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Original Article

Multiple interests across European coastal waters: the importance of a common language

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Different marine and coastal activities have diverse economic, environmental, and socio-cultural objectives, which can lead to conflict when these multidimensional activities coincide spatially or temporally. This is sometimes driven by a lack of understanding or other users' needs and consequentially adequate planning and the utilization of a common language is essential. By using a transparent approach based on multi-criteria analysis, we characterize and establish priorities for future development/conservation for all users in the coastal area using six representative European Case Studies with different levels of complexity. Results varied according to location, but significantly it was found that stakeholders tended to favour ecological and social over economic objectives. This paper outlines the methodology employed, the results derived, and the potential for this approach to reduce conflict in coastal and marine waters.

Keywords: case studies, coexist, conflict (reduction), European Coastal Zone, marine spatial planning, multi-criteria analysis, stakeholders.

Introduction

The use of European marine and coastal areas varies from traditional activities such as fishing and trade shipping, to more recent technical developments of green energy production (Ehlers and Lagoni, 2006). Demand for clean energies has progressed due to the public concerns about the sustainability of energy use (Pinkse and Dommisse, 2008). As a result of the increasing complexity of use, competition for space and for actual or perceived potential resources in the marine and coastal areas, there is an urgent need for coexistence among the different activities (Dempster and Sanchez-Jerez, 2008). This challenge is further complicated by the different degrees of acceptance by different parts of the society about decisions on marine and coastal uses (Brown *et al.*, 2002). It has been shown, however, that there is greater social acceptance when increased transparency is established in the planning and decision-making processes (Curtin and Meijer, 2006). Marine spatial planning (MSP) needs room for a compulsory conciliation, and a compromise of not only sustainable but also intentional and efficient use of resources (Ostrom *et al.*, 1999). More recently, Foley *et al.* [(2010, p. 2) after Douvere (2008)] defined ecosystem-based MSP as "an integrated planning framework that informs the spatial distribution of activities in and on the ocean to support current and future uses of ocean ecosystems and maintain the delivery of valuable ecosystem services for future generations in a way that meets ecological, economic and social objectives".

Within the process of planning, conflicts between public and private stakeholders may occur (Pinho, 2007), and different stakeholder types might interact either negatively or positively and a plethora of dissimilar interests may arise (Reed *et al.*, 2009).

The outcome of this it that information can appear too complicated to policy-makers who therefore make their decisions independently, based on their own experience.

The COEXIST project (Interaction in Coastal Waters: A roadmap to sustainable integration of aquaculture and fisheries) engaged stakeholders from six representative European Case Studies (from now on CS). The project focused on the interaction of different human activities, conflicting or synergistic and facilitated interaction between diverse sectors in the coastal zone across several European countries.

The objective of this paper is to apply a "common language"—in this case a multi-criteria analysis (MCA) approach—designed to ascertain the different stakeholder views and preferences, from different countries, with regard to sustainable use of coastal areas (Soma *et al.*, 2013). In the MCA approach used, first the legislative framework is identified in general and in specific terms (in each CS). Second, under three main overarching objectives—economic, ecological, and socio-cultural—stakeholder preferences for a range of sub-objectives were determined. Third, the preference patterns were collated by CS and by stakeholder group. Finally, the sub-objective preferences were ranked in each CS.

MCA: state of the art

MCA emerged because of the need to develop techniques to be used in processes where difficult decisions about alternative strategies have to be taken (Nijkamp, 1975; Van Delft, 1977; Kickert, 1978). MCA identify each of the choices made under a range of objectives (or sub-objectives) and assign a value to the relative importance of this choice with respect to each objective.

To determine the relative importance of the objectives selected, predetermined multiple choice options are required (Hajkowicz and Collins, 2007). These are subsequently deployed as part of the evaluation process, can be conducted out by diverse individual stakeholders or stakeholder groups and commonly involves a multidisciplinary team (Munda, 2004).

Once the stakeholders decisions have been obtained, several methods for judgements can be used to rank preferences (Yan *et al.*, 2007; Shakhnov, 2008) and/or to make pairwise comparisons (Deng, 1999; Macharis *et al.*, 2004; Soma, 2010; Saaty and Vargas, 2013). These methods of judgements are advocated within the MCA scope as suitable for decision problems and for the inclusion of stakeholders' views (Linkov *et al.*, 2006; Hajkowicz and Higgins, 2008).

However, there is a challenge when the frames and understandings of the reality of stakeholders are influenced by their different and sometimes conflicting views, goals, and demands (Lahdelma *et al.*, 2000; Mendoza and Prabhu, 2005). In addition, there is criticism of the approach relating to the inconsistencies derived from essentially judgement calls (Mendoza and Martins, 2006).

MCA for marine spatial decision-making processes

MSP is becoming important not only in Europe but also worldwide due to the needs of different societies have to address marine management concerns (Peel and Lloyd, 2004; Douvere, 2008; Kidd and Shaw, 2013). Some authors advocate that as MSP is a relatively new process that requires adequate and practical tools to be used in the inherent decision processes (e.g. Kidd and Ellis, 2012; Stelzenmüller *et al.*, 2013). Smith *et al.* (2011) suggest that MSP should be part of an integrated terrestrial and marine approach; however, Janßen *et al.* (2013) insist that unlike its terrestrial counterpart, MSP does not present meaningful delimitation of planning areas (apart from somehow vague terms for "inshore" or "offshore"), and consequently the adequate management of human activities remains a challenging process.

Some authors (e.g. O'Riordan *et al.*, 2005; Hedelin, 2007) highlight that the potential for applying MCA in decision process dilemmas is justified. The reason being is that MCA allows the inclusion of multiple and complex criteria belonging to different dimensions at a specific location to support analysis and subsequent judgement (Table 1).

While the use of MCA tools in MSP has been recorded for over a decade, more recently, models and other experimental tools have focused not only on the interactions between sectors, such as fisheries and conservation (see for example, Klein *et al.*, 2009) but also on diversified human impacts on the marine environment (see for example, Ruiz-Frau *et al.*, 2011; Stelzenmüller *et al.*, 2011). Douvere and Ehler (2009) advocate the increasing need for new location-based strategies in MSP for Europe. To achieve this, new tools will be required and particularly those that bring together stakeholders' views with different activity sectors (Christie, 2011) and spatial contexts (Berkes, 2009; Molle, 2009). Strategies which can enhance accountability, legitimacy, and transparency throughout decision-making processes are particularly relevant (Soma, 2010; Sparrevik *et al.*, 2011).

In response to these challenges, we believe that the use of a tailored MCA approach developed specifically for the purposes of coexistence in European waters, could be of significant value to the MSP process given its ability to deal with the choices derived from various, and sometimes conflicting criteria. In this MCA approach, to deal with incommensurable value dimensions of the criteria, we compare along a scale of "importance" (Munda, 2004). This is essential as while it may

Table 1. Examples of coastal and marine planning dimensions and main objectives.

	Dimensions (activities, actions, and people)		
Resources	**Temporal**	**Spatial**	**Institutional**
Economic: biological, energetic, and geological exploitation	Fishers livelihoods Trade of goods and services Energy consumption	Fishing grounds Trade routes Gas and oil fields	Fishers, producers organizations Shipping industry Energy production companies
Environmental: biodiversity protection, clean seawater, and migratory routes	Biological spawning periods Search for biomaterials: paint/fuel Resources conservation	Wild areas MPAs Nursery areas	Fishery-dependent communities Marine biologists Environmentalists
Socio-cultural: clean sandy beaches, bath-able seawater, pleasant coastal landscapes	Seasonal holidays Annual sports competitions Cultural and gastronomic events	Beach recreation areas Sailing routes Architectural and historical places Coastal summer houses	Tourists Sportspeople Local city councils

be wholly plausible to suggest that social aspects are more important than the economic considerations at a specific site, it is sometimes complicated to attribute monetary values on social dimensions to enable accurate comparison.

The common methodology developed in the COEXIST project has benefited from the trans-national and cross-disciplinary collaboration of the consortium. This stakeholder-based MCA approach was adapted to reflect local circumstances in each CS area to facilitate information collection. The main sources of information stemmed from the local stakeholders identified in each case study location and included sector representatives, public managers, researchers, and non-governmental organizations (NGOs).

Methodological approach

Conceptual model

The methodological approach used is part of a MCA based on the COEXIST framework and is outlined below. While the complete MCA framework accounts for both the spatial and temporal dimensions, the institutional dimension was central to the success of the analysis. The conceptual model used can be arranged into a hierarchical structure as depicted by Figure 1.

The development of the hierarchy starts with the definition that the goal in each CS, was to "sustain a viable coastal/marine ecosystem" in their geographic area, aiming for long-term coexistence of stakeholders with differing local agendas (economic, social, or environmental). In a broader sense, a sustainable use of the resource refers not only to activities but also to achieving or preserving relevant values, such as competitive economic activities and infrastructures that are utilized, healthy environmental status, and good living standards (Level 1).

In addition and with direct relevance to sustainability, there are already a substantial number of legislative frameworks and spatial plans in place, which must be taken into account locally, regionally, nationally, or even broader scale. These plans were identified and collected in each CS (Level 2).

Each CS developed a specific hierarchical structure, although at a general level the objectives (Level 3) are similar in all CS, comprising economic, ecological, and socio-cultural dimensions. Each of these general objectives is subsequently split into more specific objectives and sub-objectives. For instance, in the economic category, stakeholders identified objectives for allowing further developments of the main economic activities in their coastal areas, so for competitiveness, the economic sub-objectives also included issues of infrastructure improvements. In the ecological category, the sub-objectives included ensuring good water quality and conditions conducive for living resources (such as fish). Issues related with the preservation of resources as well as pollution control were also relevant and therefore included. When considering the socio-cultural category, issues of employment, constructions or heritage, and lifestyle and healthy living were seen as pertinent.

Finally, a broad range of stakeholders were identified and categorized (Level 4). It must be emphasized that identification of stakeholders is a pre-requisite of this approach and ideally should be done before identifying the hierarchy. However, for completeness when describing this conceptual model, we listed the stakeholder groups in the hierarchy below.

Case studies

The CS in the COEXIST project (Figure 2) that applied, adapted, and conducted the framework were at different scales and included the Hardangerfjord (Norway), the Atlantic coast (Ireland only), the Algarve coast (Portugal), the Adriatic Sea coast (Italy), the North Sea coast (comprising Denmark, Germany, and the Netherlands), and the Baltic Sea (Finland) (Bergh *et al.* 2012).

Primary data sources

To perceive preferences on coastal planning, a common questionnaire was developed based on a hierarchical disposition of objectives. Therefore, a set of questions was adapted to each case-study context and specificities. The questions were structured around three objectives (economic, ecological, and socio-cultural), and

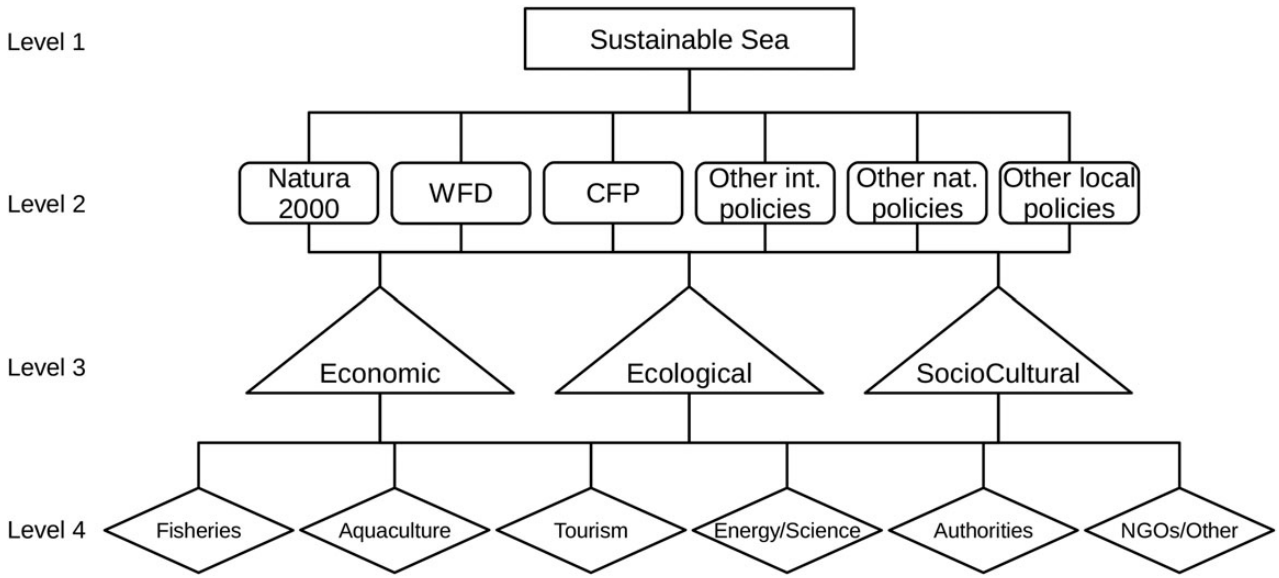

Figure 1. Conceptual model based on the COEXIST framework showing the different levels of analysis for the different CS: the main goal to achieve, the sets of legislative frameworks/spatial plans consulted (WFD, Water Framework Directive; CFP, Common Fisheries Policy, int., international; nat., national), the main objectives addressed and the groups of stakeholders involved in the process. Source: COEXIST (2011).

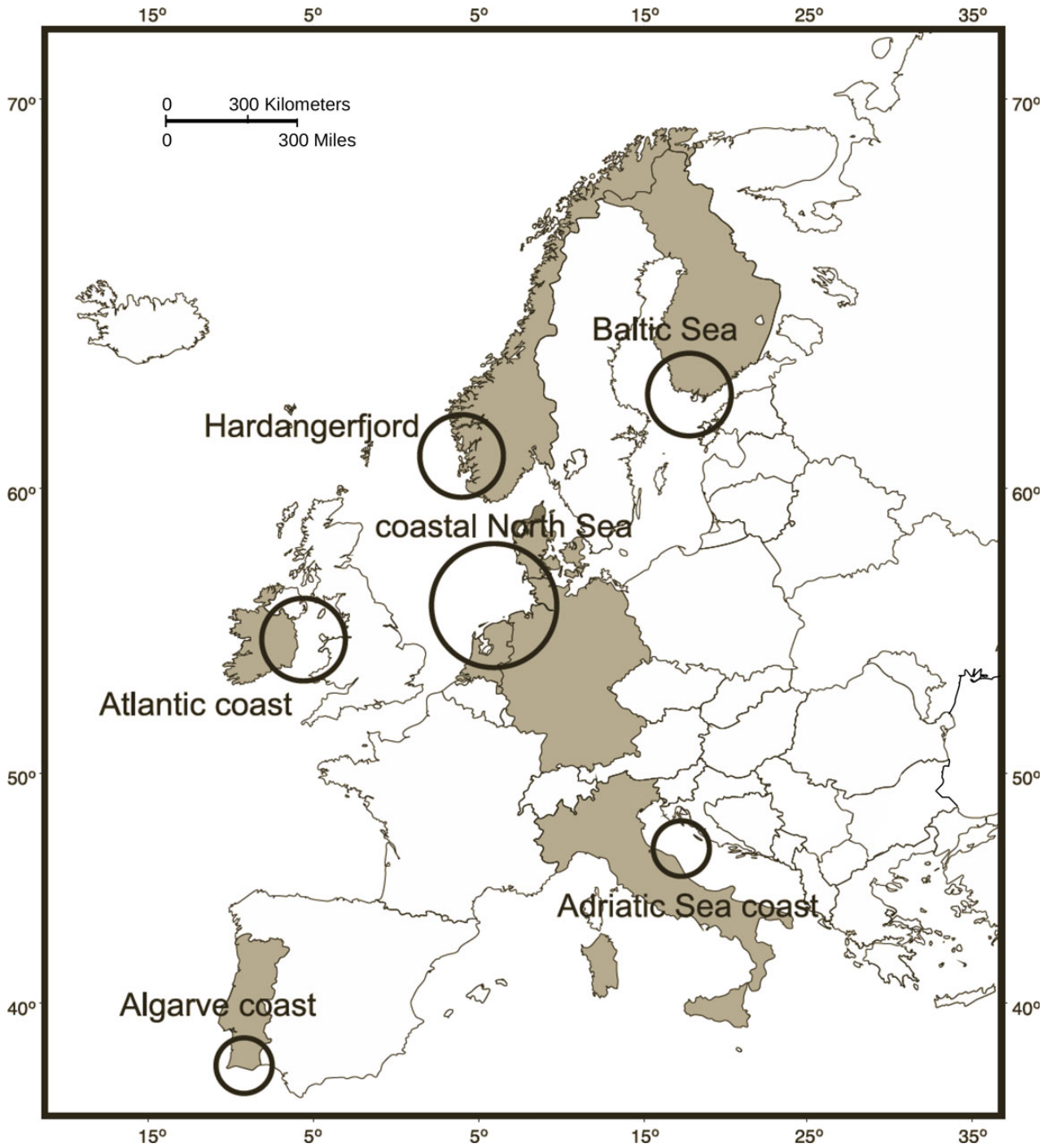

Figure 2. The case study sites of the FP7 COEXIST project that have applied the framework are represented by the circles (in grey are depicted the respective countries involved in the process). Source: Bergh *et al.* (2012).

their respective sub-objectives (Table 2). Then local stakeholders were invited to answer the questionnaire, in the context of sustaining a viable coast/sea in their location. These preferences were analysed using a pairwise comparison with a 9-point scale, as suggested by Soma (2003, 2010).

Secondary data sources

Relevant policy documents and legislation were identified; at international, European, regional, national, and local levels (COEXIST, 2011). It should be noted that at a broader level, legal frameworks do not apply evenly to all CS. For instance, the Water Framework Directive (WFD) was common to all CS; whereas the Common Fisheries Policy (CFP) was relevant to all, except CS1—Hardangerfjord (Norway), which is a non-EU country. Similarly, the Convention for the Protection of the Marine Environment of the Northeast Atlantic (OSPAR) was considered in just four CS, exceptions were CS4—Adriatic Sea (Italy) as Italy is not a signatory state, and CS6—Baltic Sea (Finland) as although Finland is a

Table 2. General example of a hierarchy of objectives used in each case study.

Main goal	**Sustainable sea**		
Main objectives	Economic	Ecological	Socio-cultural
	Obtain profitable enterprises	Conserve healthy ecosystems	Preserve high living qualities
Specific objectives	Increase profitability of firms	Ensure good water quality	Ensure coastal employment
Sub-objectives	Increase competitivity of fisheries	Avoid ballast waters	(. . .)
	Increase competitivity of tourism	Control water pollution	(. . .)
(. . .)	(. . .)	(. . .)	(. . .)
(. . .)	(. . .)	(. . .)	(. . .)

Source: COEXIST (2011).

signatory of the OSPAR convention, the Baltic Sea is not part of the territory defined under OSPAR.

Stakeholder preferences through an MCA approach

In the present analysis, all graphical computations were performed by using R version 2.14.1 (R Development Core Team, 2011) and were carried out as follows:

(i) First, the collected answers derived from pairwise comparisons from the stakeholder questionnaires were scaled from 0 to 100.

(ii) Second, ternary plots were built aiming to display stakeholders' average position score of the economic, ecological, and socio-cultural core objectives across all CS (Koleff *et al.*, 2003; Graffelman and Camarena, 2007; Palmer *et al.*, 2007). The closer a point falls to a vertex, the greater the stakeholder is attached to the objective of that particular vertex. The location of the plot provides the stakeholder's return on the relative importance of the three main objectives (Zafonte and Sabatier, 2004). Continuous data depicted in ternary plots are further analysed to find dissimilarities among case studies. Seefeld and Linder (2007) suggests that dissimilarity can be measured by using distance metrics through the method of the Euclidean distance. Coetzer *et al.* (2012) suggest that the Euclidean distance is generally accepted as the most common measure of dissimilarity in the literature. Considering the three-dimensional average points for economic (x), socio-cultural (y) and ecological (z) dimensions, and given that p and q are two case studies being compared, then:

$$p = (p_x,\ p_y,\ p_z), \tag{1}$$

$$q = (q_x, q_y, q_z). \tag{2}$$

The Euclidean distance is computed as:

$$\mathrm{d}(p, q) = \sqrt{(p_x - q_x)^2 + (p_y - q_y)^2 + (p_z - q_z)^2}. \tag{3}$$

Next, the analysis weighed up all the main objectives for each CS depicted in the ternary plots and measured the Euclidean distances of their average points. The Euclidean distance between two points in a Cartesian space measures the dissimilarity between pairs of patterns. The value of the distance indicates the extend to which pairs of patterns differ from each other. Smaller dissimilarity between two patterns is indicative of higher visual similarity between the patterns (Honarkhah and Caers, 2010).

(i) Third, different stakeholder preference attributes to each objective across CS were initially depicted in a heat plot and then allocated into clusters (dendrograms). Hentschel and Page (2003) suggest that this technique allows the recognition of patterns (i.e. between CS and stakeholder groups in the present approach). Stakeholder groups from different CS who are similar in terms of their preferences for the main objectives will be located close together in the heat plots. To better understand the results, a discrete and a continuous scale for stakeholder group preferences were defined where 0 preference corresponded to "black square" and 100 preference matched the "white square" with all the preferences in between varying in different grey hues. Dendrograms show that the most similar elements are merged hierarchically in single clusters. The order of the clusters formed indicates the patterns and relations between the elements. Similarities between elements can also be measured in dendrograms by using Euclidean distances.

(ii) Fourth, by sorting sub-objective preferences in descending order, each CS box-plot and whiskers graph shows the range of variation between percentiles. The outliers identify inconsistencies. In this analysis, the CS are independent from each other, and the analysis accounts only for the number of stakeholder respondents and the chosen number of sub-objectives. Some of the sub-objectives may be similar across CS, whereas others may not (i.e., they only make sense in the particular CS context).

Results

Legislation applied in each case study

Despite the context differences, there are several legal frameworks that are common to various CS, which are designed to regulate the diverse range of activities, and these are often in parallel with more local frameworks that have the intention to address and regulate local problems at a more granular level (Table 3).

Across the different CS in this study, stakeholders involved in the coastal planning and management process have their own sectoral interests and have diverse backgrounds (COEXIST, 2011). These stakeholders typically belong to the private or operational sector, the governmental or public sector, and NGOs. To advance the analysis, stakeholder sectors were grouped under the following categories: fisheries, aquaculture, tourism, authorities, energy, and science, NGOs and other marine-related activities. It is worth noting that stakeholders representing sectors such as shipping, transportation, and sand mining were also approached, but due to low returns from these sectors results are grouped under "others". Questionnaire responses are presented in Table 4.

Table 3. Identification of relevant legislation found for each case study.

Case study	Goal	Large-range spatial plans	National and local plans	Main activities and stakeholders
CS1—Hardangerfjord	Sustainable sea	WFD, Natura 2000, OSPAR	NPBA, CZP, ACTS	Fisheries, aquaculture, energy (hydroelectric), and tourism
CS2—Atlantic Coast of Ireland	Idem	WFD, Natura 2000, CFP, OSPAR	FR, HSBC, OREDP, ABWFL, SACs/SPAs	Fisheries, aquaculture, energy (offshore wind parks), and tourism
CS3—Algarve Coast	Idem	WFD, Natura 2000, CFP, OSPAR	POOC, POPNRF, PGRH, POEM	Fisheries, aquaculture, and tourism
CS4—Adriatic Sea	Idem	WFD, Natura 2000, CFP	RPFA, RPHD, NLTF, NPHD, ZTB, NLCMPA	Fisheries, aquaculture, energy (offshore gas), and tourism
CS5—Coastal North Sea	Idem	WFD, Natura 2000, CFP, OSPAR	PB, NPs, NSG, MSP, DFL, MPV, IMPNS, MDPDWS, PDNS	Fisheries, aquaculture, energy (offshore oil, gas, and wind parks), and shipping
CS6—Baltic Sea	Idem	WFD, Natura 2000, CFP, OSPAR	EPS, ESSWF, FMP, NADP, OPs	Fisheries, aquaculture, energy (hydroelectric), and tourism

Source: COEXIST (2011).

NPBA, National Planning and Building Act of 2008; CZP, The coastal-zone plan—at municipality and county levels; ACTS, Several Acts: The Aquaculture Act (Law of 17. June 2005 No. 79); The Food Act (Law of 19. December 2003 No. 124); The Animal Welfare Act (Law of 19. June 2009 No. 197); The Pollution Act (Law of 13. March 2003 No. 6); The Harbour and Waters Act (Law of 17. April 2009 No. 19); FR, fisheries restriction; HSBC, herring spawning box closure; OREDP, Offshore Renewable Energy Development Plan; ABWFL, Arklow Bank windfarm Foreshore Lease; SACs/SPAs, various SACs and SPAs in case study area; POOC, Coastal Edge Management Plan; POPNRF, Ria Formosa Natural Park Management Plan; PGRH, Hydrographic Region Management Plan; POEM, Maritime Space and Activities Plan; RPFA, Regional Plan for Fisheries and Aquaculture; RPHD, Regional Plan for Hydraulic Dredges; NLTF, National Law for Trawl Fisheries; NPHD, National Plan for Hydraulic Dredges; NTB, National Law for the Creation of Fishing Protected Areas; NLCMPA, National Law for the Creation of MPA Areas; PB, Plaice Box; NPs, National Parks: Schleswig-Holsteinisches Wattenmeer, Niedersächsisches Wattenmeer, Hamburgisches Watternmeer; NSG, NSG Helgoland; MSP, Marine Spatial Plan German EEZ; DFL, Danish Fishery Law; MPV, Management Plan Voordelta; IMPNS, Integrated Management Plan North Sea 2015; MDPDWS, Management and development plan for the Dutch Wadden Sea; PDNS, Policy Document on the North Sea 2009–2015; EPS, environmental permit system; ESSWF, environmental strategy of the South-Western Finland 2021; FMP, fisheries use and management plans; NADP, national aquaculture development programme 2015; Ops, other plans: local coastal master plan; local detailed coastal plan; local detailed plan; local master plan; military areas; MPAs: national commercial fishing development programme 2015; national parks.

Preferred objectives by case study

Weighing stakeholders' views are basic to determine their position (COEXIST, 2012). We treated stakeholders as having similar importance, and only considered the relative preference they gave to the different objectives (Figure 3).

The scrutiny of the different stakeholders across CS resulted in different perceptions of what were of most relevance when aiming for sustainability of the coast and sea. The number of respondents by CS differs and by examining the triangular grid analysis it is possible to verify that the dispersion of the results varies among the CS.

The Hardangerfjord case study (CS1) shows that stakeholders' views are dispersed and that stakeholders do not present balanced opinion (in the centre), but instead revealed outcomes tied to specific objectives that closely match their background. For four stakeholders, the summed variable contribution of ecological objectives (62–75%) is much more relevant than the two contributions to the economic (58–72%) and the one for socio-cultural (58%).

With the Atlantic coast case study (CS2), some stakeholders weighed the objectives evenly, whereas others preferred to focus on ecological or socio-cultural objectives; a similar pattern was found in three stakeholders for ecological prevalence (70–75%), two on social (72–78%) with three in the central area indicating no prevalent dimension.

The Algarve coast case study (CS3) shows that most of the stakeholders allocate their preferences near the central area of the ternary plot, with some predominant preferences towards ecological objectives (up to 82%); no single stakeholder shows higher preference for either economic or socio-cultural objectives.

The Adriatic coast case study (CS4) presents higher predominance near the central area, but with clear leaning towards the socio-cultural objective (from 38 to 56%); just two stakeholders show a slight predominance for ecological preference (56 to 63%) and one shows a higher preference (>80%).

The North Sea case study (CS5) shows that most preferences vary between the socio-cultural and ecological objectives; it is however important to consider that only three stakeholders allocated their preferences closest to the economic objective (from 55 to 85%).

The Baltic Sea case study (CS6) shows dispersed preferences with tendencies split between the economic and ecological objectives rather than to the socio-cultural one; with just one stakeholder within the socio-cultural area (55%).

Despite several stakeholders having shown no particular preference for any of the main objectives overall, the plotted results showing the different positions reveal that the objective for which there is the highest preference is the ecological objective, followed closely by the socio-cultural and economic objectives.

In terms of dissimilarities among the CS, there are three variables (the main objectives), and six CS. The respective Euclidean distances were computed as shown in Table 5.

From the dissimilarity matrix, we can see that the Atlantic Coast of Ireland and the Coastal North Sea CS (CS2 and 5) present the most similar patterns among the main objectives. In contrast, the Algarve Coast and the Coastal North Sea CS (CS3 and 5) present the least similar patterns. These results can be explained by considering theoretical work developed by Honarkhah and Caers (2010), who stated that the smaller the Euclidean distance between two patterns, the higher is similarity between them.

Table 4. Number of questionnaire respondents and their distribution by stakeholder group.

Stakeholder group	Fisheries	Aquaculture	Tourism	Authorities	NGOs/other	Energy/science	Total
Case study							
CS1—Hardangerfjord (Norway)	1	2	1	1	1	1	7
CS2—Atlantic coast (Ireland)	1	1	2	1	2	1	8
CS3—Algarve coast (Portugal)	3	8	2	2	6	4	25
CS4—Adriatic Sea coast (Italy)	2	1	4	4	2	1	14
CS5—North Sea coast (Denmark, Germany and The Netherlands)	8	2	3	12	6	12	43
CS6—Baltic Sea (Finland)	2	2	1	2	1	2	10
Total	17	16	13	22	18	21	107

Source: COEXIST (2011).

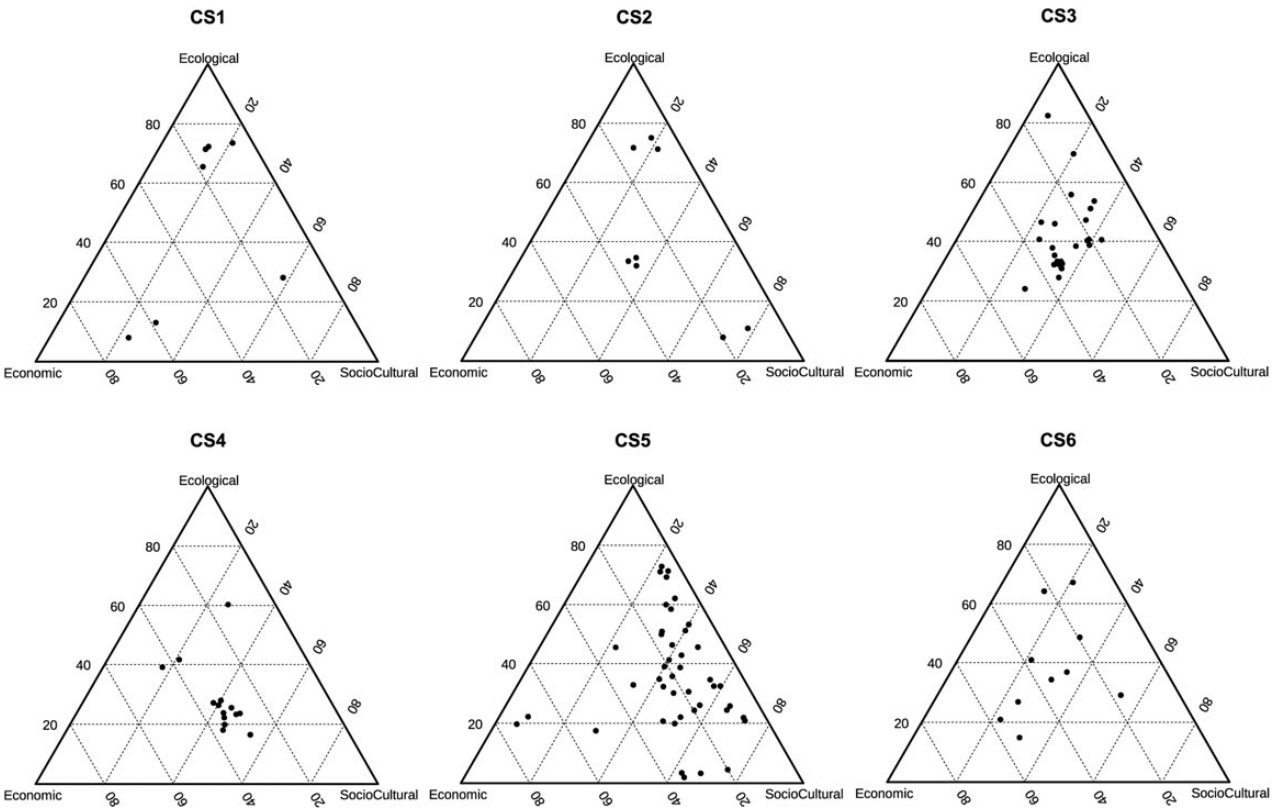

Figure 3. Ternary plots illustrating the relative stakeholders' preferences in relation to economic, ecological, and socio-cultural coastal management for the COEXIST framework ($n = 107$ stakeholders). CS1—Hardangerfjord (Norway), CS2—Atlantic coast (Ireland), CS3—Algarve coast (Portugal), CS4—Adriatic Sea (Italy), CS5—North Sea (Denmark, Germany and The Netherlands), and CS6—Baltic sea (Finland).

Importance of objectives within CS according to stakeholder group

To find how important the main objectives are to respective stakeholder groups, a cluster analysis was performed. The cluster analysis results show the permutations within a set of the six CS (columns) and another set of the six stakeholder groups (rows), which are placed so that similar CS-stakeholder categories are near each other. Also, the heat map plot uses a colour scale to show where the data are distributed according to the chosen objectives. The heat map depicts the aggregate results showing the relative position all stakeholder types assume in each CS concerning the main objectives of the questionnaire (Figure 4).

When considering all the stakeholder groups, two main clusters clearly appear across all three main objectives, but when considering the CS the clusters (may) differ. By analysing the structure of the economic dendrograms and their related heatplot, it is possible to verify that with respect to the economic objective, for example, the Algarve Coast and the Adriatic Sea CS (CS3 and 4), corresponding to southern countries, present similar preferences; some similarities are also shared among the Hardangerfjord and Baltic CS (CS1 and 6), i.e., corresponding to Scandinavian countries. Whereas Authorities, NGOs/Other and Energy/Science stakeholder groups do not place a higher importance on the economic objective, the remaining stakeholders have the opposite opinion. Representatives of the

fishery sector tend to prioritize the economic objectives more than the operational sectors of Aquaculture and Tourism. The Energy/Science stakeholders tend to give higher importance to ecological objectives in preference to the remaining two objectives. Considering the ecological objectives, the Hardangerfjord and Atlantic Irish coast CS (CS1 and 2) are the locations that present higher antagonist views among stakeholder groups, i.e. there are stakeholders attributing high priority to these objectives, whereas others have an opposite opinion. Within the socio-cultural objectives, the Algarve Coast (CS3) and Coastal North Sea case study (CS5) show a similar pattern, followed by the Hardangerfjord case study (CS1) where only the authorities differ somewhat. The largest distance (discrepancy) was noted from the results of the stakeholders of the Irish Coast case study (CS2).

Preference for sub-objectives in each CS

Each of the CS developed its own sub-objectives and it was noted that common sub-objectives were derived across several CS, whereas in some cases unique sub-objectives were developed (Figure 5). These sub-objectives were ranked by importance and despite the inclusion of the latter, it was still possible to ascertain the most influential items as part of the ranking process.

In general, it seems that stakeholders put significant attention on the ecological objective. Namely, they place particular emphasis on "ensure good water quality", which was the sub-objective most often ranked in the highest positions [1st for Hardangerfjord (CS1) and Atlantic Irish coast (CS2), 2nd for Algarve (CS3) and the Coastal North Sea (CS5), and 5th for the Adriatic (CS4)]. "Preserve target stocks (GES)" was ranked the second most relevant sub-objective [1st for the Coastal North Sea (CS5), 2nd for Adriatic (CS4) and Baltic (CS6), 9th for Algarve (CS3), and 12th for Hardangerfjord (CS1)]. Other highly relevant items are "provision of employment for coastal communities" [ranked 2nd for Irish coast (CS2), 4th for Adriatic (CS4), 5th for Algarve coast (CS3), 7th for Baltic (CS6), 10th for Hardangerfjord (CS1), and Coastal North Sea (CS5)]; and "ensure high resource rent" [ranked 1st for Algarve coast (CS3) and 3rd for Coastal North Sea (CS5)].

Table 5. Dissimilarity matrix between CS.

	Euclidean distance				
Case study	**CS1**	**CS2**	**CS3**	**CS4**	**CS5**
CS2	16.47				
CS3	27.31	27.54			
CS4	25.49	19.54	28.47		
CS5	23.19	7.88	29.67	16.05	
CS6	13.28	19.94	18.95	18.46	23.41

Discussion

MSP is a complex process that involves the interaction between values and interests of many different stakeholders. Proposals from a wide range of economic and technological sectors that are being evaluated by planning authorities (coastal managers) are receiving heightened interest from society as evidenced by the increased level of debate and the close scrutiny that is being paid to every proposal put forward for planning approval. Different projects that are carried out in the coastal area can have various levels of impact on the different stakeholders. As a consequence, therefore, before, during and after the delivery of any such projects, stakeholders may have, or feel, dissimilar degrees of benefit or detriments of the proposed scheme. Similarly, stakeholders may have their own degree of influence on the development of such projects. For instance, Macharis (2007) mentions that the evaluation of the relative importance of stakeholder groups, either in terms of impact or influence, is important to understand the value of projects to society as a whole.

Brown *et al.* (2002) point out that there is an increasing need among stakeholders of the coastal areas and the society in general, to get more information about the risks of human activities that coexist but are conflicting. The coastal area is a common ground for an enormous range of activities, and therefore it is crucial to find the best consensual decision. This explains why decisions concerning future developments in coastal areas are so heavily debated.

Planning processes have been developed in the last decades to address the need for increasing resource sustainability and to find trade-offs between human use and natural resources. In Europe, MSP is suggested as being beneficial under the *Marine Strategy Framework Directive* (MSFD), but there is no driver (MSP Directive) as yet. Currently, drivers are under European and international legal frameworks (e.g. Water Framework Directive and Natura 2000).

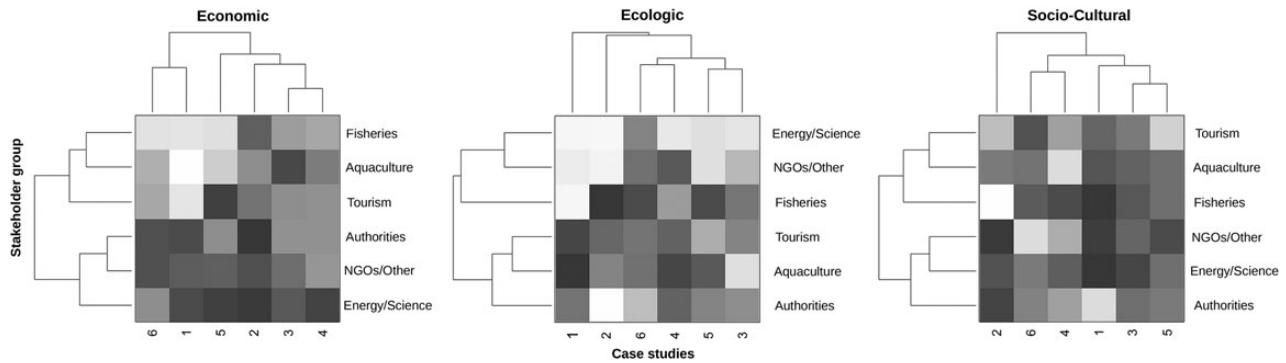

Figure 4. Heat plot screening the discriminate results applied within the scope of the COEXIST framework for each of the main objectives category (Economic, Ecological, and Socio-Cultural). Each heat plot shows stakeholder sectors by case study (CS) with their respective dendrograms. CS1—Hardangerfjord (Norway), CS2—North Atlantic (Ireland), CS3—Algarve Sea (Portugal), CS4—Adriatic Sea (Italy), CS5—North Sea (Netherlands, Germany and Denmark), and CS6—Baltic sea (Finland). All 108 shaded squares represent the importance: Higher importance is represented by small lighter grey squares and lower importance by darker squares.

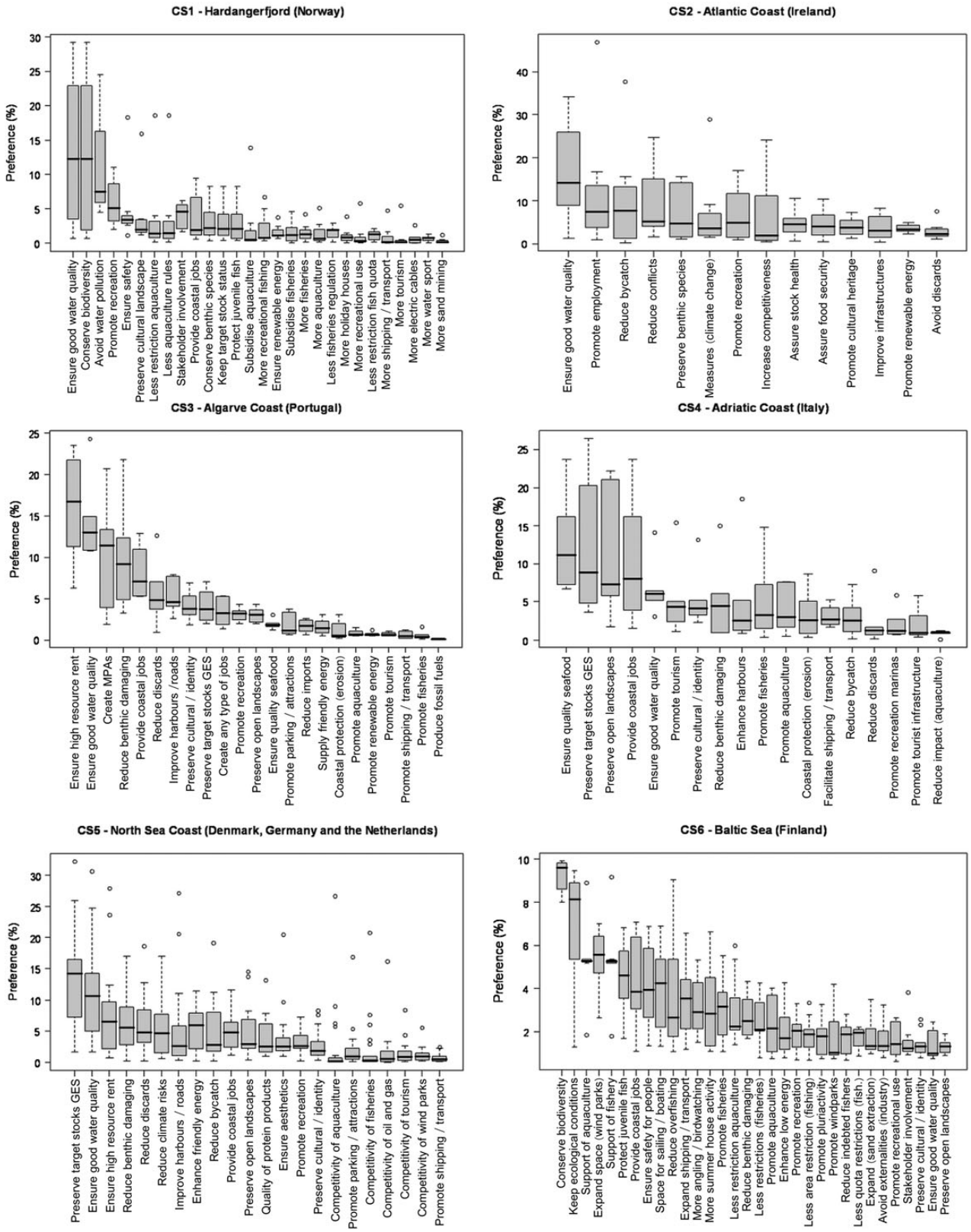

Figure 5. Box plot showing the ranking of sub-objective preferences for each case study (CS) of the COEXIST framework. (a) CS1—Hardangerfjord (Norway), 28 sub-objectives; (b) CS2—North Atlantic Coast (Ireland), 14 sub-objectives; (c) CS3—Algarve Coast (Portugal), 23 sub-objectives; (d) CS4—Adriatic Sea Coast (Italy), 18 sub-objectives; (e) CS5—North Sea Coast (Netherlands, Germany and Denmark), 22 sub-objectives; and (f) CS6—Baltic Sea (Finland), 32 sub-objectives.

Reed *et al.* (2009) highlight that the interaction between several stakeholders from distinctive institutions is a reality in disputed arenas and that a plethora of dissimilar interests is possible. Monitoring expectations from stakeholders of different groups and origins through an enquiry method, namely by using the COEXIST framework, is a feasible way to collect information on the subject under analysis. This empirically based approach assumes that stakeholders judge the subjects in the analysis against their own interests and evaluate them according to their needs (Ramos *et al.*, 2011).

The MCA approach detailed here has the advantage that the stakeholders involved come from a wide range of activity sectors CS and across a wide geographical spread (i.e. the scope of the COEXIST project). As Schwilch *et al.* (2012) highlight, it must be emphasized that the results of an approach like the one presented here are utilized by policy-makers before they make final decisions, as this should enhance social acceptance due to the greater transparency and inclusiveness. Given the increasing competition for space in coastal areas, it is also important to identify methods to support the implementation of MSP to reduce potential conflicts and increase prospective synergies. Despite differences in the geographic locations and contexts of the CS, it is possible to find similarities among their stakeholders by applying the MCA approach described. The authors believe that by using this approach it is possible to develop a common "language" and make reliable comparisons. The goal in all the CS was to achieve a "sustainable coastal/marine ecosystem". However, the term "sustainable" is open to debate. For that reason, it must be emphasized to perceive qualitatively the range and type of conflicts between activities and stakeholders that exist in each CS. This can be utilized to determine potential future conflicts between economic, biological, and socio-cultural activities and proactively debate methods of avoiding this conflict and address the "sustainability" problem. One of first steps of the MCA approach presented is to collect the view of stakeholders with different perspectives, and subsequently identify the most relevant options to consider when working towards the fulfilment of a defined main goal.

In our approach, the aggregated results (ternary plot) show that several of the stakeholders prefer a balance between all three main objectives. However, a large number favoured the ecological objective (and up to a certain extent the socio-cultural), in preference to the economic objective.

The heat plots and dendrogram results show that the three stakeholder groups that are more closely related to the production sector or industry (i.e., fisheries, aquaculture, and tourism) tend to give higher importance to economic objectives. In addition, they form a specific larger cluster, whereas the remaining stakeholder groups form a discrete one. A similar pattern is found for the socio-cultural objectives. A cluster swap did emerge between two stakeholder groups (i.e., fisheries and authorities), but only for the ecological objectives.

The heat plot and dendrogram results also illustrate that between CS, despite their different areas, contextualization of activities, and latitudinal distances, some similarities on the ecological and socio-cultural objectives can be found for the pairs: Algarve coast (CS3)—North Sea coast (CS5) and Adriatic coast (CS4)—Baltic Sea (CS6). All the remaining comparisons were dissimilar.

Despite getting an insight into stakeholders and how their background can influence their decisions, this initial treatment only deals in generalities. It does provide some material for decision makers in terms of the categories of stakeholders (i.e., by main objectives, country, and so forth), but it does not pinpoint the most sensitive and controversial issues with respect to planning in the coastal zone. For this reason, the ranking of the sub-objectives is a highly important step of the MCA approach as it demonstrates some comparable preferences between stakeholders, as well as highlighting which issues are important or not crucial in each CS.

Although we found several similarities among the coastal areas examined, the complexity and dissimilarity increased when we considered more specific objectives. The high diversity found in each CS, particularly for those sub-objectives attaining higher preference values, shows the variability across the stakeholder groups. In particular, the Coastal North Sea case study (CS5) is the one where there were more outliers, highlighting the difficulty of reaching consensual preferences. Although the number of stakeholders and dispersion of results differ among the CS, several other reasons could explain the occurrence of the diversity in the results.

There is no doubt that the scale of the different activities, as well as the intervention of the different stakeholders, varies across the CS. Traditional economic activities such as fisheries may have to compete with more recent activities such as renewable energies or nature conservation for space and for social acceptance. For instance, a new beneficial development of offshore windfarms may result in the loss of fishing grounds, at least for particular fishing segments (Berkenhagen *et al.*, 2010). Other amenities that society desires and values might not be expressed in economic terms, but more in ecological or cultural aspects. These may have greater acceptance by stakeholders involved in the process of prioritizing aspects for sustainable seas.

Broadly speaking, as found here, it is understandable that different stakeholder groups may have somewhat different positions when considering any given change (Ramos *et al.*, 2007). However, while the view of stakeholders among peers may be similar across the different CS, their weighting differs when comparing contexts and societies. However, it was not the intention of this paper to rank the stakeholders, not only because this is extremely difficult but also because it is highly controversial.

Final remarks

An assessment of the economic, social and environmental dimensions, and their more detailed aspects appears crucial, for any planning process because this encourages more transparency, accountability, and legitimacy in the decision-making processes. The stakeholder-based MCA approach introduced in this article can be used to analyse the whole range of human activities and interests found in the coastal areas. In each of the six CS, there is a unique consideration of the marine environment, local activities, and/or the needs of stakeholders. The identification of the main local activities and their operational demands in spatial, temporal, or institutional terms is of fundamental importance in understanding the different sectoral interests and determining an approach to improve mutual understanding. The proven application of the stakeholder-based MCA approach to real world situations can help by facilitating debate between sectors so as that they can (mutually) understand their competitors thought processes and why they have certain preferences for any given location.

This particular study observed that despite an overall preference towards ecological preservation—there is strong support for economic growth from the operational sectors, regardless of where they are located. Therefore, the question remains on how to complement the draft MSP Directive, as a tool to promote sustainable growth, given these diametrically opposed views. Thus, future ecosystem-based management processes such as MSP, must seek

the integration of multiple objectives and their associated management measures.

Finally, stakeholders have indicated the significant importance they attribute to being consulted regarding decisions at the European scale (COEXIST, 2012), and increased legitimacy could be obtained by using the stakeholder-based MCA approach as introduced in this study.

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