

The North Sea: co-ordinated sea use management

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ABSTRACT: The purpose of this paper is to consider the sea use management in the North Sea with reference to the re-structuring of the global and European economies; the sectoral activities including maritime transport and strategic issues, fisheries and hydrocarbons, and environment-related industries including waste disposal, recreation, research and conservation. The rapidly developing role of information management and the role of GIS is discussed. An assessment is made of the role of organisations in international agreements, including in particular the new regional marine environment conventions for the North East Atlantic and the Baltic, national coastal management initiatives, the North Sea Ministerial Conferences and the European Union, with particular reference to the Common Fisheries Policy.

Introduction

The North Sea has a vast literature associated with it, in a considerable range of academic disciplines which have the sea as a focus of interest, a literature almost certainly greater than that for any other sea area (Mathiesen 1979). In a sea use management context this is because it is arguably the most managed sea on earth, even if the nature of management often seems complex and confused (Birnie 1980), and the pace of events rather slow. In reality, since the last academic review of sea use management in the region (Freestone and IJlstra 1991), the pace of events has been remarkably fast in some respects, and potentially far-reaching. In a global context this is a reflection not only of events and technical developments in sea use management, but the European cultural milieu in which these are taking place. The cultural history of the North Sea is particularly apposite in this regard (Bang Andersen, Greenhill and Grude 1985).

The purpose of this paper is accordingly to consider the continued emergence of sea use management in the North Sea region, with particular reference to the present and foreseeable future. The starting point concerns development, the driving force to which sea use management remains largely a response, and which is considered from both a general regional perspective as well as in terms of economic sectors. The discussion then moves on to consider in turn the technical management functions of information management, assessment and profes-

sional practice (Ballinger, Smith and Warren 1994). In the case of information management in particular, the North Sea has recently been the focus of concentrated, innovative effort, and this field lies at the heart of continued progress. This is followed by consideration of the likewise innovative organisational developments in the North Sea area, with particular reference to integrated management approaches. Finally key aspects of present and future management developments are highlighted.

Development

The North Sea is located at the centre of one of the four major core regions of the global economy, namely, Western Europe (Smith 1994). It is also the core region with the longest and most complex history of development, commencing with the maritime expansion of Europe in the latter part of the fifteenth century (Vallega 1992), and progressing through the British and European industrial revolution of the late eighteenth/early nineteenth centuries to the present, arguably post-industrial phase. The southern part of the sea, shallower than 100 m., lies within the metropolitan core region of Western Europe (Smith 1991) and has an intensity and complexity of sea uses commensurate with this. Features include an extensively engineered and urbanised coastline, associated with high levels of marine pollution adjacent to the coast, extensive navigational activity, and intensive demersal fisheries. Concen-

trated areas of marine recreation are located at and adjacent to urbanised stretches of coast and, perhaps somewhat paradoxically, conservation has a high priority, especially in the Wadden Sea areas extending from Blåvands Huk to Terschelling (Smith 1992) (see also Meeseburg pp. 143–152). By contrast, the extensive northern part of the sea, between 100 m and 200 m depth, and including the Norsk Renne (Norwegian Deep), is less intensely used, except for fisheries and the offshore oil industry. Coastal urbanisation is highly localised and on a much smaller scale than in the south, and the coastline as a whole has relatively small waste inputs and, arguably, a higher conservation value.

Viewed in relation to individual maritime economic sectors, the North Sea is going through a period of profound change in the pattern of sea uses. In the fields of shipping and port development, the global economy has been going through a period of restructuring similar in scale to that of the 1930s. There has been a slowing down of investment in new tonnage, and an increase in the number of older ships, with concentration on problems of maintaining safety at sea (Safer Ships, Cleaner Seas 1994). The general position regarding shipping safety has been highlighted by a number of spectacular accidents in Western Europe, including loss of roll-on/roll-off ferries (The Herald of Free Enterprise and Estonia) and tankers (The Aegean Sea and Braer (Smith 1995)).

A second feature has been the restructuring of Western European defence arrangements following the demise of the the Cold War, highlighted by the dismantling of the Berlin Wall in 1989. Paradoxically, while NATO has gone into action for the first time in Bosnia, there is nonetheless a diminution in naval activity in the region overall, and a re-adjustment of naval strategy which places less emphasis on the conflict between the eastern and western core regions of Europe. This has meant a run-down and even closure of naval bases, such as Rosyth on the Firth of Forth.

The two main mineral resources exploited are marine aggregates and hydrocarbons. Both are mature provinces at an advanced stage of development, although some considerable potential remains in both cases. For aggregates this has meant the introduction of a new class of dredgers capable of operating in deeper water further offshore (The Crown Estate, annual reports). In the oil industry attention has focused partly inshore, for example in the Irish Sea and English Channel in exploiting fields which have relatively low start-up costs in shallow waters, to the deep water fields west of Shetland and the Troll field in the Norwegian sector (see p. 00), where a new generation of subsea production systems are being developed (Department of Energy/Department of Trade and Industry, annual reports).

The fisheries are likewise fully developed, but

suffering from massive overinvestment and over-fishing, particularly in relation to demersal stocks. There is thus a tendency towards reduction in fleet size and decline of the many small fishing communities on the coasts of Scotland and Norway in particular. A few communities, such as those of Faroe, have encountered severe economic difficulties in the early 1990s. The Common Fisheries Policy of the European Community remains under intense pressure (Holden 1994), and further substantial rationalisation is in prospect, although so far there have been no further major stock collapses on the scale of the North Sea herring in the late 1970s, and currently affecting the Grand Banks cod. In contrast, there has been a remarkable resurgence in the Atlanto-Scandian herring stock immediately to the north.

As regards the environmental groups of activities (Smith 1985), disposal of waste remains at a high level, though despite spectacular discharges such as that of the Sandoz chemical plant into the Rhine, and the tanker accidents noted above, pollution may no longer be increasing. Meanwhile, marine recreation and conservation activities continue to expand, with coastal and maritime heritage activities, both historical and environmental, being a rapidly growing focus of the leisure industry, with the potential of compensating to some extent for decline elsewhere, for example, in ports and fisheries. Meanwhile, there has been considerable investment in management-related marine science specifically dealing with the North Sea, which constitutes a major innovation, and leads naturally to discussion of information management.

Information management

Unlike most regional seas, the North Sea has since time immemorial been a cultural focus with a high degree of interaction among sea users regardless of their origins around the various adjacent coasts. This cultural unity dates from the activities and colonisation of the Norse and Danes throughout the Middle Ages, and was greatly reinforced by shipping, port and fisheries development throughout modern times (Smith and Lalwani 1984; Smith 1984). Thus there is a strong maritime heritage, now preserved to a considerable extent in the region's maritime museums, together with a maritime tradition in the numerous coastal communities still dependent on fisheries and sea trade, or now increasingly dependent in some areas on the leisure and tourism industries.

The tradition of co-operation is being maintained with the advent of new industries and activities, including the oil industry, marine science and environmental regulation. It is this which forms the starting point for the information management dimension. There have been several major starting points for co-ordinated research/information man-

agement applicable to the region. The first was the marine charting function which extends back to the late 18th/early 19th centuries and has been co-ordinated since 1971 by the North Sea Hydrographic Commission. The second is related to fisheries, and dates back a century to the moves in the 1890s to establish the International Council for the Exploration of the Sea (ICES), initially to provide the scientific basis for fisheries management through an inter-governmental organisation which effectively linked all the science laboratories concerned with fisheries-related research (Went 1972; Thomasson 1981). The work of ICES has been concerned almost entirely with the natural sciences inputs, but a significant recent development has been to begin to extend its scope to include social science inputs and data (ICES Information 1995). Purely fisheries-related work has especially since the early 1970s been supplemented by more pollution-related science, since the establishment of the Oslo and Paris Commissions at that time.

The remaining major co-ordinated initiatives date from the early 1980s. The first concerns the management data bases in shipping required by north west European ports in the countries signatory to the Paris Memorandum on Port State Control. The second is the co-ordinated marine science programme carried out by the North Sea Task Force to produce environmental quality status reports on the North Sea *per se*, which to date has perhaps been the most useful outcome of the North Sea ministerial conferences inaugurated in 1984 (Scientific and Technical Working Group 1987, 1993; Third International Conference 1990). This information building and exchange process has been supplemented by a series of North Sea focused conferences and publications on a range of scientific and management topics dating back to 1971 (Smith 1991).

The outcome of these developments is the existence of several discrete sets of data bases, networked to a limited extent, as in the shipping case, and through the activities of ICES, which are strongly linked in a variety of concrete ways. The use of these data bases is well established in ways which are likely to continue indefinitely. The continued development of information technology has, however, opened up new possibilities of immense significance. The first of these concerns the interactive use of data bases, such as electronic charts and geographic information systems (GIS), including ways in which sea users at sea can be linked to shore-based information systems. The second is the Internet, which when developed further will greatly increase the ability to access and exchange data for diverse management purposes, and indeed will be indispensable for future integrated management approaches.

North Sea management places high demands on information co-ordination, due to the fact that several countries are involved, as well as several groups of

activities, and a variety of jurisdictions and policies have also to be taken into account. Thus there are a large number of organisations holding data bases with different standards, formats, timescales and degrees of confidentiality (Smith and Lalwani 1984). The most successful co-ordination exercise to date has been that of the Dutch Rijkswaterstaat MANS project at national level (Pulles 1993). At European level an important example has been the charting of obstructions to fishing gear by the British and, to a lesser extent, the French. This has recently been further developed into the European Seabed Information Service (ESIS) concept by a group consisting of the UK Sea Fish Industry Authority, IFREMER in France, the Dutch Rijkswaterstaat and the University of Wales College of Cardiff in association with the European Union (Lalwani 1994).

The demand for ESIS comes primarily from the fishing, offshore oil and submarine cable industries for resolution of use conflicts and associated environmental impacts. The primary inputs are from existing Kingfisher and IFREMER data on obstructions, plotted on conventional hydrographic charts. Further data inputs derive from navigational charts, national geological survey data bases; oceanographic, biological and seabed data from national oceanographic and fisheries laboratories, partly co-ordinated through ICES. Inputs from major users derived from their own data bases are also added, particularly from fishermen, and the aggregate dredging, off-shore oil and submarine cable industries.

ESIS products can include paper and electronic charts in both conventional and GIS-based formats, with provision for data transmission and continuously updated data base management. Additional products may include seabed information disks, regular bulletins and an on-line inquiry service.

In the GIS field, recent developments include development of GIS systems by individual users involved in the management of, for example, aggregate dredging and marine scientific investigations. A number of commercially available software packages provide a powerful basis for application-oriented developments, including the possibility of providing output in the form of electronic charts, on-line information access and simple outputs on floppy disk, including part software. Initially, users are likely to experience difficulties in provision of information to generate the required output from GIS-based systems (See article by Lucas pp. 133-142).

There has been a very high growth in the use of the Internet in recent years (Network Wizards 1995; Sanger 1995), which provides an ideal platform for linking existing databases and servers, making access possible for authorised users in the North Sea countries. Unfortunately security is a major problem in sharing sea use information. In addition, the charges for information use have to be quantified and moni-

tored and standards defined for industry to create an open environment for authorised access and addition of new information.

Information assessment and professional practice

The main thrusts or purposes in the assessment of information in the present context concerns economic/valuation, environmental impact, and risk. The oldest of these is risk, applied in the marine insurance industry since the seventeenth century, and now also important in most aspects of engineering design, including ship operation, offshore and coastal engineering. Various forms of economic assessment are equally well established, particularly in the private sector, as part of running the numerous businesses involved in the maritime economy. Environmental impact assessment, by contrast, is a relative newcomer, dating essentially from the advent of the offshore oil industry in the 1960s and 1970s. The North Sea region, in common with other areas, is now poised on the brink of proper integration of the EIA process within business decision-making in both its economic and risk aspects (Couper 1992).

The process of technology assessment, centring on the design of the range of artefacts used in the development and management of the marine industries continues to be part of the information assessment process. Finally, the process of social impact assessment tends to lag behind, although it also was largely introduced in conjunction with the advent of the offshore oil industry (Smith 1976).

The processes of information assessment have naturally evolved according to the specific needs of the users concerned, and have fallen largely within the domains of certain professional groups (see below). In reality, elements of all of these are required for specific development projects or incidents, and terminology itself sometimes confuses any assessment of what has been covered. Fully integrated assessment is still relatively rare, and may relate more to accidents rather than the design of projects. A recent instance was the wreck of the oil tanker "M/S Braer" at Shetland in January 1993, which was followed first by the accident inquiry report (UK Marine Accident Investigation Bureau 1994), then a report by ESGOSS, specifically set up to assess the environmental impacts (Ritchie and O'Sullivan 1994), and work on social and economic impacts commissioned by Shetland Islands Council. The process of co-operation also involved thorough private sector work on economic impacts necessary for compensation payments purposes; while the incident was also undoubtedly instrumental in the establishment of the Donaldson Inquiry, with its wide remit covering the environmental management of shipping (Safer Ships, Cleaner Seas 1994).

The work of information assessment depends in

part on the roles of the main professions involved in sea and coastal management, together with the decision-making of the organisations involved. The principal professional inputs are in the fields of surveying, science, engineering, law and planning.

Surveying was arguably the first in the field, producing the charts already alluded to; together with early coastal engineering aimed at coast protection and land reclamation in the lowlying coastal marsh areas of the Netherlands, eastern England, Germany and southern Jutland (see Meeseburg pp. 143–152) (Lambert 1971). Surveying remains a public service function in the production of standard navigational charts, although this is partly subject to tendering to the private sector for the sea surveys upon which the charts are based. Large scale engineering surveying for coastal and offshore engineering is generally provided by the private sector.

Although in the present context, surveying was and remains primarily concerned in the first instance with topographic measurement of both sea and land, historically this measurement was concerned with either military priorities or as a means towards the valuation of the environment and resources concerned. Meanwhile the boundary between topographic measurement and marine science is becoming blurred, as the routine measurement of other environmental characteristics spreads, for example, pollution and ecological measurement and mapping aimed at monitoring environmental quality, both for regulatory and evaluation purposes. In this way key aspects of environmental management priorities are likely to be part of and otherwise influenced by market i.e. demand considerations.

By contrast, much if not most marine science remains publicly financed, albeit primarily applied. The initial thrust of effort involved the need for fisheries management, and this arguably remains the most important. The second applied area is concerned with monitoring and maintenance of environmental quality, the central focus of the North Sea Task Force work already mentioned, for example; while a good deal of effort is aimed at coastal science as a backup to coastal engineering. Bearing in mind the financial implications of the extensive applied programme in existence, and the degree of knowledge of the shelf sea environment, the need for pure science investigations is arguably limited, and should perhaps be primarily allied to the education sector.

The North Sea is arguably the world's leading centre of both experience and expertise in the development of both coastal engineering, already mentioned, and offshore engineering in response to the growth of the offshore oil industry over the past three decades. It has been and remains a test bed for technological advances in relatively severe temperate coastal and marine environments and, as such, the expertise involved has been exported around the world. The engineering challenge is an ongoing one,

typified, for example, in the Dutch Voordelta project, and deep water oil development (see Holt-Jensen, Figure 4 p. 219).

The North Sea was also the cradle for the initial development of the modern law of the sea in the seventeenth century, which derived from competition between the Dutch and the English in maritime trade, fisheries and seapower. It has also proved to be a model for generally amicable settlement of offshore boundaries under the new law of the sea regime, through the North Sea Continental Shelf Cases (Charney and Alexander 1993), and regulation of ports and shipping. As in the case of surveying, the focus is now shifting from boundary delimitation and conventional regulation of shipping, to the kind of environmental law required for sophisticated management of the marine environment.

Despite the attractions of sea use planning (Young and Fricke 1975), at least of inshore areas, which has been a focus of interest in the southern North Sea for over two decades, especially in the UK and the Netherlands, the real significance of planning for the North Sea environment lies in its control of land use of adjacent coasts and catchments, and hence the influence of land use upon adjacent waters. There remains an increasingly strong case for planning inputs into at least urban sea areas within Internal Waters. Existing voluntary arrangements in such areas is already approaching such a regime in practice, for example, within the jurisdictions of large ports. Meanwhile, planning as the professional regulation of human activities in relation to the environment leads naturally to consideration of organisations and integrated management developments.

Organisations and integrated management developments

The purpose of this section is to highlight the pattern of organisational and related management developments. The most significant areas of interest relate respectively to fisheries, shipping, marine environmental management and regional management, the first two being concerned with the management of specific industries, and the second two with the environment.

The revolution in fisheries management has been one of organisation, spearheaded by the Common Fisheries Policy (CFP) of the European Community (now Union), underpinned by scientific advice provided by ICES, and directly covering three-quarters of the North Sea by area, although taking into account collaboration with Norway where appropriate. The CFP is supra-national in its organisational and legal aspects, and is concerned with the onshore side of the fishing industry as well as the offshore side. From an environmental point of view, however,

it has acted as a conventional state – or superstate – in not effectively controlling overfishing, which the 1995 North Sea ministerial conference (below) has implicitly recognised in its acknowledgement that the fisheries has produced the most profound environmental impact in the North Sea region (Maggs 1995). As a result the fishing industry is entering a period of profound crisis and readjustment which will undoubtedly mean either a complete recasting of the CFP, or conceivably its abandonment, at least in its present form.

The regulation of shipping is of course nationally based, but directed and co-ordinated by the work of the International Maritime Organisation (IMO) based in London. Aside from safety and environmental aspects overseen by IMO, the commercial regulation of the industry has been extensively influenced by European practice over the years. The most significant development in the present context, however, is one of co-ordination of organisational and policy aspects through the Paris Memorandum on Port State Control, designed to regulate safety standards of ships calling at member state ports in north west Europe, and managed by the ports themselves. This system has worked very well, but cannot have the regulatory clout of a national measure such as the Oil Pollution Act 1990 in the United States (OPA90), as it does not entirely prevent any category of ship trading into the north west European region calling at the ports concerned.

In the present context, the North Sea belongs to the set of European seas covered respectively by the North East Atlantic, Helsinki (Baltic) and Barcelona (Mediterranean) Conventions concluded in the early 1990s. All three have been characterised by a sea of change in conception compared to their 1970s predecessors, in a move away from a somewhat narrowly conceived pollution-based environmental protection approach towards a broader based environmental management approach which takes into account the range of interactions between the full range of sea uses on the one hand, and acknowledges the full complexity of the marine environment on the other.

The regional management dimension has two aspects. The first concerns the instigation and continued evolution of the North Sea ministerial conferences. The political inspiration for these originated in the countries along the southern shore, and were focused on pollution. The last conference in the summer of 1995 (Maggs 1995) acknowledged that the fisheries are primarily responsible for the human impacts on the North Sea ecosystem. It is too early to assess fully the practical outcome of the conference series, but the most significant development to date has undoubtedly been the coordinated science programme operated by the North Sea Task Force, which has provided detailed quality status reports, which remain essential for effective inte-

grated management, and further strengthen the long and strong tradition of co-operative science enshrined in ICES.

The second strand of regional management interactions focus on the coast. Of all the North Sea countries, the Netherlands arguably has the longest established and most elaborate coastal management system, although the term 'coastal management' has only come to be applied in the past two decades or so. In the Dutch case, necessity has been the mother of invention due to the need to in effect build a completely artificial coast to reclaim and protect the richest agricultural land and most important settlement sites from the sea (Lambert 1971). More generally the coast is increasingly becoming the focus of a series of environmental management systems which increasingly interact there, and are operated by a range of bodies. This is currently clearly to be seen in the UK (Department of the Environment 1995) and Denmark (see Meeseburg pp. 143–152). The main strands in the system include shoreline management plans operated by coast protection authorities; catchment management plans operated by river basin authorities; inlet e.g. estuary management plans operated by conservation authorities; all of which supplement conventional land use planning. In addition, in the UK there are a wide range of regional coastal fora comprised of diverse interests in the public, private and voluntary sectors, culminating in a national Coastal Forum for England run by the UK Department of the Environment.

Present and future

In conclusion, four major points are worth highlighting. The first is the change in thinking on integrated management, which is arguably driving the continued evolution of the management system, and is currently evidenced in the activities of the organisations discussed in the immediately preceding section of this paper. The extent to which this is causing organisational change is limited. Rather a diversity of organisations with primary management responsibility are developing internally more integrated management systems while simultaneously moving outwards to interact more effectively with one another.

This process of organisational interaction in turn is focusing attention more sharply on the need to understand the relationships among the different forms of information assessment as practised by the several professional groups primarily involved in the management process. In this priorities increasingly vary according to the management task in hand. For example, in coast protection technology and environmental impact assessment applied in an engineering context is paramount; in fisheries management environmental impact, economic and social

impact applied in a scientific context are especially important.

Finally, there are two implications for information management, which are also working in the opposite direction to influence the management aspects just outlined. The first is the increasing influence of the Internet as the means of communication among data bases. In the present context the Internet is in its infancy, and the problems are considerable, but the potential for truly integrated management activity, from policy at one extreme to management tools at the other, is immense.

The second aspect, and perhaps a natural starting point for the continuing evolution of the North Sea management system, is the construction of data bases for spatially referenced data which integrate physical features with uses of the sea on a priority basis varying with intensity of use, comparable to the building up of national land surveys and their associated map series. In the near future this means preparation of electronic chart series in priority geographical areas, similar to the kind of work initiated by the UK Sea Fish Industry Authority Kingfisher Chart series, designed primarily for use by fishermen, the offshore oil industry and submarine cable firms. Such a tool, with GIS extensions and paper outputs where required for specialised applications, will provide the necessary visual bases for the integrated management of the North – and other – seas, during the next long wave of development.

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