts

A cross table was set up in which expected conflicts between uses needed to be indicated.

Table 2. Example of cross table with indication of known (and assumed) conflicts.

Criteria	Fisheries	Oil/gas	Shipping	Wind farms	Sand mining	Gravel extraction	Tourism	Aquaculture	Pipelines	Cables
Fisheries	-	-	-	-	-	-	-	-	-	-
Oil/gas	0	-	-	-	-	-	-	-	-	-
Shipping	x	0	-	-	-	-	-	-	-	-
Wind farms	xxx	0		-	-	-	-	-	-	-
Sand mining	xx	0	x	x	-	-	-	-	-	-
Gravel extraction	0	0	0	0	0	-	-	-	-	-
Tourism	0	0	x	x	x	0	-	-	-	-
Aquaculture	xx	0	x	x	x	0	x	-	-	-
Pipelines	xx	0	0	x	x	0	0	x	-	-
Cables	x	0	0	x	x	0	0	x	x	-

Based on data from several potential case study area, the number of conflicts a specific human use has with other uses can be calculated per case study area.

Table 3. Number of conflicts per human use for some candidate case studies2.

Candidate Case study	Fisheries	Oil/gas	Shipping	Wind farms	Sand mining	Gravel extraction	Tourism	Aquaculture	Pipelines	Cables
1	6	0	4	6	7	0	4	7	5	5
2	10	6	6	8	6	5	7	6	9	9
3	9	9	6	7	6	6	3	7	6	5
4	5	0	2	0	5	2	5	4	2	4
5	7	1	1	0	5	0	2	6	4	4
6	6	1	5	1	0	0	3	4	4	3
7	7	6	7	7	0	0	6	7	6	6
8	7	3	4	4	0	0	3	3	1	1
9	7	2	4	8	6	0	4	4	3	4

[2] Not all candidate case studies are included here for practical reasons; see final selection and detailed case study descriptions below. The table is included to illustrate selection methodology.

This preliminary quantification of number of conflicts based on filled out forms by the respective partners who used data and expert judgment for this preliminary analysis. This enabled us to do a first analysis on the number of conflicts specific human uses on average have.

Table 4. Number of conflicts (averaged)

Fisheries	**7.11**
Aquaculture	5.33
Wind farms	4.56
Cables	4.56
Pipelines	4.44
Shipping	4.33
Tourism	4.11
Sand mining	3.89
Oil/gas	3.11
Gravel extraction	1.44

Besides this preliminary conflict analysis, the following criteria were gathered for potential case study areas. Further below, there will be an explanation of how different aspects of this preliminary descriptions were used to come to the final selection. Elaborated descriptions are included below, including the following aspects.

3. Diversity in geography and spatial extent

This criterion is relative to the other case studies. The final selection of case studies should represent both a broad geographical range and different spatial extents (from rather small to very large areas).

4. Data availability

Each case study needs to have sufficient data on the key human pressures (as shown above), on the different ecosystem components (benthic, pelagic, air borne) and its sensitivity to external disturbances. In other words, there should be an estimate on the resilience of the different ecosystem components, with resilience defined as the capacity of a system to renew and sustain specific conditions or processes in spite of exogenous disturbances or changes in driving forces.

5. Transnationality

The marine environment is defined by different marine ecosystems in which physical, chemical and biological components are equally important in defining total system properties. Far more pronounced than in terrestrial systems, physical processes create the conditions for many important biological processes. The dynamics of the marine environment are therefore defined by a subtle and complex interplay between physical and biological processes. The geographical scale at which biota can act ranges from microns to thousands of kilometres. Several of the uses (such as e.g. shipping, oil/gas transport and fisheries) take place across borders. These need to be identified. Again, there is a need for data on these different aspects before they can be taken into account.

6. Conservation issues

In the European seas which are heavily used, it is clear that pressure reduction will play a key role if one aims to reach sustainability through the application of the ecosystem approach to environmental management. The European Birds Directive and the Habitats Directive are the two international legal bases that oblige member states of the European Community to designate marine areas as part of the Natura 2000 network. The Natura 2000 network consists of Special Protection Areas (SPAs) for birds and Special Areas of Conservation (SACs) for certain habitats and species.

Other conservation issues (e.g. designation of MPAs) embedded in international commitments (e.g. Ramsar, Ospar and CBD) as well as national decisions (such as national parks) are of importance for this criterion.

7. European MSFD

A much broader framework is provided in the Marine Strategy Framework Directive. It aims to achieve good environmental status of the EU's marine waters by 2021 and to protect the resource base upon which marine-related economic and social activities depend. The Marine Strategy Framework Directive constitutes the vital environmental component of the Union's future maritime policy, designed to achieve the full economic potential of oceans and seas in harmony with the marine environment. The Marine Strategy Framework Directive establishes European Marine Regions on the basis of geographical and environmental criteria. Each Member State - cooperating with other Member States and non-EU countries within a marine region - are required to develop strategies for their marine waters. Therefore, the case studies developed should fall under and follow the strategy of the directive. The concept of environmental status takes into account the structure, function and processes of the marine ecosystems together with natural physiographic, geographic and climatic factors, as well as physical and chemical conditions including those resulting from human activities in the area concerned.

8. Level of spatial management today

Indication of which spatially explicit management measures are present in the case study. This includes also an indication on their success/failure.

9. Participation of stakeholders

10. Policy-urgency for planning

This refers to indications of a deteriorating environment with a clear cause. It relates to the data-availability on the resilience of ecosystem components and on human activities.

11. Policy-urgency for planning

This criterion is relative to the other case studies. The final selection of case studies should represent at least a few conflicts that occur in a majority of the case studies. This assures the integration of the different case studies on a European scale.

2.4 Final selection

2.4.1 Encompassing regions

After the first gathering of information, there were still two encompassing regions lacking (Baltic Sea and Black Sea). Fortunately, the appropriate partners could be found for the Baltic Sea (Aquabiota, SE and IOPAN, PL). For the Black Sea, DELTARES (NL) was willing to take the lead and develop the case study together with IOBAS (BG). Besides, one encompassing region could be added through the Barents Sea case study (IMR, NO). In conclusion, six European encompassing regions were present, representing the European marine waters.

2.4.2 Additional pressures

Through the forms for potential case study areas, there were 18 more human pressures selected on top of those suggested earlier (archeology, beach nourishment, coastal defence, conservation, dredging, dumping sites, habitats, harbour works, industry, military, nuclear decommissioning, recreational fisheries, seaweed extraction, species, tidal energy, wave energy converters, alien species and geohazards).

2.4.3 Transnationality

Some suggested case study areas have been lumped to stress the transnationality. This was done for Maltese and Sicilian waters, both operating in the 'Sicilian strait'. Several proposed areas in the North Sea were lumped together to one Southern North Sea case study area, including five different countries (and nine MESMA partners).

Furthermore, the Baltic Sea encompasses two different regions (a Swedish part and a Polish part) and the Celtic Sea includes partners from UK and Ireland.

2.4.4 The nine selected MESMA case studies

After preliminary analyses of proposed case study areas and after taking into account the additional pressures and transnationality issues, the final selection of the case studies was made:

Table 5. The nine MESMA case studies

Case Study Number	Case Study Name
1	Southern North Sea
2	Pentland Firth and Orkney Waters
3	The Barents Sea Integrated Management Plan
4	Celtic Sea
5	The Basque country (SE Bay of Biscay) continental shelf
6	The Strait of Sicily
7	Inner Ionian Archipelago – Patraikos and Korinthiakos Gulfs
8	Black Sea
9	Baltic Sea

For each case study one or two case study leaders have been appointed (Table 6). The responsible case study leaders are also mentioned at the beginning of each case study description. The full list of contributors is available (see above, first report page).

Table 6. MESMA case studies with indication of case study leaders

Case Study Number	Case Study Name	Case Study Leader
1	Southern North Sea	**Christine Rockmann and Robbert Jak**
2	Pentland Firth and Orkney Waters	**Kate Johnson**
3	The Barents Sea Integrated Management Plan	**Lene Buhl-Mortensen**
4	Celtic Sea	**Peter Jones**
5	The Basque country (SE Bay of Biscay) continental shelf	**Ibon Galparsoro**
6	Sicilian strait	**Tomas Vega Fernandez**
7	Inner Ionian Archipelago – Patraikos and Korinthiakos Gulfs	**Vassiliki Vassilopoulou**
8	Black Sea	**Jan van Dalfsen**
9	Baltic Sea	**Julia Carlström**

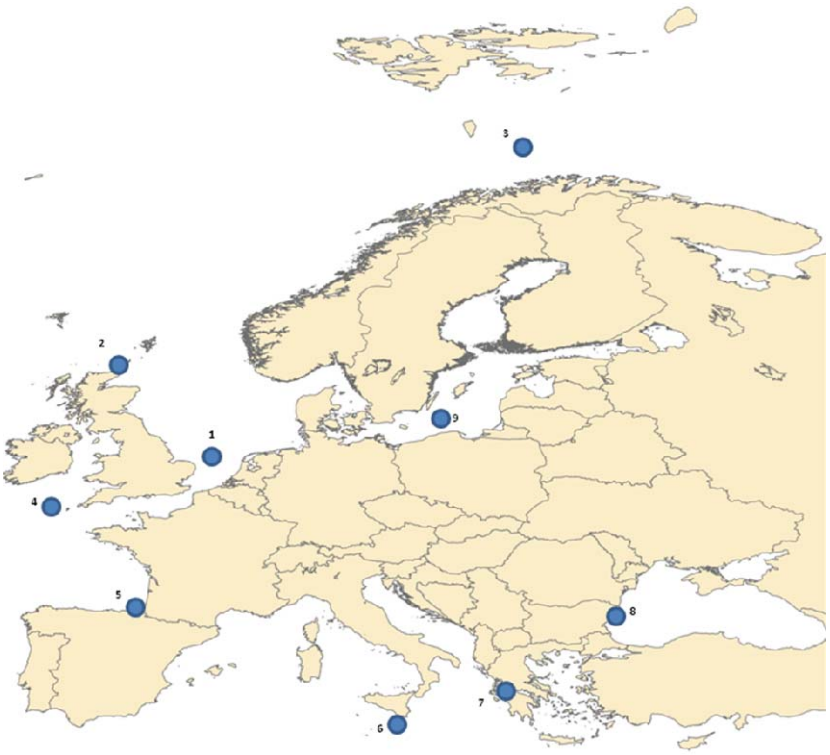


Figure 1. The nine MESMA case studies (numbers refer to Table 5 and 6).

2.5 Case studies as laboratories to test the MESMA framework

Work package 3 aims to test the MESMA concepts, strategies and methodologies in a coherent way using newly developed case studies representing the different geographical regions of the EU marine waters, existing human pressures, spatial claims and representative habitats. The comparison of many human activities in the different regions will provide a better insight on the full scope of the methodologies required to enhance a good EU-policy instrument for the Monitoring and Evaluation of the Spatially Managed Areas.

A first draft of the generic assessment framework with a detailed rationale for its contents has been developed in WP2 (D2.1) and forms the basis to evaluate the nine selected SMAs. Existing assessment strategies such as Integrated Environmental Assessment (IEA), MSP (Marine Spatial Planning) and Marine Protected areas (MPAs) suggested that the MESMA framework (Figure 2) should comprise i) the definition of key desired outcomes, ii) identification of management objectives, iii) performance indicators and thresholds, iv) monitoring and risk analysis, v) assessment of findings in relation to objectives, and vi) evaluation of current management and recommendations for adaptation.

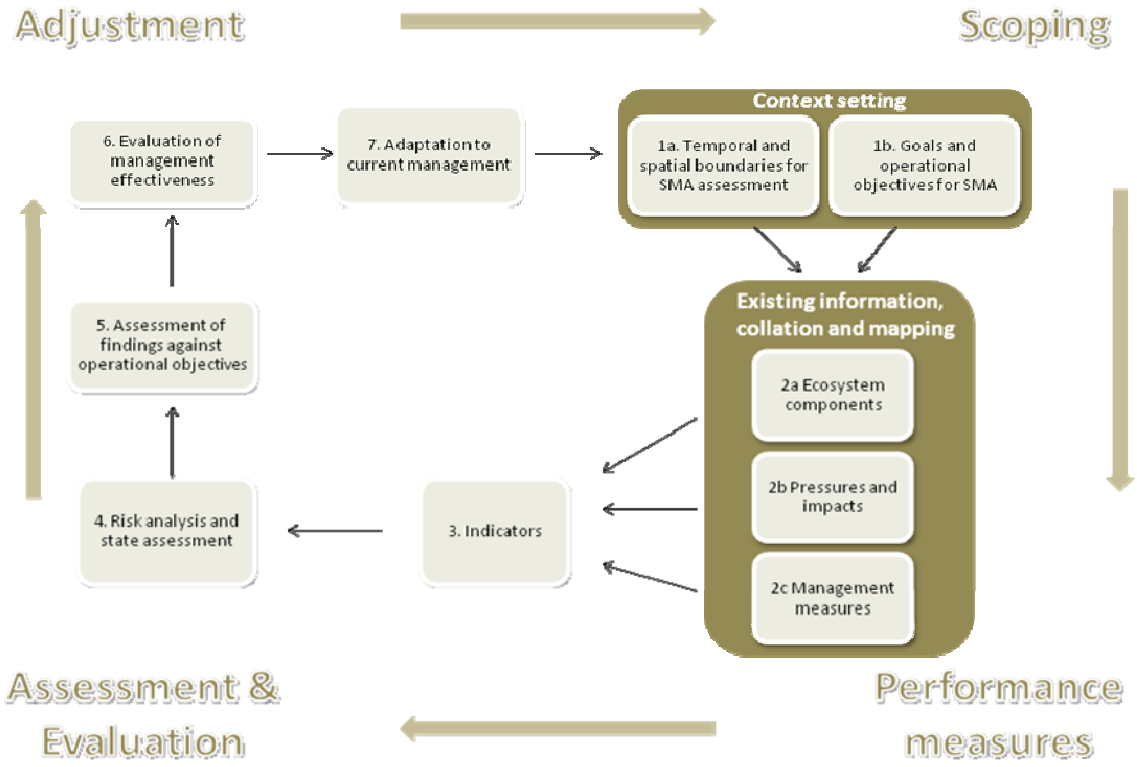


Figure 2. Proposed MESMA framework to monitor and evaluate SMAs comprising seven key steps (see D2.1 and D2.2 for detailed description).

Based on this generic framework, a 'Protocol for the application of the generic framework' has been developed in WP2 (D2.2) and comprises a manual that will be specifically tailored to be used by the case studies.

As will be clear in the case study descriptions below, the nine case study areas represent discrete spatial entities at different spatial scales where a spatial management framework such as MSP is in place, is under development or is considered. It is therefore clearly stated in deliverable D2.1 that the MESMA definition of SMAs allows for the inclusion of these case study areas which have different levels of maturity of spatial management plans. Thus the application of the MESMA framework will consequently lead to different types of assessment outputs. More precisely these outputs can fluctuate from one extreme which is a sustainability appraisal of an existing marine spatial plan, including an assessment of

the process used to develop the plan, to the other end of the spectrum which reflects an IEA with a set of qualitative recommendations to support an EBM within an SMA context (Figure 3).

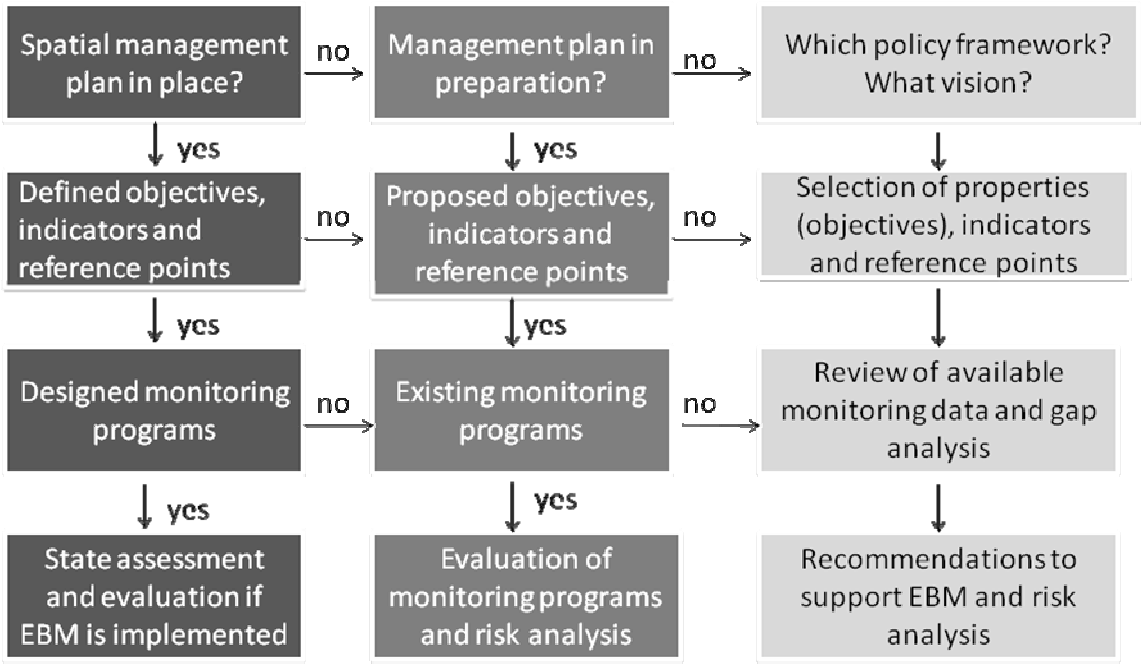


Figure 3. Conceptual flow diagram which relates the maturity of a given spatial management in a SMA together with the available data to expected assessment outcomes (taken from D2.1).

The case studies will further be used to assess how balanced governance can be achieved by an analysis of the potential of different incentives to address conflicts between top-down and bottom-up priorities.

The descriptions of the case studies have been developed in parallel with the first ideas of the MESMA framework (WP2 and WP6). Therefore, these descriptions are the ideal basis for the next step in the project which is the evaluation, testing and/or application of the general framework (D3.3). This should lead to a revised version of the framework and protocol (D2.3) and therefore, the case studies are to be considered as laboratories to test the MESMA framework.

3 Case Study Descriptions

Coordination: Marijn Rabaut and Magda Vincx

All case studies will be described here and presented as a summary, including information on the most important issues that will be tackled and a first reference –where possible- to the MESMA framework that has been developed in the same period as these case study descriptions. Extensions, details and elaborated descriptions of the case studies are added to this report as **annexes**.

3.1 Southern North Sea Case Study

Case study leaders: Christine Rockmann and Robbert Jak

3.1.1 Introduction

The Southern North Sea (SNS) Case Study is the largest MESMA case study. The case study includes nine MESMA partners from five countries, guaranteeing a highly transnational approach. The complexity of the case study area is reflected in the huge variety of biotopes, human activities, and regulations. Moreover, there are remarkable spatial differences in human uses and governance arrangements within the case study area.

The Southern North Sea is a shallow coastal sea, up to a depth of about 50 m, and the area includes the territorial waters and EEZ of Denmark, Germany, Netherland, Belgium and part of the United Kingdom. The area used for this case study follows the EEZ boundaries of the respective countries, except for the UK. Here only part of the EEZ will be considered, i.e., the English part considered in the Net Gain project, aimed to identify and recommend Marine Conservation Zones in the English North Sea. In the north, the border between English and Scottish marine waters is used.

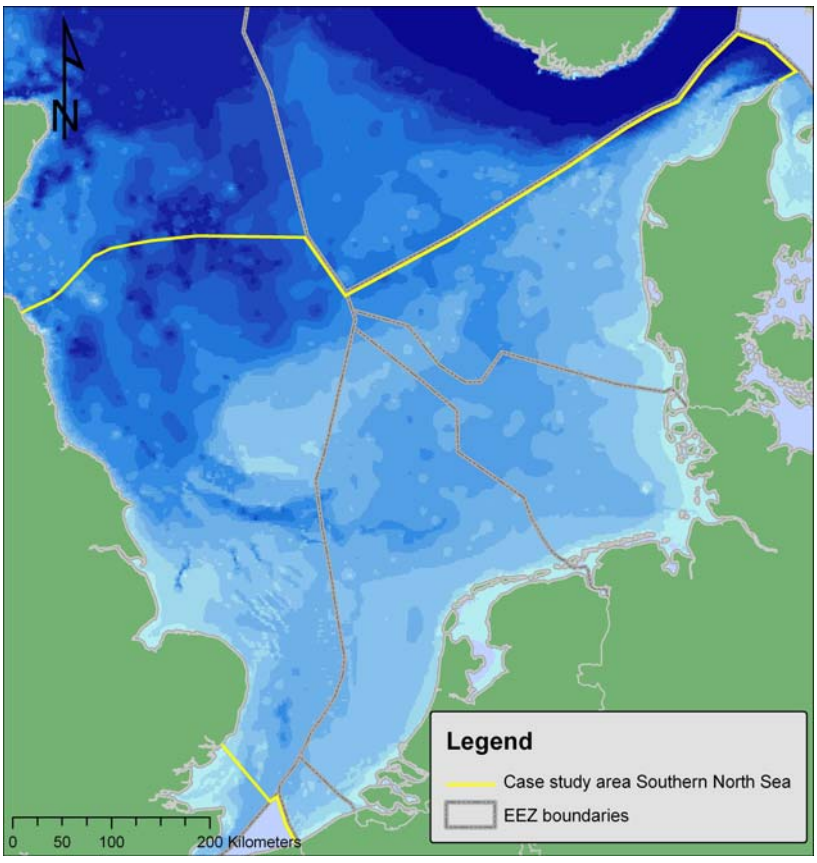


Figure 4. Map of the Southern North Sea (SNS) case study.

The input of nutrients from the Atlantic, the Channel and several rivers into the North Sea results in a highly productive sea providing several environmental services. Being a highly productive area, fisheries is an important economic sector. Other characteristic activities include shipping and mineral extraction. Renewable energy (wind farms) covers an increasing area of the sea, and so are marine protected areas in the framework of Natura 2000. Some of the impacts caused by one activity may reduce the environmental functions required by others. This may be competition for space, competition for a common resource or changes of functions in such a way that their value for others decreases.

3.1.2 Testing the MESMA framework in the Southern North Sea

The MESMA framework developed in WP2 will be used to monitor and/or evaluate the performance of spatial management in the Southern North Sea in relation to one or two specific management objectives. The steps of the framework will be evaluated on the scale of the entire Southern North Sea (Figure 6).

It is possible that we run into problems/ knowledge gaps, when testing the framework on the entire SNS scale: data and scientific knowledge is often scarce on this large geographic scale, and the variety of characteristics within the case study area may be better studied by focusing on specific aspects that are represented at a smaller spatial scale. Given the diversity of the ecological, economic, social and governance systems in the SNS, we take advantage of the fact that a lot of multi-disciplinary knowledge already exists on specific characteristics of smaller subareas within the SNS. Pro-actively, four smaller areas within the Southern North Sea have been selected (Figure 5), each with potential specific research questions considering aspects of spatial management (cf. Annex). Zooming in on these four – partly well known, and partly poorly known – marine areas will allow us to handle the complexities of the system and to infer management conclusions and recommendations to the larger scale of the SNS. The transnationality is highlighted in these in-depth analyses, too. Hence, an in-depth analysis of up to four subareas on a finer scale can follow, whenever there are gaps on the entire SNS scale (Figure 5).

The results of these in-depth analyses will be integrated to draw conclusions at the higher, i.e. the Southern North Sea, scale again. This integrative step will be driven partly by comparing similar objectives, biotopes and activities, i.e., the subarea-specific lessons learned from testing the MESMA framework (WP2) will be combined to draw conclusions on the scale of the entire SNS. For instance, we will be looking at ecological relations between subareas, differences and similarities in subareas where the same biotopes occur or the same activities take place.

Furthermore, integration on the scale of the SNS will also be driven by the governance research analysis (WP6), investigating the institutional settings that steer MSP. The conclusions of this integrative analysis might result in recommendations on how to adapt MSP in the SNS or in defining new common management objectives.

The integration from subarea scale to SNS scale will also feed a fundamental discussion on scales: do priorities shift when “zooming out”? Is there a need for management at the SNS scale? We will evaluate how the transition works from one level to another and what the implications are for spatial management of the Southern North Sea.

In short, the SNS case study starts off and ends at the Southern North Sea scale; several in-depth analyses will be carried out in four selected subareas. This **nested approach** ensures detailed insights in the spatial management process of this complex area, focusing on the comparison of spatial management of marine activities in various marine biotopes at different scales and the respective governance institutions. To test the WP2 MESMA framework, common management objectives that apply for all subareas will be identified. The nested approach will also allow monitoring and evaluating environmental performance and assessing governance at the most appropriate level. The aspects of governance vary considerably within this case study and the governance analyses will contribute to the understanding of ‘good practice’ of the spatial management of marine areas.

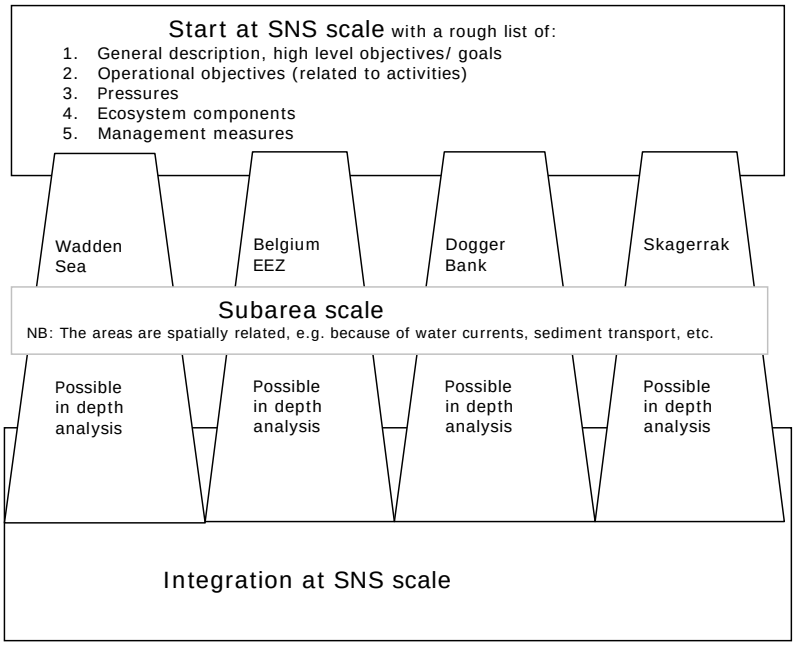


Figure 5. Flow diagram of the suggested 3-step approach, combining the integral SNS analysis and the four in-depth subarea analyses.

The selected subareas for in-depth analyses are: Skagerrak Sea, Belgian part of the North Sea, the Wadden Sea and the Dogger Bank. The highly transnational subareas comprise the Wadden Sea and the Dogger Bank, with the former being an inshore area and the latter an offshore area. The Belgian part of the North Sea and the Skagerrak area will test and apply the WP2 framework for a national and a sub-national area. Note that these areas are fully described in the Annex to this case study.

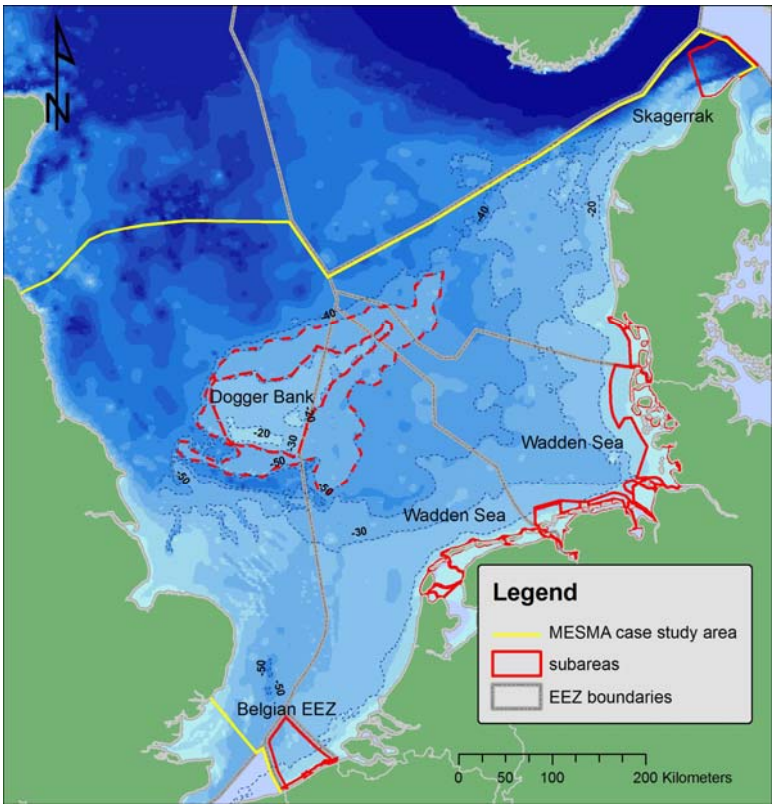


Figure 6. Map of the SNS case study, including the delineations of the four subareas for in-depth analysis.

3.1.2.1 Spatial management in the Southern North Sea

The SNS case study covers different spatial management situations from a fully developed spatial management plan to no management plan at all (See above Figure 6). It is clear that there is no overarching management plan for the whole SNS case study area. However, based on existing knowledge of the case study area and the current policy framework, it is possible to define overarching objectives, such as achieving GES (MSFD) or a certain percentage of renewable energy. These are the high level objectives that will form the basis for the evaluation of the spatial management at the scale of the Southern North Sea. At the same time, they will also be used as a basis for the in-depth analyses on the selected subareas.

A brief summary of the spatial management situation in the two transnational and two national subareas: For the Wadden Sea Area a revised management plan is in place, the" Wadden Sea Plan 2010" while for the Dogger Bank, there is currently no overarching transnational management and most management is carried out within national legislation or sectorally through binding international agreements such as the EU Common Fisheries Policy, IMO and others. With respect to the in-depth analysis of national areas within the case study, there is a spatial approach to sea use management in the Belgian part of the North Sea despite the lack of a legal zoning framework while in the Skagerrak area the focus is on the spatial management of a Natura 2000 site in the Danish offshore area, designated and managed at a national level mainly to protect harbour porpoises.

3.1.2.2 Framework steps in the Southern North Sea

In the following, we briefly discuss the different steps of the MESMA framework based on current knowledge, data-availability and expertise within MESMA.

WP2 has developed a generic (preliminary) framework in order to serve as a 'best practice guide' for the monitoring and evaluation of Spatially Managed Areas. The framework presents seven steps that should be carried out to monitor and evaluate SMAs (See above Figure 6). In the present case study (within WP3), we will use this framework to monitor and evaluate the process of spatial management in the SNS. While doing this, we will pay particular attention to and reflect upon whether following the seven steps of the preliminary MESMA framework is feasible and useful. This feedback mechanism will potentially lead to adaptations of the framework.

The degree of spatial management in the selected subareas of the SNS case study varies considerably. The four detailed subcase descriptions can be found in the Annex to the case study.

Step 1: Context setting

1a) The boundaries of the case study have already been set when defining this MESMA case study (Figure 5). This is the scale on which the first run of the MESMA framework will be performed.

Wherever it appears necessary and useful to get more detailed answers on a smaller spatial scale, the nested approach allows us to zoom in to the subareas identified in the nested approach. Very different areas, from small to large, are included for potential in depth analysis. The Dogger Bank area is preliminarily defined here as the area that is maximum 40 m deep, including the adjacent slopes and consists as such of an area of approx. 18000 km² covering parts of the EEZ of the United Kingdom, The Netherlands, Germany and Denmark. However, for this area, the boundaries are not yet fixed, and setting the boundaries is part of the case study exercise with respect to this sub-area. The boundaries may be set on a biogeographic and/or political basis. The Wadden Sea Area is defined as the so-called Cooperation Area, which is the area of the trilateral cooperation of The Netherlands, Germany and Denmark and is about 13500 km² large. The analysis of the Belgian waters includes the Belgian EEZ of the North Sea, an area of about 3600 km², while the Skagerrak study area analyzed within this case study is defined under the Habitats Directive and is only 117 km².

1b) In the definition of goals and operational objectives, we will investigate whether it is necessary to distinguish between high level goals and objectives, mostly relating to the entire SNS, and operational objectives that are locally more specific, possibly relating to a specific subarea. We expect to find high level goals, such as reaching GES or a healthy and productive ecosystem, in international conventions,

regulations, or policies. The specific realisations of high level objectives might differ per subarea, hence there might be operational objectives in other policy documents, relating to a lower, maybe national or regional level only. The overarching high level goal will be defined on the entire SNS case study level and will be used for the first run. Step 2: Existing information, collation and mapping

2a) The ecosystem components that are of importance in the SNS will be listed when working on step 2a of the MESMA framework. Based on a rough, preliminary exercise, the SNS case study comprises at least the following ecosystem components: marine mammals, infralittoral coarse sediment, circalittoral coarse sediment, infralittoral fine sand, infralittoral muddy sand, infralittoral sandy mud, sublittoral polychaete worm reefs on sediment, sublittoral mussel beds on sediment, fish, and other relevant EUNIS biotopes. Each subarea might have a different focus, e.g. in the Dogger Bank subarea, sandeel have been chosen as an important ecosystem component of this submerged sandbank habitat (cf. Annexes).

2b) The most important impacts and pressures in the Southern North Sea are related to fisheries, eutrophication, dredging and dumping, energy resource use, recreation and shipping.

2c) Management measures will be identified on the scale of the Southern North Sea as well as on the scale of smaller areas (*cf*. nested approach). The management measures identified at the different spatial scales will then be compared and analysed with respect to questions such as: Are there incentives (synergistic institutions) or disincentives (antagonistic institutions effects) in place to control activities that undermine achieving the management goals? The key focus of the review of existing management measures should be those related to the goal/objective of the case study, including their links to and influence over other sectoral laws/policies. However, other sectoral laws/policies need not be reviewed in themselves, other than in so far as how they are related to the laws/policies concerning the goal/objective.

Step 3 – 5 (3) Indicators, (4) Risk analysis, (5) Assessment against operation objectives

The selection of indicators and benchmarks, the risk analysis, the assessment of the findings against the operational objectives as well as the management effectiveness will be evaluated on the scale of the Southern North Sea, and where necessary (if differences exist), also in depth on the scale of subareas.

Step 6: Evaluation of management effectiveness

Step 6 is closely connected to the WP6 governance research analysis of the SNS case study, including the four subareas.

Step 7: Adaptation to current management

Based on the findings of the evaluation of all previous framework steps, recommendations will be made for potential adaptations to the current management regime. The findings of both, the evaluation on the scale of the Southern North Sea and on the scale of the smaller subareas (in-depth analyses), will be used to formulate recommendations on the spatial management on the scale of the Southern North Sea.

3.1.3 Governance analysis in the Southern North Sea

The governance analysis will be performed in WP6. In the Southern North Sea, the governance analysis will explore how different incentives/institutions are or can be combined to achieve long-term and strategic management goals in an effective and equitable manner. Such analyses will assess how different governance approaches - state steer, market approaches and community participation, can be combined and employed in balance to support management goals and address conflicts between users. It is important to understand the views of different stakeholders (governance, management, operational and others) on the effectiveness of the existing management measures in achieving the environmental goals/objectives, including their views on the validity of these objectives. These views will be explored through the governance research and input into the MESMA framework.

Several international policies apply to the Southern North Sea. An inventory will be made on what (generic) high level objectives have been defined for the spatial management of the (Southern) North Sea. These objectives are defined by e.g. the EU, OSPAR, and other bodies such as the Ministerial Conference for the North Sea (now part of OSPAR). On subareas level, , it will be analysed if, and how these defined high level objectives are translated or implemented in specific operational goals and/or measures by

current management at a local scale. The results from the subarea investigations will be compared, analysed and used as an input to identify and/or advice on best governance practices, if possible on subarea and SNS scale.

The in-depth governance analyses will be performed for transnational ecological units (such as the Wadden Sea and the Dogger Bank) and for nationally defined areas (the Belgian part of the North Sea and the Skagerrak area). Whereas Spatial Management is already in place for the Wadden Sea, there is no international spatial management policy for the Dogger Bank area. Therefore, the analysis of the Dogger Bank area will have a clear focus on governance, in particular with respect to the interaction between marine species (incl. protected species), sediment habitat, fisheries and wind farms. To establish MSP in this area, an analyses of best practices in and lessons learned from the Wadden Sea area could serve as an example. In the Belgian part of the North Sea governance analysis is challenging because the marine policy is divided over several institutional levels, while for the Skagerrak the governance analysis will focus on management aspects of and stakeholders concerned in the fisheries by-catch of harbour porpoise in a Natura 2000 area.

3.1.4 Nested approach – conclusions on the Southern North Sea Case Study

The in-depth analyses on the scale of subareas provide valuable information for the Southern North Sea as a whole (Figure 5). Similarities and differences in the evaluation and monitoring process (WP2 framework) on the different scales will be investigated. Subareas with similar management objectives, activities, pressures will point towards conclusions on a broader Southern North Sea scale. The insights of two fully transnational subareas can be evaluated: what are the similarities and main differences between transnational inshore and off shore areas?

Spatial management in the Southern North Sea is at very different stages of development. The in-depth analyses will provide insights in the specifics of management plans, the prerequisites for integration of spatial management plans and will point out whether plans in development should or should not evolve in the same direction as the fully developed ones. The nested approach is an excellent methodology to analyse spatial management processes on different scales in order to determine how priorities shift when zooming out to the Southern North Sea scale, determining how the transition from one level to another works and what the implications are for marine spatial management. Besides, the potential ecological relations between subareas will be highlighted together with the need for management actions taking this into account.

3.2 Pentland Firth and Orkney Waters Case Study

Case study leader: Kate Johnson

3.2.1 Preamble: The Character of the PFOW area and the Aims of the Case Study

The PFOW area is a compact busy scenic coastal area with a relatively intact and working ecosystem. Significant change is to be introduced with the imminent deployment of large scale marine energy development and the associated construction operations and infrastructure. An intense effort by the Scottish government and others to complete a statutory Marine Spatial Plan (MSP) for the area is in progress. Government objectives for the plan, which is the first under the provisions of the new Marine (Scotland) Act 2010, include:

- Give greater clarity to decision making
- Reduce uncertainty for marine developers
- Encourage economic investment
- Help protect the natural environment

The aim of this case study is to analyse and critique the PFOW MSP process as it is developed and identify benefits and disbenefits for the MESMA draft WP2 generic framework and the associated WP4 toolbox. Special attention is paid in the case study to stakeholder analysis and engagement. Local community based stakeholders and institutions will be a special focus in an area where de-population and economic hardship are a concern.

3.2.2 Steps 1a/1b Boundaries and Operational Objectives for PFOW

The Area of PFOW

The area of the PFOW has been designated for urgent marine planning by the UK and Scottish governments because of its role in the development of marine renewable energy extraction for the purpose of generating electricity (Figure 7). The area is situated in the extreme north of the United Kingdom (centred at approximately 59^0N 3^0W) in the vicinity of the Orkney Islands archipelago at the separation point between the Atlantic Ocean and the North Sea. It has been recognised as the most energy rich marine environment (wave and tide) in the United Kingdom suitable for electricity generation by virtue of its accessibility for construction, maintenance and power export. Testing of marine energy devices started around 2005 with the establishment of the European Marine Energy Centre (EMEC) in Orkney. Testing of a variety of wave and tidal technologies is well advanced and preparations are underway for commercial deployment in an intense period of activity leading to the targeted generation of over 1200MW of power from the area by 2020 - about 1000 machines. Seabed leases were awarded to private developers by the seabed owners (Crown Estates) in 2010. The concentration of construction resources is expected to be similar to those deployed for the development of offshore oil in the 1970s but taking place in an inshore area.

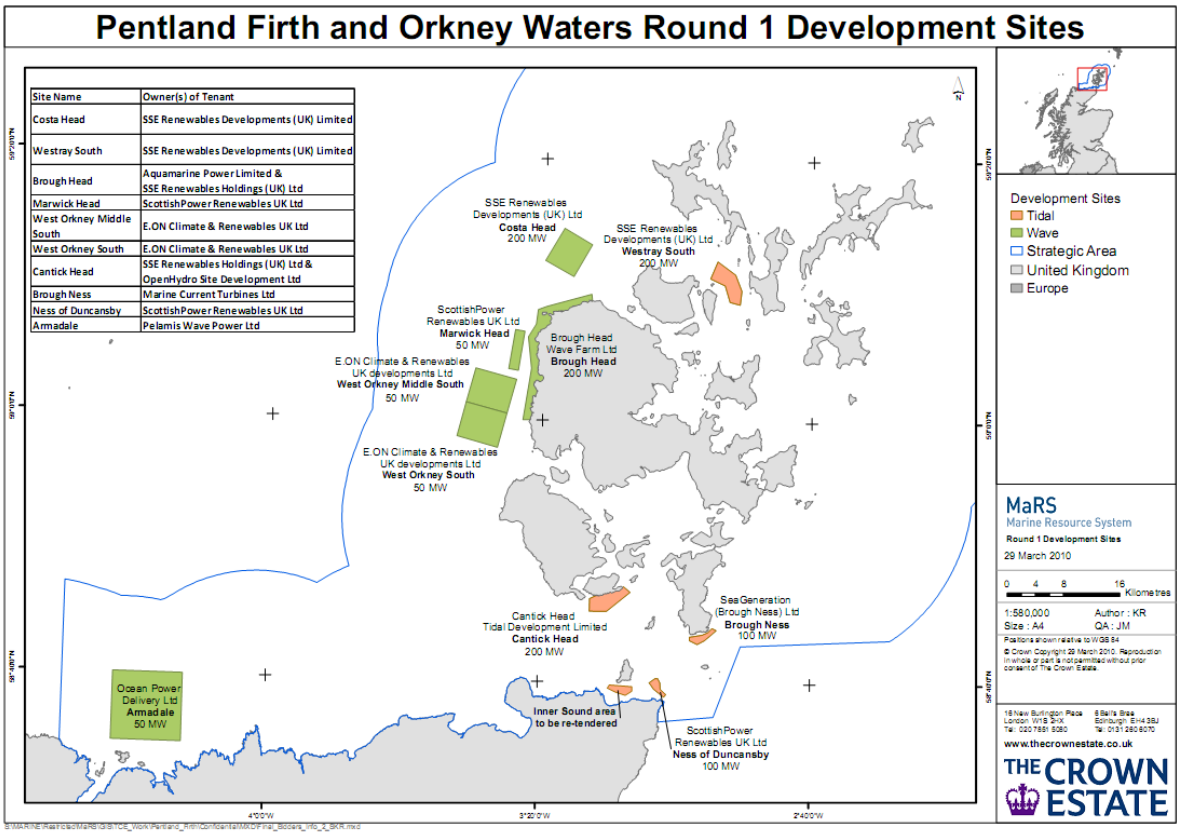


Figure 7. Plan of the PFOW area and marine renewable leases.

The boundaries of the area have been drawn to encompass the limits of the territorial sea (12 nautical miles) around Orkney which also marks the limit of jurisdiction of the Scottish government as defined by the Marine (Scotland) Act 2010. The offshore area falls within the jurisdiction of the UK government and the Marine and Coastal Access Act (2009). The jurisdiction is further complicated by powers reserved to the UK government regardless of location - these include renewable energy. Reserved powers and jurisdictional responsibilities are summarised in the annex to this case study. The Orkney archipelago comprises about 70 islands of which 20 are inhabited. The oceanography is characterised by fast flowing tidal flows between land masses and huge wave energy from the Atlantic to the west. Orkney is separated from the north Scottish mainland (Caithness and Sutherland) by the narrow Pentland Firth. The southern boundary of the PFOW area is marked by a length of north Scottish coast with a linear measure of about 80km. The overall length of PFOW coast measured around islands and inlets amounts to more than 800km. The PFOW covers an area of a little over 12000 km^2. The land area of islands within the PFOW total about 1000 km^2

The human population of the area amounts to about 35000 people (20000 in Orkney and 15000 along the coast of north Scotland). Economic activity includes agriculture, fishing, aquaculture, tourism, craft industries, shipping and offshore oilfield support. A high proportion of the population are employed in public services. The overall population is relatively stable after significant declines through the twentieth century. Several island and remote mainland communities are subject to continued decline and are designated vulnerable. The ecosystem of the PFOW is characterised by relatively clean unspoiled habitats for all forms of marine life. The coastal water quality is rated good or high with minimal and isolated bad areas related to agricultural run-off [SEPA 2009]. Most human interest in the ecology is focused on marine birds and mammals. Climate change and baseline monitoring related research into specialist organisms adapted to the high energy marine environment at these high latitudes is at an early stage (e.g. *bryozoans* adapted to fast flowing tidal streams; and *fucus disthicus* seaweeds at the southern extremity of their distribution).

Existing Plans and Objectives for PFOW

There is no overall marine spatial plan in place for the PFOW area. Several coastal habitat protection areas (SACs and SPAs) are in force and marine extensions are proposed. Within the UK and Scottish Biodiversity Action Plans (which seek to implement requirements of European and other international treat law) a number of marine species and marine habitats have also been prioritised and actions set. Areas of human activity, mainly related to shipping and fishing, have become established over the years and exist in close proximity to each other with little evidence of significant conflict. Protection measures are in place for several marine species including seals and cetaceans. Fisheries are subject to catch and effort restrictions in line with the Common Fisheries Policy (CFP). Non-quota and shellfish fisheries (inshore and community based fisheries) are subject to few restrictions but without evidence of significant stress.

The Scottish government, working through their marine administration, Marine Scotland, have initiated work towards the urgent formulation and implementation of a PFOW Marine Spatial Plan (MSP) in recognition of the instrumental change introduced by the deployment of marine energy devices. Marine energy carries with it a high economic and political priority; a policy of *'deploy and monitor'* has been adopted which means that substantial deployment will precede the completion of an MSP and continuous monitoring will guide future policy. The plan will be constructed under the new Marine (Scotland) Act 2010 which is also the vehicle for implementation of the Marine Strategic Framework Directive (MSFD).

Marine Scotland awarded consultancy contracts to private companies to research and report on an MSP framework and locational guidance to energy development companies. These reports were published in 2010 and following consultation it is expected that a draft MSP will be published in 2011/2012. A statutory plan is expected to be in place in 2013/2014.

The Legal Framework for PFOW

The entire PFOW area lies within the territorial sea of Scotland and falls to Scottish domestic jurisdiction with the exception of certain activities which are reserved to the authority of the United Kingdom parliament. These include oil and gas; marine energy; telecoms and shipping although in the case of marine energy Scotland exercises 'executive' authority (i.e. it can administer but not change the UK law). Scotland exercises control over its fisheries within the EEZ but the UK government retains all authority to liaise with the European Union about the Common Fisheries Policy (CFP). European law is transposed into Scottish or UK legislation as appropriate. The Marine (Scotland) Act came into force in 2010 introducing new provisions and acting as a focal point for existing legislation. The general duties of the new act are:

- Sustainable development and protection/enhancement of the health of the Scottish marine area
- Mitigation of climate change and adaptation to it

The main provisions of the act are to:
Introduce statutory Marine Spatial Plans (MSPs)
Take ministerial powers to declare Marine Protected Areas (MPAs)
Establish a single point of contact licensing authority for all marine activities governed by a wide range of marine and coastal legislation (Scottish, UK and European) including that related to marine energy but excluding oil and gas
Give increased protection to seals
Make minor amendments to inshore fishery legislation

An important feature of the Scottish marine legislation is the emphasis on giving full account to social and economic needs. The policy memorandum accompanying the Marine Bill asserted a policy of 'presumption of use' in MPAs [Marine Bill Policy Memorandum 2009, para 54, p12].

3.2.3 Steps 2a/2b/2c Management and Planning Components for PFOW

Spatial Data and Metadata Catalogue

A large amount of historic data exists in various metadata formats. Datasets from more recent surveys have been recorded in 'Vector' and 'Raster' formats (e.g. the Ordnance Survey datasets). Marine Scotland and Highlands and Islands Enterprise (HIE) have undertaken separate initiatives to report and summarise historic and current data. The most comprehensive of these reports is that prepared by Aquatera Ltd for HIE which includes a full metadata catalogue (see annex).

Ecotopes and Species

Marine Scotland carried out detailed surveys of the PFOW seabed in 2008/2009 from the FRV Scotia (see annex). The results of the FRV Scotia survey were made available to Scottish Natural Heritage (SNH) which has commissioned reviews of the potential conservation value of the sea bed. The area is especially noted for its seabird populations; marine mammals; organisms endemic to high energy marine environments (littoral and sub littoral); and organisms at the southern or northern limits of their distribution. Heriot-Watt University maintains a marine species list for these waters (from all known sources and records) and has considerable information now on many biotopes (within the EUNIS classification system) both littoral and sub-littoral. This information has been used to inform the local biodiversity action group which has local action plans for many UK and Scottish priority marine species and habitats, not otherwise protected by formal designations under the European directives discussed above. One unique feature of Orkney biotopes is the diversity and close proximity of many different marine habitats, from exposed wave swept inter-tidal zones, to areas of deep mud, from tidal rapids to saline lagoons.

The littoral shoreline comprises mostly steep rocky cliffs and some bays with very exposed shores. The sub-littoral includes sparse faunal turf communities and unusual biotopes found only in high tidal energy environments.

Activities, Stakeholders and Institutions

There are a large number of public and private sector stakeholders with interests in the PFOW area (see annex). The longest established, and currently the most important, activities in the PFOW are shipping and fishing. International shipping lanes carrying traffic from Europe to the Atlantic run through the Pentland Firth; ferries criss-cross the area running between islands and to the mainland; fishing vessels steam through on their way to grounds elsewhere; and smaller local fishing vessels stop to recover their creels (crab and lobster traps). Oil and gas tankers travel to and from the Flotta marine terminal in Scapa Flow. A ship to ship oil transfer business has also been established and oilfield supply boats service the offshore fields from Orkney. VMS and AIS data are available and plot all vessel activity for vessels greater than 15m in length which therefore excludes the inshore fishing fleet.

The PFOW area is on the inshore edge of Britain's richest fishing grounds and contributes about 3500t of demersal catch (about 4% of the Scottish total) and 13000t of pelagic catch (about 10% of the Scottish total) each year. These are ten year averages based on the records from five ICES rectangles which approximate well to the PFOW area. These fish are mainly caught by vessels based outside the area and landed elsewhere. The shellfish fishery is an important feature of the local economy and community catching an annual average of about 5000t of crab, lobster and scallops. Most is landed and processed locally. Tourism related businesses are an increasingly significant feature of the marine environment both indirectly in relation to shore based infrastructure and direct activities including scuba diving, leisure boating, sport fishing and sightseeing/nature watch.

The most prominent newcomers to the scene are the designers, developers and installers of marine energy converter devices. Pressed forward by macroeconomic, political and business imperative there is a determination to proceed quickly with technological and operational development. The principal stakeholders are the government on behalf of the general population who look to the macro and local economic needs of the nation; the Crown Estate who own the seabed and foreshore in the territorial sea and have a statutory duty to maximise the income from it; the developers and operators who look to the business opportunity.

The island and coastal communities of Orkney and Caithness are important and vulnerable stakeholders. The marine area is an integral part of the lives and culture of everyone, resident or visitor, to the PFOW area - it is virtually impossible to ignore it or be isolated from it. The marine 'commons' have been a source of local sustenance for centuries and marine planning legislation moves it closer to full 'enclosure'. Community and traditional knowledge exist alongside scientific and expert knowledge in the decision making process. Community based institutions therefore have a special role in the roll out of the PFOW MSP which will be addressed in the case study.

The institutional landscape in the PFOW is well developed at most levels. The two important stakeholders with the weakest institutional representation are the inshore fishers and the communities of the more remote islands. Central government administers the marine area through 'Marine Scotland', the name given to the integrated group of civil servants responsible for carrying through their democratic decisions.

Planning responsibilities will be held centrally but administratively devolved to Orkney Islands Council (OIC) and Highland Council (HC) assisted by a management group of stakeholders. The two councils are obliged to consult *inter alia* with the general public and the Community Council in the area affected by a plan. All the island communities in Orkney and some in coastal Caithness have organised themselves into Local Development Trusts (LDTs) - not for profit companies owned by the community with the aim to foster economic development in their community.

3.2.4 Case Study Outline for PFOW

The PFOW case study outline presented at the WP3 Ghent workshop addressed the four basic questions asked.

a) What are the most important issues to be addressed in the PFOW case study?

The most important contemporary issues in the PFOW area are the problems associated with accommodating the marine renewable energy industry into a sensitive and already busy marine environment.

The PFOW is an area of social, economic and environmental importance which is subject to a rising level of economic exploitation. There are rich sources of existing data including a fully developed framework document* for the PFOW Marine Spatial Plan. Completion of the MSP is pending publication of the National (UK) Marine Policy Statement (MPS) in 2011. The MPS is a statutory requirement under the MCAA and MSA.

**** PFOW Framework Document***

"This document sets out a framework for the future development of the Pentland Firth and Orkney Waters marine spatial plan. It contains a summary of existing information on different uses of the seas, shows how these different uses may impact on each other and makes recommendations for future research to ensure that the plan is properly underpinned by relevant and good quality information. It sets out how the plan will be developed. This document also sets out draft Regional Locational Guidance for the development of wave and tidal resources". Marine Scotland 2010

b) What are the most important issues which it is feasible to address in the PFOW case study?

In the context of the already advanced development of the planning regime, the most important issues which it is feasible to address in the PFOW case study are the implementation and governance of the future statutory MSP and the values attached to the elements of the plan by users, stakeholders and local communities.

c) How can a MESMA framework be implemented in the PFOW case study?

Because the PFOW planning framework is already established in the public domain it will not be possible to implement the MESMA WP2 framework straight into the PFOW case study. The case study will have the capacity to inform the WP2 framework about the successes, failures and gaps in the PFOW MSP process underway. In addition the case study (and the emerging WP2 framework) will aim to inform the work of Marine Scotland and others as the PFOW MSP progresses towards statutory status, probably around 2012.

d) What are the hypotheses, research questions, objectives and methodologies of the PFOW case study?

Hypotheses

Ziman [1978] introduced definitions of science which included 'consensuality' and 'consensibility'. 'Consensuality' rejects certainty and says that "...the general body of scientific knowledge should consist of facts and principles which are firmly established and accepted without serious doubt by an overwhelming majority of competent well informed scientists". 'Consensibility' says that: "Each message should not be so obscure or ambiguous that the recipient is unable either to give it whole hearted assent or to offer well founded objections".

The theme of the PFOW case study is 'consensibility' as it relates to informed local communities and users (especially fishers) through 'good governance'.

1. *'Good governance' is critical to the successful introduction of spatial management and planning to the marine commons and the extraction of common-pool resources.*
2. *'Good governance' requires a balance of state, market and community based institutions and measures.*

Research Questions

- What is the history of planning, institutional and regulatory development in the marine commons?
- Is there an identifiable relationship between the development of marine spatial planning, spatially managed areas and 'commons' theory [after Hardin, Ophuls, Ostrom etc.].
- Who are the users and stakeholders in the PFOW area? What past, current and future conflicts can be identified?
- In development of the PFOW Framework Marine Spatial Plan and Regional Local Guidance for marine energy:
    a. *How have the governance elements of state, market and community been addressed?*
    b. *What methods have been employed to consult with users and stakeholders?*
    c. *How have respective human and ecosystem values been evaluated?*
- What are the present values placed on the PFOW area by users, stakeholders and the communities of Orkney and the Pentland Firth coast on the Scottish mainland?

Objectives and Method

The objectives of the case study will focus on interaction between the MSP process and the local communities and particularly the interaction between the installation of marine energy devices and local fisheries. Methods employed will use multi-criteria analysis and spatial AGORA to determine non normative values of communities and stakeholders. Data will be collected through interviews, meetings and questionnaires and processed using cluster analysis.

We will also test criteria designed to evaluate links between the formal and informal elements of economies as they relate to interventions designed to facilitate the management of common pool resources:

1. *Subsidiarity in a multi-level system*
2. *Balance between formal and informal structures*
3. *Implementation capacity*
4. *Complementary interventions*
5. *Willingness to participate (or voting with their feet)*
   [After Guha-Khasnobis B, Kanbur R, Ostrom E. 2006.]

3.2.5 Next steps in PFOW

The Ghent meeting advanced the WP2 framework and set a direction for the implementation of the case studies. The objectives and methods of the PFOW case study detailed in the outline (Chapter 3 above) are unchanged. Ziman's (1978) concept of 'consensibility' and relationships to governance, stakeholders and, in particular, local communities are at the core of this case study research Our hypothesis is that stakeholder points of contact and roles in the WP2 framework process are critical to the success of spatially managed areas. This will be explored with the governance analysis under WP6.

At the Ghent meeting Heriot-Watt University undertook to complete a number of tasks with regard to the points of contact for stakeholders in the WP2 framework and to relate these to the PFOW case study and to MESMA in general.

1. Identify points of stakeholder engagement in the MESMA framework process and circulate by 31 August 2010 *(Completed - uploaded to sharepoint)*
2. Conduct a literature review of tools for stakeholder and institutional analysis and engagement. Identify tools appropriate to use in marine SMAs for inclusion in WP4. Outline draft by 30 September 2010; final by 30 June2011 *(In progress)*

3. Identify PFOW case study stakeholders and hold first case study workshop before the end of 2010 leading to fieldwork, questionnaire and detailed analysis in 2011/2012 *(Workshop arranged for 9th December 2010 in Inverness)*
4. Produce guidelines for stakeholder and institutional analysis for application to MESMA case studies and other SMAs. Draft to be circulated prior to Malta meeting in November/December 2010

Stakeholder Meetings and WP4 Toolbox for PFOW

The first MESMA stakeholder meeting for the PFOW case study will be held in December 2010 when the main question of the workshop will be around the theme of *'Who Decides and How?'*

This theme follows on from a previous meeting of PFOW stakeholders (private sector; official and government; NGOs; and academic) hosted by Heriot-Watt University which considered questions related to the deployment of marine energy converters in the area. In November 2009 a stakeholder workshop held under the MREDS (Marine Renewable Energy Development Scotland) funded by a Scottish Renewable Development Grant (SRDG) on the theme of *"Wave and Tidal Energy in the Pentland Firth Area - how much environmental monitoring is enough?"* The theme was explored through three questions:

1. What environmental data should be collected and why?
2. Who should undertake the environmental monitoring?
3. How should environmental data be collected and disseminated?

Among wide ranging results from the break out groups the question of the 'deploy and monitor' policy was significant. 'Deploy and monitor' is a policy adopted by the Scottish government to allow development to happen at an appropriate pace without having to wait for a baseline assessment.

The principal tools to be employed in this case study are literature study, interview; stakeholder forum; questionnaire; and cluster analysis. These and others to be identified will be carried forward into WP4. The stakeholder values identified will be used *inter alia* to assist with the setting of benchmarks and indicators (Step3) leading to assessment, evaluation and adaptation (Steps 4,5,6,7).

Current Research in the PFOW

A large number of research initiatives are currently underway in the PFOW area by Heriot-Watt University and others, many of them directed towards understanding of the environmental impacts from marine renewables development in the context of other important drivers such as climate change to which marine renewables are seen as part of the solution. Principal environmental research challenges include climate change; the impact of changes in the marine energy balance as energy is absorbed by energy converter devices; quantitative measurement of exposure on the shore; understanding the boundary layer and changes in flow and sediment transport on the seabed; overlap and interaction between fisheries and marine renewables. Other research prioritised by the Scottish government in the run up to the statutory MSP includes a comprehensive socio-economic study; modelling of visual impacts on the seascape; and a shipping study.

3.3 The Barents Sea Case Study

Case study leader: Lene Buhl-Mortensen

3.3.1 Introduction

The Barents Sea is Europe's last large, relatively clean, and intact marine ecosystem (Figure 8), but it is also a region subject to rapid industrial development. Escalating human activities such as commercial fisheries, oil and gas exploration, shipping, and aquaculture add to the impacts from climate change and increasing levels of toxic chemicals, and pose serious threats to the marine ecosystem and biodiversity.

It is of great significance to both Norway and Russia. The Sea and its fisheries are basis for coastal settlement in this region as reflected in the way of life and identity of people living there. It is a nursery area for large fish stocks including the world's largest stock of North Atlantic cod that support valuable fisheries and provide food for important seabird colonies and marine mammal populations.

The Lofoten Islands are home to the world's largest cod and herring stocks, pods of sperm whales and killer whales, some of the largest sea bird colonies in Europe, including puffin and cormorant, and the world's biggest cold-water coral reef. Through the MAREANO mapping program an area of 330 coral reefs, giant sand waves, gas seeps and species new to that area has been discovered.

This case is based on information and experience gained from two main activities:

1. Development, implementation and revision of a marine management plane. Experiences from the Barents Sea management plan" (BSMP)
2. Mapping to underpin knowledge based management of marine natural recourses. Input and data from MAREANO (Marine Areal Database for the Norwegian Coastal and Ocean Areas) developed to fill gaps related to seabed conditions, habitats and biodiversity through detailed mapping of depth, sediments, bottom fauna and pollutants in Norwegian waters.

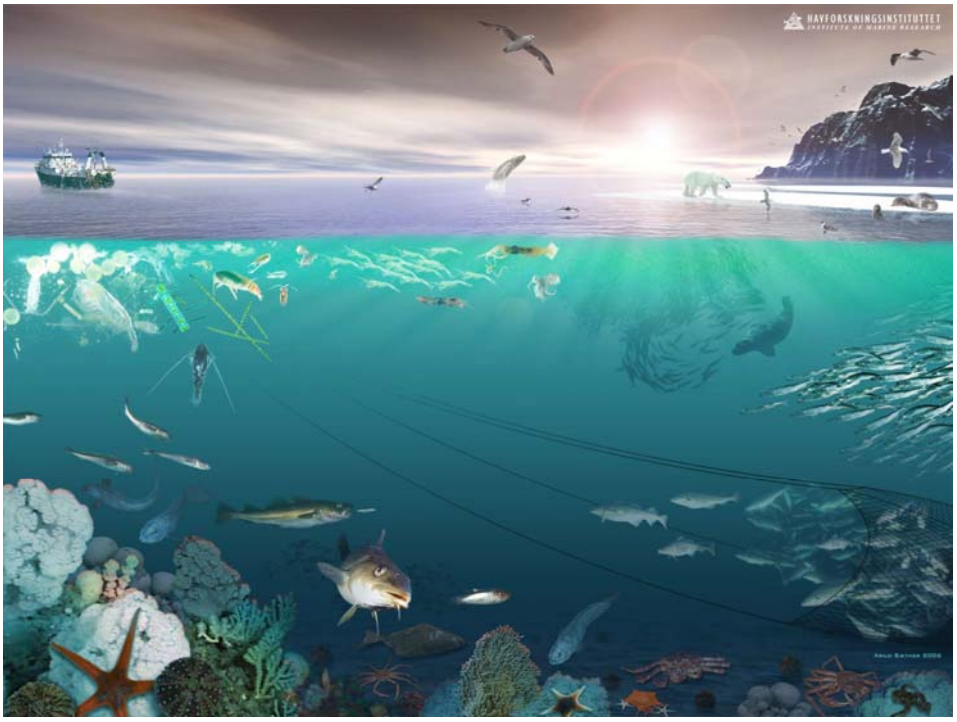


Figure 8. The Barents Sea ecosystem a schematic picture

3.3.2 Barents Sea management plan

In April 2006, the Norwegian government launched a White Paper on a new holistic management plan (Figure 10) for the Norwegian part of the Barents Sea, the "Barents Sea management plan" (BSMP). The plan aims at sustainable use of the ecosystem, within acceptable levels of pollution, with reduced risk of accidental spills, with sufficient capacity and readiness to deal with accidents, and seafood that is safe for consumption, while safeguarding biodiversity.

Following international guidelines for ecosystem-based management, the plan provides an overall framework for managing all human activities (oil and gas industry, fishing, and shipping) in the area to ensure the continued health, production, and function of the Barents Sea ecosystem.

The BSMP is state-of-the-art, has already been tested and is presently under revision. Experiences from the development, implementation and revision of the BSMP can facilitate development of a suite of practical tools for sustainable development in European seas through use of SMAs. Its scheduled revision during 2010 is also timely for MESMA. It is highly applicable to meeting objectives for each of the eight MESMA Work Packages that will provide useful guidance for the implementation, monitoring, and evaluation of SMAs.

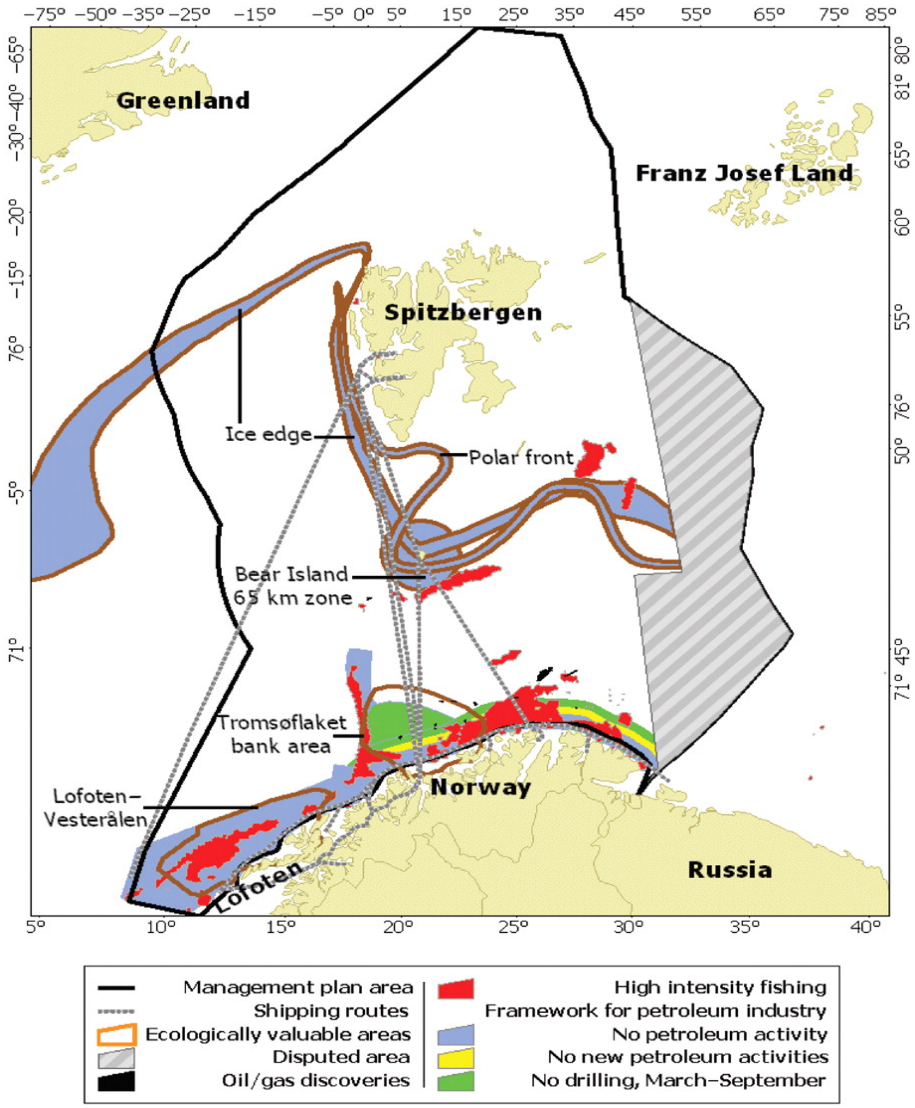


Figure 9. Area covered by the management plan for the Barents Sea. Including main fishing areas, shipping lanes, and the area-based framework for hydrocarbon extraction (2006-2010), and particularly valuable/vulnerable areas.

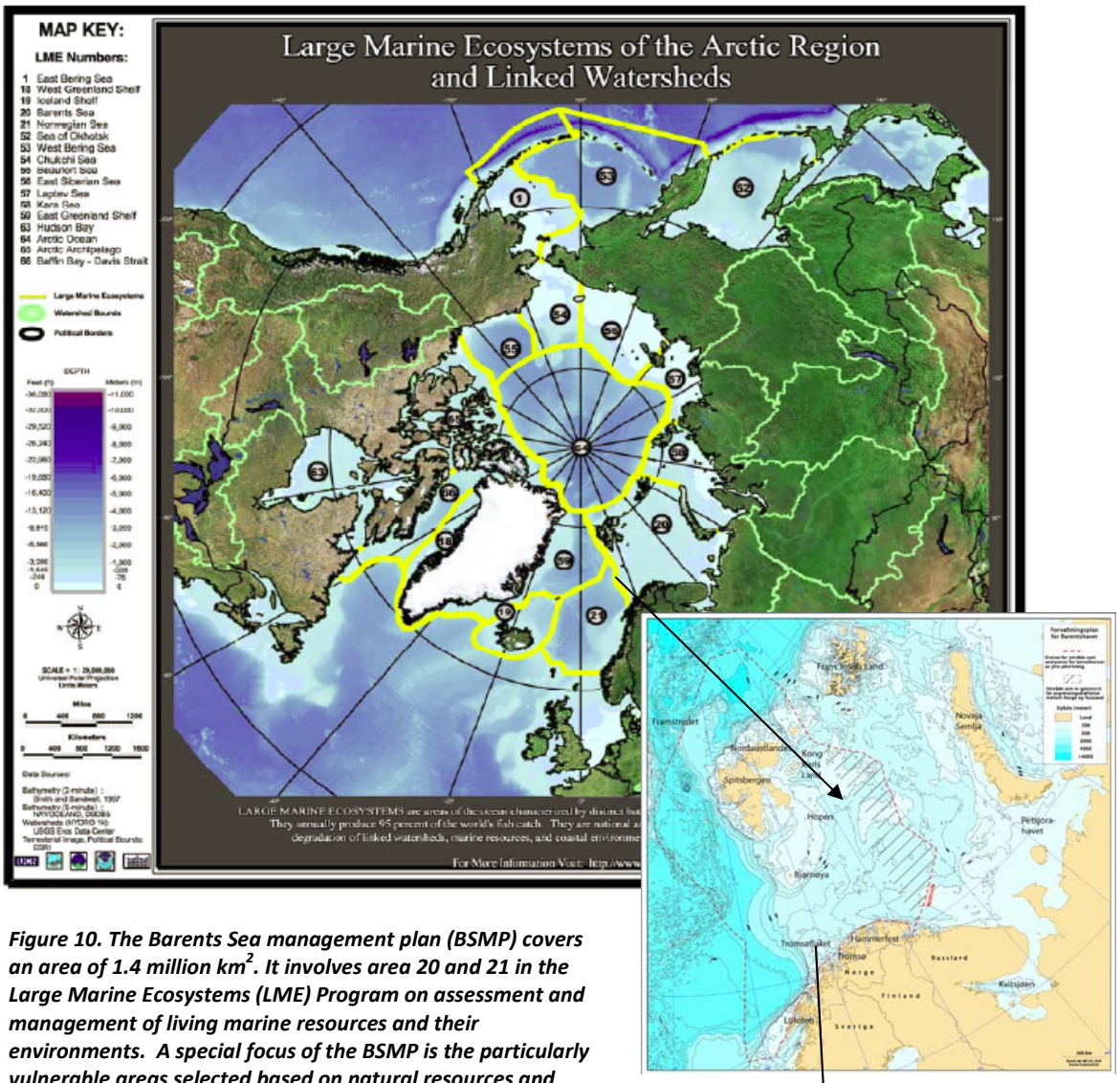
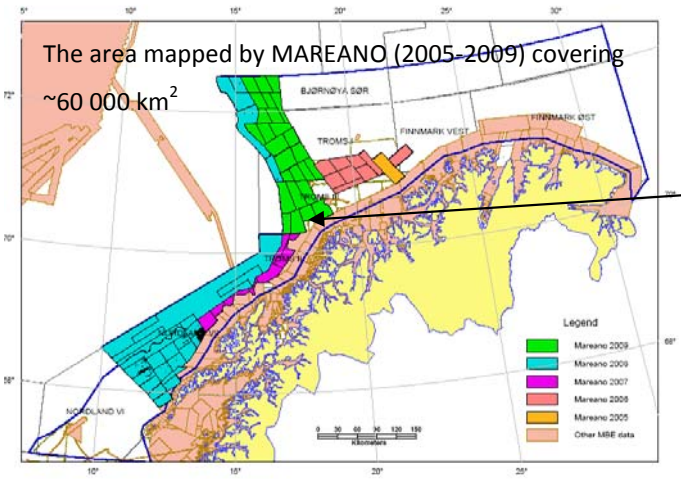
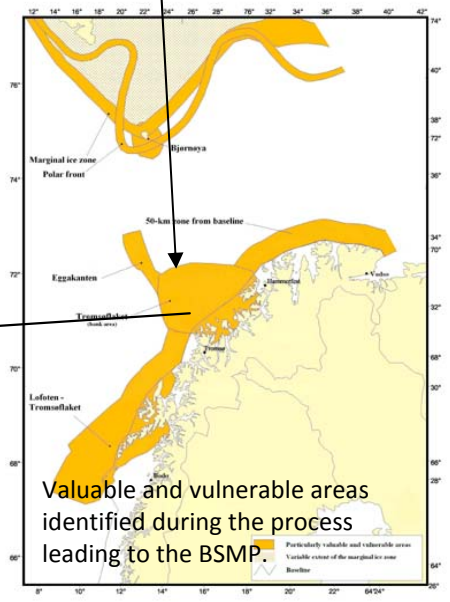


Figure 10. The Barents Sea management plan (BSMP) covers an area of 1.4 million km^2. It involves area 20 and 21 in the Large Marine Ecosystems (LME) Program on assessment and management of living marine resources and their environments. A special focus of the BSMP is the particularly vulnerable areas selected based on natural resources and user conflicts.

In the process of gaining more knowledge MAREANO has been requested to map for management in the most controversial areas were oil industry is not allowed to enter.





3.3.3 MAREANO

In the development of the BSMP important gaps in knowledge were identified. The MAREANO program was developed to fill gaps related to seabed conditions, habitats and biodiversity through detailed mapping of depth, sediments, bottom fauna and pollutants in Norwegian waters (figure 10). In the run-up phase to the revision of the BSMP in 2010, MAREANO shall provide information on environment and natural resources in the particularly valuable and vulnerable areas identified in the BSMP. As an interface with users a database and map service with systematic information about Norwegian coastal areas and seas is available to management and the public through the website www.mareano.no.

The MAREANO mapping activity upon request from the Norwegian government can provides MESMA with experience from: the use of a broad set of methods needed for geo-referenced documentation of the seabed environment and natural resources, and communicating results to the public/ stakeholders and politicians through a complicated management organization and the homepage of MAREANO. For a more detailed case description see the Annex to this case study.

3.3.4 Framework steps in the Barents Sea

Steps that has been taken when developing the BSMP (See above; Figures 2 and 3). Define and analyze existing conditions. Collecting and mapping human activities. Identify gaps in current knowledge. Collect and map the ecology, oceanography, and environment. Bioregionalization. Identifying areas of special biological value. Their effect on the environment and ecosystem (incl. Vulnerability). Identifying current conflicts and compatibilities. Studies and reports drawn up as a basis for the management plan are available athttp://odin.dep.no/md/norsk/tema/svalbard/barents/bn.html

Case study 3 addresses issues at several levels and connects to a number of work packages, e.g.:
WP2. Monitoring and evaluating SMAs
WP4. Development and evolution of management tools
WP6. Governances

Development, implementation and revision of the BSMP
Many issues have been addressed and solved that will feed directly into **WP4** (monitoring interest groups, involve stakeholders, compile existing knowledge).

Concerning the variability in setup of case studies (see above Figure 3), the Barents Sea case is in the left side of this diagram. The BSMP is presently going through a revision in light of new knowledge. This involves an evaluation also of process and implementation structure.

Concerning the generic framework of MESMA for the monitoring and evaluation of Spatially Managed Areas (See above Figure 2), the Barents Sea management is at present at step 6 and 7. MESMA can provide valuable input to the revision of the BSMP and on the other hand Case 3 can feed inn experiences to MESMA of what works and what does not and thus help to improve the MESMA framework.

Testing the MESMA framework

Topics and tools to be developed in the Barents Sea case

Six topics have been identified that are listed below together with an introduction to the topic, data available, issues to be dealt with together with tasks and deliveries.

1. **Cumulative impacts and cumulative vulnerabilities focusing on:**
   - Lessons learned from the development and revision process of BSMP.
   - Information supporting assessment of total ecosystem health status (fish, benthos, pollutants)
   - Study and quantify cumulative impacts and cumulative vulnerabilities

   Data: Compilation of existing reports on pollutants, air- and water-borne, in the Barents Sea and new data collected through MAREANO and some other monitoring programs. Documents and processes relating to the BSMP.

Issues:

- What sources on pollution were used in the development of BSMP and how was that information handled?
- Understanding processes: How is the pollutants transported in the marine ecosystem and how can this information be combined with other impact source e.g. noise, fisheries, climate changes.
- What is the relation between accumulated impacts and effects on the marine ecosystem? It is a rather simple task to present humane activities as pressures on a map but how does this relate to the actual effect on the ecosystem?

Tasks/deliveries: Review existing marine eco-toxicological knowledge of cumulative effects of pollutants. Evaluate how this knowledge was used in the present BSMP and how new information gathered is affecting the revision of BSMP. What new information is affecting the revision and what has limited impact on the processed.

2. Bottom-fauna and fisheries

The bottom trawl fishery in the Barents Sea is managed by sustainable catch quotas, considerable control measures, closed areas and mandatory grids and mesh size regulations. However, bottom trawling has devastating effects on sensitive benthic communities, such as corals and sponges. In addition, fisheries may have implications for organisms in other trophic levels as they often affect the abundance and distribution of key species in the ecosystem. However, we do not know how bottom trawling impacts the functional biodiversity of marine ecosystems. Other key unknowns are good indicators of ecological status and performance and potential recovery time scales.

Data: A combination of VMS data, results from MAREANO from the Barents Sea together with a compilation of existing knowledge of effects of fisheries are used to develop new tools/indicators for fisheries impact on ecosystems in the Barents Sea. This task can be linked to the project BIOTRAWL that has applied for funds from the Norwegian Research Counsel.

Issues:

- Effects on different levels of the food chain?
- How to use reference areas to study effects of fisheries?
- How is new knowledge on effects of fisheries affecting the revision of BSMP?

Tasks/deliveries:

- Examine impacts of trawling on habitat formers and associated biodiversity
- Examine functional groups and diversity within groups as an indicator of resilience
- Provide new fundamental macroecological knowledge that can be applied in an ecosystem-based management context to marine resource management.
- Develop biodiversity indicators of change related to fisheries, and improve understanding of the limits of resilience relevant for a sustainable and ecosystem-based management of these ecosystems

3. Habitat/Biotope mapping

Identification of valuable and sensitive areas was a novel and central tool used for spatial management in the BSMP. After 2006 much effort has been put into gathering new and more précised data on species and habitats (MAREANO), but also on developing a semi-quantitative and broad value-setting system and relevant methodology for documentation of bottom fauna (species diversity and vulnerable habitats) and environment (sediment, terrain and landscapes). Results and experience from the MAREANO mapping program. Video documentation has proven to be valuable especially for the documentation and monitoring of large long-lived and vulnerable species and geological environment. Norway has developed a national standard on visual mapping that has been translated and is under review in EU.

Data: Information/data from MAREANO on fauna and environmental data from different gears, results from modelling the relationship between fauna and environment at different scales. Depth range is 50 – 3000 meter and thus including the 'circalittoral' and 'deep-circalittoral/sub-littoral'. Data covers several rare and threatened biotopes e.g. sponge aggregates, coral gardens,

coral reefs, canyons, trenches and banks. These are with reference to biotope codes in **WP1** documents: A4.33, A5.14, A5.15, A5.25, A5.26, A5.63, A6.22, A 6.61, A6.62, A6.72, A6.81, A6.82.

Issues:

What is relevant information when mapping for management. Consensus between scientist/manager on level of mapping and amount of information needed for safe management.
How was ecologically important areas identified early in the processes developing BSMP?
How to solve the different scale/resolution of new information when revising the BSMP.

Tasks:

Evaluate how sampling gear and mapping strategy affects the information on biodiversity and productivity of benthic communities. Methodology and scale questions (**WP2**).
Based on experience from models linking habitat descriptors and fauna patterns (**WP2**) develop methodology for translation of point observations to areas showing the distribution of habitats or biological values (**WP2 and WP4**).

4. Climate related changes

The BSMP has a time horizon from 2010-2025. In the arctic the effects are pronounced due to disappearance of ice cover and the mowing of the arctic front further to the north. Shipping and fisheries are moving into new areas increasing pressures in areas that earlier were not available for these humane activities.

Issue: How should effects of changed temperature and related stress and changed distribution of fauna affect area based management?

There are a number of questions that could be addressed

1. How is environmental change accounted for in the Barents Sea integrated management plan, -are there some likely developing factors and trends that needs better coverage? How to address potentially other increasing human uses
2. How do we account for changing distribution of ecosystems and species, and impacts of associated commercial fisheries and other changing human activities in marine spatial planning? -how do we make adaptive MSP truly responsive to such changes?
3. From a legislative perspective, how do we license out a habitat currently 'non-essential' for fisheries (for example to oil & gas extraction), which over time may become an essential fish habitats (nursery or spawning area)? Should/can current licensing of sea areas take account of the possibility that these sites, due to changing distributions of fish populations and/or biodiversity, in future may become essential fish habitats or biodiversity hotspots? If so, how?
4. Monitoring –what is the required intensity of monitoring to capture ecosystem change? Is current monitoring regimes applicable to monitor long term changes in marine foodwebs? Are we sampling the right things, i.e. should we have climate-specific monitoring of the marine environment? If so, at what time-scale should this be applied to be both cost effective and at the same time sufficient to detect climate induced changes?
5. Can we estimate how quickly climate impacts might be expected and what the consequences are for MPAs / spatial management measures?

5. Achievements of the BSMP

The BSMP will be revised 2010-2011 and this is a unique process internationally. This provides a possibility to study how new data is used in this context. During the development, implementation and revision of the BSMP many issues have been addressed and solved that can feed directly into WP4 (monitoring interest groups, involve stakeholders, compile existing knowledge). This involves existing and potential user conflicts in an area of great natural value.

Issues:

Structural management of different interest groups. Stakeholder participation to develop, implement, and revise the BSMP with focus on spatial management. Experience gained allows for testing of management tools.
User conflicts and power. Petroleum activities, fisheries, NGOs ++++ in relation to revision of the management plane.

Transnational/Cross-border Issues (consequences of Russian-Norwegian agreement in April 2010 on Barents Sea border) : Russia/Norway: Oil & Fisheries

Task/deliveries:

- Examine the process of developing, implementing and revision of the BSMP
- Develop and test management tools based on experience from the process connected to the BSMP
- Measure power involved on the stakeholder side, numbers of people in industry (fisheries)

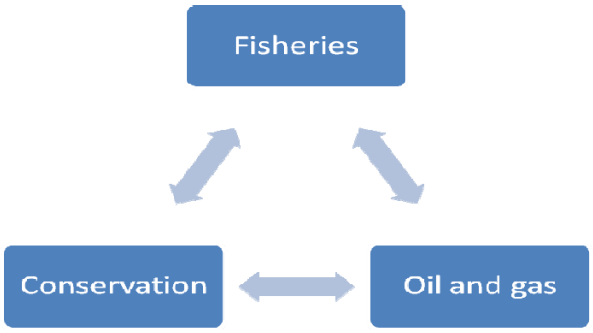


Figure 11. Key interactions in the Barents Sea case study

6. Indicators for safe management

Indicators are used for many purposes and often become too simple to make them easy to use for management purposes. They are meant to bridge over challenges when communicating across the border politics/science.

Communication of state (ecological quality) of the environment.

Natural sciences: Cumulative impact (maps), health assessment (mapping and monitoring), using indicators for monitoring and communicating ecosystem health.

Social sciences: Governance, Sector cooperation, Roles.

In this setting it is important to avoid empty indexes due to simplification of information (**WP6**) MAREANO provides experience from communication with the public and management trough web information (www.mareano.no) (**WP6**). It has also been part of the process of feeding information into the complex structure involved in the revision process of the BSMP (**WP4**). In relation to the revision of BSM a project has been launched by the Norwegian Directorate for Nature Management with the main goal to develop a model for assigning environmental value to areas based on available information of natural recourses and vulnerability. Information from MAREANO has been used in this context and experiences from this will fit well into MESMA **WP4**.

Issues:

- How do they contribute to shearing of information?
- How are systems characterized through indicators?
- What are allowable levels and targets?
- Evaluation of indicator-based management
- Crossing the borders of governance between politics, management and science
- Understanding system variation: What is the natural/pristine state?
- Fluctuation in baseline conditions.

Tasks/deliveries: Review paper ”Use of indicators” a general part dealing with the wider experience from the use of indicators and a specific part on indicator use in relation to BSMP.

- Examine the causality underpinning indicators.
- Evaluate which indicators are relevant for what purpose.
- Evaluation of benefit from indicators.

3.4 The Celtic Sea Case Study

Case study leader: Peter Jones

3.4.1 Introduction

The Celtic Sea case study will look at several on-going initiatives in the case study area, and the conflicts, challenges and good practices of marine spatial planning (MSP) that emerged from these initiatives. This case study may not involve any direct application of the MESMA framework as it is too early in the process to assess such environmental outcomes. However, it will provide important information for the MESMA framework, particularly in evaluating the key governance/institutional issues that affect the management effectiveness of a SMA, and the feasibility of and institutional requirements for implementing the key recommendations derived from the MESMA framework.

The Celtic Sea has a total area of 372,836 km², within the boundary defined by the PICES project (see below). The Celtic Sea includes British, Irish and French EEZs and continental shelf, as well as high seas to the west. The area also includes six ICES rectangles: VIIe, f, g, h, j2 and k2. The Celtic Sea provides important habitats for a number of bird and marine mammal species, as well as other coastal and marine organisms. A brief description of the ecological features of the Celtic Sea Ecosystem can be found from the PISCES website.

There has been increasing competition for ocean space in the Celtic Sea. Initiatives have been started to designate MPAs (Marine Conservation Zones and European Marine Sites) in Southwest England (see below). There are also two wind farms being planned in the Celtic Sea, as part of the UK government's commitment to install 25 GW of offshore wind capacity by 2020 (the Crown Estate website). Preliminary observations at workshops and meetings indicate that there is a feeling amongst fishermen that they are increasingly being displaced from fishing grounds in the Celtic Sea, due to the allocation of ocean space for nature conservation and offshore renewable energy development. There are, therefore, growing conflicts between the different sectors that use the Celtic Sea.

3.4.2 Sub-case studies in the Celtic Sea

Given the vast geographical area of the Celtic Sea, it is envisaged that a **nested** approach will be taken, with particular focus on selected projects, initiatives and issues within the case study area. A variety of MSP-related initiatives are already developing in the case study area. The on-going initiatives (*i.e.* sub-case studies) that will be explored in detail in the Celtic Sea case study are:

3.4.2.1 Sub-case study 1 in the Celtic Sea: The PISCES Project

PISCES (Partnerships Involving Stakeholders in the Celtic Sea Ecosystem) is an existing project to promote an integrated approach to implementing the ecosystem approach to managing the uses of this regional sea. The project has a total budget of €2.1 million (50% EC LIFE+ 50% WWF), running from June 2009 to July 2012.

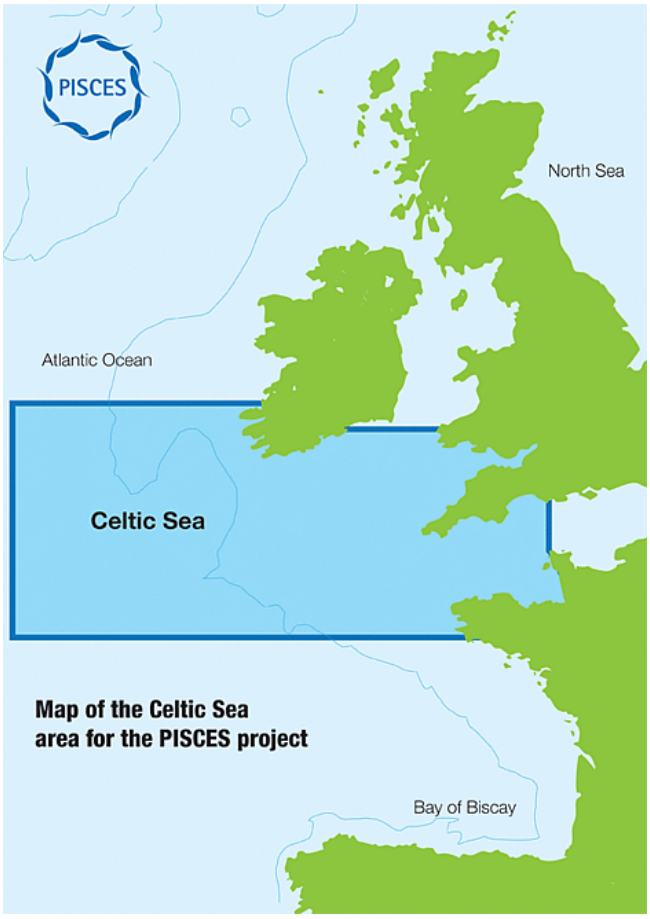


Figure 12. Map of Celtic Sea area (Map from www.projectpisces.eu)

The aim of the PISCES project is 'to bring people together to work towards a healthy, well-managed ecosystem where marine wildlife and people's livelihoods can flourish'. The following is a 'mission statement' for the PICES project:

"PISCES is bringing together the major sectors operating within the Celtic Sea. This international partnership will be working with a common goal – to find a way to manage everyone's activities sustainably. We aim to introduce an ecosystem approach to marine management that will be relevant and useful to people operating within and around the Celtic Sea. The key to the success of this project will be a set of practical guidelines" [author's emphasis; all quotes from PISCES website].

The objectives of the project is

"Working with people who represent the sectors that use the Celtic Sea to support them in:

- understanding how different sectors interact with each other to identify potential problems and solutions;
- improving communications and sharing best practice;
- analysing evidence and identifying where change can be most effective;
- developing their own practical guidelines so they can collectively operate and manage the region in a sustainable way; and
- persuading people to take responsibility for their seas."

The project includes stakeholders from the UK, Ireland, France and Spain from sectors including:

- Offshore energy
- Offshore infrastructure (cable laying etc)
- Fisheries
- Mariculture
- Shipping

- Ports
- Coastal tourism & recreation
- Aggregates

3.4.2.2 Sub-case study 2 in the Celtic Sea: Southwest England

SW England will be a particular geographical focus for the Celtic Sea case study as this area is the focus of several MSP-related initiatives, including:

- Finding Sanctuary

  This project aims to design a network of Marine Conservation Zones (MCZs) around SW England and recommend them to the UK Government in June 2011. It is envisaged that Finding Sanctuary is fundamentally about shared decision making (**Finding Sanctuary website**), i.e. through a facilitated deliberative participation approach amongst stakeholders. This is one of the four regional MCZ projects around England that aim to fulfil the objectives/obligations under the recent Marine and Coastal Access Act (2009) for England/Wales. This project is the focus of ongoing MESMA research involving observations of a series of workshops involving the participation of various stakeholders to design the MCZ network. Finding Santuary will be a particular focus for this case study as it provides some interesing insights into the use of participative approaches to fulfil statutory obligations. This project has become entangled with conflicts between uses, particularly fishing and wind farms, as the proposed MCZs have exacerbated competition for space and raised major issues concerning whether fishermen should be compensated for loss of ground to wind farms, as MCZs do not have to provide such compensation. This has, in turn, raised major equity/justice issues that will be an important focus for this sub-case study.

- SW England trial of the 'ecosystem approach'

  This is a project being undertaken by the Centre for Aquaculture and Fisheries Science (CEFAS), commissioned by the Department for Environment, Food and Rural Affairs (DEFRA), to develop an evidence-based model for assessing the ecosystem impacts of different fishing techniques and thereby to assess the cumulative ecosystem impacts of fishing in a given area.

In addition, SW England is also the area for several other MSP-related initiatives, such as the Cornwall trial of the 'annual fisheries report' approach to including fishermen's knowledge, and the designation of several European Marine Sites. Given the many MSP-related initiatives in SW England, it is likely to be a focus and test bed for approaches to implementing MSP around England/Wales under the Marine and Coastal Access Act (2009). By way of illustration, the other three MCZ projects around England adopted the Finding Sanctuary approach to deliberatively designing MCZ networks, with Finding Sanctuary having started in 2002, initially as a unilateral initiative. The coordinator of this case study (Peter Jones) also has a track record of ethnographic research in this region on the views of fishing industry and related interests on the MPA proposals that are now being pursued (Jones 2008, 2009).

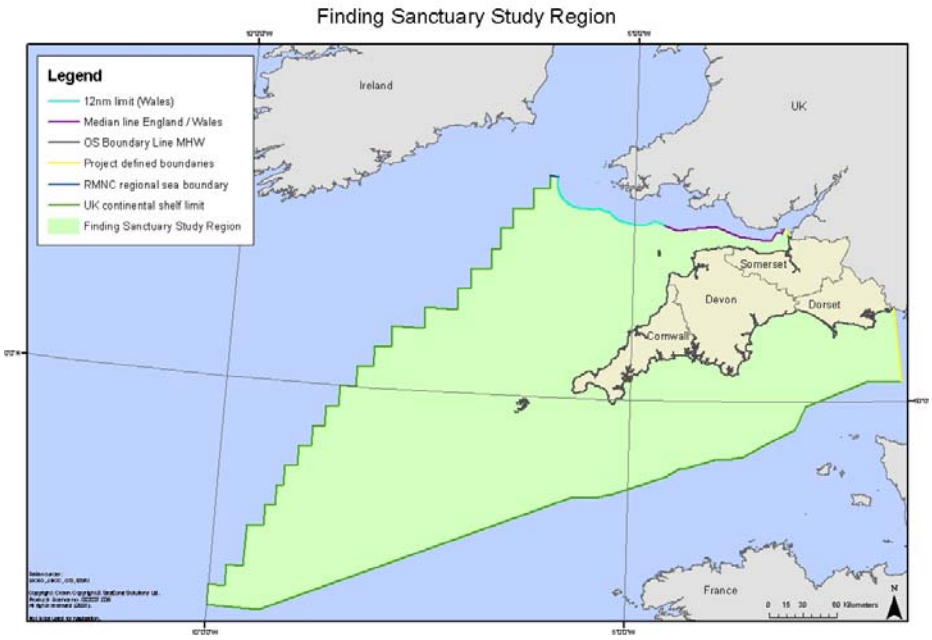


Figure 13. Map of the Finding Sanctuary study region (Finding Sanctuary website)

3.4.3 What are the most important issues you propose to tackle in the Celtic Sea?

The Celtic Sea case study will mainly look at the following issues:

3.4.3.1 Stakeholders' perspectives on MSP-related initiatives in the Celtic Sea

In the Celtic Sea case study, the perspectives of different user groups/stakeholders on MSP-related act issues will be explored, as well as their perspectives on how effectively conflicts between different users and between nature conservation and resource exploitation are being addressed.

One of the interesting features of this case study is that MPA initiatives are preceding wider MSP initiatives. In England/Wales for instance, initiatives are being developed to implement a MSP system, but the marine policy statement, on which regional marine plans will be based, will not be finalised until Spring 2011, whilst both the MCZ and European Marine Site networks are planned to be finalised during 2012. This is not an uncommon situation, as MPAs developed prior to the concept of MSP, so MPA designations often precede MSP initiatives in most regions, but it raises some interesting issues discussed in 1.1.3 concerning the co-evolution and relative roles of MPAs and MSP. In SW England, many stakeholders have questioned how MPAs can precede the development of MSP, particularly given that other major spatial allocations of 'blocks' for wind farms are also underway.

3.4.3.2 The effectiveness of different governance approaches in achieving MSP objectives in the Celtic Sea

The PISCES project aims to develop guidelines to promote an integrated ecosystem approach through facilitated deliberations amongst stakeholder representatives. It was stated on the PISCES project website that '*a cross-sectoral approach is essential so that different groups can develop a common understanding of how to achieve this aim and safeguard the future for themselves and others. PISCES will be working across industries and countries - France, Spain, UK & Ireland – to produce practical guidelines* ***for*** *the*

*people and **by** the people, who use the Celtic Sea*' (original emphasis). The main governance approach taken in the PISCES is deliberations amongst stakeholder representatives facilitated by the Environment Council.

This raises the following questions:

- Can agreements be reached amongst stakeholder representatives from different sectors and different member states on proposed measures and initiatives through facilitated deliberations to achieve this aim?
- How can conflicts be managed through such participative processes?
- How can these agreed measures/initiatives be implemented amongst the existing sectoral policies (AKA institutions) at EU (particularly CFP) and national levels?
- Will the outputs and outcomes from this initiative constitute 'MSP'?

The Finding Sanctuary project aims to establish a network of Marine Conservation Zones (MCZs) around SW England through a facilitated deliberative participation approach amongst stakeholders. The designation of such MCZs is mainly driven by the legal obligations established under the new Coastal Access Act (2009) for England/Wales. Therefore, an important difference between the PISCES and Finding Sanctuary projects is that the latter represents an interesting combination of legal and participative incentives, involving a strong state steer through 'tempered' instrumental facilitation' (Jones and Burgess 2005, Roberts and Jones 2009). In the PISCES project, by contrast, there are no specific legal obligations that must be fulfilled through project activities. Whether and how this difference in the governance approaches taken in the two projects will result in differences in the outcomes of participative processes will be an interesting issue to explore in the Celtic Sea case study.

3.4.3.3 Identification of incentives and disincentives for MSP in the Celtic Sea

In the sub-case studies, the incentives (synergistic institutions) and disincentives (antagonistic institutions) for MSP will be identified. The incentives and disincentives can be breakdown into the following five categories:

- Economic
- Interpretative
- Knowledge
- Legal
- Participative

The sub-case studies will explore the combinations of the above incentives that appear to have been effective to address conflicts and promote the fulfilment of the aims of the projects. They will also explore the ways that existing and emerging institutions constituting the context of the Celtic Sea, *ie* not directly linked to PISCES and related initiatives, function as incentives (synergistic institutions) and disincentives (antagonistic institutions) for MSP.

3.4.4 MESMA-framework implementation in the Celtic Sea

It is envisaged that this case study will not involve any direct application of the MESMA framework, nor will it follow the full evaluation cycle of the MESMA framework in conducting the case study. However, within the sub-case studies, there are already initiatives that promote or implement, with stakeholder participation, the ecosystem approach in managing the use of ocean resources. For instance, stakeholder knowledge concerning the spatial and temporal distribution of ecosystem features and different activities is being gathered by Finding Santuary through the FisherMap project involving face-to-face mapping and through online mapping. The PISCES project is also employing interactive mapping. The Finding Sanctuary project is obliged to develop a network of MCZs that complies with national ecological network guidance and the related compatibility matrix, and it will be particularly interesting to see how this is achieved through participative approaches, subject to the scrutiny of the science advisory panel. Such initiatives resembles the approach that will be taken if the MESMA framework is applied and there may be scope to assess them using such a framework. This will allow us to draw out examples of good and bad practices for MSP based on evaluations of on-going project activities in the Celtic Sea, and to assess

the feasibility of implementing the key recommendations derived from the application of the MESMA framework elsewhere.

It will also be interesting to compare the processes that are followed through the Celtic Sea initiatives with the MESMA framework and see where they are consistent and where they depart from this framework, and the implications in terms of what constitutes good and bad practices, e.g. do the PISCES and Finding Sanctuary processes represent additions to, elaborations/adaptations of &/or alternatives to the MESMA-framework?

Although this case study will not involve any direct application of the MESMA framework, the MESMA framework can provide some guidance for some elements of this case study research. The governance research analyses incorporating an evaluation of such scientific framework approaches will be an important emphasis of this case study.

3.4.5 Research hypotheses in the Celtic Sea

1. That effective MSP can be achieved through a variety of approaches involving combinations of incentives as appropriate to a given context.
2. That contextual institutions and their driving forces, in which MSP initiatives are, in reality, embedded, function as both incentives (synergistic institutions) and disincentives (antagonistic institutions) to MSP. Such contextual institutions can be considered in terms of the 'institutional landscape', which any given SMA is part of. MSP initiatives in any given SMA can thus be considered as being focused on the following inter-related aims:
    a. instrumentally developing synergistic institutions to promote 'effective' MSP within the SMA;
    b. influencing wider scale institutions, where realistically feasible, such that they become more synergistic;
    c. resisting the impacts of wider scale antagonistic institutions (markets, other sectoral institutions, etc) that it is not realistically feasible to influence.
3. That these institutions represents the complexities of participation, conflict management and implementation processes that, in reality, surround the boxes and arrows of adaptive collaborative management (ACM) frameworks such as that proposed by MESMA.
4. That analyses of the institutional landscape and the influence of MSP on these institutions are necessary to gain an understanding of the options for MSP and the development of 'good practice' for MSP processes, thus complementing the MESMA framework by providing rich contextual institutional analyses of governance issues through the case studies.

These questions/hypotheses can be adapted for application to the other eight case studies and as such constitute a 'realist empirical institutional analysis' for WP6, integral with WP3. It is argued that it is essential to analyse MSP initiatives in the context of and, indeed, as part of, the wider institutional landscape, as these institutions represent both challenges (antagonistic) and opportunities (synergistic) for MSP. The proposed approach will provide for the governance elements of the MESMA framework to be analysed using a consistent approach that considers MSP for a given SMA as part of a wider institutional landscape.

3.4.6 Key uses of the Celtic Sea

Table 7. Key human uses in the Celtic Sea

Activity	Degree/Extent	Impacts	Outline description
Fisheries	Major	Major	Many important demersal and pelagic fisheries
Oil/gas	Minor	Minor	One oil platform, as well as exploration licenses
Shipping	Major	Minor	Major merchant shipping routes
Renewable energy	Major	Major	Wave energy 'hub' project off Cornwall as well as two proposed major wind farm projects in Bristol Channel and off Dorset
Aggregate extraction	Medium	Minor	Occurs (more info needed)
Tourism	Major	Minor	Occurs (more info needed)
Aquaculture	Minor	Minor	Occurs (more info needed)
Pipelines	Minor	Minor	Present (more info needed)
Cables	Medium	Minor	Various telecom and electricity cables

Quantitative and qualitative data is available for all these activities and is currently being intensively mapped and analysed as part, *inter alia*, of the Finding Sanctuary and PISCES spatial planning initiatives.

3.4.7 Transnational issues in the Celtic Sea

The Celtic Seas is one of the sub-regions listed in Article 4(2) of the MSFD, with which spatial sub-divisions of the North-East Atlantic Ocean must be compatible. The Celtic Sea, as defined by the PISCES project, encompasses French (Brittany), UK (SW England and South Wales) and Irish (SW Ireland) marine territories, as well as High Seas to the west of Ireland. The fisheries of the Celtic Sea are diverse and relatively productive, so they are accessed by fishing vessels from most member states. Indeed, Spanish stakeholder representatives are involved in the PISCES project (some of the funding came from WWF Spain, I think) as many Spanish vessels exploit fisheries in this region. As such, the MSP of the Celtic Sea under the PISCES project will require a great deal of cross-border integration, including through the CFP. The PISCES project has been launched as "developing important lessons for the implementation of [integrated] marine legislation across the Celtic Sea, Europe and potentially across the world." Similarly, the Finding Sanctuary project extends beyond 6nm so all fishiing restrictions will have to be agreed and implemented through the CFP, raising very significant transnational issues.

3.4.8 Conservation issues in the Celtic Sea

This is a moot point, as the need for an ecosystem approach to provide for the restoration of marine ecosystems, including their constituent fish stocks, is a contested issue amongst some stakeholders. An analysis will be undertaken as to the priorities for restoration in the Celtic Sea, but a preliminary assessment indicates that the priorities are the restoration of certain fish stocks as well as the restoration of cetacean populations and biogenic reefs. With regards to MPAs, the target of both the European Marine Sites and national designations, such as MCZs, is the representation of all habitat types and the development of an ecologically coherent network, though this term is open to interpretation (Jones and Carpenter 2009).

3.4.9 Level of spatial management today in the Celtic Sea

There are spatial allocations to various sectors (e.g. planning of MCZs, European Marine Sites and two offshore wind farms), but there is little overall inter-sectoral integration. An MSP framework for England & Wales is being developed through the Marine Act.

3.4.10 Participation of stakeholders in the Celtic Sea

Again, there are sectoral approaches to providing for stakeholder participation but there are no overarching approaches for inter-sectoral and integrated MSP, though both the PISCES and Finding Sanctuary projects are following stakeholder participation approaches, and the emerging MSP Framework aims to provide for full public consultation. The PISCES project is driven by the recognition of the need to address conservation issues, to improve over-arching sectoral management and to provide for stakeholder participation in such MSP, where the Finding Sanctuary project has a conservation sectoral focus.

3.5 The Basque Country (SE Bay of Biscay) Continental Shelf Case Study

Case study leader: Ibon Galparsoro

3.5.1 Study area location and characteristics [Step 1a, Step 2a][3]

The Basque continental shelf is located in the southeastern part of the Bay of Biscay (Figures 14 and 15), in the border between France and Spain. This case study is considered as representative of the eastern Atlantic area of the MESMA study area. The continental shelf in this zone is very narrow, ranging from 7 to 20 km (Uriarte, 1998), and comprises the total length of the coastline of *c.a.* 150 km. The total area of the continental shelf (up to 200 m water depth) is *c.a.* 2,307 km^2. The surface corresponding to inner waters (defined as the polygon delimiting between the baseline connecting capes and the coastline) is *c.a.* 365 km^2 and it is managed by the regional government. The portion of the national EEZ in front of the Basque Country is *c.a.* 11,003 km^2 (the total area of the EEZ of Spain is 1,256,091 km^2).

The area shows some specific characteristics in terms of biodiversity and marine resources, but it also shares common human activities with other European regions. The Basque continental shelf is small in extent but human activity is intense and diverse. It is characterised by holding some specific (or nearly specific) economic activities such as red seaweed extraction *Gelidium corneum*. Moreover, new activities are foreseen to develop such as wave energy converter installation which may involve conflicting interests.

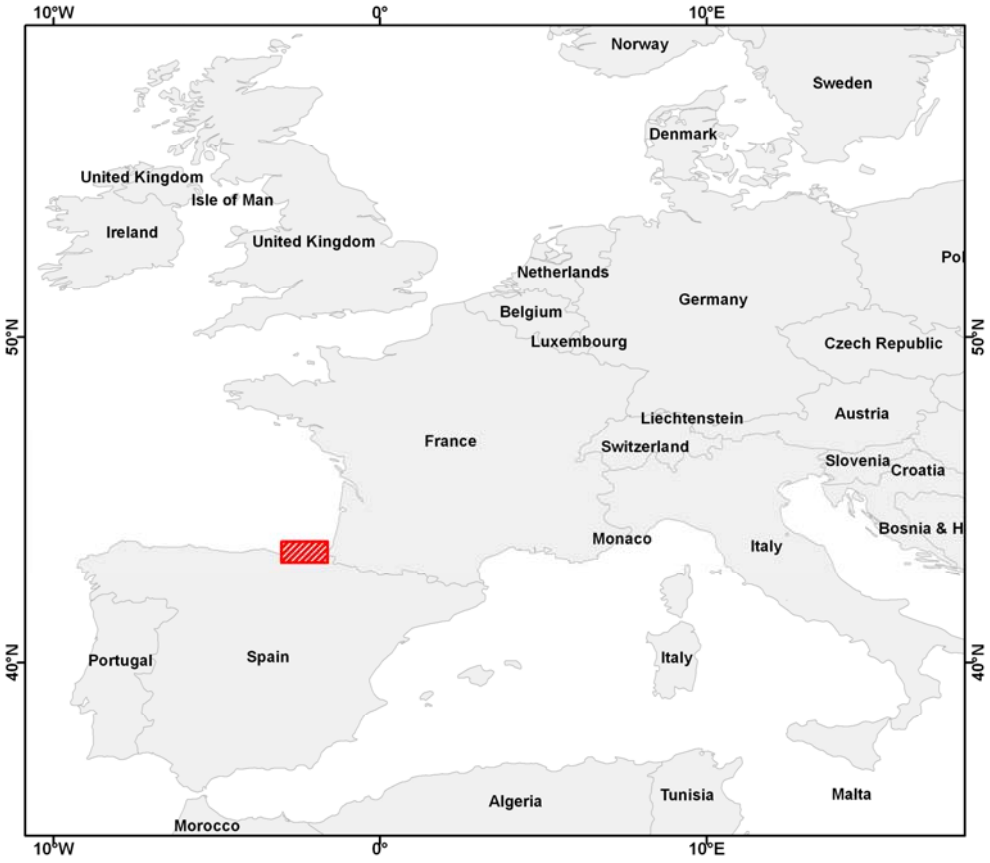


Figure 14. Basque Country case study location within the MESMA region.

[3] See Annex.

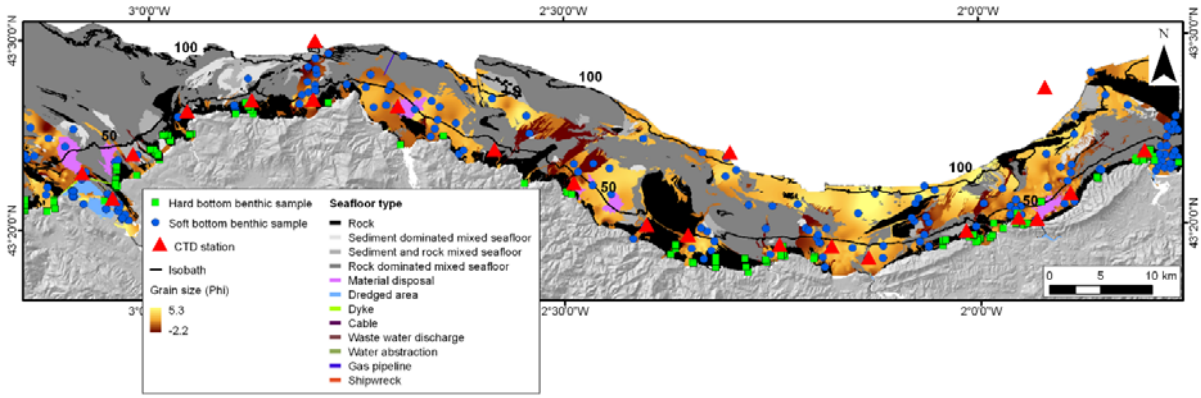


Figure 15. Morphosedimentary map, benthic and CTD data available in the Basque continental shelf up to 100 m water depth (Galparsoro et al., 2010b).

3.5.2 Key human users in SE Bay of Biscay [Step 2b]

Main human users/pressures are listed in the annex. Apart from the traditional activities, new specific uses which are foreseen to happen in the next years such as wave energy converters, wind farms and aquaculture have been added. Most of this information is available in GIS format and ready to use.

3.5.3 Number of conflicts in SE Bay of Biscay [Step 2b]

The number of conflicts between key uses and activities in the Basque continental shelf are listed in the annex to this case study.

3.5.4 Data availability in SE Bay of Biscay [Step 2]

3.5.4.1 Physico-chemical data [Step 2a]

3.5.4.1.1 Seafloor characterisation

Bathymetry and sedimentary composition:

In 2005, a seafloor mapping programme commenced with the aim of benthic habitat mapping and seafloor characterisation of the Basque continental shelf. This investigation integrates different remote sensing and *in situ* sampling techniques to cover a continuum from land to circalittoral marine environments, with a total area of 1,096 km^2. Among them, multibeam echosounder (MBES) (operating up to 100 m water depth, producing 1 m horizontal resolution grid bathymetry and backscatter), topographic LiDAR (terrestrial land to mid-intertidal zone) (Chust *et al.*, 2008), bathymetric LiDAR (up to 20 m water depth, producing 2 m horizontal resolution grid) (Chust *et al.*, 2010b; Galparsoro *et al.*, 2010b), and aerial photography (Chust *et al.*, 2007) techniques have been used.

3.5.4.1.2 Ocean column characterisation

Since 1995 at each season of the year, the Basque waters quality monitoring network includes oceanographic data obtained from CTD stations (Borja *et al.*, 2004). Moreover, data from 3 offshore oceanographic buoys (from January 2007 to March 2009), and 6 littoral ocean-meteorological stations (from 2001 to 2009) are available.

Moreover, satellite imagery including Sea surface Temperature, chlorophyll-a concentration and total suspended matter is available since 2002.

3.5.4.2 Marine biodiversity in SE Bay of Biscay [Step 2a]

3.5.4.2.1 Seafloor characterisation and benthic habitats

In 2005, a seafloor mapping programme commenced with the aim of benthic habitat mapping and seafloor characterisation of the Basque continental shelf. This investigation integrates different remote sensing and *in situ* sampling techniques to cover a continuum from land to circalittoral marine environments, with a total area of 1,096 km^2. Among them, multibeam echosounder (MBES) (operating up to 100 m water depth, producing 1 m horizontal resolution grid bathymetry and backscatter), topographic LiDAR (terrestrial land to mid-intertidal zone) (Chust *et al.*, 2008), bathymetric LiDAR (up to 20 m water depth, producing 2 m horizontal resolution grid) (Chust *et al.*, 2010b; Galparsoro *et al.*, 2010b), and aerial photography (Chust *et al.*, 2007) techniques have been used. *In situ* subtidal samples correspond to biological benthic data (including invasive and exotic species), which include 413 grabs from soft-bottom (period 2003-2008), and 405 samples from rocky seafloor taken by divers (period 1992-2009). Oceanographic data were obtained from 21 CTD stations (sampled since 1998 at each season of the year), within a monitoring network (Borja *et al.*, 2004). Moreover, data from 3 offshore oceanographic buoys (from January 2007 to March 2009), and 6 littoral ocean-meteorological stations (from 2001 to 2009) are available.

In 2009, benthic habitat map of the intertidal and continental shelf (up to 100 m water depth) was produced using EUNIS habitat classification and identifying Community Interest Habitats (Galparsoro *et al.*, Accepted).

3.5.4.2.2 Marine mammals

The project "Cataloging the areas of special interest to the conservation of cetaceans in the Bay of Biscay" (called BIZKAIZET) within the Framework Agreement with the Department of Agriculture, Fisheries and Food of the Basque Government, started in 2003. The project was launched to respond to a parliamentary agreement reached in 2001 that reflected the need to create a whale sanctuary in the Bay of Biscay. The project is focused in the active cooperation in development of protocols, pilot conservation areas and the delimitation of areas of conservation interest.

Between 2007 and 2008, AZTI-Tecnalia participated in an international project "*Cetacean Off-shore Distribution and Abundance"* (called CODA), project coordinated by the Sea Mammal Research Unit at the University of St Andrews. The Project objectives were map the distribution, estimate abundance and investigate habitat preferences of cetacean species in offshore European Atlantic waters. The primary species of interest are the common dolphin (Habitats Directive Annex IV and subject to bycatch), the bottlenose dolphin (Habitats Directive Annex II), the sperm whale and other deep-diving species (vulnerable to powerful underwater sounds), and the fin whale (the main baleen whale species in the area) (Hammond *et al.*, 2009).

3.5.4.2.3 Demersal fish

Data regarding to catch landings in ports (weight and price) of the Basque Country are provided by the sales records. The data cover the period 2001-2008.

In summer 2010, experimental trawls were carried out to study the composition of fish communities both, in trawling grounds and in those grounds where fishing activity is forbidden. The objective of the investigation is to compare the composition of species between the two zones.

3.5.4.2.4 Pelagic fisheries

There are data records about the main pelagic fisheries operating from Basque country ports mainly, anchovy, sardine, mackerel, horse mackerel, albacore and bluefin tuna.

The spatial extension of these fisheries goes beyond the shelf edge, but the shelf has an important role as spawning and nursery area in the case of anchovy, sardine and horse mackerel, and a migration path in the case of mackerel. Tuna distribution is often beyond the shelf edge.

Data available include catch landing in the Basque Country ports, data from fishermen logbooks and data from scientific surveys (Yearly Ichthyoplankton DEPM surveys in May, TRIANNUAL surveys in April, Anchovy Juvenile surveys in September).

3.5.4.2.5 Ecological Good and Services Valuation

Currently, a study is being developed to value biodiversity and goods and services, within the Basque shelf, including different components of the system. The methodology which has been applied is that developed by Derous (2007). The valuation map is expected to be finished within this year 2010.

3.5.4.3 Main economic activities in SE Bay of Biscay [Step 2b]

3.5.4.3.1 Fisheries

Main fishing activities are centered on the coastal water bodies. The most important commercial species are mackerel, anchovy and tuna, representing more than 90% of the captures. The coastal artisanal fleet of the Basque Country uses different fishing gears, known as "minor arts", that have their own legislation. These include: gillnet gear, bait and tackle pots. Besides the already mentioned "minor arts", the artisanal coastal Basque fleet used to a lesser extent other gear each of which is equipped with their own legislation, where the most common are the bottom longline, longline semi or stone-ball, the surface drift longline fishing for sharks, and the scratch wheel. The gear and fishing gear used by artisanal coastal fleet is divided into four groups: Arts, gill nets, hook hoists, Pots and Artifacts. The coastal artisanal fleet of the Basque Country, comprising 175 vessels, is distributed between the two maritime provinces with a total of 16 ports, 11 in the province of Bizkaia and 5 in Gipuzkoa. The coastal industrial fleet has a wide variability in the types of boats, finding boats type “txipironera” "(small size and without the bridge) to large vessels (with lengths close to 30 m) and with the latest detection technology in schools of fish, telecommunications and navigation. In addition, the technical characteristics of the vessels together with determining the number of crew, fishing gear used throughout the year and consequently the succession of fishing crafts. The average length of the artisanal fleet, between perpendiculars, is 13.5 m, the smallest boat 5.1 m and the largest is 26.6 m. The average gross tonnage is 28.7 TRB (minimum of 0.8 and maximum of 118.3), while the average power is 177 hp oscillating in a range of powers that range from 9 (minimum value) to 624 (maximum). The average crew of the fleet is 3.6 men, having smaller vessels with one crew member and the largest with eight crew members. Those with more men are engaged in the coastal albacore (*Thunnus alalunga*) and mackerel (*Scomber scombrus*), while those of two men are boats of small-medium sized, some with fishing nets and longlines. The age of the ships, in the year of construction, is on average in 1990, being the oldest boat constructed in 1965 and the most modern in 2003. There are 4 trawlers operating in pair bottom trawling (two fishing units or pairs) (blue whiting, mackerel) and one operating in single trawl (blue whiting, horse mackerel); all they are based in the port of Ondarroa. The regulation for trawling in waters in front of the Basque Country keeps this gear out of the 100 m water depth as a general rule. Nevertheless, there are some areas in which the trawling is forbidden out of 100 m depth waters as well, some of these areas are preserved for traditional fishing. There are about 55 purse seiners based in the Basque Country and shared in 11 ports, most of these boats alternate purse seining with pole and lines for tuna, using this gear during summer and purse seining the rest of the year (mackerel, pilchard, horse mackerel). There is not official information regarding to the recreational fisheries, but could be quite important for certain species (tuna or cephalopods).

3.5.4.3.2 Seaweed extraction

The red seaweed *Gelidium corneum* is a commercial natural resource. Today (after the Prestige oil-spill) prices have fallen to 0.15-0.20 euros / kg fresh. The total average catches before, were between 3,000 and 5,000 t, of which only 500 t were of direct exploitation and the rest of algae detached from the rocks after storms (named “arribazones” in Spanish). Currently there are a low number of catches, but considering that almost no fishermen are devoted to it, it is estimated that *c.a.* 1,500 and 3,000 t (always fresh weight) is collected.

3.5.4.3.3 Shipping

There are 28 ports within the Basque water bodies: 3 commercial harbours, 6 marinas, 19 combining fishing activities and marinas.

Bilbao is the biggest port with a mean traffic of 31.6 million tonnes. Main activities of the port are related to energy products, chemicals, steel, paper, fresh products and frozen foods, minerals, cement, machinery of all types and sizes (http://www.bilbaoport.es/aPBW/web/es/autoridad/memorias/index.jsp). In the field of cruise ship traffic, include the docking of 30 cruise ships.

The second port is Pasajes with a total traffic of 35,300 tonnes in 2008. The largest volume of goods have been, steel scrap, coal and cars. Concerning fish, traffic has risen to 12,008 tons (http://www.puertopasajes.net/memoria_anual_puerto_pasajes.php?lang=es).

The smallest commercial port is Bermeo with 253.7 tonnes and 133 vessels in 2008. Main traffic products are machinery (mainly diesel engines), containers and transformers. The transport of chemicals such as sodium sulfate and silicates, loading and unloading of timber and planks (http://www.elcorreo.com/vizcaya/v/20100404/vizcaya/trafico-comercial-crece-bermeo-20100404.html).

The number of vessels in marina is 2,468 at docs and 720 funded and it is foreseen to increase the number of vessels up to 1,268 in the next years (http://www.ivap.euskadi.net/r59-738/eu/contenidos/informacion/jornada_pesca_recreativa/es_8692/adjuntos/puertos_deportivos.pdf).

3.5.4.3.4 Tourism

The seaside is one of the main attractions of the Basque Country, where steep cliffs alternate with river mouths, marshes and more than 40 urban and wild beaches. Tourism is an important sector in the Basque Country, although there is no data available for 2010, data for 2008 show that tourist spending in the Basque Country was 3,596 million €, which represent the 5.3% of the gross domestic product (from 2000 to 2004, source: Eustat); the success of this industry depends partially on the quality of the sandy beaches and the ebb tidal deltas (Liria et al., 2009). In turn, tourism has a major impact on the beach and dune habitat degradation since almost all beaches of the Basque coast are at present already naturally- or artificially-confined (Chust et al. 2009), and because beaches are small in extent, occurring between the dominant sea cliffs along the coast.

3.5.4.3.5 Environmental protection

As in other countries, Basque Country policy objectives are mainly the result of international obligations to protect and restore marine habitats, accepted in international and regional conventions. These objectives have to be fulfilled at regional and national scale (see Section 6 for further information).

3.5.4.3.6 Oil/gas

There is not oil and gas extraction activity in the area except a gas storage infrastructure under the seafloor with gas conduction tubes laying on the shelf.

3.5.4.3.7 Aquaculture

Aquaculture industry has historically been a marginal activity in the Basque Country where it represents just 1.2% of the total fishing production of the region. Marine and continental aquaculture production in the Basque Country, during 2008, declined to 220 t and 553 t respectively. Nowadays, the contribution of the Basque region to the Spanish aquaculture productivity is very low representing 0.3% of the total Spanish (marine & freshwater) fish production (272.596 t, in 2006). During the period 1997-2004, Basque aquaculture production experienced an average annual growth rate of 27% (whereas 4.7% and 15.8% belonged to marine and freshwater aquaculture, respectively). Since 2004, this growth trend has been reversed to -6.7% for marine aquaculture; meanwhile, continental aquaculture keeps growing at a sustainable rate of 13.5%. Such production trends emphasise the very negative outlook of the Basque aquaculture sector.

Recently, the Basque Government has decided to promote aquaculture with the aim of creating a sustainable and complementary activity to the fishing and conservation sector operating within the

region. For such purposes, the local stakeholders together with the Basque Government have coordinated the formulation of the Draft Regional Marine Aquaculture Plan 2009-2014. It is assumed that the Basque Country is in an excellent position to capitalize on aquaculture opportunities. Its contents described state of the art developments, regulatory considerations, market and RTD tendencies and strategies, SWOT analysis, technological planning (species, systems), local resources (stakeholders for investment, research or education in aquaculture developments), and 12 ICZM studies based on specific proposals for the development of new onshore aquaculture farms.

The region, located within close proximity to many major Spanish markets, has endemic abundance of natural and agricultural resources, and boasts a dedicated network of technological specialists, infrastructures and fishing enterprises. The region also has many high quality businesses that are actively involved in support services such as marketing, feed manufacturing, transportation or energy production.

ONSHORE: In 2010, there are two marine flatfish aquaculture companies using seawater and/or discharging used waters with average annual productions of 400 t fish per year. The Basque freshwater aquaculture sector is represented by 2 intensive on-growing farms of trout and eel, with annual production levels of 700 t and 300 t, respectively. They discharge used waters to some specific rivers that will immediately flow into the Cantabric sea. The rest of existing companies have either liquidated or filed for bankruptcy.

OFFSHORE: In 2010, there are not still commercially run mariculture areas in the Basque offshore. In 2011, two offshore areas will be available for the deployment of RTD activities based on shellfish and macro algae production. Meanwhile, for such purpose the Basque Public Administration is working on the acquisition of two experimental licenses for the production of shellfish. The areas will be located at 0.5 miles from the Basque coast and will have a footprint of 10.000 m^2 each one. The experimental production goals range 40t per year.

3.5.4.3.8 Wave energy converters

The Ministry of Science and Innovation of the Spanish Government launched in 2005, the Strategic Outstanding Project on Marine Energy, led by Tecnalia (www.tecnalia.es). The main objective of this project is the technological development of marine energy converters. Basic information, specific data, and the analysis, study and evaluation methodologies needed for the adequate environmental impact assessment of the marine wave energy technologies is provided in Bald et al (2010a).

Wave energy converters testing site called BIMEP (Biscay Marine Energy Platform) is foreseen to be built. It is an ocean infrastructure for research, demonstration and operation of wave-energy capturing systems on the open sea. Construction will start in 2011 (http://www.eve.es/energia_marina/index_cas.htm).

3.5.4.3.9 Wind farms

At present, there is no project for offshore windfarms installation but a Strategic Environmental Study of the Spanish Littoral for the Installation of windfarms has been conducted.

3.5.4.3.10 Pipelines

Constructed pipelines includes: three waste water discharge and two water captions for aquaculture.

3.5.4.3.11 Cables

Submarine telephone cables are present near to Bilbao.

3.5.4.3.12 Dumping site

Dumping activity includes four harbour dredging material disposal and an old blast furnace slag disposal (abandoned in 1995: Borja et al., (2008). The extent, biological and inorganic pollutant monitoring information is available.

3.5.4.3.13 Sand mining

This activity is limited and only focused on beach nourishment. Extracted sand is 1 Mm^3 in Asabaratza in 1995 and in2002; 2 Mm^3 in Orio since 1950; 5 Mm^3 in Bilbao and 10 Mm^3 in Muskiz between 2010 and 2011.

3.5.5 Ecosystem vulnerability and resilience in SE Bay of Biscay [Step 4]

Benthic habitat maps obtained by means of multibeam bathymetry and 1,400 benthic grab samples. Coastal habitat characterisation with aerial images, bathymetric LiDAR and topographic LiDAR. Satellital information (e.g., chlorophyll, sea surface temperature) is available (Galparsoro *et al.*, 2010b; Galparsoro *et al.*, Accepted).

Intertidal habitat historic changes have been analyzed for the last 50 years, assessing the relative contribution of anthropogenic, natural and climate change drivers of these changes (Chust *et al*., 2009). The projected sea level changes in the Bay of Biscay have been estimated for long-term climate change scenarios, and the impacts of this change on Basque coastal habitats and infrastructures was assessed by generating flood risk maps expected by the end of this century (Chust *et al.*, 2010a). For instance, sandy beaches within the Basque coast are expected to suffer shoreline retreats of between 25% and 40% of the average beach width as a consequence of a sea level rise of 49 cm by the end of the 21st century (Chust et al. 2010). Likewise, we have assessed the distribution of salt marsh vulnerability during this century as the sea level rises.

During 2010-2011, process-driven habitat mapping approach will be developed in order to estimate the seafloor habitats stability and disturbances they withstand produced by oceanographic processes such us sediment remobilization due to wave action, seafloor annual temperature range, oxygen saturation, etc. This research will give an insight on the resilience of natural habitats and natural status recovery capacity after an alteration of the habitat (Galparsoro *et al.*, 2010a).

3.5.6 Conservation issues in SE Bay of Biscay [Step 2b,c]

Conservation issues refer to information, relative to instruments and measures legally, established to preserve ecosystems and species. In this respect, an environmental inventory needs to include the existing environmental protected items to the projects' scope. Thus, international, European and autonomic scopes should be are explained according to the analysis made by Solaun *et al*. (2010), Bald *et al.* (2010b) and Uriarte *et al*. (2009) (*cf.* Annex to this Case Study).

In terms of naturalness, after recent recovery of the most polluted aquatic systems, fishing seems to be the main pressure on offshore marine habitats, but not enough scientific research has been applied to this particular subject (Borja *et al.*, 2009). List of identified and mapped Natura2000 habitats in the Basque coast and continental shelf (*cf.* Annex to this Case Study for list of habitats and protected features).

3.5.7 European Marine Strategy Framework Directive (MSFD) in SE Bay of Biscay [Step 2c]

Different integrative methods to assess the good ecological status within the Water Framework Directive are being investigated and implemented in the Basque country. These steps involved also the development of methods for good environmental status assessment. The concept of environmental status takes into account the structure, function and processes of the marine ecosystems together with natural physiographic, geographic and climatic factors, as well as physical and chemical conditions including those resulting from human activities in the area concerned. Main steps taken are:

- Habitat mapping and habitat suitability modelling
- Pressures and impacts (human uses) mapping
- Biodiversity valuation and goods and services valuation
- Climate change impacts
- Marine Spatial Planning

AZTI-Tecnalia is playing an active role in the implementation of this directive, participating in 4 out of the 11 descriptors' international working groups, and having published the next papers:

Borja, A., 2006. The new European Marine Strategy Directive: difficulties, opportunities, and challenges. Marine Pollution Bulletin, 52: 239-242.

Van Hoey, G., A. Borja, S. Birchenough, S. Degraer, D. Fleischer, P. Magni, L. Mortensen, I. Muxika, H. Reiss, A. Schröder, M. Zettler (in press). The use of benthic indicators in Europe: from the Water Framework Directive to the Marine Strategy Framework Directive. Marine Pollution Bulletin.

Borja, A., M. Elliott, J. Carstensen, A.-S. Heiskanen, W. van de Bund (in press). Marine management – towards an integrated implementation of the European Marine Strategy Framework and the Water Framework Directives. Marine Pollution Bulletin.

3.5.8 Level of spatial management today in SE Bay of Biscay [Step 2c]

First approach for the spatial management was the "Territorial Sectoral Plan for the Protection and Ordination of the of the Basque country littoral zone" (approved in the Basque Government Council March 13, 2007). The management level is in the range of minimum width of 500 meters from the inner edge of the seashore, which is the seashore area defined by the Law of Coasts (national level law: *Ley 22/1988, 28 de julio, de costas;* regulates the identification, protection, use, and policing of maritime-terrestrial public domain and especially the seashore). This zone extends to the margin of rivers, where it is influenced by the tides. The main goal of the plan was to achieve greater environmental and ecological protection of the natural heritage. Essentially, it aims to become a decisive instrument, from the consideration of the Basque coast as a whole, requires an effective protective measures that will reduce the impacts arising from activities that put pressure on it. It is not only to protect and manage, but also, to optimize the coordination of regional and urban planning actions between governments that operate on the coastal and terrestrial environment, so as to guarantee the maximum efficiency to preserve environmentally what is healthy and improve or regenerate, where appropriate, areas that require it.

The PTS of the coast also complements the finally adopted PTS of the Wetlands Management and margins of rivers and streams, and strengthen and deepen the level of overall protection of the Basque coast.

In the area of management, establishes the criteria for protection, improvement and conservation of natural resources; and on the one hand, the guidelines for governing public use on the coast. Along with this, proposes criteria for designation of special protection areas and for the inclusion of certain areas in the catalogue of environmentally sensitive areas to fulfil the purposes of the General Law of Environment of the Basque Country.

For the purposes of coastal protection, defines various categories of protection and, in turn, proposes a range of uses permitted in each of these categories, in accordance with the provisions of other environmental planning instruments or referred for specific planning areas along the coast (Urdabai, natural parks, protected biotopes, areas belonging to the Natura 2000 European Ecological Network, ports, etc.) (http://www.ingurumena.ejgv.euskadi.net/r49-565/es/contenidos/informacion/pts_litoral/es_7559/presentacion_c.html).

Finally, the first attempt to the spatial planning approach in the case study was carried out for the suitability analysis, to select zones for harnessing wave energy. A series of technical, environmental and socioeconomic character parameters were taken into account, and classified as constraining or excluding to the wave energy captors installation. Final result was a map for helping stakeholders and decision-makers with a suitability index that identifies the most appropriate locations for wave energy harnessing activity (Figure 16).

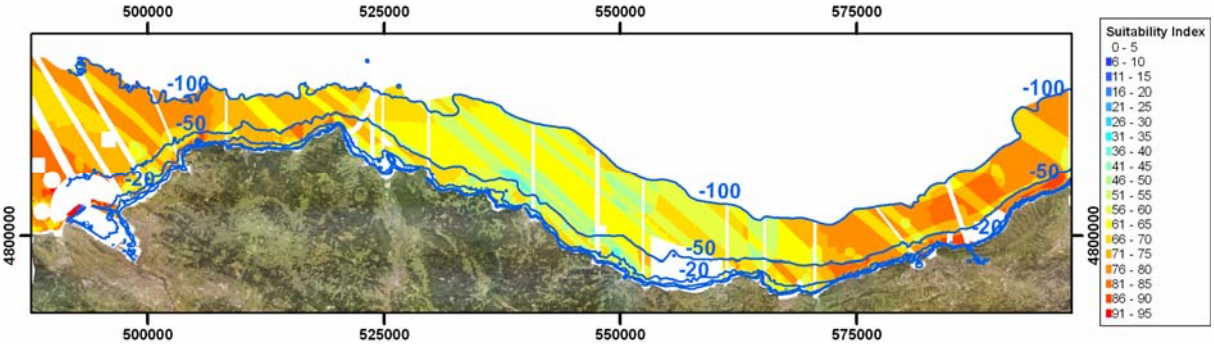


Figure 16. Suitability index for wave energy harnessing in the Basque continental shelf

3.5.9 Participation of stakeholders in SE Bay of Biscay [Step 1b, 2b, 6, 7]

At a regional scale, the Environment, Regional Planning, Agriculture and Fisheries Department of the Basque Government will be involved, together with Industry, Innovation, Commerce and Tourism Department. Other stakeholders to take into account will be diving clubs, local municipalities, and non-governmental organisms.

3.5.10 Policy-urgency for planning in SE Bay of Biscay [Step 1b]

Basque continental shelf is small in extent but, as mentioned before, human activity is important producing a high number of pressures. Moreover, new activities are foreseen to develop such as wave energy converter installation and offshore aquaculture activity, which makes spatial planning necessary and required in order to reach to a sustainable development and conflicts minimisation.

3.6 The Strait of Sicily Case Study

Case study leader: Tomas Vega Fernandez

3.6.1 Description of the study area

The Strait of Sicily is a large and dynamically active area connecting the Eastern and Western basins of the Mediterranean Sea.

1.1 Geography. The Strait of Sicily is approximately located at L 011.20° E and l 37.20° N (Fig. 10). It consists of a two-sill system separated by a deep basin and contains a number of canyons, trenches and seamounts that separates the Western Mediterranean from the Eastern Mediterranean. The Strait is about 145 Km wide and 300 m deep in its narrowest section. On the southern coast of Sicily, the shelf is bounded by two wide (approx. 100 km) and shallow (100 m on average) banks on the western side (Adventure Bank) and on the eastern side (Malta Bank), whereas it narrows considerably along its middle part. A central narrow passageway cuts along the NW-SE axis the Strait of Sicily and forms an intermediate basin with an average depth of 500 m. Flat-bottomed deep trenches reaching depths of 1100–1200 m off Pantelleria, 1300 m off Linosa, and 1650 m in the Malta graben (rift valley), are situated in the central part of this basin to the west of Malta.

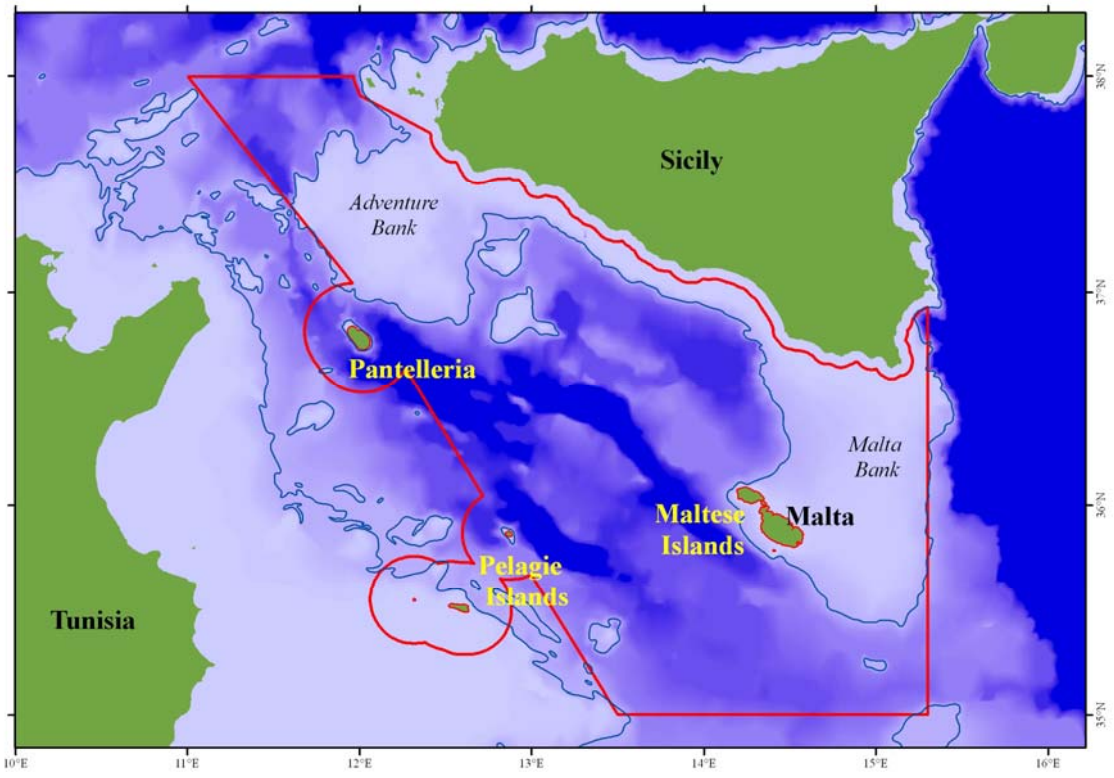


Figure 17. Study area as defined by the polygon in blue. The shaded area indicates international waters, while the open blue represents national waters.

1.2 Oceanography. The general pattern of the circulation in the central Mediterranean is characterized by an inflow of fresh modified Atlantic Water (MAW) flowing eastward near the surface (above 200 m depth) and an outflow of deeper salty water (in the 200–500 m depth range), the Levantine Intermediate Water (LIW), flowing in the opposite direction (*cf.* Oceanographic map in the Annex to this Case Study). These two currents convey high amounts of energy which interact with the complex orography of the bottom and the dominant winds to generate a number of oceanographic phenomena, which constitutes an ocean triad (*sensu* Bakun, 2006) in the study area. Enrichment processes (upwelling, mixing), transport processes (current drifts), and concentration processes (convergence through fronts, vortices) favour the retention of eggs and larvae.

1.3 Productivity. The oceanographic characteristics of the Strait of Sicily allow high primary productivity, which is coupled with important pelagic and demersal fisheries. Mazara del Vallo holds the largest fishing fleet in Italy and one of the largest in the Mediterranean, mainly concentrated on demersal species. Another important fleet, which exploits both demersal and small pelagic fishes, is based in Sciacca.The study area offers feeding and/or spawning areas to a number of ecologically and economically important marine species. For example spawning areas for bluefin tuna (*Thunnus thynnus*); spawning and nursery areas for sword fish (*Xiphias gladius*), anchovy (a possible subpopulation of *Engraulis encrasicolus*), pink shrimp (*Parapenaeus longirostris*) and great white *shark* (*Charcharodon charcharias*); nesting c*olon*ies of the loggerhead turtle (*Caretta caretta*) exist on the Pelagie Islands, which are amongst the few remaining nesting sites for this species in this part of the Mediterranean; feeding areas for fin whale (*Balaenoptera physalus*) and possibly for bottlenose dolphin (*Tursiops truncatus*) are present off Lampedusa; breeding colonies of Cory's shearwater (*Calonectris diomedea*) exist on the rocky coast of the Sicilian Strait islands, and of Yelkouan shearwater (*Puffinus yelkouan*) in Malta. In the Strait of Sicily, spawning and nursery grounds have been identified for hake (*Merluccius merluccius*) at 100–200 m on the Adventure and Malta Banks; nursery grounds of greater fork beard (*Phycis blennoides*) at 200–400 m on the Adventure Bank and in the eastern Strait; spawning and nursery grounds of red mullet (*Mullus barbatus*) at 100 m on the Adventure and Malta Banks; spawning and nursery grounds of pink shrimp (*Parapenaeus longirostris*) on the Adventure Bank and the Ionian Shelf vortices, respectively.

Geographical information: Location of main oceanographic features, satellite estimation of sea surface temperature (SST) and Chl-a concentration in surface waters are available on the web. Catch r*ates of demersal spec*ies from bottom trawl surveys at different levels of aggregation (*assemblage, taxon*omic group, life stage), nesting sites and feeding grounds for Yelkouan shearwater (*Puffinus yelkouan*) in Malta (http://www.lifeshearwaterproject.org.mt/) are available at Sicilian and Maltese research institutions. GIS maps are available in Arc or MapInfo format.

1.4 Biodiversity. The geographic position, the moderate depths and the variety of habitat types promote high values of biodiversity within the Mediterranean context. Prominent features include deep coral assemblages, cold seep communities, rare habitat formers (*Isidella elongata*, *Funiculina quadrangularis*, deep-sea corals), rare or endemic species (Maltese ray *Leucoraja melitensis,* Scherattinarian *Cladopsammia rolandi*), high biotope heterogeneity, persistent diversity of demersal species, and large fluxes of Atlantic and Indo-Pacific exotic species.

A GIS map of the RAC/SPA biocenoses of the study area already exists in Arc format (Garofalo et al. 2004). This will be completed with information about the Maltese Fisheries Management Zone (FMZ) and then converted to the EUNIS/MESMA classification system. The biocenoses known to be present in the study area can be found in the Annex to this Case Study.

1.5 Geohazards. The case study area presents a number of risks for off-shore and on-shore structures and coastal populations, associated with geological processes that occur in the submarine realm. These risks include (a) seismogenic faults in the continental margin (the Calabrian Arc subduction complex) in the southern Ionian Sea, which generates earthquakes in the entire area; (b) submarine landslides due to the collapse of sediment masses along continental margins; (c) volcanic activity along the margin of the the Ionian shelf, the trench along the axis of the Strait, and transform faults;(d) failure of the flanks of submarine volcanoes, rendered unstable by eruptive activity and loading, or weakened by hydrothermal alteration and rift fracture zones, which may result in large-volume landslides with significant tsunamigenic potential.

3.6.2 Human uses in the Strait of Sicily

Humans have been exploiting the study area for thousands of years. The most important uses selected for MESMA purposes are fishing, aquaculture, conservation, shipping and tourism. Other important uses for which only limited information exists are oil drilling and extraction, deployment of gas pipelines and communication cables, construction of wind-mill farms. Although information is often limited to the mere presence, these facilities are of strategic importance and occupy the seabed excluding any other use, thus their importance in marine spatial management is high. A detailed description of the human uses in the Strait of Sicily is provided in the Annex to this case study. Here we will focus on the conflicts between uses.

3.6.3 Potential conflicts in the Strait of Sicily

The conflicts are known to occur between pairs of the selected uses, on the basis of territory occupancy and well documented impacts on organisms and their environment. Conflicts are defined as a loss of the suitability of the territory for a specific use as a result of the activity of another (i.e. different) type of use. A cross table of conflicts between human uses of the Strait of Sicily can be found in the Annex to this Case Study, together with a full description of the potential conflicts.

3.6.4 Current status of spatial management in the Strait of Sicily

Some sectoral spatial management (SM) plans exist for a few activities (e.g. fishing, see section on the Maltese FMZ below; Pelagie Islands MPA), but there is no integrated SM plan in the area.

3.6.4.1 Management plans, political vision and policy framework

In Sicily, the terrestrial domain depends on municipalities while the maritime territory depends on the government and it is enforced by the Coast Guard, which is a military force. MPAs were managed by municipalities years ago, but the role was overtaken by the Ministry of Environment, which (provisionally) gave the responsibility of management and enforcement to the Coast Guard (several years ago). Being a military force heavily involved in the surveillance of an European border and faced with an oversized fishing fleet, Coast Guard seems to consider MPA management among the last of its priorities. Coastal protected areas on land are managed by the Regional Government with no jurisdiction on the sea. However, the Regional Government regulates fisheries and give some types of concessions in the sea around Sicily. Exploitation of fossil fuels is instead regulated by the Ministry for the Economic Development. Enforcement is responsibility of the Coast Guard, Carabinieri, Financial Guard and State Police, plus the Army.

The concepts of planning for development and controlling development at sea in the Maltese Islands are embedded as one of the core functions of the Malta Environment and Planning Authority (MEPA) where Section 30 (2) of the Development Planning Act of 1992 extends MEPA's jurisdiction for development control and planning to both land and sea. MEPA is responsible for preparing development plans and planning policies in consultation with Government departments, private organisations and other persons relating to planning. In addition to its planning functions, MEPA is also the Competent Authority empowered to implement the Environment Protection Act (2001). In 2010, six out of nine Ministries in the Maltese Islands which are directly involved in regulating coastal and marine areas or uses were identified.

The principles of marine spatial planning have been in action since the introduction of the Development Planning Act in 1992. However, as is the case in most European countries, Malta still designates ocean space on a case-by-case basis, and a holistic marine spatial plan has yet to be developed by the Maltese Government. The Armed Forces of Malta (AFM), the police force as well as fisheries control officers employed by the Ministry for Resources and Rural Affairs (MRRA) are in charge of enforcing existing laws concerning the marine environment. Sectoral regulations related to marine spatial management in the Strait of Sicily have been summarized in the Annex. It concerns basically fisheries and nature conservation regulations. Besides, the main legislation regarding shipping is the above mentioned UNCLOS, while different tourist components are legislated specifically (e.g. laws regulating trade).

3.6.4.2 Existing monitoring programs and data.

EU directives on the monitoring of environmental and fisheries of quality are assimilated in national laws. With some delay, these laws are now implementing regular monitoring programs on spatially defined sectors of the sea. Data on abundance and demography of demersal and small pelagic fishery resources is routinely collected by the Institute for Coastal Marine Environment (CNR-IAMC) in GSA 16 and by MCFS (Malta Centre for Fisheries Sciences) in GSA 15 under the coordination of the General Fisheries Commission for the Mediterranean (GFCM). The Environmental Agency of the Sicilian regional government is the responsible for environmental monitoring programs. With regards to fisheries monitoring, three scientific surveys are being carried out on an annual basis: the Mediterranean

International Trawl Survey (MEDITS), the Mediterranean International Acoustic Survey (MEDIAS), and the Italian National Working Group on Demersal Resources (GRUND) survey.

3.6.4.3 Data availability and accessibility. Gap analysis

Basic research programs have been conducted in the study area by different research bodies. As a result, maps of the main marine biotopes exist. A detailed map of biotopes, including the distribution of *Posidonia oceanica* meadows, found within the 1-mile zone surrounding the coast of the Maltese Islands is available through MEPA. Geo-morphological maps of some areas (MPAs, banks) are known to exist but they should be requested to their owners. Landings and fleet data for Sicily should be requested to Port Authorities, the Ministry of Agricultural and Forestry Policies and the Institute for Economic Research in Fishery and Aquaculture (IREPA), and are partly available at CNR-IAMC. In the Maltese Islands comparable data is available through MRRA. Additional regular environmental monitoring programs are still being organized and reliable data are to be collected soon since the Sicilian regional government has already incurred in EU penalties.

Regarding the gap analysis of existing SM plans, it cannot be conducted because specific objectives were not defined for the study area and proper data are not available.

3.6.4.4 Potential stakeholders in the Strait of Sicily

The list of potential stakeholders to be involved in in MESMA is in the Annex.

3.6.4.4.1 Estimated cost of meetings with stakeholders.

A rough estimated cost of stakeholder meetings is about € 18,000 per year. This figure encompasses thirty persons attending the meeting in Sicily, plus the same number in Malta, on the basis of an initial estimated cost of € 300 per person. The cost should then be multiplied by the number of meetings to be organized if several rounds are needed. The number of rounds is still to be defined.

3.6.4.5 Objectives, indicators and benchmarks in the Strait of Sicily

As stated above, no specific objectives has been stated for the SM initiatives undertaken in the study area. In the absence of specific data, generic objectives seem to be not matched. Indicators and benchmarks applicable to the study area are indicated below (3.6.5.6).

3.6.5 Applicability of the SMA concept to the Strait of Sicily

3.6.5.1 Spatial boundaries of the Strait of Sicily

For the MESMA purposes, the case study area is defined as the marine territory encompassed by the Geographical Sub-Areas (GSAs) 15 and 16 according to the classification of the FAO General Fisheries Commission for the Mediterranean (FAO-GFCM), which divides the Mediterranean Sea into 24 GSAs for assessment and management purposes (see map in the Annex to this case study). The spatial boundaries of the case study area (Figure 17) are defined as those of GSAs 15 (the Maltese Archipelago and its economic exclusive zone) and 16 (off the western and southern coasts of Sicily), including Pantelleria Island and the Pelagie Islands with their 12-mile water surround, which are under Italian jurisdiction. The northern border is defined at 3 miles off the southern coast of Sicily. The study area includes national waters under Italian and Maltese jurisdiction, as well as international waters subjected to the United Nations Convention on the Law of the Sea (UNCLOS).

3.6.5.2 Goals and operational objectives of the Strait of Sicily

The goal of this case study is to assess the potential for the implementation of a SM plan in the Strait of Sicily in order to minimize conflicts between users.

Task: The main operational objectives are two: first, to ensure and organize stakeholder participation and second, to ensure protection of fragile and important areas by managing their uses, and to preserve ecosystem functions and services (see section 3.6.1). Protection should be given in particular to species of economic importance (in line with the sustainability principle), and to species and habitats which are rare, endemic, or endangered.

Activities: Stakeholder participation can be fostered through meetings where the concept and scope of SM planning is explained. The ideas should be conveyed in order to make them both accessible and appealing to a wide audience of stakeholders ranging from managers to end-users.

Tools: It should be formative to show how SM has helped to govern conflicts in other places in similar circumstances. At least in Italy, many end-users of the sea tend to be diffident towards managers.

3.6.5.3 Ecological components involved in the Strait of Sicily

The main ecological components that need to be considered in order to ensure the sustainability of the selected uses (fishing, aquaculture, shipping, tourism and conservation) in the case study area are at least the following:

Organisms.
- Coastal assemblages
- Benthic assemblages.
- Demersal assemblages.
- Pelagic assemblages.

Environment.
- Water column (physical and chemical parameters).

Processes.
- Production (ocean triads, see above).

Goods.
- Integrity of sandy beaches.

Services.
- Feeding areas.
- Spawning areas.
- Nursery areas.

The addition of further uses in the study area would imply new components to be considered in order to assess sustainability.

3.6.5.4 Pressures and impacts in the Strait of Sicily

Eight of the nine uses selected for MESMA purposes are pressures on the environment. Conservation, which is the ninth use, simply relays on the regulation of the other uses.

Pressures.
- Fishing [1]
- Aquaculture [2]
- Shipping [3]
- Tourism [4]
- Oil exploitation [5]
- Gas transport [6]
- Communication cables [7]

- Wind-mill farms [8].

The above eight pressures, isolated or acting synergistically, generate a number of impacts on the receiving environment, which are at least the following:

Impacts (see also description of uses, above).

- Acoustic contamination [mostly generated by 3, 5 and possibly 8].
- Landscape disruption [3 (port facilities), 5 and 8].
- Sediment resuspension (port facilities) [3].
- Collisions with large organisms [3].
- Pollution [2, 4].
- Delivery of contaminants [3, 5].
- Sea bottom modification (smothering of organisms and habitats) [1 and 4 as press impacts, also 6 and 8 as pulse impacts during deployment].
- Decimation of non-target populations (discards of trawl fisheries) [1].
- Alteration of the size structure of stocks [1].
- Modification of food webs [1].
- Drastic reduction of fecundity of stocks (by fishing relict portions of populations) [4, in synergy with 8].
- Beach erosion [4].
- Biohazards (from synthetic chemicals and disease reservoirs) [2].
- Diffusion of alien species [3 and 4, also 5 as stepping stones].
- Genetic erosion [1].

3.6.5.5 Existing management measures in the Strait of Sicily

Some sectoral management measures already exist in the case study area. They are briefly detailed below.

3.6.5.5.1 MPAs in the Strait of Sicily

Marine Protected Areas (MPAs) and Sites of Community Importance for the Mediterranean biogeographical region (SCIs) (as listed in the Commission Decision 2008/335) occur throughout the case study area. MPAs, which are instituted along the coastline following the national legislation, often have largely generic (e.g. nature protection, fisheries enhancement, etc.) objectives. SCIs aim at the conservation of habitats and species according to the EC Habitat Directive (1992/43/EEC) and are listed in EC Decision 2008/335/EC. The Habitat Directive was transposed into Maltese law primarily by the Flora, Fauna and Natural Habitats Protection Regulation, 2003 (LN 311 of 2006) where, the latter provides the legal framework for designating terrestrial and marine areas of national and international importance in the Maltese Islands.

One Italian and five Maltese MPAs are located in the study area.

The former is the Pelagie Islands MPA, which was instituted in 2002 (Min. Decree 21 Oct. 2002) and is provisionally managed by the Municipality of Lampedusa and Linosa.

The latter include:

5. An area which stretches from Rdum Majjiesa to Ras ir-Raħeb in the north-west of Malta (Government Notice 1138 of 2005);
6. the marine area surrounding Dwejra in Gozo (Government Notice 161 of 2007, updated by Government Notice 851 of 2010);
7. Mġarr ix-Xini, a bay in Gozo (Government Notice 851 of 2010);
8. an area between Għar Lapsi and Filfla to the south-west of Malta (Government Notice 851 of 2010);
9. a significant stretch of area along the north-east of the Maltese Islands (Government Notice 851 of 2010).

The last four sites provide protection to more than 80% of *Posidonia oceanica* beds found in Maltese waters. The marine protected area between Rdum Majjiesa and Ras ir-Raħeb is listed as a SCI. Moreover,

within a 1.1 nautical mile radius from Filfla, no vessel may be moored, berthed or anchored and no person is allowed to carry out any kind of activity connected with underwater diving or sea sport (Government Notice 173 of 1990). However fishing is allowed within the zone.

Twenty SCIs and Specially Protected Areas (SPAs) occur along the southern Sicily coast (Regional Decree, 21 Feb. 2005), five of which are located inside the case study area in the Pelagie and Pantelleria Islands. Although they aim at maintaining and restoring the status of natural habitats, only SCIs and SPAs that fall within the boundaries of an MPA or a nature reserve are managed to some degree.

Greenpeace International has proposed a network of coastal and high seas MPAs covering the whole Mediterranean Sea (Greenpeace, 2006). There is also a specific proposal for a high sea MPA in the Strait of Sicily, aimed at preserving the numerous rare habitats and species and biodiversity hotspots present in the area (Greenpeace, 2009).

3.6.5.5.2 Maltese Fisheries Management Zone.

Malta is surrounded by a 25 nautical mile Fisheries Management Zone (FMZ). Within the FMZ regulations are in place to spatially manage offshore trawling: trawling within the 25 nautical mile zone can, according to legislation, only take place at designated sites (detailed in Annex Va of EC 1967/2006; Figure 18).

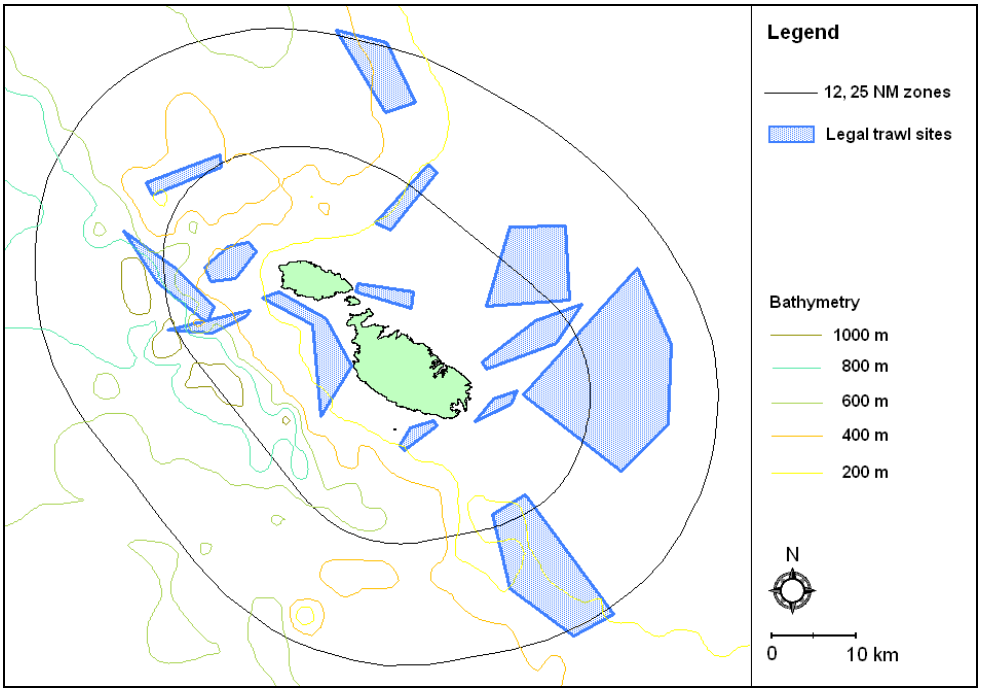


Figure 18. Legal trawling zones within Malta's 25 nautical miles FMZ, as detailed in EC 1967/2006.

These trawlable areas were chosen when Malta joined the EU in 2004, and were based on an FAO study on the location of areas suitable for trawling in Maltese waters carried out in 1976 and 1977. Trawling is only allowed within the FMZ by vessels not exceeding an overall length of 24 m, and the overall capacity of the trawlers allowed to fish in the zone cannot exceed 4 800 kW. Moreover, the total fishing effort of all vessels is not allowed to exceed an overall engine power and tonnage of 83 000 kW and 4 035 GT respectively, and the fishing capacity of any single vessel with a license to operate at less than 200 m depth cannot exceed 185 kW.

3.6.5.5.3 Proposal for the protection of nursery areas.

The management plan for Italian distant trawlers in the Strait of Sicily for 2009-2013 includes the identification of two nurseries of hake in which trawling is prohibited all year round. This measure is still not implemented.

3.6.5.5.4 Trawl ban in coastal waters.

According to EC Reg. 1967/2006 the use of towed gears is prohibited within 3 nautical miles from the coastline or at <50 m depth where such depth is reached at <3 miles from the coast, in an attempt to limit conflicts with inshore set-gear fishermen and to protect coastal nurseries. Furthermore trawling is always prohibited within 1.5 nautical miles from the coast, regardless of the depth. However, the lack of enforcement in Italian seas poses a serious threat to the success of this measure.

With regards to coastal fisheries management around the Maltese Islands, the Maltese Government Notice 206 of 1934 contains fishery regulations which prohibit fishing in specific areas at certain times of year. Some of these restrictions are for reasons of public health, while others are to protect nursery grounds. In addition, Malta Maritime Authority's Notice to Mariners No. 67 of 2004 stipulates that in view of artificial reefs having been laid between St. George's shoals and St. Julian's Point, spear fishing, and the use of fishing gear such as set bottom lines, trammel nets, encircling gillnets, entangling nets, demersal pots and traps are prohibited in the area. Fishing around wrecks, which are important dive sites, is prohibited since the issuing of the Notice to Mariners on 'Conservation areas around wrecks' (Notice to Mariners No. 5 of 2008). Finally, in order to protect breeding colonies of Yelkouan shearwaters (*Puffinus yelkouan*) located at the Rdum tal-Madonna, the Malta Maritime Authority declared a restricted area, where, besides other restrictions, fishing activities using strong lights are prohibited between the beginning of February and the end of July (Notice to Mariners No. 6 of 2008).

3.6.5.5.5 Bilateral agreements.

Several agreements have been ratified: (i) for transport of methane between Italy and Tunisia, between Italy and Libya, and between Italy and Malta; (ii) for transport of electricity between Italy and Malta; (iii) for the regulation of continental shelf boundaries between Malta and Libya (1985 Malta-Libya Continental Shelf Delimitation Ratification Act / Malta Government Notice 67, 1987); and (iv) for closing the "Mammellone" grounds, along the Tunisian shelf, to Italian trawlers.

3.6.5.5.6 Consortiums.

The Decree of the Italian Ministry of Agriculture and Forests of 14 September 1999 established the creation of Consortiums for the management of artisanal fishing (Co.Ge.Pa.), which aim at enhancing and supporting the artisanal fisheries. In Sicily such consortiums are still underway.

3.6.5.6 Indicators and benchmarks for the Strait of Sicily

Information from indicators should be managed through thematic maps. It is intended to consider timelines wherever possible. Alternatively stakeholders' suggestions for defining reliable reference values may be used where better alternatives are not available. Once reference values are matched, new and higher reference values can be proposed. Otherwise departures from the reached reference values should be periodically checked on monitoring data, for example through quality control analysis.

A list of comprehensive indicators is provided by the DEDUCE project website (http://www.deduce.eu/results.html). A list of indicators is also provided by the Marine Strategy Framework Directive (MSFD, EC Dir. 56/2008). These lists can be found in the Annex to the case study.

3.6.5.7 Risk analysis for the Strait of Sicily

Probabilistic risk analysis can be performed comparing the successful realization of general principles, as measured by proper indicators, vs. trade-off among conflicting uses. The department of general principles should be quantified for each specific use, and the associated probabilities estimated by numerical models. Risk would lead to a loss of sustainability or potential for future development of certain uses. For example, in the neighbouring Gulf of Castellammare (NW Sicily) it has been observed that differences in the normative framework determine different trade-offs about the economic convenience of legal vs. illegal fishing by trawl fishermen, so that probabilities of infractions change accordingly (Stefanoni et al., 2008). A habitat model can also be performed in order to forecast future scenarios.

3.6.5.8 Assessment of findings vs. operational objectives in the Strait of Sicily

Assessment can be done by checking the results of our case study indicators against operational objectives, e.g. having good environmental status as well as sustainable economic activities. It is intended to apply a hierarchical approach at spatial level and among levels of organization in order to facilitate the task.

3.6.5.9 Evaluation of management effectiveness in the Strait of Sicily

Evaluation can be performed by interviewing stakeholders to measure their level of satisfaction regarding management measures.

3.6.5.10 Generation of recommendations for current management on the basis of the experience gained during the application of the MESMA framework

Recommendations can be drawn after testing working hypotheses within and among case studies. Rejected hypotheses would lead to recommendations against certain management initiatives, while those hypotheses sustained by empirical results can be used to generate recommendations for good practices in SM.

Possible working hypotheses could involve the following issues:

i. Assessment of potential and present impacts among uses grouped into sectors (e.g. energy, fisheries, conservation, etc.) across case studies.
ii. Application of nature conservation vs. ecosystem approach as policy principles within and among case-studies.
iii. Determination of the hierarchy of principles within and among case studies, taking into account social, economic and cultural status of the stakeholders.
iv. Determination of the relative importance of top-down vs. bottom up management initiatives.

As an example, issue (iii) could be treated by analysing which types of principles (economic, political and ecological) are nested within which ones. Stakeholders in highly developed areas would be expected to give more consideration to conservation principles, which in turn would drive political principles and constrain economical principles to be sustainable. By contrast, management in underdeveloped areas might prioritize economic principles, fuelled by political principles that give less attention to ecological principles.

The above example could also be analysed in issue (iv), in which the social, economical and cultural status of the stakeholders would promote the supremacy of top-down or bottom-up governance initiatives.

Malta has already developed an integrated coastal zone management (ICZM) plan, therefore integrated SM should be easier to implement than in Sicily, where no integrated management plans are present. In Sicily, to make things more complicated, there is a mixture of local and national legislative prerogatives. Therefore an end-user committee that involves representatives from the relevant departments of Sicilian and national Regional governments could likely help in the development and application of SM.

Further recommendations could be drawn from the analysis of the working hypotheses. For example, it could be advisable to focus on economic or ecological benchmarks depending on the social, economic and cultural status of the area to manage. It could be advisable to define operational objectives aimed at filling gaps (e.g. information) in stakeholder status in order to make them more collaborative in an effective SM implementation.

3.7 Inner Ionian Achipelago – Patraikos and Korinthiakos Gulfs Case Study

Case study leader: Celia Vassilopoulou

3.7.1 Introduction

The study area has well defined spatial boundaries and encompasses a great variety of habitats and species, including 10 NATURA-2000 marine sites and more than 25 Special Protection Areas for the conservation of wild birds (79/409/EEC). It hosts several endangered marine species such as the Monk Seal (*Monachus monachus*), the loggerhead sea turtle Caretta caretta, the bottle-nosed dolphin Tursiops truncatus, and the common dolphin Delphinus delphis. Enhanced anthropogenic activities occur both along the coasts of the study area and in offshore waters. Human pressures in the coastal zone include fisheries, urbanization, heavy industry, tourism, aquaculture, and shipping, while in offshore waters the main pressures come from fisheries and shipping. Growing conflicts exist among human uses and between uses and nature conservation. See Annex to this Case Study for more information on coastal morphology and coastal morphodynamics.

3.7.2 Testing the MESMA framework for the Greek case study

3.7.2.1 Spatial Management or Management plans in the Greek case study

As there is no specific management plan for the area a synthesis of the following thematic management plans have to be taken under consideration:

- Master plan for the urban development in Greece
- Master plan for the tourism development in Greece
- Master plan for fisheries in Greece
- Master plan for aquaculture in Greece

Legal framework

In parallel, a synthesis of the results on the implementation of the relevant European (EU) legislation has to be taken under consideration, as follows:

- 92/43/EEC Habitat Directive (marine Natura-2000 sites)
- 2000/60/EC Water Framework Directive (water bodies and ecological quality classification)
- 2008/56/EC Marine Strategy Directive
- 2371/2002 Council Regulation (EC) on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy.

3.7.2.2 Framework steps in the Greek case study

3.7.2.2.1 STEP 1 Context Setting of the Greek case study

1a) The boundaries of the case study have already been set when defining this MESMA case study.

1b) Definition of goals and operational objectives

The following objectives are derived from the aforementioned legislation:

- Biodiversity protection and sustainable management (Habitat Directive)
- Good Ecological Status for all the costal water bodies until 2015 the latest (Water Framework Directive)
- Good Environmental Status of all territorial waters until 2020 the latest (Marine Strategy Directive)

Further to the above an effort to balance multiple objectives (ecological, socio-economic and governance) considering trade-offs within human activities and between uses and conservation will be made through consulting selected stakeholders.

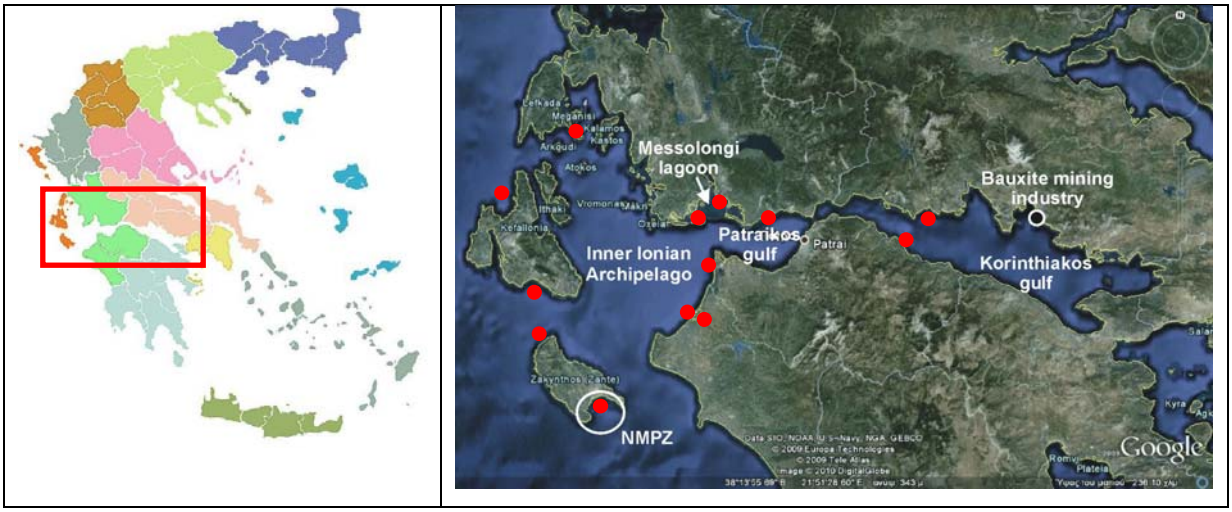


Figure 19. Administrative Regions (left) and Natura 2000 sites (right) in the case study area "Ionian Archipelago and adjacent gulfs"

3.7.2.2.2 STEP 2 Existing Information collation and mapping of the Greek case study

2a, 2b and 2c Existing conditions will be defined through data analysis by producing habitat and human activities mapping to visualize priority habitats as well as potential conflicts. A cohesive understanding of spatial patterns of habitat quality/ human activities and issues related to natural risks (climatic, geological) will highlight important concerns in spatial planning and management of the area. .

Issues that will be tackled will look into:

- Conservation *vs* Human Activities
- Conflicts among Human Activities
- Natural pressures (climate change, geohazards) *vs* Conservation
- Natural pressures (climate change, geohazards) vs Human Activities

Priority conservation issues in the study area were described in the previous draft compiled in April 2010 in the section referring to "Habitat types and priority species present in the study area and conflicts". As for human uses, activities related to fisheries, aquaculture, shipping, industry and tourism will be considered. One of the major tasks undertaken under the case study will be the creation of detailed, comprehensive maps of the marine area, identifying where and how it is used by humans and what protected species and habitats exist within it. Our efforts will also focus on the identification of factors driving specific patterns of use, and the study of how existing uses are related to policies, exploring how these uses could be affected by changes in policies or environmental features. Finally, the interaction of certain natural pressures related to climate change and geohazards with conservation issues as well as with human uses will be also addressed. Below there is a description of the activities/tasks involved with accomplishing the defined objectives.

Habitat/protected species mapping

Issues: Several anthropogenic activities are known to pose significant threats to the ecological quality and the viability of the *Posidonia seagrasses* in the study area. Coralligenous formations are extremely exposed to various anthropogenic activities that take place in the wider coastal area (pollution, coastal structures, commercial and recreational fisheries, anchoring, scuba diving, etc.) especially to fishing by mobile gears or static nets. Moreover, growing conflicts exist among economic activities, mainly fishing, and the need for conservation of marine species. The absence of habitat mapping and actual protection measures has led to the deterioration of these habitats as well as the decline of certain protected/endangered species the last decades.

Tasks: The existing data will be compiled and the gaps will be identified and prioritized. New data will be collected through satellite and aerial imagery, vessel-surveys (side-scan sonar, multi-beam sonar, ROV) and SCUBA surveys to a selected number of sites of potential interest in the study area to increase our knowledge on the distribution of priority habitats. Based on existing and new data, habitat maps will be produced and restrictions to human specific activities will be proposed to ensure the conservation of priority and sensitive habitats. Distribution maps of selected protected species in the study area will be produced by compiling existing information. Restricted surveys for the collection of new data will be conducted focusing on the fan mussel *Pinna nobilis*, the date mussel *Lithophaga lithophaga*, and the two species of seahorses (*Hippocampus hippocampus* and *H. guttulatus*).

Human uses mapping

a. Fisheries & Aquaculture

Issues: Commercial and recreational fishing within this area is intense, including bottom trawlers, purse-seiners and a very large number of small (<10 m in length) coastal vessels (>4000). The latter underlines the high socio-economic importance of the small-scale fishery sector in the area. However, there are intense conflicts between small scale fisheries and trawl fisheries, as well as between small scale fisheries and recreational fisheries. Another issue of importance is the documented impact of fishing activities on habitat deterioration and on decline of protected species populations. Furthermore many aquaculture installations are located in coastal sites and small bays, liable to produce excessive amounts of nutrients and deposit organic material in the exploited area. There are ongoing conflicts between environmental groups and aquaculture sectors which will be also tackled in the frame of this case study.

Tasks: In order to evaluate the impacts of the fishery sector, data derived in the frame of HCMR surveys will be used, along with data collected by other institutions (regional authorities, universities, prefectures' departments etc) that will be also gathered and compiled to shed light on the development of commercial and recreational fisheries, comparing and contrasting relevant issues. In parallel, data related to aquaculture enterprises will be gathered and conflicts with fisheries as well as with other activities and conservation goals will be quantified.

b. Urbanization - Industrial/shipping activity

Issues: Two relatively big cities are located on the coasts of the study area along with some **smaller** residential settlements. The coast in these areas is intensively used for domestic, commercial, recreational and transportation purposes. These uses are expected to increase, along with growing urbanization, industrialization, and transportation, putting even greater pressure on the living and non-living resources of the coastal ocean. In the area there are some small scale industrial activities which are closely related to the urbanized areas. Significant quantities of heavy 'metals' are introduced to the marine environment by direct discharges of industrial wastes and through the release of shipping-related pollutants since one of the biggest harbours in Greece, the Port of Patras, exists in the region. In fact, according to the *Transboundary Diagnostic Analysis for the Mediterranean Sea*, published in 2005, the marine region off Patras is considered as a pollution hot spot. Shipping and transportation are also known to conflict with other human activities eg. aquaculture, fishing and tourism.

Tasks: Compilation of relevant data and information from related studies will enable assessment of pollution levels and identification of conflicts between different activities and with conservation needs.

c. Tourism/recreational activities

Issues: Touristic activities are flourishing mainly along the southern coasts of Korinthiakos Gulf and the islands of the Ionian Sea. The seasonal pressure on coastal areas from the sheer number of people visiting them can be great. The threat from tourism infrastructure is acute. Moreover, there are small marinas built primarily for recreational use by small boats which in some cases disturb the coastal zone and have certain environmental impacts. There are documented cases of sports/recreational activities conflicting with conservation objectives (ie. Leisure vessels dropping anchor on sensitive habitats) but also with other human activities eg. fisheries.

Tasks: Collection of data/information to identify the touristic activities taking place in the coastal zone of the study area and determine focal conflicts with other activities and conservation needs.

d. Coastal constructions and erosion

Issues: The study site suffers from extreme erosion phenomena focused mainly on the coast of Peloponnissos. Man made coastal works, mainly fishing ports, marinas, as well as seawalls, breakwaters,

groins and jetties have disturbed seriously the along shore sediment transport, often resulting in severe erosion and beach loss. Superimposed on this, sand and gravel extraction from numerous river beds of northern Peloponnissos result in sediment starving of the beaches.

Tasks: In order to assess the extent of the problem, it is scheduled to employ remote sensing images to detect coastal retreat/accretion patterns over the past 10 years or more. In-situ short visits will provide ground truth and deeper insights of the problem.

Natural pressures

a. Climate change

Issues: The vulnerability and impacts of climate change on Hellenic marine and coastal biodiversity are discussed in recent studies, which provided footprints of the impact of climate change with regards to expansion of tropical-subtropical species originating from the western tropical Atlantic and Pacific, northern expansion of thermophilous fish, mucilage events and HABs, mass occurrence of scyphomedusae, changes in planktonic and benthic abundance, changes in demersal resources, molecular and biological changes, and alien species invasions. Certain issues related to climate change such as alien species invasions and HABs were documented in the study area and they have a strong negative impact on recreational activities and tourism.

Tasks: Certain areas considered as hot-spots of climate change effects will be investigated either by compiling existing information or by conducting new samplings related to updating information on alien species, or by questionnaires to evaluate pressures by toxic microalgae and jellyfish.

b. Geohazards and coastal erosion

Issues: The study area is characterized by strong seismic and faulting activity, which is the triggering factor for various geohazards threatening the coastal zones: coseismic coastal collapse and/or failure phenomena, vertical movements of the shoreline due to faulting, progradation of the shoreline due to high sedimentation rates and impact of tsunamis generated on the adjacent steep slopes have been reported frequently.

Tasks: Vulnerability of the natural environment from marine geohazards will be considered, and areas exposed to such threats will be identified.

Data availability

The case study is based on information and experience gained from several activities of the Hellenic Center for Marine research during the last 10 years

- Habitat mapping of the Natura 2000 sites
- Environmental Impact Assessment of aquaculture
  - Korinthiakos gulf
  - Echinades islands (Inner Ionian archipelago)
  - Kefalonia island (Ionian islands)
- Environmental Impact Assessment of mineral wastes disposal in Antikira area (Korinthiakos gulf)
- Environmental Impact Assessment of hot water disposal (thermal pollution from electric power station) in Antikira area (Korinthiakos gulf)
- Marine pollution data (MEDPOL)
- Hellenic network for Aquatic Invasive species (ELNAIS).
- WFD assessment (water bodies and ecological quality classification).
- Fisheries data (e.g. MEDITS, experimental surveys, observers onboard commercial vessels)
- Oceanographic/geological data

Also, existing data on specific uses (eg. related to tourism and shipping) will be gathered from the respective authorities, compiling also data (e.g. on socioeconomic issues, status of endangered species) that are scattered to various sources (universities, independent studies, national statistical service, prefectures). Finally restricted surveys to gather new data (e.g. distribution of selected endangered species, hotspots of alien invasions) will be organized.

3.7.2.2.3 STEPS 3 to 7 in the Greek case study

Relevant and reliable indicators to evaluate effectiveness at meeting defined objectives will be developed and reference points will be decided after deliberation with stakeholders . The risk analysis, the assessment of the findings against the operational objectives as well as the management effectiveness will be evaluated. , Recommendations will be made for potential adaptations to the current management regime

Stakeholder engagement/communication

Selected stakeholders will be invited to take part in the End-user committee of the Greek case study aiming to establish a fruitful collaboration through knowledge exchange, identification of common goals/objectives and needs to successfully address the challenges of building good relationships and trust. (reference to WP6)

Suggestions for tools

During the end-user meeting in December 2010 the type of management tools (WP4) that need to be developed will be clarified according to the specific needs of local and national stakeholders (management authorities and policymakers) and with the aim to deliver the required consensus or capacity outcomes.

3.8 The Black Sea Case Study

Case study leader: Jan van Dalfsen

3.8.1 Introduction

Focus of the case will be environmental improvement and cross border issues related to MSP

- International cooperation and agreements for sustainable development and protection of the Black Sea ecosystem
- Assessment of establishment of a cross border Network of marine protected areas to represent the Black Sea Basin and stop further deterioration of the of the Black Sea marine environment, as well as actions to manage and plan human use and activities.
- Use of plankton species, such as e.g. jelly fish (ctenophores), as indicators for water quality, changes in the system and human impact.

Figure 20. Black Sea area.

The proposal anticipates on the theme of the EU FP-7 call 2011 : In particular a cross-thematic call 'The Ocean of tomorrow', focusing on the Mediterranean and Black Sea basins, is foreseen to support the development of ecosystem-based regulations, policies and management practices.

The Black Sea is bordered by Bulgaria, Georgia, Romania, Russia, Turkey, and Ukraine. It covers a total of 422.000 km² along which Bulgaria has a coastline of 378 km. Major water input comes from a series of large rivers which flow into the northern and western parts of the Black Sea. Most important are the Danube, the Dnepr and the Don. Inflow of water from the major river systems coupled with limited outflow have led to the Black Sea being nutrient-rich and highly productive and developed into a unique system.

3.8.2 Policy-urgency for planning in the Black Sea

The Black Sea region is increasingly becoming a priority on the international agenda. In fact, a regional approach is gradually developing as actors understand that common problems need to be addressed jointly in order to find effective solutions (from: Commission on the Black Sea). Common interest and potential conflicts are present in the Black Sea region in nature protection and restoration, fisheries, regional industrial activities and accompanying pollution impacts, including oil development and

production, development of transport infrastructure, including projects for regular maritime links between the ports of bordering states. Minor pressures exist from tourism and sand mining.

In this context it is important to balance the different economical, social and ecological interests in the area, in such a way that these are integrated on all spatial levels to strengthen the dialogue and cooperation so as to contain and ultimately resolve conflicts with peaceful means. However, cooperation efforts are seriously hampered by a number of factors such as uneven economic and political development within and among countries, nationalist forces, and longstanding animosities between regional players. Little policy oriented research exists on the challenges and opportunities for cooperation in the Black Sea region, meaning that it is harder to develop sound, evidence-based policies. Moreover, existing research tends to focus on specific topics (e.g. energy, transport, the environment, etc.), and/or be based in a rather one-sided view (national or Western/Euroatlantic).

The case study will describe and analyze the links between economical, social and ecological marine spatial planning processes with the aim of provide practical input for the development of a long-term strategy towards evaluation and monitoring of MSP in the Black Sea, both national and regional.

In Bulgaria there is a policy-urgency for planning - the ecological status (census WFD) is poor and in risk to not meet the requirement for at least good quality by 1015.

3.8.3 Key human pressures in the Black Sea

Coastal development, river diversion, over-exploitation of resources, introduction of alien species, pollution and other activities have , however, led to a marked degradation in the quality of the marine environment, especially due to a high level of eutrophication and loss of visibility. The main environmental problems in the Black sea (and consequently research efforts) are:

- eutrophication (there is intensive monitoring of H2S spatial and temporal distribution);
- waste coming from rivers Dnepr, Danube and Don
- fisheries: Some twenty-six species of fishes have traditionally been commercially harvested in the Black Sea, including valuable taxa such as sturgeon, bluefish, bonito and turbot. Marine commercial fish food webs dramatically changed in the north-western Black Sea on both pelagic and benthic environments. Fisheries landings, diversity and equitability strongly decreased between 1965–1970 and 2001–2005 International fishing quotas regulation - is largely disrupted because of the political tensions in the area; and illegal fishing occurs. Overfishing is a serious problem leading to declining stocks, although the accidental introduction of the predatory ctenophore (comb-jelly) Mnemiopsis leidyi to Black Sea waters is seen as well as a major cause. This comb-jelly feeds on plankton, including fish eggs and fry, and appears to have no known predators in the Black Sea. Populations of this species exploded in the late 1980s and subsequently decreased, although the species is now well established, with seasonal blooms which occur during the breeding season
- oil and gas transport and production. The Black Sea is not a major production area, but reserves off the west coast of Georgia may be significant. There is a growth in transport of crude and refined products. Novorossisk sea port is the main oil terminal; in addition there are gas and crude oil pipelines on the bottom of the Black sea –

Next to above mentioned activities and problems there are additional impacts and potential conflicts as a result of human activities such as increasing coastal development and tourism, aquaculture, sand extraction and offshore cable installation.

In this case study we will focus on the deteriation of the ecosystem and the compliance with international commitments and obligations to protect and restore marine habitats. However, the Black Sea is bordered by both EU and non-EU countries which makes this highly interesting due to the different setting of national legislations and cross-border issues. Within the bordering countries, different Ministries are responsible for different aspects such as fisheries, environment and transport, resulting in coordinated efforts at the national levels being sub-optimal. There is a constant political tension in the area where in addition to the differences between EU and non- EU countries also tension exist between EU and Turkey and tension between Russia, Ukraine and Georgia, especially in the recent years.

3.8.4 Level of spatial management today in the Black Sea

Currently the greatest problem of Black Sea management is the institutional one: all the ecological problems largely are so huge because of the lack of coordinated management among countries.

National networks are yet not in place and a compulsory regional policy on the matter does not exist. The latest Strategic Action Plan 2007 for the Black Sea only recommends increasing the number and area of MPAs - networking and international managements are far beyond the horizon. The political set up is different in EU and non-EU countries, national legislations are also variable, e.g. until 2007 Turkey did not have any legal provisions for establishing MPAs.

Investigating the present policies and recommendations on their status and analyzing the drawbacks in realizing these will make the case study very valuable in addressing regional differences and developing a toolbox that offers practical guidance.

3.8.5 Conservation issues in the Black Sea

Anticipating and following the European Directives research is being done to designate and install marine reserves as part of the Natura 2000 network in the EU member countries Bulgaria and Romania. A common management of a cross-border network of MPA's is, however, yet not installed. A spatial plan has been developed but this is also not in place yet. The case study will include the analysis of the Natura2000 marine network in Bulgaria and Romania. Proposals have been made for the establishment of reserves in the Bulgarian–Romanian border area (cape Siviburum, cape Kartalburum) including a marine reserves at the shallow waters in front of the Krapets village and Shabla.

This Black Sea case will include the EU countries Bulgaria, Romania and Turkey (Candidate member), but cross border issues involve also non EU members as Ukraine, Russia and Georgia. The Black Sea region is, however, very far from designating and having a common management of a cross-border network of MPAs.

Zones for marine reserves were proposed to protect the Turbot (Psetta maxima) spawning habitats: This species suffers overexploitation of the stock during a long period. Only recently the marine fishing legislation adviced restrictions on the small size catches. Installing protected areas will contribute to the population conservation and will facilitate the implementation of legislation recommendations. Additional reserve areas are proposed to protect endangered Seal Monk (Monachus monachus). This species belongs to the group of top-predators, which distinction together with reduction of the dolphins abundance was the main reason for the trophic cascades in 80's, with deleterious effects on the whole ecosystem. Establishment of protected areas will couple together strong ecological effects (biodiversity conservation and restoration of the endangered species) and socioeconomic effects (restriction of the poaching and bottom trawling and drag-net fishing).

The sandbank "Koketrays" is situated in Bourgas bay, Bulgarian Black Sea coast. It is a representative example of the habitat type 1110 "Sandbanks which are slightly covered by sea water all the time", listed in Annex I of the Habitats Directive. Benthic fauna is exceptionally rich and threatened species included in the Black Sea Red data book occur in the area. Human pressures on the sandbank encompass bottom beam-trawling for collection of Rapana venosa (whelk, fished for its meat) and dredging for sand extraction. "Koketrays" was declared a protected site in 2001 with the objective to protect the biological diversity of benthic fauna. Prohibited activities include sand extraction, fishing with mobile bottom gear, pollution with oil products and other waste. Annual monitoring has been carried out and the observations suggest improving of the ecological state (defined according to the Water Framework Directive) after the designation of the sandbank as a MPA as a result of the management measures taken.

According to the UNEP-World Conservation Monitoring Centre (*World Protected Areas Data Base, 2007*), some 125 protected areas have been designated bordering the Black Sea coast (see annex). These vary in size from tiny scientific reserves of 1 ha up to the Danube Delta Biosphere Reserve in Romania with 576,216 ha. However, in many cases, it is not clear from the designation data whether or not any coastal zones, let alone sub-shore marine waters, are covered by the protected area, so the list in the annex must be treated with caution and taken as a "long list" which needs further investigation. At present, it appears

that some 1.1 million ha of coastal/marine protected areas have been designated by Black Sea countries, but about half of this is represented by the Danube Delta Biosphere Reserve in Romania alone.

3.8.6 Data availability in the Black Sea

There is a lot of research ongoing in the Black Sea, administered both from local country initiatives as well as funded by international organizations. Data availability and quality for all sectors and pressures is presently uncertain, but ecological data can be obtained for Bulgaria. It is important that data is available that will allow accurate description of the conflict between the users. Both conflicts and data availability can be indicated quantitatively.

Data are available on input from the different rivers, mainly the Dnepr and Danube (monitoring of P and N - there are some World Bank programs, mainly administered from Ukraine. Although scattered, information is expected to be available on several human activities and other pressures in the different countries. For the Varna region marine area data are available on a number of human uses and pressures present, as well as number of conflicts. Environmental data are held by IO-BAS.

Data acquisition will depend on both MESMA members and non-MESMA parties. This by addressing existing contacts from the MESMA partners in the region and raise interest to be involved as "stakeholders" (see Chapter 9). Presently contacts do exist with institutes in Bulgaria, as well as in Turkey, Romania, Ukraine and Russia (Information in Russian need not to be a major drawback as some colleagues are be able to read Russian). If data acquisition for the region is too difficult, we can fall back on data available for the Varna region as data are available on a number of human uses, pressures present and number of conflicts.

3.8.7 Participation of stakeholders in the Black Sea

Essential to the project is the identification and participation of stakeholders from the different sectors present in the Black Sea surrounding countries Bulgaria, Georgia, Romania, Russia, Turkey, and Ukraine. Different stakeholders are presently active in the region, which are partly represented by the Commission of the Black Sea and the International Commission for the Protection of the Danube River (ICPDR). These Commissions will be consulted as well as the responsible authorities and other stakeholders. Through e.g. the Black Sea Economic Centre, other institutes and parties we will approach the network of Black Sea Marine research and development organizations and data centers. The MESMA framework will be used to analyze these actors and their role in marine spatial planning in the area.

3.8.7.1 Potential Stakeholders & partners (data collection)

- Commission of the Black Sea
- International Commission for the Protection of the Danube River
- Organization of Black Sea Economic Cooperation (BSEC)
- Parliamentary Assembly of the Organization of the Black Sea Economic Cooperation (PABSEC)
- National Institute of Marine Geology and Geo-ecology, Bucharest, Romania.
- Bulgarian Academy of Sciences - Institute of Geography, Sofia, Bulgaria,
- The Black Sea Economic Centre
- Company for Environment and Coast, Kiel, Germany
- Institute of Geography of Russian Academy of Sciences, Moscow, Rusian Federation,
- EGE University, Bornova-Izmir, Turkey,
- Black Sea NGO Network, Varna, Bulgaria,
- Oceanological Centre of the National Academy of Science, Sevastopol, Ukraine,
- Borrowed Nature (NGO) Bulgaria
- FAO (fisheries data)
- WWF

3.8.7.2 Important network and existing projects

- Commission on the Black Sea
- Black Sea SCENE project (25 partners from countries bordering on the Black Sea – Ukraine, Russia, Turkey, Romania, Bulgaria, Georgia – together with seven partners from EU Member States and one Associated State
- SESAME (http://www.sesame-ip.eu/scientist/black-sea)
- ENCORA
- ICPDR - International Commission for the Protection of the Danube River
- Black Sea Environment Programme (BSEP) involving Bulgaria, Romania, Turkey, Georgia, Russia and Ukraine.
- The Marine Aggregate Network
- www.blackseaweb.net
- www.grid.unep.ch
- www.irex.org/programs/symp/01/matthews.pdf

3.8.8 Approach of the Black Sea case study

The case study will have a step wise approach in the scope of work, especially in scaling up the geographical boundaries (from Varna MPA to cross-border Bulgaria- Romania Natura 2000 implementation into a "overall" Black Sea region). This will be dependent on WP2 framework set up requirements, data availability, as well as depending on MESMA partners and stakeholder involvement from the wider region. Involvement of other MESMA partners will be of great importance for this case, but in doing so offering the opportunity of a broad transnational cooperation between the partnership. After a stakeholder assessment potential stakeholders will be approached to participate in the upcoming period.

- Varna region marine area: several human uses and pressures present, as well as number of conflicts and conservation issues, ecological quality status (census WFD), present Natura2000 sites, analysis of the present MSP plan which is developed although not in place yet
- Natura2000 marine network in Bulgaria and Romania. Designation of MPAs, conservation and ecological quality status, *recommendations to increase the number and area of MPAs (The latest Black Sea Strategic Action Plan 2007)*
- Cross border issues with non EU- member states: how is cross-border MSP addressed (for a number of sectors or activities) and is there a form of Monitoring & Evaluation set-up? What can we learn from this that is of importance to the EU Commission
- Data availability as issue (which especially seems to be the case here), how to deal with this: illustrate the challenges of lack of availability of &/or access to data

For the different scales of assessment in the case study area, it is necessary to develop an overview of ecosystem components, their sensitivity and services, as well as the socio-economic activities that take place. Based on this information assessment will be made from which a selection will be made of priority pressures. Next to this a review will be made of existing MSP-related initiatives or which are being developed for the different geographical scales, their goals, the different parties involved and the role these parties play at what moment during the decision process. In this case study we aim at identifying the key components in the decision making process, e.g. in the case of MPA designation; which are the criteria for site selection and to what purpose where they installed. Are the objectives and goals clear and is there an evaluation process to monitor incentives vs realisation.

What are the most important issues you propose to tackle in the Black Sea case study?
Interesting in this case is the assessment of the different processes that are needed in the different scales, ranging from national to regional, to develop an integrated ecosystem approach in spatial management.

Furthermore, due to the large uncertainties in acquiring data both from the EU member states in the region as well as from non-EU Black Sea countries, it is of great value to investigate and suggest solutions to overcome such drawbacks, in the utilization and developed of a practical MESMA framework. If through this case it becomes clear that for the Black Sea region on certain human use, pressures or environmental values the lack of data, its quality or severe difficulty in obtaining these, are hampering the

testing of the generic concepts, guidelines, criteria and models developed in WP2 and in WP4, this also be an important result that should be communicated with the European Commission.

What are the most important issues you think are feasible to tackle in the Black Sea case study?

Analysis of the spatial management approach and actions taken towards the Natura2000 marine network in Bulgaria and Romania with the aim of developing guidance on monitoring and evaluation of the environmental, social and economic incentives.

Detection and description of key information gaps and or resisting forces that seriously hamper the application of the MESMA framework for the analysis of national, cross border and regional approaches to address and solve conflicts in spatially managed areas.

How do you think you can implement a MESMA-framework the Black Sea case study?

See 11:" Approach"

What are your research hypotheses the Black Sea case study?

- A lack of data and information as well as of information exchange prevent a coherent MSP process for the Black Sea region, especially where cross border issues arise
- Different goals and drivers present in Non – EU member states have serious consequences for the process of engagement in Black Sea MSP; where do different policies in the region interfere with integrated ecosystem approach in spatial management?
- Development of some key environmental indicators for ecosystem health will help to address the environmental problems through spatial planning.

3.9 The Baltic Sea Case Study

Case study leader: Julia Carlström

3.9.1 Summary

The Baltic Sea Case study focuses on two coastal areas in the Baltic Sea; Puck Bay in Poland and Östergötland County in Sweden. The areas share some characteristics; both being marine areas with brackish water and having quite similar climates and largely the same species. Located in the Baltic Sea, both areas form a part of the Helsinki Commission (HELCOM) area and are being managed under the HELCOM Baltic Sea Action Plan (BSAP). However, there are also great differences between the two areas. Östergötland County has a relatively well developed spatial management, existing plans for nature conservation and relatively few stakeholder conflicts. In Puck Bay there is no spatial management plan and strong conflicts between fisheries, nature conservation and tourism. A pilot plan has been developed for the area but it has not been implemented. The Baltic Sea case study will compare and evaluate the current situations and existing management measures in the two areas, as well as develop recommendations for adaptations of the managements using Marxan analyses and the MESMA WP2 framework.

3.9.2 Aims of the Baltic Sea case study

- Compare current situations and existing management measures between the areas (Östergötland County and Puck Bay)
- Analyse conflicts – identification of potential stakeholder conflicts and the reasons for conflicts or lack of conflicts
- Test the MESMA WP2 framework
- Do Marxan analyses for the two areas
- Develop recommendations for adaptations of management and if needed propose new operational objectives and management measures.

3.9.3 Descriptions of Baltic Sea Case study areas

3.9.3.1 Östergötland County

Östergötland County is situated at the Swedish east coast at approximately 59° 30'N 17°E (figure 21). The total area of Östergötland County is 14,624 km^2, whereof 2335 km^2 constitutes the Baltic Sea.

Östergötland County is divided into 13 municipalities, whereof three (Norrköping, Söderköping and Valdemarsvik) are situated by the coast. The human population of Östergötland is 430,000 people, whereof 151,000 live in the coastal municipalities. An important part of the physical planning is the comprehensive municipality plans. These plans regulate the development and usage of water and land within the municipalities. Municipality programmes for nature conservation are integrated parts of the comprehensive plans. Most of the coastal and marine area of Östergötland is pointed out as an area of national interest for nature conservation and recreation. Parts of the area are also pointed out as areas of national interest for fisheries and energy production.

Östergötland County encompass the Baltic Sea Protected Area (BSPA) Missjö-S:t Anna, established under the Helsinki Commission (HELCOM). There are 53 Natura 2000 areas that encompass marine waters, whereof nine with marine Natura 2000 habitats. There are also 47 nature reserves that encompass marine waters, but of these, only four have described marine values and management plans and regulations with the aim of conserving these values. In addition to these larger areas, there are 65 protected areas for sea birds and 1 for seals. These areas are mainly no entry areas during part of the year for protection of bird breeding areas or seal haul out sites.

The marine environment of Östergötland is very varied; from four great bays that extend far westwards into the country via an archipelago comprising some 6300 islands and skerries, to open sea to the east. With great variation in e.g. bathymetry, wave exposure, freshwater outflows and human activities Östergötland County encompasses several different habitat types (figure 22).

Being a typical Baltic Sea environment with brackish water of low salinity (about 0.2 – 10 psu), the diversity of marine species is low compared to areas with higher salinity. But another effect of the low salinity is that a many freshwater species thrive in the area, resulting in an ecosystem with a mixture of marine and freshwater species. Examples of important marine habitat forming species are bladderwrack *Fucus vesiculosus*, eelgrass *Zostera marina* and blue mussels *Mytilus edulis*. A few examples of habitat forming freshwater species are the pondweeds *Potamogeton pectinatus* and *P. perfoliatus* and milfoils *Myriophyllum* spp. Both marine and freshwater fish species are present. Some species of commercial value are cod *Gadus morhua* and herring *Clupea harengus* (marine species) as well as perch *Perca fluviatilis* and pike *Esox lucius* (freshwater species). Among birds and marine mammals, the white tailed eagle *Haliaeetus albicilla* and the grey seal *Halichoerus grypus* are examples of well-known species that are recovering in the area.

The inner (eastern) parts of the coastal area of Östergötland are the most densely populated parts. The largest city in the area is Norrköping (approximately 85,000 inhabitants) which is situated at the innermost end of Bråviken, the largest bay in Östergötland. The smaller cities Söderköping and Valdemarsvik are also located in the innermost ends of two great bays, the bay Slätbaken and the bay Valdemarsviken.

The archipelago in the east is more scarcely populated. Many inhabitants still utilise the area's natural resources in a traditional way for small scale commercial fishing, grazing grounds for cattle etc., thus contributing to conservation of the area's cultural values and cultural landscape. Such activities are however decreasing in the area. The archipelago is now facing new challenges as tourism, boat traffic and activities such as sports fishing, kayaking and sailing increase. Management measures for dealing with this change are presented in a proposed management plan for the BSPA-area Missjö-S:t Anna which is located in the region.

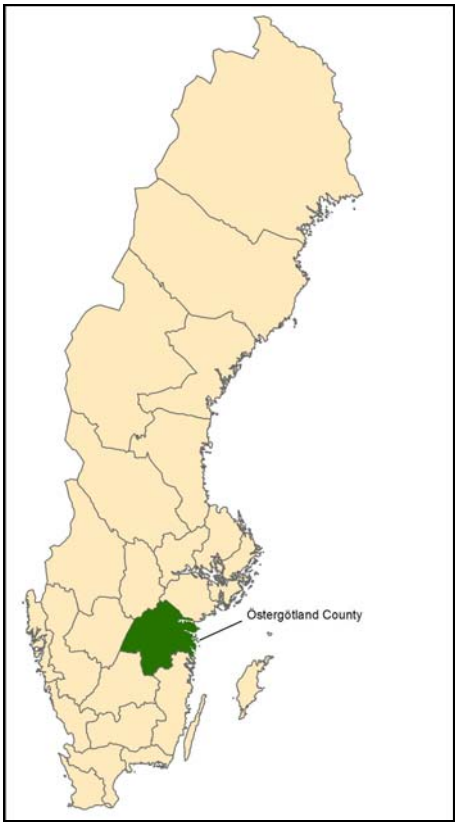


Figure 21. Östergötland County in Sweden

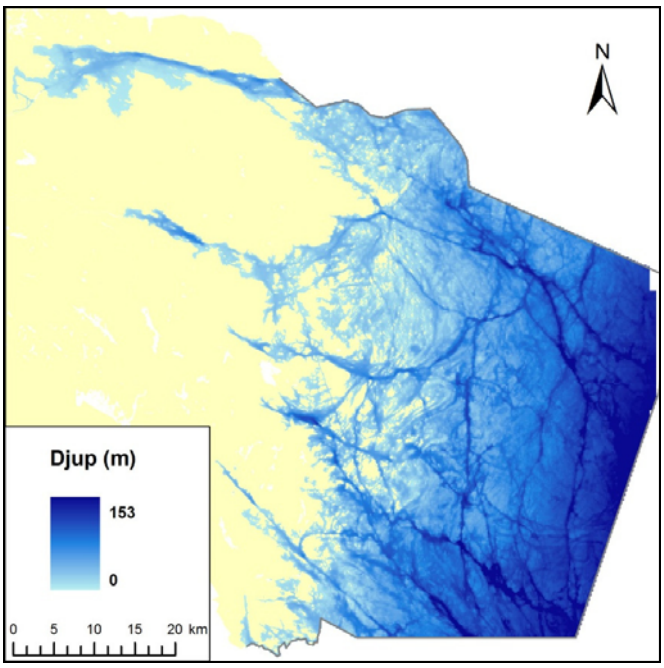


Figure 22. Östergötland bathymetrical chart

3.9.3.2 Puck Bay

3.9.3.2.1 Geography

The Puck Bay is the part of the Gulf of Gdansk that is the system of estuaries, in which there is a mix of brackish and marine waters (figure 23). Freshwater comes from terrestrial sources, mainly the Vistula River, the second largest river flowing into the Baltic Sea. The Puck Bay is the South-western part of the Gdansk Basin and the Western part of the Gulf of Gdansk. It is enclosed by the large curve of the shores. In the North it is separated from the open sea by the Hel Peninsula and its Eastern border is the line that connects the Cypel Helski with the Kamienna Gora. For the purpose of this study, the area was slightly expanded to the East up to the administrative borders of Gdynia to be consistent with the first Polish pilot spatial plan developed under the PlanCoast Project. It is therefore defined as the marine territory between the Cypel Helski (18°48'29,12''E, 54°35'33,71''N) and the border between Gdynia and Sopot municipalities (18°33'43,15'' E, 54°27'51,46''N). The total region equals to 40.550 ha, entire area of the coastal belt is 55 km2 (with the coastline length of 117 km). The Puck Bay is the part of Polish internal waters according to the international law of the sea. It is the subject to the most intensive anthropogenic pressures and conflicts in the Polish Marine Areas, used extensively by tourists and fisheries. The region is under the influence of the Tricity agglomeration, which has the population of about 760,000 inhabitants. The Tricity metropolitan area is even larger – it has the population of over 1 million people. The Tricity comprises of the two large harbour cities – Gdynia (cargo passengers) and Gdansk (cargo, LPG) and the spa town Sopot. The whole area is ecologically extremely vulnerable and is therefore covered by the NATURA 2000 network with the areas planned for bird (OSO) and habitat (SOO) protection. The part of the Puck Bay is also covered by the coastal Landscape Protection Park recommended together with the Kepa Redlowska Reserve as the Baltic Sea Protected Areas (HELCOM BSPA).

Figure 23. The Puck Bay

3.9.3.2.2 Oceanography

The Puck Bay is divided into the Inner Puck Bay and the Puck Bay. The Inner Puck Bay is the only sheltered marine bay in Poland and it is delineated by the natural limits of the sandy shallows of the Ryf Mew between the villages of Rewa and Kuznica. There are significant differences between these two parts of the bay. The Inner Puck Bay is notably shallower and its bottom profile is more varied with numerous furrows, shoals and depressions. The waters of the Puck Bay are brackish, microtidal and eutrophic with the salinity ranging from 3 to 8 PSU. Although the coasts of the Puck Bay are predominately sandy biotopes (sand dunes) and moraine seashore line, their geomorphology is rather diverse – with beaches, grass meadows, small river mouths, cliffs and artificial concrete walls. The surface sediments are primary fine and medium sand, clays and sand-silt-clays. The Puck Bay is the transitional zone between the land and the water. Its climate is therefore shaped by the land, but also influenced by the Gulf of Gdansk and the waters of the Gdansk Deep. It is characterized by the relatively high sunshine duration (approximately 1600 hours per year for the Hel Peninsula), strong Western and North-western winds, moderately high relative humidity, existence of sea aerosols and relatively stable course of daily and annual air temperatures.

3.9.3.2.3 Biological valuation

The biological valuation was based on habitat characteristics, species richness and organisms biomass and density. The Puck Bay is one of the two biologically most valuable areas within the Polish Exclusive Economic Zone, yet it is also one of the most degraded one. The natural value of this area is raised by the high biodiversity of benthic fauna and the presence of rare and protected species. This covers the unique assemblages of macrophytes (seagrass, read algae) and the high concentration of species in small areas.

The underwater meadows (with Zostera Marina as main habitat builder) increase the biodiversity including the numerous of crustaceans, juveniles of bivalves and gastropods. However, today's three patches of seagrass beds are only the modest remnants of the meadows that were present in this bay until 1950s. The Puck Bay is also an important breeding and resting habitat for many fish species (flat fish, herring, gobiids), birds wintering place (diving ducks and swans) and occasional site of sea mammals occurrence (grey and ringed seals).

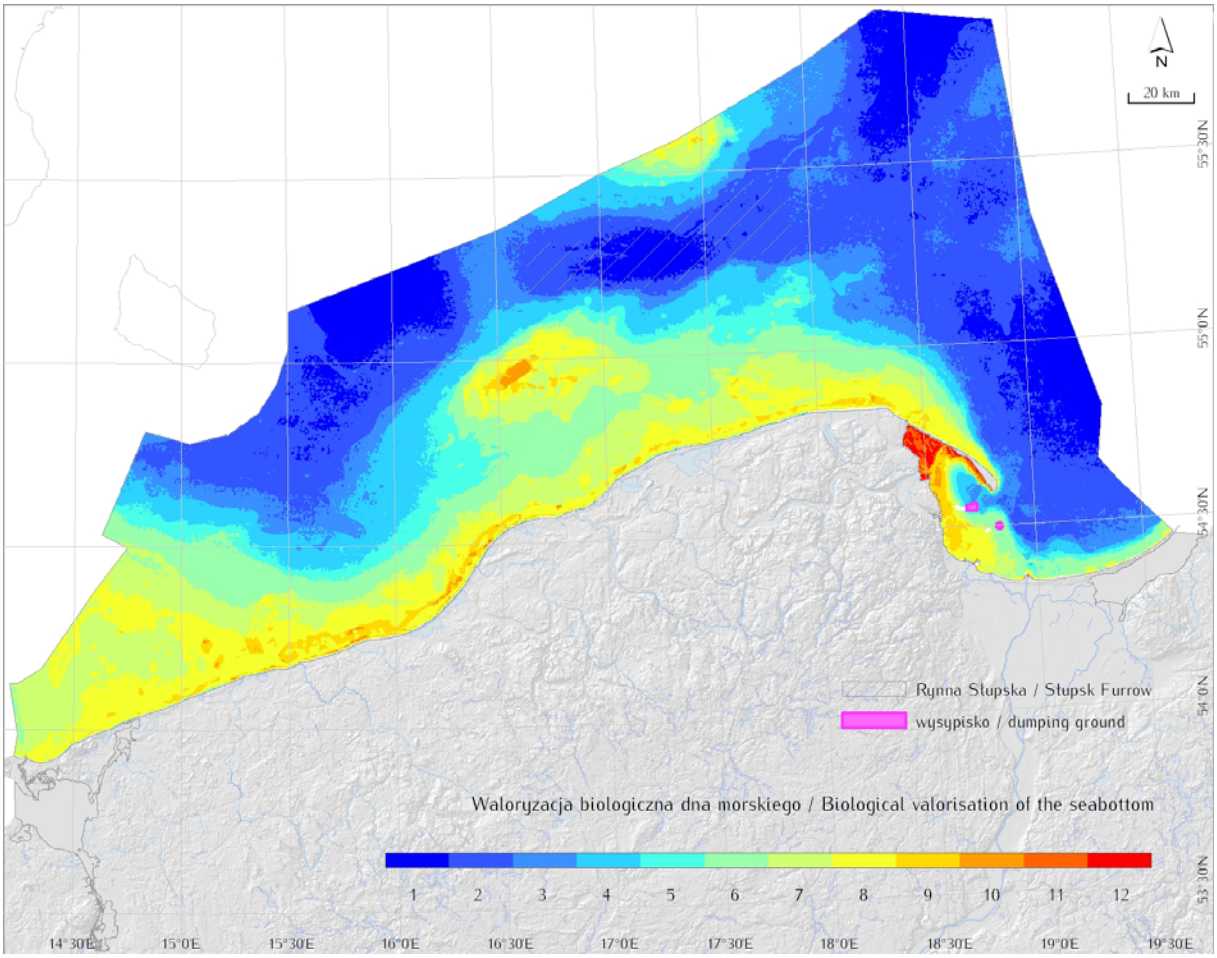


Figure 24. Biological valorization of the seabottom after Weslawski et al 2009

3.9.4 Testing the MESMA framework in the Baltic Sea case study

3.9.4.1 STEP 1 Context Setting of the Baltic Sea case study

1a) Setting temporal and spatial boundaries for SMA assessment in the Baltic Sea Case Study Areas

Spatial boundaries

Östergötland County

Spatial boundaries are already mapped in following detailed GIS layers from the area:

- Coastline and islands
- County borders
- Municipality borders
- Nature reserves
- Natura 2000-areas
- BSPA area
- Protected areas for seals and birds

- Areas of national interest for nature conservation, recreation, fisheries etc.

Puck Bay
The following geographical information is available: GIS maps created: bathymetry based on the IOUG and the Naval Hydrographic Office data and the compilation of the selected isobaths from navigational charts), surface sediments (results of the over 10 000 samples of upper 0.5 m. – State Geological Survey), near-bottom water temperature, salinity, PAR radiance (regression modelling supported by field observation), near bottom currents (numerical modelling – HIROMB at SMHI) and wind waves (SWAN wave model). Raw data are available for some of the sites.

Temporal boundaries

Östergötland County
Temporal boundaries will be set in cooperation with the county administrative board, the municipalities etc. Different types of management plans have different temporal boundaries, e.g. the comprehensive municipality plans should be revised every fourth year.

Puck Bay
Currently there is no spatial management plans in the Puck Bay. The idea of the Maritime Spatial Planning (MSP) is however introduced in the national legislation. Since 2003 there is a legal possibility to create maritime spatial plans, based on article 37a of the Act on Maritime Areas of Poland and Maritime Administration. Within the project PlanCoast, the pilot maritime spatial plan for the Western Gulf of Gdansk (Puck Bay as defined for MESMA framework) was prepared. It is aiming to define different uses of the water surface, water column, sea bottom but also the air. The pilot plan covers the sea part only, although all the terrestrial influences concerning the development of the coastal areas were considered. The plan is supposed to be of a strategic character, but also aims at reflecting the local issues. Its general objective was to contribute to support minimizing the space conflicts in a way that supports the sustainability of the ecosystem and coastal communities development. In particular the pilot plan tries to decide on (1) the use of the sea space, (2) limitations in the use, (3) public investment requirements, (4) objectives for environment and cultural heritage protection. The pilot spatial plan is neither legally binding nor effective and cannot be formally implemented unless approved as a legal act by the Ministry of Infrastructure.

1b) Goals and operational objectives

Östergötland County
Goals and operational objectives are planned to be identified in cooperation with Östergötland County Administrative Board and Norrköping Municipality, and by collating information from management plans for nature reserves, BSPA, comprehensive plans for the other municipalities, sectoral goals for the area etc. There are comprehensive management plans in place for the municipalities of Norrköping and Söderköping, but the current plan for Valdemarsvik is out-of-date.

Puck Bay
The pilot maritime plan as prepared within the PlanCoast project defines neither clear management goals and objectives nor suggests any indicators or benchmarks that would allow to assess its potential implementation. Therefore the MESMA Puck Bay case study will try to breach these gaps. We will focus on the nature protection measures in order to ensure the proper management of biologically fragile and important habitats and species as well as on commercially exploited species. We will also try to facilitate these measures with the GES descriptors – biodiversity, sea floor integrity and food webs. Since the idea of Marine Protected Areas is not present in Polish legal system, we will also investigate this issue and will aim at incorporating it in the maritime spatial planning in the Puck Bay. Stakeholders' participation and governance aspects will be the second major objective to be tackled in the Puck Bay case study. We aim at comparing the top-down and bottom-up management initiatives and deliberate, which of the two approaches is appropriate for the local conditions. Broad public participation is the maritime planning is not required according to the present Polish regulations. However, we assume that human beings are the part of any kind of ecosystem (the Puck Bay in this case) and that they interact directly with the environment through sector activities, governance and management strategies. We will also focus on interactions between the stakeholders (especially the fisheries communities and tourism) and nature

conservation. The proposed study aims at combining the fundamental environmental processes, sectoral system of economic activities and social attitudes, values and descriptions.

3.9.4.2 STEP 2 Existing information collation and mapping in the Baltic Sea case study

3.9.4.2.1 2a) Ecosystem components

Östergötland County

AquaBiota has extensive knowledge of the area and comprehensive datasets covering important ecosystem components in the area. In a project for Östergötland County Administrative Board, AquaBiota has produced distribution maps of blue mussels, 17 species or species groups of algae, and eight species or species groups of vascular plants using spatial modelling (Carlström et al. 2010). In addition to this, a method to identify and delineate preliminary marine areas of biological significance has been developed and maps have been produced for five habitat types of biological significance; blue mussels, bladder wrack, non-filamentous red algae, vascular plants and eelgrass. GIS grids with a spatial resolution of 25*25 m are available for these species and species groups, covering the whole area of Östergötland County.

In addition to the GIS layers on species and species groups, the environmental GIS layers listed below are available. The spatial resolution of the salinity and bottom current grids varies between 50*50 – 500-500 m, the others all have a spatial resolution of 25*25 m.

The available grids are:

- Depth
- Slope
- Aspect
- Sun/bottom angle
- Curvature
- Wave exposure
- Substrate
- Maximum bottom current
- Minimum bottom salinity

Puck Bay

The Puck Bay is unique because of its shallowness, low salinity and the shelter from the open sea. Relatively high biodiversity, underwater meadows, rare and relict coast flora and fauna species characterize this site. Fundamental environmental processes and major ecological components need to be considered to ensure the good environmental status and safe and sustainable use of the sea. The ecosystem description and assessment in this case study will at least identify the following components: (1) physical and chemical parameters of the water column, (2) organisms (benthic assemblages, pelagic assemblages, flat fish, herring, gobiids, diving ducks and swans, species included the European Red List of Threatened Animals and Plants,), (3) habitats (underwater meadows – Zostera marina, Cahrophyceae, Potamogen spp., Ruppia maritime, Zanichellia palustris, sandflats not covered by sea water), (4) goods (integrity of the sand beaches), (5) services (feeding, spawning and nursery areas) and (6) processes (sink-source dynamics).

Geographical information available: GIS maps created: occurrence, distribution and abundance of zoobenthos, phytobenthos, fish communities, birds and sea mammals. Raw data are available for some of the sites.

Missing data: There is a lot of research going on in the Polish part of the Baltic Sea in general and in the Puck Bay in particular. However, despite being generally well studied, the Puck Bay lacks modern and regular monitoring of environmental parameters (automated buoys, cables) and current census of seabirds. The data on entrepreneurs and developers activities are also fragmented and irregular, tourism is practically not monitored or quantified. The investigation on non surface freshwater outflow patterns is in the early stage and the similar issues concern the population census of key macrophytobenthos species. The situation is even more complicated when moving to the open sea. Data availability and quality is significantly reduced there, often based on broad generalisations and/or modelling and therefore insufficient for detailed spatial planning.

3.9.4.2.2 2b) Pressures and impacts

Baltic Sea

In the project HELCOM HOLAS, presented in spring 2010, GIS layers on 52 anthropogenic pressures have been compiled for the HELCOM area (the Baltic and Kattegat Seas). The anthropogenic pressures have been classified according to the list of 18 pressures in Annex III, Table 2 of the Marine Strategy Framework Directive of the European Union. For some pressures, there exist direct measurements, e.g. discharge of radioactive substances. The majority of the pressure data has been derived through data on the human activities which act as drivers of those pressures and thus the human activities function as proxies for the pressures. For example, spatial distribution of smothering has been quantified based on the known disposal sites of dredged material. In addition, the quantification of pressures has been done using different ways: for example harbours have been used as a proxy for the pressure "sealing of sea bed" and the annual total cargo turn-over has been used to scale the pressure. On the other hand, wind farms describe the same pressure in offshore areas, but the number of turbines per assessment unit is the variable to scale the pressure.

Östergötland County

For the BSPA Missjö – S:t Anna, 19 pressures have been identified and their potential impacts on seven natural values have been estimated on a three-grade scale (low/ medium/ high). An overview of the pressures and natural values is given in a table. In the next step, the drivers behind the 19 pressures have been identified. This has also been followed by an analysis of action strategies to counteract the drivers and thereby reduce the risks of negative impact by the pressures. An overview of pressures and natural values in the BSPA St Anna in Östergötland, Sweden, is provided in the Annex to this Case Study.

Puck Bay

Fishery

This includes all areas exploited by the commercial and recreational fishery. Commercial fisheries in the Puck Bay are dominantly small open boats (n=123 in 2006) which operate in the whole case study area, during all four seasons. The major fishing ports are Kuznica and Jastarnia (n>24, in 2005). The Outer Puck Bay is also where the deployment of fixed gear used to catch flounder, salmon, trout, cod, pike and perch is concentrated. Recreational fishery is concentrated at specific points such as shipwrecks, or large rocks. These sites are not available for trawling and the probability of catching large fish there is also higher. It is also piers and harbour infrastructure based activity.

Tourism

Tourist activities are dependent on natural amenities and the marine environment quality. Recreation includes all coastal sea bathing areas, beaches, windsurfing, diving, kite surfing and sports involving small boats. The most common leisure activities in Poland are sunbathing, swimming and spending time on sandy beaches. Yachting is rather expensive and less popular in Poland than in other Baltic countries. Motor boating, windsurfing and diving are easier accessible and are gaining popularity. Underwater tourism is not widely recognized and therefore not much is known on cultural heritage suitable for that purpose. Recreational facilities for high tourist season are usually insufficient and the capacity of the tourist resorts is often significantly exceeded. This creates constantly increasing demand for construction of new marinas, improving existing accommodation and transport infrastructure.

Nature protection

Nature conservation areas in the Puck Bay have been designated by national legislation (Landscape Protection Park), HELCOM (BSPA - Landscape Protection Park and the Kepa Redlowska Reserve) and the EU under the Habitat's and Birds' Directives (NATURA 2000). Officially three habitats (offshore reefs – 1170, large shallows inlets and bays – 1160 and seagrass beds - 1120) listed in the annex exist within the case study area. The natural scientists however recognize the Ryf Mew as the fourth protected habitat - sandflats not covered by sea water (1140). Industrial activities are not banned from the NATURA 2000 areas, but the detailed Environment Impact Assessments need to be prepared prior to commencing such activities. The European Red List of Threatened Animals and Plants includes the following species which are found in the Puck Bay: harbour porpoise, ringed seal, *Alosa fallax*, *Alosa alosa*, *Petromyzon marinus*. Species conservation comprises all Baltic mammals, several fish species and nearly all birds occurring permanently or periodically in the area in question. Sea birds are also the resource of most social concern and recognition (charismatic species) and the one that is assigned the largest protection area.

Other uses
Technical uses are of less importance in the Puck Bay. Dumping sites, pipelines and their buffer zones, navigation routes and potential wind farm locations are all present in the case study area. They do not constitute overlapping interests at the moment, but as the human expansion towards the sea space is increasing they might be expected in the future. Limited parts of the Puck Bay are military areas. They might be closed temporarily for exercises, but these closures are rare, announced long before the exercises and therefore so far non-conflicting.

Existing and potential conflicts
The major conflict for space is between the conservation issues and fishery which operates in 100% of protected areas in the Puck Bay. The major obstacles for tourism are again the nature protection and fishery. The least competition for space comes from navigation and infrastructure. The latter one might be even positively linked with recreation – marinas, piers and similar facilities.

Internal conflicts can also arise within the field of conservation. The protection of some species, primarily large carnivores, is contradictory to the protection of other valuable species (e.g. seals vs. salmon or reintroduced sturgeon). It is also the case that the NATURA 2000 sites in Poland have been erected on the sea without sufficient information on what is protected, where, when and why. This issue is less reflected in the Puck Bay as it is one of the most valuable parts of the Polish Marine Areas. It might still be risen when the level of space competition increases. Nevertheless it creates difficulties for spatial planning and for defining without further investigations which human activities should be limited or restricted and during what part of the year.

Fishery is the main competitor with nature protection areas in the Polish part of the Baltic Sea, including the Puck Bay and is one of the major threats to sea birds and mammals. It is estimated that some 17 000 birds die in fishing nets every year in the Gulf of Gdansk alone. Although sea mammals do not have the local populations in the Puck Bay and only occur there sporadically, they are supported by the public concern causing difficulties to fishing activities that are therefore limited by introducing the stricter conservation measures. These can include bans on certain types of gear and requirements for instrumentation to deter these animals. Recreational fishery can be identified as new important competitor. At present, the conflict between recreational and commercial fisheries is not visible as the same communities are involved in both sub-sectors. That will of course be a subject for the change in the long term. According to many studies, over-fishing not only causes serious problems for the sustainable population growth, but in the long run will also deprive fishermen of their economic bases. As a result catching efforts may be intensified to compensate for decreasing resources.

The Puck Bay is the largest water recreation centre in the Southern Baltic and is the key Polish site for windsurfing. Nature protection is in intense competition with recreation in terms of space but also in terms of time. There are indications that the public wants free access to places it regards as attractive. These sites are usually important for animal protection. The Ryf Mew, the offshore sandbar, is such a site in the Puck Bay. It should also be noticed that the subjective value of any environmental system is affected by individual preferences and the so called social experience. The ecosystem in a pristine state might thus be given less value than a changed or transformed system simply because it might meet better the personal imaginations and personal needs, be they economical, spiritual, cultural, religious or aesthetic. This is the case of the Puck Bay where underwater vegetation is viewed as a nuisance. The iconic characteristic of the beach is therefore more valued than its natural state. The most important period for sea bird protection is winter, so there is no direct conflict with the tourist activities which are concentrated in the summer months. The concentration in summer season results in strong pressures not only on sandy beaches, but also on the nearby coastal land. Traffic jams and road congestions are typical problems for land areas around the Puck Bay as well the lack of parking space and alternative public transportations. Constant demands for the transport infrastructure development is followed by the need for new marinas, hotels and other tourists facilities often in ecologically valuable locations. That also includes bars and restaurants on the beach itself or in the immediate vicinity of the coast. The visitors also expect the beach to get widened and the beach access to be improved, but the exploitation of sand is the direct threat to the bottom habitats, especially the underwater meadows. To meet these demands, sand is widely used for stabilisation and renovation of camping beaches and for the beach nourishment. The whole range of tourist-related activities affect the natural beach-sea ecosystem and that (1) can result in degradation of natural and cultural landscapes, (2) will influence the beach fauna, (3) litter left by tourists

is a factor of increasing importance, (4) urban planning order might be put under different kinds of pressures.

Conservation areas may require that natural coastal processes should be unchanged and free of human intervention. Coastal protection can not only disrupt coastal dynamics (currents and sediment transports), but also change the coastal landscape and cultural values associated with it. The Hel Peninsula is threatened with flooding and overflows during storm surges and the demand for coastal protection strategy appears. As identified above the need of beach replenishment is one of the major reasons for sand extraction, but can impose the turbidity effect. In the near future this conflict may be strengthened due to climate change and related sea level rise.

The development of technical installations introduces new factors of environmental stress. Mechanical pressures, thermal barriers, acoustic pollution (noise), magnetic and electrical fields directly affect different species and their spawning grounds, can lead to habitat fragmentation and therefore can obstruct the migrations of fish, birds and mammals. No precise data is however available for the Puck Bay. New threats are also posed by terrestrial activities and can include pharmaceutical wastes from discharge waters, extensive salt discharge from the ongoing construction of salt caverns or emissions of contaminants to atmosphere and waters.

Aquaculture is not an issue in the Puck Bay as well as in the whole Polish Marine Areas. There are no operating installations and only a few experimental research activities are undertaken. Polish coastal waters are characterized by low salinity, seasonality and large exposed areas and therefore sea farming will unlikely become an important sector in terms of sea space competition.

Underwater cultural heritage (wrecks, settlement structures) has not been sufficiently evidenced, yet. Presence of historical heritage will have to be examined when preparing the investment plans and the Environmental Impact Assessment for the new constructions and will probably result in the investment costs increase.

3.9.4.2.3 2c) Current management measures

Östergötland County

Existing management measures will be identified in cooperation with the county administrative board and/or municipalities. Management measures differ between subareas within the county (e.g. different municipality plans). Management measurements also depend largely on national and European/international policy frameworks. The coastal area of Östergötland is pointed out as an area of national interest for recreation and nature conservation. There are also smaller areas of national interest for fisheries and energy production in Östergötland. Depending on area, management measures may range from no-entry areas to detailed active management of specific subareas. There are specific management measures for Natura-2000 areas and nature reserves and management measures are proposed for the BSPA-area Missjö-S:t Anna. For the BSPA area an adaptive management approach following the so called “Open Standard” workflow has been chosen. An overview of the Open Standard workflow is presented in Figure 25. More information is available at www.conservationmeasures.org.

Figure 25. The Open Standard workflow.

Puck Bay

Although, the Puck Bay is not currently the spatially managed area, the Act on Maritime Areas of Poland and Maritime Administration incorporates maritime spatial planning in the governance and legislation system. The Act regulates planning of the sea space, but its stipulations are very general. It is not even clearly defined whether maritime spatial plans are more of legally binding or indicative (strategic) character. This constitutes serious drawbacks in both the existing law and its possible implementation.

According to the Act, the spatial plan should determine (1) sea areas different uses and their limitations, (2) public investments distribution, (3) directions of transport and technical infrastructure development and (4) protection of environment and cultural heritage. Although no formal requirements exist, the planning process would advantage if other relevant policies (e.g. energy transportation or environmental) are taken into consideration.

Director of the territorially competent maritime office is responsible for maritime spatial plans preparation. The plans should cover the sea area only, have no extension to the land and include the forecast of the expected environmental impacts. It is either the state budget or the investor that bears the plan preparation costs. The plan can only become binding and effective when formally accepted by the Minister responsible for construction, spatial order and housing (currently the Minister of Infrastructure) in collaboration with the ministers responsible for maritime economy, agriculture, environment, internal affairs and with the Minister of National Defence. This cross-sectoral coordination on the central level is the only formally required as public participation is not recognized as essential. Coordination with coastal municipalities is required, if the plan concerns the territorial and/or the internal waters. However, when developing their terrestrial counterparts, maritime spatial plans are not the subject of similar consultation.

The Minister of Infrastructure should also decide on the scope of spatial development plans for internal waters, territorial sea and the Polish Exclusive Economic Zone. The scope should in particular determine

the requirements concerning the planning materials, type of cartographic elaborations, nomenclature, documentation standards and methods. These regulations are currently missing in the country legal system and therefore there is no possibility to issue legally binding maritime spatial plan.

The integrated sea-use planning and management is also undermined by the overlapping competences of different Ministers. For example the NATURA 2000 areas are designed by the Ministry of the Environment and military areas can be designated by the Polish navy. However, in the present situation it might be as well considered as an advantage for the nature conservation measures.

The key drawbacks of the Act on Maritime Areas of Poland and Maritime Administration include (1) lack of detailed objectives and principles or marine spatial planning, (2) lack of distinctions between plans for different types of Polish marine waters, (3) lack of structure and hierarchy of the maritime plans and (4) lack of formally supported stakeholders participations. It should also be emphasized that Polish law neither provides any obligations for monitoring or reviewing the maritime spatial plans nor specific procedures for international collaboration and coordination.

Stakeholders
It is essential for the MESMA framework to identify stakeholders from the different sectors. Initially the stakeholders at the national (and regional) level can be divided into six major groups all present in the Puck Bay case study. They are: (1) local, regional or central authorities (including maritime administration and other managing bodies), (2) sectoral unions and associations (e.g. fishermen, tourists or coastal municipal associations), (3) environmental and conservation organizations (NGOs), (4) scientific community (universities and research institutions), (5) industry and (6) general public, particularly tourists.

A lot of international organizations and networks are active in the Baltic Sea region. They collaborate on different levels and cover different areas of interests may they be economic, environmental, scientific or governmental. Some (like HELCOM or ICES) are quite influential, other are of less importance. In the Puck Bay MESMA case study, we will also investigate these associations in terms of how important and helpful they are (or might be) with regard to environmental measure in spatial planning.

3.9.4.3 STEP 3 Indicators and benchmarks in the Baltic Sea case study

General indicators

Östergötland County
Examples of general indicators that can be used for the Östergötland County are:

- MSFD indicators
- BSPI (Baltic Sea Pressure Index) indicators
- DEDUCE (Sustainable Development of European Coastal Zones) indicators

BSPI indicators: HELCOM HOLAS has estimated the cumulative pressure using the Baltic Sea Pressure Index (BSPI), as well as the impact of these pressures on the ecosystem using the Baltic Sea Impact Index (BSII). The methods have been developed using the method described in a paper by Halpern et al. (2008) as a starting point. Both approaches should be seen as first steps towards a better understanding of the magnitude and spatial distribution of anthropogenic pressures in marine environment at a Baltic Sea wide scale. BSPI and BSII have been quantified for 5×5 km2 areas over the whole Baltic Sea marine and coastal area. Altogether the area contains 19,276 assessment units. This unit size is small enough to reveal coastal point sources and impacts of cities and other point sources. Moreover, it is small enough to avoid false signs of impacts in areas where pressures and biotopes should not meet.

Area specific indicators are available from management plans of e.g. nature reserves and the BSPA Missjö – S:t Anna. For the BSPA specific indicators have been identified for each of the following seven natural or cultural “values” that have been identified in the area:

- Marine mammals and birds
- Beach- and sea cliff environments
- Shallow marine environments <6 m
- Deep marine environments >6 m
- Cultural landscape

- Forest
- Fish

Examples of indicators for Shallow marine environments are: bladder wrack, eelgrass, bottom fauna index, cover of blue mussels, sedimentation, red algae, toxic substances in mussels, water quality and water transparency.

Puck Bay
No clear operational goals and objectives are defined for the Puck Bay and therefore no indicators for testing are available. Their definition will be one of the most important goals of MESMA framework application in the Puck Bay. We will focus on marine environmental measures and will aim at developing environmental indicators that could help to address the ecosystem health and sustainability issues in spatial planning. Lack of data and possibility to establish reasonably easy assessment system will also be a key factor within this study. We will analyze the list of already existing indicators (e.g. BSPI, MSFD indicators or these in the DEDUCE project) and will follow to develop the MESMA WP 2 guidelines on selection of indicators and benchmarks, including the areas where no reference values are available.

3.9.4.4 STEP 4 Risk analysis

Östergötland County
A risk analysis will be conducted for selected indicators (identified in previous section).

3.9.4.5 STEP 5 Assessment of findings against operational objectives in the Baltic Sea case study

Östergötland County
In the BSPA Missjö- S:t Anna, a general assessment is currently being carried out to evaluate how the suggested management affects of the values, threats and resources of the area i relation to defined objectives. Although necessary financial and personnel resources to fulfil the proposed management actions are not currently available, the County Administrative Board presume that these will be available and the objectives will be met. The reason to this is that the area has high conservation values, both as a BSPA area and, among others, classified as an area of national interest for nature conservation. The County Administrative Board assess that measurable results will have been obtained within five years and all proposed actions within the program completed within 10-15 years.

For the remaining of the Östergötland County, an assessment of findings against operational objectives will be carried out at county or municipality level. The tasks include e.g. assessment of the level of success, identification of gaps where objectives are not met, and assessment of indicators/performance measures.

3.9.4.6 STEP 6 Management effectiveness in the Baltic Sea case study

Östergötland County
Management effectiveness will be evaluated at county and/or municipality level. Examples of issues to evaluate are:

- Success of reaching conservation goals
- Success of handling conflicts
- Stakeholder happiness/involvement
- Monitoring procedures

3.9.4.7 STEP 7 Recommended adaptations of management in the Baltic Sea case study

In order to recommend adaptations of spatial management Marxan analyses will be performed. Marxan is a tool that is used for designing new reserve systems, reporting on the performance of existing reserve

systems and for developing multiple-use zoning plans for natural resource management. Marxan is also a useful tool for identification of areas that meet targets for biodiversity features for minimal cost as well as for identification of tradeoffs between conservation and socio-economic objectives.

3.9.4.8 STEPS 4 to 7 for Puck bay

remarks for further steps

The MESMA framework further steps (4 to 7) require the selection of operational objectives and indicators. The scope of the Puck Bay case study has been introduced in the previous sections. Since the other Baltic Sea case study subarea (Östergötland County) is more advanced in terms of management measures, we will compare the situations in these two areas and will try to assess the reasons behind.

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5 Annexes

5.1 Annex to Southern North Sea Case Study

Case study leaders: Christine Rockmann and Robbert Jak

This annex provides details for the subcase study areas within the Southern North Sea case study that have been defined for in depth analyses.

5.1.1 Belgian Part of the North Sea

Coordination: Kris Hostens

5.1.1.1 Introduction

The Belgian part of the North Sea (BPNS) is a shallow coastal area including various types of valuable habitats and being intensely used for several human activities, including shipping, fisheries and the production of wind energy. The increase demand for space for the construction of wind mills, potentially conflicts with other existing activities (e.g. fisheries and shipping), the designation of nature conservation areas (Natura 2000) and/or environmental standards.

5.1.1.2 Study area

The Belgian part of the North Sea (BPNS) has a coastline of about 65 km and extends about 87 km offshore from the coast. Despite its small size (only 3600 km²), the BPNS is characterized by several valuable habitats, partly related to the presence of a complex system of sandbanks. This almost unique sandbank area stretches out from Zeeland to Calais. Such an area is otherwise only found in the southeast of England (Maes *et al*., 2005a).

In the GAUFRE project (Towards a Spatial Structure Plan for Sustainable management of the Sea), a first attempt is made to produce an optimal spatial planning on the BPNS. The first section in that report (Maes *et al*., 2005b) gives a detailed description of the legal, geophysical and ecological zonation and the infrastructure on the BPNS.

Figure 26 shows a map of the BPNS with indication of both the allocated areas for different human activities and the allocated MPAs (from Maes *et al*., 2005b). Note that the windmill turbine concessions on the map are not up to date. Also, the recently advertised Natura 2000 area is not shown on the map.

The boundaries of the BPNS with France, the Netherlands and the UK were established in several treaties (See Vlimar gazetteer on the VLIZ website for more information).

5.1.1.3 Current management

Douvere *et al*. (2007) discuss the marine spatial planning in the BPNS. Generally it can be stated that there is no real spatial management plan in place. Nevertheless, there is a spatial approach to sea use management despite the lack of a legal zoning framework. All spatial management approaches are in principal made on a more sectoral basis.

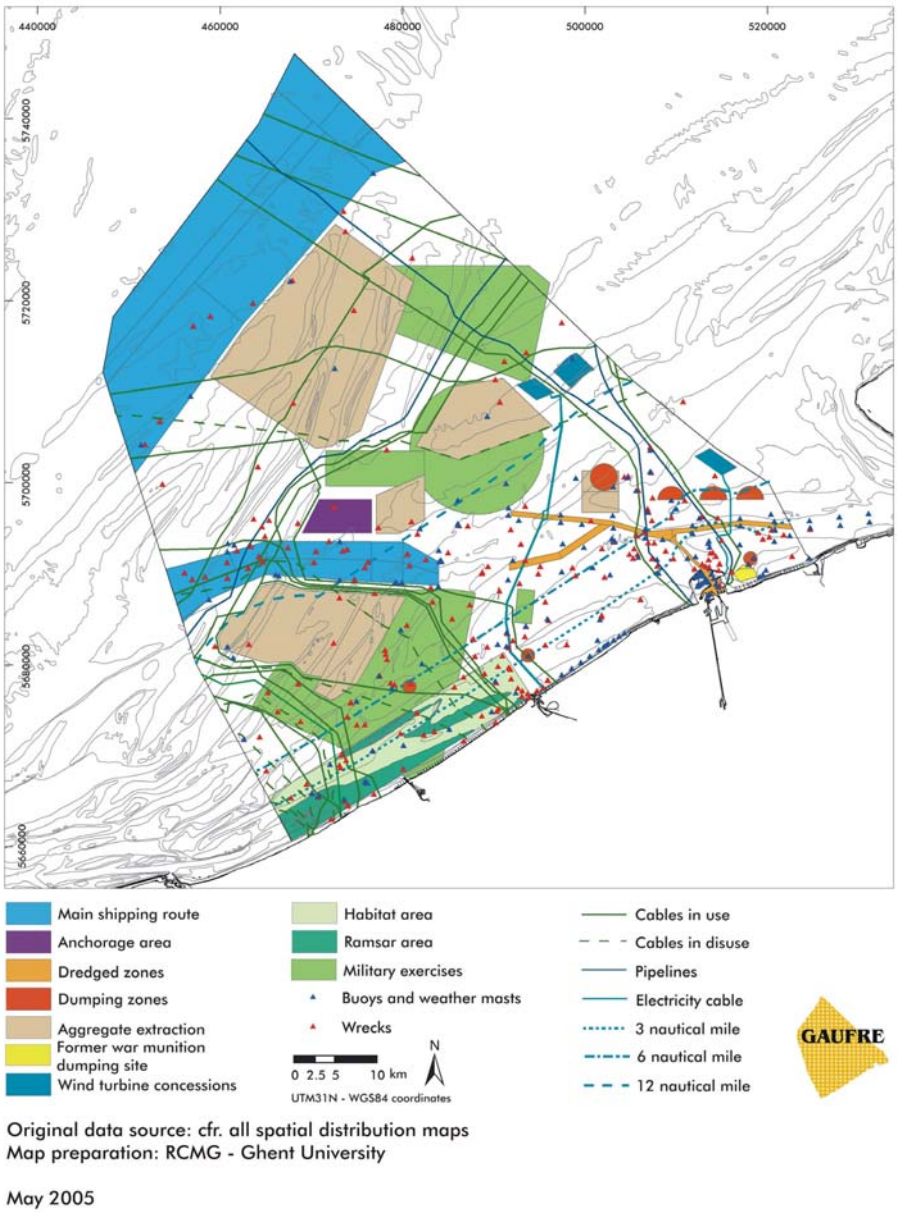

Figure 26. The Belgian Part of the North Sea and the distribution of human activities and Marine Protected areas.

5.1.1.4 Relevant aspects for testing the MESMA frame work

The Mesma framework is described above and presented in Figure 2.

5.1.1.4.1 1a. Set temporal and spatial boundaries for SMA assessment

The BPNS extends to about 87 km from the present- day coastline (65 km long), covering an area of about 3600 km². The sea-floor topography is characterized by the presence of sandbanks and swales. In the swales, water depths can reach 30-40 m MLLWS (level of mean lowest low water at spring tide), whereas in the near shore area minimal depths of less than 5m occur. The sandbanks can be tens of kilometers long, one to several km wide, and up to 20m high (Mathys, 2009).

5.1.1.4.2 1b. Define goals and operational objectives for SMA

High level goal: sustainable management of human activities at sea:

- Offshore wind energy defined area 200 m² → reach an installed capacity of 2000 MW. This is important in the context of our European targets for 2010 and 2020.
- A policy plan for sustainable gravel and sand extraction.
- Sustainable management of fish stocks through EC concept of maximum sustainable yield.

High level goal: protection and preservation of marine biodiversity

- Delimitation of Natura 2000 sites in the Exclusive Economic Zone (EEZ)
- Development of conservation objectives for the Natura 2000 sites

5.1.1.4.3 2a.Identify ecosystem components

The following habitattypes can be identified on the BPNS:

- A5.13 Infralittoral coarse sediment (more specified: A5.134 *Hesionura elongata* and *Microphthalmus similis* with other interstitial polychaetes in infralittoral mobile coarse sand)
- A5.14 Circalittoral coarse sediment (more specified: A5.145 *Branchiostoma lanceolatum* in circalittoral coarse sand with shell gravel)
- A5.23 Infralittoral fine sand (more specified: A5.231 infralittoral mobile clean sand with sparse fauna)
- A5.24 Infralittoral muddy sand (more specified A5.241 *Echinocardium cordatum* and *Ensis spp*. In lower shore and shallow subtlittoral slightly muddy fine sand and 5.244 *Spisula subtruncata* and *Nephtys hombergii* in shallow muddy sand)
- A5.33 Infralittoral sandy mud (more specified: A5.331 *Nephtys hombergii* and *Macoma balthica* in infralittoral sandy mud and A5.333 *Mysella bidentata* and *Abra spp* in infralittoral sandy mud)
- Sublittoral polychaete worm reefs on sediment.

5.1.1.4.4 2b. Identify pressures and impacts

Criteria	Fisheries	Oil/gas	Shipping	Wind farms	Sand mining	Gravel extraction	Tourism	Aquaculture	Pipelines	Cables
Fisheries										
Oil/gas	0									
Shipping	x	0								
Wind farms	xxx	0	x							
Sand extraction	xx	0	0	x						
Gravel extraction	0	0	x	0	0					
Tourism	0	0	x	x	x	0				
Aquaculture	xx	0	0	x	x	0	x			
Pipelines	xx	0		x	x	0	0	x		

In order to test the framework we will focus on 4 main factors and their mutual relationships: fisheries, sand extraction, wind farms and conservation.

5.1.1.4.4.1 Sand extraction

The following data is available:

- Sediment grain size distribution
- Geomorphology (multi-beam)
- Geology (cf. PhD Mieke Mathys)
- Macro- and epibenthos (and also meiobenthos) and fish data (De Backer *et al*., 2010; Vanaverbeke et al., 2007)
- Impact of aggregate extraction on a pan-european level (European proje*ct MA*GGNET; several annual reports and Cooperative *Resear*ch reports of the ICES WGEXT expert group)

5.1.1.4.4.2 Windmills

- Baseline studies (Degraer & Brabant, 2009)
- Early impact assessment: (Degraer *et al.*, 2010)
- hydro-geomorphology
- underwater noise
- effects of hard substratum on soft bottom macrofauna/fish
- Windspeed (a European project on offshore wind energy focusing on finding sound sites for wind farms at the North Sea)

5.1.1.4.4.3 Fisheries

Generally it can be stated that there are no sound data available on the fishing effort on the BPNS. Basic VMS data are available, but only for the Belgian vessels. There is a continuous effort to get data from other flag ship vessels fishing on the BPNS.

ICES provides data per data quadrant (i.e. the southern part of the North Sea), hence no detailed information for the BPNS.

Data on landings from Belgian fishing vessels are available, but most of these catches do not originate from the BPNS.

Besides that, some indirect data on fishing activity (but without data on catch size) are available from INBO and Dienst zeevisserij (counting fishing vessels while monitoring sea birds and during vessel control monitoring by plane). These data were analysed in Depestele *et al.* (2008), and can be used as proxy for fishing effort on the BPNS.

5.1.1.4.5 2c. Identify existing management measures

5.1.1.4.5.1 Sand extraction

In Belgium, sand and gravel exploitation at sea started in 1976 (29.000 m^3). Over the past few years, the exploitation increased and now the total amount fluctuate around 1.800.000 m^3 a year (www.mumm.ac.be and ICES, 2009)

Till 2008, extraction activities on the BPNS were mainly concentrated on the Kwintebank, due to the presence of suitable sand and its close location to the harbor. In 2000, the formation of a depresson in the central Kwintebank was observed while investigating the bathymetric and the morphological evolution of the Kwintebank. Since federal legislation prohibits further exploitation when deepening of >5 m occurs with respect to the most recent hydrographical charts, this area had to be closed for extraction activities in February 2003. Until 2004 extraction was allowed in two areas on the BPNS. A new Royal Decree (RD) of September 2004 described new conditions, geographic limits and procedures for granting licenses for the extraction of sand on the BPNS. In this Royal decree, 3 sand extraction zones were defined. From 2008 onwards sand extraction was more spread with the major part extracted on the Buitenratel and the Thorntonbank (De Backer *et al*., 2010).

More information can also be found in chapter 3, section 6 of the GAUFRE report (Maes *et al.*, 2005b).

Possible conflicts between sand extraction and fisheries, windmill parks, electricity cables,…

Conflicts in the past: With the allocation of an area for the windmill parks there was an overlap with a sand extraction area. As a solution a new area was allocated as sand extraction zone. However, this area possibly contains a greater biodiversity. (which may cause a conflict with conservation).

5.1.1.4.5.2 Windmills

The European directive 2001/77/EG imposes upon each member state a target contribution figure for the production of electricity from renewable energy sources that should be achieved in 2010. For Belgium, this target figure is 6% of the total energy consumption. In January 2008, the European Commission launched its new Climate Plan, and a new target for Belgium was set at 13% by 2020. Since the Royal Decree of 17 May 2004 assigned a zone for the production of electricity in the BPNS, three companies, C-Power (Thorntonbank: 60 turbines, 330 MW), Belwind (Blighbank: 110 turbines, 330 MW) and Eldepasco (Bank zonder Naam: 36 turbines, 180-252 MW), were granted a domain concession and an environmental permit to build and exploit an offshore wind farm. In 2010, three other companies, Norther, Rentel and Seastar, obtained a concession, but still have to apply for an environmental permit. Both C-power and Belwind already started the installation of an offshore wind farm.

Building windfarms has an impact(both positive and negative) on other users like tourism, shipping, fishing , sand extraction,… (Degraer & Brabant, 2009; Degraer *et al*., 2010).

5.1.1.4.5.3 Fisheries

Fisheries at sea are a Flemish competence, with the exception of issuing and controlling technical standards related to the vessels and manning. The latter is a federal competence.

Belgian marine fisheries policy and management come under the umbrella of the Common Fisheries Policy (CFP) of the EC. Management is based on regulating the quantities of fish caught, through a system of Total Allowable Catches (TACs).
For the Belgian territorial sea, the access is limited depending the origin of the vessel, the power and the size of the vessel. This regulation belongs to national legislation.

At the beginning of 2010, the Belgian fishing fleet consisted of 89 motorized vessels, with a total power of 51590 kW and a gross registered tonnage of 16048 GT. The main fishing grounds of the Belgian fleet are the southern and central North Sea. Other important fishing grounds are the English Channel, the Celtic Sea and the Irish Sea. Beam trawling for flatfish is the dominant activity in the Belgian fisheries fleet (lv.vlaanderen.be).

Not only the Belgian fleet but also vessels from neighboring countries fish at the BPNS.

5.1.1.4.5.4 Conservation

In Belgium, the designation and management of Natura 2000 in the marine environment belong to the competences of the federal government. Within the framework of the Natura2000 network, a royal decree of 2005 designated three areas for the protection of certain bird species and two areas for the protection of certain habitat types. These habitat types were “Sandbanks which are slightly covered by sea water all the time” (Natura 2000 habitat type code 1110) and “reefs” (Natura 2000 habitat type code 1170). The EC urged Belgium to really focus on the shallow sandbanks when delineating Natura2000 areas since these areas are quite unique in European waters.

The protection of the sites include some limited prohibitions of certain activities, a procedure for an appropriate assessment for plans and projects, the making of a policy plan and the use of voluntary user agreements with stakeholders. Several measures cannot be restricted under the federal legislation (Cliquet & Decleer, 2009).

The five selected zones of the Natura2000 network cover a considerable surface. This causes conflicts with almost all users. Throughout the whole process, stakeholder participation is considered as an essential ingredient for defining and successfully managing protected areas in the BPNS.(Douvere *et al*.,2007)

Wind farms can possibly serve as “refugium” for fish or for aquaculture (mutual effect conservation-windmills)

The next steps of the framework will be described depending on the guidelines of the framework.

5.1.1.5 Data

The Flanders Marine Institute (VLIZ) is the coordination and information platform for marine scientific research in Flanders (and Belgium). All available data can be requested and will be consulted after approval from the respective scientific research institutes who own the data. Many of these data sets are already geo-referenced and many data have already been reworked into GIS-layers.

Also the MUMM with its Belgian Marine Data Centre (BMDC) possesses most chemical and partly biological data from Belgian research undertaken with the RV. Belgica.

Most basic GIS-layers, like delineations of areas, are already made available by VLIZ (cf VLIMAR gazetteer) and MUMM.

5.1.1.6 Governance

Besides the international obligations, the Belgian North Sea policy is divided over several institutional levels with the federal level and the regional level (Flemish Region) as the most relevant. In this regard, the federal government has authority over environmental policy and protection of the marine environment, wind farms at sea, shipping, military activities, aggregate extraction, cables and pipelines. The Flemish Region is responsible for policy areas such as nature policy on the beach and the hinterland, recreation, ports, fishing, dredging, piloting and coastal defense (Rabaut *et al.*, 2009).

Several Belgian marine institutes have experience with specific surveys (ILVO, Marine Institute, VLIZ) and there is a close collaboration between the institutes, the sectors and the governance.

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5.1.2 Spatial management of fisheries in harbour porpoise (*Phocoena phocoena*) protected Natura 2000 site in the Danish Skagerrak

Coordination: Thomas Kirk Sørensen

5.1.2.1 Introduction

Harbour porpoises and fisheries interact in several ways including, bycatch, food depletion and noise pollution caused by sonar and vessel engines. It is therefore very likely that temporal and spatial overlaps between fisheries and porpoises will result in management conflicts, especially within porpoise hotspot areas such as the Natura2000 area in the Danish part of the Skagerrak. Many Natura 2000 sites represent fishing grounds with high economic value, and as a consequence authorities face great challenges in relation to the development of management plans for such sites.

The Skagerrak sub-case study will investigate to what extent maritime activities, with a focus on fisheries bycatch and (to a lesser degree) noise, threaten the status of harbour porpoise populations within and around a Natura 2000 site in the Danish part of the Skagerrak and consider which management measures are necessary and feasible in order to reduce impacts of fisheries on porpoise populations and ensure the favourable conservation status of the Natura 2000 site.

The sub-case study will analyze governance conflicts that apply to the management of harbour porpoises and fisheries in general and within Natura 2000 sites in particular, i.e. with a focus on national and international laws, policies, and obligations.

The combination of an on the ground study of particular harbour porpoise Natura 2000 sites in connection with analyses of underlying governance issues will provide concrete and overarching recommendations for feasible and effective management of harbour porpoises in relation to fisheries in general and within Natura 2000 protected areas in particular.

5.1.2.2 Study area

The study area is centered in the Danish part of the Skagerrak Sea, which is a transition zone between the North Sea and the Kattegat Sea and other inner Danish waters. The area of interest in the sub-case is a large Natura 2000 site on the northern tip of Denmark. The site is designated to protect especially harbour porpoises, although sandbanks are also included as a habitat to be protected. The Natura 2000 site is approximately 117 km^2 (268.500 ha) in size environment consists mainly of sandbanks (see figure 27 below).

The sub-case study will also focus on general interactions between fisheries and harbour porpoises. Since the North Sea population of porpoises moves over great distances, and since many of the governance

aspects are relevant and can be applied to other sites, the distribution of the North sea harbour porpoise population will be used as a second boundary in the study.

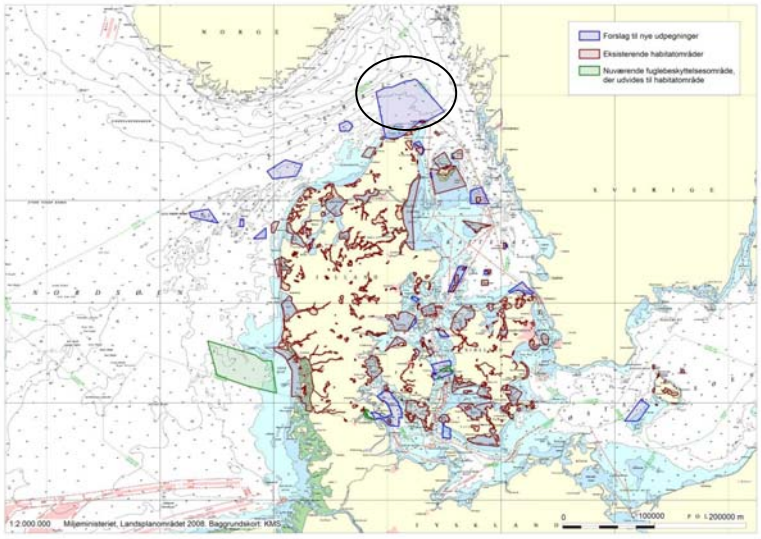

Figure 27 Maps of study area in the Skagerrak Sea

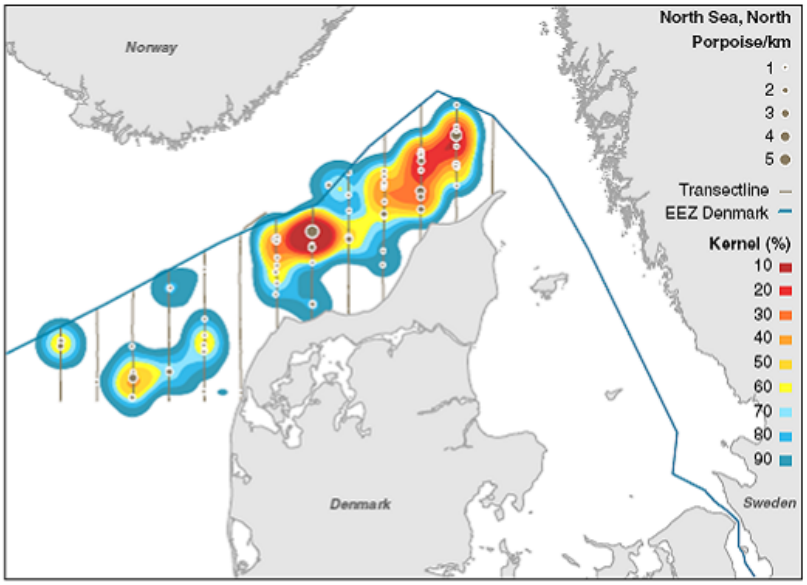

Figure 28. Kernel density map of harbour porpoises based on 3 aerial surveys conducted in Skagerrak/ northern North Sea in 2006-2007 covering the summer and fall from August to October. Observations and track-lines as well as the national border are shown (NERI Technical Report No. 657, 2008)

5.1.2.3 Current management

Harbour porpoises in Danish waters are currently managed under the Habitats directive. As the harbour porpoise has been classified as an Annex II and Annex IV species, management must achieve or maintain a favorable conservation status not only within designated Natura 2000 sites but also in all waters where the species occurs. Specific management plans have not yet been developed for the Skagerrak or other Danish Natura 2000 sites, although the obligation of environmental impact analyses for plans and projects within Natura 2000 sites is in place.

In relation to conservation of harbour porpoises, the fishery is also regulated by the EU council regulation 812/2004 , which demands the use of acoustic deterrent devices (so called *pingers*) on gillnets with mesh sizes larger than 220mm and any gillnets with a total length that does not exceeds 400 metres. Monitoring of bycatch of marine mammals is also an obligation in relation to gillnetters larger than 15m.

The Marine Strategy Framework Directive (MSFD) aims to achieve good environmental status (GES) for EU waters by 2020. 11 descriptors of GES have been developed, a number of which are directly relevant for harbour porpoise management, e.g. descriptors relating to marine noise, food webs and biodiversity.

5.1.2.4 Relevant aspects for testing the MESMA frame work

The Mesma framework is described above and presented in Figure 2.

1a. The spatial boundaries of the SMA (Natura2000 site) is well defined.

1b. The Goal of the SMA is to achieve or maintain the harbour porpoise at a favourable conservation status. In parallel there are goals and objectives in connection with the Common Fisheries Policy, the MSFD, the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS) under the auspices of the Convention on Migratory Species (CMS or Bonn Convention) and other overarching policies and conventions.

2a. Ecosystem considerations include mainly the overfishing of prey species (food availability)

2b. Fisheries and noise as well as disturbance through the physical presence of fishing activity.

2c. Habitats directive, Regulation 812/2004, MSFD, CFP and others

3. In relation to the Habitats directive favourable conservation status is the only stated benchmark. In relation to e.g. ASCOBANS the aim is to reduce bycatch to levels not exceeding 1.7% of the population. Indicators and benchmarks will be elaborated within sub-case study work.

4. The effects of gillnet fishery, other fisheries, noise and other impacts will be described and elaborated within case study work.

5. To be determined.

6. To be defined and described within sub-case work as a main output.

7. To be defined and described within sub-case work as a main output on the basis of 1-6.

5.1.2.5 Data

In order to determine potential conflict areas between porpoises and fisheries within the Natura 2000 site national VMS data (vessels >15m), log books, fishing area statements (vessels <15m), and high resolution GPS and highly unique video data from video monitored gillnetters will be used. The porpoise data will be collected from satellite tagged porpoises and international surveys. These data can together be analysed in order to reveal overlapping spatial patterns and hereby indicate potential interactions and conflicts between porpoises and fisheries with this Natura 2000 area.

A limited portion of the *raw* data which will be used is restricted and will only be available for DTU Aqua, although published maps and other data will be available in MESMA.

Data used in the sub-case will include harbour porpoise satellite data, Scans 1+2 aerial observation surveys, fishing vessel video monitoring data, vessel monitoring system (VMS) data, fish landings data, shipping traffic data, seismic data and data for other relevant maritime activities.

5.1.2.6 Governance

Within MESMA the sub-case will focus heavily on governance, in particular in relation to the interaction between the harbour porpoises and the fishery: Fisheries have large numbers of incidentally bycaught porpoises every year and effective, feasible solutions must therefore be developed to reduce these bycatch numbers in order to allow for coexistence of fisheries and harbour porpoises within and around Natura 2000 sites. On a related note, while acoustic deterrents are proposed as one solution to prevent bycatch of marine mammals, the work will analyse the conflicts that noise pollution from such pingers may create, i.e. creating new management conflicts that contradict the objectives of marine protected area establishment. Interactions between fisheries and harbour porpoises are already a highly prioritized

governance issue both within the EU and on national level through the Council regulation 812/2004, the Habitats directive and the MSFD.

Although gillnet fisheries are considered to be a low-impact, selective fishery, i.e. having a green image among markets and stakeholders, bycatch of marine mammals and birds is a serious issue that contradicts this image. In light of the many positive aspects of gillnets it is of societal and environmental importance that the detrimental effects of the fishery are reduced or eliminated so gillnetting remains a viable alternative to higher-impact fisheries.

5.1.2.7 Stakeholders

The main stakeholder in the sub-case is the fishery operating within and around the Natura 2000 site since the fishery is responsible for the bycatch incidents and because the sector will be directly affected by management plans implemented for harbour porpoises as an Annex IV species and for the Nature 2000 site.

Within the project “Fully documented fishery on small gillnets” (currently run by DTU Aqua), fishermen in the area are already involved in e.g. data collection via video monitoring of fishing activity and catches (including bycatch), i.e. participation that will increase the knowledge related to impacts which will feed directly into future management planning.

5.1.2.8 End user committee

An end user committee will be established for the sub-case study which will include representatives from government and non-government stakeholders. Participants are to be determined as sub-case study develops.

5.1.3 Governance and spatial management of the Dogger Bank

Coordination: David Goldsborough

5.1.3.1 Introduction

The Dogger Bank is in many respects an interesting marine area. This permanently submerged sandbank is situated in the Exclusive Economic Zones (EEZs) of four North Sea countries: The United Kingdom, The Netherlands, Germany and Denmark, see figure 29. Historically the Dogger Bank is known for its rich fishing grounds and as a result the Dogger Bank is well known. As a submerged sandbank the Dogger Bank potentially qualifies as a special area of conservation (SAC), i.e. a Marine Protected Area (MPA) under the Habitats Directive, and this has led to many discussions on the status of the Dogger Bank in the four involved countries in the past decade. The current status of the Dogger Bank is that it is: a German Natura 2000 site, a Dutch proposed Natura 2000 site, Denmark has not assigned a specific status to the area and the UK is in the final stages of a consultation on the Dogger Bank possible Special Area of Conservation (pSAC). This consultation is on the scientific selection of the Dogger Bank SAC and its associated impact assessment. This in combination with the EU push for an Integrated Maritime Policy, specifically with the implementation of the Marine Strategy Framework Directive (MSFD), leads to a whole new playing field regarding governance and spatial management of the Dogger Bank.

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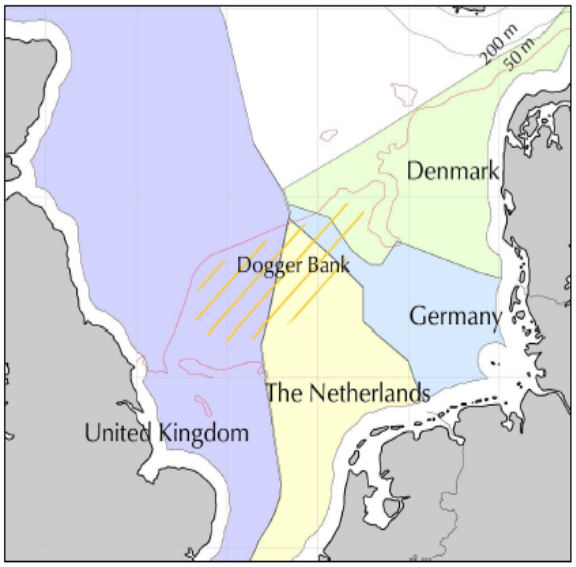

Figure 29. Map of the North Sea showing the general location of the Dogger Bank and the boundaries of the Exclusive Economic Zones (EEZs) of Denmark, Germany, the Netherlands and United Kingdom (WWF Germany 2004)

5.1.3.2 Study area

The Dogger Bank study area comprises the entire sandbank, with a total surface area of 17600 square kilometres. To delimit the borders of the Dogger Bank we use the criteria defined by Germany and adopted by the Netherlands for defining the borders of their Natura 2000 sites. These criteria delineate the borders of the Dogger Bank based on the depth and the slope of the sandbank and define the Dogger Bank as the area that is maximum approximately 40 m depth including the adjacent slopes. Figure 30 shows the 20, 30 and 40 meter depth line of the Dogger Bank.

Figure30. Water depth at the Dogger Bank area (Source: Senkenberg: http://www.senckenberg.de/root/index.php?page_id=3188)

The German part of the Dogger Bank (Figure 31) is 1624 km^2 and was nominated based on the habitat type sandbank (Code 1110) and two species: the harbour porpoise (*Phocoena phocoena*) and the common seal (*Phoca Vitulina*).

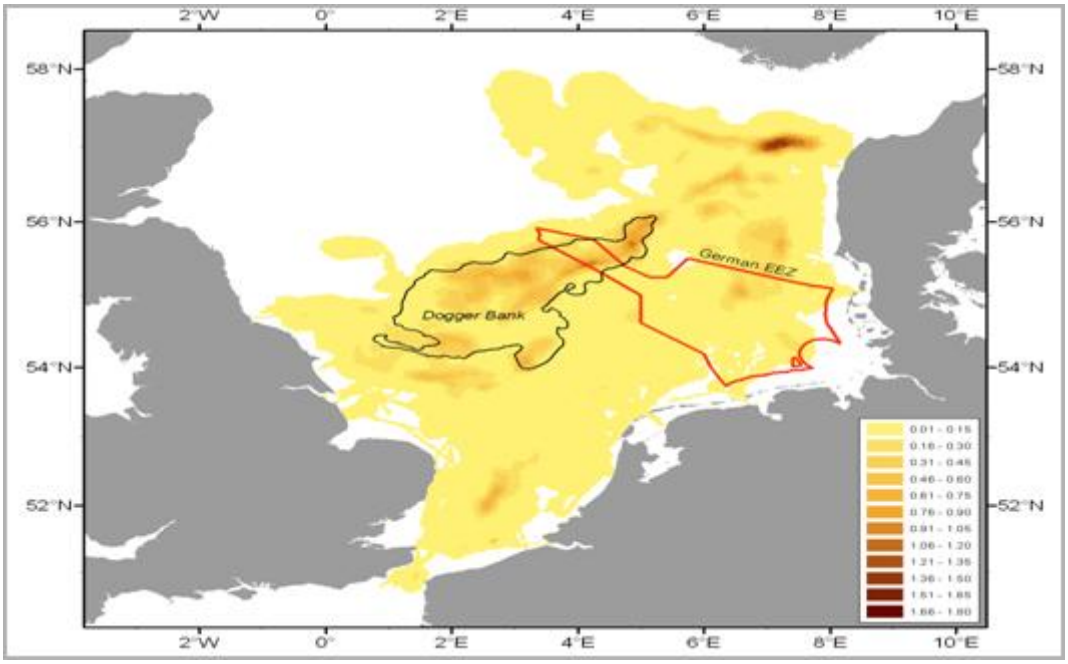

Figure31. The German EEZ in relation to the Dogger Bank area (Jeff Ardron 2008)

The Natura 2000 site in the Dutch part of the Dogger Bank is 4718 km^2 and was nominated based on the habitat type Sandbanks covered all the time (H1110).

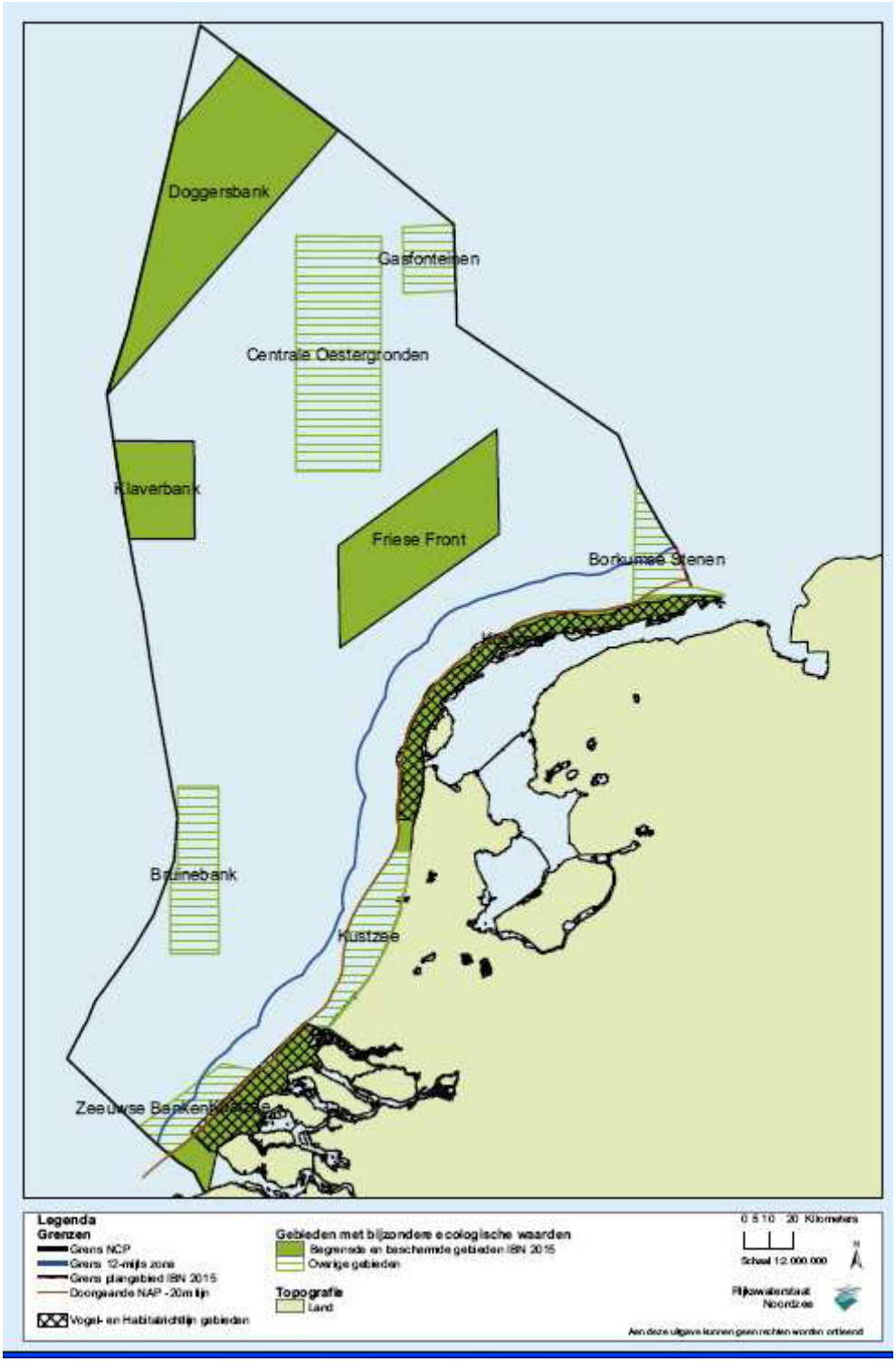

Figure 32. The location of designated Natura 2000 sites (squared), notified Dutch marine Natura 2000 sites (in green) and other areas of special ecological value (shaded) (IDON 2005)

An area of 2,339 km ^{2}of the UK zone of the Dogger Bank was proposed as a possible SAC in 2010,(see Figure 33) to protect sandbanks, harbour porpoises and common and grey seals. In 2009 a wind farm area was granted with a completely different delineation, see Figure 34.

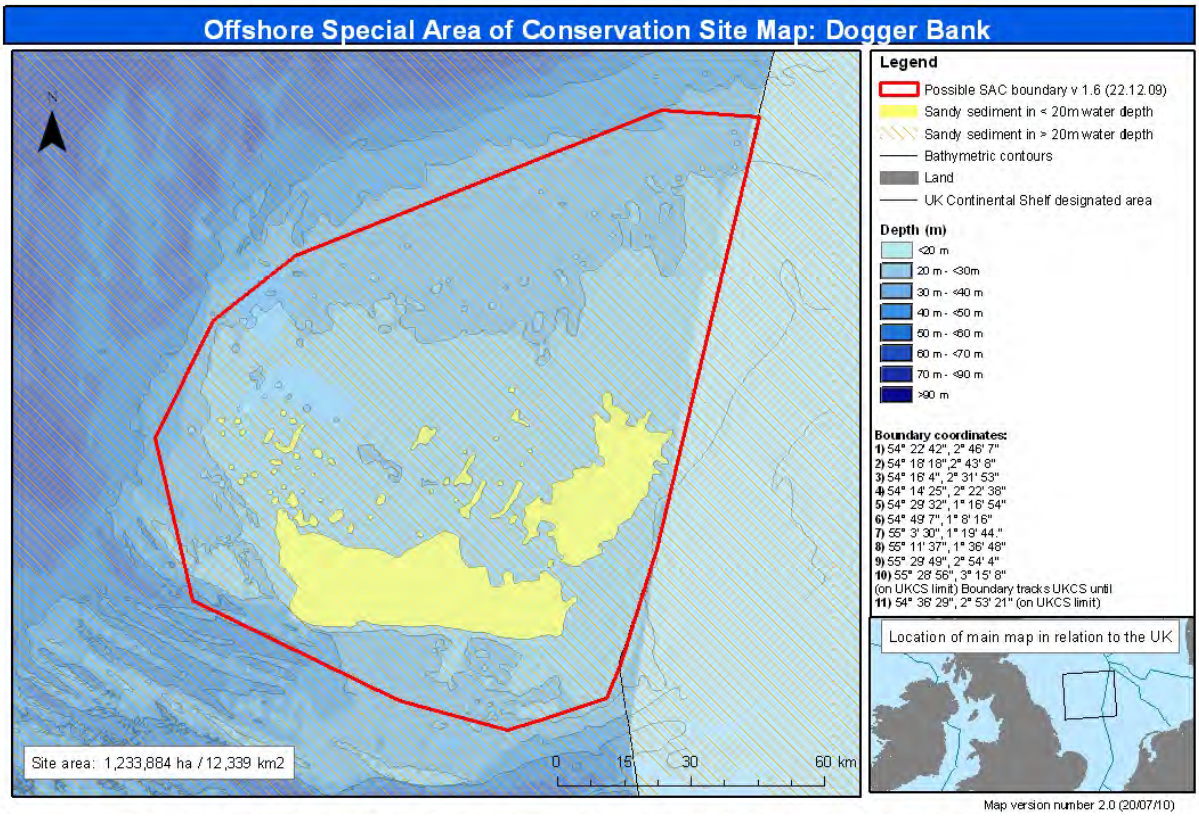

Figure33. Suggested delineation of the UK part of the Dogger Bank (Source: JNCC 2010: http://www.jncc.gov.uk/PDF/DoggerBank_SACSAD_v6_0.pdf)

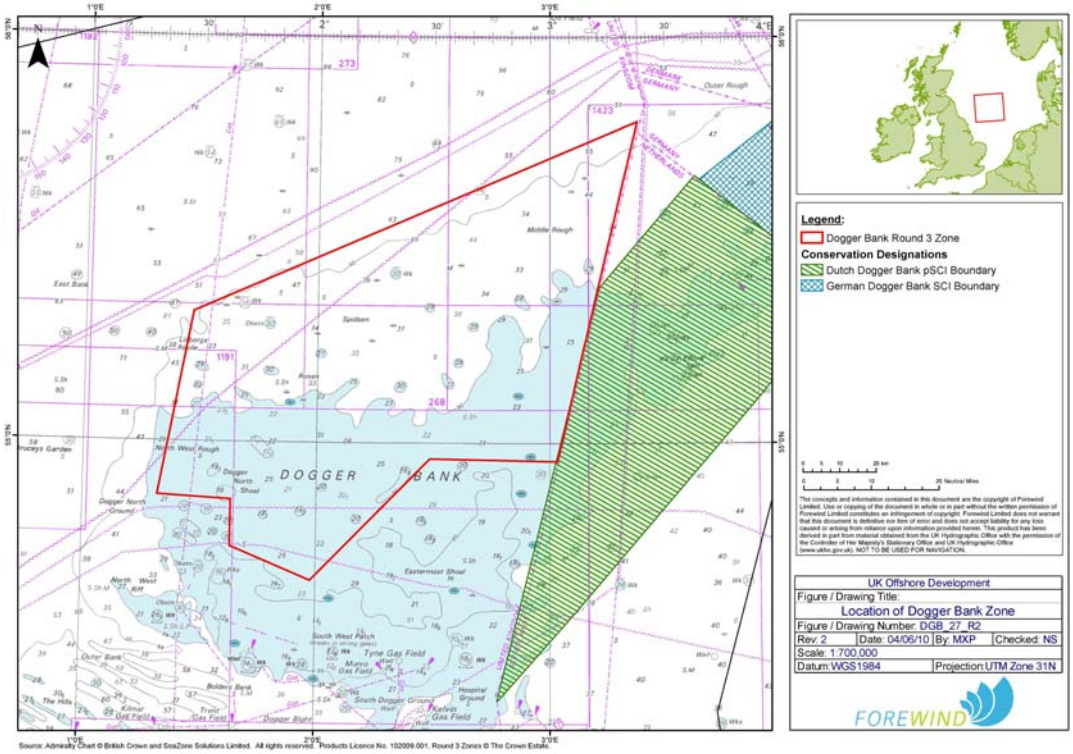

Figure 34. Dogger Bank wind farm zone (Source: http://www.forewind.co.uk/files/DGB_27_R2.pdf)

5.1.3.3 Current management

Currently there is no overarching transnational management of the Dogger Bank; most management is carried out within national legislation.

The German EMPAS project was carried out by ICES in the period 2006-2008 to find acceptable management plans for fisheries in the 10 German marine Natura 2000 sites, including the German part of the Dogger Bank.

In 2009 the project Fisheries Measures in Protected Areas (FIMPAS) started in the Netherlands. This project aims at the introduction of fisheries measures in marine protected areas in the Exclusive Economic Zone of the Dutch North Sea by the end of 2011.

The UK part of the Dogger Bank has in 2010 been proposed for establishment as a SAC (see Figure 33). This proposal was followed by a consultation which is currently underway. Prior to this proposal, the UK launched a very ambitious wind energy program in 2009. Within this program the UK Dogger bank was selected as a suitable site for a large scale (9000 MW) wind energy site. In 2009 the bid for constructing this wind park was granted to the Forewind consortium. The total surface area that will be occupied by this wind farm on the UK part of the Dogger Bank is 8,660 km^2, this is less than the 12,339 km^2 of the potential SAC area proposed in 2010, and additionally the wind energy site only partly overlaps with this pSAC

The Danish part of the Dogger Bank has not been identified as a specific marine area and it currently falls under Danish legislation which applies to the offshore EEZ.

The Marine Strategy Framework Directive (MSFD) aims to achieve good environmental status (GES) for EU waters by 2020. 11 descriptors of GES have been developed, most of which are directly relevant for spatial management of important species and habitats of the Dogger Bank, e.g. descriptors relating to marine noise, food webs, commercial fish species, seabed integrity and biodiversity.

5.1.3.4 Relevant aspects for testing the MESMA frame work

The Mesma framework is described above and presented in Figure 2.

1a. The spatial boundaries of the SMA are not well defined. The German and Dutch Natura 2000 sites are well defined but the Danish and UK parts are not. Transnational collaboration has not happened yet.

1b. The overall Goal of the SMA is to achieve good environmental status by 2020. For the Natura 2000 sites conservation objectives were and will be established, concerning mostly the habitat status and the protection of sea mammals. In parallel there are also goals and objectives in connection with the Common Fisheries Policy and other overarching policies and conventions (e.g. OSPAR).

2a. Ecosystem considerations include mainly the destruction of habitat, disturbance of species and lack of food for specific species.

2b. Fisheries and noise as well as bottom/ sediment/ benthic communities disturbance through the physical presence of fishing activity and through the building of wind turbines (artificial hard substrate)?.

2c. Habitats directive, Regulation 812/2004, MSFD, CFP and others

3. In relation to the Habitats directive favorable conservation status is the only stated benchmark. And to come: certain descriptors of the MSFD to reach GES?

4. The effects of commercial fisheries, noise, construction and other impacts will be described and elaborated within case study work. For instance, the Dogger Bank subcase will (in collaboration with other WPs) include the testing and refining of a tool to evaluate the risk of management decisions implemented locally that may have negative consequences for the achievement of environmental objectives on a regional, North Sea scale, i.e. an issue of great relevance to the MSFD. This work will focus on the sandeel as a widespread, key species in the North Sea ecosystem that is heavily dependent on specific, essential habitats within the Dogger bank subcase area that are important for a number of maritime sectors.

5. To be determined.

6. To be defined and described within sub-case work as a main output.

7. To be defined and described within sub-case work as a main output on the basis of 1-6.

5.1.3.5 Data

The emphasis is on studying how the four countries have dealt with the Dogger Bank in the past decade, and how it will or could progress. Experiences from the subarea of the Wadden Sea and other work carried out within the SNS case study will be extrapolated to provide suggestions for better transnational collaboration in management of protected features (i.e. Dogger Bank Natura 2000 sites) and in achieving an ecosystem approach to spatial management of maritime activities across national boundaries of the Dogger Bank area, both of which are requirements of EU environmental directives.

An overview of relevant data requirements will be presented, and suggestions may be made of which data are needed for impact assessment that are currently not available, and differences in the use of data on the Dogger Bank between countries will be illustrated. For example, where the Netherlands has basically used available scientific data and knowledge for their Natura 2000 nomination, the UK opted to obtain additional data from e.g. commercial activities from their part of the Dogger Bank. Using the sandeel as a focal species, the subcase work will also describe how novel uses of existing data can be applied to circumvent potentially negative effects of spatial management decisions on the ecosystem of the Dogger Bank and the greater North Sea.

5.1.3.6 Governance

The Dogger Bank sub-case will investigate governance and spatial management of the Dogger Bank from the perspective of the four Member States. Cross border, transboundary collaboration issues will be studied as well as the interaction between Natura 2000 and other relevant EU legislation, with an emphasis on the MSFD.

The sub-case study will analyse governance conflicts that apply to fisheries management, proposed wind farms, and other activities that might conflict with Natura 2000 site objectives. In these analyses the focus will be on national and international laws, policies, and obligations. The analyses will provide valuable insight in the interaction between Natura 2000 and other EU legislation and policies, e.g. the MSFD and the Common Fisheries Policy (CFP).

The governance analysis is expected to identify discrepancies and antagonisms between the different policies and legislations. We expect to find that the involvement of stakeholders and transboundary cooperation are not well structured and embedded in the governance processes. Recommendations may be defined based on the analyses of ‘best practice’ in the other areas, especially for the internationally governed Wadden Sea.

5.1.3.7 Stakeholders

The Dogger Bank represents a feature of the North Sea which is managed by the governments of several member states that face the challenge of implementing EU environmental regulations while also tending to the needs and interests of various maritime sectors and stakeholders. For instance, across much of the Dogger Bank various commercial fisheries, carried out by fishermen from different member states under the umbrella of the EU Common Fisheries Policy, constitute a major, multinational group of stakeholders. In some cases the fishing sector of one member state may even be a major stakeholder within the national boundaries of a neighbour. National or international environmental organisations are also likely to play an important role in the Dogger Bank area. Within respective national boundaries various stakeholders may be present that warrant particular attention: in the UK zone the wind energy sector is a major stakeholder, while other national zones may include other major stakeholders such as the oil and gas industry. Such activities may in particular represent a management conflict in the protected Dutch, German and UK zones of the Dogger Bank, where impacts might hinder achievement of environmental

objectives. The role and dynamic of these stakeholders will be investigated during the course of the project.

5.1.3.8 End user committee

As a transboundary case study a large number of stakeholder are involved in the Dogger Bank, these include stakeholders with mainly member state interest, e.g. wind consortia, as well as stakeholders that are interested in the whole Dogger Bank, e.g. fisheries and international NGOs. Representatives of stakeholder organisations will be invited to participate in the end user committee. In this transboundary/transnational committee the findings of this case study will be discussed. Potential representatives will be identified and approached as the sub-case study develops.

5.1.3.9 References

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5.1.4 Spatial Management of the Wadden Sea Cooperation Area

Coordination: Sandra Vöge

5.1.4.1 Introduction

The Wadden Sea is a highly dynamic ecosystem and represents an inshore area with a transition zone to the North Sea (the offshore zone). The Wadden Sea subarea will function as a best practice example in management and protection, since a transnational management of the area is already in place. The Marine Spatial Planning is developed at a high level, and therefore the analyses for this subarea should focus on the success and failing of governance on the basis of the range of tools applied in achieving Good Environmental Status (GES) and socio-economic objectives. The analysis of governance has a strong link with WP 6. The experiences with the international management of the area will be used to describe the types of tools that were and/or are used and to analyse how they fit in the management framework. This is linked to WP 4. Furthermore the Mesma framework developed in WP 2 will be tested.

5.1.4.2 Study area

The Wadden Sea is a shallow sea bordering the North Sea coasts of the Netherlands, Germany and Denmark. The area of the trilateral cooperation, the so-called Cooperation Area ("Wadden Sea Area") is 13,500 km^2 large and stretches from Den Helder in the Netherlands to Blåvands Huk in Denmark (figure 35). The Wadden Sea Area is identified by the participating governments and includes a nature conservation area. The geographical range of the Wadden Sea Area is (Wadden Sea Plan 2010):

- the area seaward of the main dike, or where the main dike is absent, the spring-high-tide-water line, and in the rivers, the brackish-water limit;
- an offshore zone 3 nautical miles from the baseline as fixed nationally or where the Conservation Area exceeds the 3 nautical mile the offshore boundaries of the Conservation Area;
- the corresponding inland areas to the designated Ramsar and/or EC Bird Directive areas being the adjacent inland marsh areas of the Danish Wadden Sea Region designated as international nature protection areas and the Bird Directive Areas of Schleswig-Holstein adjacent to the Conservation Area;
- the islands.

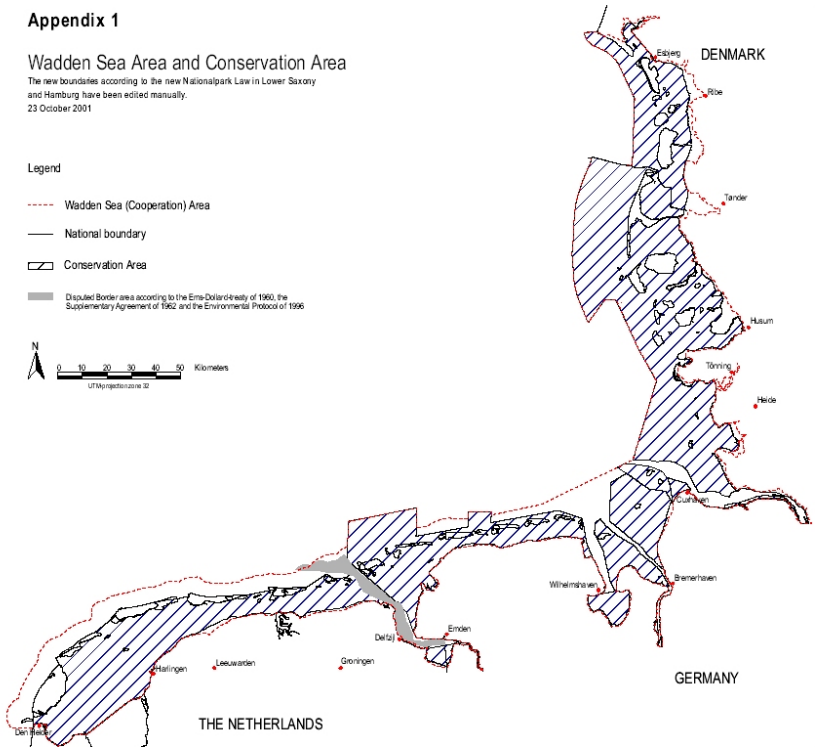

Figure 35. The Wadden Sea Cooperation Area, including the Conservation Area (CWSS 2010a).

The tidal flats cover about two-thirds of the tidal area and are one of its most characteristic features. The Wadden Sea is famous for its rich flora and fauna. Hundreds of thousands of shorebirds, ducks, and geese use the area as a migration stopover or wintering site. Since the middle ages man has changed the Wadden Sea landscape due to *i.a.* dike construction and land reclamation. A large number of activities interfere with each other and may conflict with the protection of the ecological entity, as well as the landscape and cultural heritage of the area.

A variety of habitats is present in the Wadden Sea including circalittoral, infralittoral, and sublittoral sediments consisting of mud and sand, sublittoral polychaete worm reefs and mussel beds.

5.1.4.3 Current management

Trilateral management

For the Wadden Sea Area a revised management plan is in place, the "Wadden Sea Plan 2010". In accordance with the "2010 Joint Declaration on the Protection of the Wadden Sea", the Wadden Sea Plan (WSP) provides a framework for the integrated management of the Wadden Sea Area as an ecological entity, as well as its landscape and cultural heritage, within the cultural entities. It sets out a series of management targets, as well as policies, measures, projects and actions to achieve these targets, to be implemented by the Wadden Sea countries the Netherlands, Germany and Denmark.

The WSP 2010 was developed with the participation of local and regional authorities and interest groups. It is a political agreement (meaning it is a legally non-binding document of common political interest) and will be implemented by the three countries in cooperation and individually, by the competent authorities on the basis of existing legislation and through the participation of interest groups.

The Trilateral Monitoring and Assessment Program (TMAP) aims to assess the status of implementation of the trilateral targets of the WSP and to provide a scientific assessment of the status and development of the Wadden Sea ecosystem. The TMAP provides the basis information for the Quality Status Report (QSR). Up to now, there are two QSRs (2004 and 2009) describing and evaluating the recent developments in the Wadden Sea and giving recommendations for policy and management.

Most parts of the Wadden Sea Area have been designated as wetlands of international importance under the Ramsar Convention and as NATURA 2000 sites under the EU Habitat and Bird Directives. In 2009, the

Dutch and German parts of the Wadden Sea were inscribed on UNESCO's World Heritage List. The Wadden Sea Conservation Area is the core of the national protection and management regimes, consisting of the Wadden Sea national parks and nature reserves.

National protection and management

The Netherlands Wadden Sea

Since 1980 the Netherlands Wadden Sea is protected according to the Key Planning Decision Wadden Sea (PKB), also called the Wadden Sea Memorandum, which is a national physical planning document defining the overall objectives of conservation, management and use of the Wadden Sea (amended 1993). The objectives and conditions of the Wadden Sea Memorandum are binding upon all state, regional and local authorities. The area for which the Wadden Sea Memorandum is valid is also a nature protection area, with the exception of the major shipping lanes and areas directly south of the islands.

According to the Dutch nature protection law it is prohibited to undertake activities which destroy and damage the protected area including its flora and fauna or its scenic importance without permission. Within the protected area some areas have been closed for the whole or part of the year. This concerns mainly areas which are important for seals and breeding birds. About a quarter of the tidal flats has been closed for cockle and mussel fishery.

The German Wadden Sea

In Germany the coastal federal states are responsible for the implementation of the Federal Nature Conservation act. Schleswig-Holstein, Lower Saxony and Hamburg have established national parks for the major parts of the Wadden Sea in 1985, 1986 and 1990 respectively. Within the federal state Bremen a small part of the Wadden Sea is situated, which has been partly designated as a nature reserve.

The objectives of the national parks are to protect the Wadden Sea and to allow natural process to take place with a minimum degree of disturbance and other detrimental effects of human activities. The national parks have been divided into two or three zones of which the zone I embraces ecological valuable areas. Therefore, strict regulations apply to the zone I including prohibition of public admittance. In zone II utilization and activities are allowed under such conditions that the overall protection objectives are not impaired. The national parks are managed by an administrative unity, the national park administrations, which are responsible for the implementation of the provisions of the national park instruments.

The Danish Wadden Sea

In Denmark the Wadden Sea was declared a nature and wildlife reserve by Statutory Order in 1982. The order has been amended on two occasions; the last one was issued in 1999. The objective is to conserve the Wadden Sea as a nature area of national and international importance. It is, in general, prohibited to undertake activities which destroy or permanently change the natural environment of the Wadden Sea. Strict regulations apply to areas of special importance for seals and birds in which public admittance is prohibited. In other areas recreational boating and other recreational activities have been strictly regulated. Mussel and cockle fishery is prohibited in the major part of the tidal area. In the remaining areas, particularly the main shipping routes and the area offshore of the islands, no general restrictions apply. In 2010 Denmark also designated its Wadden Sea area as a national park, although this novel status does not entail any new regulations or restrictions.

5.1.4.4 Relevant aspects for testing the MESMA framework

The Mesma framework is described above and presented in Figure 2.

5.1.4.4.1 1a. Set temporal and spatial boundaries for SMA assessment

Spatial boundaries of the Wadden Sea subarea are described in the WSP 2010, it is the Cooperation Area by the trilateral cooperation of the Netherlands, Germany and Denmark.

Temporal boundaries are set by the WSP 2010, the progress of the implementation of the trilateral policies and management entailed in the WSP will be evaluated every six years.

5.1.4.4.2 1b. Define goals and operational objectives for SMA

Examples for goals and objectives stated in the WSP 2010 and concerning conservation are:

- Achieving a natural ecosystem, its functions and characteristic biodiversity (goal).
- Increase the area which is natural, dynamic and undisturbed (operational objective).

5.1.4.4.3 2a. Identify ecosystem components

The Wadden Sea covers a high number of habitat types, which are classified according to Natura 2000. Due to the complexity of habitat types within the Wadden Sea Area and difficulties in classification, attempts to classify habitat types according to EUNIS failed so far. In the Wadden Sea Area 44 habitat types according to the EC habitats directive can be identified (Table 8).

Table 8 Habitat types according to the EC habitats directive in the Wadden Sea Area.

Main type	Code	Habitat type name
Open sea and tidal areas	1110	Sandbanks which are slightly covered by sea water all the time
	1130	Estuaries
	1140	Mudflats and sandflats not covered by seawater at low tide
	1150	Coastal lagoons
	1160	Large shallow inlets and bays
	1170	Reefs
Sea cliffs and beaches	1210	Annual vegetation of drift lines
	1220	Perennial vegetation of stony banks
	1230	Vegetated sea cliffs of the Atlantic and Baltic coasts
Salt marshes	1310	*Salicornia* and other annuals colonizing mud and sand
	1320	Spartina swards (*Spartinion maritimae*)
	1330	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
Dunes	2110	Embryonic shifting dunes
	2120	Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")
	2130	Fixed coastal dunes with herbaceous vegetation ("grey dunes")
	2140	Decalcified fixed dunes with *Empetrum nigrum*
	2150	Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)
	2160	Dunes with *Hippophaë rhamnoides*
	2170	Dunes with *Salix repens* ssp.*argentea* (*Salix arenariae*)
	2180	Wooded dunes of the Atlantic, Continental and Boreal region
	2190	Humid dune slacks
Inland dunes	2310	Dry sand heaths with *Calluna* and *Genista*
	2320	Dry sand heaths with *Calluna* and *Empetrum nigrum*
	2330	Inland dunes with open *Corynephorus* and *Agrostis* grasslands
Standing water	3130	Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*
	3150	Natural euthrophic lakes with *Magnopotamion* or Hydrocharition-type vegetation
	3160	Natural dystrophic lakes and ponds
Running water	3260	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
Temperate heath and srcub	4010	Northern Atlantic wet heaths with *Erica tetralix*
	4030	European dry heaths
Semi-natural dry grassland	6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*)(*important orchid sites)
	6230	Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and

Main type	Code	Habitat type name
		submountain areas, in Continental Europe)
Semi-natural tall-herb humid meadows	6410	*Molinia* meadows on calcareous, peaty or clavey-silt-laden soils (*Molinion caeruleae*)
	6430	*Hydrophilous* tall herb fringe communities of plains and of the montane to alpine levels
Mesophile grassland	6510	Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)
Sphagnum acid bogs	7110	Active raised bogs
	7140	Transition mires and quaking bogs
	7150	Depressions on peat substrates of the Rhynchosporion
Clacerous fens	7210	Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*
	7230	Alkaline fens
Forests	9190	Old acidophilous oak woods with *Quercus robur* on sandy plains
	91D0	Bog woodland
	91E0	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)
	91F0	Riparian mixed forest of *Quercus robur, Ulmus laevis* and *Ulmus minor, Fraxinus excelsior* or *Fraxinus angustifolia* along the great rivers (*Ulmenion minoris*)

5.1.4.4.4 2b. Identify pressures and impacts

Main activities and impacts of the Wadden Sea Area relate to:

1. Agricultural use
2. Civil air traffic
3. Coastal protection
4. Dredging and dumping
5. Energy resources: Gas and oil, pipelines, wind energy
6. Extraction of sand and clay
7. Fisheries, shrimp and flatfish trawling, shellfish harvesting
8. Shellfish farming
9. Harbour and industry
10. Hunting
11. Infrastructure
12. Military activities
13. Nature and landscape management
14. Pollution
15. Public awareness
16. Recreation and tourism, water sports, other tourist activities
17. Shipping
18. Species/site protection (several Natura 2000 features)

5.1.4.4.5 2c. Identify existing management measures

For the Wadden Sea management measures exist, which have been introduced in all three countries, such as (CWSS 2010b):

- for sea defence it has been agreed to prohibit, in principle, further embankments of the Wadden Sea and to minimize unavoidable loss of habitats by sea defence measures;
- for mussel fishery the negative ecological impact on the Wadden Sea shall be limited by closing considerable parts of the Wadden Sea for this activity;
- zones shall be established covering the most sensitive areas where no recreational activities are allowed.

5.1.4.5 Data

Data of the Trilateral Monitoring and Assessment Program on several parameters are available on request (CWSS 2010c).

The Wadden Sea Forum is in the course of setting up a Web-GIS project with regard to existing data about economic uses and nature protection in the Wadden Sea Region and the EEZs. Cooperation is appreciated by the Wadden Sea Forum.

5.1.4.6 Governance

The Wadden Sea region as a whole may serve as a "best practice example" of an SMA, since an international plan has successfully been established. The governance analysis may focus on institutional analysis, stakeholder involvement, governance tools, and lessons to be learned from previous management processes (development of management plan, compare WSP 1997 and WSP 2010).

However, not all arrangements have lead to successful management. As an example, the conflict-laden Ems-Dollard region could be used as a case for adapting integrated management tools and for conflict resolution.

Furthermore, the following research questions will be additionally addressed: i) what are the key elements of present governance arrangements that potentially support or undermine GES and ii) how can conflicts be managed through the Wadden Sea Plan.

5.1.4.7 Stakeholders

For the Wadden Sea Area a stakeholder platform exists, the Wadden Sea Forum (WSF 2010). The WSF is informed about the MESMA project and especially the ICZM working group of the WSF is interested in information and knowledge exchange. Sandra Vöge attended the 11th meeting of the WG ICZM in September 2010 and was invited to be a working group member for the future.

5.1.4.8 References

CWSS 2010a: http://www.waddensea-secretariat.org/trilat/area/area.html

CWSS 2010b: http://www.waddensea-secretariat.org/trilat/brochure/5elements.html

CWSS 2010c: http://www.waddensea-secretariat.org/TMAP/Data-Unit/Data.html

Wadden Sea Plan 1997: http://www.waddensea-secretariat.org/news/documents/TGC-Stade/Stade-D.pdf

Wadden Sea Plan 2010:
http://www.bundesumweltministerium.de/english/water_management/downloads/doc/45780.php

Wadden Sea Quality Status Report 2004: http://www.waddensea-secretariat.org/QSR/index.html

Wadden Sea Quality Status Report 2009: http://www.waddensea-secretariat.org/QSR-2009/index.htm

WSF 2010: http://www.waddensea-forum.org

5.2 *Annex to the Annex to the Pentland Firth and Orkney Waters Case Study*

Case study leader: Kate Johnson

5.2.1 Plan of the PFOW area and marine renewable leases

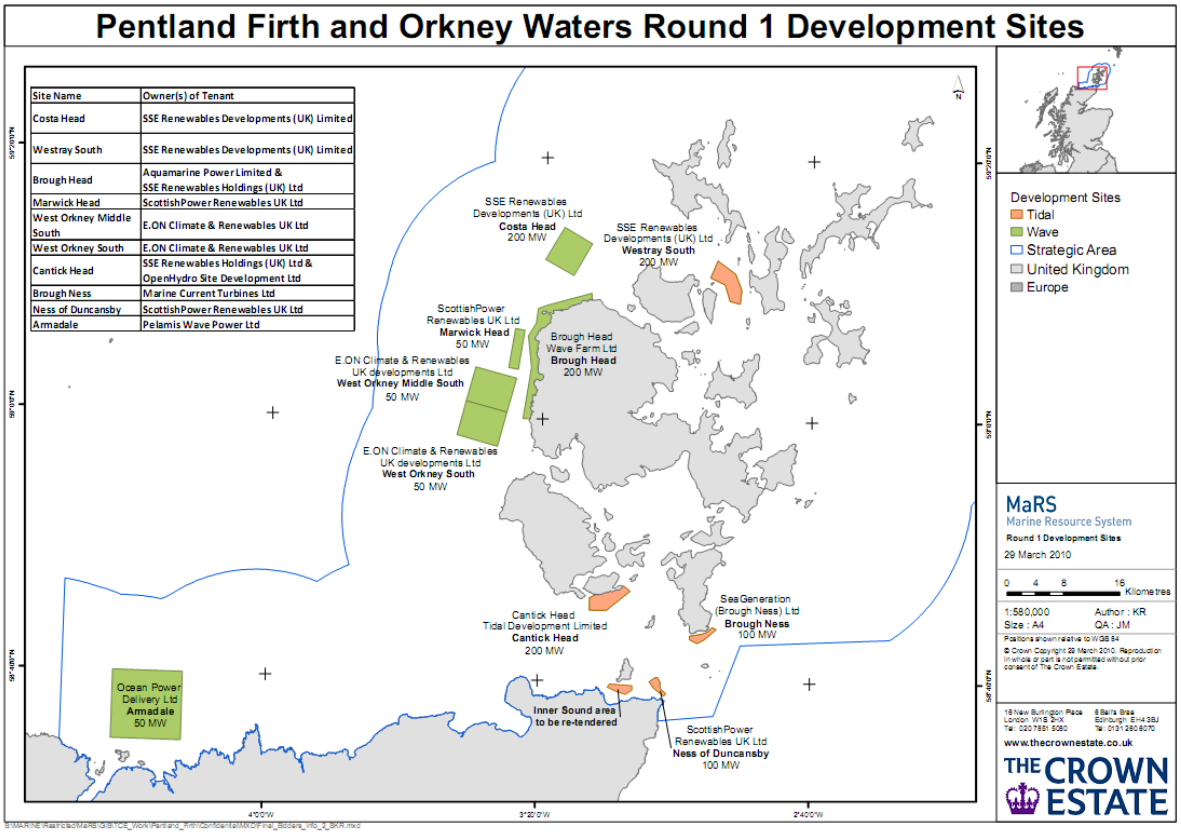

Figure 36. Plan of the PFOW area and marine renewable leases

5.2.2 Scottish government powers

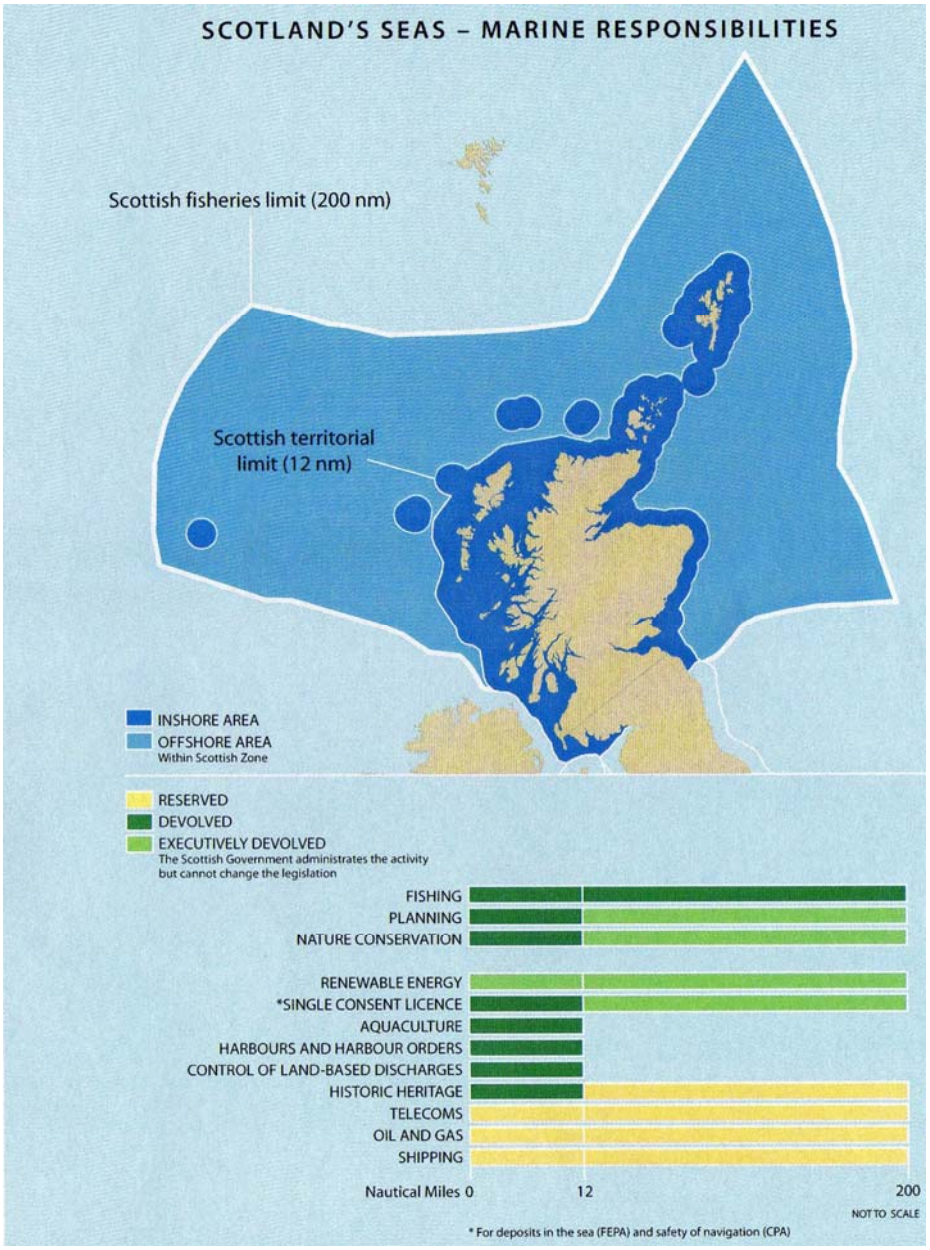

Figure 37. Scottish government powers

5.2.3 Metadata Catalogue

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Table 2.2 Geology, Seabed Sediments and Sediment Transport Metadata Catalogue

Table 2.3 Weather and Climate Metadata Catalogue

Table 2.4 Marine and Coastal Processes Metadata Catalogue

Table 2.5 Seabed Contamination and Water Quality Metadata Catalogue

Table 2.6 Benthic Ecology Metadata Catalogue

Table 2.7 Fish and Shellfish Metadata Catalogue

Table 2.8 Marine Mammals Metadata Catalogue

Table 2.9 Marine Birds Metadata Catalogue

Table 2.10 Protected Sites and Species Metadata Catalogue

Table 2.11 Marine and Coastal Historic Environment Metadata Catalogue

Table 2.12 Seascape Assessment Metadata Catalogue

Table 2.13 Commercial Fisheries and Mariculture Metadata Catalogue

Table 2.14 Shipping and Navigation Metadata Catalogue

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Table 2.22 Electric and Magnetic Fields Metadata Catalogue

Table 2.23 General Datasets Metadata Catalogue

Table 3.1 Additional datasets and Data Sources

Table 3.2 Projects currently ongoing (data available in near future)

5.2.4 Biotope Survey Summary

PFOW Seabed Survey by FRV Scotia on behalf of Marine Scotland (2008/2009)

Survey work
In 2008 and 2009, Marine Scotland Science undertook detailed surveys of the seabed in the Pentland Firth and Orkney waters from *FRV Scotia* in relation to potential renewable energy developments. Multibeam acoustic bathymetric data were supported by underwater video and still images of the seabed.

Sharing the data
These *data* were made available to Scottish Natural Heritage, who commissioned reviews of the potential conservation value of the seabed. The video and still images were used to identify the biotopes present in the survey area. Most sites examined in the Pentland Firth displayed low diversity circalittoral tideswept rocky communities, dominated by a sessile fauna of barnacles (Balanus crenatus) and dahlia anemones (Urticina felina), with an area of coarse, and apparently impoverished, sediment in the southwest of the Firth. Elsewhere, the habitats were predominantly sandy, sand-scoured rock or mixed substrates of sand and stones, with low diversity communities.

Summary of findings*:*

- *The main seabed habitats found were rocky (bedrock, boulders or stones) with some associated coarse sand or gravel;*
- *Generally, the animal communities on the seabed were of low diversity;*
- *Renewable energy developments are considered unlikely to have a significant effect on the habitats or species of conservation value found in the areas surveyed.*

This *data layer* provides access to summaries of the biotope classifications and seabed imagery and you can read more about the Pentland Firth and Orkney waters work in the *Marine Energy* section of this site. www.scotland.gov.uk/Topics/marine/science/MSinteractive/pentlandorkney

5.2.5 Pentland Firth and Orkney Waters - Users and Conflicts

A. Key human users

The Pentland and Firth and Orkney Waters (PFOW) comprise an area now designated for the development of large-scale offshore and coastal, wave and tidal energy developments. Already the area contains one of the busiest and most hazardous shipping routes in Europe (Pentland Firth), one of the largest European oil terminals (Flotta in the Orkney Islands), fisheries and aquaculture and conflicts between these, as well as with and between archaeological, tourism and recreational interests. Many of these sectors have been well-studied and much data are available.

Table 9. Key human uses in PFOW

Criteria	PFOW Total Activity Level	PFOW Spatially distributed
Fisheries	Φ	θ
Oil/gas	Φ	Φ
Shipping	Φ	Φ
Wind energy	Φ	Φ
Wave energy	Φ	Φ
Tidal energy	Φ	Φ
Archaeology	θ	θ
Military	θ	θ
Tourism/Recreation	Φ	θ
Aquaculture	Φ	Φ
Pipelines	Φ	Φ
Cables	Φ	Φ
Conservation	Φ	Φ
Nuclear decommissioning	Φ	Φ

Quantitative (Φ) or qualitative (θ) data available

B. Number of conflicts

The number of conflicts already apparent in this sea area is large, and the development of offshore wind wave and tidal energy resources will increase and aggravate those already in existence. Moreover, the uncertainties of the environmental and ecological impacts of these new developments are of substantial concern at the present time.

Table 10. Number of Conflicts in PFOW

	Fisheries	Oil/Gas	Shipping	Wind energy	Wave energy	Tidal energy	Archaeology	Military	Tourism/Recreation	Aquaculture	Pipelines	Cables	Conservation	Nuclear Decommissioning
Fisheries	xx	-	-	-	-	-	-	-	-	-	-	-	-	-
Oil/Gas	xx	0	-	-	-	-	-	-	-	-	-	-	-	-
Shipping	xx	x	xx	-	-	-	-	-	-	-	-	-	-	-
Wind energy	xxx	xx	xx	0	-	-	-	-	-	-	-	-	-	-
Wave energy	xxx	xx	xx	0	0	-	-	-	-	-	-	-	-	-
Tidal energy	xxx	xx	xxx	0	0	0	-	-	-	-	-	-	-	-
Archaeology	x	0	0	x	x	x	0	-	-	-	-	-	-	-
Military	xx	0	0	x	x	xx	x	0	-	-	-	-	-	-
Tourism/Recreation	0	0	0	xxx	xx	xx	xx	x	xx	-	-	-	-	-
Aquaculture	x	0	0	0	0	0	x	0	xxx	xx	-	-	-	-
Pipelines	xx	0	0	0	x	0	x	0	0	0	0	-	-	-
Cables	xx	0	0	0	x	0	x	0	0	0	0	0	-	-
Conservation	xxx	x	x	xxx	xx	xxx	0	x	xx	xxx	x	x	0	
Nuclear Decommissioning	xx	0	0	0	0	0	0	0	xxx	x	0	0	0	0

5.3 Annex to the Barents Sea Case Study

Case study leader: Lene Buhl-Mortensen

5.3.1 The Barents Sea Integrated Management Plan & MAREANO as a tool for Spatial Management

5.3.1.1 Introductory Comment

The Barents Sea and areas off the Lofoten Islands, a region of the Northeast Atlantic, are comparable to waters in other regions of Europe that are subject to multiple pressures arising from human activities/human-induced threats. These pressures include: increasing oil and gas extraction; commercial fishing; heavy shipping traffic; a large aquaculture industry; transport of contaminants; tourism; invasive species; and effects from climate change.

In April 2006, the Norwegian government launched a White Paper on a new holistic management plan for the Norwegian part of the Barents Sea, including the fishery protection zone around Svalbard (Anon 2006). The plan aims at sustainable use of the ecosystem, within acceptable levels of pollution, with reduced risk of accidental spills, with sufficient capacity and readiness to deal with accidents, and seafood that is safe for consumption, while safeguarding biodiversity.

Following international guidelines for ecosystem-based management, the plan provides an overall framework for managing all human activities (oil and gas industry, fishing, and shipping) in the area to ensure the continued health, production, and function of the Barents Sea ecosystem. This strategy (concepts, model, and guidelines) for integrated spatial management of sensitive marine environments presents a strong and highly relevant example of marine spatial management that can be useful to MESMA as a Case Study. The Barents Sea management plan (BSMP) is state-of-the-art, and has already been tested. It can facilitate development of a suite of practical tools for sustainable development in European seas through use of SMAs. Its scheduled revision during 2010 is also timely for MESMA. It is highly applicable to meeting objectives for each of the eight (8) MESMA Work Packages that will provide useful guidance for the implementation, monitoring, and evaluation of SMAs.

In the development of the BMP important gaps in knowledge were identified. The MAREANO (Marine Areal Database for the Norwegian Coastal and Ocean Areas) program was developed to fill gaps related to seabed conditions, habitats and biodiversity through detailed mapping of depth, sediments, bottom fauna and pollutants in Norwegian waters. In the run-up phase to the revision of the BSMP in 2010, MAREANO shall provide information on environment and natural resources in the particularly valuable and vulnerable areas identified in the BSMP. As an interface with users a database and map service with systematic information about Norwegian coastal areas and seas is available to management and the public through the website www.mareano.no.

The MAREANO mapping activity upon request from the Norwegian government can provides MESMA with experience from: the use of a broad set of methods needed for geo-referenced documentation of the seabed environment and natural resources, and communicating results to the public/ stakeholders and politicians through a complicated organization and the homepage of MAREANO. As a case this project can provide valuable input to several tasks in MESMA as WP 2, WP4 and WP5. *For more details on the development and follow up of the BSMP and the MAREANO methodology see appendix.*

General Description of Barents Sea & Lofoten Islands

The Barents Sea is Europe's last large, relatively clean, and intact marine ecosystem, but it is also a region subject to rapid industrial development. Escalating human activities such as commercial fisheries, oil and gas exploration, shipping, and aquaculture add to the impacts from climate change and increasing levels of toxic chemicals, and pose serious threats to the marine ecosystem and biodiversity.

It is of great significance to both Norway and Russia. The Sea and its fisheries are basis for coastal settlement in this region as reflected in the way of life and identity of people living there. It is a nursery area for large fish stocks including the world's largest stock of North Atlantic cod that support valuable fisheries and provide food for important seabird colonies and marine mammal populations.

The Lofoten Islands are home to the world's largest cod and herring stocks, pods of sperm whales and killer whales, some of the largest sea bird colonies in Europe, including puffin and cormorant, and the world's biggest cold-water coral reef. Through the MAREANO mapping program an area of 330 coral reefs, giant sand waves, gas seeps and species new to that area has been discovered.

5.3.1.2 Key Human Users

Table 11. Key human uses in the Baltic Sea

Criteria	Case Study Barents Sea
Fisheries	Φ θ
Oil/gas	Φ θ
Shipping	Φ θ
Wind farms	0
Sand mining	0
Gravel extraction	0
Tourism	Φ θ
Aquaculture	Φ θ
Pipelines	Φ θ
Cables	Φ θ
Species	Φ θ
Habitats	Φ θ

Fisheries: The Barents Sea supports traditional fisheries that are important to the culture and economy of Northern Norway and Russia; it is subject to intensive commercial fishing pressure from both countries. It is an important feeding area and supports large fisheries for cod, capelin, haddock, herring, sea perch, catfish, plaice, halibut, Atlantic salmon, and redfish.

Shipping: The Barents Sea is crossed by important shipping/transport (oil & freight) routes. Presently the ship traffic can be divided in six areas; five along the coastline of Northern Norway and one around Spitsbergen Isles. The ship traffic comprises traffic with fishing vessels, sea transport of both passengers and goods. There is increasing transit of oil tankers from the Russian seaports and oil fields in the eastern part of the Barents Sea.

Oil and Gas Development: The Norwegian Barents Sea holds an estimated 2.2 bbl oil and 30 tcf of gas. Of these reserves, some 90% are yet to be discovered. Russia's Barents Sea shelf (including the Pechora Sea) clearly holds vast volumes of oil and gas, but estimates of reserves potential in the area tend to vary. Estimated oil reserves are 4 bbl, while estimated gas reserves are estimated at a gigantic 878 tcf. Development of these reserves has started on the Norwegian side, while Russian offshore development is anywhere from three to ten years away. Development will include both gas and oil; oil fields on both sides of the border lie in close proximity to key areas for biodiversity.

Aquaculture: Aquaculture is the fastest growing food sector in the world. In the Arctic sealice, contaminated discharge, and escaping fish remain problems. There is already a large salmon and trout industry in northern Norway. In northwest Russia there is some production of salmon, rainbow trout and mussels. The Russian market for seafood is growing, and both the Norwegian and Russian governments advocate further development of aquaculture in the Barents Sea Region (NAGODA & ESMARK 2004).

Tourism: Promotion of tourism across national borders has led to considerable recent growth in this industry, which today contributes significantly to the economy of the Barents Sea region. The Arctic region is under steadily increasing pressure from tourism, but little is known about the overall impact in the Barents Sea. Relevant tourism activities include:

- Sea Kayaking,
- River rafting,
- Coast and Deep sea fishing,
- Recreational fishing,
- Guided fishing tours
- Fjord and Coastal Voyages / Arctic Cruises

5.3.1.3 Number of conflicts

Table 12. Number of conflicts in the Baltic Sea

Criteria	Fisheries	Oil/gas	Shipping	Wind farms	Sand mining	Gravel extraction	Tourism	Aqua-culture	Pipelines	Cables
Fisheries	XX*									
Oil/gas	XXX	-								
Shipping	X	0	-							
Wind farms	0	0	0	-						
Sand mining	0	0	0	0	-					
Gravel extraction	0	0	0	0	0	-				
Tourism	X	X	X	0	0	0	-			
Aquaculture	X	X	X	0	0	0	X	-		
Pipelines	XX	0	0	0	0	0	0	0	-	
Cables	X	0	0	0	0	0	0	0	X	-

*Different fisheries (e.g. active/passive gears) often conflict *within* the sector.

Stakeholder Conflicts

A map showing conflicting activities in the BSMP area is shown in figure 38.

Norway vs. Russia: Transnational/Cross-border Issues: The long-standing dispute between Russia and Norway regarding their maritime boundaries in the Barents Sea has not yet been resolved.

Shipping vs. Fisheries: In the management plan area, there is considerable fisheries activity over the whole of the continental shelf and along the continental slope towards the deep-water areas of the Norwegian Sea. This means that the route that most vessels follow along the coast from the Lofoten Islands to Stad at 62°N passes through or close to intensively used fishing grounds. Some fisheries operate year round, with vessels scattered over the whole area, while others are seasonal fisheries, with large concentrations of fishing vessels in certain areas.

A considerable proportion of the ship traffic into and out of the Norwegian Sea passes Stad, most of it at distances within 25 nautical miles of land, and traverses areas that are intensively fished at certain times of year.

Oil & Gas vs. Fisheries: Ever since oil and gas activities started on the Norwegian continental shelf more than 40 years ago, the authorities have emphasized the importance of coexistence with other industries and with the fisheries industry in particular. This has laid the foundation for value creation both from Norway's valuable oil and gas resources and from its rich fisheries resources. Two of the key elements of the Government's model for coexistence with other industries are a comprehensive system of impact assessments at all stages of petroleum activities and the prohibition of certain operations, such as exploration drilling and seismic surveying, at times of year that are particularly important periods for fish stocks and the fisheries industry. However, there are problems related to the occupation of areas and the acquisition of seismic data. When new areas are opened up for petroleum activities, environmental and fisheries-related requirements are drawn up for each block.

Seismic shooting, a technique used in oil exploration, has been reported to severely affect fish distribution, local abundance, and catch rates in the entire area of investigation (Engås et al. 1996).

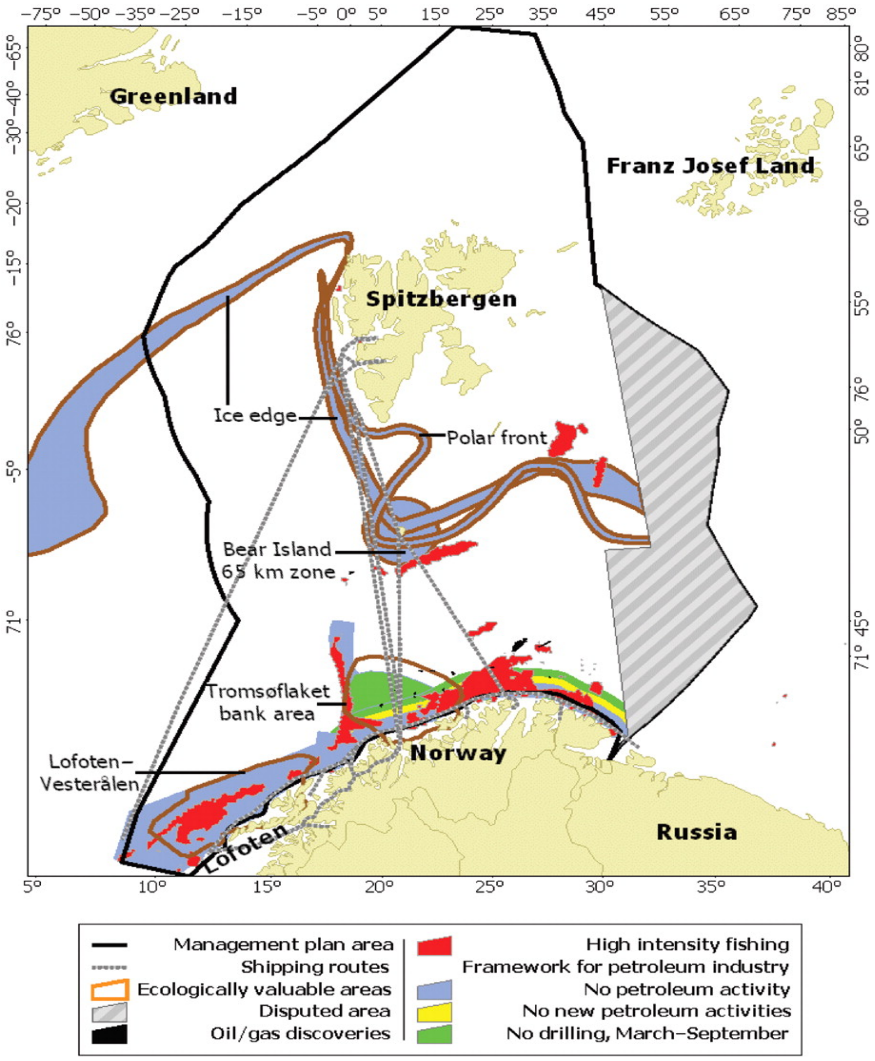


Figure 38. Area covered by the management plan for the Barents Sea. Including main fishing areas, shipping lanes, and the area-based framework for hydrocarbon extraction (2006-2010), and particularly valuable/vulnerable areas

5.3.1.4 Diversity in geography and spatial extent

The area covered under the BSMP is the offshore continental shelf of the Barents Sea, the adjoining slope towards the Norwegian and Greenland Seas, and the continental shelf and slope off the Lofoten Islands (Figure 39). The inner border was set to 1 nautical mile off the coast because water inshore of that is managed according to the EU Water Framework Directive. Transboundary threats are treated under both plans.

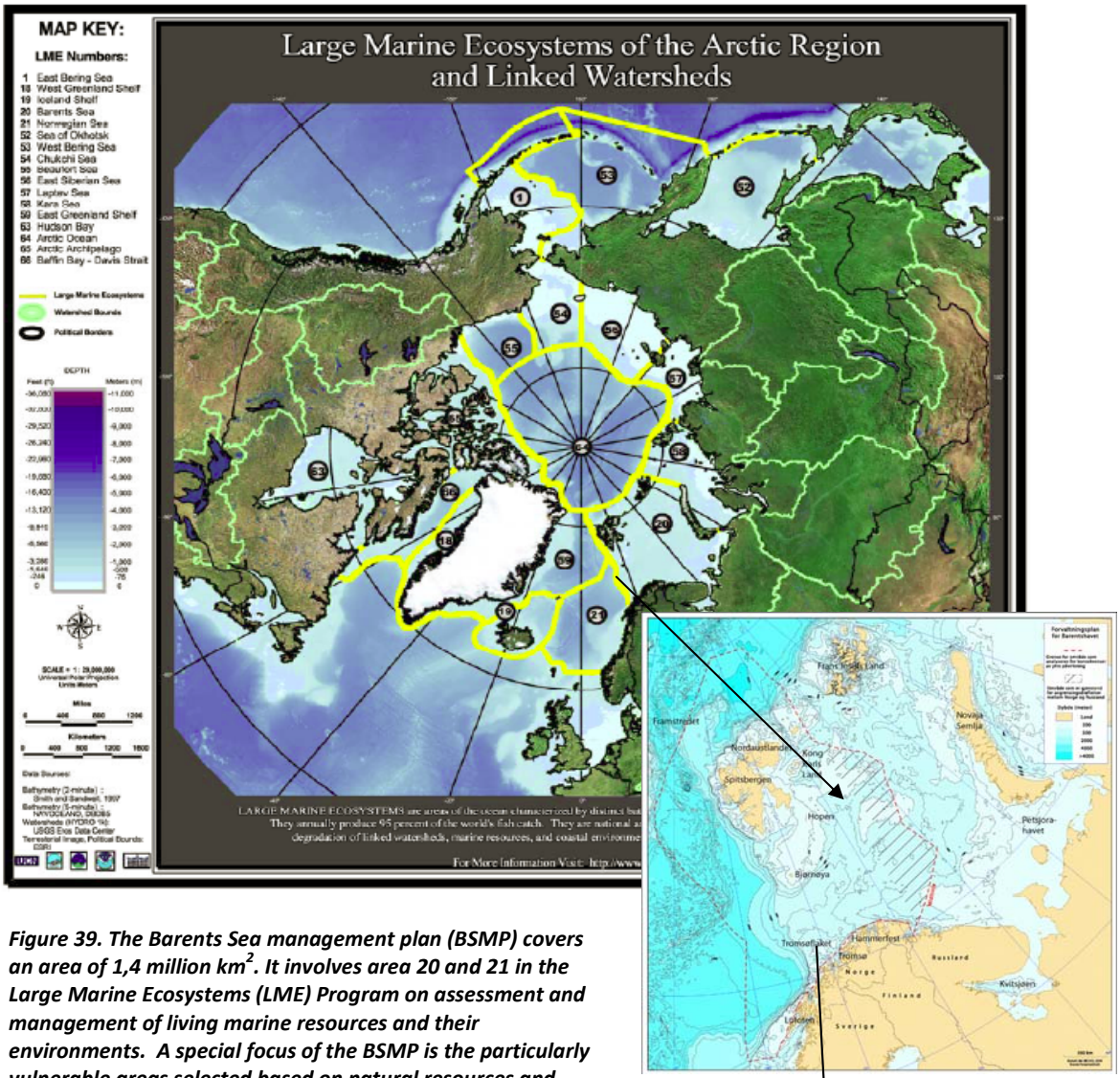
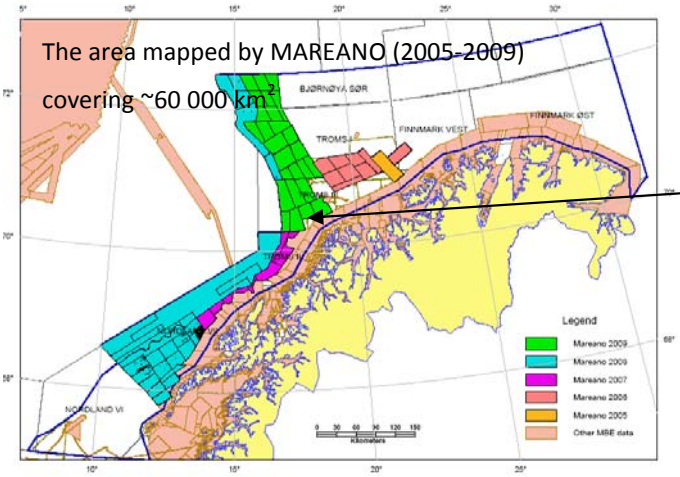
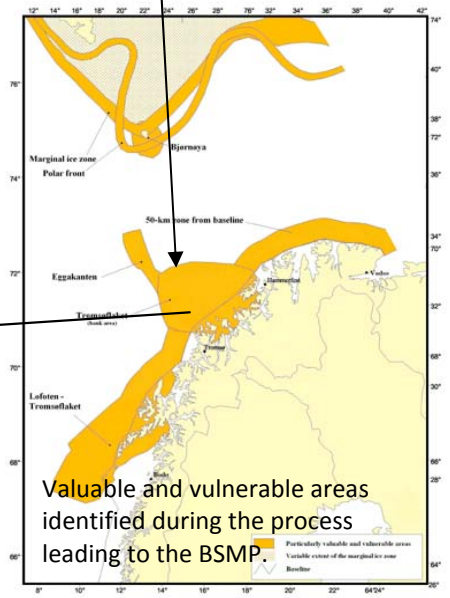


Figure 39. The Barents Sea management plan (BSMP) covers an area of 1,4 million km^2. It involves area 20 and 21 in the Large Marine Ecosystems (LME) Program on assessment and management of living marine resources and their environments. A special focus of the BSMP is the particularly vulnerable areas selected based on natural resources and user conflicts.

In the process of gaining more knowledge MAREANO has been requested to map for management in the most controversial areas were oil industry is not allowed to enter.



The area mapped by MAREANO (2005-2009) covering ~60 000 km^2



Valuable and vulnerable areas identified during the process leading to the BSMP.

5.3.1.5 Data Availability

The Institute of Marine Research continuously collects large amounts of data from all Norwegian seas. The Norwegian Marine Data Centre was established as a national data centre for handling of marine environmental- and fish data, and to present data products. The group's main activity is to collect secure quality and store all of the data on marine environment and fish and make the data available for scientists. Three large research projects provide relevant data useful for this case study:

MAREANO (Marine AREA Database for NOrwegian waters) maps depth and topography, sediment composition, biodiversity, habitats and biotopes as well as pollution in the seabed in Norwegian coastal and offshore regions. MAREANO is coordinated by the Institute of Marine Research, in collaboration with the Geological Survey of Norway and the Norwegian Hydrographic Service.

The Barents Sea Ecosystem Survey systematically monitors all major biotic and abiotic components of the Barents Sea, and is a major tool for carrying out the management plan. It is jointly carried out by the Institute of Marine Research, Norway and the Polar Research Institute of Marine Fisheries and Oceanography, Russia. International scientists use the survey to conduct research or gather samples.

SEAPOP (SEAbird POPulations) is a long-term monitoring and mapping program for Norwegian seabirds that was established in 2005. The program represents a new initiative for these activities in Norway, Svalbard and adjacent sea areas, and will provide and maintain base-line knowledge of seabirds for an improved management of this marine environment. The data analyses aim to develop further models of seabird distribution and population dynamics using different environmental parameters, and to explore the degree of covariation across different sites and species. This knowledge is urgently needed to distinguish human influences from those caused by natural variation.

5.3.2 Transnational (cross-border)

Norway and Russia share the stocks of cod, haddock and capelin in the Barents Sea. Close cooperation between the two countries is needed to ensure rational joint management of these fishery resources. As result of this collaboration, a joint report series is produced annually by Norway's Institute of Marine Research (IMR) and Russia's Polar Research Institute of Marine Fisheries and Oceanography (PINRO) (Stiansen and Filin 2009). Despite recent diplomatic negotiations, the long-standing dispute between Russia and Norway regarding their maritime boundaries in the Barents Sea has not yet been resolved. There are issues pertaining to the former Cold War boundary between the Russia and Norway (and other countries of Western Europe). The changing and transboundary nature of the marine fisheries requires management approaches that recognize an ecosystem perspective in fisheries research and management.

5.3.2.1 Conservation Issues

Vulnerabilities: Map of areas identified as particularly valuable and vulnerable by the BSMP are shown in figure 39. Coral reefs and other seafloor communities are vulnerable to industrial activities. Installations for drilling and production of oil and gas can lead to physical destruction of the bottom communities. However, the major threat comes from discharges of oil, drill cuttings and drilling mud. Many organisms living on the seafloor filter nutrients from the seawater, and are susceptible to pollutants even at low concentrations. Toxic substances accumulate in benthic organisms; through the process of bioaccumulation toxics are transported to higher trophic levels.

Fish eggs and larvae are particularly vulnerable to toxic chemicals found in oil. Small amounts of oil in seawater can be lethal to cod larvae. Chemical substances found in "produced water" — water extracted along with oil and gas from the reservoirs — has been shown t affect the reproductive capacity of cod. A common trait of several Barents Sea fish stocks, including capelin, cod, and herring, is that huge concentrations of egg and larvae are found in relatively small areas. An oil spill affecting any of these areas would have severe impacts for both the local fish community and the wider ecosystem.

During the nesting season, parent birds use the sea areas within a 100 kilometer radius as their main feeding grounds. If oil is present on the sea surface near seabird colonies, it is likely to affect a large

number of breeding birds. Auks and other diving seabirds suffer greatly as the oil sticks to their feathers and causes them to freeze to death.

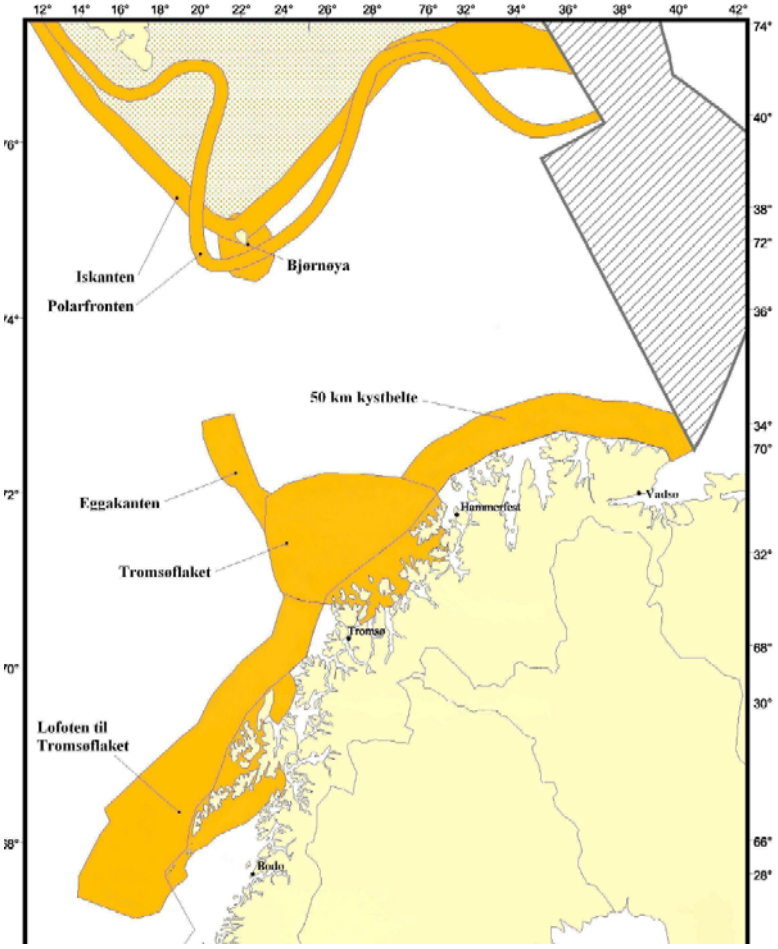


Figure 40. Vulnerable areas identified in the Barents Sea management plan.

5.3.2.2 Pressures

In the case description form we would like to include environmental pressures, because a given area is rarely affected by a single pressure alone and pressure-related stressors may have synergic, additive, or antagonistic effects, the integration of knowledge and approaches from different disciplines is crucial for effective protection and spatial management. Pressures on marine ecosystems include coastal population density and continued population growth in general; both of which are accompanied by increased consumer demand for marine products, increased waste disposal, rapid alteration of coastal habitats, uncontrolled industrial pollution, inadequate institutional structures for managing marine resources, lack of property rights and management regimes within international waters, and lack of understanding/awareness of marine ecosystem processes and the effects of human actions on marine biodiversity. Most of the world's marine ecosystems are stressed by a combination of these factors.

In the proposed case there are areas with high combined pressure from fisheries, petroleum industry, shipping and climatic change overlapping with vulnerable habitats such as coral- and sponge-reefs, spawning grounds, and gas seeps. These areas have been closed until a revision of the management plan is completed in 2010.

The MAREANO mapping program has provide new information from these areas covering: detailed topography, geology, pollutants, bottom fauna (biotopes, diversity biomass and productivity). This provides a baseline for the revision of the BSMP and for monitoring effects of pressures that could lead to the loss of marine biodiversity through: habitat loss, intense overexploitation, pollution and sedimentation, species introductions, and climate change.

Corals and petroleum industry: Discharge of drill cuttings have been found to affect corals located close to the well (Mortensen & Lepland) there are no studies indicating safe distance between drilling site seabed installations and live corals. Norwegian coral areas have been closed to fisheries but no measures action effects from the petroleum industry has been taken.

Bottomfauna and fisheries: Bycatch is a serious threat to several species of fish and seabirds, and bottom trawling has devastating effects on sensitive benthic communities, such as corals and sponges. It is estimated that between 30 and 50% of *Lophelia* reefs are either impacted or destroyed by trawling (Fosså J.H. et al. 2002).Passive gear like long-lines and gillnets anchored on the bottom also impact the coral reefs, but to a considerably lower extent than trawling (Mortensen et al. 2004). In addition, fisheries may have dramatic implications for organisms in other trophic levels as they often affect the abundance and distribution of key species in the ecosystem.

Oil & Gas Extraction / Pollution: The unique values of the Barents Sea and Lofoten Islands are threatened by a new and potentially extremely damaging activity: oil and gas development. It is believed that the Barents Sea hold up to one third of the world's remaining undiscovered oil and gas. However, harsh climate conditions and short and simple food webs make this marine ecosystem particularly vulnerable/sensitive to pollution from chemicals and oil. A 2001 moratorium on exploration in the Norwegian sector, imposed due to environmental concerns, was ended in 2005 following a change in government. A terminal and liquefied natural plant is now being constructed at Snøhvit and, as the Arctic ice cap shrinks due to global warming, it is thought that Snøhvit may also act as a future staging post for oil exploration in the Arctic Ocean. This promises increases in both petroleum extraction activity and transport shipping.

Shipping: Shipping in and through the Barents Sea is expected to continue to increase substantially over the coming years, possibly by a factor of ten by 2020. This is due to the development of new petroleum fields in the Barents Sea, and also because transport of petroleum from existing inshore fields is likely to be shifted from pipelines to ships (WWF 2010).

An accident with a ship containing oil, radioactive wastes or other hazardous cargo could have devastating effects on both biodiversity and industries. Many oil terminals are poorly secured and the coastline in the ecoregion is among the most hazardous in the world, with rough weather and innumerable islands, skerries and rocky shallows. In addition to accidents, both operational discharges and illegal dumping of oil in the sea is a widespread practice in shipping, giving rise to a number of chronic pollution problems. The introduction of alien species via ships' ballast water is another major environmental problem. With increased shipping, in particular exports of high-density cargoes, the volume of ballast water discharged into the Barents Sea will increase.

Long-range Transport of Pollutants/Contaminants: Contaminants have been measured in all compartments of the Arctic environment and its ecosystems —air, soils and sediments, snow and ice, seawater and freshwater, birds and mammals, and humans. They are transported to the Arctic by the air and by oceans and rivers. Within the Arctic, they are redistributed, also by ice transport pathways. The air provides a fast transport route — bringing contaminants from Europe to the Arctic within a matter of days. Air transport is particularly important in winter when air masses from Europe travel up into the Arctic, where they are trapped by the stable conditions shat prevail during the long Arctic winter. Ocean transport is slower, but more important for contaminants that partition into water and sediments rather than air and aerosols. Releases of radionuclides, such as caesium and technetium, from the European reprocessing plans at Sellafield (UK) and Cap de la Hague (France) can be traced as they follow the currents flowing north from the Atlantic into the Barents Sea and the Arctic Ocean, transporting contaminants from agricultural and industrial areas within their basins (Arctic Monitoring and Assessment Program, 2002).

Invasive Species: During the mid to late 1960s the red king crab (*Paralithodes camtschaticus*) from West Kamchatka was intentionally released by Russian scientists in the Kolafjord in the east Barents Sea (Russia) to create a new and valuable fishery resource in the region (Orlov and Karpevich, 1965; Orlov and Ivanov, 1978). Since then, the crab has spread both east along the Kola Peninsula, and westwards into the Norwegian zone (Jørgensen 2006). Laboratory results indicate that the susceptibility of native, shallow water, epibenthic communities to red king crab predation, must be considered significant when foraging rates are contrasted with observed natural scallop biomass (Jørgensen 2005). Increase in the red king crab stock in recent years has also resulted in by-catch problems, particularly in the gillnet fishery. The

crabs impact the long-line fishery by removing bait from hooks, thereby reducing catches of targeted fish (Sundet and Hjelset 2002).

Aquaculture & Water Fouling: Poorly managed and poorly regulated aquaculture, however, can have severe negative impacts through the release of excessive nutrients and chemicals, as well as escapes of farmed fish and the risk of disease transfer. The expansion of the aquaculture industry gives rise to two overriding concerns: the intrusion of fish farms into vulnerable marine and coastal areas, and the overall sustainability of an industry that depends on large catches of wild fish to feed farmed fish.

In the Barents Sea there are different types of aquaculture. Mussel farming is conducted in sea, with natural seeding, and apart from potential local conflicts with seabirds, this production has no significant environmental impact on the marine ecosystem. On-shore fish farming of species such as charr and trout is possible in Arctic areas, even in low temperatures, if clean water and energy for heating is available. Environmental impacts of such production are limited. However, the extraction of freshwater from rivers can have severe impact on the river habitat. Discharge of waste water can contain harmful concentrations of nutrients, chemicals, and be a potential source of infection of, for example, the lethal salmon parasite Gyrodactylus salaries.

Fisheries / Overfishing: The two predominant commercial species in the Barents Sea are capelin (Mallotus villosus) and cod (Gadus morhua). The Barents Sea capelin stock and the Northeast Arctic cod stock are likely the largest in the world. Herring (Clupea harengus) is at times important in the Barents Sea. Other commercially exploited species include haddock (*Melagrammus aeglefinus*), saithe (*Pollachius virens*), Greenland halibut (*Reinhardtius hippoglossoides*), polar cod (*Boreogadus saida*), and two species of redfish (*Sebastes marinus and S. mentella*). Overfishing has led to the decline of fish species, changes in marine food webs and fisheries crises in the Barents Sea. The Ecoregion is one of the main areas of commercial fisheries in the world, and fishing is probably the activity currently affecting biodiversity there to the highest degree. In addition to the decline in targeted fish stocks such as capelin and cod, fisheries also affect other organisms. Almost as a rule, regional governments set quotas significantly higher than recommended by scientists. Another tendency is that the increasing capacity of the fisheries demands a steady supply of fish and shows little flexibility to reduce catches when stocks are declining.

Climate Change: Climatic changes have considerable effects on the Barents Sea ecosystem; it likely to transform as a consequence. These changes likely represent both natural variations and effects of anthropogenic emissions of CO2 and other greenhouse gases. The relative importance of these two sources is not completely understood. Reproductive failure and negative population trends in ice-dependent marine mammals are possible effects of climate change. Expected changes to the ecosystem will likely include an increase in water temperatures of the Barents Sea and a corresponding decrease in sea ice cover. Changes in the physical conditions will have impacts on the marine ecosystem: although primary production will slightly increase, the production of zooplankton species will decrease. This is due to a comparative advantage of Atlantic zooplankton species over Arctic zooplankton species.

Commercially important fish stocks will be redistributed. Spawning area of capelin is going to shift eastwards towards a region along the western coast of Novaya Zemlya. Spawning will take place earlier in the year due to the increase in water temperatures. The mainly adult capelin population will migrate towards the north-eastern part of the Barents Sea.

As the Arctic sea ice decreases, the potential for shipping activity increases, along with resulting pressures on the ecosystem resulting from shipping activity. Open Arctic waters could also create otebe a potential for increased, fishing and oil exploration.

5.3.2.3 European MSFD

This case study based on the development (2002-2005) of the BSMP with a revision 2010 and the role of the MAREANO-mapping program providing new knowledge for the revition is directly relevant in relation to the following descriptors in MSFD: 1-6 and 8. Both the BSMP, existing knowledge of recourses in the area and the ongoing mapping approach is in accordance with demands in the MSFD. In particular do the fisheries management and the benthic fauna and habitat mapping provided by MAREANO represent a stat of the art practise in line with the MDFD. The visual documentation of fisheries damage to benthos together with VMS indicating fisheries activity makes it possible to addresses descriptor 6. The thorough

mapping of bottom fauna with a newly developed Norwegian video-standard (now become an EU-standard) together with sampling of all benthic components (infauna, epifauna anf hyperbenthos) to cover productivity and species diversity is highly relevant to MSFD descriptors 1,2,4.

The MSFD lists 11 descriptors of good environmental status.

1. Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.
2. Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems.
3. Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.
4. All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.
5. Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters.
6. Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.
7. Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems.
8. Concentrations of contaminants are at levels not giving rise to pollution effects.
9. Contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards.
10. Properties and quantities of marine litter do not cause harm to the coastal and marine environment.
11. Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment.

5.3.2.4 Level of spatial management today

The BSMP was launched for the area in 2006. The area Troms II, Nordland VII and Eggakanten were designated as a temporary petroleum-free zones by the Norwegian government in December 2003. The BSMP identifies ecologically valuable areas (Figure 38) and requires strict regulation of activities in these areas:

To reduce conflict between fisheries and shipping, Norway has applied (through the International Maritime Organization) to move shipping lanes outside Norwegian territorial waters (its 12-mile limit).

To avoid future conflict, some areas will be closed to hydrocarbon exploration and exploitation (Lofoten, Bear Island, the Polar Front, and the ice edge; Figure 38).

The framework for hydrocarbon extraction has been the focus of political debate around the plan, and will probably continue to be so.

Several new sector-specific area-based measures are also considered, including plans for extension of marine protected areas and the use of seasonally closed areas to protect spawning aggregations, fish eggs and larvae, and juvenile fish and shellfish.

The Lofoten Islands in northern Norway were designated as a temporary petroleum-free zone by the Norwegian government in December 2003.

For details see appendix.

5.3.2.5 Participation of Stakeholders

The Barents Sea plan uses cross-sectoral approach to governance where stakeholders are involved in the management process to insure a balance between:

- Petroleum development
- Increasing maritime transport
- Exploitation of marine resources (fisheries, aquaculture,)
- Need for environmental awareness and protection

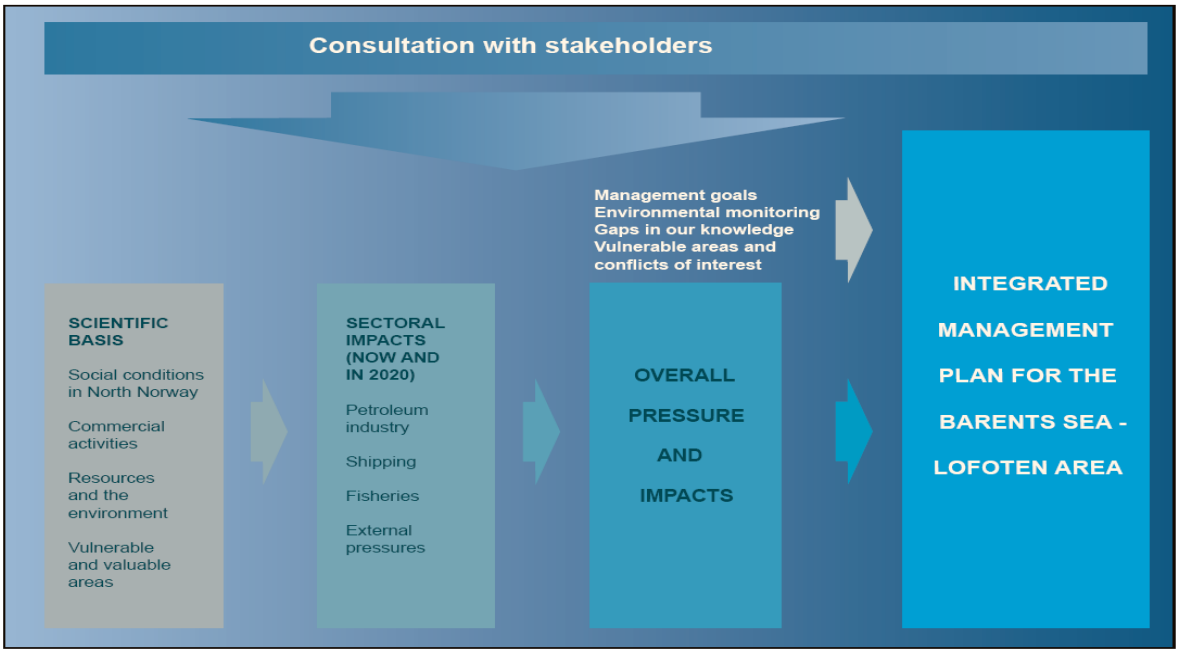


Figure 41. The consultation process leading to the integrated management plan for the Barents Sea–Lofoten area

5.3.2.6 Policy-urgency for Planning

The Barents Sea marine ecosystem is to be safeguarded for future generations as a basis for long-term value creation. Changes in industrial structure are making it more important to develop a robust cross-sectoral management regime.

The area has major potential for value creation in the future. There is rapidly-growing activity in new fields such as oil and gas extraction, transport of oil – mainly from Russia – along the coast, cruise traffic along the coast and around Svalbard, and marine bio-prospecting.

Such activities must be regulated and coordinated with more traditional activities, and a balance must be struck between the various interests involved.

The common denominator for all activities in or on the sea is that they interact in some way with the marine environment.

5.3.2.7 Commonality in Conflicts

The Norwegian region of the Barents Sea and areas off the Lofoten Islands is comparable to waters in other regions of Europe that are subject to multiple pressures arising from human activities/human-induced threats. These pressures include: increasing oil and gas extraction; commercial fishing; heavy shipping traffic; a large aquaculture industry; transport of contaminants; tourism; invasive species; and dramatic effects from climate change.

5.4 Annex to the Celtic Sea Case Study

Case study leader: Peter Jones

Figure 42. Outline of the PISCES project

5.5 Annex to the Basque Country (SE Bay of Biscay) Continental Shelf Case Study

Case study leader: Ibon Galparsoro

Table 13. Key human users in the Basque continental shelf area

User	Data availability[4]	
Fisheries	Φ	Pelagic, demersal and benthic species: fish, crustaceans, etc. Different fishing gears
Recreational fisheries	Φ	Coastal, diving and by boat (molluscs, crustaceans and fishes)
Oil/gas	Φ	Gas storage under the seafloor and gas conduction tubes laying on the shelf
Shipping	Φ	Three commercial harbours along 150 km coastline
Wind farms	0	There are not wind farms but viability studies have been asked for possible location selection
Sand mining	Φ	Limited. Only for beach nourishment
Tourism	Φ	High use in different ways: beach, diving, surfing, etc.
Aquaculture	Φ	Onshore, using seawater and discharging used waters. Aquaculture is foreseen to develop offshore (cages, long-lines)
Pipelines	Φ	Three for waste water discharge and two water caption for aquaculture
Cables	Φ	Submarine telephone cables
Seaweed extraction	Φ	Red seaweed *Gelidium corneum* as a commercial natural resource
Wave energy converters	Θ	Infrastructure construction will start in 2010 called bimep: Biscay Marine Energy Platform.
Dumping site	Φ	Harbour dredging material disposal and blast furnace slag disposal. Extent, biological and inorganic pollutant monitoring information are available
Recreational fishing	0	There is only partial data, recreational fishing from coast and small boats is important. From boats the most important target species are tuna and squid
Recreational activities: sailing	0	There are several recreational ports in the Basque coast, although sailing is not very important
Recreational activities: whale-watching	0	There are at least two companies providing these services
Recreational activities: promenade	0	
Harbour use	0	New commercial harbour is foreseen to be constructed in the next years
Marine Protected Areas	Φ	
Waste water disposal		

[4] Availability of quantitative (Φ), qualitative (θ) or no (0) data is represented with symbols.

Table 14. Use conflicts detection matrix

Criteria	Fisheries	Oil/gas	Shipping	Wind farms	Sand mining	Gravel extraction	Tourism	Aquaculture	Pipelines	Cables	Seaweed extraction	Wave energy converters	Dumping sites
Fisheries													
Oil/gas	x												
Shipping	x	0											
Wind farms	-	-	-										
Sand mining	x	-	-	-									
Gravel extraction	-	-	-	-	-								
Tourism	-	-	-	-	x	-							
Aquaculture	x	-	x	-	x	-	x						
Pipelines	x	-	-	-	x	-	0	xxx					
Cables	x	0	0	-	x	0	0	x	x				
Seaweed extraction	x	0	0	-	0	0	0	0	0	0			
Wave energy converters	xx	0	x	-	0	0	x	x	0	0	0		
Dumping sites	xx	0	0	-	xx	0	x	xx	xxx	xx	0	x	

Table 15. international, European and autonomic scopes in conservation issues

Scope	Normative	Goal
International	The Ramsar Convention on Wetlands (Ramsar, 1971; www.ramsar.org)	Embodies the commitments of its member countries to maintain the ecological character of their Wetlands of International Importance and to plan for the "wise use", or sustainable use, of all of the wetlands in their territories. Ramsar is not affiliated with the United Nations system of Multilateral Environmental Agreements, but it works very closely with the other MEAs and is a full partner among the "biodiversity-related cluster" of treaties and agreements. The Convention establishes an international listing of wetlands known as "RAMSAR wetlands" which includes coastal areas (inland and sea-land area).
	The Man and the Biosphere Programme (MaB) (Paris, 1971) (http://portal.unesco.org/science/en/ev.php-URL_ID=6393&URL_DO=DO_TOPIC&URL_SECTION=201.html)	Developed by UNESCO (better known as "Biosphere Reserves") to promote land management is conducted according to sustainable development. The M&B programme establishes an international listing of terrestrial and coastal marine ecosystems known as " Biosphere reserves". They are nominated by national governments and remain under the sovereign jurisdiction of the States where they are situated.

Scope	Normative	Goal
	Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris, 1972; http://whc.unesco.org/	Provides the so-called "Heritage Areas", and despite the declaration of this type of space does not imply changes in national legislation established In this case, yes it requires the competent administration to implement the necessary conservation measures contained in the Convention.
	Convention on Migratory Species (Bonn, 1979; www.cms.int):	Under United Nations Environment Programme umbrella; conservation of wildlife and habitats on a global scale. Conservation of the listed species in the annex must be achieved by means of international or global agreements (compulsory legal treaties), memoranda (less formal instruments) or action plans. The *Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas* (ASCOBANS), including waters of Bay of Biscay, has not been signed by the Spanish government, but the French homologue has. http://www.ascobans.org/index0101.html).
	United Nations Convention on the Law of the Sea (Montego Bay, 1982) www.un.org/Depts/los/index.htm	Legal framework related to the use and exploitation of the sea and its resources (living and nonliving). Annex I includes a list of highly migratory species to be protected. To date, no implementation therein. *United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks* (in force as from 11 December 2001).
	The Convention on Biological Diversity (Río de Janeiro, 1992; http://www.cbd.int/)	"Conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding".
	Pan-European Strategy for Ecological and Landscape Diversity (European Council, 1995; www.strategyguide.org/)	To cover the implementation of the Convention on Biological Diversity. The action plan of threatened species established in 1996 by the Strategy has been developed under the umbrella of the "Convention on the conservation of wild life and natural environment in Europe" (Bern Convention).
	Geosites Programme (1996, Unesco)	The Geosites project is developed by *Global Geosites Working Group* (GGWG). The main goal is to make an international catalog of sites of geological interest of scientific and educational interest for geological science worldwide. They are nominated by national governments and remain under the sovereign jurisdiction of the States where they are situated.
REGIONAL	Convention on the protection of the Northeast Atlantic (OSPAR Convention, www.ospar.org)	Mechanism by which fifteen Governments of the western coasts and catchments of Europe, together with the European Community, cooperate to protect the marine environment of the North-East Atlantic. Convention includes the "List of Threatened and/or Declining Species and Habitats" and a "representative networks of MPAs by 2012". Law 42/2007 on Natural Heritage and Biodivesity Spanish Government establishes that species which are protected and listed in any annex of Directives and International Conventions, will be part of the List of Wild Species under a Special Protection Regime.

Scope	Normative	Goal
	Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention, conventions.coe.int/treaty/en/Treaties/Html/104.htm)	To conserve wild flora and fauna and their natural habitats, especially those species and habitats whose conservation requires the co-operation of several States, and to promote such co-operation. Appendix I includes strictly protected flora species, Appendix II strictly protected fauna species and Appendix III protected fauna species; Emerald Network comprises Natura 2000Network areas and protected areas of European states that are not part of the EU. Applied through the Directive 92/43/CEE of the European Council on the conservation of natural habitats and wild fauna and flora (Habitats Directive) and Directive 79/409/CEE of the Council, on the conservation of wild birds (Birds Directive).
EUROPEAN	Habitats & Birds Directive	Protection of the listed species in any annex by means of special protection areas for birds (SPAs) and special areas of conservation (SAC). All of them will take part in the Natura 2000 Network. Law 42/2007 on Natural Heritage and Biodiversity, establishes that species listed as protected in annexes of Directives, such as the Habitats and Birds Directive, will take part of the List of Wild Species under a Special Protection Regime.
	European Geoparks Network (EGN) http://www.europeangeoparks.org/	To protect geodiversity, to promote geological heritage to the general public as well as to support sustainable economic development of geopark territories primarily through the development of geological tourism. The network has drawn together territories from across Europe that share these aims and which are now working together in an active and dynamic way to achieve them.
NATIONAL	Law 42/2007 on Natural Heritage and Biodiversity	To "establish the basic legal regime for conservation, sustainable use, improvement and restoration of natural heritage and biodiversity, as part of the duty to preserve law and to enjoy a suitable environment for the development of the individual". The Spanish List of Natural Heritage and Biodiversity includes 11+1 catalogues: "Spanish Catalogue of Endangered Habitats", "Spanish List of Wildlife with Special Protection Regime (including the Spanish Catalogue of Endangered Wildlife)", "Spanish List of Marine Habitats and Species", "Spanish Catalogue of Protected Areas, Natura2000 areas and other areas protected by international instruments", Spanish List of Interest Inventory Geological representative Spanish Catalogue of Alien Species, etc.
	Draft Law on Marine Environment Protection http://www.mma.es/secciones/participacion_publica/acm/prot_medio_marino.htm	This law incorporates into Spanish legislation "Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for Community action in the field of marine environmental policy (Marine Strategy Framework Directive)". Member States should take necessary measures to achieve or maintain good environmental status of marine environment (before 2020), by a national marine strategy for each region, subregion or subdivision.
	RD 1727/2007, 21st December, on cetacean's prevention and protection measures	To prevent or minimize the impact on cetaceans generated by whale watching activities either for tourism, scientific, recreational, educational or any other circumstances.
BASQUE	Law 16/1994 on Nature Conservation in the Basque Country http://www.euskadi.net/bopv2/datos/1994/07/9402695a.pdf	Establish basic principles and tools to protect Basque natural enviroment to ensure: a) sustainable use of species and ecosystems; b) natural ecosystems preservation and geological interest areas protection; c) maintenance of essential ecological processes and habitats of species of fauna and flora living in the wild, ensuring genetic diversity; Establishes the development of the Basque Catalogue on Threatened Species of Marine and Wild Flora and Fauna (in extinction risk, vulnerable, rare and of special interest) and a Basque Natural Areas Network (natural park, marine biotope, singular tree).

Scope	Normative	Goal
S E C T O R I A L	International Maritime Organization www.imo.org	*Particularly Sensitive Sea Area* (PSSA) is an area that needs special protection through action by IMO because of its significance for recognized ecological or socio-economic or scientific reasons and which may be vulnerable to damage by international maritime activities. The criteria for the identification of particularly sensitive sea areas and the criteria for the designation of special areas are not mutually exclusive. In many cases a Particularly Sensitive Sea Area may be identified within a Special Area and vice versa. *Special Area* (SA) is "a sea area where for recognised technical reasons in relation to its oceanographical and ecological conditions and to the particular character of its traffic, the adoption of special mandatory methods for the prevention of sea pollution by oil, noxious liquid substances, or garbage, as applicable, is required." Under the Convention, these Special Areas are provided with a higher level of protection than other areas of the sea (MARPOL 73/78, in Annexes I, II and V).
	Law 3/2001, 26th March, on Marine Fisheries	Marine reserves establishes by Fisheries Administrations taking into account all agencies related to the protection or exploitation of fisheries resources.

5.5.1 Natura 2000 Habitats in Basque Coast

COASTAL AND HALOPHYTIC HABITATS

Open sea and tidal areas
1110 Sandbanks which are slightly covered by sea water all the time
1130 Estuaries
1140 Mudflats and sandflats not covered by seawater at low tide
1160 Large shallow inlets and bays
1170 Reefs

Sea cliffs and shingle or stony beaches
1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
1310 Salicornia and other annuals colonising mud and sand
1320 Spartina swards (*Spartinion maritimae*)

MEDITERRANEAN AND THERMO-ATLANTIC SALTMARSHES AND SALTMEADOWS
1420 Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*)

COASTAL SAND DUNES AND INLAND DUNES
2110 Embryonic shifting dunes
2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)
2130 *Fixed coastal dunes with herbaceous vegetation (grey dunes)

ROCKY HABITATS AND CAVES

Other rocky habitats
8330 Submerged or partially submerged sea caves

FORESTS
91E0* Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Pandion*, *Alnion incanae*, *Salicion albae*)
92A0 *Salix alba* and *Populus alba* galleries

Moreover, benthic habitat mapping approach was conducted in 2009 identifying benthic habitats with EUNIS classification. 25 habitat classes have been identified (Figure 43).

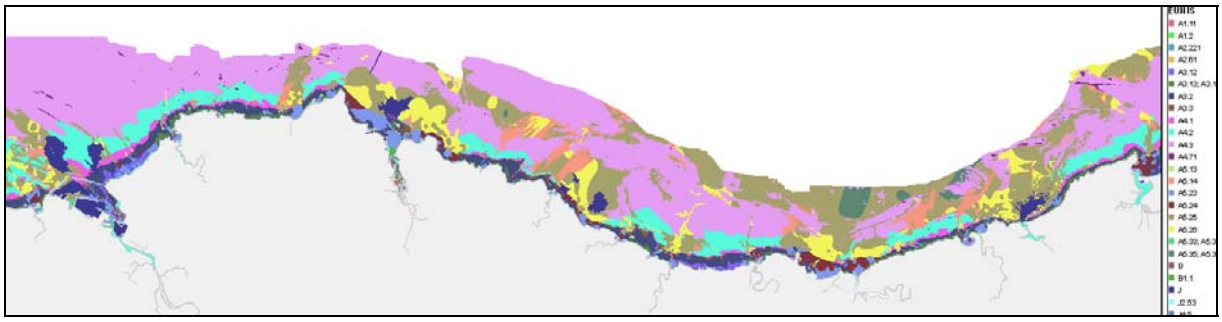


Figure 43. EUNIS benthic habitat distribution.

5.5.2 Protection features in the Basque country

5.5.2.1 Special Protection Areas for Wild Birds

ES0000144 Ría of Urdaibai
ES0000243 Txingudi Estuary

5.5.2.2 Community Interest Habitats present in the Basque country

ES2120004 Ría of Urola
ES2120010 Ría of Oria
ES2120014 Ulia coastline
ES2120015 Urumea river
ES2120017 Jaizkibel coastal cliffs
ES2120018 Txingudi-Bidasoa estuary
ES2120014 Ulia coastline and cliffs

5.5.2.3 International interest wetlands according to Ramsar

Urdaibai

Txingudi

5.5.2.4 Biosphere reserve of Urdaibai decla

Urdaibai covers an area of 220 km^2 and was designated by UNESCO in 1984 (http://www.unesco.org/mabdb/br/brdir/directory/biores.asp?mode=all&code=SPA+09). The territory is characterized by a hydrographic basin that ends creating a great salt marsh and a coastal landscape with high sheer cliffs and capes. The economy leans heavily on metallurgy, fishing/ maritime activities and forestry, and on the exploitation of local resources (arable and cattle farming). There is also a tourist trade, centred mainly on the local beaches, the historical towns (Gernika) and the natural environment. The area is implementing a management and land use plan and a development plan including socio-economic aspects and promoting sustainable activities such as quality tourism, agriculture and forestry.

5.5.2.5 Other marine protected biotopes

Gaztelugatxe: 158 ha

Declared by the Decree 229 / 1998 of 15 September (BOPV 2 of October 1998)

Due to its good condition most ecological importance of this coastal area lies in its capacity as breeding grounds for fishes. That is why any recovery program fishing off our coast should begin with the protection of this vital coastal habitat. Regarding fishing activity, the scarcity of examples of good size, coupled with the steepness of the seafloor and the strong swell which makes difficult to work with fishing gear in these shallow waters, makes the area unattractive to professional fishermen. Traps are used only during the winter to catch crab and the use of gill nets for mullet on sandy bottoms. It must be added the occasional draft of a trammel by vessels of the nearby port of Bermeo.

Deba-Zumaia:
The coastal area between Deba and Zumaia has been declared as Protected Biotope in 2009 10th of February. This Biotope includes a 8 km length coastal area and 4,299.7 ha. This area is characterized by the presence of fancifully layered deposits, known as flysch, with high scientific interest in the field of Palaeogeography, Palaeoclimatology and Palaeoecology due to the presence of the transition between the Paleocene-Eocene and the Cretaceous. Moreover the benthic communities in the intertidal rock platforms have also high interest due to high diversity.

The Protected Biotope includes terrestrial and marine zones. In terms of management, the marine area is zoned using three degrees of protection:

(i) Areas with special uses (low protection): includes the intertidal and subtidal areas of two beaches of tourist interest (71 ha).
(ii) Areas of marine protection (medium protection): fishing is allowed (3541 ha).
(iii) No-take areas (high protection). 141 ha.

The process of determining protected areas has not been accepted by some local people. This was mainly due to the presence of high illegal captures of octopus an other species in some intertidal areas, which is considered almost as a traditional practice.

5.6 Annex to the Strait of Sicily Case Study

Case study leader: Tomas Vega Fernandez

5.6.1 Geographical Sub-Areas and international waters in the case study area

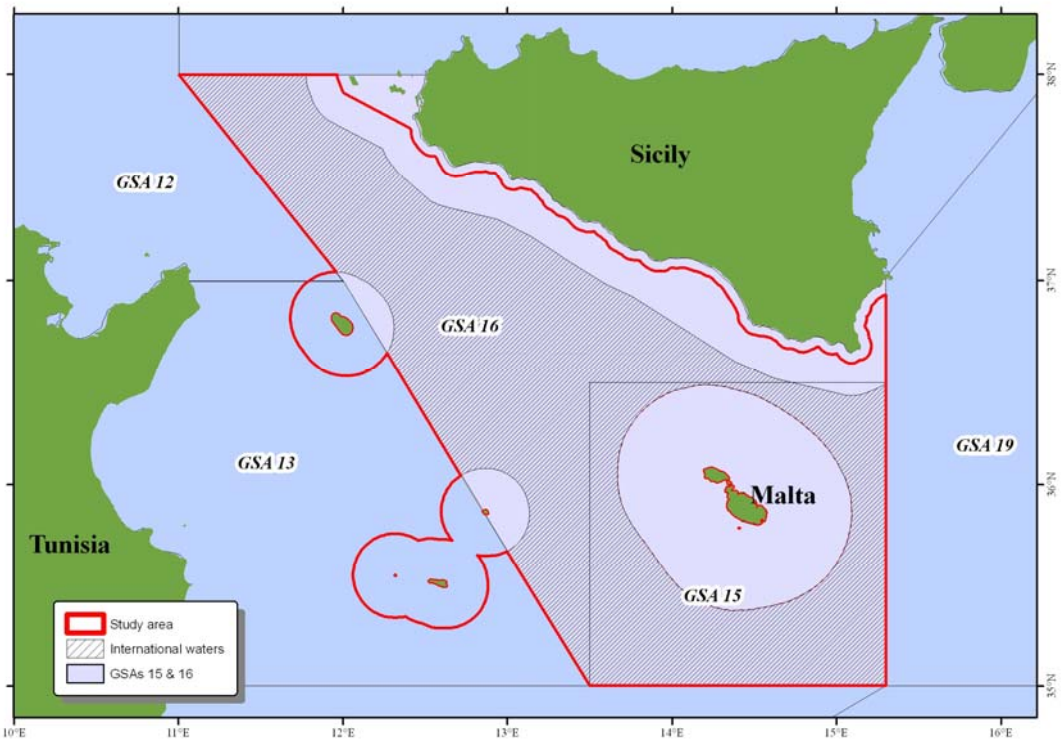


Figure 44. Geographical Sub-Areas and international waters

5.6.2 Most relevant oceanographic features of the study area

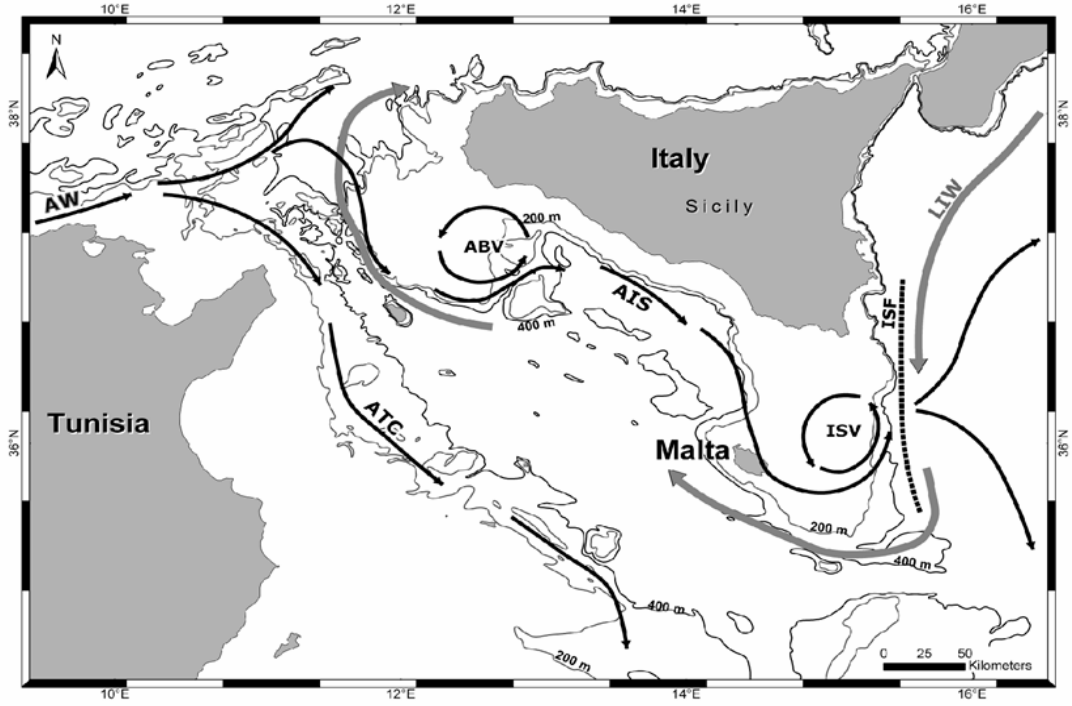


Figure 45. Most relevant oceanographic features of the study area

5.6.3 Biocenoses in the study area

[A4.26] Mediterranean coralligenous communities moderately exposed to hydrodynamic action.
[A4.265] Association with *Sargassum* spp.
[A4.267] Algal bioconcretion with *Lithophyllum frondosum* and *Halimeda tuna*.
[A4.269] Facies with *Eunicella cavolinii*.
[A4.26A] Facies with *Eunicella singularis*.
[A4.26B] Facies with *Paramuricea clavata*.
[A4.26C] Facies with *Parazoanthus axinellae*.
[A5.23] Infralittoral fine sand.
[A5.39] Mediterranean communities of coastal terrigenous muds.
[A5.46] Mediterranean animal communities of coastal detritic bottoms.
[A5.47] Mediterranean communities of shelf-edge detritic bottoms.
[A5.51] Maërl beds.
[A5.53] Seagrasses.
[A6.31] Communities of bathyal detritic sands with *Gryphus vitreus*.
[EUNIS A6.513; RAC/SPA V.1.1.3 (VB-PSF)] Communities characterized by *Funiculina quadrangularis*.
[EUNIS A6.514; RAC/SPA V.1.1.4 (VB-VC)] Communities characterized by *Isidella elongata*.

In addition, the following biocenoses are reasonably though to be present in the study area, but direct confirmation is still lacking:
[A4.261] Association with *Cystoseira zosteroides*.
[A4.262] Association with *Cystoseira usneoides*.
[A4.263] Association with *Cystoseira dubia*.
[A4.264] Association with *Cystoseira corniculata*.
[A4.266] Association with *Mesophyllum lichenoides*.
[A4.268] Association with *Laminaria ochroleuca*.
[A4.26D] Coralligenous platforms.

5.6.4 Human uses in the Strait of Sicily

5.6.4.1 Fishing in the Strait of Sicily

The Strait of Sicily holds a multigear, multispecies fishery, with a highly heterogeneous fleet widely dispersed in a large number of ports. The study area comprises the FAO Geographic Sub Areas (GSAs) 15 (Malta) and 16 (South and West of Sicily).

5.6.4.1.1 Sicilian Fishing Fleet

As of 2008, the Sicilian professional fishing fleet operating in the GSA 16 consisted of about 1370 vessels, with a total 29000 Gross Tonnage (GT) (IREPA[5], unpublished data). By the same year, there were 1112 registered boats with a total 12157 GT in GSA 15. Fishing activities include: shallow- and deep-water bottom trawling, pelagic and bottom long-lining, and trammel-gillnetting.

The Sicilian fleet operating in the GSA 16 is divided in three main segments:

- Small-scale fishery: about 800 vessels, 58% of the total fleet consisting of small to medium size vessels (mostly <18 m length overall (LOA)) that fish on the Sicilian continental shelf. This fleet uses various set gears (nets, longlines, traps, etc.) that target demersal fish and yields about 10% of total annual registered landings.
- Bottom trawl fishery: about 470 vessels, 34% of the total fleet, which yield 60% of total annual registered landings. The Sicilian trawl fishery can be further split up into two segments: about 300 small coastal trawlers measuring 12-24 m LOA (short-distance fishery with 1-2 days trips) and about 170 large trawlers operating in international waters (long-distance fishery with 3-4 week trips) that exceed 24 m LOA.
- Other: this is a heterogeneous segment which includes purse seiners, offshore longliners and other gears. This fleet amounts to about 115 vessels, 8% of the total fleet, which yield about 30% of total annual registered landings.

A recreational fishery is well developed in the area, which sometimes uses powerful boats and a wide array of professional and sport fishing gear spanning from nets to pots to lines to spear guns. This fishery is based in the western Sicily ports (year round) as well as in the small islands (in summer) and targets large-sized high-priced fish around wrecks and rocky shoals. Sport fishing is loosely regulated and rarely enforced. It has progressively attained a high level of sophistication and has become a high-tech activity which selectively targets the last fractions of unexploited game-fish populations. Vertical jigging and illegal spear-fishing using SCUBA are currently depleting fish populations in those habitats remained inaccessible to other more traditional fishing methods. Regulations like marine reserve boundaries and individual quotas are poorly obeyed. Sport fishermen conflict with traditional fisheries through unfair competition by illegally marketing highly targeted fish and other seafood like sea urchins. A census of recreational fishermen across Italy (including Sicily) will start in 2011 (Min. Decree 6 Dec. 2010).

5.6.4.1.2 Maltese Fishing Fleet

In 2008 the Maltese fleet consisted of 2820 registered fishing vessels, with only 58 vessels large enough to be considered as industrial vessels (i.e. over 15 m in length). These industrial vessels are trawlers, longliners and netters, which except for the bottom trawlers can be considered multipurpose since they engage in various fishing activities, changing gears from one season to the next (see table below). The remaining artisanal boats are owned by full-time, part-time and recreational fishermen, and overall the social importance of fisheries outweighs the economic importance of the sector in Malta. The most important fishery within the FMZ is the trawl fishery for demersals, with obvious environmental concerns related to this fishing technique. The main targets of trawling vessels are the highly priced crustaceans *Aristaeomorpha foliacea* (red shrimp), *Parapenaeus longirostris* (pink shrimp), and *Nephrops norvegicus*

[5] IREPA: Institute for Economic Research in Fishery and Acquaculture, www.irepa.org

(Norway lobster), as well as the fish species *Merluccius merluccius* (Mediterranean hake), *Mullus barbatus* (red mullet) and *Mullus surmuletus* (striped red mullet).

Other fisheries taking place within the zone are those making use of bottom set longlines, lampara nets / purse seines, fish aggregation devices and drifting surface longlines. These fisheries are operated on a seasonal basis, according to the particular targeted species' migratory or biological behaviour (Table below).

Table 16. Seasonal pattern of fishing activity in the Maltese FMZ

Fishing Activity	Period	Fishing Gear	Species
Trawl Fishery	All year	Bottom Otter Board Trawl Nets	Red Shrimp, Pink Shrimp, Norway Lobster, Hake, Red Mullet, Striped Red Mullet
Demersal Fishery	January – July	Bottom Set Longlines	Wreck Fish, Bream
Small Pelagic Fishery	March – August	Lampara / Purse seine, Cane Pots	Bogue, Mackerel
Fish Aggregation Device (FAD) Fishery	August – December	FADs and Surrounding Nets	Dolphinfish, Pilot fish, Amberjack
Swordfish Fishery	All year	Drifting Surface Longlines	Bluefin tuna, Swordfish, Spearfish, Dolphinfish

Geographical information: A GIS map of the spatial and seasonal distribution of the fishing effort over the study area can be assembled from Italian and Maltese databases.

5.6.4.2 Aquaculture in the Strait of Sicily

Aquaculture in the case study area is concentrated in Malta, where it started in the late 1980s, with culture of marine finfish in offshore cages. The most important species being reared were sea bream and sea bass, with annual production increasing dramatically during the 1990's from 60 tonnes in 1991 to a peak of 1800 tonnes in 1998 through the operation of six commercial farms. Due to decreased prices for these two species throughout the Mediterranean region production dropped, and at least in part got replaced by the much more lucrative business of fattening bluefin tuna (*Thunnus thynnus*) in tuna pens. According to EU figures, in 2008 the biggest part of the 7165 tonnes of farmed fish produced was blue fin tuna, worth around 100 million Euros and mostly exported to Japan.

However, this lucrative business is only benefiting a handful of businesses in Malta. The majority of the Maltese population is perceiving tuna penning as having a negative impact on coastal and marine ecology, polluting the surrounding areas, and negatively effecting tourism. Indeed, although obliged to frequently monitor water quality, all farms are at present located very close to shore. As a result there has been considerable public pressure on the government to move tuna farms further offshore, at least 6 kilometres away from the coastline. However, a site at present under consideration by the Malta Environmental Planning Authority (MEPA), located southeast of Malta is facing strong opposition from the council of the closest village, Marsaskala.

Aquaculture produces conflict with conservation and tourism through a number of impacts on the environment that has been documented for this type of activity, including:

- excess nutrient loads to aquatic ecosystems;
- use of chemicals which may accumulate in the ecosystem, specially antibiotics;
- resistant-disease reservoirs and vectors;

- interaction with fisheries including the effect of escaped exotic cultured species;
- genetic erosion of wild stocks;
- interactions with other uses of coastal zones.

5.6.4.3 Shipping

Over the past half century, shipping has greatly expanded in the Mediterranean Sea. Between 1985 and 2001, a 77% increase was recorded in the volume of ship cargo loaded onto and unloaded off Mediterranean ports. Most heavy vessels that cross the Strait of Sicily are directed to the Atlantic or the Suez channel. Every year, 220000 ships greater than 100 tons cross the Mediterranean basin and approximately 30% of international sea-borne volume originates from or is directed towards the 300 ports in the Mediterranean Sea. These values are expected to grow three or four fold in the next 20 years. A large number of ferries, fast ferries, hydrofoils and military and recreational vessels are present in the study area. Shipping generates a number of environmental impacts like noise, collisions with cetaceans, and the release of chemicals (remarkably oil) and inert solids (e.g. glass, paper, plastic, etc.). Collisions between carriers and fishing vessels are said to happen, but we lack sound data. Nevertheless we suffered the loss of the CNR oceanographic vessel "Tethys" following a collision with a carrier in the study area in 2007. There are also spatial conflicts between ships and fishing vessels. For example the bunkering zone on Hurd's Bank off the coast of Malta used to be a traditional fishing ground, and there is competition for space during the lampuki season, when there are large numbers of FADs, the swordfish corridors, pleasure and commercial boats.

Geographical information: Major shipping routes can be drawn from maritime charts. Within Maltese territorial waters, all vessels have to be equipped with AIS, and the data is transmitted via satellite and plotted on a map (http://www.marinetraffic.com/ais/default.aspx?level0=100).

5.6.4.4 Tourism

Tourism represents the main source of gross domestic product (GDP) for the small islands in the Strait. It is centred during summer and pervades many aspects of the local economy from local trade to house and boat renting. Maritime traffic increases to provide transport, freshwater and raw materials to the increased population during the warm season.

The classical response to the touristic demand focuses on the complete occupation of the upper beaches and the suitable coastline. Therefore the main environmental impact is related to habitat degradation, destruction and fragmentation. Other aspects related to crowding can also be tracked.

Geographical information: Municipalities within the Strait of Sicily have GIS maps in which the location of tourist zones, including the types of allowed activities, are shown. In the Maltese Islands such data can also be provided by MEPA. Furthermore, occupancy of the territory is recorded by municipalities as well as the National Statistics Office (NSO) in Malta.

5.6.4.5 Conservation

The Strait of Sicily holds important species and habitats that deserve protection, based on the following conservation criteria:

(a) Uniqueness or rarity. Habitats/species/geomorphologic features that could be considered rare, depending on the scale of observations, include:

(a.1) Geomorphologic features: submarine volcanic activity; mud volcanoes; (potential) cold seep.

(a.2) Habitat forming species: the scleractinian coral *Cladopsammia rolandi* (endemic to the Mediterranean), cold water deep-sea coral mounds composed of *Lophelia pertusa*, *Madrepora oculata* and *Balanus* spp., the yellow tree coral *Dendrophyllia cornigera*, the octocorals *Isidella elongata*, *Corallium rubrum* and *Funiculina quadrangularis*. The potential presence of cold seep communities. Coralligenous communities and "mäerl" beds exist in places where bottom trawling is not possible.

(a.3) Other rare species: Maltese skate *Leucoraja melitensis* is now confined largely to the Sicilian Straits. A colony of an undescribed species of large deepwater oyster (*Neopycnodonte* sp.) has been recorded living on fossilised coral mounds in the Linosa Trough.

(b) Special importance for life history stages of species. Interactions of hydrological features with the bottom orography create suitable spawning and recruitment conditions for a number of demersal and pelagic species of economic and/or ecological importance.

(c) Importance for threatened, endangered or declining species and/or habitats. Bottlenose dolphins inhabit inshore waters around the Pelagie Islands. Striped dolphins and fin whales are also present in the area, while loggerhead turtles, leatherback and green turtles are observed occasionally. The Maltese skate, great white shark, porbeagle, shortfin mako, sandbar shark, giant devil ray, and blue shark are also present. Bluefin tuna populations are declining drastically as a result of overfishing.

(d) Vulnerability, fragility, sensitivity, or slow recovery. Benthic habitats and communities summarized in point a.2 are vulnerable and fragile. Species specially sensible to human effects and slow to recover include: fin whales, numerous species of elasmobranchs and the turtles.

(e) Biological productivity. Total biomass of demersal fish species is particularly high on the Adventure Bank, to depths of 100 m. Other specially productive benthic habitats include those in point a.2 above.

(f) Biological diversity. A persistent area of high demersal fish diversity is located on the Adventure Bank, up to depths of 100 m. High demersal fish species diversity is also recorded at 400–600 m in the northwestern Strait of Sicily and on the eastern edge of the Maltese FMZ. Benthic habitats with high associated diversity also include those summarized in point a.2.

For the above mentioned reasons two areas within the Strait of Sicily have been proposed for protection by Greenpeace, WWF and ACCOBAMS (see *3.6.5.5.1 MPAs in the Strait of Sicily* in the case study description).

Geographical information: Several oceanographic and benthic features are already mapped (main currents, topography, biocenoses). Sites of major ecological and fishing importance are or can be indicated by experts in the respective fields with little effort. Coordinates of MPA boundaries are available. Spawning and nursery areas have been identified and placed into a GIS map for some target species: hake (*Merluccius merluccius*), greater fork beard (*Phycis blennoides*), deep-water rose shrimp (*Parapenaeus longirostris*), red mullet (*Mullus barbatus*) and octopus (*Octopus vulgaris*). Nesting sites of turtle (*Caretta caretta*) are known and records of sightings of cetaceans exist. Hot-spots of persistent demersal biodiversity have already been identified.

5.6.4.6 Oil exploitation

Drilling for oil is increasing off the southern coast of Sicily. Concessions are released by the Ministry for the Economic Development, but are heavily contested by the Sicilian Regional Government and by coastal municipalities. Seismic shooting is intensively used for exploratory purposes. Subsequently oil wells are drilled and finally oil is extracted from platforms for a number of years. These activities have a direct impact on the marine environment, in conflict with conservation and tourism. Fishing and shipping are also affected by the loss of fishing grounds and space, respectively. The main impact of seismic shooting by compressed-air guns is the production of high levels of noise. The intensity and frequency of this acoustic contamination has a negative effect in marine mammals. The impact of such noise on fish is less clear, since dissimilar results are reported in the scientific literature. It seems that the effect of seismic shooting on fish depends on the species. During drilling, the resulting mud is usually deposed around the drilling facility and toxic substances like e.g., heavy metals can be released. During platform operation, diffuse oil spills are known to occur, which are known to be the main source of oil contamination in the sea. The local landscape is disrupted. Bottom-laid structures are left onto the bottom after use and obsolete platforms are commonly sunk. Apart from conservation issues, conflicts arise because no other activity is allowed within the concession area. At least three oil platforms exist currently in Sicilian waters and new concessions are solicited. Few oil wells exist in Malta at present but exploration activities with a potentially high importance for the Maltese economy are underway.

Geographical information: position of oil facilities, which can be displayed in a GIS map. Severity of diffuse oil spillage can be estimated from numerical models.

5.6.4.7 Gas transport

Gas pipelines are perceived as strategic for the Italian economy. A substantial part of the imported natural gas consumed in Europe arrives through the Strait of Sicily. Two main systems are present within the case study area. First, the Transmed pipeline system transfers $24x10^9$ m^3 of gas per year from Algeria to Sicily *via* Tunisia. Such volume is planned to increased to $27.3x10^9$ m^3 by 2012. Second, the Greenstream pipeline transports $8x10^9$ m^3 of gas per year from Libya to Sicily, and it is expected to increase to $11x10^9$ m^3 by 2011. There is a feasibility analysis in course for linking Malta to the Greenstream pipeline. Pipelines enter in conflict with other uses of the sea bed, like fishing and anchoring, which are forbidden within the concession area. Recently a pipeline of the Transmed system got broken, apparently due to an anchoring ship.

Geographical information: position of concessions, which can be displayed in a GIS map.

5.6.4.8 Communication cables

The vast majority of over-seas communications is driven through submarine cables, which represent huge investments by different multinational consortiums. At least six of them cross the study area including the SEA-ME-WE-3 network, which is the largest in the world. The impact of submarine cables consists in the loss of ground for other uses, since all other activities on the sea bed are forbidden within the concession area. Despite the trawl ban, cables were sometimes reported to be cut by fishing trawlers close to the case study area.

Geographical information: position of concessions, which can be displayed in a GIS map.

5.6.4.9 Wind-mill farms

There are several projects for the construction of wind-mill farms in the banks of the Strait of Sicily. These include the Adventure bank (with a total power of 60 MW), the Pantelleria bank (168 MW) and the Talbot bank (354 MW): http://www.4wind.it/index.html

Malta is also proposing to introduce an offshore wind-mill farm close to the shore at Is-Sikka l-Bajda which is located in the north-eastern coast of Malta, about 1.5 km off Rdum tal-Madonna, limits of Mellieha. The proposed Sikka l-Bajda wind farm would be located 3 to 5 km from the tourist accommodation areas of St. Paul's Bay, Bugibba and Qawra and 5 km away from Ghadira beach. The closest residential area is Qawra (Ta' Fra Ben area), about 3 km from the nearest turbine. The project covers a sea area of around 11 square kilometres with water depths varying between 10 and 35 m.

The projects contemplate the direct anchorage of generators to the rocky bottom of offshore banks. This is in conflict with conservation efforts, since offshore bank communities are both exclusive and fragile. In some instances, the banks hold the last remains of relict Mediterranean communities in a near-pristine status that is impossible to find elsewhere. In addition, the banks are of main importance for the sustainability of many fished populations due to their role as spawning and nursery grounds. Therefore the construction of wind-mills is in direct conflict with conservation interests. Moreover, wind-mill farms have an indirect effect on fisheries both altering the oceanography of spawning and nursery grounds, and facilitating sport fishing by concentrating fishes (FAD effect) and allowing easy localization of the banks. High seas MPAs covering some of the banks and the area around Malta have been proposed by Greenpeace and ACCOBAMS.

Geographical information: position of concessions, which can be displayed in a GIS map.

5.6.4.10 Metadata availability.

Basic metadata in ISO compliant formats created with ArcCatalogue are available at CNR. In Malta, the majority of metadata is in ISO compliant formats created with JRC Metadata Editor. However, this is not the case for all the data.

At present there are neither lists of keywords or controlled vocabularies relating to marine spatial planning in the study area, nor lists of datasets (i.e. inventories). However, a metadata inventory is underway in order to satisfy the requirements of the INSPIRE directive.

Relevant datasets (from raw data up to shapefiles and maps) exist as examples under various thematic areas.

5.6.5 Conflicts between human uses

Table 17. Conflicts between human uses

Criteria	Fishing	Aquaculture	Shipping	Tourism	Conservatiom	Oil exploitation	Gastransport	Communication cables
Fishing								
Aquaculture	XX							
Shipping	XX	XX						
Tourism	XX	XX	X					
Conservation	XX	XX	X	XX				
Oil exploitation	XX	XX	X	XX	XX			
Gas transport	XX	0	X	0	X	X		
Communication cables	XX	0	0	0	0	X	X	
Wind-mill farms	XX	0	X	XX	XX	X	X	0

3.1. Fishing: Professional fishing has the largest number of conflicts with the selected uses. There are several different reasons for this: (i) conflict with offshore aquaculture plants, oil platforms, cables and pipelines, and offshore wind farms for seabed use; (ii) competition between inshore artisanal fishing and recreational fishing for resource use and for illegal fish trade on the side of recreational fishers; (iii) conflict between artisanal and industrial fishing due to gear loss and resource use; (iv) collisions between fishing and commercial vessels (rarely reported); (v) conflict between recreational fishermen and SCUBA divers, which have become frequent in the Maltese Islands over the past few years; (vi) bottom trawling has huge ecological effects that concern conservation like smothering of benthic organisms and habitats, by-catch and discard of non-target species, alteration of the size structure of populations, and change of food webs.

The results of recent stock assessment indicate that fishing capacity in the Strait of Sicily is severely oversized. This situation is partially a result of Sicilian past policies aimed at increasing the fleet and at subsidizing the fishery. More recently the Italian and Sicilian governments adopted a management plan within the actions of CE Reg. 1198/2006 (European Fisheries Fund) which include a 25% reduction of trawlers having the 2007 fishing capacity as a baseline. This reduction has to be obtained in the period 2008-2013.

Recreational fishing in Italy is a "nowhere land" where controls and enforcement are heavily poor. Recreational fishing is regulated under the Act on Fishing (no. 963/1965) and its enforcement decree (Presidential Decree no. 1639/1968). A recent decree (Min. Decree of 6 December 2010) has introduced a census of all Italian recreational and sport fishermen.

3.2. Aquaculture: Intensive aquaculture in the case study area is mainly carried out in offshore net cages. There is a number of well documented impacts of fish farms on marine organisms and their environment (pollution, biohazards from synthetic chemicals and disease reservoirs, spread of exotic species, genetic erosion of wild stocks). Therefore aquaculture comes into conflict with conservation and tourism. This interaction occurs at several spatial and temporal scales. Loss of species diversity can be rather local, while genetic erosion of the stocks can affect geographical regions. Although exotic species cannot be reared, sometimes aquaculture has incidentally introduced new species (for example, parasites in broods). Tourism is locally affected by landscape deterioration, but also by odours and oil deposits, and by organic enrichment of the receiving waters. Aquaculture negatively interacts with professional fishing because of loss in fishing ground. However, it seems to encourage recreational fishing because fish concentrate around aquaculture facilities (FAD effect). The importance and extent of sport fishing around the cages greatly depends of the local enforcement, since any activity is forbidden within the concession area. Finally, shipping across the concession area is forbidden.

3.3. Shipping: Large ships (cargoes, tankers) are expected to move across preferential corridors that are well defined on nautical charts. Nonetheless, collisions with fishing vessels (both professional and recreational) and research vessels have occurred, although such accidents are rarely reported. Ships cannot cross aquaculture facilities and have negative impacts on tourism by producing pollution which frequently reaches beaches (plastics, tar). Recreational and commercial ships can also cause the loss of set fishing gear. Anchoring causes significant loss of coastal habitat-forming organisms, in particular seagrass. Shipping is relevant to conservation issues due to the production of noise, the release of chemicals (mainly light fractions of oil), the facilitation of invasions by exotic species, and collisions with marine mammals and turtles. Construction of port facilities produce large environmental impacts on the neighbouring marine environment, in terms of landscape modification, change in the water circulation pattern, sediment resuspension and disposal. Maintenance of port practicability by dredging poses serious threats to benthic communities by sediment resuspension and disposal, and the release of accumulated contaminants.

3.4. Tourism: Tourism represents the main source of income in the small islands of the case study area and has been traditionally based on the use of the beaches, which led to an urbanization of most suitable coastal areas. A specific aspect of summer tourism is recreational fishing, which can be very efficient with the aid of new technologies. This activity is likely to lead to the decimation of the last reservoirs of large-sized fish species living on rough bottoms that are often inaccessible to most professional gear, with potentially large impacts on the fecundity of stocks. Other tourism initiatives include diving, sea trips and fishing tourism (which is an activity regulated by *ad hoc* legislation). The most relevant conflicts between tourism and aquaculture, as well as between tourism and shipping, have been discussed above. However, tourism also has direct impacts on the environment that pose important concerns to conservation. The upper beaches are usually "cleaned" of wreck and marine debris. Machines and people produce smothering and trampling of coastal habitats and organisms. Beach nourishment can also occur. Some coastal morphologies are modified to facilitate the access of people to the sea, or to adapt the coast profile to common "standards". Uncontrolled spear fishing and harvesting of edible invertebrates by tourists is wide-spread, and enforcement is generally lacking, although a national census of recreational fishers will start in 2011 across Italy (including Sicily).

Crowding during summer easily exceeds the capacities of small towns or villages to process wastes, so that pollution and accumulation of rubbish can occur. Heavily increased demand of fishing products promotes the (illegal) sale of catches by sport fishers and harvesters, which may have a considerable negative impact on the incomes of professional fishers. Contamination by light and noise can also occur in some places.

3.5. Conservation: Conservation is the result of measures aimed at protecting habitats and species from human impacts. As such, it may conflict with human uses of the natural environment. Firstly, by banning certain uses within a protected area, secondly, by regulating such uses and thirdly, by promoting environmental-friendly practices. In doing so, local people may perceive that conservation threatens their

way of life or potential for development. Fisheries, aquaculture, shipping and port facilities, as well as tourism usually support local economies. Therefore conflicts may or may not arise, depending on whether local stakeholders perceive that conservation initiatives provide them benefits or losses. This is often linked to the availability and diffusion of information. When limited information is available to local stakeholders, conservation may for instance generate conflicts with shipping if shipping is restricted or banned in certain areas. Also, conservation imposes more complicated ways to carry out certain routines like anchoring, disposal of wastes, etc. Conservation also is perceived as a threat to fishing activities due to the loss of fishing grounds since MPAs usually protect whole ecologically important communities. Conservation is also in conflict with tourism because the number of MPA visitors is sometimes limited, while the current political vision of the tourist industry in the Strait of Sicily is often merely based on the quantity of tourists (mass tourism). Reciprocally, the designation of a protected area can lead to crowding by tourists looking for “pristine” nature. In Italy, recurrent amnesties for infringement of building regulations have promoted a common feeling that “void” coastal territory is a resource to be claimed for building. Therefore conservation is strongly opposed in populated coastal areas where many people wish to construct or to enlarge their own properties. Finally, conservation poses some constraints to aquaculture developments in terms of suitable area, use of chemicals, reduction of environmental impact and insurance against the spread of exotic species. These initiatives raise production costs. More importantly, conservationists publicise against aquaculture for reasons that cannot be addressed, such as potential suffering of reared animals, potential diffusion of diseases due to crowding, and genetic erosion of wild stocks.

3.6. Oil exploitation: Direct impacts on the environment include the generation of high levels of acoustic contamination during the exploration by seismic shooting, as well as during drilling and routine platform maintenance. Diffusion and the risk of massive oil spillage can also occur. Moreover, release of toxic substances (such as heavy metals) from the sediments also occur from drilling. Platforms attract and concentrate some fish species, making them more vulnerable to fishing. Impacts on other uses of the sea derive from the fact that all other uses are forbidden within the concession, maritime traffic is locally increased and land-based facilities are generally necessary.

3.7. Gas transport: Direct impacts on the environment are related to the excavation of trenches to hold the pipeline in coastal zones. Trench excavation produces direct loss of benthic habitat, and sediment resuspension produces clog and burial of surrounding communities. In deep bottoms the pipe is uncovered and its impact is limited to the loss of the occupied sea bottom. Conflicts with fisheries derive from the loss of fishing grounds. In addition, ship anchoring is forbidden in the pipeline area. Heavy pipe damage has recently occurred in the case study area due to accidental anchoring.

3.8. Communication cables: Direct impact is limited to occupation of the seafloor. Cables are placed deep and therefore little impact with other uses arises, apart from the loss of available space. Since trawling is forbidden in the concession area, it represents a loss of fishing grounds.

3.9. Wind-mill farms: Offshore wind farms impact heavily with conservation efforts. Direct impacts result from drilling and fixing the wind-mills, with loss of local benthic communities and damage to surrounding assemblages. Water circulation pattern and sediment profile are expected to change close to the wind-mills, with possible implications for resident benthic communities. Some fish species are attracted and concentrated (FAD effect): this increases their vulnerability to recreational and professional fishing. Fish concentration around artificial structures has a negative effect on the surrounding benthic communities through intense predation. Electromagnetic fields could pose other environmental concerns. Conflict with fishing and shipping is also due to territory occupancy. Wind-mill farms also enter in conflict with tourism by disrupting the landscape.

Table 18. Main administrative involvement in coastal and marine area

	Office of the Prime Minister	Min for Justice & Home Affairs			Min for Tourism & Culture			Min for Competitiveness & Communications	Min for Resources & Infrastructure			Min of Health, the Elderly & Community Care	Min for Investment, Industry & Information Technology			Min for Rural Affairs & Environment			
	Armed Forces of Malta	Police Corps	Civil Protection Dept.	Property Division	Malta Tourism Authority	Heritage Malta	Superintendency of Cultural Heritage	Malta Maritime Authority	Malta Resources Authority	Works Division	Oil Exploration Division	Dept of Health	Water Services Corporation	Malta Freeport Corporation	Malta Enterprise	Agricultural Services & Rural Development Department	Fisheries Control & Conservation Division	Wasteserv Ltd.	MEPA
Land ownership				X							X				X				
Development control																			X
Port Management								X						X					
Bunkering								X											
Yachting								X											
Fisheries	X																X		
Aquaculture																	X		X
Agriculture				X					X			X				X			X
Quarrying									X										X
Groundwater extraction									X			X							X
Soil									X							X			X
Hydrocarbons											X								
Energy production									X										
Water production									X				X						
Waste										X								X	
Biodiversity																			X
Pollution Control	X		X					X				X							X
Cultural Heritage						X	X												X

5.6.6 SM related legislation in the Strait of Sicily

The following legislations apply to fishing in the Strait of Sicily:

European and international legislations

- FAO Code of Conduct for Fisheries (1995).
- FAO Technical Guidelines on fisheries management (1997).
- Council regulations (EC) No 2371/2002 and No 865/2007 (Common Fishery Policy)
- Council regulation (EC) No 1967/2006 (Fisheries Regulation for the Mediterranean).
- Common Fisheries Policy (CFP, No 1967/2006/EC).
- Council regulation (EC) No 1198/2006 (European Fisheries Fund).
- General Fisheries Commission for the Mediterranean (GFCM, Recommendations and Resolutions).

Italian legislations

- Act 963/1965, “Disciplina della pesca marittima”.
- Presidential Decree 1639/1968, Enforcement rules of Act 963/1965.
- Act 41/1982 “Piano per la razionalizzazione e lo sviluppo della pesca marittima”.
- Decree 14 September 1999, establishment of Consortiums for the management of artisanal fishing (Co.Ge.Pa.).
- Decree 24 March 2009, Long term management plan (LTMP,) adopted by the Italian Management Fishery Plans (IMFP) to reduce the Sicilian fleet capacity and regulate distant trawlers operating in the Strait of Sicily (GSA 12, 13, 14, 15 and 16) within 2013.
- Min. Decree 6 December 2010, Census of recreational and sport fishermen.

Maltese legislations

- Government Notice 206 of 1934 (Fishery Regulation).
- Maltese Fisheries Conservation and Management Act of 2001.

- Notice to Mariners 137 of 1990 (Berthing / navigation near Filfla).
- Maritime Authority's, Notice to Mariners No. 67 of 2004 (Artificial reefs).
- Notice to Mariners 24 of 2007 (Fishing Restricted Area).
- Maritime Authority's, Notice to Mariners No. 5 of 2008 (Conservation areas around wrecks).

The following legislations apply to conservation in the Strait of Sicily:

European and international legislations

- Birds Directive (BD, 79/409/EEC).
- United Nations Convention on the Law of the Sea (UNCLOS, 1982).
- Convention on Biological Diversity (CBD,1992).
- Habitats Directive (HD, 92/43/EEC).
- Agenda 21.
- Natura 2000 network.
- Water Framework Directive (WFD, 2000/60/EC).
- Common Fisheries Policy (CFP, 1967/2006/EC).
- Marine Strategy Framework Directive (MSFD, 2008/56/EC).
- Towards an Integrated Marine Policy for better governance in the Mediterranean (COM 2009/466).
- Criteria and methodological standards on good environmental status of marine waters (Comm. Dec. 2010/477/EU).

Italian legislations

- Act no. 979/1982 on the defence of sea.
- Act no. 34/1991 on protected areas.
- Decree 30 March 2009, list of Italian Sites of Community Importance (SCIs) and Special Protection Areas (SPAs).

Maltese legislations

- Development Planning Act (1992).
- Environment Protection Act (2001) Flora, Fauna and Natural Habitats Protection Regulation, 2003 (LN 311 of 2006).
- Government Notice 112 of 2007 (Rdum Majjiesa).
- Government Notice 161 of 2007 (Dwejra).

5.6.7 Potential stakeholders

Science & advocacy stakeholders.

- Institute for Marine Coastal Environment of the Italian National Research Council (CNR-IAMC).
- University of Palermo – Department of Ecology (conservation studies).
- University of Palermo – Department of Jurisprudence (maritime law).
- ISPRA (Research institute involved in the case study area).
- University of Malta – Department of Biology.

Conservation organizations (environmental NGOs)

- WWF.
- Greenpeace.
- ACCOBAMS.
- RAC-SPA.
- LIPU.
- BirdLife Malta.
- Friends of the Earth Malta.

Policy stakeholders

- FAO-GFCM

- Italian Ministry of Environment and Protection of Land and Sea
- Italian Ministry of Agriculture, Food and Forests
- Italian Ministry of Economic Development
- Italian Ministry of Infrastructures and Transport
- Italian Ministry of Tourism
- Sicilian Council for Agriculture and Food Resources
- Sicilian Council for Territory and Environment
- Sicilian Council for Tourism, Sport and Events
- Malta Environmental Planning Authority (MEPA)
- Malta Ministry for Resources and Rural Affairs (MRRA)
- Malta Resources Authority (MRA)
- Malta Tourism Authority (MTA)
- Transport Malta (TM)
- Malta National Statistics Office (NSO)
- Malta Maritime Authority (MMA)
- Malta Water Services Corporation (WSC)
- Superintendence of Cultural Heritage

Regulatory stakeholders (management and enforcement authorities).

- MPA management bodies.
- Fisheries Department of the Sicilian Council for Agriculture and Food Resources.
- Fisheries Department of Sicilian Provinces and Municipalities in the case study area.
- Fisheries Technological District of Mazara del Vallo.
- Fisheries Observatory Board.
- Chamber of Commerce.
- Consortiums for the management of artisanal fishing (Co.Ge.Pa.) (newly established).
- Coast Guard departments of the ports in the case study area.
- State Police, Carabinieri, Financial Guard.
- Armed Forces of Malta
- Malta Police Force
- Control Directorate, Ministry for Resources and Rural Affairs of Malta

Operational stakeholders.

- Fishermen's cooperatives of the Sicilian ports: Trapani, Marsala, Mazara del Vallo, Porto Empedocle, Sciacca, Licata, Lampedusa, Pantelleria, Scoglitti, Gela, Pozzallo, Porto Palo di Capo Passero.
- Ship owners association.
- Lega Navale Italiana (Italian Naval League).
- Assoziazione di produttori di Mazara del Vallo (Association of producers).
- Pro-loco (Associations promoting local tourism).
- FIPSAS (Italian Federation of Sport Fishing and Underwater Activities).
- PADI (Sport SCUBA Diving Association).
- CMAS (World Confederation of Underwater Activities).
- FourWind (Wind-mill farms).
- ENEL (Italian energy power provider - Gas pipelines).
- ? (submarine communication cables).
- Malta Fisheries Cooperatives.

Others.

- An observer from Malta for Sicilian enduser meetings.
- An observer from Sicily for Maltese enduser meetings.
- One or more counterparts from Tunisia.

5.6.8 Indicators

5.6.8.1 Deduce indicators

(a.1) Demand for property on the coast
(a.1.1) Size, density and proportion of the population living on the coast
(a.1.2) Value of residential property
(a.2) Area of built-up land
(a.2.1) Percentage of built-up land by distance from the coastline
(a.3) Rate of development of previously undeveloped land
(a.3.1) Area converted from non-developed to developed land uses
(a.4) Demand for road travel on the coast
(a.4.1) Volume of traffic on coastal motorways and major roads
(a.5) Pressure for coastal and marine recreation
(a.5.1) Number of berths and moorings for recreational boating
(a.6) Land taken up by intensive agriculture
(a.6.1) Proportion of agricultural land farmed intensively
(a.7) Amount of semi-natural habitat
(a.7.1) Area of semi-natural habitat
(a.8) Area of land and sea protected by statutory designations
(a.8.1) Area protected for nature conservation, landscape and heritage
(a.9) Effective management of designated sites
(a.9.1) Rate of loss of or damage to, protected areas
(a.10) Change in significance of coastal and marine habitats and species
(a.10.1) Status and trend of specified habitats and species
(a.10.2) Number of species per habitat type
(a.10.3) Number of Red List coastal area species
(a.11) Loss of cultural distinctiveness
(a.11.1) Number and value of sales of local products with regional quality labels or European PDO/PGI/TSG
(a.12) Patterns of sectoral employment
(a.12.1) Full time, part time and seasonal employment per sector
(a.12.2) Value added per sector
(a.13) Volume of port traffic
(a.13.1) Number of incoming and outgoing passengers per port
(a.13.2) Total volume of goods handled per port
(a.13.3) Proportion of goods carried by short sea routes
(a.14) Intensity of tourism
(a.14.1) Number of overnight stays in tourist accommodation
(a.14.2) Occupancy rate of bed places
(a.15) Sustainable tourism
(a.15.1) Number of tourist accommodation units holding EU Eco-label
(a.15.2) Ratio of overnight stays to number of residents
(a.16) Quality of bathing water
(a.16.1) Percentage of bathing waters compliant with the guide value of the European Bathing Water Directive
(a.17) Amount of coastal, estuarine and marine litter
(a.17.1) Volume of litter collected per given length of shoreline
(a.18) Concentration of nutrients in coastal waters
(a.18.1) Riverine and direct inputs of nitrogen and phosphorus in inshore waters
(a.19) Amount of oil pollution
(a.19.1) Volume of accidental oil spills
(a.19.2) Number of observed oil slicks from aerial surveillance
(a.20) Degree of social cohesion
(a.20.1) Indices of social exclusion by area
(a.21) Relative household prosperity

(a.21.1) Average household income
(a.21.2) Percentage of population with a higher education qualification
(a.22) Second and holiday homes
(a.22.1) Ratio of first to second and holiday homes
(a.23) Fish stocks and fish landings
(a.23.1) State of the main fish stocks by species and sea area
(a.23.2) Recruitment and spawning stock biomass by species
(a.23.3) Landings and fish mortality by species
(a.23.4) Value of landings by port and species
(a.24) Water consumption
(a.24.1) Number of days of reduced supply
(a.25) Sea level rise and extreme weather conditions
(a.25.1) Number of 'stormy days'
(a.25.2) Rise in sea level relative to land
(a.26) Coastal erosion and accretion
(a.26.1) Length of protected and defended coastline
(a.26.2) Length of dynamic coastline
(a.26.3) Area and volume of sand nourishment
(a.27) Natural, human and economic assets at risk
(a.27.1) Number of people living within an 'at risk' zone
(a.27.2) Area of protected sites within an 'at risk' zone
(a.27.3) Value of economic assets within an 'at risk' zone

5.6.8.2 indicators of the MSFD

(b.1) The quality and occurrence of habitats and the distribution and abundance of species. To be in line with prevailing physiographic, geographic and climate conditions.
(b.2) Presence and levels of non-indigenous species introduced by human activities. To be at levels that do not adversely alter the ecosystem.
(b.3) Biological limits of populations of all commercially exploited fish and shellfish. To be safe and exhibiting a population age and size distribution that is indicative of a healthy stock.
(b.3.1) Fish abundance.
(b.4) Abundance, diversity and levels of all elements of the marine food webs, to the extent that they are known. To occur at values capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.
(b.4.1) Nutrient source apportionment.
(b.5) Occurrence of human-induced eutrophication. To be kept under eutrophic levels that give rise to harmful algal blooms, oxygen depletion, etcetera.
(b.5.1) Chlorophyll-a concentration.
(b.5.2) Concentration of nutrients.
(b.5.3) Oxygen concentration.
(b.5.4) Water transparency.
(b.5.5) Phytoplankton communities.
(b.5.6) Inputs of nutrients (riverine and direct discharges).
(b.6) Sea-floor integrity. To be at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.
(b.6.1) Species composition of benthic invertebrate fauna.
(b.7) Permanent alteration of hydrographical conditions. They should not adversely affect marine ecosystems.
(b.7.1) Currents.
(b.7.2) Water exchange.
(b.7.3) Salinity.
(b.7.4) Bathymetry.
(b.8) Concentrations of contaminants. These should include the introduction of energy (point 11 in MSFD), like underwater noise or heat, as well as the introduction of inert materials, like plastics. . To be kept at levels not giving rise to adverse effects to the marine environment.

(b.8.1) Temperature.
(b.8.2) Oil slicks.
(b.8.3) Atmospheric deposition of non-toxic contaminants.
(b.8.4) Hazardous substances in sediments.
(b.8.5) Chemical contamination “hot spots”.
(b.8.6) Inputs of organic compounds
(b.9) Contaminants in fish and other seafood for human consumption. They should not exceed levels established by Community legislation or other relevant standards.
(b.9.1) Hazardous substances in biota.
(b.9.2) Metals.
(b.10) Properties and quantities of marine litter. To be below levels that could cause harm to the coastal and marine environment.

5.7 Annex to the Inner Ionian Achipelago – Patraikos and Korinthiakos Gulfs Case Study

Case study leader: Celia Vassilopoulou

5.7.1 The marine Natura 2000 sites in the study area

Introduction

A large number of marine Natura 2000 sites are included in the Greek MESMA case study area "Inner Ionian Archipelago and adjacent gulfs". These sites are either Sites of Community Importance (SCI) deriving from the implementation of the EU Habitats Directive (92/43/EEC), or Special Protection Areas (SPAs) designated by Member States under the EU Birds Directive (79/409/EEC). Some of them have additional national or international conservation status, as they are declared National Parks or areas under the Ramsar Convention.

Methodology

In the next pages the identity of each Natura 2000 site which is included in the study area will be presented. The emphasis will be put on the biodiversity (conservation targets), as well as on the conflicts and threats. The study area is shared between five different administrative Regions ("peripheries") but marine Natura sites have been designated by the Greek authorities only in three of them. The three chapters that follow present the Natura sites which are included in each of these Regions: the Region of Ionian Islands, the Region of Western Greece ("Dytiki Ellada) and the Region of Central Greece ("Sterea Ellada"). The Inner Ionian Archipelago lies in the first, whereas Patraikos gulf in the second as well as the south-western part of Korinthiakos gulf. The north-western of Korinthiakos gulf lies in the third Region (Figure 46). It is worth mentioning that in a large part of Korinthiakos gulf, which covers most of its central and eastern part, no marine Natura sites have been designated by the Greek authorities, probably due to stakeholder pressures (mining in the north, urbanization in the south), although several NGOs have protested about the ecological value of the area. Discussion is however still open.

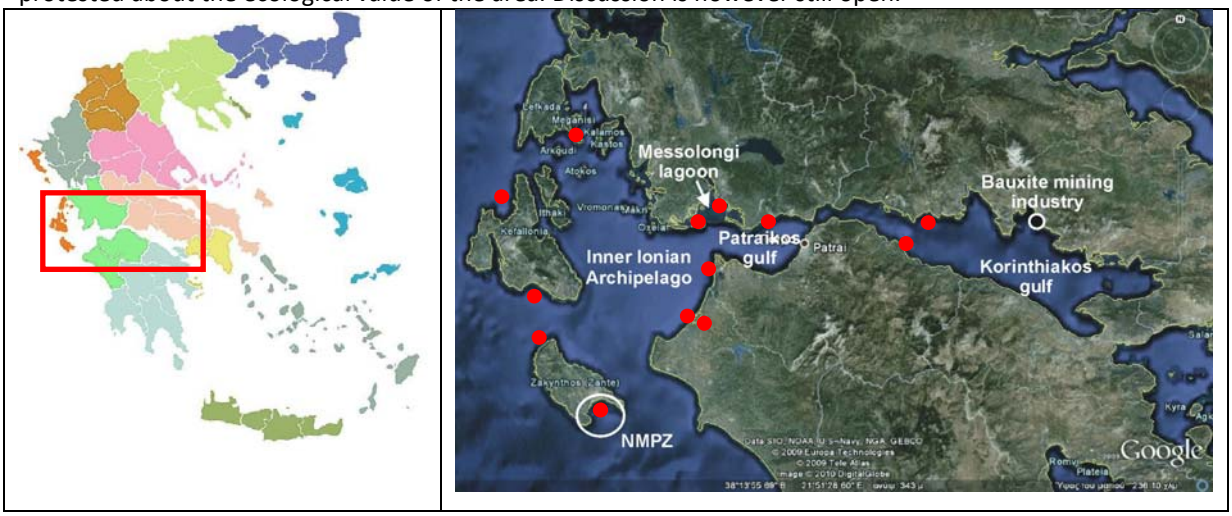
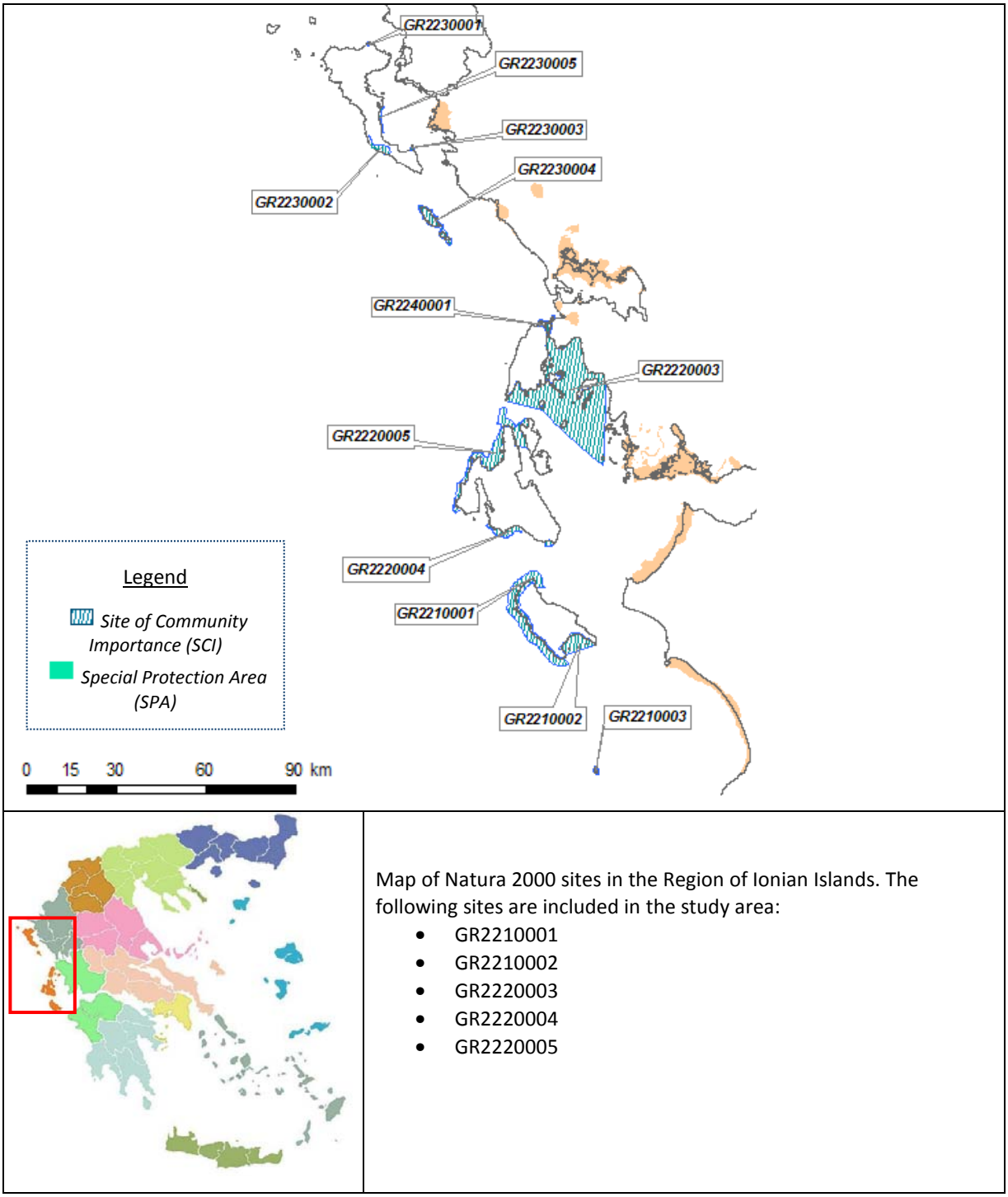


Figure 46. Administrative Regions (left) and Natura 2000 sites (right) in the case study area "Ionian Archipelago and adjacent gulfs"

The presentation of the Natura sites which are included in the study area will be based on the following sources:

1. Dafis S., Eva Papastergiadou, K. Georghiou, D. Babalonas, T. Georgiadis, Maria Papageorgiou, Thalia Lazaridou and Vasiliki Tsiaoussi, 1996. Directive 92/43/EEC The Greek "Habitat" Project NATURA 2000: An Overview. Life Contract B4-3200/94/756, Commission of the European Communities DG XI, The Goulandris Natural History Museum – Greek Biotope/Wetland Centre. 917 p.

2. Greek Ministry of Environment, 2001 (in Greek). "Identification and description of habitat types at sites of interest for conservation" Study 5: Marine habitats (P. Panayotidis Ed.), Athens 2001.
3. Roumelioti N., 2009 (in Greek). "Marine Natura 2000 sites in the Greek seas", MSc Thesis (P. Panayotidis supervisor), National Technical University of Athens, 530 p.

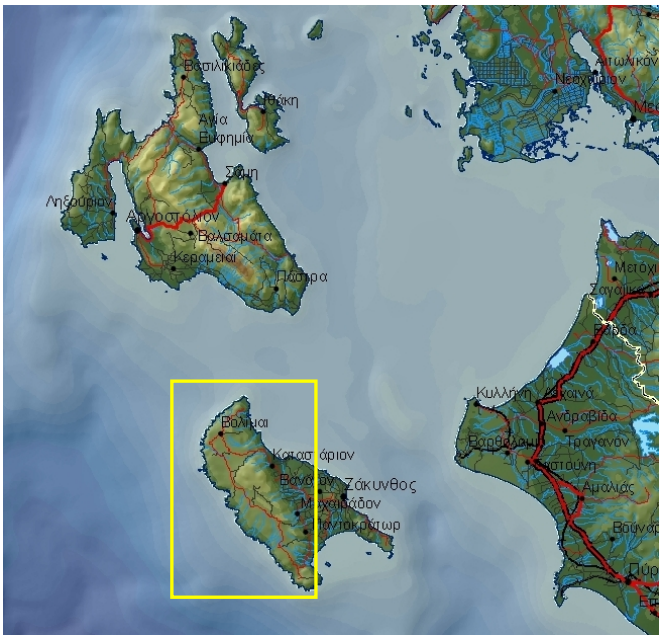


Map of Natura 2000 sites in the Region of Ionian Islands. The following sites are included in the study area:

- GR2210001
- GR2210002
- GR2220003
- GR2220004
- GR2220005

Figure 47. Region of Ionian Islands (Source: Greek Ministry of Environment)

Name: WESTERN AND NORTH EASTERN COASTS OF ZAKYNTHOS ISLAND		
Code: GR2210001	**Conservation status:** SCI/SPA	
Location: 20°41′ E, 37°51′ N		
Administrative authority: Region of Ionian Islands		
Total surface (ha): 21419.24	**Marine surface (ha):** 16861.40	
Coastline length (km): 46	**Depth (m):** 50	



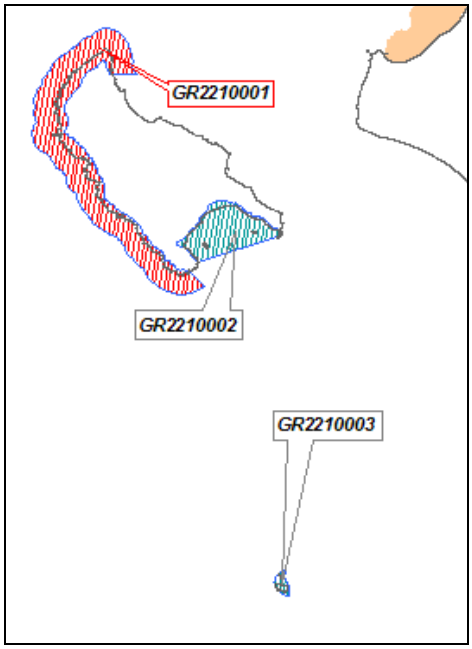


***Figure 48. Geomorphology (left) and extent (right) of the site GR2210001. (*Source: HCMR / GIS Laboratory)**

Geography and geomorphology: Bearing the official name “Dytikes kai Vorioanatolikes Aktes Zakynthou”, the site covers the entire western coast of Zakynthos island as well as part of the north eastern coast. The landscape is dominated by sharp calcareous rocks, forming sea cliffs and marine caves.

Vegetation and animal life: The dominant vegetation on the cliffs is shrubs (with endemic *Limonium* spp.) and phrygana (*Sarcopoterium spinosum*). The rest of the area consists of rocky hills partially occupied by pine forests (*Pinus halepensis*), sclerophyllous grazed “macquis” forests with *Quercus suber* and/or *Quercus ilex*, as well as cultivated areas (Dafis *et al*., 1996).

The marine part is not very extended, as the bottom is sharp and goes down to 50 m deep near the coastline. Seagrass meadows (*Posidonia oceanica*) cover the sandy parts of the seafloor (habitat type 1120) and big brown algae (*Cystoseira* spp.) formations cover the rocky part (habitat type 1170). Marine caves (habitat type 8330) occur along the coasts of the site. The dominant vegetation in the caves is the sciaphyllic association *Udoteo-Aglaothamnietum tripinatum*. The habitat type 8330 is linked to the nesting areas of the monk seal *Monachus monachus*. Dolphins (*Ziphius cavirostris, Delphinus delphis*) are also observed in the site.

Table 19. Marine habitat types of the site GR2210001 listed in Annex I of the Habitats Directive.

CODE	%COVER	REPRESENTATIVITY	CONSERVATION	GLOBAL ASSESSMENT
1120	10	A Excellent	A Excellent	A Excellent
1170	2	B Good	B Good	B Good
8330	10	A Excellent	A Excellent	A Excellent

Source: Greek Ministry of Environment, 2009

The site is also important for birds living in shrub and coastal habitats as well as for migratory birds, because it lies on a main eastern Mediterranean migration corridor. Important bird species in the site are: *Phalacrocorax aristotelis* and *Falco eleonorae*. Other important animals are *Myotis blythi, Testudo hermanni, Elaphe quatuorlineata* and *Elaphe situla.*

Ecological value, conflicts and threats: The seaside cliffs are hosting the most important of Zakynthos island flora, including a number of rare plant species. The most important element of the marine part is the presence of the Mediterranean monk seal (*Monachus monachus*) in the caves of the site. Finally, the site is important for the migratory birds.

Tourist motor boat activity is becoming very common in the site, which is not accessible by road. Daily cruises to visit the caves are organized during the summer period. Thus, there is important conflict between tourism and wild life protection.

Name: LAGANAS BAY (CAPE GERAKI-KERI) AND ISLETS OF MARATHONISI AND PELOUZO		
Code: GR2210002	**Conservation status:** SCI	
Location: 20°52′ E, 37°43′ N		
Administrative authority: Region of Ionian Islands		
Total surface (ha): 6957.70	**Marine surface (ha):** 6079.27	
Coastline length (km): 20	**Depth (m):**	

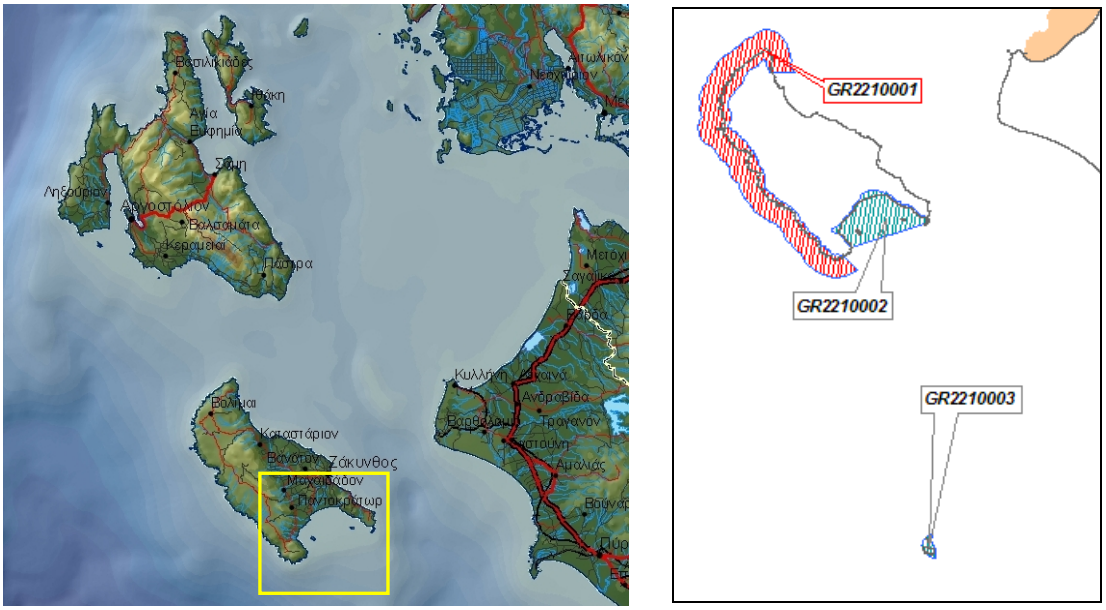


Figure 59. Geomorphology (left) and extent (right) of the site GR2210002 (Source: HCMR / GIS Laboratory)

Geography and geomorphology: Bearing the official name "Kolpos Lagana Zakynthou (Akr. Geraki-Keri) kai Nisides Marathonisi kai Pelouzo", the site includes the wide Laganas Bay with its extended high hydrodynamic sandy beach (exposed to southern winds) as well as isles Marathonisi and Pelouzo to the south with sharp rocky coasts.

Vegetation and animal life: The site is well known for its sandy beaches which are considered as the main nesting areas of the sea turtle *Caretta caretta* in the Mediterranean. The presence of *Posidonia* beds (habitat type 1120) is generally extensive although in central Laganas Bay the coverage becomes sparse and the species *Caulerpa prolifera* and *Cymodocea nodosa* are dominant (soft substrata with vegetation 119B). In between the coastline and the *Posidonia* beds we find sandbanks (habitat type 1110) without vegetation or scattered *Cymodocea nodosa*. At the rocky coasts of the isles and at the capes bordering Laganas Bay there are reef formations (type 1170) which co-exist with *Posidonia* beds in deeper waters. The rest of the site consists of soft substrata without vegetation (type 119A). Beyond the beach there is common Mediterranean vegetation with endemic species. Some important vertebrates have been

observed in the area (apart from bird species) amongst which is the *Algyroides moreoticus,* a species of lizard endemic to the Peloponnese and some Ionian islands.

Ecological value, conflicts and threats: Together with Strofades islands the site is included in the national marine park of Zakynthos. The contradiction between ecologists who fight for the strict protection of the site and a section of local stakeholders who support tourist development is remarkable.

Nevertheless, the site is very important for the nesting of *Caretta caretta* . Keeping in mind that nesting is a critical stage of the biological cycle of *Caretta caretta* relevant with the survival of the species, the ecological importance of the site becomes rather high, magnified also by the fact that both the terrestrial and the marine part of the site are characterized by the presence of important habitats (sand dunes, sandy beaches, rocky coasts, sharp cliffs) which all together form a high quality ecosystem.

Table 20. Marine habitat types of the site GR2210002 listed in Annex I

CODE	%COVER	REPRESENTATIVITY	CONSERVATION	GLOBAL ASSESSMENT
1110	14.47	A Excellent	A Excellent	A Excellent
1120	44.58	A Excellent	B Good	B Good
1170	1.75	A Excellent	A Excellent	B Good

Source: Greek Ministry of Environment, 2009

Table 21. Marine habitat types of the site GR2210002 not listed

CODE	%COVER	REPRESENTATIVITY	REL SURFACE	CONSERVATION	GLOBAL ASSESSMENT
119A	43,11	A		A	A
119B	8,88	A		A	A

Source: Greek Ministry of Environment, 2001

Table22. Syntaxonomic table of the site GR2210002.

Class	Order	Alliance		Association	
HALODULO-THALASSIETEA	Thalassietalia	Cymodoceion nodosae	111020	Cymodoceetum nodosae	111021
POSIDONIETEA	Posidonietalia	Posidonion oceanicae	112010	Posidonietum oceanicae	112011
CYSTOSEIRETEA	Cystoseiretalia	Cystoseiron	117010	Ass. *Cystoseira amentacea*	117011
CYSTOSEIRETEA	Cystoseiretalia	Cystoseiron	117010	Ass. *Cystoseira schiffneri*	117016
HALODULO-THALASSIETEA	Thalassietalia	Cymodoceion nodosae	119B10	Cymodoceetum nodosae	119B11
CYSTOSEIRETEA	Cystoseiretalia	Cystoseiron	117010	*Cystoseira compressa*	

Source: Greek Ministry of Environment, 2001

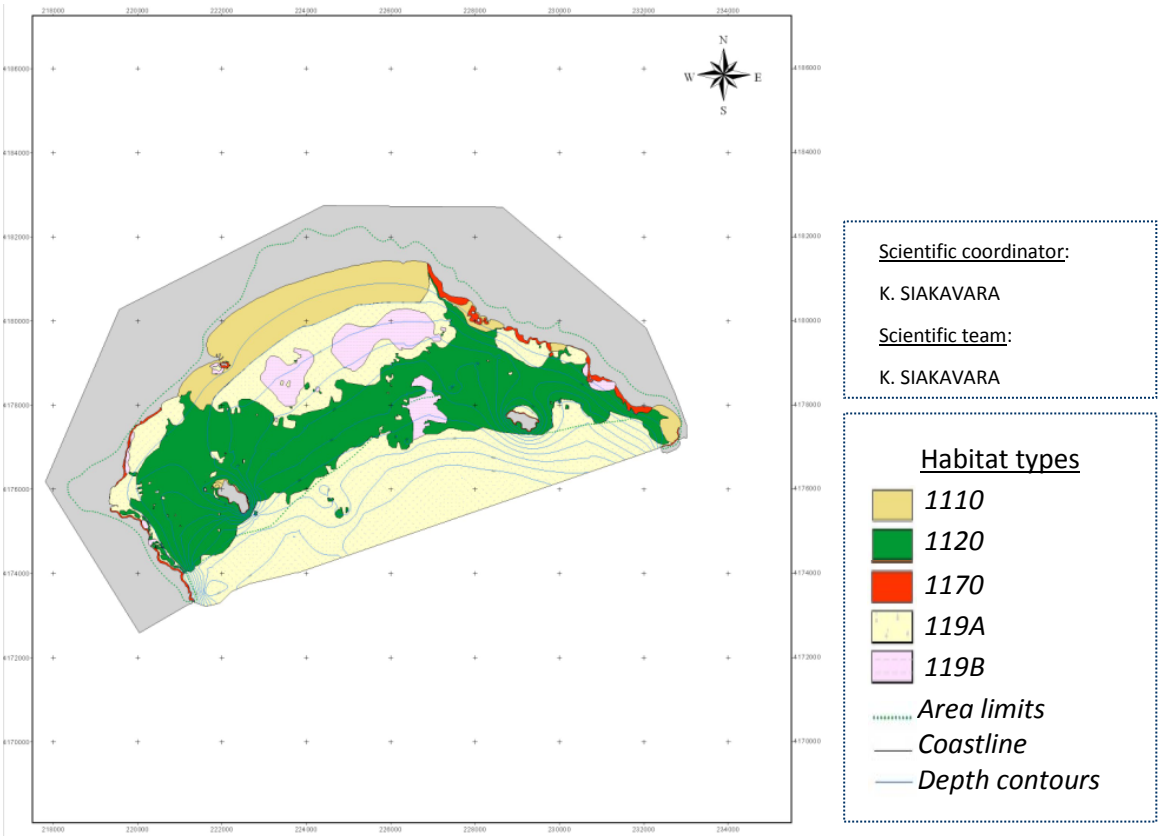
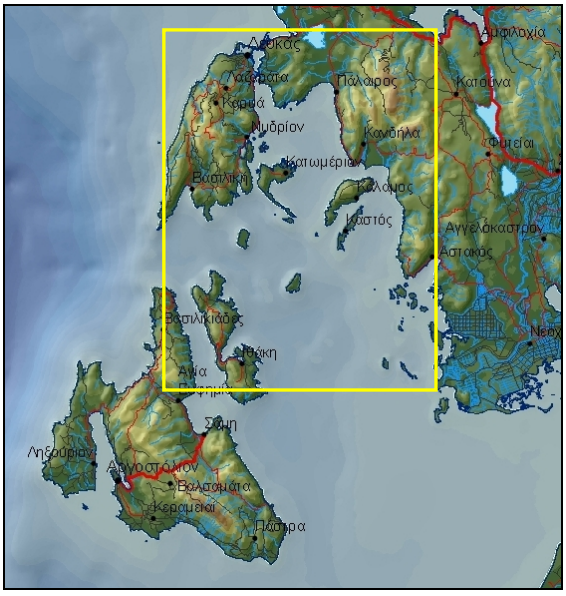


Figure 50. Distribution of marine habitat types in the site GR2210002 (Source: Greek Ministry of Environment, 2001)

Name: INNER IONIAN ARCHIPELAGO (MEGANISI, ARKOUDI, ATOKOS, VROMONAS)		
Code: GR2220003	**Conservation status:** SCI	
Location: 20°56′ E, 38°30′ N		
Administrative authority: Region of Ionian Islands		
Total surface (ha): 88333.27	**Marine surface (ha):** 86620.10	
Coastline length (km): 230	**Depth (m):**	



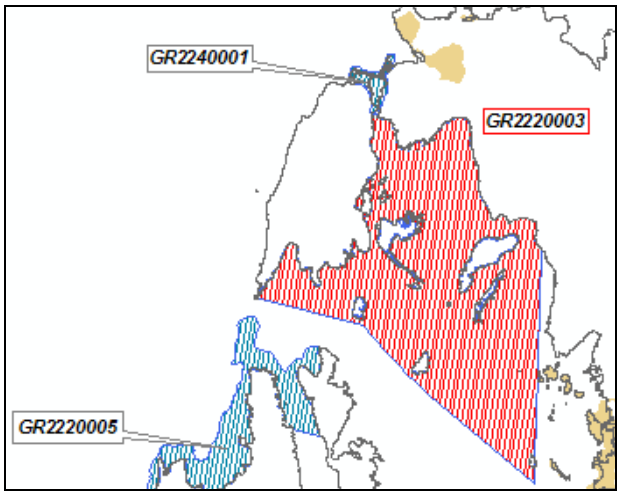


***Figure 51. Geomorphology (left) and extent (right) of the site GR2220003 (*Source: HCMR / GIS Laboratory)**

Geography and geomorphology: Bearing the official name "Esoteriko Archipelagos Ioniou (Meganisi, Arkoudi, Atokos, Vromonas)", this is mainly a marine site which is bordered by the island of Lefkada to the west, Kefalonia and Ithaki to the south and mainland Greece (Prefecture of Aitoloakarnania) to the east and north. It includes an important archipelago of 36 small islands. Meganisi, Kalamos, Kastos and Skorpios islands are the only ones inhabited. High hydrodynamic rocky coasts are dominant except from the straits between the islands where we find low hydrodynamic coasts.

Vegetation and animal life: The marine environment of the archipelago offers shelter to many important predator species, a fact that highlights the ecological abundance of the area. Common dolphins (*Delphinus delphis*) and various shark species are among these. There are also many submerged and partly submerged sea caves which form an ideal habitat for monk seals (*Monachus monachus*). Owing to this, the site constitutes one of the most important areas in Greece (and in the Mediterranean in general) for this mammal which is the most threatened with extinction in Europe. Two other extremely important marine species, the *Tursiops truncatus* dolphin and the *Delphinus delphis* dolphin, are sympatric in the site. The population of the *Delphinus delphis* which is encountered in the site is one of the few (three or

four) in the entire Mediterranean. Animals of this species survive in the area most probably as a remnant of a population which once occupied the waters of the Adriatic and Ionian seas.

Moreover, the geomorphology of the coasts creates various potential habitats for the marine and terrestrial flora and fauna. A very common habitat species of the site is Seagrass meadows (*Posidonia oceanica*) and their conservation status is currently excellent. There are also reef formations (habitat type 1170) in less extended areas. The biggest part of the site is covered with soft substrata without vegetation (119A). The land vegetation is made up of *Juniperus phoenicea* which is in good ecological status, shrubs, *Pinus halepensis* trees and olive groves.

Ecological value, conflicts and threats: The site was designed for the protection of the marine mammals. For that reason the surface of the site is huge (more than 80.000 ha of marine surface). Although the presence of human activity is very limited, some conflicts occur between conservation and aquaculture. Navigation of large ferries from Patras port to Italy is also a potential thread.

Table 23. Marine habitat types of the site GR2220003 listed in Annex I of the Habitats Directive.

CODE	%COVER	REPRESENTATIVITY	CONSERVATION	GLOBAL ASSESSMENT
1120	10.07	A Excellent	A Excellent	A Excellent
1150	0.01	B Good	B Good	B Good
1170	0.22	A Excellent	A Excellent	B Good
8330	0	A Excellent	A Excellent	B Good

Source: Greek Ministry of Environment, 2009

Table 24. Marine habitat types of the site GR2220003 not listed in the Habitats Directive

CODE	%COVER	REPRESENTATIVITY	CONSERVATION	GLOBAL ASSESSMENT
119A		A	A	A

Source: Greek Ministry of Environment, 2001

Table 25. Syntaxonomic table of the site GR2220003.

Class	Order	Alliance		Association	
POSIDONIETEA	Posidonietalia	Posidonion oceanicae	112010	Posidonietum oceanicae	112011
CYSTOSEIRETEA	Cystoseiretalia	Cystoseiron	117010	Ass. *Cystoseira crinitophylla*	117013
CYSTOSEIRETEA	Cystoseiretalia	Cystoseiron	117010	Ass. *Cystoseira spinosa*	117014
CYSTOSEIRETEA	Cystoseiretalia	Cystoseiron s.l.	117020	Ass. *Corallina* spp. , *Jania* spp. & *Amphiroa* spp.	117021
CYSTOSEIRETEA	Cystoseiretalia	Cystoseiron	117010	*Cystoseira brachycarpa* var. *balaerica*	

Source: Greek Ministry of Environment, 2001

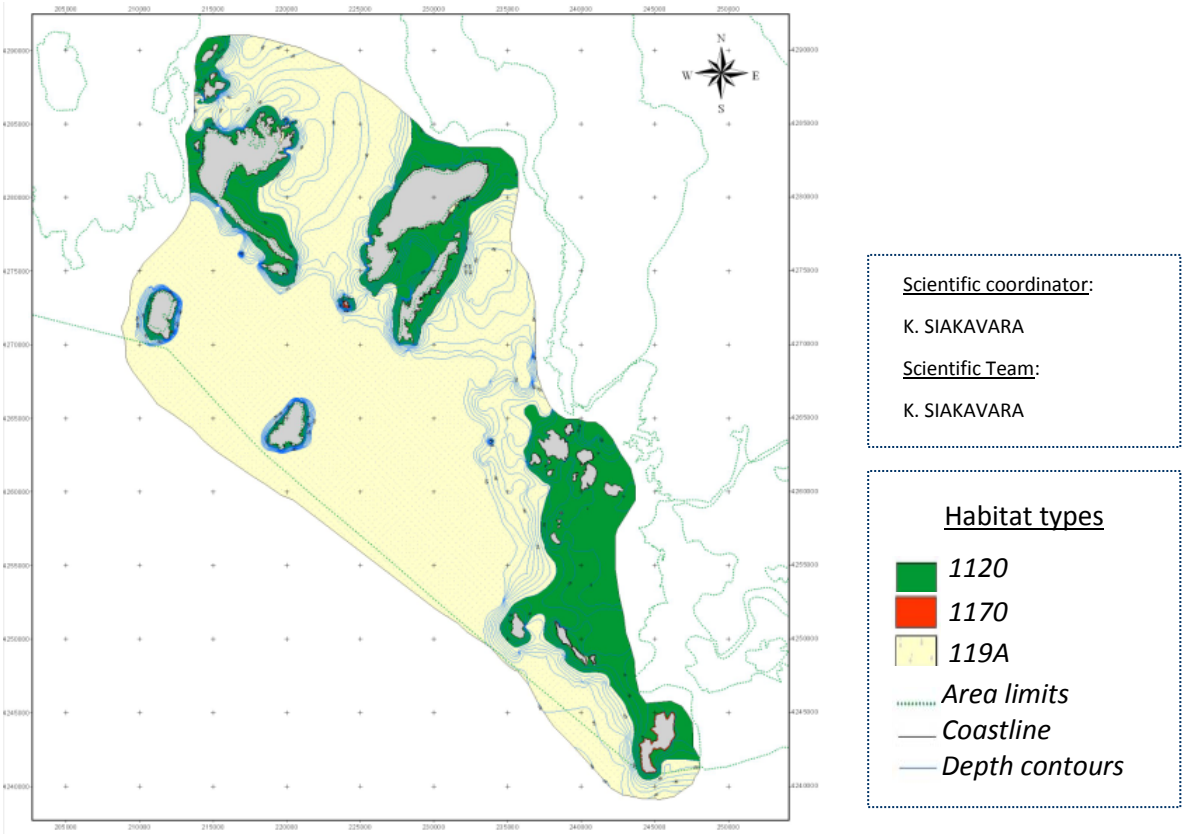
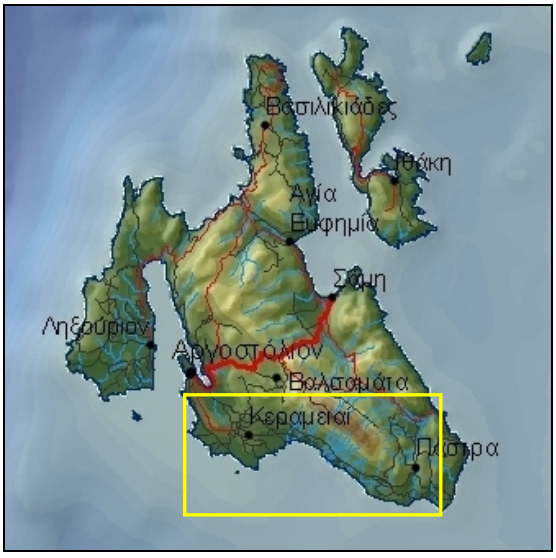


Figure 52. Distribution of marine habitat types in the site GR2220003 **(Source: Greek Ministry of Environment, 2001)**

Name: MARINE AREA FROM ARGOSTOLI TO VLACHATA (KEFALONIA) & MOUNTA BAY		
Code: GR2220004	**Conservation status:** SCI	
Location: 20°34΄ E, 38°06΄ N		
Administrative authority: Region of Ionian Islands		
Total surface (ha): 3736.16	**Marine surface (ha):** 3734.72	
Coastline length (km): 29	**Depth (m):**	



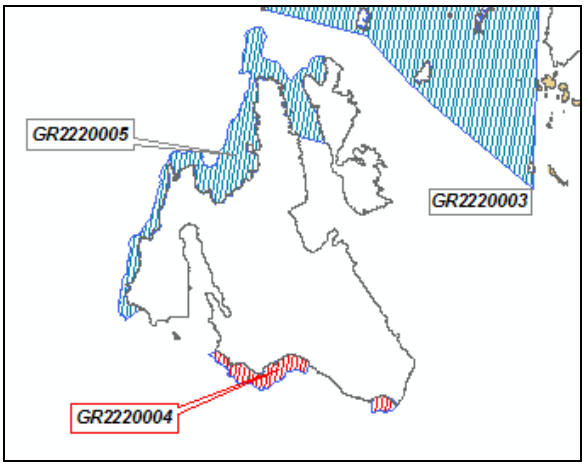


Figure53. Geomorphology (left) and extent (right) of the site GR2220004 **(Source: HCMR / GIS Laboratory)**

Geography and geomorphology: Bearing the official name "Paraktia Thalassia Zoni apo Argostoli eos Vlachata (Kefalonia) & Ormos Mounta", the site includes the marine area between the entrance of Argostoli Gulf and the village of Lourdata, as well as the small bay of Mounta to the south east of the island of Kefalonia.

Vegetation and animal life: High hydrodynamic coasts are dominant, with seagrass meadows (*Posidonia oceanica,* type 1120) and reef formations (habitat type 1170), whereas there are some parts with sandbanks (habitat type 1110). We can distinguish between two separate areas in terms of their characteristics:

- The rocky western-northwestern coast
- The sandy eastern-southeastern coast

Between these areas, there is a transitional zone with mixed characteristics. The sea bed in the first instance is rather heterogeneous, with a combination of soft and hard substrata and *Posidonia* beds co-existing with big brown algae forest«δάσος» φωτόφιλων φυκών (*Cystoseira crinita*). This quite rare combination has special ecological value and runs from the coastline to the depth of 40m. The dense

vegetation starts from the area of the airport to the east, demonstrates the best growth conditions near the bay of Agia Pelagia (due to the presence of reefs) and reaches the coast at the village of Lourdata.

Soft sand substrata are dominant in the second area (habitat types 1110 and 119A). Due to their high hydrodynamism these areas are usually not covered by vegetation (although there are scattered areas with *Cymodocea nodosa*). *Posidonia* beds begin at 10-15 m depth and extend to 40 m underwater. A rocky cape to the west indicates the west boundary (coast of Lourdata), where common habitats of the type 1170 (reefs) occur.

Finally, the bay of Mounta is considered as the most important reproducing site in Kefalonia for the sea turtle (*Caretta caretta*).

Ecological value, conflicts and threats: The high quality of the marine habitats give to the site a unique ecological value. Nevertheless, tourism is rapidly developing in the area and the major thread is the construction of marinas and port facilities.

Table 26. Marine habitat types of the site GR2220004 listed in Annex I

CODE	%COVER	REPRESENTATIVITY	CONSERVATION	GLOBAL ASSESSMENT
1110	3.79	B Good	B Good	B Good
1120	45.71	A Excellent	A Excellent	A Excellent
1170	7.88	A Excellent	A Excellent	A Excellent

Source: Greek Ministry of Environment, 2009

Table 27. Marine habitat types of the site GR2220004 not listed

CODE	%COVER	REPRESENTATIVITY	CONSERVATION	GLOBAL ASSESSMENT
119A	19.87	A	A	A

Source: Greek Ministry of Environment, 2001

Table 28. Syntaxonomic table of the site GR2220004.

Class	Order	Alliance		Association	
POSIDONIETEA	Posidonietalia	Posidonion oceanicae	112010	Posidonietum oceanicae	112011
CYSTOSEIRETEA	Cystoseiretalia	Cystoseiron	117010	Ass. *Cystoseira crinita*	117012

Source: Greek Ministry of Environment, 2001

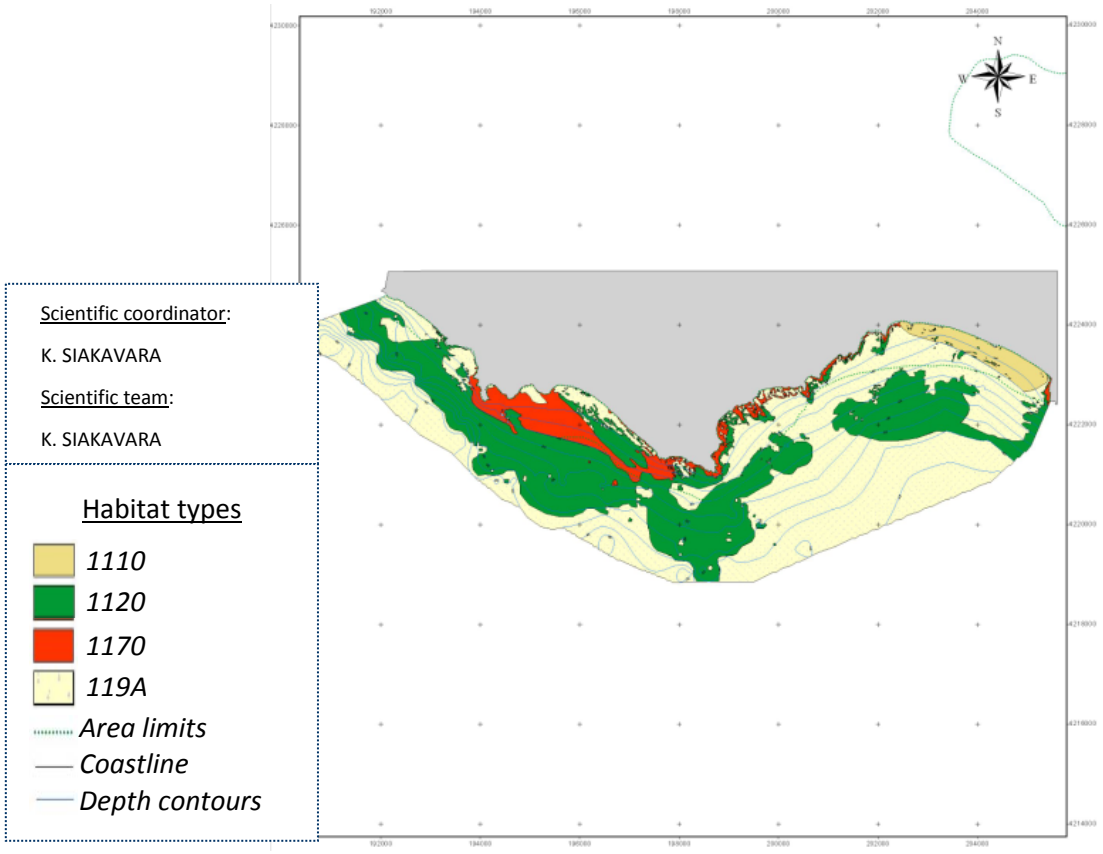
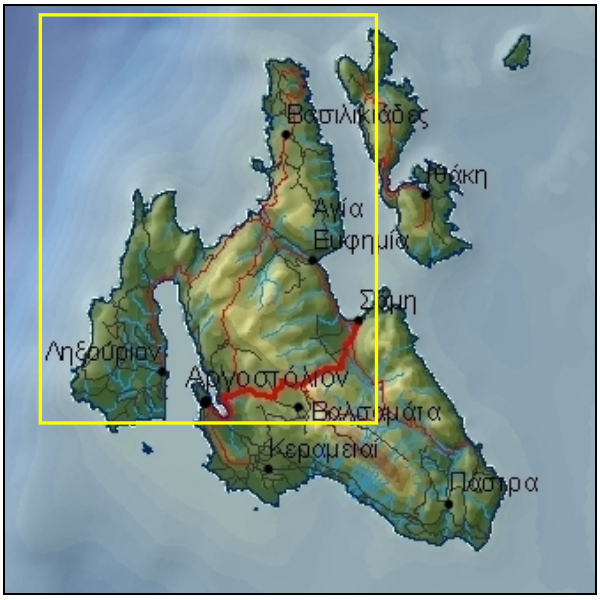


Figure 54. Distribution of marine habitat types of the site GR2220004 **(Source: Greek Ministry of Environment, 2001)**

Name: WEST COASTS OF KEFALLONIA - KEFALLONIA ITHAKI STRAIGHT - NORTHERN ITHAKI		
Code: GR2220005	**Conservation status:** SCI	
Location:		
Administrative authority: Region of Ionian Islands		
Total surface (ha): 18742.55	**Marine surface (ha):** 18741.50	
Coastline length (km): 90	**Depth (m):**	



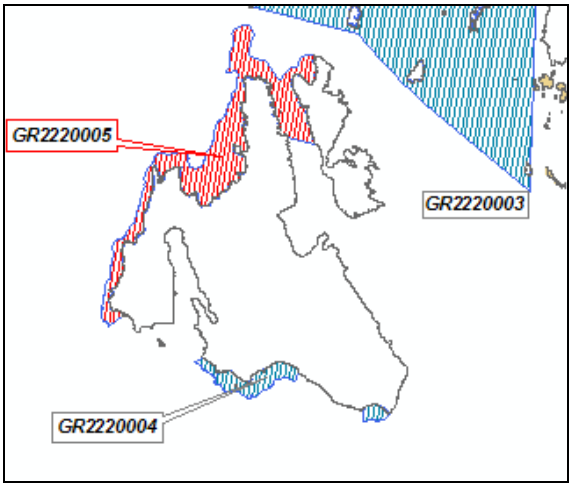


Figure 55. Geomorphology (left) and extent (right) of the site GR2220005 **(Source: HCMR / GIS Laboratory)**

Geography and geomorphology: Bearing the official name "Dytikes Aktes Kefallinias - Steno Kefallinias Ithakis - Boria Ithaki (Akrotiria Gero Gompos - Drakou Pidima - Kentri - Ag. Ioannis)", this site extends from the 200 m depth contour to a narrow terrestrial band of 50m width. The coastal zone starts from the middle of the Kefalonia - Ithaki Channel and extends to the SW of Kefalonia (Cape Gero Gompos) and northern Ithaki (Cape Drakou Pidima).

Vegetation and animal life: This is an important site for the Mediterranean monk seal (*Monachus monachus*). From 1985 until 1995 five research projects have been carried out on the islands with the aid of the European Union. Fundamental monitoring activities of the population and the nesting sites and recording of damaging on fishing equipment have been run by the NGO ARCHIPELAGOS after completion of the projects. A constant population of 15-25 individuals living in the area represents 5-7% of the world's population and 10% of the Greek population. Ten to fifteen individuals is estimated to be the number of individuals of a certain period and not the standing population. During the 15-years period of research a total number of 30-35 individuals has been recorded. The whole area is also very important for several cetaceans included in the Bern Convention: *Delphinus delphis* (reproduction), *Stenella coeruloalba*

(resident), *Grampus griseus* (sporadic), Ziphius cavirostris (resident), *Balaenoptera physalus* (probably resident) and *Pseudorca crassidents* (one observation), *Tursiops truncatus*. Orcinus orca (in Bern Convention) and *Physeter catodon* have been reported by local fishermen offshore NW Zakynthos and the west coast of Kefalonia. In general, both terrestrial and marine habitats are in good conservation status in a quite intact natural environment. The site comprises extended *Posidonia oceanica* meadows (habitat type 1120), large shallow inlets and bays (1160), marine caves (8330), as well as reefs (1170) and sea cliffs.

Ecological value, conflicts and threats:

The high variety marine mamals gives to the site a unique ecological value. Nevertheless, tourism is rapidly developing in the area and the major thread is the motor boats (daily cruisers) visiting massively the area during summer.

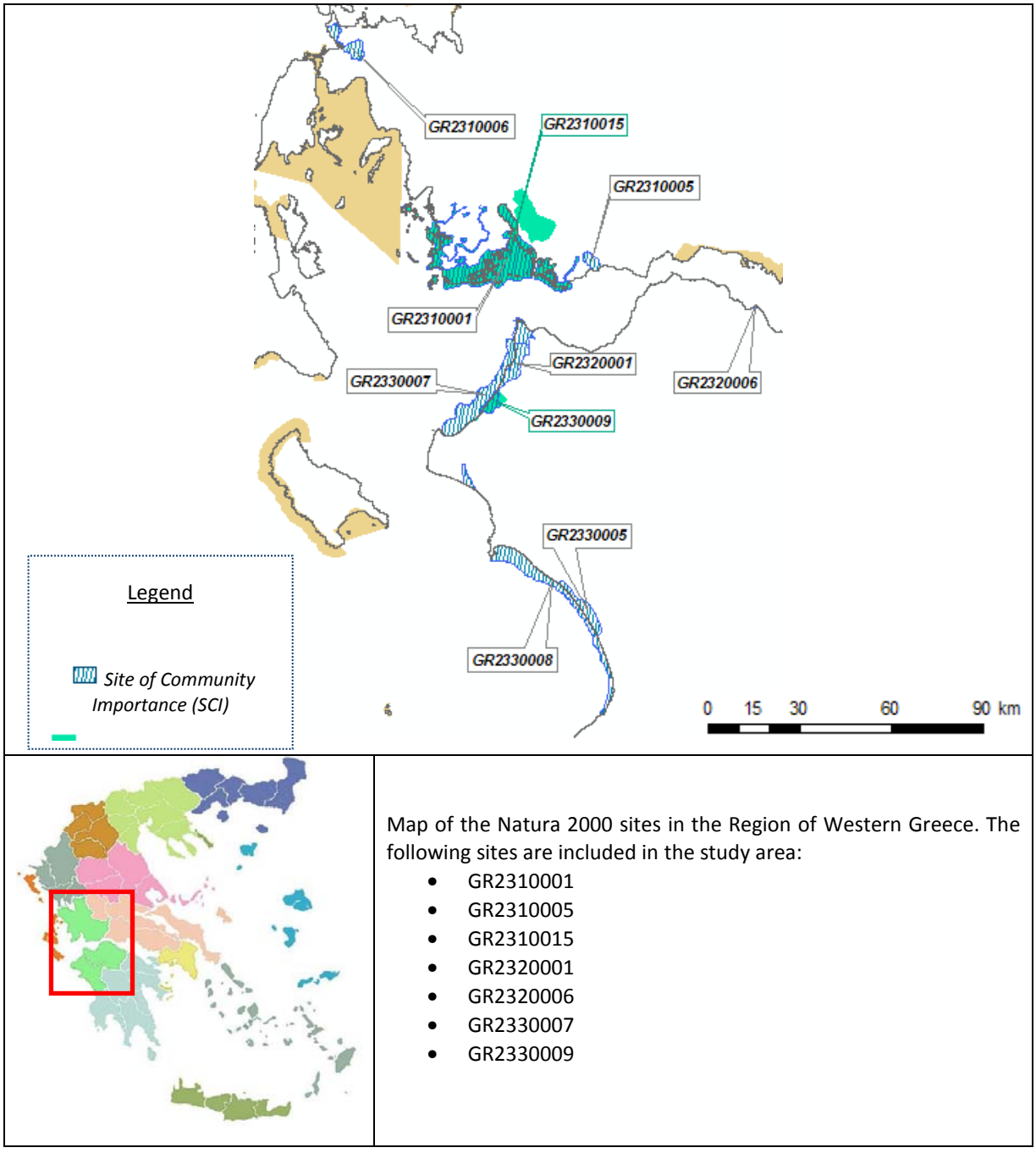
The site also includes areas with special archaeological value such as: the Loizos cave at the bay of Polis in Ithaki, the greater area of Hersonisos in Fiskardo Kefalonia and the submarine archaeological site south of Fiskardo.

Table 29. Marine habitat types of the site GR2220005 listed in Annex I

CODE	%COVER	REPRESENTATIVITY	CONSERVATION	GLOBAL ASSESSMENT
1120	20	A Excellent	A Excellent	A Excellent
1160	30	A Excellent	A Excellent	A Excellent
1170	5	A Excellent	A Excellent	A Excellent
8330	1	A Excellent	A Excellent	A Excellent

Source: Greek Ministry of Environment, 2009

REGION OF WESTERN GREECE



Map of the Natura 2000 sites in the Region of Western Greece. The following sites are included in the study area:

- GR2310001
- GR2310005
- GR2310015
- GR2320001
- GR2320006
- GR2330007
- GR2330009

Figure 56. Region of Western Greece (Source: Greek Ministry of Environment)

Name: ACHELOOS DELTA, MESOLONGI - AITOLIKO LAGOON, EVINOS DELTA, ECHINADES ISLANDS, PETALAS ISLAND		
Code: GR2310001	**Conservation status:** SCI	
Location: 21°15′ E, 38°20′ N		
Administrative authority: Region of Western Greece		
Total surface (ha): 35509.89	**Marine surface (ha):** 20389.40	
Coastline length (km): 80	**Depth (m):**	

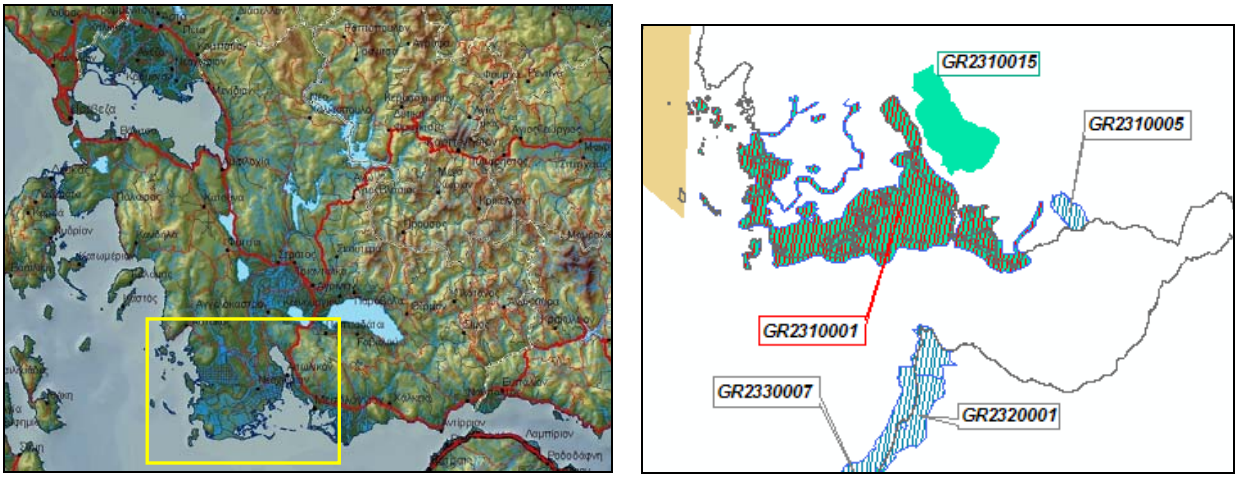


***Figure 57. Geomorphology (left) and extent (right) of the site GR2310001 (*Source: HCMR / GIS Laboratory)**

Geography and geomorphology: Bearing the official name "Delta Acheloou, Limnothalassa Mesologgiou-Aitolikou, Ekvoles Evinou, Nisoi Echinades, Nisos Petalas" the examined site is a complex ecosystem located in western central Greece. It is one of the most significant wetlands in Greece, extending to the Ionian Sea. The Mesolongi lagoon predominates in the central part of the wetland system. There are also a number of other smaller lagoons to the north (Aitoliko lagoon), east (Kleisova), and the west (Gourounopoules, Paliopotamos). The lagoons are relatively shallow: their maximum depth is about 2 m but large areas have a depth of about 1 m. Only the Aitoliko lagoon has a maximum depth of 28 m. Mesolongi and Aitoliko lagoons are connected through a channel.

The lagoons of Mesolongi lie behind a fragmented sandy coastal ridge which is located between the mouth of river Evinos to the east and the Koutsilaris hill to the west; they are connected with the Patraikos Gulf (which forms part of the Ionian Sea) through a large opening. To the eastern part of the Mesolongi plain there is the delta of river Evinos. In the most western part of the site the delta of the river Acheloos occurs. Most of the plain is formed from the sediments deposited by these two rivers. Evinos has deposited sediments that cover the whole area from Mesolongi eastwards, while sediments from the river Acheloos cover the area from Mesolongi to the west. In the western part of the site, the sediments of the river Acheloos surround several rocks and hills, of which the Koutsilaris (433 m) is the highest. Several former beds of the river Acheloos can be distinguished in the same part. The estuaries of Evinos

river extend from the east shore of the Kleisova lagoon to the foot of Mt. Varasova. River Evinos springs from Mt. Vardousia and flows into the Patraikos Gulf. It has a length of 110 km and its drainage basin is 1,070 km^2.

Vegetation and animal life: Although the examined site is a compact ecosystem that has been strongly influenced by human activities, it still has significant ecological value. The flora and fauna of the area is very special due to the extensive presence and dominance of water taxa.

There is a great variety of habitats. There are extended areas with salt marshes where the genus Salicornia and Arthrocnemum are dominant, as well as extended shallow areas with rich submerged vegetation with species of Ruppia, Enteromorpha and Zostera. There are also extensive, dense reed communities (Phragmitetum) which cover substantial areas, mainly in places where freshwater flows into the lagoons. Such areas occur mainly on the north and northeast shores of the Kleisova lagoon and along the western shore of the Mesolongi lagoon, the eastern shore of the Aitoliko lagoon at the shore of the Skantzochoiros lagoon, drainage channels and the edges of Acheloos river. In these reed-beds, *Phragmites australis* and *Typha latifolia* dominate. Despite intense agriculture, substantial hedges of natural vegetation with *Phragmites australis*, *Tamarix parviflora* and *Juncus maritimus* also grow between the small fields. A fraction of the wild fauna lives in these microbiotopes. Furthermore, more animals exist in the drainage channels and the surrounding natural vegetation. Close to the reed beds, stands of *Scirpetum maritimi* occur. These communities are observed mainly in the area of Poros as well as in areas NE of Kleisova lagoon. It is also worth mentioning that a long, wide coastal strip with sand dunes occurs to the south west of the area. The main ammophilous associations occurring there are Agropyretum mediterraneum, Ammophiletum arenariae and Cakiletea maritimae. On the islet of Louros, a significant cluster of *Juniperus phoenicea* grows at the inner places behind the dunes. All this area is extremely valuable. Clusters of Quercus macrolepis, macquis and phrygana (with Phlomis fruticosa as the dominant taxon) grow on the surrounding hills.

Acheloos river is the second largest river in the Balkans. Three main types of riparian forests grow on its estuaries as well as along its banks:

- Riparian forests with *Salix alba* and *Populus nigra* as dominant species (such forests occur mainly in the southern area of the delta as well as along the river banks),
- A forest of *Fraxinus angustifolia* near Lesini, which is the most valuable part of the riparian vegetation of this area,
- Clusters with *Tamarix parviflora* and *Vitex agnus-castus* (mainly in the southern part of the Delta at Kali-Chitsa, as well as along the bank of the river).

At the coastal zone extending from the east shore of the Kleisova lagoon to the west of the mouth of Evinos river (ca. 3 km in length and 0.5 km width), the land is lower than sea level and is devoid of discharge, resulting in overflow due to rain water. In that place an extensive saltmarsh with gradiated natural vegetation (Tamaricetum, Juncetum, Arthocnemetum, Salicornietum) is developed.

The coasts of Echinades islands include a large number of submerged and partly submerged caves, which are important habitats for the monk seal. The species *Tursiops truncatus* and *Delphinus delphis*, which have been recorded in the area, are included in Directive 92/43/EEC, the Bern and Bonne Conventions, the CITES Convention and CORINE-Biotopes. They are also protected by Greek legislation (Presidential Decree 67/1981). The species *Delphinus delphis* is included in the Greek Red Data Book under category “Vulnerable”. The non coastal parts of the islands are in very good natural and ecological status and are used by sea birds as reproduction grounds. They are also very interesting in terms of phyto-sociology and management. The most important vertebrate taxa include bats of the genus Rhinolophus and Myotis (both are included in the Greek Red Data Book as “Endangered” and “Vulnerable” respectively). The turtle species *Testudo hermanni* and the snake species *Elaphe quatuorlineata* are included in Annex II of the Directive 92/43/EEC. The remaining taxa are protected by the Bern Convention and the Greek Presidential Decree 67/1981. An important habitat of the area is that of seagrass meadows *Posidonia oceanica* (habitat type 1120).

Table 30. Marine habitat types of the site GR2310001 listed in Annex I of the Habitats Directive.

CODE	%COVER	REPRESENTATIVITY	CONSERVATION	GLOBAL ASSESSMENT
1110	0	C Significant	C Average	C Significant
1120	0.27	C Significant	C Average	C Significant
1130	0	C Significant	C Average	C Significant
1140	0	C Significant	C Average	C Significant
1150	55.09	B Good	B Good	B Good
1170	0.16	C Significant	C Average	C Significant

Source: Greek Ministry of Environment, 2009

- The flora of the area includes many interesting, endemic species, which are either rare or endangered. An important species is the pure Fraxinus forest (the only one in Greece) that exists near the Lesini area. Relicts from such a riparian forest occur also on the eastern banks of Evinos river.

The area also has great ornithological value as it is an important area for reproduction, passing and overwintering of waterfowls and birds of prey.

Ecological value, conflicts and threats: The site is protected under the Ramsar Convention; it has been declared a National Park and it is an Important Bird Area (for Greece). The riparian Fraxinus forest in the Prefecture of Aitoloakarnania is known as monument of the nature.

Name: OROS VARASOVA		
Code: GR2310005	**Conservation status:** SCI	
Location: 21°36′ E, 38°21′ N		
Administrative authority: Region of Western Greece		
Total surface (ha): 1443.30	**Marine surface (ha):**	
Coastline length (km):	**Depth (m):**	

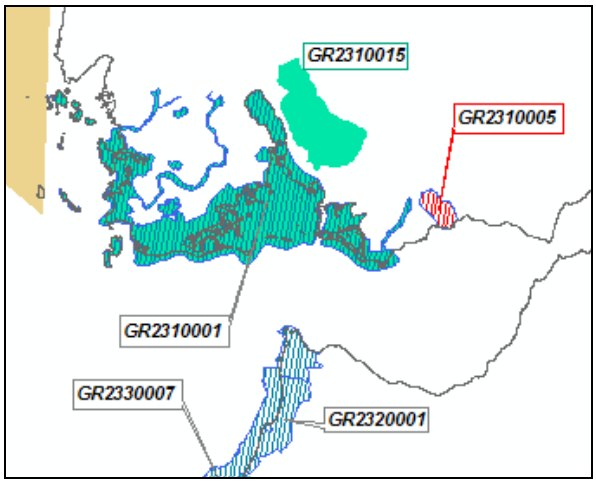


***Figure 58. Geomorphology (left) and extent (right) of the site GR2310005 (*Source: HCMR / GIS Laboratory)**

Geography and geomorphology: Official name "Oros Varasova". Mount Varasova is situated in the south-western part of Aitoloakarnania, east of the Evinos river estuaries.

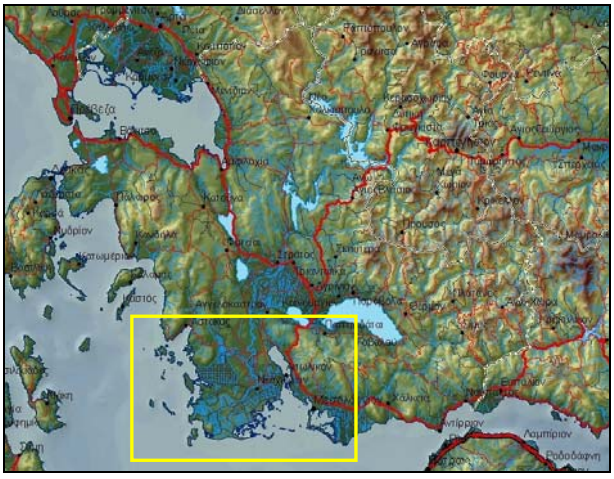
Vegetation and animal life: Very characteristic of the island are its extensive steep slopes with sparse chasmophytic vegetation to the south, south-eastern and south-western parts. These slopes descend steeply to the coast, near the villages of Kato Vasiliki and Kryoneri. At the lower altitudes of its eastern, north-eastern and northern sides shruby vegetation is developed. This vegetation is in a good state of conservation in several places, while in others it has been degraded because of overgrazing or fires. The upper part of these areas is almost bare with sparse chasmophytic vegetation and in several places sparse, wooded areas consisting mainly *of Quercus ilex, Olea europea* and *Juniperus phoenicea.* The lower part of the western side of the mountain is covered by phrygana, while the upper part is characterized by steep slopes with sparse chasmophytic vegetation. At the foot of the southern part of the mountain, between the two vertical cliffs, a small marsh occurs during the winter. In this place *Juncus* predominates.

The special interest of Mt. Varasova as a unique biotope is due to its steep almost vertical slopes which make it a significant refuge for an important flora and fauna. In these places, many endemic or rare species live. The most important plant species is *Centaurea alba subsp. heldreichii*, rare local endemic, which grows on limestone cliffs near the sea, mainly near the village of Kryoneri. As far as the non-bird vertebrate fauna of this site is concerned, some species listed in Annex II of the Directive 92/43/EEC have

been reported as occurring there. Of these, the bat *Rhinolophus ferrumequinum* is a threatened taxon mentioned in the Greek Red Data Book as “Vulnerable”.

A remarkable avifauna inhabits this site. The most important bird taxa are some birds of prey, such as *Aquila chrysaetos, Hieraaetus fasciatus* and *Falco peregrinus*. The extensive wetlands of Mesolongi and Evinos river neighbouring Mt. Varasova is one more reason indicating its major importance and value.

Name: ACHELOOS DELTA, MESOLOGGI - AITOLIKO LAGOON, EVINOS DELTA, ECHINADES ISLANDS, PETALAS ISLAND, WEST ARAKYNTHOS & KLEISOURA STRAIGHT		
Code: GR2310015	**Conservation status:** SPA	
Location: 21°15′ E, 38°20′ N		
Administrative authority: Region of Western Greece		
Total surface (ha): 44185.62	**Marine surface (ha):** 20389.40	
Coastline length (km):	**Depth (m):**	



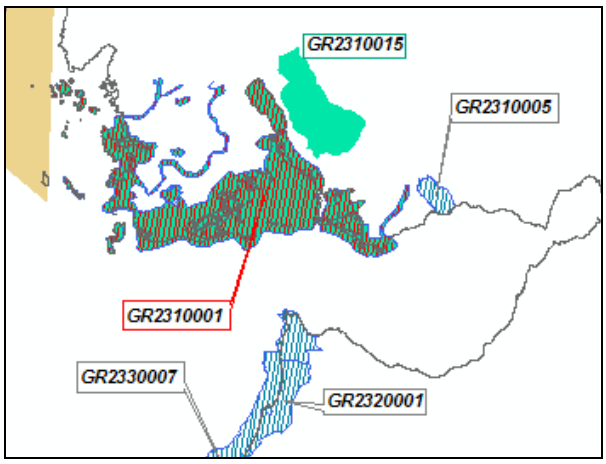


***Figure 59. Geomorphology (left) and extent (right) of the site GR2310015 (*Source: HCMR / GIS Laboratory)**

The site bears the official name “Delta Acheloou, Limnothalassa Mesolongiou-Aitolikou kai Ekvoles Evinou, Nisoi Echinades, Nisos Petalas, Dytikos Arakynthos & Stena Kleisouras”. The site has similar characteristics to the site GR2310001 which was described in the previous paragraphs.

Name: KALOGRIA LAGOON, STROFILIA FOREST AND LAMIA MARSH, ARAXOS		
Code: GR2320001	**Conservation status:** SCI/SPA	
Location: 21°22′ E, 38°10′ N		
Administrative authority: Region of Western Greece		
Total surface (ha): 3533.89	**Marine surface (ha):**	
Coastline length (km): 15	**Depth (m):**	

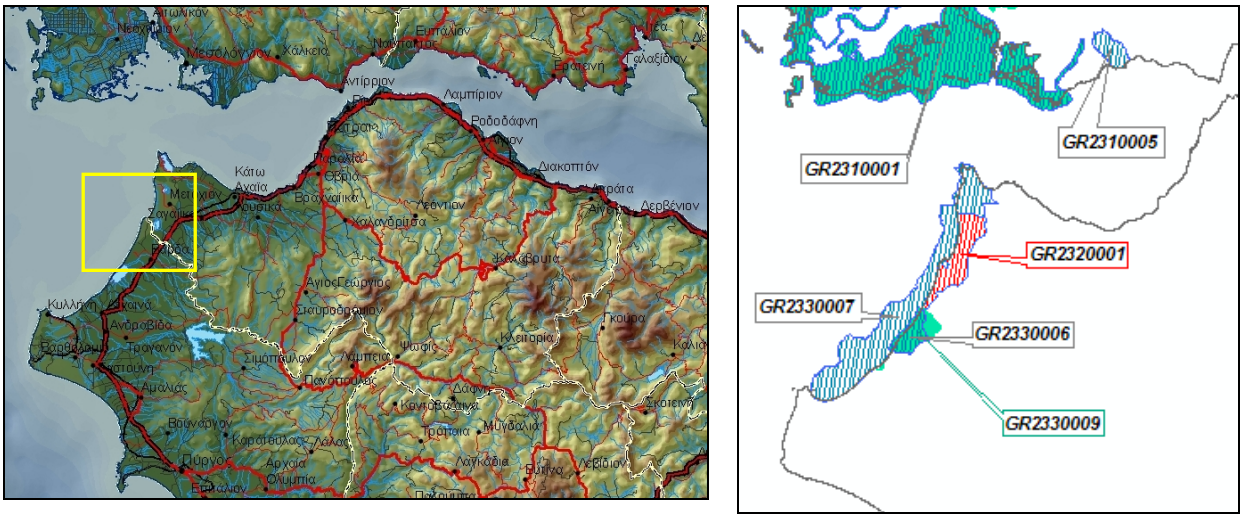


***Figure 60. Geomorphology (left) and extent (right) of the site GR2320001 (*Source: HCMR / GIS Laboratory)**

Geography and geomorphology: Bearing the official name "Limnothalassa Kalogrias, Dasos Strofilias kai Elos Lamias, Araxos" the site is a wetland system, located in NW Peloponnisos, which occupies a coastal zone of about 22 km length by 1.5 km width. It is a compound coastal ecosystem and includes the lagoons of Prokopos and Kalogria (or Pappas), the Lamia marshes, as well as the forest of Strofilia.

Vegetation and animal life: The forest ecosystem of Strofilia is of great ecological interest because it is the most extensive *Pinus pinea* forest in Greece and one of the biggest in Europe. The non-forest ecosystems such as sandy hills, fresh- and salt-water wetlands wet meadows and sandy beaches are also of significance. In spite of human activities a significant part of the sand-dunes is in good ecological condition. *Centaurea niederi* which is a plant listed in Annex II of the Council Directive 92/43/EEC and the Bern Convention, is a rare local Greek endemic, which grows on calcareous rocks in the Kalogria area (hill Mavra Vouna).

Ecological value, conflicts and threats: The site is part of a larger Ramsar area and has to be considered as site complex together with the sites GR2330006, GR2330009 and GR2330007.

Table 31. Marine habitat types of the site GR2320001 listed in Annex I of the Habitats Directive.

CODE	%COVER	REPRESENTATIVITY	CONSERVATION	GLOBAL ASSESSMENT
1140	1	C Significant	C Average	C Significant
1150	10	B Good	B Good	B Good

Source: Greek Ministry of Environment, 2009

Name: AIGIO SALT MARSHES		
Code: GR2320006	**Conservation status:** SCI/SPA	
Location: 22°06′ E, 38°15′ N		
Administrative authority: Region of Western Greece		
Total surface (ha): 31.98	**Marine surface (ha):**	
Coastline length (km):	**Depth (m):**	

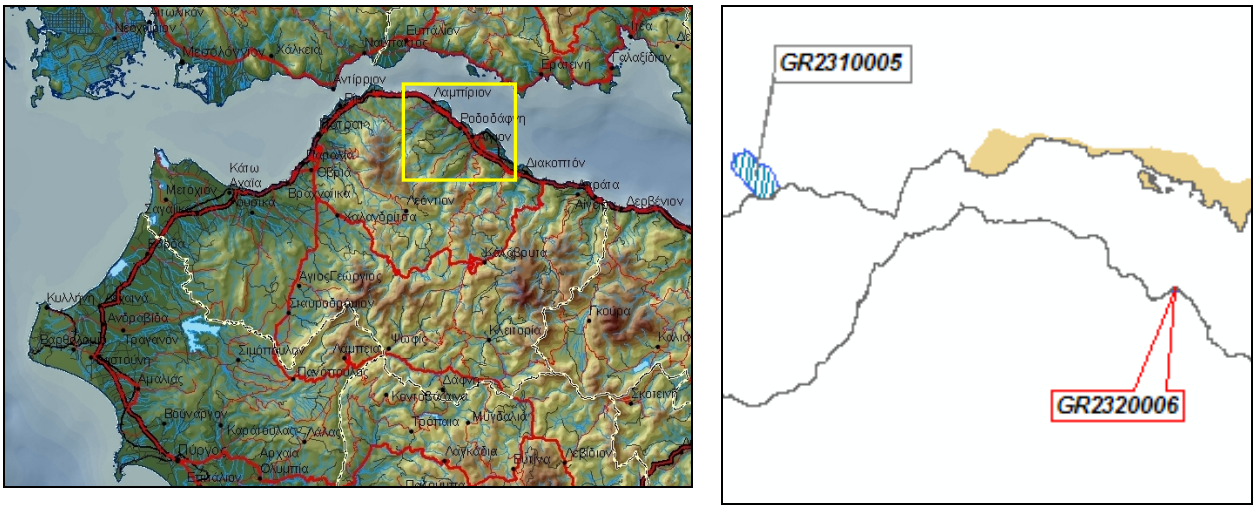


***Figure 61. Geomorphology (left) and extent (right) of the site GR2320006 (*Source: HCMR / GIS Laboratory)**

Geography and geomorphology: Official name “Alyki Aigioy”. The site is a wetland system with triangular shape located at the cape Gyftissa near the town of Aigio in the Gulf of Korinth.

Vegetation and animal life: The site, in spite of its small size, constitutes a very important ecosystem, gathering all the main characteristics of a typical wetland. It includes a small coastal lagoon (habitat type 1150), temporarily drying out in the summer, which is surrounded by reeds and saltmarsh vegetation. A small degraded cluster of Tamarix occurs at the southern part of the site.

In the eastern part of the site, the small sandy beach (width 20m) is colonized by the plant community *Agropyretum mediterraneum*. Further inland, the vegetation is successional with a mixture of ammophilous species with species of brackish water (wet meadows with *Juncus sp.*), a pure zone with *Juncus acutus, Juncus maritimus* and *Juncus heldreichianus* and an extensive reed belt.

Ecological value, conflicts and threats: The reed belts and salt marshes are in a very good state and from an ornithological point of view they are very significant, because they offer refuge to migrating waders. Many taxa have been observed so far visiting the area during the winter and spring months. Among them there are many common bird species and sometimes even swans and flamingos. Some of the species recorded are threatened in Greece. This species diversity, which is the highest among the Peloponnesian wetlands, combined with the facility of bird observation, make the Alyki salt marsh a remarkable area for scientific, educational and amusement purposes.

Only the habitat type 1150 (coastal lagoon) has been recorded in the area. However there are significant sandy habitats and underwater meadows that need to be mapped so that the site can be extended to the 50m depth contour.

Table 32. Marine habitat types of the site GR2320006 listed in Annex I of the Habitats Directive.

CODE	%COVER	REPRESENTATIVITY	CONSERVATION	GLOBAL ASSESSMENT
1150	12.74	B Good	B Good	B Good

Source: Greek Ministry of Environment, 2009

Name: KOTYCHI LAGOON, BRINIA		
Code: GR2330006	**Conservation status:** SCI	
Location: 21°18′ E, 38°00′ N		
Administrative authority: Region of Western Greece		
Total surface (ha): 1314.63	**Marine surface (ha):**	
Coastline length (km): 10	**Depth (m):**	

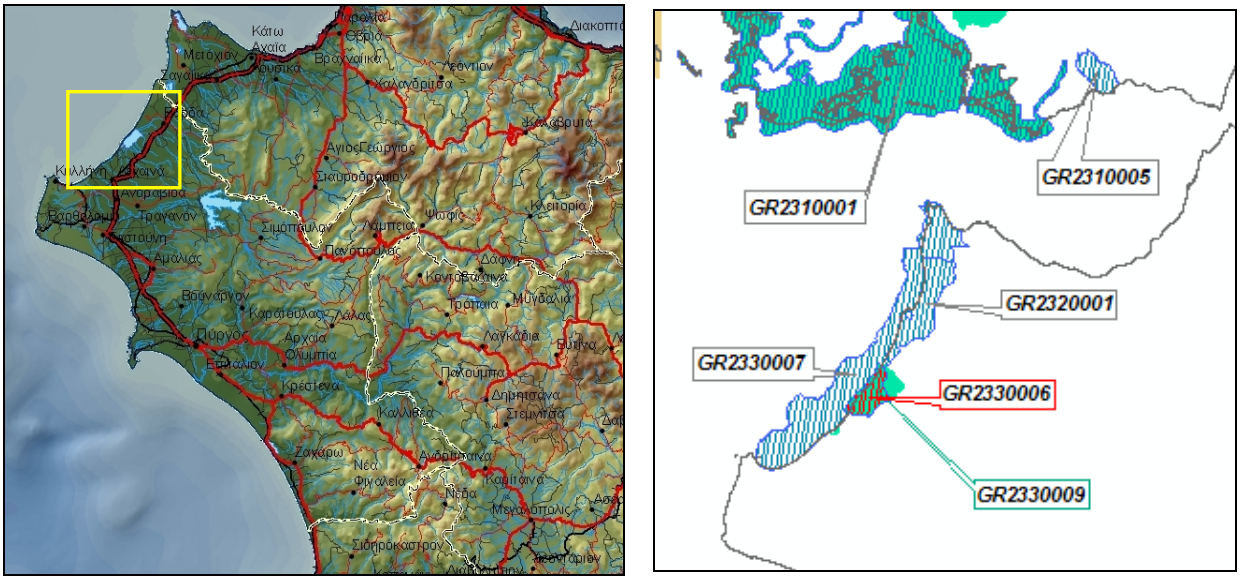


***Figure 62. Geomorphology (left) and extent (right) of the site GR2330006 (*Source: HCMR / GIS Laboratory)**

Geography and geomorphology: Official name "Limnothalassa Kotychi, Brinia". Kotychi is a brakish coastal lagoon situated a few kilometres north of the cape of Kyllini. It is separated from the open sea by a narrow sand strip 4.5 km long and 30 m wide and communication is constant via an opening. The lagoon is the recipient of the water from nine streams, providing it with the fresh water of rainfall, as well as of the water from the drainage and overflow canals of the irrigation network of Pineios river dam.

Vegetation and animal life: Kotychi is the largest and the most significant lagoon in the Peloponnese. Although agricultural activity has been intensified around the wetland, the habitats themselves have not been significantly affected by such activities. From an ornithological point of view, the lagoon has great ecological important because it is the southernmost lagoon on the western migration route of many birds.

In this zone dunes with the dominating species *Ammophila arenaria* develop mainly near the opening of the lagoon, as well as to the northwest of it. Halophytic communities consisting mainly of *Arthrocnemum fruticosum* or *Salicornia europaea* grow almost all around the lagoon, as well as on the islets occurring in

the lagoon itself. The participation of the species *Halimione portulacoides* in these communities is also significant.

Great surfaces with *Scirpus maritimus* grow on the northern side of the lagoon. Brackish water vegetation grows in a large area of the shallow lagoon, characterized by the species *Ruppia cirrhosa* and *Zostera nolti*.

In the salty water of the lagoon, the species *Ruppia maritima* and *Enteromorpha intestinalis* occur. It is noticeable that around the halophytic communities, extensive meadows (many of them cultivated) occur. Small salt marshes with Salicornia, Juncus and reed beds exist south of the lagoon along ditches. In the north western part of the site, there is a pine forest together with shruby vegetation which forms actually part of the southern part of Strofilia forest.

The flora of this lagoon includes the species *Halocnemum strobilaceum*, the populations of which are very degraded in Greece and must be protected. Also, the species *Cotula coronopifolia* has an interesting geographical distribution from a phytogeographical point of view. *Pancratium maritimum* is a species whose populations have been reduced along the Greek coasts. Furthermore, the examined area constitutes a natural ecological laboratory for education and research and is also widely used for fishing. As regards the fauna of the lagoon, some vertebrate species of Annex II of the Directive 92/43/EEC have been recorded. The sandy beach of the site and especially the belt-shaped islet in front of the lagoon is a nesting site for the sea turtle *Caretta caretta*, while the fauna of the site includes more important species such as *Valencia hispanica, Valencia letourneuxi, Pipistrellus pipistrellus, Anguis cephallonicus, Vulpes v. hellenica, Rana epeirotica, Rana ridibunda, Ablepharus kitaibelii, Eryx jaculus* etc.

Ecological value, conflicts and threats: Zoologically, this site is also important because of the interesting avifauna living in the area. This avifauna includes waterfowls, waders and birds of prey, many of which are threatened taxa in Greece. Due to such rich fauna, Kotychi lagoon is considered as an Important Bird Area for Greece and is a Ramsar Convention Site.

During the last decades the agricultural activity covers all the surroundings of the lagoon. There are no available data on the fauna and flora but eutrophicaton phenomena are observed (anoxic crises with sulfur smell).

The importance of the site requires management together with the adjacent sites.

Table 33. Marine habitat types of the site GR2330006 listed in Annex I of the Habitats Directive.

CODE	%COVER	REPRESENTATIVITY	CONSERVATION	GLOBAL ASSESSMENT
1140	2.51	C Significant	C Average	C Significant
1150	54.11	B Good	B Good	B Good

Source: Greek Ministry of Environment, 2009

Name: COASTAL AREA FROM KYLLINI TO TOUMPI-KALOGRIA		
Code: GR2330007	**Conservation status:** SCI	
Location: 21°17′ E, 38°01′ N		
Administrative authority: Region of Western Greece		
Total surface (ha): 13166.35	**Marine surface (ha):** 10929.70	
Coastline length (km): 53	**Depth (m):**	

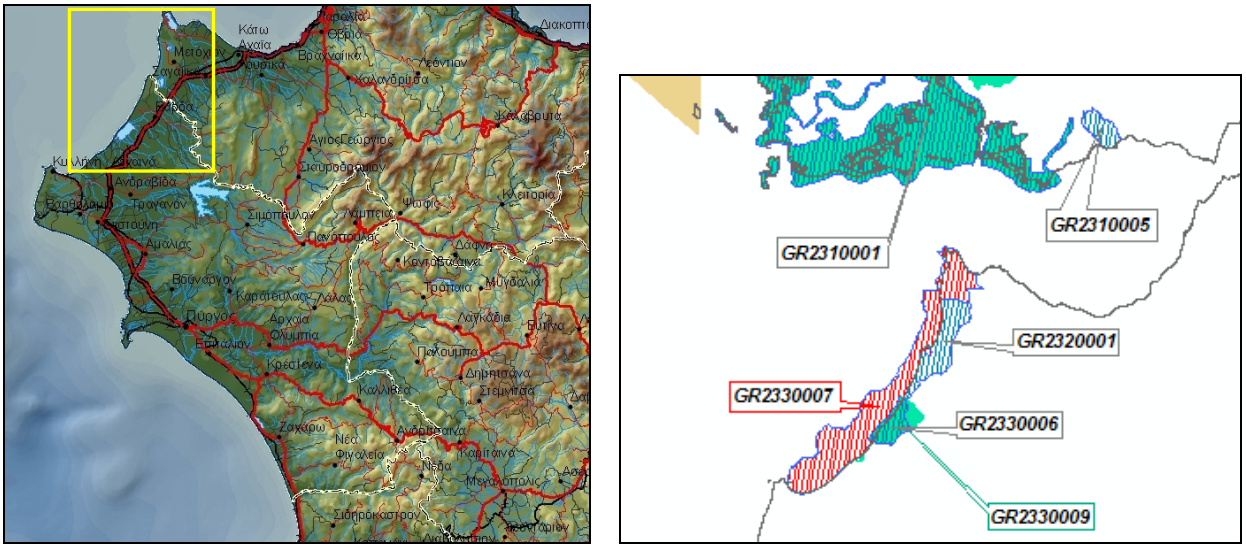


***Figure 63. Geomorphology (left) and extent (right) of the site GR2330007 (*Source: HCMR / GIS Laboratory)**

Geography and geomorphology: Bearing the official name "Paraktia Thalassia Zoni apo Akr. Kyllini eos Toumpi-Kalogria", the site includes the coastal area extending from Kalogria beach to the Kyllini cape. High hydrodynamic beaches dominate the area.

Vegetation and animal life: Small rocky formations with *Cystoseira spp.* vegetation (habitat type 1170, reefs) are combined with a large continuous sandy beach about 5 km long (habitat type 1110, sand banks) and towards the sea large Posidonia meadows (habitat type 1120). The upper limit of the meadows is 10-15 m and the deeper is 35-40 m depth. In sheltered bays the meadow starts at 1-2 m depth and large amounts of dead Posidonia leaves are accumulated on the coastline. Meadows with *Cymodocea nodosa* are observed between the sandbanks and Posidonia.

Apart from the above mentioned habitats the sandy beaches of the site play an important role as nesting grounds for the loggerhead sea turtle *Caretta caretta*. The Bottle-nosed Dolphin *Tursiops truncates* is also very common in the area. The beach from Kalogria to Manolada is backed by a dune system with typical vegetation such as *Ammophila arenaria* and *Euphorbia paralias.* Further up the dunes, there is a strip of *Juniperus phoenicea, Pistacia lentiscus,* etc. The coastal forest of Strofilia starts after the dunes, which is gradually substituted by agricultural land. Further south, the beach is comprised of fine sand and is backed by low-lying dunes down to the mouth of Kotichi lagoon where the sandstrip becomes narrower. South of the lagoon the beach becomes too narrow and muddy, thus unsuitable for nesting.

Table 34. Marine habitat types of the site GR2330007 listed in Annex I of the Habitats Directive.

CODE	%COVER	REPRESENTATIVITY	CONSERVATION	GLOBAL ASSESSMENT
1110	32.3	A Excellent	A Excellent	A Excellent
1120	36.9	A Excellent	B Good	B Good
1150	3.4	B Good	B Good	B Good
1170	0.2	B Good	B Good	B Good

Source: Greek Ministry of Environment, 2009

Table 35. Marine habitat types of the site GR2330007 not listed in the Habitats Directive.

CODE	%COVER	REPRESENTATIVITY	CONSERVATION	GLOBAL ASSESSMENT
119A	39.66	A	A	A

Source: Greek Ministry of Environment, 2001

Table 36. Syntaxonomic table of the site GR2330007.

Class	Order	Alliance		Association	
HALODULO-THALASSIETEA	Thalassietalia	Cymodoceion nodosae	111020	Cymodoceetum nodosae	111021
POSIDONIETEA	Posidonietalia	Posidonion oceanicae	112010	Posidonietum oceanicae	112011
CYSTOSEIRETEA	Cystoseiretalia	Cystoseiron s.l.	117020	Ass. *Corallina* spp. , *Jania* spp. & *Amphiroa* spp.	117021
CYSTOSEIRETEA	Cystoseiretalia	Cystoseiron	117010	*Cystoseira compressa*	

Source: Greek Ministry of Environment, 2001

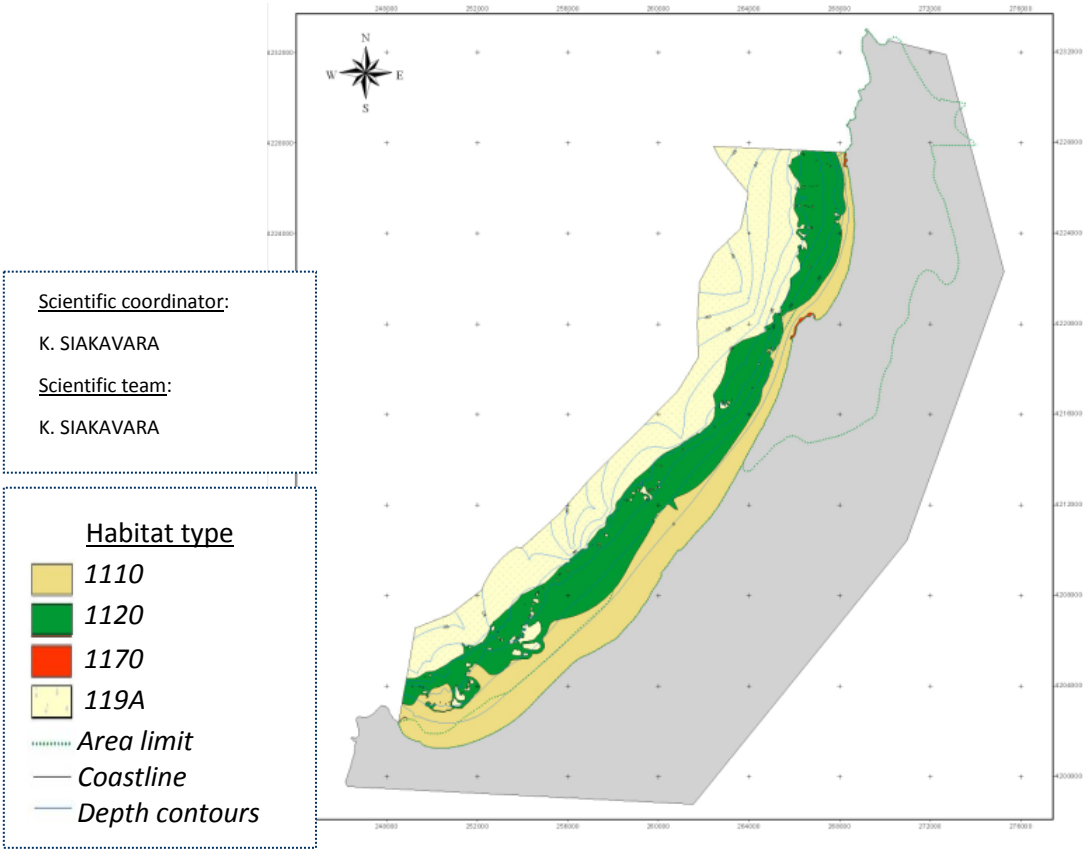


***Figure 64. Distribution of marine habitat types in the site GR2330007 (*Source: Greek Ministry of Environment, 2001)**

Ecological value, conflicts and threats: The site GR2330007O is the marine front of the sites GR2320001, GR2330006 and GR2330009. It is also part of a larger Ramsar site. Thus, the site complex has a specific ecological value (birds, fresh water and marine fauna and flora). During the last decades there is a continuous extension of the agricultural lands. In parallel the human presence on the beach is increasing (cars, motor boats.

Name: KOTYCHI LAGOON – LECHENA SALT MARSHES		
Code: GR2330009	**Conservation status:** SPA	
Location: 21°18′ E, 38°00′ N		
Administrative authority: Region of Western Greece		
Total surface (ha): 2337.83	**Marine surface (ha):** 332.39	
Coastline length (km): 10	**Depth (m): 50 m**	

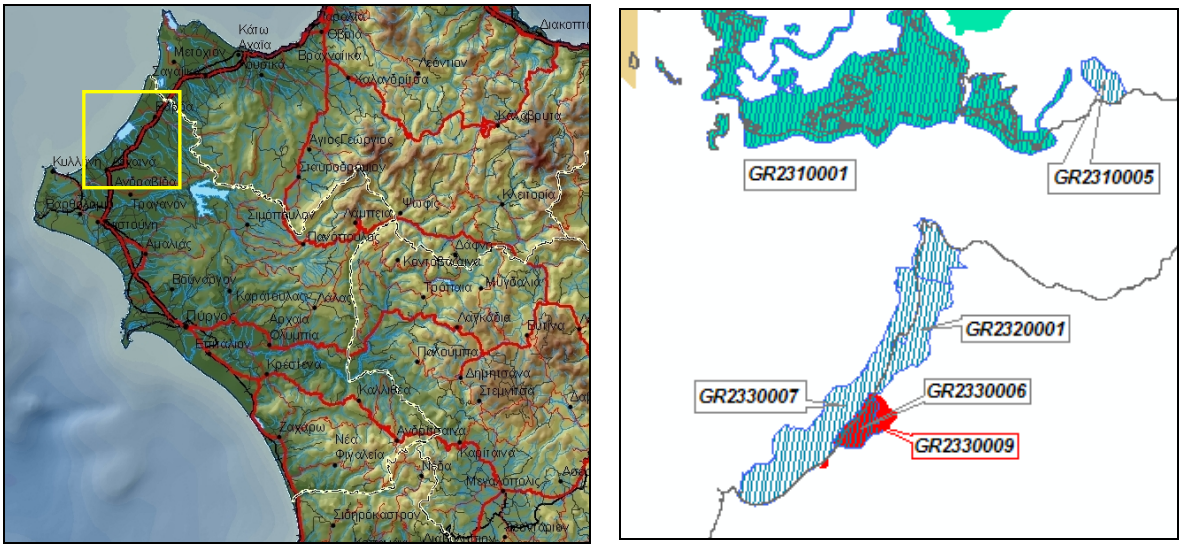
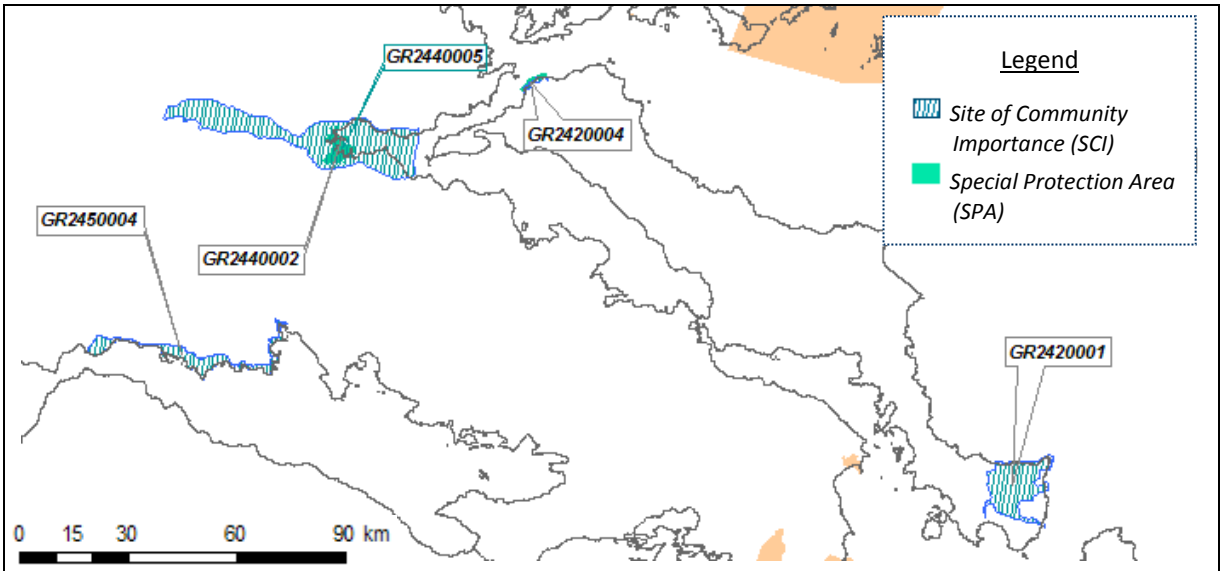


***Figure 65. Geomorphology (left) and extent (right) of the site GR2330009 (*Source: HCMR / GIS Laboratory)**

Official name “Limnothalassa Kothyci - Alyki Lechenon”.

This site has similar characteristics to the site GR2330006 which have already been mentioned in the previous paragraphs.

REGION OF CENTRAL GREECE



Map of the Natura 2000 sites in the Region of Central Greece. The following sites are included in the study area:

- GR2450004

Figure 66. Region of Central Greece (Source: Greek Ministry of Environment)

Name: COASTAL ZONE FROM NAFPAKTOS TO ITEA		
Code: GR2450004	**Conservation status:** SCI	
Location: 22°13′ E, 38°22′ N		
Administrative authority: Region of Central Greece		
Total surface (ha): 10618.68	**Marine surface (ha):**	
Coastline length (km): 80	**Depth (m):**	

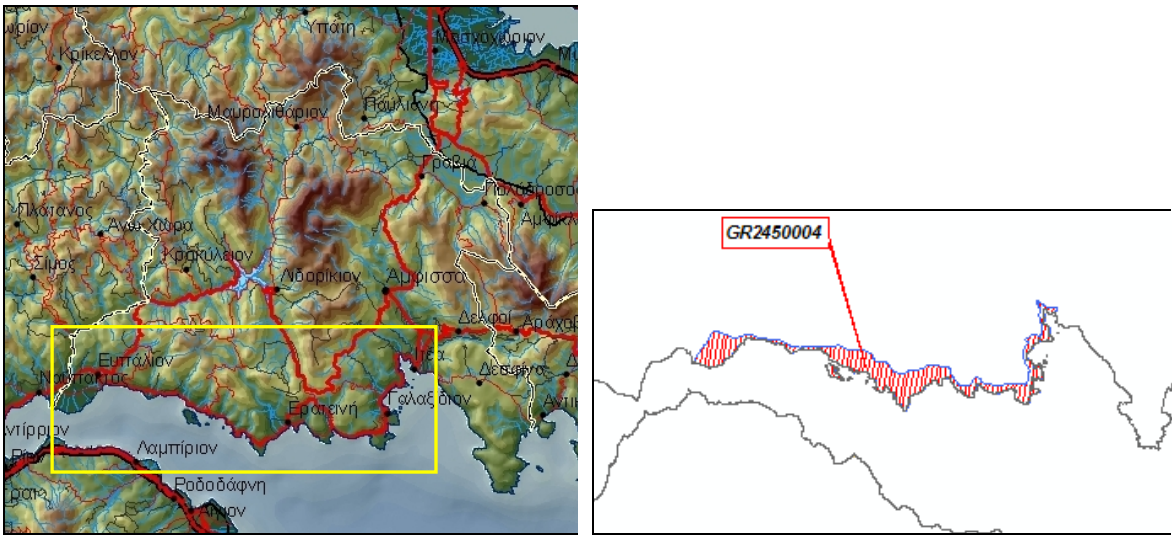


***Figure 67. Geomorphology (left) and extent (right) of the site GR2450004 (*Source: HCMR / GIS Laboratory)**

Geography and geomorphology: Bearing the official name "Paraliaki Zoni apo Nafpakto eos Itea" This area was initially proposed as terrestrial Natura site, but after the habitat mapping carried out by HCMR we consider that the marine area from 0 to 50 m depth has to be included.

Vegetation and animal life: The most interesting terrestrial feature in the site is the well structured juniper forests (*J. phoenicea*), which covers large compact surfaces with important aesthetic value.

The marine front is dominated by rocky formations (habitat type 1170). Some sand banks (habitat type 1110) occur at Mornos river delta. Posidonia meadows (habitat type 1120) are present but not abundant, due to the sharp coastline.

Ecological value, conflicts and threats: In the terrestrial part of the site the most important ecological feature is the juniper forest, and in the marine the Posidonia meadows. These meadows, although small play an important ecological role as nurcery grounds for Korinthiakos gulf. Motor winch fisheries are the most important thread for the meadows. We consider that the scarce patterns of the meadows is due to this type of fisheries).

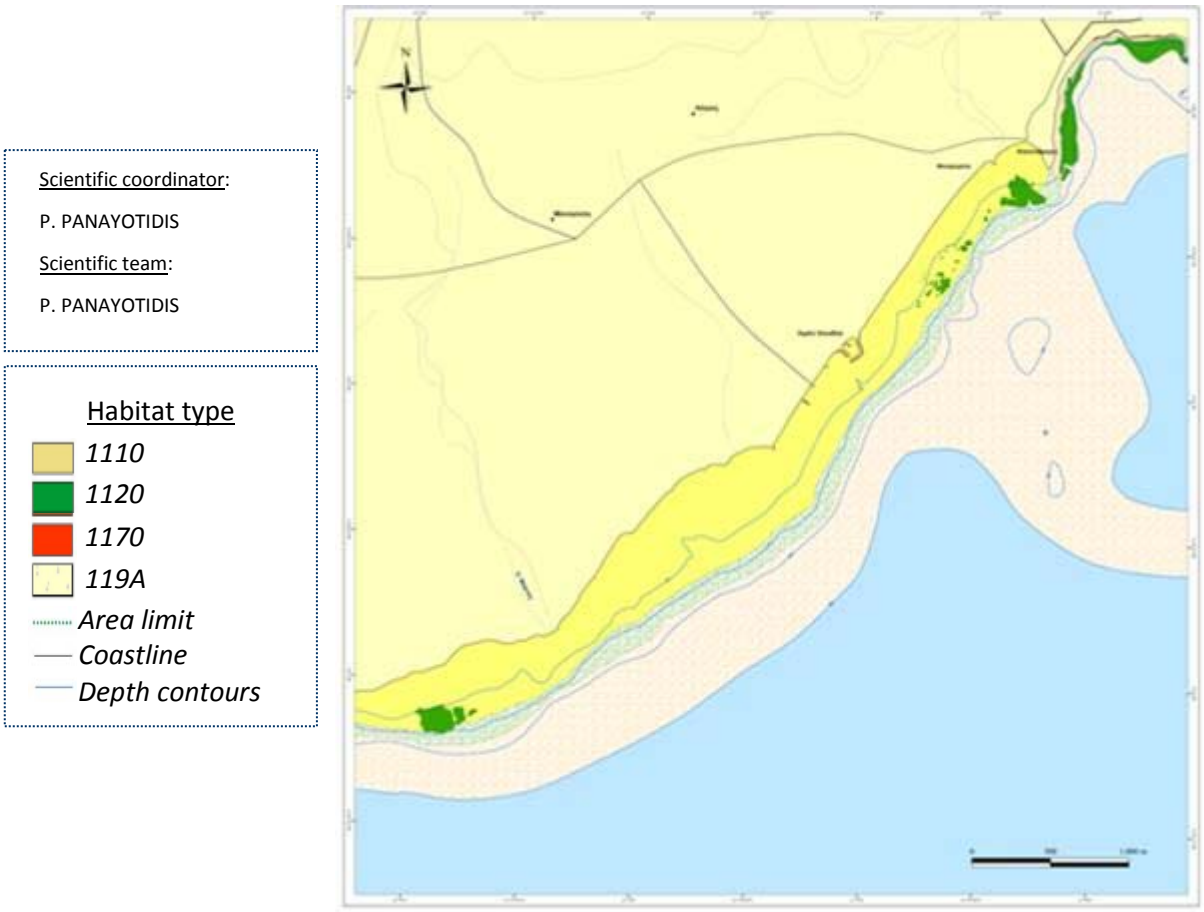


***Figure 68. Distribution of marine habitat types in the site GR2450004 (*Source: HCMR / GIS Laboratory, 2008)**

5.7.2 Coastal morphology and coastal morphodynamics (Erosion and geo-hazards as threats for the human activities on the coastal zone)

5.7.2.1 Introduction

5.7.2.1.1 The aim

The aim of this topic is to study the coastal morphology and coastal morhodynamics of the selected study area. Emphasis will be given in erosion problems and to the associated with these problems issue of the fresh water uses (dams, reservoirs, water extractions). Description and mapping of human activities along the coastal zone of the study area will be carried out also. Finally the natural hazards and human activities threats on the coastal system will be assessed.

5.7.2.1.2 To be familiar with the term "geodiversity"

Geodiversity is the variety of ***earth materials***, ***forms*** and ***processes*** that constitute and ***shape*** the Earth, either the whole or a specific part of it (Gray, 2004).

One aspect also of the "geodiversity" is related to the earth-forms, to the geo-forms, usually expressed as morphology and more concrete as geo-morphology, comprising landforms, which are connected to the main geological characteristics, mineral and rocks, water, folds, faults, etc.

An other aspect of the "geodiversity" is related to natural processes that continue to act upon, maintain or modify either earth-form or earth-material (for example tectonics, water cycle and the related weathering, erosion and sediment transport, etc)

The “geodiversity” is principally concerned to the abiotic part of our planet. The term “geodiversity” is etymologically comparable to biodiversity and it finds similar usage in defining the scope of aspects of nature conservation. “Geodiversity” refers to the basic quality to be conserved, “geoconservation” represents the activity of trying to conserve it and “geoheritage” is applied to specific examples that have been identified as warranting conservation management.

5.7.2.2 The natural boundaries of the system to be studied

To support the aim of our task we base our scientific work on the principles of a systemic approach. The drainage basins form the natural boundaries of the study area system (Fig.69,left) divided for practical reasons into three subsystems (Fig, 69, right).

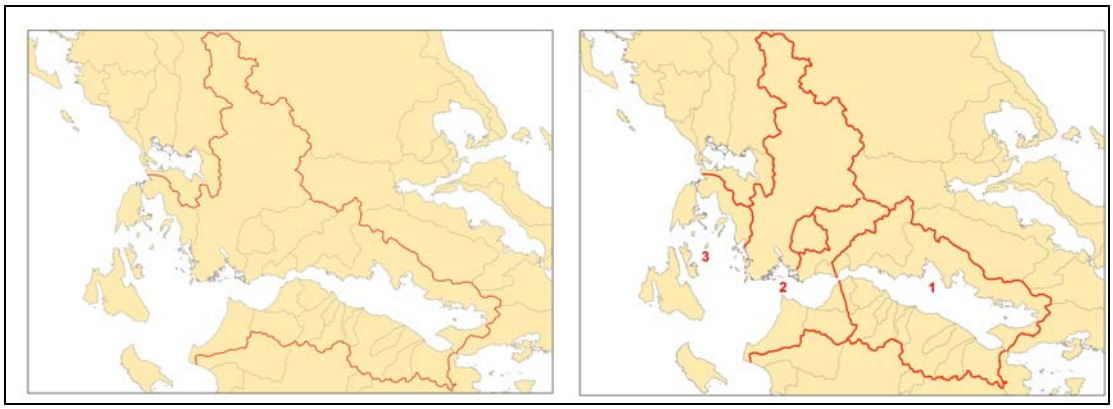


Figure 69: The boundaries of the study area based on the drainage divides (left), subdivided for practical reasons into three subsystems (right).

5.7.2.3 Methods

The data: The above mentioned approach of the topic will be based on existing information, as well as on information gained in the frame of MESMA project.

- -The drainage basins form the natural boundaries of the study area system. Geological and geomorhological data will be unified and digitalized. The data will be extracted from the existed topographical and geological maps 1:50.000.
- -Existing reports will be exploited, as well as published scientific papers.
- -Field work related to description and classification of the coasts and the coastal dynamics will be carried out.

5.7.2.4 Geodiversity of coastal system – Coastal morphology coastal dynamics

5.7.2.4.1 Factors controlling the geodiversity of the coastal system

The coastal system of the study area shows a variety of coastal landforms, such as cliffs and rocky shores, beaches and deltaic coasts. These coastal landforms have been developed and are constantly changing under the influence of a range of morphogenetic factors, including geology and geodynamics, geomorphology, as well as rainfall and hydrograpnic network, controlling the sediment supply to the coasts, and some climatic factors such as winds, which regulate the wave regime.

The lithology of the geological formations of the drainage basins of the study area consists of alpidic formations, mainly calcareous rocks, flysch (sandstones, mud rocks, marls) and post-alpidic formations (sands, sandstones, mud and mud rocks, marls, limestones) (Fig. 70).

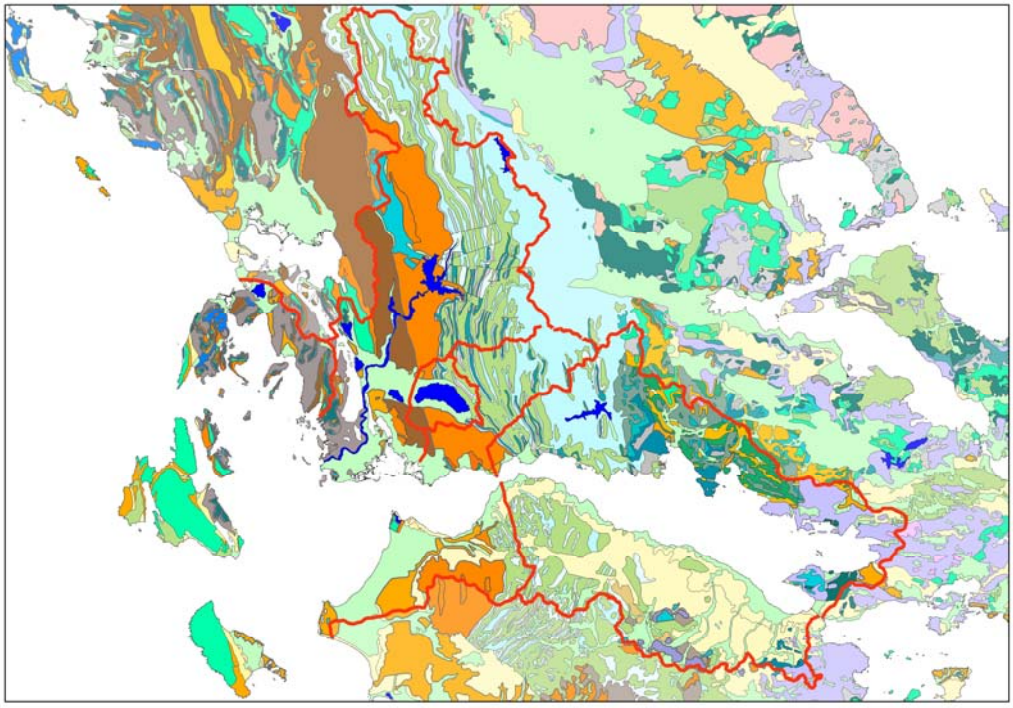


Figure 70. The geological formations of the study area

The geodynamic, as the internal factor and the climate conditions, as the external factor in the geological evolution led to the formation of a complex system of landforms (Fig. 71) and a also complex system of hydrographical network (Fig. 72).

Figure 71. The geomorphological characteristics of the areas included in the drainage basins of the study areas.

Figure 72. The hydrographical network of the areas included in the drainage basins of the study areas.

The geodynamical evolution of the area led to alternating coastal landforms. A significant part of the coasts are cliffs and rocky shores and they consist of hard calcareous rocks, which are relatively resistant to coastal erosion processes. On the other hand, where the cliffs are composed of relatively softer rocks, i.e. flysch, the erosion occurs more rapidly. A small portion of the coasts are cliffs with beaches (coastal strips) on the geological substratum of the postalpidic Plio-Pleistocene (Neogene) formations, which consist of soft sandstones, mudrocks and marls. An other significant portion of the coasts are depositional coasts, which are formed, where clastic sediments are supplied. These areas are mostly embayments of tectonical origin into which riverine sediments build deltaic coastlines.

A significant factor for sediment supply is rainfall. Greece is divided into two zones related to rainfall. Central and western Hellas receives an annual rainfall of more than 1 600 mm/year, whilst in eastern Greece the rainfall is limited in most areas to less than 600 mm/year. This has resulted in the formation of coastal types with more depositional coasts in the western part than in the eastern part.

The predominant waves that affect the coasts of the Greek area are generated by northerly winds, as well as by southerly stormy winds, from the open Mediterranean Sea.

5.7.2.4.2 Classifying geodiversity – Types of coasts – Dynamics

Cliffs and rocky shores

This type of coasts covers a significant part of the coast of the study area. Cliffs and rocky shores are found mostly along faulting systems and the cliff morphology is related to the lithology and to the tectonic movements, which are characterised by the uplifting as well as by the subsistence of tectonic blocks.

- The simplest cliffs are found where the rocks are decomposed by marine erosion along faults. Some cliffs are high and some are low. The erosion of the cliff face can lead to a shore formation at the base of the cliffs, consisting of rock debris. The faulting system and the lithology, characterised by calcareous rocks, are the factors leading to cliff formation of this type. This type of rocky coasts characterizes partly the coastline of the Ionian island complexes, which are included in the study area of the project (Fig. 5).

Figure 73. Cliffs along faults with a shore formation at the base from the calcareous rocky coasts of the Ionian island of Lefkas.

- The northern coasts of the Korinthiakos Gulf (Fig. 6) which is a tectonically very active area and is characterised by an intensive faulting of a NE/SW – W/E system, resulted in many tectonic blocks, which undergo independent vertical movements. Expression of this block fragmentation is the formation of an island array and rocky headlands. The general trend of the tectonic movements is subsidence.

Figure 74. Cliff coasts in the tectonically block fragmented active area of the northern border of the Korinthiakos Gulf.

- The coasts consisting of calcareous rocks are a very common type of rocky coast in the study area, which show gentler slopes of the adjacent land morphology. The general trend of the tectonic vertical movements in those areas is subsidence.

Cliffs with beaches on postalpidic Plio-Pleistocene (Neogene) geological formations

The coasts of this type are narrow strips of beaches at the base of cliffs on postalpidic Plio-Pleistocene (Neogene) geological formations. These formations are tectonically uplifted relatively soft sedimentary rocks, consisting of sandstones, mudstones and marls, and are undergoing relatively rapid erosion processes. The erosion of these rocks produces sharp cliff faces of different heights (usually from 10-20 m) and erosion products, which form the narrow strips of beaches at the base of the cliffs. This type of coast is relatively common in areas where post alpidic formations occur. Such areas are found on the coastlines

of north Peloponnisos and Ionian islands. An example of this type of coast is shown in the figure. In this figure the sharp cliff face on the Plio-Pleistocene geological formations is clearly depicted as well as the beach at the base of the cliff face (Fig. 75).

Figure 75. The sharp cliff face on the Plio-Pleistocene geological formations and the beach at the base of the cliff face (South Zakynthos).

Depositional coasts

We can classify a variety of coastal types as depositional coasts, which have the common characteristic that they may be enlarged by deposition of sediments.

Depositional coasts receive sediments from various sources, mainly transported by rivers, either large rivers draining wide catchments and transporting large quantities of sediment, or where the rivers drain steep hinterlands.

Within the group of depositional coasts are the beaches and the coastal barriers, the lagoons and the most important and continuously changing delta coasts.

Beaches and barriers - Dunes

- Beaches consist of unconsolidated deposits of sand and gravel on the shore and they have different forms. They are long and curved or they form curved pocket beaches between rocky headlands.
- Coastal barriers are narrow strips of land consisting entirely of sandy material. An excellent example of coastal barriers are those of the deltaic deposits of the Acheloos river (Fig. 76). The coastal barrier is formed by a dominant longshore transport of the beach sediment from west to east and encloses the lagoon system of Messolongi.

Lagoons

Coastal lagoons are areas of relatively shallow water that have been separated from the sea by the deposit of sand barriers. The most important lagoon complexes are in the Messolongi-Aitolikon area.

Additionally, we can name the Araxos lagoon and the Kotychi logoon in the NW part of the Peloponnisos. The size of these lagoons is a few square kilometres.

Figure 76. Coastal barriers formed by a dominant longshore transport of the beach sediment and enclosed lagoonal system. Deltaic depositions of the Acheloos river in western Hellas.

Deltas

Delta is a term used to define geomorphologically the depositional lowlands formed around river mouths. The rivers deliver an abundant water and sediment yield to the coast, which depends on the geology and geomorphology of the drainage basin as well as the climate and rainfall, controlling the weathering of the rocks and the erosion and transport of the weathering products.

The size and shape of the deltas depend mainly on two factors:

- the rate of rivers sediment yield, and
- the effects of waves on the accumulating sediments.

In the study area the tide fluctuations are relatively small diminishing the role of tides in building delta types.

The deltas in the study area are formed by relatively stark fluvial supply. The Acheloos delta, (Fig. 9) is formed by large quantities of sediments, which have been delivered to the river mouth. The enlargement of the delta front is relatively rapid. The wave action shapes the deposited material into cuspate outlines, sorting the delivered material to form sandy beaches and trailing spits.

With less supply material and relative strong incident wave action, delta outlines become lobate. This is the delta type of the Mornos river in Korinthiakos Gulf.

Figure 77. The Acheloos delta in western Hellas. Delta material shaped into cuspate outlines sorting the delivered material to form sandy beaches and trailing spits.

Typology of the coasts

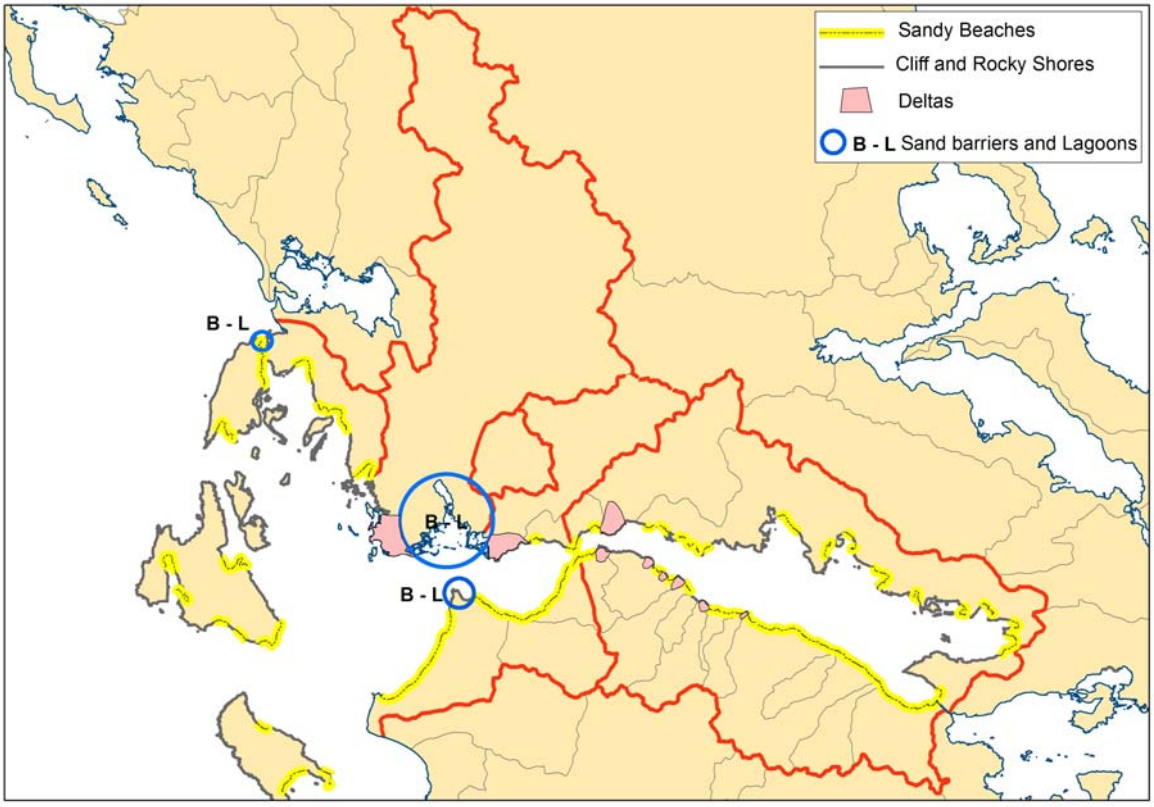


Figure 78. Classification of the coasts of the study area.

Conclusion remarks

Studying the coastlines, which are the active boundaries between lithosphere, hydrosphere and atmosphere, we can discover how essential the nature of coasts is and how it is determined by large scale changes of the earth's system e.g. geological and geodynamic processes, which extend in space and time as well as by more local and rapid changes e.g. weather conditions, waves etc.

These processes in coastal areas produce changes that extend from a few meters to many kilometres and that can occur in a few seconds, hours, or days. These processes mark the large or the small scales in space and time and this leads to the integrated approach of the study of coastlines.

5.8 Annex to the Baltic Sea Case Study

Case study leader: Julia Carlström

Table 37. Pressures and natural values in the BSPA St Anna in Östergötland, Sweden

Pressures	Marine env. < 6 m	Marine env. > 6 m	Cultural landscape	Shorelines	Fish	Marine mammals and birds	Forests	Total pressure
Wood fires							Low	**Low**
Migration obstructions					Low			**Low**
P and N discharge	High	High			High	Med		**High**
Buildings		Low	Low	Low	Low	Low		**Low**
Wood clearance							Med	**Low**
Insufficient cultivation/ grazing			Med				High	**Med**
Oil dispersal	Low	Low		Low	Low	Med		**Low**
Commercial fishing					Low			**Low**
Recreational fishing					Low			**Low**
Motorboats/ jetskis		High		Low		Low		**Med**
Dredging		Low						**Low**
Mink						Med		**Low**
Environmental contaminants						Med		**Low**
Climate changes		Low			Low			**Low**
Invasive marine species	High	High			High	Med		**High**
Shallow muddy areas filled up with weeds					Low			**Low**
Fires on rocks				Med				**Low**
Tipping	Low							**Low**
Insufficient management of cultural elements			High					**Med**
Total pressure	**High**	**High**	**Med**	**Low**	**High**	**Med**	**Med**	**High**