

**Particularly Sensitive Sea Area (PSSA)  
Wadden Sea Feasibility Study**

**Advice to the Trilateral Wadden Sea Cooperation**

**Final report**

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## **Executive Summary**

1. The Wadden Sea is an exceptional, highly dynamic tidal ecosystem of world importance. Biophysically it represents an interconnected morphological system with the adjacent North Sea, significant in terms of unique ecological, socio-economic, scientific and cultural characteristics. Wadden Sea characteristics of particular significance include biomass productivity, habitats and species, spawning and breeding grounds, tourism and recreational activities, shipping, fisheries, scientific research and cultural heritage. Together these constitute a unique resource, worthy of the highest order of conservation, use management and stewardship.
2. Environmental protection of the Wadden Sea is perceived as a trilateral Governmental responsibility. It is currently achieved by national and international environmental protection legislation and designation; regulation of maritime and terrestrial activities; and a high level of co-ordinated management. The Wadden Sea Conservation Area has been recommended for nomination as a World Heritage Site, subject to a consultation process
3. Nevertheless, the integrity of the Wadden Sea remains vulnerable to the impact of international maritime activities. This is the case both in terms of the volume of maritime traffic using the southern North Sea and given that the Wadden Sea naturally functions as an importing system with a water circulation that contains contaminants in a zone a few dozen kilometres wide along the coast. Evidence suggests that the Wadden Sea coast is adversely affected by operational marine pollution as well as being vulnerable to accidental pollution impacts. Furthermore, the most likely origin of such pollution is the adjacent North Sea, which is one of the most frequented sea areas worldwide. A large oil or chemical spill would have potentially disastrous and long-term effects on the Wadden Sea ecosystem. Any such incident would also be difficult and costly to remediate (Chapter 4).
4. The Wadden Sea and an adjacent zone of the North Sea qualifies for Particularly Sensitive Sea Area (PSSA) status under the IMO criteria expressed in A.720(17) amended by A.885(21). It also qualifies under new guidelines, which have been approved in principle by the Marine Environmental Protection Committee. Although the IMO Guidelines require that the area need qualify for identification as a PSSA under only one of the categories of criteria, the Wadden Sea is significant for socio-economic, and scientific, and arguably for full ecological reasons as well (Chapter 5).
5. In particular this study suggests that the Wadden Sea qualifies as a PSSA on the basis of ecological uniqueness, critical habitat, dependency, productivity, spawning and breeding grounds, ecological vulnerability and economic benefit, recreation human dependency, research, baseline and monitoring studies, and education. These criteria relate to PSSAs within and beyond the limits of the territorial sea but may also be used by national administrations to identify PSSAs within their territorial seas (Chapter 5).
6. The overriding benefit of the Australian PSSA designation, which has now been in place for 10 years, is stated to be the recognition of the area by the IMO, enabling Australia to gain acceptance of some management measures by the IMO that might

otherwise have been rejected. An analysis of trilateral Wadden Sea discussions over the period 1994-2000 highlighted initial conflict with application for MARPOL 73/78 Special Area status for the North Sea and concerns that the identification of a Wadden Sea PSSA would lead to limitations for shipping and activities in harbours (Chapter 6).

7. An analysis of stakeholder views drawn from a questionnaire survey has confirmed that the concept of a Wadden Sea PSSA continues to be contentious. However, the weight of subjective opinion was in favour of a PSSA application, and the draft IMO Assembly resolution confirms that a PSSA may be identified within a Special Area and that the criteria with respect to the identification of PSSAs and Special Areas are not mutually exclusive (Chapter 6).
8. The principal benefits of a Wadden Sea PSSA designation are perceived by stakeholders to be:
  - ◆ Heightened international awareness of environmental value
  - ◆ Introduction of additional measures to minimise potential environmental damage
  - ◆ Recognition of local priorities by international interests
9. The principal burdens are perceived by stakeholders to be:
  - ◆ Additional costs for commercial interests
  - ◆ Confusion between navigational safety and environmental protection on charts
  - ◆ Policing and monitoring responsibilities
10. It is argued that, on balance, the benefits of Wadden Sea PSSA designation outweigh the burdens. An overriding benefit is considered to be the message that PSSA designation sends out internationally as to the irreplaceable environmental value of the Wadden Sea. It has the potential to provide an incentive for better found ships and their management together with a disincentive to sub-standard shipping in line with the 'polluter pays principle'. It is also considered that PSSA designation would heighten awareness of enforcement agencies and the judiciary. The PSSA concept recognises the competence of existing as well as any proposed additional risk management and reduction measures. The criteria also reflect the full range of economic activities associated with the Wadden Sea Area. Furthermore the costs associated with designation and implementation, depending on the associated protective measures involved, are modest (Chapter 6).
11. In addition to meeting at least one of the ecological, socio-economic or scientific criteria for the identification of a PSSA, IMO guidelines call for consideration of a combination of vessel traffic characteristics and natural factors. In both these areas it can be demonstrated that the Wadden Sea Area is at risk from international shipping. A combination of the exceptional density of commercial shipping, the presence of fishing vessels and recreational craft, and the quantity of harmful substances carried result in the heightened probability of a pollution incident. This is combined with the changing nature of shoals and banks that extend well offshore, numerous wrecks, frequent poor visibility and onshore gales. Proposed offshore wind farms, high speed ships and Wadden Sea port expansion plans will exacerbate the situation (Chapter 7).

12. Subject to questions of risk acceptability, the evidence suggests that significant measures are in place to help ensure the safety of shipping and to integrate shipping and other activities in the Wadden Sea and adjacent North Sea. Prospective future international measures, regional agreements and local initiatives (harmonisation) are set to further improve this situation (Chapter 7).
13. The potential benefits and costs of introducing any additional associated protective measures to regulate international shipping activities, associated with PSSA designation, are disputed by stakeholders. It is argued, however, that since the benefits to the environment are largely unquantifiable, the principal determinant of which measures should be considered is the benefit to shipping safety against the cost of implementation. Further consideration of a limited package of additional measures, which would need trigovernmental agreement, is proposed (Chapter 7).
14. Three associated protective measures, within the purview of IMO, are considered particularly appropriate. A vessel traffic management system (VTMS) for the Wadden Sea would entail implementation and operational costs for government; the cost of mandatory reporting for certain vessels is deemed to be negligible; and compulsory pilotage for certain vessels would pass additional costs onto the international shipping community. None of these measures would necessarily serve to reduce the competitiveness of the Wadden Sea ports to any great extent; they would all reduce the risk to the Wadden Sea environment posed by international shipping; and they all complement and enhance existing national and international protective measures as well as prospective future international measures. However, a detailed cost benefit risk assessment would need to be carried out before any such measures could be formally proposed (Chapter 7).
15. The pros and cons of a series of boundary delimitation options for a Wadden Sea PSSA designation have been evaluated. These have taken into account existing levels of protection, vulnerability, stakeholder views on benefits and burdens and the need to protect higher risk areas. Boundary considerations were further informed by a Clarification and Consensus meeting of a limited number of mainly German stakeholders in Hamburg on 4<sup>th</sup> April, 2001. A matrix of core and buffer areas is presented. However, the decision as to what is an acceptable environmental risk, and therefore the delimitation of a PSSA, is ultimately a political one (Chapter 8).
16. A case is made for defining the Wadden Sea Conservation Area as the PSSA core area, with a buffer zone contiguous to core area extending offshore to include areas of hazard. The extent of the recommended buffer zone is also partly determined by the prevailing direction of wind and currents, that combine to send any accidental or operational pollutants in the direction of the most environmentally significant parts of the Wadden Sea resource. It is argued that any additional associated protective measures are generally appropriate for the buffer zone rather than the core area, the latter being well served by existing measures (Chapter 8).
17. The principal recommendation of this feasibility study is therefore that an application for PSSA designation, based on these findings and containing those associated protective measures confirmed as advantageous and achievable, should be made to

IMO. An application for Wadden Sea PSSA designation could go forward on the basis of no additional associated protective measures. However, as stated earlier, the preferred option suggested by this feasibility study includes consideration of additional associated protective measures. If an application is put forward on this basis, associated protective measures either need to be agreed in advance of an application (and thus the reasons why the proposed associated protective measures are the preferred method for providing protection for the area to be identified as a PSSA must be explained) or a proposal for at least one protective measure must be submitted within two years of the approval in principle of the PSSA (Chapter 9).

18. It is also recommended that research is commissioned to quantify operational pollution throughout the Wadden Sea Area. Such information would provide a basis on which to determine the effectiveness of protective measures and their enforcement (Chapter 9).
19. Finally it is recommended that any action taken to progress a PSSA application should take account of the need for wider understanding and acceptance of the concept. Any such initiative should be targeted at decision-makers and regulators; the international shipping community; and the local Wadden Sea population (Chapter 9).

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## **Chapter 1. Introduction**

### **1.1 The Research context**

- 1.1.1 The context for this research is provided by the 8<sup>th</sup> Trilateral Governmental Wadden Sea Conference, held in Stade 1997, which endorsed a study on the possibilities for a proposal to the International Maritime Organisation (IMO) to designate the Wadden Sea and an adjacent zone as a Particularly Sensitive Sea Area (PSSA).
- 1.1.2 There are currently two designated PSSAs: the Great Barrier Reef, Australia (MEPC 30/44), and the Sabana-Camaguey Archipelago in Cuba (MEPC 40/74). Proposals from Egypt (MEPC 43/6/1) and Columbia (MEPC 43/6/7) have also recently been considered and a proposal for designation of the marine area around the Florida Keys has been submitted by the United States (MEPC 46/5).
- 1.1.3 IMO Guidelines in Resolution A.720(17) (adopted in 1991) and amended in Resolution A.885(21) (adopted in 1999) allow areas to be designated a PSSA if they fulfil a number of criteria, including: ecological criteria, such as unique or rare ecosystem, diversity of the ecosystem, or vulnerability to degradation by natural events or human activities; social, cultural and economic criteria, such as significance of the area for recreation or tourism; and scientific and educational criteria, such as biological research or historical value. When an area is approved as a PSSA, specific measures can be used to control the maritime activities in that area, such as routing measures; strict application of MARPOL discharge and equipment requirements for ships, such as oil tankers; and installation of Vessel Traffic Services (VTS).
- 1.1.4 The Marine Environment Protection Committee (MEPC 45/20) of the IMO has approved, in principle, new guidelines for designation of a PSSA, which will supersede the current procedures and are intended to make the process of consideration at IMO simpler, taking into account environmental, ship safety and navigational aspects. A draft Assembly resolution, incorporating the new guidelines was considered at the 46<sup>th</sup> session of MEPC (MEPC 46/6) and will be submitted to the twenty-second session of the Assembly in November 2001. It has been assumed that these new guidelines will apply to any Wadden Sea PSSA decision, and therefore these have been used to inform the study.
- 1.1.5 On this basis, given the timing of the above amendments to the guidelines, the output from this work be instrumental in informing Trilateral Wadden Sea Cooperation of the potential for the Wadden Sea to be designated a PSSA. It will also potentially attract close scrutiny from all those involved or interested in PSSA designation.

## **1.2 Main purpose of PSSA designation**

- 1.2.1 IMO Assembly resolution A.720(17) in 1991 adopted Guidelines for the Designation of Special Areas and the Identification of Particularly Sensitive Sea Areas (the Guidelines). The procedures contained in this document were further elaborated upon by Assembly resolution A.885(21), adopted in 1999. As their primary function was to encourage better use of existing measures, the Guidelines reviewed routing, discharge and other measures available through existing IMO treaty and non-treaty instruments such as MARPOL, SOLAS and COLREGs, and detailed the procedures necessary for their adoption.
- 1.2.2 While leaving the door open to future developments, the Guidelines called for only two changes regarding PSSAs: first, to amend the General Provisions on Ship's Routing to make explicit their use for environmental purposes; and secondly, to make the Special Area discharge standards under MARPOL available inside PSSA. Thus, as envisaged by the Guidelines, no additional legal basis was required for protective measures to be established for PSSAs, unless a coastal state sought to go beyond generally available measures.
- 1.2.3 The importance of the PSSA concept to international lawyers lies in the implications of its further development. From an ecological perspective, the jurisdictional zones established under the laws of the sea (including the 1982 LOSC), that vary according to where a vessel is or where it is heading, may lead to difficulties in establishing coherent and effective management regimes, on the basis that marine ecosystems can straddle a variety of jurisdictional zones. For example, in the territorial sea, a coastal state may enact regulations regarding marine environmental protection if they do not 'hamper' foreign vessels' right of innocent passage.
- 1.2.4 In the Exclusive Economic Zone (EEZ), only internationally accepted rules and regulations may be adopted. The PSSA concept offers the opportunity to enable the development of common jurisdictional and enforcement regimes for environmentally significant marine areas. The value of designation as a PSSA is that it offers coastal states an opportunity to utilise more effectively their existing powers to regulate the passage of ships through the territorial sea. It could also be useful as a managerial framework to address other sources of potentially threatening marine activities, such as offshore resource exploitation, or to enhance fisheries and wildlife protection.
- 1.2.5 The PSSA concept has now reached an interesting juncture. The reports of the various meetings of the Marine Environment Protection Committee of the IMO, reveal something of a disparity of viewpoints regarding the future role of the PSSA. The protected area, in its many manifestations, is now perceived as a key device in the battle for sustainable development. Protection of areas for a wide variety of specific environmental and resource purposes and from an equally wide variety of specific threats is now envisaged by a growing number of national, regional and global instruments. The majority of these instruments develop distinctive terms to describe identical concepts, sometimes for identical areas.

While diversity and flexibility is to be welcomed, there is perhaps a risk that if the original objectives for designing or identifying areas for protection become obscured or confused, the chances of the practical realisation of those objectives may be diminished.

- 1.2.6 The main purpose of considering a proposed Particularly Sensitive Sea Area designation for the Wadden Sea, would therefore be to establish protective measures that may be necessary to ensure comprehensive protection of a sensitive area, but lie beyond coastal state competence to be imposed unilaterally, and must be pursued through the appropriate international legal channels. As such the designation is directly linked to the achievement of *Sustainable Development*.
- 1.2.7 It is important to note that a PSSA is not a marine protected area (MPA), although it may be co-incident with an MPA. Procedures for the identification of PSSAs and the adoption of associated protective measures remain under review by IMO and are set out in Annex 3.

### 1.3 Research aims

- 1.3.1 The central purpose of the research is, in accordance with the Terms of Reference (Annex 2), to:
- “Undertake an assessment as to whether the Wadden Sea and an adjacent zone would qualify for being identified as a PSSA, on the basis of the Guidelines for the Identification of PSSAs as adopted by the IMO and a description of the Wadden Sea relevant for the Guidelines.”*
- 1.3.2 To achieve this the research team defined the central objectives, in line with the explanatory note of the Terms of Reference to be as follows:
- ◆ To consider the *vulnerability* of Wadden Sea and an adjacent zone of the North Sea to the impacts of international maritime activities (Task I);
  - ◆ To confirm whether the *Wadden Sea and an adjacent zone is qualified for PSSA* designation (Task II);
  - ◆ To describe the potential *benefits and burdens* that PSSA designation would bring to the Wadden Sea and an adjacent zone (Task III);
  - ◆ To appraise *associated protective measures*, namely whether the current regulations and measures for protection are sufficient for designation and/or identify any additional requirements (Task IV);
  - ◆ To consider the *delimitation of a Wadden Sea PSSA* incorporating the advantages and disadvantages of different PSSA boundary options (Task V); and
  - ◆ To draw *conclusions and recommendations* including a summary to be used within political considerations of the Trilateral Wadden Sea Co-operation (Task VI).

- 1.3.3 The Terms of Reference for this study also required the study to incorporate an inventory that has been made of the existing shipping regulations and measures for the protection of the marine environment and the safety of shipping in the Wadden Sea and the adjacent North Sea. This inventory includes the shipping measures installed by primarily Germany and the Netherlands off the coast of the Frisian Islands. Work on a description of the Wadden Sea relevant for the PSSA Guidelines and information on the significance of the area, referring to the IMO criteria, undertaken by Common Wadden Sea Secretariat (CWSS), has also to be included.

#### **1.4 Structure of the report**

- 1.4.1 This report presents the strategic information and advice in accordance with the research aims above. Contextual chapters explain definitions used and the methodology adopted (Chapters 2 and 3).
- 1.4.2 Subsequent chapters relate to each of the objectives based on a description, significance and vulnerability assessment for the Wadden Sea (Chapter 4). Chapter 5 sets out in detail and evaluates those aspects of the Wadden Sea that relate to IMO criteria for PSSA designation. Chapter 6 presents an analysis of the stakeholder questionnaires and considers the balance of benefits and burdens associated with designation. Chapter 7 reviews the risk from international shipping activities; considers measures in place to manage the risks identified; and presents an evaluation of the need for any new risk reduction measures. Chapter 8 sets out boundary delineation options with advantages and disadvantages for each.
- 1.4.3 Finally, Chapter 9 draws together the conclusions from the previous chapters and presents recommendations. This chapter in particular has been informed by views expressed at the Clarification and Consensus meeting held on 4<sup>th</sup> April 2001 in Hamburg.

## Chapter 2. Definitions

### 2.1 IMO definitions

- 2.1.1 The following definitions and abbreviations used throughout this report are drawn verbatim from Annex 1 of IMO A21/Res.885 Procedures for the identification of Particularly Sensitive Sea Areas and the Adoption of Associated Protective Measures.
- 2.1.2 *Associated Protective Measure* – an international rule or standard that falls within the purview of IMO and regulates international maritime activities for the protection of the area at risk.
- 2.1.3 *Guidelines for the Designation of Special Areas and the Identification of Particularly Sensitive Areas (Guidelines)* – the Guidelines adopted by Assembly resolution A.720(17) in 1991, as amended, which are primarily intended to assist IMO and Member Governments in identifying, managing, and protecting sensitive sea areas.
- 2.1.4 *Identification of a particularly sensitive sea area* – a determination by IMO that a proposing Member Government, in accordance with the Guidelines, has established a need for Associated Protective Measures for a particular sea area because of the area’s recognised ecological, socio-economic, or scientific characteristics and its vulnerability to damage (that is, injury or environmental harm) by identified international maritime activities.
- 2.1.5 *International maritime activities* – vessel traffic and other vessel-based operations that are subject to regulation by international rules and standards within the purview of IMO.
- 2.1.6 *Member Governments* – those governments which are Contracting Parties to the Convention on the International Maritime Organisation.
- 2.1.7 *IMO* – the International Maritime Organisation (IMO), which is the international body responsible for identifying areas as Particularly Sensitive Sea Areas and adopting the Associated Protective Measures.
- 2.1.8 *Particularly Sensitive Sea Area (PSSA)* – an area that needs special protection through action by IMO because of its significance for recognised ecological or socio-economic or scientific reasons and which may be vulnerable to damage by international maritime activities.
- 2.1.9 *Proposing Member Government* – a Member Government (or Governments) submitting an application for PSSA identification with its Associated Protective Measures to IMO.

## **2.2 Other terms used in this report**

- 2.2.1 The following definitions and abbreviations used throughout this report apply specifically to the Wadden Sea.
- 2.2.2 *Joint Declaration on the Protection of the Wadden Sea* – declaration of intent of the countries to consult each other in order to co-ordinate their activities and measures to implement a number of legal measures for the comprehensive protection of the Wadden Sea Region as a whole.
- 2.2.3 *Trilateral Conservation Area, in short the Conservation Area* – the most ecologically sensitive and valuable part of the Wadden Sea as defined by the three Wadden Sea countries.
- 2.2.4 *Trilateral Co-operation Area, in short the Wadden Sea Area* – an area which is larger than, and which encloses the trilateral Conservation Area as identified by the three Wadden Sea countries, delimited offshore to 3 nautical miles. The Wadden Sea Area is the geographical range of the Trilateral Wadden Sea Plan.
- 2.2.5 *Shared principles* – agreed management principles adopted to guide protection and management decisions within the Wadden Sea Area.
- 2.2.6 *Traffic separation scheme* – a routeing measure aimed at separation of opposing streams of traffic by appropriate means and by the establishment of traffic lanes.
- 2.2.7 *Inshore traffic zone* – a designated area between the landward boundary of a traffic separation scheme and the adjacent coast, to be used in accordance with the provisions of rule 10(d), as amended, of the International Regulations for Preventing Collisions at Sea (Collision Regulations), 1972.
- 2.2.8 *Deep-water route* – a route within defined limits which has been accurately surveyed for clearance of sea bottom and submerged obstacles as indicated on the chart.
- 2.2.9 *Vessel traffic services* – any service implemented by a competent authority, designed to improve safety and efficiency of traffic and the protection of the marine environment.

## Chapter 3. Methodology

### 3.1 Introduction

3.1.1 The basis of this study is the collection, analysis and presentation of existing information and current understanding about the validity of a possible Wadden Sea PSSA designation. The types of information collected, and the methodology used are shown below:

*Table 1: Data collection and analysis methodologies*

<b>Task</b>	<b>Method used</b>
Vulnerability assessment	Desk study and incorporation of CWSS description and significance data
Qualification for PSSA	Desk study and stakeholder opinion
Benefits and burdens of designation	Interview with GBRMPA, secondary analysis of meetings and stakeholder opinion analysis
Adequacy of existing measures	Desk study, focus group of mariners, stakeholder opinion
Delimitation	GIS interpretation of desk studies and synthesis of previous tasks
Conclusions and recommendations	Supported by views of a clarification and consensus meeting

### 3.2 Desk studies

3.2.1 Information was drawn from the following sources:

- ◆ Published sources (CWSS; IMO; Hydrographic Office)
- ◆ Gauss shipping activity reports
- ◆ General internet web sites
- ◆ Stakeholder web sites

It has been assumed that the new guidelines (MEPC 46/6 Annex 2) will apply to any Wadden Sea PSSA decision, and therefore these guidelines have been used to inform the study.

### 3.3 Stakeholder questionnaire survey

3.3.1 A self-completed questionnaire survey of stakeholders was undertaken as the primary means of gauging opinion about the acceptability of the PSSA in principle and soliciting views on attendant measures. A copy of the questionnaire is presented in Annex 3.

3.3.2 The questionnaire approach was favoured in order to structure the survey and set out clearly those issues of primary interest to the research. The questionnaire was designed to be as simple as practicable, given the complexity of the issues being



researched and was presented in English. All respondents were guaranteed anonymity.

- 3.3.3 A stratified sample of 95 organisations and individuals was drawn up, to include representation from all the main interests in maritime activities in the Wadden Sea. This included commercial marine operators; policy makers, regulators, administrators; organisations affected by pollution and environmental quality; and organisations not affected by pollution and environmental quality. A balance of interests was achieved as far as possible with reference to the roles of respective stakeholders, as set out in the table below:

*Table 2: Roles of respective stakeholders*

<b>Government, administrators, regulators</b>	<b>Industry and NGOs</b>
Define the required policy and find a means of delivery	Observe policy and comply with measures
Balance various interests	Advise on effects of policy proposals and offer expertise
Take a holistic approach	Influence policies and deliver outcomes
Maintain influence internationally	Have regard to wider ‘public’ interest
Achieve sufficient consensus to enable policy to succeed	Assist the delivery of policy
Influence those affected to deliver the required outcomes	Lobby for necessary changes

- 3.3.4 Respondents were given four weeks in which to complete and return the questionnaire, with the research team ensuring that the response rate was maximised by undertaking follow-up emails and telephone calls. This yielded 35 responses, although not all of these returned the questionnaire, preferring instead to make wider written comments.

- 3.3.5 The responses to the questionnaire, stratified by stakeholder category are shown below:

*Table 3: Questionnaire responses*

<b>Category</b>	<b>Number in sample (%)</b>	<b>Number received (%)</b>
<b>Government, administrators, regulators</b>	<b>37 (39)</b>	<b>20 (57)</b>
NL	8 (8.4)	5 (14.3)
D	15 (15.8)	6 (17)
DK	7 (7.4)	5 (14.3)
Communities, regions, advisory	7 (7.4)	4 (11.4)
<b>Industry and NGOs</b>	<b>58 (61)</b>	<b>15 (43)</b>
International shipping sector	9 (9.5)	1 (2.9)
Environmental NGOs	8 (8.4)	2 (5.7)
Education	4 (4.2)	2 (5.7)
Local vested interests	8 (8.4)	2 (5.7)
National shipping sector	10 (10.5)	2 (5.7)
Terminal operators	4 (4.2)	2 (2.9)
Ship owners	4 (4.2)	2 (5.7)
Oil companies	8 (8.4)	1 (2.9)
Navigation & meteorology bodies	3 (3.2)	1 (2.9)
<b>Total</b>	<b>95</b>	<b>35</b>

The overall response rate of 37% is considered acceptable but the balance of responses is skewed towards Governmental stakeholders. Proportionately a more comprehensive response was received from The Netherlands and Denmark than Germany. At least one response has been solicited from each stakeholder sub category, although the response rate from international shipping interests and oil companies was disappointing. The process was criticised by a number of stakeholders not in favour of a PSSA who considered the questionnaire to be exclusively focussed on environmental concerns and thus lacking in objectivity and the timescale too short for organisations representing member interests.

### **3.4 Risk evaluation**

- 3.4.1 The evaluation of adequacy of existing protective measures and the potential need for additional measures was determined partly on the basis of a risk assessment.
- 3.4.2 Risk is defined as the product of probability of failure, and the consequence of the failure. If either or both of these happen to be very low, they will result in very low risk level. This study has paid particular attention to scenarios where the probability may appear to be low but the consequence level is high, as is the case for most maritime casualties.
- 3.4.3 Time allocated for this part of the project, however, did not justify an in-depth quantitative assessment of the situation. For this reason, risk to the environment has been qualitatively argued and a judgement made to determine the level.

### **3.5 GIS interpretation**

- 3.5.1 Possible delimitation proposals of a potential Wadden Sea PSSA using a MapInfo Geographic Information System (GIS) have been constructed. MapInfo provides a good user interface and allows easy map query and customised map production.
- 3.5.2 As required by the Terms of Reference delimitation options include the Wadden Sea Conservation Area to the Wadden Sea Area proper plus parts of the adjacent North Sea, with and without buffer zones. The points in favour and points against each of these options have been evaluated by each of the sectorial experts (i.e. shipping, ecology, economy).

### **3.6 Clarification and consensus workshop**

- 3.6.1 The research team presented preliminary conclusions to a meeting of a limited number of organisations from whom information had been sought throughout the previous study tasks. This formal workshop session involved the entire research team, a representative from CWSS and delegates from organisations identified in earlier stages of the research.

## **Chapter 4. Description, significance and vulnerability**

### **4.1 Introduction**

- 4.1.1 The purpose of this chapter, which corresponds to Task I of the terms of reference for the feasibility study, is to determine whether the significant characteristics of the Wadden Sea and an adjacent North Sea zone are vulnerable to the impacts of international maritime activities.
- 4.1.2 Much of this information is fundamental to Part 1 of any PSSA application as it provides the rationale to determine whether a PSSA designation is useful as a means of further protecting the Wadden Sea environment.

### **4.2 Description and significance of the Wadden Sea**

- 4.2.1 Geographically the Wadden Sea extends along the North Sea coasts of The Netherlands, Germany and Denmark from Den Helder in The Netherlands to Blavandshuk in Denmark. The Wadden Sea Area is an area of some 9500 km<sup>2</sup>, with a further 4000 km<sup>2</sup> representing the transition zone to the North Sea. Of the Wadden Sea Area some 30% is within the jurisdiction of The Netherlands, 60% within the jurisdiction of the Federal Republic of Germany, and 10% within the jurisdiction of Denmark. The geographical location of the Wadden Sea is illustrated in Figure 1.

#### Physical characteristics and significance

- 4.2.2 The bathymetry of the North Sea is a relic of the ice ages. Since then shallow southern sediments have been much exposed to tides and wave action, resulting in the formation of undulating sands and elongated sandbanks. The adjacent North Sea water is part of a continental water mass stretching along the eastern shore of the North Sea Southern Bight. This is distinct from Channel water and separated by a front off the western Dutch coast (Laevastu, 1983; OSPAR Commission, 2000). The mean currents of the North Sea form a cyclonic circulation with a residual current which runs into a southwest-northeast direction from the Channel along the Wadden Sea coast to Jutland and further north to the Skagerrak and the Norwegian coast. North Sea sediment moves with the water circulation and is deposited in the Wadden Sea at places with low current velocities and little wave action. This current also transports pollutants from rivers and residues from shipping and offshore operations (e.g. non-biodegradable pollutants, garbage and oil), including accidental and operational pollution associated with international maritime activities, to the Wadden Sea coast.
- 4.2.3 As a result the Wadden Sea is a highly dynamic ecosystem with a complex geomorphology of dunes, beaches, river mouths, salt marshes, sands and tidal flats, tidal channels, barrier islands that separate the Wadden Sea from the North Sea and an ‘offshore’ transition zone to the North Sea. Four large sheltered bays can

be identified: the Ho Bugt in Denmark, the Jadebusen and the Leybucht in Lower Saxony and the Dollard in the Dutch-German border area.

- 4.2.4 The Wadden Sea and the adjacent North Sea have many physical and biological interconnections. The adjacent North Sea, up to the 20-m isobath, forms one morphological system with the Wadden Sea proper. Sediments are transported back and forth between the Wadden Sea proper and the adjacent North Sea in a virtually closed system. Organic matter imported from the North Sea into the Wadden Sea is remineralised, and forms the basis for the high biological productivity of the Wadden Sea system. There is also migration of several species (fish, birds, mammals) between the Wadden Sea and the adjacent North Sea.
- 4.2.5 The tides determine the exchange of water with the North Sea. In the larger part of the Wadden Sea the water is exchanged for new North Sea water within a week. This exchange includes any substances dissolved in or carried by the water.
- 4.2.6 The Wadden Sea is also part of the continental water mass of the North Sea, within which a large volume of river water, which is relatively light, spreads slowly over the salt seawater. A combination of slow spread and generally strong west to east residual current along the coast, contain any contaminants in a zone a few dozen kilometres wide along the coast. Between the shore and the barrier islands the water is well mixed, being relatively shallow and subject to strong tides. Beyond the barrier islands there is sometimes summer stratification.
- 4.2.7 The wind regime, determined by average air pressure differences, is predominantly south-westerly over the southern North Sea, with significantly higher wind velocity in winter months.

#### Ecological characteristics and significance

- 4.2.8 The biomass productivity of the Wadden Sea is one of the highest in the world, comparable to that of tropical rainforests. This high productivity forms the basis for the international ecological importance of the area. The Wadden Sea provides a multitude of transitional zones between land, the sea and freshwater environment, forming an exceptional species richness. Among these transitional zone organisms, there is a high degree of ecological specialisation. Conversely, on the tidal flats, only a few species of flora and fauna have adapted to the extreme environment. Of these, however, exceptionally high numbers can be found.
- 4.2.9 The Wadden Sea is an important habitat for fish. A total of 162 fish and lamprey species are known in the Danish-German-Dutch Wadden Sea. 72 of these species are migrants entering the area occasionally, the total number of resident species in the Wadden Sea Area is 90. In total 20 species of fish and lamprey are threatened in at least one sub-region of the Wadden Sea. Of these, 19 species are threatened in the entire area and are therefore placed on the Trilateral Red List. Two species of the listed fish and lamprey species are (probably) extinct in the entire Wadden Sea Area. The status of five species of fish and lamprey species is critical, five species are (probably) endangered, the status of six is vulnerable and one species is

susceptible. The Wadden Sea is the main nursery ground for fish and shrimp species, which are hatched in the North Sea. The commercial fishery of the North Sea is dependent on these nursery ground facilities and derives considerable annual income from them.

- 4.2.10 The tidal flats of the Wadden Sea form the largest unbroken stretch of mudflats in the world. They are characterised by an ever-changing pattern of bars and gullies. Characteristic biological features of this highly dynamic habitat are, amongst others, mussel beds, lugworm flats and eelgrass (*Zostera*) fields. At low tide, the tidal flats are important feeding, roosting and/or moulting areas for birds and seals. The high biological productivity of the tidal area is also, in part, the basis for shellfish fisheries and mussel cultures. The salt marshes of the Wadden Sea are Europe's largest coherent salt marsh area and constitute an essential element of the Wadden Sea ecosystem. More than 250 invertebrate animal species are endemic in the Wadden Sea. Wetland and coastal birds mainly use salt marshes as breeding areas. For migrating birds, the salt marshes are an important feeding area and they serve as resting ground during high-tide periods.
- 4.2.11 The Wadden Sea is also the main staging area for birds migrating from the breeding grounds in the arctic tundra of Northeast Canada, Greenland, Scandinavia and North Siberia to the wintering grounds in Europe and West and South Africa. It is estimated that 10 to 12 million birds pass through the area each year. The Wadden Sea "store-room" makes it possible to build up the necessary energy reserves to migrate thousands of kilometres without further food intake. The Wadden Sea is vital for some 50-bird species originating from a large part of the Northern Hemisphere. Among these are many rare and threatened species. The area is of international importance for at least 52 geographically distinct populations of 41 species. In about 20 populations, more than half of the individuals utilise the Wadden Sea at some stage in their annual life cycle. For about 10 species almost the entire population occur in the Wadden Sea. For more than 30 bird species, the Wadden Sea is an indispensable breeding area. The Common seal (*Phoca vitulina*), the Grey seal (*Halichoerus grypus*) and the Harbour porpoise (*Phocoena phocoena*) may be regarded as indigenous Wadden Sea marine mammal species. As top predators, these species are important indicators of the quality of the whole ecosystem. The Common seal is the most numerous native marine mammal species in the Wadden Sea. Based on annual surveys, there were some 17,000 individual seals living in the Wadden Sea in 1999/2000.

#### Socio-economic characteristics and significance

- 4.2.12 Tourism and recreation is of major importance for the Wadden Sea Region. In the Schleswig-Holstein Wadden Sea region for example, the income effect from tourism has been calculated to be approximately 285 million Euro per annum (equivalent to 9,000 jobs). Almost 20% of the income in the region is generated by the tourism industry. In terms of visitor numbers, the Wadden Sea is a very important vacation region. More than 15,000 permanent and guest berths in the region signify the importance of the area for watersports. Tidal flat walking,

undertaken by hundreds of thousands of people each year along the whole coast, is an activity that can only be enjoyed in the Wadden Sea.

4.2.13 The Wadden Sea Area is close to major shipping routes. Some of these routes pass the coastal waters to the west and north of the Wadden Sea. Several major ports are situated within, or at the border of, the Wadden Sea Area. There is intensive traffic between the Wadden Sea ports and harbours outside the area. The shipping lanes of Hamburg, Bremerhaven and Wilhelmshaven are connected with the Traffic Separation Schemes (TSS) leading to Rotterdam and the English Channel.

4.2.14 The Wadden Sea is also an important area for fisheries. The most important branches of fisheries in the Wadden Sea are the Blue mussel (*Mytilus edulis*) cockle (*Cerastoderma edule*) and Brown shrimp (*Crangon crangon*). The total annual landings (all three countries) were 97,482 metric tons of Blue mussels in 1999.

#### Scientific and cultural characteristics and significance

4.2.15 The Wadden Sea is one of the most intensively studied areas in the world and is the subject of a large number of national and international scientific research programmes. There are several scientific institutions in all three countries mainly dealing with the Wadden Sea.

4.2.16 The Wadden Sea is well known for its long history of human settlement in the face of the dynamic force of nature. The values of the landscape and cultural heritage are intimately related to the economic and social development of the coastal area and are, by international standards, unique and of universal significance. The cultural-historic and landscape values encompass, besides the immaterial culture, many age-old landscape elements, hidden archaeological objects, works of art, folklore and traditions. The material culture deals with hydrological devices, hunting and fishing technologies, agriculture, trade, and defence structures. Other outstanding artefacts include archaeological monuments, typical houses, churches and settlement patterns.

### **4.3 Existing level of environmental protection**

4.3.1 Since 1978 the environmental protection of the Wadden Sea as an entity has been perceived as a joint mission for the three Wadden Sea countries, resulting in the Joint Declaration on the Protection of the Wadden Sea in 1982. Co-ordinated stewardship of the Wadden Sea has, as a consequence been strengthened and intensified over the past twenty years. Trilateral Governmental policy is underpinned by the guiding principle agreed at the Esbjerg Conference in 1991, “to achieve as far as possible, a natural and sustainable ecosystem in which natural processes proceed in an undisturbed way”. Agreed management principles and common objectives are embodied in the Trilateral Wadden Sea Plan (CWSS, 1998), which is valid for the whole Trilateral Cooperation Area and includes the Conservation Area (see Figure 2).

4.3.2 The value of the Wadden Sea ecosystem is recognised in the level of protective measures currently in force, with the majority of the area being under both national and more recently international legal protection for nature conservation. The national protection regimes form the Wadden Sea Conservation Area, consisting of the Wadden Sea national parks and nature reserves. For the remaining parts of the Trilateral Wadden Sea Cooperation Area, other instruments are also being applied. The supra-regional ecological significance of the Trilateral Wadden Sea Cooperation Area is recognised by the following designations covering major parts of the area:

- ◆ Wetlands of international importance (Ramsar Convention 1971);
- ◆ Special Protection Areas (SPAs) under the EC Birds Directive 1979;
- ◆ Special Areas of Conservation (SACs) under the EC Habitats Directive 1992 and thus part of NATURA 2000; and
- ◆ UNESCO Biosphere reserve (Germany and The Netherlands).

4.3.3 These designations effect environmental protection through legislation aimed at controlling and restricting certain resource use measures. Policies with respect to pollution and water quality have, to a large extent, been determined by the North Sea Conferences together with measures taken to reduce the impacts of shipping. Principal elements include :

- ◆ Regulation of activities (e.g. by zoning);
- ◆ Navigation restrictions;
- ◆ Prohibited/restricted resource uses including gas exploitation and fisheries;
- ◆ Shipping prohibitions (part or whole year) in seal nursing and bird reserves;
- ◆ Whale protection area (Schleswig-Holstein).

4.3.4 It should be noted that the Ems Dollard, Jade, Weser and Elbe shipping lanes are not included in the German Conservation Area (Lower Saxony National Park); and the shipping lane to the Port of Esbjerg is excluded from the Ramsar designation and Natura 2000 designations.

4.3.5 A feasibility study for the Trilateral Wadden Sea Cooperation/Common Wadden Sea Secretariat (Burbridge, 2000) concluded that the Wadden Sea Conservation Area meets all the UNESCO criteria to qualify as ‘natural property’ in terms of a World Heritage Site, representing one of the world’s greatest wetland ecosystems. In this respect the following factors were cited as being of particular importance:

- ◆ Extensive scale of dynamic interaction of physical and biological processes, which makes the Wadden Sea one of the finest examples of a fully functional, large scale temperate coastal wetland
- ◆ Wide range of complex, relatively undisturbed, mosaic of habitats of international importance
- ◆ High biologically productivity
- ◆ Visual diversity including the dramatic and beautiful seascape
- ◆ Integrity assured by major conservation efforts of the Wadden Sea states

There is a high level of commonality between the UNESCO criteria and the PSSA criteria, which are considered in detail in Chapter 5.

- 4.3.6 On this basis, the Wadden Sea merits a “level of environmental protection and wise management that is unprecedented throughout Europe...in terms of harmonised international and national policies, management arrangements, and integrated environmental monitoring and assessment processes” (Burbridge, 2000).

#### **4.4 Vulnerability of the Wadden Sea to damage from international maritime activities**

##### Impacts of shipping on the marine environment.

- 4.4.1 Shipping and associated port operations exert a range of pressures on the marine environment. Paradoxically, while shipping is seen by some as a contributor to marine pollution, in other areas it is seen as being the most environmentally acceptable mode of transport. Impacts can be accidental or operational. Environmental impacts caused by accidents tend to be acute, whereas those attributable to marine operations are usually chronic. Accidental impacts are likely to be unique and can only be anticipated by scenario setting. However, legislation can help minimise risk, and mitigation of the effects of accidents can be approached from a ‘tool box’ perspective. Operational impacts can also be controlled by legislation, whilst mitigation can be planned and controlled. To place this in context, marine transport was estimated to have contributed some 12% of marine pollutants in 1990.

##### Accidental impacts

- 4.4.2 Marine accidents, groundings or strandings may result in localised damage and disturbance to the seabed, but may also lead to loss of:
- ◆ Oil, either as cargo or bunkering fuel, or
  - ◆ Hazardous cargo, including noxious liquid substances and harmful substances carried by sea in packaged form e.g. pesticides, liquefied gas.

The effects will be unique to the situation but the fuel or cargo will have a wide range of toxic or physical effects on marine habitats. The main impacts of both oil and chemical spills are either physical, e.g. smothering by crude oil, or, toxic, e.g. lethal effects of spilt oil or chemicals. It is thought that birds, molluscs and fish eggs and larvae are particularly at risk from accidental spills. Accidental spills of oil or other hazardous cargo also adversely affect socio-economic activities. This is particularly true for fisheries; oil can smother shellfish beds, it is toxic to fish eggs and fry, and the tainting of fish and shellfish flesh by oil is known to impact on fish sales. Fishing grounds and shellfish beds may become subject to closure orders and, as a result, directly affect the fisheries economics of the area. The physical effects of an oil slick impact indirectly on tourism, resulting in reduced tourism and compromised amenities. For example, harbours and marinas that are oiled may be closed or seen as less attractive to visit resulting in lost dues and indirectly, loss of income in associated areas.



- 4.4.3 While not common, collisions with marine mammals do occur and are particularly associated with high-speed craft. Propeller injuries have also been reported on marine mammals.

#### Operational impacts

- 4.4.4 Operational oil spills of both cargo and bunkering fuel are usually small but repetitive. The effects of these spills are chronic and localised. Impacts on marine habitats include physical disturbance, toxic effects on sensitive species and organic enrichment of sediments. Annual operational spills, represent the second largest input of oil into the marine environment.
- 4.4.5 Emissions of SO<sub>x</sub>, NO<sub>x</sub>, CFC's and VOCs are all regarded as contributing to atmospheric pollution leading to global warming, poor air quality and acid rain. The input of sulphur and nitrogen oxide by shipping is small in global terms. However, in regions with a large volume of shipping traffic, there may be localised poor air quality, which could have health implications for local residents. VOC's from cargo, may also cause environmental and health damage at a local level.
- 4.4.6 Antifouling toxins comprise the biocides, such as TBT and triazines, within antifouling coatings, these can leach into the surrounding water and accumulate in benthic organisms and sediments. Biocides, by their nature, are harmful to a range of marine organisms. The nature of this toxicity is chronic and can affect such functions as morphology, growth and reproduction of a range of marine species. Any contaminant that is bioaccumulated in marine organisms, particularly shellfish, may pose an economic and health risk.
- 4.4.7 The introduction of non-native species via the discharge of ballast water is well documented. These species can be detrimental to local species through competition for space or nutrients or they can be toxic and affect local fisheries. Historically many of the established introduced non-native species take the form of competitive or pathogenic species, either of which can have a detrimental effect on commercial shellfish beds. Toxins accumulated by shellfish can be harmful to the health of human and marine mammals e.g. PSP. The *vibrio* bacterium responsible for causing cholera is also known to be transported in ballast tanks and represents a human health hazard.
- 4.4.8 There is some evidence that vessel noise can disturb marine mammals and fish. There is particular concern over cetaceans that may experience disturbance to feeding and breeding. Cargo handling noise may also disturb mammals e.g. seals and waterfowl.
- 4.4.9 Ship and boat wash may result in increased water turbidity and accelerated erosion of intertidal and shallow water habitats. The resuspension of sediment may also lead to resuspension of toxins in the sediment. Currently there is concern regarding the impact of wash generated by fast-craft.

- 4.4.10 Waste disposal at sea and inappropriate discharge of waste in ports is another operational impact. This includes sewage, garbage, oil and other residues. Marine mammals and birds can swallow or become entangled in plastic litter from ships, often leading to fatalities. Marine debris is generally unsightly and not attractive to visitors, thus impacting on tourism. Medical products present within debris may pose a health risk. Distinguishing between ship or land garbage is difficult, but studies on UK beaches have estimated that shipping generated some 17.4% of the total debris.
- 4.4.11 Maintenance and capital dredging disturbs the sea bed, leading to damage of benthic ecosystems (physical damage and smothering by sediment), as well as increased levels of suspended sediments and attendant pollutants/nutrients in the water column.

#### Impacts on the Wadden Sea

- 4.4.12 It is difficult to differentiate the environmental impacts of international maritime activities from other pressures in an area as large as the Wadden Sea. Significant contamination enters the Wadden Sea, for example, via rivers with highly industrialised and agronomised catchments; tourism disturbance can adversely affect seal pup survival; and relative sea-level rise is likely to exacerbate erosion of saltmarsh habitat.
- 4.4.13 However, as the table below suggests, the ecological significance of the Wadden Sea is perhaps the characteristic most vulnerable to international maritime activity. In particular, the Wadden Sea ecosystem is a dynamic balance whereby nutrients are used as quickly as they are produced and external influences upon this balance could have significant effects in terms of biological productivity. Clearly, however, both socio-economic and cultural characteristics also depend directly and indirectly on ecological characteristics.
- 4.4.14 The volume of maritime traffic using the Wadden Sea and adjacent sea area confirms that this is one of the most frequented sea areas worldwide. WWF (2000) quantified this in terms of both shipping movements (260,000 pa) and tonnes of cargo transferred in the German North Sea ports (171.5 million tonnes in 1999). Whilst these figures do not differentiate between international and domestic maritime activities there is little doubt that shipping activity is significant.
- 4.4.15 The following evidence is indicative of environmental stress related to international maritime activities:
- ◆ Oil pollution in the Wadden Sea is mainly assigned to illegal discharge of fuel oil residues at sea rather than major shipping accidents. This situation of chronic pollution with heavy fuel oil residues has not changed since 1980s when oil sampling began. ICONA (1992) suggested that most slicks have a volume of under 1 cubic metre and that the relationship between oil and shipping is clear within shipping routes. A concentration of production platform oil spills has also been recorded to the south-east of Texel. An

evaluation of shipping derived oil pollution is presented in the trilateral Quality Status Report (De Jong *et al.*, 1999 : 117);

- ◆ The trilateral Quality Status Report (De Jong *et al.*, 1999 : 111) also recorded levels of TBT in sediment of up to 1000 times ecotoxicological assessment criteria (EAC) ranges as developed by OSPAR; and
- ◆ The amount of dredged material dumped into the entire Wadden Sea Area - because of maintenance dredging of shipping lanes within the Wadden Sea Area - varied between 31 million tons and 67 million tons/year (wet weight) in the period 1989 – 1997.

*Table 4: The impact from maritime activities on significant characteristics*

Significant characteristic	Impact from maritime activities
<u>Ecology</u>	
Productivity	Accidental oil; hazardous spills; operational oil; antifouling; non-native species; waste pollution
Fish spawning and breeding	Accidental oil; hazardous spills; antifouling; non-native species; dredging
Habitats	Accidental oil; hazardous spills; operational oil; wash; dredging
Species	Accidental oil; hazardous cargo; collision; operational oil; antifouling; non-native species; noise disturbance; waste pollution; dredging
<u>Socio-economic</u>	
Tourism and recreation	Accidental oil; hazardous spills; operational oil; air emissions; non-native species; noise disturbance; waste pollution
Shipping	
Commercial fisheries	Accidental oil; hazardous spills; operational oil; non-native species; dredging
<u>Science and culture</u>	
Research	Accidental oil; Hazardous spills; non-native species; dredging
Landscape and heritage	Accidental oil; hazardous spills; operational oil; air emissions; non-native species; waste pollution

4.4.16 The greater Wadden Sea is, as a result of its specific hydrography, morphology and meteorology, an importing system, which makes it especially vulnerable to pollution. The residual current transports pollutants from the continental rivers, but also, garbage, oil and other residues from shipping and offshore operations into the North Sea coastal zone bordering the Wadden Sea from where beaching on the barrier islands and import into the Wadden Sea takes place.

4.4.17 Consequently if an accident results in a major spillage of oil or other hazardous substance in the coastal waters, the tides, currents and wind will carry these substances into the Wadden Sea. The operational circulation model of the Bundesamt für Seeschifffahrt und Hydrographie (BSH) and associated computer simulations of dispersion processes (Lagrangian dispersion model) confirm this situation. A large oil or chemical spill would have potentially disastrous and long-

term effects on inter-tidal habitat, and the fish and bird species that are dependent on this area. The very nature of the Wadden Sea with its salt marshes and tidal flats makes this area particularly vulnerable to the adverse effects of oil and chemical spills and also makes it particularly difficult to develop effective clean-up activities in the aftermath of such spills.

4.4.18 Thus, the ecological integrity of the Wadden Sea remains vulnerable to the impact of international maritime activities. This is the case both in terms of the volume of maritime traffic using the southern North Sea and as a result of water circulation that contains contaminants in a zone a few dozen kilometres wide along the coast. An assessment of the measures currently in force to limit and control this vulnerability is presented in Chapter 6 and opinions of stakeholders relating to the level of risk from maritime activities is presented in Chapter 7.

4.4.19 A composite map of vulnerability is presented in Figure 3. As legal nature conservation designations the Trilateral Conservation Area (including the Whale Protection Area), habitat areas according to the EC-Habitat Directive and the Special Protection Areas according to the EC- Birds Directive, are included in the map. These areas are scientifically validated 'hard' data, which forms the basis for the designations. In terms of presentation of vulnerability important areas like biomass productivity and fish breeding and spawning concentrations are missing, because of insufficient data. As a generalisation, however, primary production concentrations and commercial fish nursery concentrations are found in the adjacent North Sea.

## **4.5 Conclusions**

4.5.1 The Wadden Sea is a very significant resource, and can be defined as 'critical or irreplaceable natural capital'. Significance can be established in terms of biogeography, ecology, socio-economics, scientific value and cultural importance.

4.5.2 The outstanding attributes of the Wadden Sea Area are recognised by national and international nature conservation designations; through trilateral agreements and policies; and in terms of a recommendation that the Wadden Sea Conservation Area should be considered for submission to UNESCO as a 'natural property' World Heritage Site.

4.5.3 The Wadden Sea resource remains vulnerable to accidental and operational impacts of maritime activities. Whilst the relative impact of such activities (i.e. compared to other impacts such as land-based pollution), must be taken into account; the large volume of maritime traffic using the adjacent North Sea and the specific hydrography, morphology and meteorology of the Wadden Sea, which makes the Region a natural importing system, are fundamental factors.

- 4.5.4 There is evidence of the adverse effects of operational pollution on the Wadden Sea coast, however, lack of co-ordinated quantified data should be addressed. The risk of accidental pollution confirms the need for proactive counter measures, co-ordinated anti-pollution measures, and a quick response in the event of an accident. The ability to contain pollution offshore, away from the Wadden Sea Area coastline and those characteristics considered to be of particular significance is essential.

## **Chapter 5. Wadden Sea eligibility for PSSA designation**

### **5.1 Introduction**

- 5.1.1 IMO have defined a list of ecological, socio-economic and scientific criteria for the identification of a PSSA. The guidelines emphasise that these criteria apply specifically to the adoption of measures to protect such areas against damage from international shipping activities.
- 5.1.2 To achieve Task II of the feasibility study the characteristics of the Wadden Sea have been described against each of the criteria set out in the guidelines in the following paragraphs.

### **5.2 PSSA qualification criteria analysis**

#### Ecological criteria

##### 5.2.1 Uniqueness or rarity

The Wadden Sea is the largest European wetland ecosystem, with the greatest biological dynamic. As such it is ‘the only one of its kind’. Its tidal flats form the largest unbroken stretch of mudflats world-wide, accounting for 60 percent of all tidal areas in Europe and North Africa. The salt marshes of the Wadden Sea are the largest coherent salt marshes of Europe and constitute an essential element of the Wadden Sea ecosystem. Several rare and extremely rare species can be found in the different habitats of the Wadden Sea. For example, over 160 fish and lamprey species are known in the Wadden Sea, of which 19 species are threatened in the entire Wadden Sea and are therefore placed on the Trilateral Red List. The Wadden Sea is also a main staging area for birds migrating on the African-Eurasian Flyway. The Wadden Sea is vital for about 50 bird species, many of them rare or endangered. The area is of international importance for at least 41 bird species.

##### 5.2.2 Critical habitat

The Wadden Sea ecosystem contains critical habitat for 2,500 marine species in the intertidal and subtidal zones and about 2,300 semi-terrestrial species, mostly the flora and fauna of the salt meadows. The importance of Wadden Sea habitats for

birds, seals, shellfish and fish species stems from high levels of primary production. This is due to the presence of the factors essential for high primary production, i.e. the shallow water, which provides sufficient light for algae to grow, and the many nutrients, which are also essential for algal growth. In particular, the Wadden Sea is a critical habitat for *Sabellaria* reefs and *Zostera* fields, which are endangered in the North Sea. The Wadden Sea is a critical habitat for several fish and shrimp species.

### 5.2.3 Dependency

The Wadden Sea is the temperate equivalent to the Great Barrier Reef (GBR) inasmuch as the ecological processes of the area are highly dependent on the dynamic biophysical processes. Several rare and extremely rare species (including threatened species), which are dependent on Wadden Sea habitats, are found in the region. Several fish species from the North Sea are also dependent on the Wadden Sea as their main nursery ground. The Wadden Sea is the main staging area for birds migrating from the breeding grounds in the arctic tundra of north-east Canada, Greenland, Scandinavia and North Siberia to the wintering grounds in Europe and West South Africa. It is estimated that 10 to 12 million birds pass through the area and stay there for shorter or longer periods. The Wadden Sea ‘store-room’ makes it possible to build up the necessary energy reserves to migrate thousands of kilometres without further food intake. The Wadden Sea is vital for about 50 bird species originating from a large part of the Northern Hemisphere. Among these are many rare and threatened species. The area is of international importance for at least 52 geographically distinct populations of 41 species. In about 20 populations, more than half of the individuals utilise the Wadden Sea at some stage of their annual life cycle. For about 10 species, almost the entire populations occur in the Wadden Sea.

### 5.2.4 Representativeness

The Wadden Sea supports highly representative ecological processes and natural characteristics associated with tidal flats and saltmarsh systems.

The representativeness of this extensive stretch of tidal flats and largest coherent saltmarsh area can be gauged by the levels of international nature conservation designation. Major parts of the Wadden Sea have been listed as a habitat area under the EC Habitats Directive and/or the EC Wild Birds Directive. A majority of the Wadden Sea Area is hence, now part of NATURA 2000. Major parts of the Wadden Sea have also been designated as Ramsar sites under The Convention on Wetlands of International Importance Especially as Waterfowl Habitat 1971 (Ramsar Convention).

The Wadden Sea Conservation Area has been identified as worthy of inscription as a World Heritage Site as it meets all of the UNESCO criteria as a ‘Natural Property’ representing one of the World’s greatest wetland ecosystems (Burbridge, 2000).

### 5.2.5 Diversity

The Wadden Sea provides a multitude of transitional zones to the land, the sea and the freshwater environment, which is the basis for an exceptional biodiversity. This includes 2,000 species of spiders, insects and other invertebrates in the salt marshes and 1,800 in the marine and brackish areas. Among these organisms, there is a high degree of ecological specialisation. The marine environment serves as a nursery for 50 species of fish, supports 300 species of invertebrates and 1100-1200 micro and meiobenthos species.

### 5.2.6 Productivity

The productivity of the Wadden Sea in terms of biomass is one of the highest in the world, comparable to that of the tropical rainforests. This high productivity provides the basis for the wide international importance of the area. This exceptional natural biological productivity is the main reason for the area's role as an important nursery area for North Sea fish and for the high numbers of breeding and migrating birds that feed in the area. The productivity is the net result of biological and physical processes, which result in an increase in biomass. On the tidal flats, only a few species of flora and fauna have adapted to the extreme environment. Of these, however, exceptionally high numbers can be found. Summer primary production, phytoplankton taking up carbon dioxide and nutrients, can exceed 1000 mg C per sq. m per hour in the middle of the day in the area of the Frisian Front, which marks the transition between the shallow, turbulent and sandy southern half of the Netherlands Continental Shelf (NCS) and the deeper northern half, where two water masses meet (ICONA, 1992).

### 5.2.7 Spawning or breeding grounds

The Wadden Sea is a critical spawning ground, breeding ground, and nursery area for bird, fish and marine mammal species.

For more than 30 birds species, the Wadden Sea is an indispensable reproduction area. For some endangered species, like Little tern (*Sterna albifrons*) and Kentish plover (*Charadrius alexandrinus*), the Wadden Sea has special significance and responsibility; and for three species e.g. Avocet, the Wadden Sea is of crucial importance, because more than 50% of the north-western European population breeds in the Wadden Sea Area. The most important breeding areas are the salt marshes, and, to a lesser extent, the dunes and beach plains of the islands. Typical Wadden Sea birds are Redshanks (*Tringa totanus*), Black-tailed godwit (*Limosa limosa*), Oystercatcher (*Haematopus ostralegus*), Ringed plover (*Charadrius hiaticula*), Avocet (*Recurvirostra avosetta*) and a number of species of ducks, geese, gulls and terns.

The Wadden Sea is the main nursery ground for fish species that are hatched in the North Sea. The commercial fishery of the North Sea is dependent on these nursery ground facilities and derives considerable income from them. 80% of the plaice (*Pleuronectes platessa L.*) and 50% of the sole (*Solea solea*) and in some years a large part of the North Sea herring, grow up in the Wadden Sea. The German

Bight is a particularly important nursery for 1-2 year old cod (*Gadus morhua* L.), sole and plaice. Concentration areas for spawning sole are also found off Texel (ICONA, 1992)

The most numerous native marine mammal species in the Wadden Sea is the common seal (*Phoca vitulina*). Based on annual surveys, there were some 17,000 individual seals living in the Wadden Sea area in 1999/2000. For the Common seal, sand banks in the tidal area and beaches and for the Grey seal (*Halichoerus grypus*) dunes and salt marshes, are essential for the maintenance of the vital biological functions such as whelping, nursing, breeding, moulting and feeding.

#### 5.2.8 Naturalness

The Wadden Sea is one of the last near natural large scale ecosystems remaining in central Europe. This transitional environment between land and sea is characterised by the constant change of flood and ebb tides, great fluctuations in salinity, high temperatures during summer and occasional ice cover in winter. These circumstances have created numerous ecological niches, colonised by species that have adapted to the extreme environmental conditions.

Large parts of the Wadden Sea are still in pristine condition and have not been unduly affected by human activity. However, since the Middle Ages man has changed the Wadden Sea landscape by building dykes and reclaiming land.

#### 5.2.9 Integrity

The Wadden Sea is a biologically functional unit inasmuch as it contains all the ecosystem components required for the continuous existence of the species within that system. It is an effective, self-sustaining ecological entity whose value can be effectively protected. However, as coastal sea, there are many interactions with the North Sea and the north-western European mainland.

#### 5.2.10 Vulnerability

The ecology of the Wadden Sea is vulnerable to the impacts of international maritime activities (see Chapter 4). The nature of the salt marshes and tidal flats makes them particularly vulnerable to the adverse effects of any oil and chemical spills. A number of the characteristics described above also make Wadden Sea ecology more vulnerable at certain times of the year and in certain locations. For example, for the most important commercial fish species the spawning season varies, but collectively it lasts from December to June; the eggs and larvae are pelagic (i.e. they live in the water column) and fry remain pelagic until they seek out the seabed in the course of the summer.

#### 5.2.11 Biogeographic importance

The biogeographic importance of the Wadden Sea is without question. This too is recognised by criteria determining international nature conservation designations and the region's complex biogeographic composition. The Wadden Sea is listed as



a well-known marine protected area in the global list of different biotypes in IMO Resolution A.720(17) paragraph 1.1.3.

#### Social, cultural and economic criteria.

##### 5.2.12 Economic benefit

The Wadden Sea is of particular importance to the utilisation of the living marine resources which depend on a healthy ecosystem and productive resources, including commercial, recreational and subsistence fishing, harvesting, and aquaculture. For example, the total annual landings from the principal shellfisheries in the Wadden Sea (all three countries) were 97,482 metric tons gross of Blue mussels in 1999, approximately 49,000 tons wet weight of cockles in 1999 (mostly Netherlands, other parts have been more or less closed for cockle fisheries except for one license each in Denmark and Lower Saxony).

##### 5.2.13 Recreation

The Wadden Sea is extremely important for recreation and tourism. Approximately 8-10 million tourists visit the Wadden Sea Region annually, mainly because of its unique nature. In almost every part of the Region, tourism is an important economic activity in terms of both income and employment. ‘Sustainable Tourism in the Wadden Sea Region’, an Inter-Regional Wadden Sea Co-operation, EU Demonstration Tourism Project (IWSC, 2000), has ascertained that on most of the islands and at some of the mainland locations tourism is the most important economic activity. For example, in the Schleswig-Holstein Wadden Sea region, the income effect from tourism has been calculated to be approximately EURO 285 million, which is equivalent to 9,000 jobs calculated on the basis of the average income. Almost 20% of the earned income in the regions stems from the tourism industry. The total number of overnight stays for the whole of the Wadden Sea region can be estimated at some 53 million in the mid 1990s, which in addition to the millions of day trippers makes it the most important vacation region in Germany, and one of the most important ones in the two other countries. Tourism in coastal areas such as that of the Wadden Sea is based on intact nature and the recreational activities are based both on land and water. Without natural assets there can be no outdoor recreation.

The special natural conditions under which the culture of the area has developed allow the Region to offer the tourist an insight into a special realm of European history, in which man has had a distinct role in creating not only the culture itself, but also in contributing to the development of a unique landscape.

##### 5.2.14 Human dependency

The Wadden Sea Region is a discrete geographical entity, and so has many common cultural and historical elements. Man’s ability to adapt to the dynamic natural environment of the Region is visible in the cultural traits of all three Wadden Sea countries. The cultural-historic and landscape values of the area are

intimately related to the economic and social development of the coastal area and, by international standards, unique and unrivalled (CWSS, 1998). The cultural-historic and landscape values encompass, many age-old landscape elements, hidden archaeological objects, and works of art, folklore and traditions. The material culture deals with hydrological devices, hunting and fishing technologies, agriculture, trade, and defence structures. Other outstanding artefacts are among others archaeological monuments, typical houses, churches and settlement patterns.

The Region is also of particular importance for the support of traditional subsistence of the local human population. LANCEWAD (Landscape and Cultural Heritage in the Wadden Sea Region) is a trilateral project that is preparing an inventory of landscape and cultural heritage focussing on long settlement history and intra-regional distinctiveness.

### Scientific and educational criteria

#### 5.2.15 Research

The Wadden Sea is one of the most intensively used scientific study areas in the world and is the subject of a large number of national and international research programmes. There are several long-established scientific institutions mainly dealing with Wadden Sea matters. For example, in Germany, the Wadden Sea Station Sylt and the Senckenburg Institute in Wilhelmshaven were founded in 1924 and 1928 respectively and the Coastal research Institute on Norderney in 1937 to further biological research in the coastal zone. The biological station on Helgoland was founded in 1892 and is now, in common with the Wadden Sea Station of Sylt, part of the Alfred-Wegener Foundation for Marine and Polar Research. The Netherlands Institute for Sea Research (NIOZ) on Texel was founded in 1876 as the Marine Zoological Station and is one of the major European oceanographic institutes. Wadden Sea research is currently carried out by a number of research institutes and universities in co-operation with partners in the three Wadden Sea countries or on an international level. (De Jong, 1990). Trilateral scientific co-operation started in 1975 with the first International Scientific Wadden Sea Symposium. The 10<sup>th</sup> and most recent Wadden Sea Symposium was held in Groningen in 2000 and continued to recommend enhanced protection of the Wadden Sea ecosystem. Trilateral co-operation in the field of monitoring and research has been agreed upon at the Trilateral Governmental Conferences and is now co-ordinated by a Trilateral Working Group. Under the auspices of the Trilateral Wadden Sea Plan management related research projects are being carried out to identify, on the basis of scientific evidence, areas of special concern e.g. breeding/rearing areas for the protection of the Harbour Porpoises (*Phocoena phocoena*); further research is being carried out in areas where Grey Seal pups rest regularly; in addition a study into the possible effects of enhanced relative sea-level rise, and an investigation on shellfish stocks (e.g. *Spisula*) and the impact of fishery on the benthic stocks, seaward of the islands. The results of these research projects will serve to develop proposals for future integrated coastal defence and nature protection, and the safeguarding of food stocks for birds.

#### 5.2.16 Baseline and monitoring studies

Long-term surveys started in the Wadden Sea in the 1960s mostly as an initiative of single institutes or scientists. During the 1970s and 1980s monitoring programmes were established, which focussed mainly on aspects related to eutrophication and pollution (e.g. nutrients and plankton since 1971, zoobenthos since 1969, contaminants in water, sediment and biota since 1982). In the 1990s, the programmes were supplemented by monitoring of species, habitats and indicators of climatic change. Currently the integration of processes and biological effects into regular monitoring is under discussion. In all three countries, monitoring programmes are well established to obtain basic information about the ecosystem but also to inform specific management measures (e.g. mussel fisheries). Extensive programmes of baseline studies, for example 'Ecosystem Research Schleswig-Holstein Wadden Sea 1989-1996' (Stock *et al.* 1996; Kohlus and Kupper, 1998) have informed policy concerning the amendment of the National Park Law. Latterly, collaborative monitoring of baseline conditions with regard to biota and environmental characteristics has been enshrined in the Trilateral Wadden Sea Co-operation. Trilateral co-ordinated monitoring started in 1989 with regular counts of breeding birds and development of common guidelines to harmonise the counting methods in the three countries (Halterlein *et al.*, 1995). This was followed by trilateral co-ordinated monitoring of migratory birds and seals. In 1994 the Trilateral Monitoring and Assessment Programme (TMAP) was employed, entailing a common package of TMAP parameters and associated harmonising of data exchange, handling and analysis. The common monitoring program for the entire Wadden Sea and provides the common framework for the assessment of the status of the Wadden Sea ecosystem and the implementation of the Trilateral Targets. Recent local monitoring initiatives are also often supplementary to the requirements of TMAP, for example the National Park Office in Tönning (Schleswig-Holstein) has installed a socio-economic monitoring programme (SOM Watt). Comprehensive assessments of the Wadden sea ecosystem have been prepared in the framework of trilateral Wadden sea co-operation, integrating data from different baseline and monitoring studies in the three countries. The first integrated study was submitted to the 6<sup>th</sup> Trilateral Governmental Conference in Esbjerg in 1991. The second assessment was published in 1993 as part of the OSPAR North Sea Quality Status Report (De Jong *et al.*, 1993). The third baseline performance indicators were presented in the most recent Trilateral Quality Status Report (De Jong *et al.*, 1999). Concerns include levels of nitrate loads; levels of TBT; settling conditions for fine-grained sediments; the decline of stable blue mussel bed and seagrass areas; and high anthropogenic impact on estuaries and decline of selected bird populations (e.g. Kentish plover, Little tern) due to lack of undisturbed breeding habitats on beaches.

#### 5.2.17 Education

The Wadden Sea Area offers broad opportunities to demonstrate particular natural phenomena in a unique ecosystem, which is used in several Universities in the Wadden Sea countries, as well as in Wadden Sea Public Information Centres and

Museums around the entire Wadden Sea. The Worldwide Fund for Nature have produced an inventory of Wadden Sea visitor centres.

### 5.2.18 Historical value

Although the new draft guidelines (MEPC 46/6 Annex 2) no longer include this element of the *Scientific and educational criteria*, it can be shown that the Region has exceptional historical and archaeological significance containing one of the best North Sea densities and conditions for conservation of sites of marine archaeological value, both in terms of the remains of lost ships and submerged settlements. The Wadden Sea is well known for its long history of human settlement in the face of the dynamic force of nature. The historic values of the landscape and the cultural heritage are intimately related to the economic and social development of the coastal area and are, by international standards, unique and of universal significance.

## 5.2 PSSA qualification evaluation

### 5.3.1 The World Heritage listing feasibility study established the Wadden Sea as:

- ◆ An outstanding example of ongoing geomorphic, ecological and biological processes, with superlative natural phenomena, and most important/significant natural habitats for biodiversity conservation including threatened species
- ◆ An integrated system incorporating key interrelated ecological elements, significant size, and long-term protection policies.

There is a high level of commonality between the natural property criteria for World Heritage listing and the ecological criteria for PSSA designation.

### 5.3.2 A summary evaluation of each of the PSSA criteria is given in the table below:

Table 5: PSSA criteria – summary evaluation for the Wadden Sea

Key	
☺ ☺ ☺	unequivocally meets criteria
☺ ☺	substantively meets criteria
☺	in part meets criteria

Ecological criteria	
Uniqueness or rarity	☺ ☺ ☺
Critical habitat	☺ ☺ ☺
Dependency	☺ ☺ ☺
Representativeness	☺ ☺ ☺
Diversity	☺ ☺ ☺
Productivity	☺ ☺ ☺
Spawning or breeding grounds	☺ ☺ ☺
Naturalness	☺ ☺
Integrity	☺ ☺
Vulnerability	☺ ☺ ☺

<b>Social, cultural and economic criteria</b>	
Economic benefit	☺ ☺ ☺
Recreation	☺ ☺ ☺
Human dependency	☺ ☺ ☺
<b>Scientific and education criteria</b>	
Research	☺ ☺ ☺
Baseline and monitoring studies	☺ ☺ ☺
Education	☺ ☺ ☺
Historic value	☺ ☺ ☺

- 5.3.3 The Wadden Sea qualifies without question under the **Socio-economic** criteria as demonstrated in the ‘Sustainable Tourism in the Wadden Sea Region’ (IWSC, 2000) report in addition to the Landscape and Cultural Heritage in the Wadden Sea Region (LANCEWAD) study.
- 5.3.4 It also qualifies under the **Scientific and educational** criteria as demonstrated by the long history of scientific and educational activity and the number of research projects.
- 5.3.5 It is also arguable that the Wadden Sea qualifies under the **Ecological** criteria as demonstrated by the overwhelming evidence under the sub-criteria. Only two of these sub-criteria will need to be argued carefully in any submission of an application for designation of the Wadden Sea as a PSSA.
- ◆ The sub-criteria of *Naturalness* requires a lack of human-induced disturbance or degradation. This will need to be carefully argued in any application, as it is the historic intervention of man, which has helped to create and stabilize many ecological niches. Nevertheless, there are still large parts of the Wadden Sea, which are in pristine condition and have not unduly been affected by human activity.
  - ◆ The sub-criteria of *Integrity* requires that the area is a biologically functional unit, which is an ecologically self-sustaining entity. Again this will need to be carefully argued in any application due to the geographical openness of the region to the North Sea. However, it could be argued that it is this very openness to the North Sea which on the one hand provides the natural dynamics between the tidal area, the islands and the offshore zone, but also leaves the whole of the Wadden Sea region vulnerable to anthropogenic impacts.
- 5.3.6 This evaluation based on secondary sources is endorsed by stakeholder views. Stakeholders emphasised the ecological importance of critical habitat, uniqueness and spawning and breeding ground criteria. Critical habitat in relation to relative sea-level rise was also highlighted. A number of responses questioned integrity, representativeness and naturalness. The economic importance of recreation and tourism (e.g. high guest/local resident ratios); fisheries (e.g. Port of Harlingen); and commercial maritime trade (e.g. Elbe estuary); and the longstanding scientific and educational values (e.g. Forschungstelle Küste on Norderney) associated with the Region were undisputed. Those against the PSSA designation largely omitted this section of the questionnaire.

- 5.3.7 On this basis, the Wadden Sea qualifies for PSSA status under the IMO criteria expressed in MEPC 46/6 Annex 2 paragraph 4.4. Although the IMO Guidelines require that the area need qualify for identification as a PSSA under only one of the categories of criteria, the Wadden Sea is significant for socio-economic, and scientific, and arguably for full ecological reasons as well.
- 5.3.8 In addition, the draft IMO Assembly resolution confirms that a PSSA may be identified within a Special Area and that the criteria with respect to the identification of PSSAs and Special Areas are not mutually exclusive (MEPC 46/6, paragraph 4.5)

## **5.4 Conclusions**

- 5.4.1 The purpose of PSSA designation is inextricably linked to the concept of sustainable development. The designation provides an opportunity to utilise existing powers more effectively; to regulate the passage of shipping through territorial sea; and to establish a managerial framework to address unacceptable environmental impacts.
- 5.4.2 The Wadden Sea comprehensively meets the ecological, socio-economic and scientific and educational criteria established by IMO for PSSA designation.
- 5.4.3 The Guidelines (MEPC 46/6 Annex 2 paragraph 4.3) state that:  
“The criteria relate to PSSAs within and beyond the limits of the territorial sea. They can be used by IMO to designate PSSAs beyond the territorial sea with a view to the adoption of international protective measures regarding pollution and other damage caused by ships. They may also be used by national administrations to identify Particularly Sensitive Sea Areas within their territorial seas.”
- 5.4.4 It should also be noted that the evidentiary requirement for qualification against the PSSA criteria, as set out in the Guidelines, is kept distinct from the requirement to justify any proposed associated protective measure(s). In other words, the Wadden Sea Area qualifies for PSSA status, in the opinion of the authors of this report, on the basis of the significant characteristics described, irrespective of whether or not any associated protective measures are considered appropriate.

## **Chapter 6. Benefits and burdens of PSSA designation**

### **6.1 Introduction**

6.1.1 Task III of this study requires a consideration of the benefits and burdens of a Wadden Sea PSSA in general. This has been achieved by considering secondary information and by gauging a range of stakeholder views.

### **6.2 Evidence from existing and proposed PSSA designations**

6.2.1 To date, only two PSSA designations are in force and thus objective information on the value of the designation is limited and geographically specific. Nevertheless, a dialogue with the Project Manager for Shipping and Maritime Pollution Response within the Water Quality and Coastal Development Group of the Great Barrier Reef Marine Park Authority (GBRMPA) has been held as part of this study.

6.2.2 The principal benefit of the Australian designation, which has now been in place for 10 years, is perceived to be the recognition of the area by the IMO, enabling Australia to gain acceptance of some management measures by the IMO that might otherwise have been rejected. Enhanced environmental protection has resulted in costs to industry due to specific management measures (e.g. coastal pilotage), although these are not specific to the PSSA declaration, and they are considered to be reasonable. The PSSA application followed widespread consultation and gained the unanimous support of industry and the local community.

6.2.3 The Great Barrier Reef PSSA has significantly raised awareness of the area within the shipping community. Ottesen *et al.* (1994) stated that ‘owners and operators of small vessels are sensitised to the significance of the environment and as a result tend to encourage higher watchkeeping levels and mandatory rest periods. However, grounding of the 21,000-tonne container ship, *Bunga Teratai Satu*, on the Great Barrier Reef in November 2000 serves to illustrate that accidents will still happen.

6.2.4 The United States proposal to designate the marine area around the Florida Keys as a PSSA (MEPC 46/5), states that “the objective of PSSA designation is to address the area’s vulnerability to damage by international shipping, increase maritime safety, and heighten mariners’ awareness of the sensitivity of, and risks to navigation in, this area.”

### **6.3 Trilateral discussions 1994-2000**

6.3.1 The concept of a Wadden Sea PSSA was initiated in 1994 with the rationale that the designation could serve to provide:

- ◆ Awareness and attendant publicity through nautical publications (Notices to Mariners, passage planning charts; pilots; IMO publications);

- ◆ Aid to international agreements re: routeing;
- ◆ Benefits of ITZ regimes to wider area; and
- ◆ An example of good practice within EU.

The intention was to agree a draft proposal and environmental description of Wadden Sea PSSA (1.9.94) for consideration at MEPC 37.

- 6.3.2 A meeting of representatives of the Wadden Sea countries later that year (15.9.94) failed to agree on the draft proposal. Most significantly the proposal was not acceptable to Germany on the basis that, at that time, it was not in accordance with German position on MARPOL 73/78 Special Area designation for the whole North Sea.
- 6.3.3 As a consequence, at the 7<sup>th</sup> Trilateral Governmental Conference in Leeuwarden (30.11.94), ministers agreed :
- ◆ to study and consider a proposal to the IMO to designate the Wadden Sea and an adjacent zone as a PSSA (§ 64.1); and they
  - ◆ recognised the shipping measures installed by The Netherlands and Germany off the coast of the Frisian Islands (§ 64.2).
- 6.3.4 The principle of whether or not to consider PSSA designation was revisited at a trilateral meeting on 24.9.96. At this meeting it was agreed that PSSA and Special Area designations are mutually supportive. However, attempts to draft a PSSA proposal to the IMO were unsuccessful and a particular concern was that the entrance to the harbours in the Wadden Sea Area would be complicated by PSSA designation.
- 6.3.5 On this basis ministers at the 8<sup>th</sup> Trilateral Governmental Conference in Stade (22.10.97):
- ◆ noted the progress being made within IMO to reduce the environmental impact of shipping, “especially with the mandatory routeing measures for oil and chemical tankers off the Dutch and German Wadden Sea coast”(§23);
  - ◆ noted that all relevant measures had been taken inside the Wadden Sea Area or in the adjacent area according to enable PSSA designation (§24); and
  - ◆ endorsed “a study on the possibilities for a proposal to the IMO to designate the Wadden Sea and an adjacent zone a Particularly Sensitive Sea Area (PSSA)” (§25).
- 6.3.6 Most recently WWF Project Team Pallas published an independent report (WWF, 2000) calling on the trilateral government conference in 2001 to apply for PSSA designation and suggested a range of associated measures.



## 6.4 Analysis of stakeholder views

6.4.1 A synopsis of the views of the main organisations with a direct interest in this topic has been compiled from responses to the questionnaire survey. All figures are presented as percentages of the sample of 35 respondents.

6.4.2 Fundamentally, a division between those in favour of pursuing PSSA status (represented in tables as +) and those against (represented as -) remains. A significant number of stakeholders are also undecided (represented in tables as ?). The division is both in terms of national and sectoral interests as shown in the following tables. Of the sample, which is roughly equally split between the nationalities of the three Wadden Sea countries and other interests, half were in favour and one fifth against. There is no national consensus but Dutch and Danish stakeholders are mostly in favour or undecided and German stakeholders mostly against or undecided. The sample is skewed in favour of policy makers, regulators and administrators, the majority of whom (69%) are in favour of pursuing PSSA designation. Those who consider themselves affected by environmental interests are environmental groups, fisheries and tourism. Those not affected either had a wider remit or over-riding economic responsibilities. Commercial and economic interests were under-represented in the response sample but are the principal source of objections.

*Table 6: Stakeholder replies by nationality regarding possible PSSA designation*

<b>Nationality</b>	<b>+</b>	<b>?</b>	<b>-</b>	<b>Total (%)</b>
NL	23	7	0	30
D	7	9	10	26
DK	10	7	3	20
Other and International	10	7	7	24
<b>Total %</b>	<b>50</b>	<b>30</b>	<b>20</b>	<b>100</b>

*Table 7: Stakeholder replies by sector regarding possible PSSA designation*

<b>Sector</b>	<b>+</b>	<b>?</b>	<b>-</b>	<b>Total (%)</b>
Commercial marine operator	3	0	10	13
Policy maker, regulator, admin	37	10	7	54
Affected by environmental interests	10	13	0	23
Not affected by environmental interests	0	7	3	10
<b>Total %</b>	<b>50</b>	<b>30</b>	<b>20</b>	<b>100</b>

6.4.3 The majority of stakeholders sampled had an area of interest that included the Wadden Sea and the adjacent North Sea. Only 17% suggested their area of interest was limited to the Wadden Sea or the Wadden Sea and the Inshore Traffic Zone. However, as shown below, there was no consensus about whether enough is known about the economic or environmental implications of marine pollution in the Region, particularly the implications for tourism and fisheries.

*Table 8: Stakeholder opinion concerning economic and environmental implications of marine pollution*

<b>Opinion of stakeholders</b>		+	?	-	<b>Total (%)</b>
Enough known about Economic Implications	No	30	16	4	50
	Yes	20	7		27
Enough known about Environmental Implications	No	34	16	4	54
	Yes	16	7		23
Not completed			7	16	23
Total %		50	30	20	100

Many feel that information on this subject is lacking and thus, by implication, a more detailed study of the environmental impact of shipping in the southern North Sea is needed. However, a number of stakeholders in favour of PSSA designation suggested enough is known concerning direct costs to justify action, and it is the indirect costs that are more difficult to ascertain. The majority of those not in favour of PSSA designation declined to give an opinion on this issue.

6.4.4 Once again there is a diversity of views relating to the adequacy of existing measures to regulate maritime operations and reduce the likelihood of accidents. Nevertheless, as shown below, 70% of the stakeholders sampled, including the majority of those against pursuing the PSSA designation, believe that the Wadden Sea is at risk from large ships carrying hazardous substances (in combination with prevailing winds):

*Table 9: Stakeholder opinion concerning operational factors posing a risk to the environment of the Wadden Sea*

<b>Operational factor</b>	+	?	-	<b>Total (%)</b>
Vessel types	27	17	4	48
Harmful substances	37	23	10	70
Traffic characteristics	30	17	0	47
No comment		7	7	14

Less than 50% believe there is a risk from the variety of vessel types or traffic characteristics but individuals highlighted concerns related to:

- ◆ High densities of traffic with ships and fishing vessels crossing traffic lanes;
- ◆ The combination of different types of recreational and commercial traffic;

- ◆ Illegal discharges of oil, garbage and sewage; and
- ◆ The implications of natural navigational hazards including strong tidal movements, prevailing onshore winds, shallow coastal waters, narrow sinuous fairways, and storms associated with the North Sea

6.4.5 Those against PSSA designation included the following arguments within their feedback:

- ◆ Existing protection measures in place are sufficient, particularly if properly enforced in a co-ordinated way;
- ◆ Few accidents have been recorded in the Wadden Sea despite its high traffic density;
- ◆ Some of the suggested additional measures are being addressed internationally;
- ◆ Doubts that any new regulations will really protect the area (e.g. extra protection/measures could not have prevented Pallas accident and grounding) but may adversely restrict fairways, dredging and fisheries;
- ◆ If necessary improvements can be realised at the national level and/or by bilateral co-operation; and
- ◆ Implications of promulgation through charts (i.e. the chart used as a management ‘tool’ for environmental matters as well as for safety of navigation could lead to the chart becoming too ‘cluttered’ with information which could adversely effect its role).

6.4.6 Views of those in favour or undecided about PSSA designation as to who should pay for PSSA designation were equally split between those who consider governments, and thus the tax payer, should pay and those who advocate that the shipping industry should pay under the ‘polluter pays principle’. A view was also expressed that no appreciable extra cost need be involved. Indeed it was felt by some that better organisation of existing resources, including sharing of resources between the Wadden Sea countries, would be advantageous. A combination, with governments to provide infrastructure costs e.g. for tugs or harbour subsidies (also to avoid disadvantages in competition with ports with less valuable and sensitive ecosystems to consider) and users to contribute, was also suggested.

6.4.7 Stakeholders were also asked to specify a favoured outcome should an application for PSSA designation be taken forward. The results are shown below:

*Table 10: Stakeholder opinion concerning the appropriateness of additional protective measures*

<b>Favoured outcome</b>	<b>+</b>	<b>?</b>	<b>-</b>	<b>Total %</b>
Status quo	10	3	7	20
Additional measures if endorsed by majority	34	10	0	43
Further consultation	3	14	0	17
Additional measures in any event	3	0	0	3
No response	0	3	14	17
<b>Total %</b>	<b>50</b>	<b>30</b>	<b>20</b>	<b>100</b>

Additional commentary included a view that more stringent control of existing measures, especially with regard to operational discharges, was needed. Within the sample, 60% supported additional measures, if endorsed by the majority and/or further consultation. This consideration of potential additional measures might be considered valid, albeit that some stakeholders felt that this should more closely involve the shipping industry.

## 6.5 Benefits and burdens

6.5.1 The principal generic benefits of PSSA designation suggested by the stakeholder interviews include:

- ◆ Heightened international awareness of environmental value:
  - Political signal
  - Better compliance with regulations and thus reduced risk of accidents and better decision-making
- ◆ Potential introduction of additional measures to minimise environmental damage:
  - Reduction of pollution hazards, especially illegal discharges and air emissions
  - Safe havens to contain damaged vessels
  - More time to react to problems
- ◆ Recognition of local priorities by international interests:
  - In court may constitute a factor for heavier fines thus allowing public prosecutors to act against offenders, mainly in the fields of illegal discharges and irresponsible behaviour
  - Benefits to recreation, tourism and local fisheries

6.5.2 The principal generic burdens suggested by the stakeholder interviews include:

- ◆ Additional costs for ships bound for ports within the PSSA
- ◆ Reduced competitiveness
- ◆ Danger of under evaluation of wider maritime concerns with no assurance that the environment will be better safeguarded:
- ◆ Potential confusion between navigational safety and environmental protection on charts:
- ◆ Additional bureaucracy (especially related to reporting requirements):
- ◆ Policing and monitoring responsibilities:
  - Competence disputes (Federalism)
  - Additional infrastructure and operation costs for governments

6.5.3 Each of these points has been considered in relation to international shipping, economy and ecology as summarised in the following tables:

*Table 11: Evaluation of benefits and burdens for international shipping*

<b>International shipping benefits and burdens</b>	
<b>Suggested generic benefit</b>	<b>Evaluation</b>
Heightened international awareness of environmental value	<p>Message that shipping presents an environmental risk but that shipping interests are concerned about the environment and enhanced navigational safety</p> <p>Recognition of the importance of shipping to the Wadden Sea states</p>
Potential introduction of additional measures to minimise environmental damage	<p>Incentive for better found vessels/management</p> <p>Reassurance that measures are in place</p> <p>Greater support for shipping needs from wider community</p>
Recognition of local priorities by international interests	Disincentive to sub standard shipping
<b>Suggested generic burden</b>	<b>Evaluation</b>
Additional costs for commercial interests	<p>Costs relate to measures. Most measures in place or being put in place.</p> <p>Shipping sector should bear some burden of need to protect unique environmental asset.</p> <p>Potential loss of competitiveness, related to any associated protective measures, which should be determined by further study into the question of which ports would be affected by additional costs and which would not be.</p>
Danger of under evaluation of wider maritime concerns with no assurance that the environment will be better safeguarded	Assurance cannot be 100%, but PSSA put all stakeholders 'on notice'.
Potential confusion between navigational safety and environmental protection on charts	Can be addressed by relevant agencies and maritime education and training
Additional bureaucracy	Record keeping requirements would be in line with measures
Policing and monitoring responsibilities	State responsibility

*Table 12: Evaluation of benefits and burdens for the Wadden Sea economy*

<b>Economic benefits and burdens</b>	
<b>Suggested generic benefit</b>	<b>Evaluation</b>
Heightened international awareness of environmental value	<p>Wadden Sea states more marketable (e.g. ecotourism relies on clean environment)</p> <p>Reduced cost of dealing with public pressure and bad publicity relating to marine pollution</p> <p>Reduced cost of accident and emergency &amp; compensation claims</p>
Potential introduction of additional measures to minimise environmental damage	<p>Potential costs of measures (e.g. costs to provide safe havens)</p> <p>Reduced costs of clean-up</p>
Recognition of local priorities by international interests	<p>Heavier fines move burden from local communities to source of pollution (polluter pays principle)</p> <p>Acceptance that environment is not a ‘free good’</p> <p>Incorporates local economic interests (e.g. shell fisheries and tourism) unlike nature conservation designations</p> <p>Does not impede plans for port expansion</p> <p>Evidence of political response/investment in environmental protection as a response to “Pallas” incident</p>
<b>Suggested generic burden</b>	<b>Evaluation</b>
Additional costs for commercial interests	Costs related to any additional measures (e.g. pilotage)
Danger of under evaluation of wider maritime concerns with no assurance that the environment will be better safeguarded	Valuation of the environment continues to be elusive in practice
Potential confusion between navigational safety and environmental protection on charts	Cost of awareness raising
Additional bureaucracy	<p>Costs related to PSSA implementation</p> <p>Costs in terms of record keeping</p>
Policing and monitoring responsibilities	<p>Costs borne by authorities</p> <p>Potential offset of costs to shipping (e.g. harbour dues)</p>

*Table 13: Evaluation of the benefits and burdens for Wadden Sea ecology*

<b>Ecology benefits and burdens</b>	
<b>Suggested generic benefit</b>	<b>Evaluation</b>
Heightened international awareness of environmental value	Wadden Sea is temperate marine ecosystem of global significance  Sustainable development best practice example  Will help address operational pollution problems
Potential introduction of additional measures to minimise environmental damage	Less impact  Complements Special Area status  Additional protective measures can be directed at resources currently not adequately protected  Reassurance of ability to ‘contain’ damage
Recognition of local priorities by international interests	Health of natural systems underpins whole region  Reassurance to Wadden sea communities that environmental concerns are taken seriously
<b>Suggested generic burden</b>	<b>Evaluation</b>
Additional costs for commercial interests	Commercial interests should recognise ecological values
Danger of under evaluation of wider maritime concerns with no assurance that the environment will be better safeguarded	Sustainable development requires a balance of all interests
Potential confusion between navigational safety and environmental protection on charts	
Additional bureaucracy	
Policing and monitoring responsibilities	Closer links between science and commercial interests, fostering better co-operation for the wider region

## 6.6 Alternatives

6.6.1 Clearly, whilst the PSSA possibility provides a framework, within which IMO measures can be implemented, additional protective steps can be implemented without the designation. These include:

- ◆ Close co-operation between the public prosecutors of the three Wadden Sea countries with regard to illegal discharges in and near the Wadden Sea area, leading to stricter enforcement of existing measures and larger fines;
- ◆ More active information dissemination, indicating the vulnerability of the Wadden Sea, through existing communication channels such as Notes to Mariners, notes in Pilot books; and
- ◆ Improved shore reception facilities in north-west Europe; regulations for EU Open Waters; and better Port State control.

## 6.7 Conclusions

- 6.7.1 Evidence from existing and proposed PSSAs is positive. It also indicates the importance of explaining the concept to the wider community and convincing them as to its efficacy. This is a common requirement when dealing with environmental risk (Margolis, 1996).
- 6.7.2 The idea of a Wadden Sea PSSA continues to be contentious. However, the weight of subjective opinion, drawn from the stakeholder questionnaire, is in favour of a PSSA application.
- 6.7.3 Benefits of Wadden Sea PSSA designation outweigh the burdens on the basis that:
- ◆ The PSSA concept recognises the competence of existing as well as any proposed additional risk management and reduction measures;
  - ◆ The cost to international shipping associated with PSSA designation is relatively modest, largely linked to any proposed additional measures and consistent with the polluter pays principle;
  - ◆ The PSSA criteria reflect the importance of the full range of economic activities associated with the Wadden Sea Area;
  - ◆ The supra-regional environmental importance of the Wadden Sea would be reinforced, particularly in terms of vulnerability to risks associated with international maritime activity, consistent with the precautionary principle;
  - ◆ The direct and indirect costs of dealing with a major pollution incident (in addition to what is actually achievable) on a soft sediment shoreline are significantly more than for a rocky shoreline, due to logistics associated with restricted access (Collinson, pers.com. 2001); and
  - ◆ The threat to the Wadden Sea environment from the impact of international shipping is largely derived from maritime activity in the adjacent North Sea zone.
- 6.7.4 A key benefit is the message that PSSA designation sends out to the international shipping community concerning the intrinsic value of the Wadden Sea environment. This would also serve to heighten awareness of enforcement agencies and the judiciary.
- 6.7.5 Alternatives to PSSA and additional measures that do not require IMO approval can be pursued in parallel.
- 6.7.6 Furthermore, lack of consensus does not preclude consideration of additional associated protective measures and boundary options.



## **Chapter 7. Adequacy of existing measures to control maritime activities**

### **7.1 Introduction**

- 7.1.1 Task IV of this feasibility study was to consider associated protective measures. Specifically the study was asked to produce an assessment of whether existing measures are sufficient and whether additional ones are needed.
- 7.1.2 As a basis for this debate, other considerations for the identification of a PSSA, as prescribed by the IMO guidelines (MEPC 46/6 Annex 2 Paragraph 5.1), have been considered. A combination of vessel traffic characteristics and natural factors are influential in identifying whether the area is at risk from international shipping activities. However, the main focus of the chapter is to consider the adequacy of measures to control maritime activities in the Wadden Sea and the adjacent North Sea zone.

### **7.2 Vessel traffic characteristics**

#### Operational factors

- 7.2.1 Types of maritime activities in the Wadden Sea that may increase risk to the safety of navigation include a mix of small fishing boats, recreational craft and oil and gas rigs. Water depths are comparatively shallow and deep draft ships may navigate with a small underkeel clearance for long distances. The problem of shallow water is compounded by:
- ◆ numerous wrecks, the majority of which have been located and swept;
  - ◆ Mine danger areas - although the risk to surface navigation is minimal and the recognised shipping routes are considered free of danger, mines are a hazard for fishing, anchoring and seabed activity;
  - ◆ Military exercise areas, which include firing practice and naval manoeuvres, including submarines on or below the surface in the German Bight; and
  - ◆ Marine exploitation activity, including survey vessels, oil and gas drilling rigs, production platforms and seabed installations and pipelines but which are to the west and north of the area.

#### Vessel types

- 7.2.2 All manner of vessels pass through or adjacent to the area. These include high-speed vessels, large tankers and bulk carriers with small under-keel clearance. They also include many smaller coastal ships, whose condition and level of crew training is questionable. Lang (2001) strongly reaffirmed problems globally associated with low cost crews (e.g. Russian and Ukrainian), minimal manning, and lack of English language ability. The table below gives details of traffic occurrence in the German Bay and Jade 1999 according to ship types. The figures confirm a predominance of product tankers. These are likely to be small to medium sized ships (2,500 – 40,000 DWT). Oil, chemical and gas tankers range enormously in size from small vessels to very large tankers (1,500 – 350,000

DWT). Bulk carriers and container ships are the largest vessels. The table emphasises the range of vessels using the Wadden Sea and adjacent North Sea.

### Traffic characteristics

7.2.3 The coasts of the English Channel and the southern North Sea include major ports and consequently the sea areas have some of the highest traffic concentrations in the world. The southern North Sea also experiences considerable through traffic to and from the Baltic Sea and Scandinavia. Shipping traffic in the southern North Sea can be differentiated into route committed shipping, fishing and random traffic. A high proportion of the latter is supply shipping. While position fixing for ships has improved considerably with the availability of the Global Positioning System (GPS), the collision hazard has increased with the growth in shipping movements. Estimates for the whole offshore North Sea area suggest “more than 420,000 shipping movement per year, of which approximately 260,000 shipping movements are in the area of The Netherlands continental shelf” (Gauss, pers. com. 2001).

Table 14: An example of Wadden Sea traffic characteristics

Traffic occurrence (traffic lanes/areas only) in the German Bay and Jade 1998 and 1999														
	All '99	'98	T-Ger '99	'98	Ger-West-A	'98	Jade App - '99	'98	Elbe App '99	'98	Inshore T Z '99	'98	54°N and NW	'98
1-5	63	124	8	27	0	2	0	0	27	32	0	0	0	2
B	2238	2672	1340	1068	347	379	165	263	942	853	0	0	26	28
C	8043	8171	5816	5127	59	108	75	194	4406	4060	0	0	38	24
G	25533	27246	11767	16000	367	421	423	704	16609	15546	1	0	656	599
H	3637	2365	1849	1582	351	251	114	79	2308	1486	0	0	269	88
L	1050	923	411	365	92	117	52	102	531	336	0	0	326	150
M	4299	4170	369	540	90	84	168	138	1112	507	44	45	8	2
O	4132	5243	1169	1584	635	655	596	702	1878	1801	1	0	426	332
P	3067	1883	1158	529	86	72	32	27	1564	756	0	0	103	74
R	2575	0	1513	0	270	0	24	0	1731	0	0	0	314	0
S	2570	2251	400	468	42	37	66	66	830	519	7	5	11	10
V	2336	2885	1594	1687	9	84	105	202	685	997	1	1	13	137
X	1698	1751	295	250	43	26	68	91	405	243	4	1	11	0
Tot	61241	59684	27689	29227	2391	2236	1888	2569	33028	27136	58	52	2201	1446

**Key:**

- T-Ger '99 = Tersch-German Bight
- Ger-West-A = German Bight-Western Approach '99
- Jade App '99 = Jade Approach '99
- Elbe App '99 = Elbe Approach '99
- Inshore T Z '99 = Inshore Traffic Zone '99
- 54°N & NW = 54°N and NW North sea '99
- 1-5 = inland ships
- B=Bulk Carrier; C=Container ship; G=Product tankers; H=Chemical tankers; L=Gas tankers; M=Navy/Authorities; P=Passenger/ferries; R=Roll-on Roll-off; S=Special ships; V=Car transporters; X=Others

[Source: Gauss pers. Com. 2001] WSD NW; Quelle Verkehrsdaten Verkehrszentrale Wilhelmshaven.

### Harmful substances carried

7.2.4 Oil tankers, oil product tankers, chemical tankers and gas tankers, together with other product carriers, are the ship types associated with the highest technical failure risk. Liquid and solid bulk carriers represent the oldest ships and those most prone to structural failure. Many thousands of these ships use the area regularly.

## **7.3 Natural factors**

7.3.1 Navigational hazards in the Wadden Sea Area are compounded by long periods of poor weather, tidal streams, and low coastlines. In addition, changes to water depths due to seabed sand wave movement and the possibility of negative tide surges due to meteorological conditions add to the hazard for deep-draft vessels. A number of geographically specific factors make navigation difficult and pollution risk higher in the southern North Sea. These are:

7.3.2 Hydrographical factors:

Within the area the water depth can be as shallow as 0m in areas adjacent to emergent shoals up to an average depth of approximately 40m in the offshore zone. This risk can only be quantified by undertaking a time series analysis of past surveys (ideally 6 monthly), having liaised with the relevant charting authorities (i.e. databases for original hydrographic survey data in order to identify trends). For the purposes of this study, however, it is considered sufficient to highlight the following specific considerations:

- ◆ mobile sand waves and changes to charted depths by gales and tidal streams;
- ◆ offshore tidal levels which are difficult to predict due to co-tidal effects and negative surges up to 2m;
- ◆ low lying and uniform appearance of mainland coast and Frisian Island chain making fixing by radar and visual difficult;
- ◆ the presence and changing nature of shoals and banks which extend well offshore due to the high sediment content of rivers feeding into the coastal zone; and
- ◆ numerous wrecks, which rotate over time due to scouring, resulting in unpredictable clearances within comparatively short timescales.

7.3.3 Meteorological factors:

The general climate and weather conditions for the region are described in the Admiralty Sailing Directions North Sea (East) Pilot (Hydrographer of the Navy, 2000). Specific considerations are:

- ◆ the frequency of poor visibility with coastal areas affected by radiation fog and sea fog. Sea fog can last all day and radiation fog (most common in winter and spring) may also, on occasions, be very slow to clear;

- ◆ onshore gales are not uncommon whenever a deep depression transits the area. The pilot states that ‘gale frequencies for coastal waters are usually about half those recorded over the open sea. Records for Helgoland and Die Elbe show that most gales last for less than 4 hours, 20% for 4 – 6 hours, 10% for 6 – 10 hours and 4% for 12 hours or more’ (Hydrographer of the Navy, 2000 p. 42); and
- ◆ Sea ice in the coastal waters in winter, although in normal winters the area is completely or almost completely ice free.

#### 7.3.4 Oceanographic factors:

The oceanographic characteristics of the region have already been described in section 4.2.2. Specific considerations are:

- ◆ tidal streams in the German Bight set alternately southeast and northwest, but closer inshore, run parallel to the coast and into estuaries with a flood tide;
- ◆ ‘continental water’ is retained near the coast for the whole of the Wadden Sea due to the regional circulation pattern; and
- ◆ vertical mixing of water throughout the year within the Wadden Sea because of turbulence from strong currents and summer stratification in the adjacent North Sea.

These characteristics are considered to be fundamentally important when determining the area in which any maritime pollution incident would be contained. Mapping of the spread of pollutants, such as Apron plus 1993/94, highlights the way in which non-biodegradable pollutants of this nature drift and are confined within a discrete but extensive geographic area.

## 7.4 Other considerations

### Evidence of damage

7.4.1 Stakeholders in favour of PSSA designation cite numerous examples of oil and chemicals being washed ashore; containers being lost overboard; evidence of the illegal discharge of bilge oil; and ships taking short cuts outside designated sea-lanes. Operational discharges are perhaps more significant than accidental pollution, but they are difficult to quantify.

### Past incidents

7.4.2 Calls for stricter surveillance and more severe action against offenders are often driven by the environmental impacts and perceived impacts of past incidents. This has been amplified by the recent history of significant incidents world-wide such as the *Esso Bernica* docking at Sullom Voe terminal (1978); *Braer* in Shetland (1993), *Sea Empress* in Pembrokeshire (1996), *Erika* off France (1999); *Multitank Ascania* in the Pentland Firth (1999); *Jessica* in the Galapagos Islands (2001); and the tanker *Baltic Carrier* in the sea lane between the north German coast and the Danish island of Falster (2001).

7.4.3 Given the vessel traffic characteristics of the Region (as described in section 7.1), the Wadden Sea and adjacent North Sea has an excellent record of few accidents and incidents. During the period 1995-1999 a total of almost 800,000 ship movements in the German North Sea resulted in just over 100 incidents less than 30% of which resulted in tug deployment.

7.4.4 Nevertheless, within the Wadden Sea incidents such as *Sherbro* (1994), *Paraffin* (1998), *Pallas* (1998) and more recently *Lucky Fortune* (1999), almost stranded on the island of Sylt but saved by a tug, have brought into question the ability to respond to accidents including time factor, co-ordination and overall responsibility. In particular, the *Pallas* accident, reported by Reineking (1999), is considered by environmentalists to have compounded previous oil pollution incidents. The *Pallas* caught fire 55nm off the Danish coast, drifted aground off Germany's Amrum Island, and spilled 244 tonnes of intermediate fuel oil and sludge after stranding. As a result some 26,000 birds were oiled and 16,000 died. Following the accident:

- ◆ An independent German expert commission reviewed the capacity of emergency tugs and fire fighting vessels, together with the availability of technical pollution countermeasure equipment and, in March 2000, presented 30 suggestions on improving reaction in the case of future accidents;
- ◆ A 'weak-spot' analysis was undertaken by State Government in Schleswig-Holstein; and
- ◆ A German Admiralty Court in Kiel held an investigation.

It is debatable whether this incident was avoidable. Tug boats were available but grounding was not avoided due to adverse weather.

#### Foreseeable circumstances under which significant damage could occur

7.4.5 In future maritime activities will be influenced by the changing balance of port and flag state interests and the Wadden Sea ports will want to incorporate the development of VLCCs, roll-on/roll-off, high speed craft and containerisation. Predicted trends are:

- ◆ Small ships will continue to be replaced by larger vessels, although tankers and bulk carriers are not expected to increase in size significantly;
- ◆ Conventional cargo shipping will continue to be reduced in favour of container ships; and
- ◆ More high speed ships.

7.4.6 High speed ships currently operating on short sea ferry routes, have potential adverse impacts on ecology, amenity value and safety of sites used for recreation. In future fast cargo ships are predicted. Impacts include:

- ◆ Increased risk of collision – ships operating over 30 knots become the may be required to become the 'avoiding vessel'. For many traditional sea users the offshore implications of high speed ship development are far-reaching and fundamental;
- ◆ High speed ships use up to four times as much fuel resulting in air pollution and operational hydrocarbon discharge; and

- ◆ Research has highlighted wake generation impacts – above a critical speed the wash can become ‘focussed’ producing particularly high waves; a long period, high energy, non-dispersive wash is produced, which is still energetic and potentially dangerous when breaking; ‘trail’ waves are particularly dangerous to small open boats.

7.4.7 The German Wadden Sea ports in particular have expansion plans to accommodate container shipping and proposed offshore wind farms present additional hazard.

7.4.8 A composite hazard and measures map is presented in Figure 4. The principal features that have been mapped are complex shipping traffic areas, Traffic Separation Schemes, Deep Water Routes, military exercise areas, potential areas for offshore wind parks, oil and gas exploitation sites, VTS and radar coverage.

#### Stresses from other environmental sources

7.4.9 The stress from other sources has already been highlighted and these chemical loadings are rigorously monitored (see section 5.2.16). The Wadden Sea ecosystem is therefore already under stress from land-based pollution.

### **7.5 Review of existing regulations in the Wadden Sea region**

7.5.1 The existing arrangements for managing international maritime activities throughout the Wadden Sea comprise a complex combination of international and national legislation, routeing measures, port pilotage, vessel traffic systems and navigational warnings (see Figure 4).

7.5.2 A review of the coverage of existing regulations has been undertaken based on information drawn from the CWSS summary of existing regulations, IMO Ships’ Routeing, Admiralty Charts, and Admiralty List of Radio Signals relating to pilotage, VTS and reporting systems. The practical experiences of ship’s officers currently navigating in the area have also been taken into account. The CWSS summary of existing regulations is included in Annex 4.

#### Navigation

7.5.3 Radio navigational warnings contain information that directly affects safety of life at sea. They are issued by VTS centres for their areas of responsibility and sea warning service at Cuxhaven for the entire German area. Warnings by NAVTEX are made through Netherlands coast guard at IJmuiden. Warning by VHF are made via Bremen MRCC. Storm flood warnings and water level predictions, e.g. unusually low sea levels, are broadcast as a navigational warning.

7.5.4 Position fixing is primarily through Differential GPS and electronic charts, so negating many of the navigation difficulties noted above, although it is recognised that not all ships will be so equipped. Navigation techniques include waypoint navigation and parallel indexing on buoys to monitor progress. Radar beacons

(racons) provided on some buoys are particularly useful by providing identification of the mark, the racon on VL Centre and Borkumriff in particular. Buoys and beacons are well lit and maintained. Radar navigation off the land is of relatively little value as it is low lying and some distance away.

- 7.5.5 The problem of depths needs to be seen in the context of the ship's draft but the likelihood of pollution resulting from stranding is low because of the soft bottom of mud and sand. However, this is a question of timing. Whilst there is lower immediate potential of breaking hull integrity, if it is not possible to remove the ship relatively quickly from sand (i.e. bow wedge), it will break up through hogging and sagging. Furthermore, anchoring in the vicinity of pipelines will pose a danger. The tidal streams are not considered a particular problem to navigation and NAVTEX is a reliable way of receiving navigational warnings.
- 7.5.6 Shelter from a southwest wind can be obtained in the lee of Friesian Islands, but there is no escape from strong northerly winds, which can produce a heavy sea. It is often foggy in the area. Tidal ranges vary between 1m and 3m, being greatest towards the inner German Bight and tidal streams about 1-2 knots maximum.

#### Collision avoidance

- 7.5.7 The density of commercial shipping, especially in the shipping lanes, and the presence of fishing vessels and recreational craft in the summer is a major consideration for safety and pollution prevention. IMO routing schemes are in place in southern North Sea to simplify traffic flows so reduce the collision hazard. The main routes in the southern North Sea are:
- ◆ Deep Water Route and Traffic Separation Scheme (TSS) from North Hinder to the German Bight via the Frisian Junction, which has been specially surveyed;
  - ◆ Coastal Route and TSS off Texel, Vlieland, Terschelling and which joins the Deep Water Route & TSS at the Jade Approach TSS; and
  - ◆ Inshore Traffic Zone (ITZ), between the Coastal Route and the coast.
- 7.5.8 The Deep-Water Route is mandatory for the following classes of ship:
- ◆ Tankers of 10,000 GT + carrying oils as defined under Annex 1 of MARPOL 73/78;
  - ◆ Ships of 5,000 GT+ carrying noxious liquid substances in bulk categories A or B of Annex II of MARPOL 73/78;
  - ◆ Ships of 10,000 GT+ carrying noxious liquid substances in bulk categories C or D of Annex II of MARPOL 73/78; and
  - ◆ Ships of 10,000 GT + carrying liquefied gases in bulk.
- 7.5.9 These ships are required to avoid the sea area between the mandatory route and the adjacent Friesian Islands' coast, except when joining or leaving the route at the nearest point to the port of departure or destination. These ships are required to use the mandatory route, or part of it, when:
- ◆ Sailing from North Hinder to Denmark, Germany or the Netherlands north of 53°N and vice versa;
  - ◆ Sailing between North Sea ports of Netherlands and/or Germany, except in

cases of adjacent port areas;

- ◆ Sailing between UK or Continental ports south of 53°N and Scandinavian or Baltic ports; and
- ◆ Sailing between North Hinder, UK or Continental North Sea ports south of 53°N and offshore and shore-based oil-loading facilities in the North Sea area.

7.5.10 Ships using the mandatory route for tankers from the North Hinder to the German Bight are recommended to use adequately qualified deep-sea pilots in the North Sea. In the vicinity of the TSS all ships are required to conform with Rule 10 of the Convention for the International Regulations for Preventing Collisions at Sea, 1972, as amended (COLREGS).

7.5.11 The Vlieland junction adjacent to Terschelling is problematical. Traffic conditions are busy and there are often fishing vessels operating in the area, including the TSS, fishing for flatfish (plaice, sole), roundfish (cod) and shrimps. Fishing boats account for 29% of the total shipping traffic (15% in the area of the main shipping routes). Approaching the area from the east is difficult at night as lights of ships and buoys can be lost against the background of floodlit gas and oil installations. Although there is radar surveillance at Den Helder, Terschelling & Schiermonnikoog this is for port entry and departure and Wadden Sea traffic only. Aircraft surveillance is undertaken periodically, and when ships are reported in contravention of the regulations regarding Traffic Separation Schemes and Inshore Traffic Zone.

7.5.12 The second area identified as a problem is the junction at the eastern end of the TSS adjacent to the R. Elbe and R. Jade entrances, especially between the Elbe and E3 pillar buoys with ships heading for the Inshore Traffic Zone. Traffic can be dense and there are often situations where the movement of vessels may be hard to interpret. However the German Bight VTS area is highly competent and very useful: it provides a high level of anti-collision advice to mariners in its area. This compares with the absence of radar monitoring of the TSS off Vlieland. This is highlighted as an area at risk because of junction and traffic density.

#### Pilotage, port entry and departure

7.5.13 European Directive 93/75/EEC requires the Master and Operator of vessels carrying dangerous or polluting goods to report cargo details entering or leaving EC ports.

Dangerous goods are defined in:

- ◆ The International Maritime Dangerous Goods (IMDG) Code
- ◆ The International Gas Carrier (IGC) Code
- ◆ The International Bulk Carrier (IBC) Code

Polluting goods are defined in MARPOL Annexes I, II & III.



7.5.14 In The Netherlands, harbour pilotage is compulsory for ships over 60m in length and for all vessels carrying oil, gas or chemicals. Voluntary deep-sea pilotage is available for ships required to use the North Hinder-German Bight mandatory route for tankers. Communications are normally carried out via VHF radio and ships are required to maintain a listening watch on VHF. Radar assistance is available on request in some ports. Pilotage is compulsory for Harlingen and other ports in the Wadden Sea.

7.4.15 In Germany, pilotage in the German Bight is compulsory for:

- ◆ Petroleum, gas and chemical tankers over 150m in length or 23m beam en route to and from Rivers Ems, Jade, Weser or Elbe;
- ◆ Bulk carriers, other than oil, gas & chemical over 220m length or 32m beam en route to and from the R. Elbe Range;
- ◆ Ships over 250m length or 40m beam en route to and from the R. Weser or Jade; and
- ◆ Other vessels over 350m length or 45m beam en route to or from R Jade, Weser or Elbe Range.

Pilot to be requested 24 hours prior to arrival at the pilot station, or on departure from the previous port of call. Update on ETA 6 hours and 2 hours before arrival.

District pilotage is compulsory for:

- ◆ Gas, chemical or petroleum in bulk, unloaded tankers if not cleaned, degassed or inerted after having carried oil with a Flash Point <35°C; and
- ◆ Other vessels over 90m length or 13m beam.

Pilot to be requested 12 hours before arrival or on departure from previous port.

Pilot stations location is changed in bad weather to a more sheltered location closer inshore. However, pilotage is compulsory between the normal position and the sheltered position for outward-bound vessels:

- ◆ >170m in length or 28m beam other than oil, gas or chemical vessels on the Rivers Ems, Jade, Weser and Elbe; and
- ◆ Car carriers & Ro-Ro vessels outward bound >130m in length or 21m beam in Rivers Ems, Jade and Weser.

7.5.16 In Denmark pilotage is compulsory for the following:

- ◆ Loaded oil tankers >1500 DWT;
- ◆ Loaded chemical tankers carrying dangerous liquid chemicals covered by the IMO Chemical Code;
- ◆ Gas carriers;
- ◆ Vessels carrying radioactive cargoes;
- ◆ Towing vessels of 150GRT+ navigating in dredged channels or marked navigation channels, into or past harbours or pilot stations (excluding harbour manoeuvres); and
- ◆ Tankers with uncleaned tanks not secured by inert gas.

Vessels inbound send requests for pilots 6 hours and 1 hour in advance to the appropriate pilot station.

- 7.5.17 In German waters, as in many other areas, there have been problems picking up pilots from their small cutters in bad weather. This means that vessels sometimes have to make their approach into the estuaries before the pilot can come aboard, or at times not take on a pilot at all. During these occasions radar assistance is available in most German ports. Communication by VHF radio is adequate with a range of 25 miles. The use of the recommended deep-sea pilot for the North Hinder-German Bight route is considered beneficial, but in some instances the cost of the recommended pilots is considered a deterrent to their use. In future, introduction of new technology (small water area twin hull) is likely to make new pilot tenders a more stable working platform.
- 7.5.18 Fatigue of ships' officers is considered a problem, especially in short sea shipping, when sailing from port soon after completion of cargo operations, officers may be tired following periods on duty in difficult conditions, e.g. through the English Channel and Dover Straits. Lang (2001) drew attention to the effects of fatigue and sleep deprivation at sea as a major international human factors related maritime safety problem.

#### Vessel traffic services (VTS)

- 7.5.19 VTS provide regulatory measures to prevent accidents and/or threat to the environment, control traffic flow by information warning, advice or instruction. The original aim of VTS was improve safety of navigation in and out of port, but this has been extended in some cases to monitor traffic flowing through an area. Participation in the VTS may be voluntary or mandatory. Ships are required to maintain a listening watch on VHF and to report to the VTS centre. The information to report will vary but usually includes a:
- ◆ Sailing plan;
  - ◆ Position report;
  - ◆ Deviation report; and
  - ◆ Incident report.
- 7.5.20 In the Netherlands VTS is provided:
- ◆ VTS Den Helder: All vessels equipped with VHF are requested to participate in this system. Vessels within the area should report when entering and leaving the VTS area. Traffic surveillance is provided;
  - ◆ VTS Terschelling: Reporting is mandatory for all vessels entering or leaving the VTS area;
  - ◆ Wadden Sea Central Reporting Station: Is responsible for co-ordinating the relevant maritime authorities with regard to all incidents within the Wadden Sea area;
  - ◆ VTS Schiermannikoog: Provides radar surveillance services for the Terschelling-German Bight TSS with range up to 48 miles; and
  - ◆ VTS Delfzijl: VTS is mandatory for all vessels, which includes an information service.

7.5.21 In Germany there are eleven VTS provided by the authorities on the North Sea coast. The five most relevant are:

- ◆ VTS Inner German Bight: This is a mandatory system and ships entering the area covered by the VTS must maintain a continuous listening watch on VHF. The area of coverage extends westwards along the Terschelling-German Bight TSS as far as the Borkumriff buoy opposite the entrance to the R. Ems and the between GW7 & GW9 buoys marking the southern boundary of the German Bight Western Approaches TSS. A Sailing Plan is required for all vessels entering the German Bight proceeding eastwards and southwards, and also when leaving port within the VTS area. Position Reports are required at subsequent intervals, and if necessary, a Deviation Report and an Incident Report. Radar assistance may be requested or by order of the VTS Centre for vessels under mandatory pilotage when visibility is less than 4000m. Information broadcasts are made at intervals, and on demand, regarding the safe passage of ships, traffic situation and vessels with restricted manoeuvrability.

- ◆ VTS Ems Traffic is mandatory for:

- ◆ Inward bound vessels from the German Bight, 50m or more in length
- ◆ In VTS Ems, vessels 40m or more in length
- ◆ Vessels carrying dangerous goods in bulk (gas, chemical and oil)
- ◆ Nuclear powered vessels

Vessels entering the VTS area must maintain a continuous listening watch on VHF. It is mandatory for vessels to send:

- ◆ A Sailing Plan, inward bound from the north (54°N) and east (6° 54'E), and for other vessels when entering the VTS area.
- ◆ Position Reports
- ◆ Deviation Report
- ◆ Incident Report

Radar advice is available on request, or if instructed by the VTS Centre

- ◆ VTS Jade Traffic is mandatory for

- ◆ Vessels of 50m or more in length
- ◆ Vessels carrying dangerous goods in bulk (gas, chemicals and oil)
- ◆ Unloaded tankers if not cleaned, degassed or completely inerted after carrying petroleum/products with a flashpoint <35°C
- ◆ Nuclear powered vessels

Vessels are required to maintain a listening watch on VHF. A Sailing Plan is required to be sent on passing Jade 1 lt. buoy, if not already reported to the German Bight VTS. Deviation Report and Incident Reports are required if necessary. Radar advice is provided on request or if instructed by the VTS Centre when:

- ◆ Visibility is less than 3000m
- ◆ The PV is in a sheltered position
- ◆ When light buoys are withdrawn, due to ice
- ◆ When required by the traffic situation or on request

Information broadcasts are provided at intervals.

- ◆ VTS Bremerhaven Weser Traffic is mandatory for
  - ◆ Vessels more than 50m or more in length
  - ◆ Vessels carrying dangerous goods in bulk (gas, chemical & oil)
  - ◆ Unloaded tanker which is not cleaned, degassed or completely inerted after carrying oil/oil products
  - ◆ Nuclear powered vessels

Vessels entering the Bremerhaven Weser VTS area are required to maintain a listening watch on VHF. It is mandatory to send the following reports:

- ◆ A Sailing Plan on entering the Bremerhaven Weser VTS area from sea, or from a harbour or berth within the VTS area
- ◆ Position Reports
- ◆ Deviation Report
- ◆ Incident Report

Radar advice is available on request, or if instructed by the VTS when:

- ◆ Visibility is less than 1,000m
- ◆ PV is in a sheltered position
- ◆ Light buoys are withdrawn because of ice
- ◆ When required by the traffic situation.

- ◆ VTS Cuxhaven Elbe Traffic is mandatory for:
  - ◆ Vessels of 50m or more in length within the area of Cuxhaven Elbe traffic or Brunsbuttel Elbe traffic.
  - ◆ All sea going vessels within the area of Hamburg Port traffic and all internal vessels over 100m or of carrying dangerous goods
  - ◆ Vessels carrying dangerous goods in bulk (gas, chemical & oil)
  - ◆ Unloaded tankers if not cleaned, degassed or completely inerted after carrying oil with a FP <35°C
  - ◆ Nuclear power vessels

Vessels entering the VTS Area of Cuxhaven Elbe Traffic must maintain a listening watch on VHF. It is mandatory for vessels to send the following reports:

- ◆ Sailing Plan 30 minutes before entering the VTS Area of Cuxhaven Elbe Traffic from the sea or before leaving a harbour or berth within the Cuxhaven Elbe Traffic
- ◆ Position Reports
- ◆ Deviation Report
- ◆ Incident Report

7.5.22 The VTS provision in the German Bight is highly regarded and it may be that in order to improve the safety of navigation off Vlieland, a similar system is required in order to reduce chances of collision. There are no further VTS along the German and Danish coasts within the Wadden Sea.

### Environmental protection measures intended to reduce or combat pollution

- 7.5.23 Zones of responsibility are established under the Bonn Agreement (effective since 1989, amendment effective since 1994), for co-operation in terms of aerial surveillance and dealing with pollution of the North Sea by oil and other harmful substances. Bilateral arrangements also apply between the Wadden Sea states in terms of Joint Maritime Contingency Plans.
- 7.5.24 The 1990 London International Convention on Pollution Preparedness, Response and Co-operation (OPRC), promotes international co-operation in the event of a major oil pollution threat between all North Sea countries.
- 7.5.25 Council Directive 93/75/ECC of 13 September 1993 concerning minimum requirements for vessels bound for or leaving Community ports and carrying dangerous or polluting goods (known as the Hazmat Directive) has been in force since 1995. The European Commission has been collecting data and commissioning studies as to the effectiveness of this Directive, which has highlighted the following shortcomings:
- ◆ Lack of clarity and poor application of departure notification procedures – the system is often not fully understood by masters and shipowners, particularly those from outside the EU;
  - ◆ Problems in transmitting cargo information due to lack of procedures or standard format for the transmission and exchange of data;
  - ◆ No clear definition of competent authorities and no regular updating of the list of competent authorities;
  - ◆ The definition of ‘ship’ has the effect of requiring only those vessels bound for or leaving a Community port and carrying dangerous or polluting goods to report accidents or incidents, not vessels in transit; and
  - ◆ In most cases, information notified under the Directive is merely stored by the recipient for use in the event of an accident, but otherwise remains unused: thus the information collected is not put to any good use.
- 7.5.26 The designation of the North Sea as a MARPOL 73/78 Special Area according to Annex 1 has been in force since 1999 and the designation as a Special Area according to Annex V entered into force in 1990/91. This effects a ban on the discharge of oil, oily waters and garbage.
- 7.5.27 In summary, significant measures are in place to help ensure the safety of shipping and to integrate shipping traffic with other uses. Measures are also in place to try to reduce pollution and provide contingency measures. Whilst shortcomings are evident, there is also some evidence that the latter are resulting in improvements. For example, a good correlation between oil incidents recorded in the Traffic Separation Scheme region by Central Information Centre in Cuxhaven and oil-rate recorded for the Guillemot on the German North Sea coast is reported by Fleet and Reineking (2000). The general decline in oil rates of these birds is possibly considered to be due to the positive effects of MARPOL agreements and aerial surveillance implemented to detect illegal discharges from shipping. This is

perhaps early evidence that designation of the North Sea as a Special Area according to the MARPOL 73/78 Annex 1 has had some effect.

## **7.6 Prospective future international measures**

### Accident risk reduction and compensation

- 7.6.1 Crew competence has been addressed under the revised International Convention on Standards of Training, Certification & Watchkeeping for Seafarers 1995 (STCW 95), which came into force in 1997, with a grace period of five years, making compliance with the convention compulsory for all signatories to the convention. IMO has issued the list of countries that have complied, and thus be approved in late May/early June 2001. It is possible to deny entry for flags that have not satisfied the IMO of their compliance with the convention. This can be policed and enforced through Port State Control;
- 7.6.2 Shipping management has been addressed through the introduction of the International Management Code for the Safe Operation of Ships and for Pollution Prevention (International Safety Management (ISM) Code, which will be mandatory for all ships over 500 GT from July 2002. Issues that have been identified and covered under ship management are:
- ◆ Technical: reliability, maintenance, automation, improved performance;
  - ◆ Personnel: selection, competence, education and training, leadership, motivation;
  - ◆ Operational: inspection and maintenance methods, operational instructions and procedures;
  - ◆ Safety management: management, organisation, routines, emergency planning and training, safety training;
  - ◆ Top level management: safety policy, provision of resources, creation and enhancement of safety culture; and
  - ◆ Job factors: physical environment (shift, noise, vibration, temperature), service conditions, adequate tools.
- 7.6.3 Requirements for vessels to have automatic identification systems will be phased in between 2002 and 2007, according to the December 2000 amendments to Chapter V of SOLAS. Ships built on or after 1st July 2002 are required to be fitted with AIS. For ships engaged on international voyages built before that date the following timetable applies:
- ◆ Passenger ships to be fitted with AIS not later than 1st July 2003;
  - ◆ Tankers, not later than first survey for safety equipment on or after 1st July 2003;
  - ◆ Other ships of 50,000 gross tonnage or more, not later than 1st July 2005;
  - ◆ Other ships between 3,000 and 10,000 gross tonnage, not later than 1st July 2006;
  - ◆ Other ships between 300 and 3,000 gross tonnage, not later than 1st July 2007.)

7.6.4 Proposals for new EU legislation as follows:

- ◆ A substantial amendment to the existing Directive on Port State Control is envisaged, in order to improve inspection in ports, as existing arrangements are deemed to be unsatisfactory. Banning of sub-standard ships (including drawing up a black list of ships that may no longer enter EU water) and more stringent inspections of ships, including oil tankers, posing a risk is envisaged.
- ◆ An amendment of the existing Directive on classification societies, to which Member States delegate a large part of their verification powers, with the general aim of supervising the activities of the societies more closely is proposed.
- ◆ EU representation has been made to IMO to phase out single hull oil tankers by 2010 as part of the response to the *Erika* oil spill disaster in 1999. Single hull is higher risk than double hull, which is designed to keep oil inside the hold even if outer surface of ship is pierced. In April 2001 MEPC 46 decided to accelerate the phasing-out of single hull tankers.
- ◆ A proposal for the introduction of a notification system for ships carrying dangerous or polluting goods, which includes the basic provisions of Directive 93/75/EEC, but makes changes to reflect legal and technological developments at international level. These include a more flexible procedure for notifying information and inclusion of ships in transit to conform to IMO Resolution A.851(20); and

7.6.5 The Compensation limit for pollution damage caused by a marine oil tanker spill has been increased to £180m, an increase of 50%, available through the Oil Pollution Compensation Fund 1992. Approved by IMO Legal Committee, and subject to 'tacit acceptance' will come into force in 2003.

Operational pollution risk reduction

7.6.6 Proposals to further reduce the operational environmental impacts of shipping generally include moves to reduce the emissions of acidifying gases sulphur dioxide (SO<sub>2</sub>) and nitrogen oxides (NO<sub>x</sub>). A recent EC report advocates a 1% limit on sulphur in marine fuels for all vessels travelling in European territorial waters. The current IMO limit is 4.5%, with the Baltic and North Seas to be designated as low sulphur fuel zones (max limit 1.5%), but the latter is yet to be ratified. Shipping accounted for only 10% of European emissions of these gases in 1990 but this is set to rise to 30% in 2010 as control is strengthened on land-based sources. It is estimated that a 1% limit would cut emissions by 36% (ICE, Oct/Nov, 2000 Issue 6 p.21).

7.6.7 In April 2001 MEPC 46 also voted on a draft convention banning ship paint containing TBT. A ban on new TBT paints is planned from 2003, with a total ban from 2008.

## **7.7 Stakeholder views**

7.7.1 Stakeholders responding to the questionnaire survey were asked to rate the adequacy of existing protective measures for the Wadden Sea. Generally the weight of opinion indicated support for existing measures. However, criticisms of individual measures were as follows:

- ◆ The extent of MARPOL 73/78 Annex 1 Special Area status is welcomed but enforcement of its provisions is an issue, which calls into question both monitoring and level of protection offered. This regulation is not yet implemented into Dutch national law and some stakeholders wanted the introduction of all Annexes;
- ◆ There was recognition that EU Directive 93/75 is undergoing revision (EU, 2000);
- ◆ There was much support for the existing routeing measures but some dissatisfaction with its positioning, some consider the coastal TSS too close to the Wadden Sea, and see its lack of coverage for the north-eastern part of the Region as a weakness;
- ◆ Denmark has always been opposed to the introduction of “Right of Way Vessels”, because the term is not contained in COLREGS;
- ◆ Plans by The Netherlands government to relax existing pilotage requirements were cited as a concern, but these were subsequently found to relate to harmonisation of river and sea pilotage and pilotage exemption rules;
- ◆ Whilst there was strong support for the present VTS provision, concern was expressed regarding the lack of coastal coverage and co-ordination between the individual VTS;
- ◆ Some stakeholders questioned the age and availability of tugs and emergency response vessels, suggesting that tugs were only directly available in harbour areas. However it has been subsequently confirmed that there is always an offshore tug with oil combat equipment available for the North Sea, with tugs stationed in Wilhelmshaven and Cuxhaven, as well as a chartered tug ‘Oceanic’ off Helgoland on 24 hours standby; and
- ◆ It was noted that aerial surveillance only gives information on the state of affairs at a certain moment and that mutual assistance can be agreed but then must be carried out.

7.7.2 Stakeholders also called into question the ability of all crews to respond to an emergency. The issues of maritime training, substandard operations and irresponsible behaviour are also relevant.

## **7.8 Acceptability to stakeholders of potential additional measures**

7.8.1 The stakeholder questionnaire sought opinions on a range of potential additional special protection measures that might be options within a PSSA framework. There was, however, no agreement on any specific additional measure or range of additional measures. Those in favour of a PSSA, in particular environmental groups, see a wide range of additional measures as being advantageous. Several governmental supporters of PSSA designation have firm views that a number of



measures would be inappropriate on the basis of cost and practicality. Stakeholders undecided on whether to pursue a PSSA designation, have mixed views, but at least one respondent strongly opposed each additional measure. Support for additional measures was very limited from those against PSSA designation. Analysis of these responses is presented below, both in terms of a summary of comments divided into pros and cons for each measure and a tabular summary of mean values.

#### 7.8.2 Comments on each potential additional measure are presented below:

##### Mandatory ships reporting system

Pros: seen as important to give responsible bodies a complete picture of shipping activity

Cons: currently being developed in IMO and EU; provides information only and thus must be closely linked to response options; would not avoid groundings; existing measures are sufficient

##### Automated vessel identification

Pros: crucial in terms of law enforcement in order to find offenders and obtain necessary evidence (however, necessitates monitoring)

Cons: AIS-system will be mandatory soon anyway, coming into force 2003 (adopted by MSC of IMO Chapter V in SOLAS)

##### Increased radar surveillance

Pros: present coverage is not complete or far reaching enough

Cons: very costly; experience from works in connection with fixed link between Sweden and Denmark indicates very limited in terms of preventing collisions and groundings; existing measures are sufficient

##### SOx emission control

Pros: important for air quality of the Region; less input into the sea

Cons: ability to enforce is critical; doubts as to relevance

##### Additional traffic separation schemes

Pros: useful in the north-eastern part of the Wadden Sea between Denmark and Schleswig-Holstein; important to zone off offshore wind parks; reduction of collision risk

Cons: no perceived added value; traffic flow does not call for such a measure; existing measures are sufficient

##### Changes and additional routeing measures (avoiding/away from Wadden Sea)

Pros: would allow more response time in event of an accident; appropriate for commercial ships carrying hazardous substances

Cons: no perceived added value; not relevant to Danish part of Wadden Sea Area; existing measures are sufficient

Extended pilotage requirements

- Pros: easier to enforce pilotage than detect/prohibit spills and illegal dumping; ability to control substantial ships with dangerous cargoes and ‘dangerous’ substandard ships; moves by The Netherlands and Germany to weaken the Wadden Sea pilotage regulations and rationalise pilotage seen by some as unacceptable
- Cons: impractical, currently under heavy political discussion; existing measures are sufficient.

Emergency towing pennants for all vessels

- Pros: already SOLAS requirement for tankers; if the *Pallas* had had a towing pennant it might have made it easier to get her under tow;
- Cons: can only be realised world-wide by IMO; to extend to AA ships would be irrelevant and unnecessary

Special rules for anchorage

- Pros: could be of great value in an area with heavy traffic, such as approaches to river Elbe, where anchorages are established
- Cons: existing rules are sufficient

Closure of waters to certain types of vessels or cargoes (areas to be avoided)

- Pros: could close Wadden Sea for single hulled tankers
- Cons: partly already in place, natural limitations due to water depth + VTS measures; unnecessary if other measures are taken; free cargo transfer must be warranted

Speed restrictions

- Pros: useful in Wadden Sea only linked to ship type (e.g. high speed ferries)
- Cons: already in effect in most sensitive Wadden Sea areas; does not enhance safety of navigation

Prohibitions/restrictions on cargo transfer

- Pros: would reduce risk of pollution from dangerous substances
- Cons: free cargo transfer must be warranted; problems likely with enforcement

Required submission of pre-filed passage plans

- Pros: can be targeted at certain types of vessels
- Cons: existing rules are sufficient; no advantages

Special under keel clearance restrictions

- Pros: would target ships carrying potentially hazardous cargoes
- Cons: existing rules are sufficient; commercially unacceptable (e.g. deep draft vessels that use traffic separation scheme Off Jade have very limited depth of water at their disposal) and a grounding only likely closer to shore

Regulation of offshore bunkering

- Pros: should be avoided in the southern North Sea
- Cons: already regulated by national authorities

Further prohibition of intentional discharges including ballast water

Pros: reduced risk to indigenous Wadden Sea ecology

Cons: already developing at IMO; ‘intentional’ needs clear definition; needs enforcement, if current rules were complied with there would not be a problem

Seasonal closures to protect migrating mammals

Pros: relevant to certain areas only where migrations take place

Cons: already in existence

Identification of buffer zone contiguous to the core area

Pros: harmful spills close to shore are always more hazardous than those further offshore

Cons: only relevant if PSSA is endorsed

Safe Havens

Pros: ability to cope with situations such as chemical accident MS Ostzee

Cons: additional cost; practical problems in that some areas might be suitable but dependent on the nature of the incident

Additional emergency response vessels

Pros: can be based on expert judgement; towing capability; perceived need to serve German Bight

Cons: current provision considered sufficient; can be realised at national or bilateral level

7.8.3 Stakeholders were asked to rank additional special protection measures and thus identify which, in their opinion, were the most appropriate for enhanced environmental protection of the Wadden Sea. For the ranking 1=most appropriate, 5=least appropriate. The aggregated (mean) results are presented in the table below. A distinction is made between government and non-government stakeholders in favour of pursuing a PSSA, in an attempt to differentiate between ethical and utilitarian considerations.

7.8.4 The table clearly shows the range of opinion, and highlights the difference, between those stakeholders who believe satisfactory environmental protection of the Wadden Sea and adjacent North Sea requires a range of additional measures and those who believe the current provision is sufficient.

7.8.5 In particular the German Federal Ministry of Transport considered existing measures to be sufficient and highlighted the following initiatives currently in an advanced planning stage:

- ◆ Setting up a coast-wide radio network of the entire German area of the North and Baltic Sea coasts, with AIS on-shore receiving stations and appropriate AIS infrastructure;
- ◆ Introduction of compulsory tests for masters permitted to sail without pilots;
- ◆ Uniform emergency management (project “maritime emergency care”);

- ◆ Development of a new concept for maintaining and equipping a reserve of emergency tugs; and
- ◆ Further intensification of Port State Control.

Table 15: A breakdown of stakeholder opinion regarding possible additional protective measures

Potential measure	+Non-government	+Government	?	-
Mandatory ships reporting system, automated vessel identification,	1.6	2	3.2	5
Increased radar surveillance	1.8	2	2.3	3.5
SOx emission control area MARPOL Annex VI	1.3	2.5	2.8	5
Additional traffic separation schemes	2.3	3	3.6	1.3
Changes and additional routeing measures (avoiding/away from Wadden Sea)	2	3.4	3.8	4.8
Extended pilotage requirements:				
a) More ship categories	1.4	2.6	4	3.8
b) Smaller ships	3	3	3	4.5
c) Tug escort	3.5	3	3.3	4.5
Emergency towing pennants for all vessels	2.8	3.2	3.2	5
Special rules for anchorage, such as designated anchorage area, no anchor zones, special anchor watch areas	3.3	2.3	3.7	2.8
Closure of waters to certain types of vessels or cargoes (areas to be avoided)	4	2.2	4	4.5
Speed restrictions	2.3	2.4	4	4.5
Prohibitions/restrictions on cargo transfer	1	1.8	3.8	4
Required submission of pre-filed passage plans	1.7	2.2	4.5	4.5
Special under keel clearance restrictions	2.5	3	3.8	4
Regulation of offshore bunkering	3.5	2.4	4.4	4
Further prohibition of intentional discharges including ballast water	2.3	2.7	3.3	4.3
Seasonal closures to protect migrating mammals	1	2.4	2.6	4.3
Identification of a buffer zone contiguous to the core area	3	3	4.6	4.5
Safe Havens	1	2	4	4
Additional emergency response vessels	2	2	2.4	2.3
	1	2.5	3	3.7

## 7.9 Potential Wadden Sea PSSA associated protective measures

7.9.1 The balance of stakeholder opinion suggests a limited combination of additional measures is worthy of further consideration. These include:

- ◆ Mandatory ships reporting system incorporating automated vessel identification;
- ◆ Additional radar surveillance off Vlieland;
- ◆ SO<sub>x</sub> emission control;
- ◆ Limited additional traffic separation schemes (NE Wadden Sea);
- ◆ Realignment of shipping lanes north and to the west of Helgoland
- ◆ Emergency towing pennants for vessels in addition to oil tankers;
- ◆ Extended compulsory pilotage;
- ◆ Special rules for anchorage, where anchorages are already established (e.g. no maintenance rules or engine to be on standby at all times);
- ◆ Speed restrictions for certain vessels;
- ◆ Further prohibition of intentional discharges with appropriate enforcement capability; and
- ◆ Safe havens.

7.9.2 The Guidelines state that ‘associated protective measures for PSSAs are limited to actions within the purview of IMO’ (MEPC 46/6 paragraph 6.1). Designation of a Special Area or emissions control areas, adoption of ships’ routing and reporting systems near or in the area, and other measures such as compulsory pilotage schemes or vessel traffic management systems (VTMS) are suggested as options.

7.9.3 Associated protective measures adopted or proposed for other PSSAs are also indicative of what might be considered. They comprise:

- ◆ Great Barrier Reef – compulsory pilotage for all ships over 70m bound to or from an Australian port, or navigating a prescribed section of the inner route of the Great Barrier Reef (1991); and mandatory ship reporting for all ships of 50m or more, all tankers and INF Code ships and vessels towing, where the ship and tow exceed 150m (1997);
- ◆ Sabana-Camaguey Archipelago – Traffic separation scheme and regulations relating to discharges of oil, oily mixtures, noxious liquid substances, garbage and ballast water (1998); and
- ◆ Florida Keys – inclusion of existing Areas to be Avoided (ATBAs); an amendment to one ATBA; and three mandatory no anchoring areas (proposed 2001).

7.9.4 However, any measures should be ‘specifically tailored to meet the need of the area at risk’ (A21/Res. 885 paragraph 3.2.3). On this basis the authors of this report consider the following additional protective measures worthy of further consideration:

- ◆ The use of VTS is recommendatory within international waters. A Wadden Sea area VTMS would promote a more harmonised and integrated approach to monitoring the flow of traffic. It is considered that this would markedly reduce

the risk of potential accidents by monitoring compliance with existing routeing measures and compliance with rule 10 of COLREGs;

- ◆ Similarly, mandatory reporting for certain classes of vessels would reduce the risk of marine accidents (collisions and groundings) in the Wadden Sea and adjacent North Sea. As explained in section 7.6.3, older smaller vessels are likely to be the last to be fitted with AIS. These same ships could endanger other ships through their errors in navigation, even if their cargo capacity is not as large; and
- ◆ Compulsory pilotage for certain vessels in the Deep-Water route is also considered advantageous.

7.9.5 This is not considered to be an exhaustive list. Measures such as the introduction of safe havens are considered extremely useful but not in the purview of IMO. The EU is likely to demand stricter surveys by flag and port states commensurate with heightened risk (e.g. vessel age). Movement of the Traffic Separation Scheme further offshore would offset risk without significant costs, was relatively well supported by stakeholders and was proposed by WWF (2000), but the current system is considered effective. Furthermore, the existing arrangements have determined locations for offshore oil and gas installations. Any proposed changes would require detailed simulation studies, not least to ensure compatibility with other areas and sectors. However, if deemed appropriate at a later stage, this measure could be included for further research. Other measures, such as tolls for transiting PSSA are not realistic given the importance of the competitiveness of Wadden Sea ports.

7.9.6 Any additional associated protective measures should be investigated in terms of a cost benefit risk assessment and in collaboration with national agencies. Any such investigation is beyond the remit of this study. However, in broad terms, for the three associated protective measures suggested:

- ◆ The burden of cost for VTMS would need to be borne by government, although for some facilities ships also pay a VTS due. A set up similar to that which currently operates in the Port of Rotterdam, but expanded to cover the PSSA, might be envisaged with a control centre co-ordinating all the information gathered from shore-based radars and VTS monitoring stations for the Wadden Sea. Future technology, such as satellite monitoring, likely to be in place within the next two years, will make this proposition more cost effective;
- ◆ The cost of mandatory reporting is negligible. It is debatable whether additional manpower would even be needed to monitor VHF signals depending on the location of the nominated point of reporting. The compulsory introduction of AIS transponders in 2003 will also help such a measure but, until all ships are so equipped, reporting by VHF will still be needed. For this associated protective measure Wadden Sea governments would need to determine those ship types deemed to pose a threat; and
- ◆ The burden of cost for compulsory pilotage would need to be borne by the international shipping industry. North Sea pilots are self-employed and charge on a daily basis (approximately \$1000/day). For large vessels, with operational costs in the order of \$1 – 2 million per year (Drewry Shipping Consultants,

1999) and significant voyage costs that include fuel, port dues and transit fees, such an additional burden is considered to be minimal, although ship owners are sensitive to such costs.

7.9.7 The relative merits of these associated protective measures should be considered in relation to ship type. Thus, for example:

- ◆ VTMS would confer the ability to identify areas of shipping congestion and, if necessary, re-route traffic. Thus, for example, through traffic using the Southern North Sea Traffic Separation Scheme could be given prior warning of concentrations of fishing operations, creating expectation and awareness. An area VTMS might also be linked to a supra-regional system (e.g. Channel, Rotterdam, Wadden Sea, German Bight) thus creating better linked coverage throughout the whole area;
- ◆ Mandatory reporting might apply most effectively to North Sea shipping, particularly vessels that are very familiar with their routine passages, for whom the requirement for more vigilance would reduce risk; and
- ◆ Compulsory pilotage is most appropriate for large ships, which have little or no experience of the local Wadden Sea conditions.

## **7.10 Conclusions**

7.10.1 Vessel traffic characteristics - The exceptional density of commercial shipping, together with the presence of fishing vessels and recreational craft in the Wadden Sea and adjacent North Sea make the region vulnerable to risk of collision.

7.10.2 Natural factors - The combination of meteorological, hydrological, oceanographic and additional complicating factors (e.g. marine exploitation activity) make the Region navigationally complex.

7.10.3 Other considerations, including reports of damage to the Wadden Sea environment from maritime operations, past incidents and cumulative stress attributed to pollution from other sources, suggest a more co-ordinated policy would be advantageous.

7.10.4 Significant measures are in place to help ensure the safety of shipping and to integrate shipping and other activities in the Wadden Sea and adjacent North Sea. This study has confirmed that:

- ◆ Navigational hazards are offset by means of a comprehensive navigational warning system and GPS for position fixing;
- ◆ Collision avoidance is enhanced by IMO routing systems, although the Vlieland junction adjacent to Terschelling is perceived to be problematic;
- ◆ Pilotage is targeted at ship types posing the highest risk but weather, fatigue of ship's officers and cost of recommended pilot for the Deep-Water route are all considered relevant;
- ◆ VTS in the German Bight is highly regarded but co-ordination between VTS may be lacking; and

- ◆ Evidence to support the effectiveness of measures to reduce operational impacts is variable and enforcement of these measures is a problem internationally.
- 7.10.5 Significant attention internationally has been given to the identification of maritime risks and their reduction. Prospective future international measures will also help protect the Wadden Sea.
- 7.10.6 Stakeholder views on existing measures reveal widespread support but concerns exist. Specific criticisms were directed at the perceived lack of effectiveness of some measures intended to reduce both accidental and operational pollution as a result of poor enforcement.
- 7.10.7 A limited package of additional associated protective measures, which cannot be introduced unilaterally, is worthy of consideration and further investigation. The associated protective measures suggested, which are available through IMO and can thus be part of Wadden Sea PSSA designation, are as follows:
- ◆ A Wadden Sea Area Vessel Traffic Management System
  - ◆ Mandatory reporting for certain vessels
  - ◆ Compulsory pilotage for certain vessels using the Deep Water Route
- 7.10.8 It should be emphasised that an application for Wadden Sea PSSA designation is possible on the basis of those protective measures currently in place. Indeed, as explained in the previous chapter, there are benefits, principally in terms of awareness raising, of such a strategy. However, the recommendation of this study is that enhanced protection of the Wadden Sea and adjacent North Sea environment from the impacts of international shipping, can be achieved on the basis of one or more additional associated protective measures. The associated protective measures indicated have different merits and relate to risks posed by different ship types. Further research and study of marine traffic including the nature of traffic (loads carried, manning, range of activity, ownership and type), the nature of operations (pattern, purpose, variability), traffic flow patterns and route characteristics is needed to support any argument for their introduction.
- 7.10.9 Furthermore, the focus of any additional associated protective measures should be the adjacent North Sea, where hazards have been identified and from where, due to the oceanographic and meteorological conditions described in sections 4.2 and 7.3, any pollution would be imported into the Wadden Sea Area.



## **Chapter 8. Delimitation of a Wadden Sea PSSA**

### **8.1 Introduction**

8.1.1 Consideration of proposals for potential delimitation of a Wadden Sea PSSA, with advantages and disadvantages related to shipping, ecology and economy was the objective of Task V.

### **8.2 Past deliberations**

8.2.1 Previous proposals and trilateral discussions have highlighted different viewpoints regarding a potential PSSA boundary.

8.2.2 When the idea of a Wadden Sea PSSA was initiated in 1994 the following was proposed:

- ◆ A core area – Wadden Sea + to inner boundary of NE traffic lanes incorporating Inshore Traffic Zones (ITZ)
- ◆ A buffer area – extending towards but not including the Deep Water Route
- ◆ Exact boundaries to be established by the Wadden Sea countries but showing consistency; and
- ◆ Descriptive references to shipping routes rather than co-ordinates to allow flexibility.

8.2.3 At the subsequent trilateral meeting in Hamburg (24.9.96), delimitation discussions focused on the Dutch North Sea west coast and whether the whole area of the Deep Water Route should be included. It was considered that a PSSA Wadden Sea should be identified without discriminating between a core area and buffer zone. A preliminary delimitation was agreed, pending the Dutch position on the suggested enlargement in the south at the start of the Deep Water route, that equated with the 12 nautical mile limit.

### **8.3 Practice elsewhere**

8.3.1 In Australia the PSSA boundaries cover the marine portion of the Great Barrier Reef World Heritage Area, which was declared in 1981 (Schedule 1 to the Great Barrier Reef Marine Park Act). The maritime areas of the Great Barrier Reef consist of internal waters within the territorial sea baselines, waters of the three-mile territorial sea and waters of the Australian fishing zone. The greater part of the inner route through the Great Barrier Reef is within Australian internal waters as created by baselines proclaimed in 1983.

8.3.2 The proposed Florida Keys PSSA is mostly within the United States territorial sea, with a small portion extending beyond 12 nautical miles into the United States contiguous zone.

## **8.4 IMO guidance**

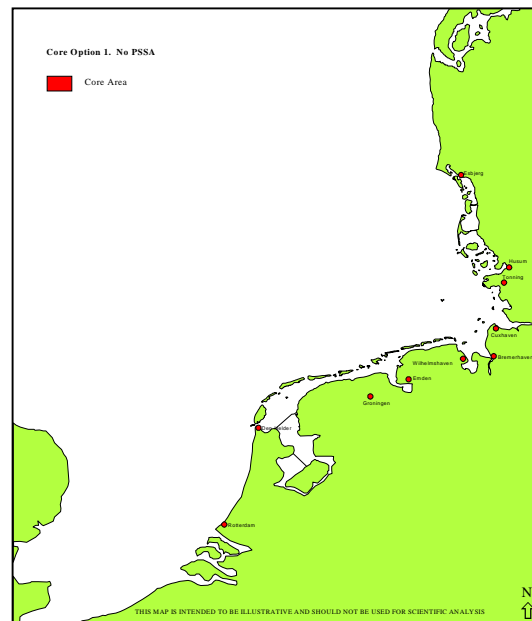
- 8.4.1 A.720(17) paragraph 1.4.9 establishes that there is no definite size of PSSA. It states that “the term ‘area’ is flexible, with every part of the marine environment which meets the criteria being eligible to be PSSA”. It also states that “the design of a PSSA, including a buffer zone, depends on the environmental risk, which should be reduced”.
- 8.4.2 The proposed new Guidelines (MEPC 46/6 paragraph 6.3) continue to confirm that in some circumstances “a proposed PSSA may include within its boundaries a buffer zone, in other words an area contiguous to the site-specific feature (core area) for which specific protection from shipping is sought. However, the need for such a buffer zone should be justified in terms of how it would contribute to the adequate protection of the core area”.
- 8.4.3 The Wadden Sea is considered by this feasibility study to be such a circumstance. The value of the Wadden Sea Conservation Area is well appreciated and this area contains the majority of criteria that constitute a PSSA. The greatest threat stems from an adjacent area further offshore, where much of the international shipping activity is concentrated and from which, as a result of natural processes, any pollution is likely to travel towards the coast.
- 8.4.4 On this basis it is the interpretation of the authors that a Wadden Sea PSSA could be designated in an area beyond the administrative borders of the Wadden Sea Area; in an area to include any combination of national waters, territorial sea and/or EEZ; and that the combination of any core and buffer area together constitute the PSSA.

## **8.5 PSSA options**

- 8.5.1 The following boundary delimitation options for a possible Wadden Sea PSSA designation have been put forward as part of this feasibility study. These take into account existing levels of protection, vulnerability, stakeholder views on benefits and burdens and the need to protect higher risk areas, and thus reflect the results of the earlier tasks.
- 8.5.2 Core Options

The site-specific feature (core area) for which specific protection from shipping is sought is the area that meets the PSSA criteria as determined by IMO.

### Core Option 1 : No PSSA



This option has been chosen because there is not a 100% agreement on the value of a PSSA. It requires no change to current maritime activities or management.

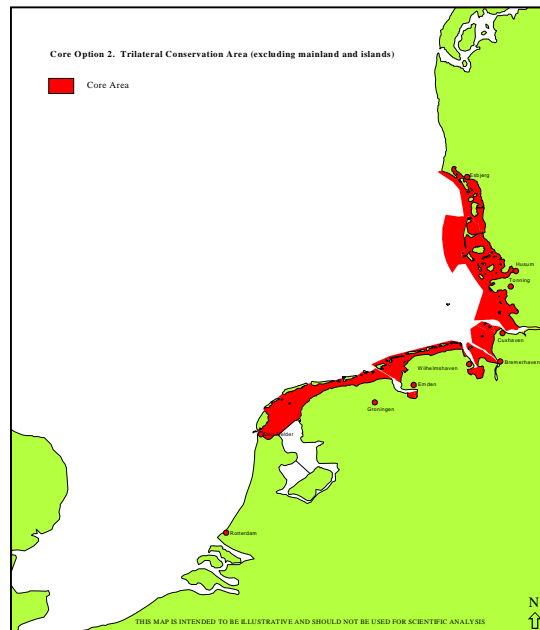
#### Points in favour

- ◆ Resources/energies can be put into making existing measures more effective
- ◆ No infrastructure or operational costs for national governments
- ◆ No immediate short-term additional operational costs for commercial interests
- ◆ No changes to existing navigational directions
- ◆ Does not compromise existing use patterns

#### Points against

- ◆ Fails to send political message to the international shipping community regarding the environmental value of the Wadden Sea
- ◆ Misses an opportunity to exercise the precautionary principle
- ◆ Relies on international solutions to trilateral problems
- ◆ Potential long-term costs as a result of environmental damage
- ◆ Complicit in the perpetuation of current problems
- ◆ Against the wishes of the 'majority' of stakeholders
- ◆ Does not provide a deterrent to sub-standard ships

## Core Option 2 : Wadden Sea Conservation Area



This option has been chosen because it focuses on the existing area of agreed conservation value. The boundaries are coincident with the marine part of the Wadden Sea Conservation Area and also include the Whale Protection Area.

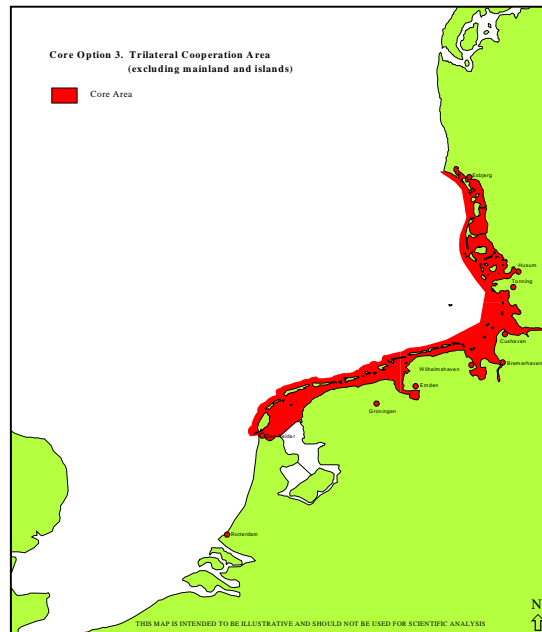
### Points in favour

- ◆ Heightened international awareness of environmental value
- ◆ Consistent with proposed World Heritage Site nomination
- ◆ Framework to achieve reduced risk of accidents and better decision-making
- ◆ Possible introduction of limited additional measures to minimise environmental damage
- ◆ Recognition of local priorities by international interests
- ◆ Minimal additional costs for commercial operators, dependent upon measures
- ◆ Clear focus on core areas of environmental value
- ◆ Provides a deterrent to sub-standard ships

### Points against

- ◆ Does not incorporate all vulnerable areas
- ◆ Areas further offshore may be perceived as sacrificial or unimportant
- ◆ Does not include shipping routes
- ◆ Fails to cover all areas of risk and thus the range of any associated protective measures is confined to a limited area
- ◆ Additional costs for implementation, plus infrastructure and operation, dependent upon measures
- ◆ Largely within Internal Waters

### Core Option 3 : Wadden Sea Area



This option has been selected on political and administrative grounds. It is coincident with the boundary of the marine part of the Trilateral Wadden Sea Co-operation Area. It is suggested as an option as it includes a larger area of environmental value and extends further seaward than previous options to include part of the Inshore Traffic Zone.

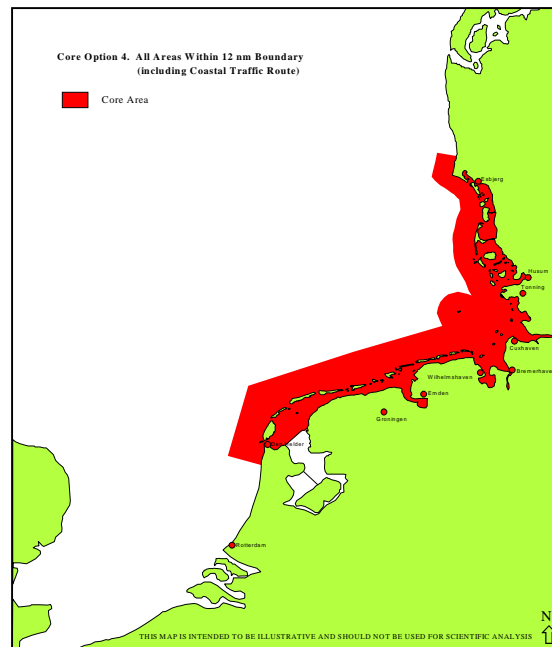
#### Points in favour

- ◆ Heightened international awareness of environmental value
- ◆ Includes proposed World Heritage Site nomination area
- ◆ Framework to achieve reduced risk of accidents and better decision-making
- ◆ Possible introduction of limited additional measures to minimise environmental damage
- ◆ Recognises that port approaches have environmental value
- ◆ Recognition of local priorities by international interests
- ◆ Limited additional costs for commercial operators, dependent upon measures
- ◆ Recognised management boundary with history of co-operative management
- ◆ Provides the Wadden Sea Area with equal PSSA status (no areas with potential to be perceived as sacrificial or unimportant)
- ◆ Clear political rationale for boundary delimitation
- ◆ Provides a deterrent to sub-standard ships
- ◆ Includes part of Inshore Traffic Zone

#### Points against

- ◆ Does not incorporate vulnerable areas outside Co-operation Area
- ◆ Increased costs associated with monitoring and enforcement, dependent upon measures
- ◆ Does not include shipping routes
- ◆ Fails to cover all areas of risk and thus the range of any associated protective measure is confined to a limited area
- ◆ Additional costs for implementation, plus infrastructure and operation, dependent upon measures
- ◆ Some opposition from shipping interests since it includes the main shipping routes to the harbours in the Wadden Sea Region

### **Core Option 4 : All areas within 12nm boundary (including Coastal Traffic Route)**



This option has been chosen on the grounds that it seeks to include a greater area of environmental importance as well as a greater area of maritime hazard. The 12nm boundary presents a manageable and appropriate zone. In the southern North Sea, the boundary has been extended slightly beyond 12nm to include the Coastal Traffic Route.

#### **Points in favour**

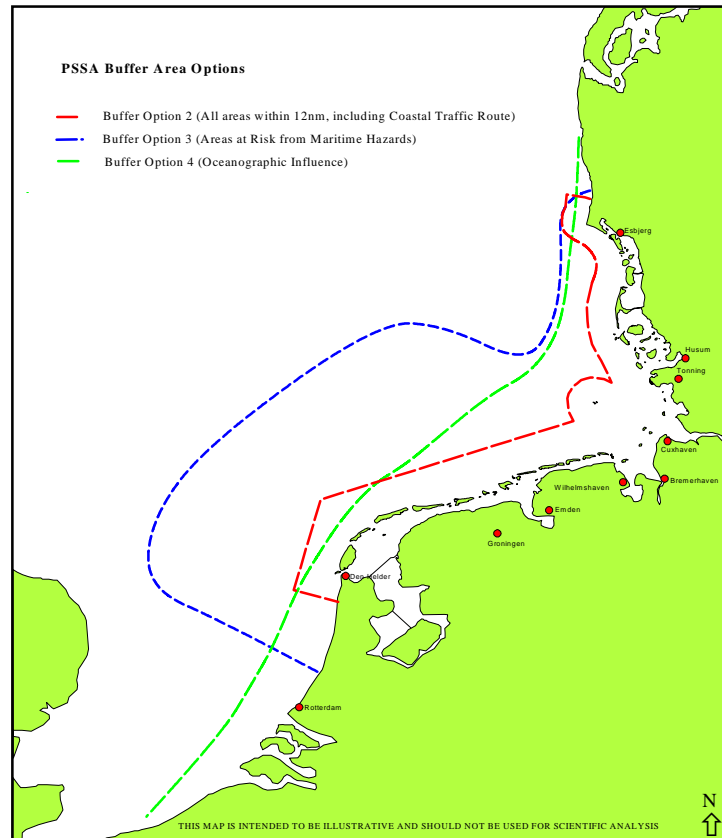
- ◆ Strong political signal
- ◆ Complements Special Area status
- ◆ Includes proposed World Heritage Site nomination area
- ◆ Heightened international awareness of environmental value
- ◆ More extensive framework to achieve reduced risk of accidents and better decision-making
- ◆ Facilitates the introduction of more comprehensive additional measures to minimise environmental damage
- ◆ More comprehensive coverage of vulnerable areas
- ◆ Recognition of local priorities by international interests
- ◆ Does include elements of shipping routes
- ◆ Movement of traffic away from Wadden Sea into the Deep Water routes
- ◆ Provides a deterrent to sub-standard ships

#### **Points against**

- ◆ Additional costs associated with monitoring and enforcement, dependent upon measures
- ◆ Additional costs for commercial operators, dependent upon measures
- ◆ Additional costs for implementation, plus infrastructure and operation, dependent upon measures
- ◆ Does not include the entire shipping routes and therefore fails to cover all areas of risk and thus the range of any associated protective measure is confined to a limited area

### 8.5.3 Buffer options

Buffer options are possible delimitations of areas contiguous to the core areas that would contribute to the adequate protection of the core options.



#### **Buffer Option 1 : no buffer**

This option requires no change to current maritime activities or management.

##### **Points in favour**

- ◆ Acknowledges the adequacy and effectiveness of existing measures to manage the impacts of international shipping on the Wadden Sea environment.
- ◆ Focuses any PSSA designation on the Core Area that qualifies for designation under IMO criteria.
- ◆ No associated costs.

##### **Points against (depending also on the selection of the Core Area)**

- ◆ Fails to acknowledge that the area of greatest risk lies outside any Core Area and within the adjacent North Sea
- ◆ Does not serve to provide additional protection both to those criteria identified as ‘irreplaceable natural capital’ within any Core Area or features, such as productivity or spawning and breeding grounds, which lie further offshore.

### **Buffer Option 2 : all areas within 12nm boundary (including Coastal Traffic Route)**

This option seeks to include a greater area of environmental importance as well as a greater area of maritime hazard. The 12nm boundary presents a manageable and easily defined zone. In the southern North Sea, the boundary has been extended slightly beyond 12nm to include the Coastal Traffic Route.

#### **Points in favour**

- ◆ In combination with a smaller Core Area this option recognises the need to manage risk in the area immediately adjacent to the Wadden Sea
- ◆ 12nm represents a recognised and established marine political boundary

#### **Points against**

- ◆ Assumes a smaller Core Area
- ◆ Fails to cover areas of risk and thus the range of any associated protective measures is confined to a limited area

### **Buffer Option 3 : area at risk from maritime hazards (Risk Area)**

This option seeks to cover the main areas of maritime hazard. The boundary was also determined through reference to environmentally vulnerable areas beyond the Wadden Sea Conservation Area and takes into account the direction of drift for any pollution incident determined by a combination of sea water density and wind driven currents (Bowden, 1983). The predominantly westerly wind (direction, strength and frequency), with significantly higher wind velocity in winter months, as well as the wind generated currents, heightens the risk of impact from any incident offshore. In other words a vessel with problems and/or pollutants in the water will drift south and west towards the Wadden Sea Area at a speed of anything up to 5 knots depending on wind, tide and vessel type. The extent of this buffer option therefore provides an opportunity to intervene in an approximate 5-6 hour response time should such an incident occur. The Netherlands policy on non-use of aerial chemical dispersants in the case of oil pollution is relevant. In such an eventuality a number of vessels would need to be mobilised to achieve containment/recovery of pollution and minimise shoreline impacts.

#### **Points in favour**

- ◆ Acknowledges the risk associated with international shipping in a significant area of the southern North Sea (traffic concentration areas and natural factors) including the high density of gas and oil installations off the north-west coast of The Netherlands
- ◆ Accepts the existing emergency capability based in Rotterdam, which could be mobilised to counter a shipping problem off the south-west coast of The Netherlands before it would be likely to adversely affect the significant characteristics of the Wadden Sea environment
- ◆ Heightened international awareness of environmental value because the Core Area is protected by the high-risk Buffer Area

#### **Points against**

- ◆ Additional costs depending on measures



**Buffer Option 4 : oceanographic influence**

This option seeks to include the area in which a pollution incident would potentially be confined. The boundary was determined through consideration of the movement of water within the southern North Sea (Laevastu, 1983; OSPAR Commission, 2000). In particular, attention has been given to the distinction between Continental water and Channel water masses, and their separation by a front off the western Dutch coast. This distinction is more definite in summer thus the buffer boundary is an approximation of the winter and summer situation. Mapping of the spread of pollutants, such as Apron Plus 1993/94, highlights the way in which non-biodegradable pollutants of this nature drift and are contained within a discrete but extensive geographic area. Transit time for pollutants depends on different characteristics of the substances concerned, climatic variability, changes in atmospheric forcing and changes in water density (OSPAR Commission, 2000).

**Points in favour**

- ◆ Respects scientific arguments for the potential dispersal of the majority of marine pollutants
- ◆ Comprehensively buffers any of the Core Area proposals
- ◆ Accepts the existing emergency capability based in Rotterdam, which could be mobilised to counter a shipping problem off the south-west coast of The Netherlands before it would be likely to adversely affect the significant characteristics of the Wadden Sea environment

**Points against**

- ◆ Additional costs depending on measures
- ◆ Fails to recognise the wider area of risk accounted for in Buffer option 3
- ◆ Does not accept the argument of reduced risk south-west of the Wadden Sea

8.5.4 Given the range of options presented, there are a number of potential combinations of core and buffer areas. These are presented below.

*Table16: Viable combinations of core and buffer areas*

		Buffer Options			
		1. No buffer	2. 12nm	3. Risk area	4. Oceanographic
Core Options	1. No PSSA	Viable	Non-viable	Non-viable	Non-viable
	2.Conservation area	Viable	Viable	Viable	Viable
	3.Co-operation area	Viable	Viable	Viable	Viable
	4. 12nm	Viable	Non-viable	Viable	Viable

## **8.6 Conclusion**

- 8.6.1 Although several of the combinations have merit, it is the view of the research team that a core consisting of the Wadden Sea Conservation Area (Core Option 2) and a buffer consisting of the Risk Area (Buffer Option 3) presents the most viable and justifiable combination.
- 8.6.2 This core option conforms to the ideals of PSSA status and would provide an enhanced level of environmental protection. This combination has two key justifications: first, the core area focuses on the area of maximum environmental value and is already acknowledged as such by the Wadden Sea states; and secondly, the buffer area focuses on the areas that present greatest maritime risk to the Wadden Sea Area both in terms of vessel traffic characteristics and natural factors. These are therefore the areas in which greater vigilance is required.

## Chapter 9. Conclusions and recommendations

### 9.1. Conclusions

9.1.1 The Wadden Sea is a very significant resource, and can be defined as ‘critical natural capital’. Significance can be established in terms of biogeography, ecology, socio-economics, scientific value and cultural importance. The outstanding attributes of the Wadden Sea are recognised by national and international nature conservation designations; through trilateral agreements and policies; and in terms of a recommendation that the Wadden Sea should be considered for submission to UNESCO as a ‘natural property’ World Heritage Site. The Wadden Sea resource remains vulnerable to accidental and operational impacts of maritime activities. Whilst the relative impact of such activities (i.e. compared to other impacts such as land-based pollution), must be taken into account; the large volume of maritime traffic using the adjacent North Sea and the specific hydrography, morphology and meteorology of the Wadden Sea, which makes the Region a natural importing system, are critical factors. There is subjective evidence of the adverse effects of operational pollution on the Wadden Sea coast but an absence of co-ordinated quantified data should be addressed. The risk of accidental pollution confirms the need for proactive counter measures, co-ordinated anti-pollution measures, and a quick response in the event of an accident. The ability to contain pollution offshore, away from the Wadden Sea Area coastline and those characteristics considered to be of particular significance is essential.

9.1.2 The purpose of PSSA designation is inextricably linked to the concept of sustainable development, adopted by the Stade Declaration as a guiding principle. The designation provides an opportunity to utilise existing powers more effectively; to regulate the passage of shipping through territorial sea; and to establish a managerial framework to address unacceptable environmental impacts. The Wadden Sea Conservation Area comprehensively meets the criteria established by IMO for PSSA designation, albeit that the ecological criteria of *naturalness* and *integrity* must be substantiated. The Guidelines (MEPC 46/6 Annex 2 paragraph 4.5) state that:

“The criteria relate to PSSAs within and beyond the limits of the territorial sea. They can be used by IMO to designate PSSAs beyond the territorial sea with a view to the adoption of international protective measures regarding pollution and other damage caused by ships. They may also be used by national administrations to identify Particularly Sensitive Sea Areas within their territorial seas.”

The inter-relationship between the Wadden Sea and the adjacent North Sea zone is such that the value and significance of the former is dependent upon and inextricably linked to the latter.

9.1.3 The idea of a Wadden Sea PSSA continues to be contentious. However, the weight of subjective opinion, drawn from the stakeholder questionnaire, is in favour of a PSSA application. The draft IMO Assembly resolution confirms that a PSSA may

be identified within a Special Area and that the criteria with respect to the identification of PSSAs and Special Areas are not mutually exclusive (MEPC 46/6, paragraph 4.5). In the opinion of the authors of this study benefits of Wadden Sea PSSA designation outweigh burdens on the basis that:

- ◆ The PSSA concept recognises the competence of existing as well as any proposed additional risk management and reduction measures;
- ◆ The costs to international shipping associated with PSSA designation are relatively modest, largely linked to any proposed additional measures and consistent with the polluter pays principle;
- ◆ The PSSA criteria reflect the importance of the full range of economic activities associated with the Wadden Sea Area, many of which depend upon a clean and well functioning environment;
- ◆ A PSSA designation would reinforce the supra-regional environmental importance of the Wadden Sea, particularly in terms of vulnerability to risks associated with international maritime activity, consistent with the precautionary principle;
- ◆ The direct and indirect costs of dealing with a major pollution incident on a soft sediment shoreline are significantly more than for a rocky shoreline; and
- ◆ The threat to the Wadden Sea environment from the impact of international shipping is largely derived from maritime activity in the adjacent North Sea zone.

An overriding benefit is considered to be the message that PSSA designation sends out internationally as to the value of the Wadden Sea. Put simply ‘What price the Wadden Sea?’

9.1.4 A significant risk to the Wadden Sea environment from international maritime activities exists. The exceptional density of commercial shipping, together with the presence of fishing vessels and recreational craft in the Wadden Sea and adjacent North Sea make the region vulnerable to accidental and operational pollution. The combination of meteorological, hydrological, oceanographic and additional complicating factors (e.g. marine exploitation activity) make the region navigationally complex. Other considerations, such as past incidents, also highlight the advantages of a more co-ordinated trilateral approach.

In response to the combination of vessel traffic characteristics and natural hazards in the Wadden Sea, significant measures are in place to help ensure the safety of shipping and to integrate shipping and other activities in the Wadden Sea and adjacent North Sea. This study has confirmed that:

- ◆ Navigational hazards are offset by means of a comprehensive navigational warning system and DGPS for position fixing;
- ◆ Collision avoidance is enhanced by IMO routing systems, although the Vlieland junction adjacent to Terschelling is perceived to be problematic;
- ◆ Pilotage is targeted at ship types posing the highest risk but weather, fatigue of ship’s officers and cost of deep sea pilots (voluntary) are all considered relevant;
- ◆ VTS in the German Bight is highly regarded but co-ordination between VTS may be lacking; and

- ◆ Evidence to support the effectiveness of current measures to reduce operational impacts is variable and enforcement of these measures is a problem internationally.

Significant attention internationally has been given to the identification of maritime risks and their reduction. Prospective future international measures, regional agreements and local initiatives (harmonisation) will help protect the Wadden Sea. Stakeholder views on existing measures reveal widespread support but specific concerns exist. Criticisms were directed at the perceived lack of effectiveness of some measures intended to reduce both accidental and operational pollution. On this basis a limited package of additional associated protective measures is worthy of consideration.

- 9.1.5 The potential PSSA delimitation options proposed offer alternative attempts to balance maritime risk and environmental vulnerability. The decision as to what is an acceptable level of risk, and therefore the delimitation of a PSSA, is ultimately a political one. However, the research team has identified several viable core and buffer area options for the delimitation of a potential PSSA. The preferred option of the research team is a core area co-incident with the existing Wadden Sea Conservation Area, with a buffer area that incorporates the main areas where maritime hazard may be generated. This is suggested as it identifies the core area of environmental value as most worthy of protection, while also identifying as a buffer the areas that present greatest risk to the natural capital of the Wadden Sea. This option has the advantage that there is little doubt that the Conservation Area would meet PSSA designation criteria. Furthermore, the buffer area is relatively extensive and so would provide enhanced protection for the core area, given the prevailing meteorological, oceanographic and hydrographic characteristics.

## 9.2 Recommendations

9.2.1 It is recommended that the Trilateral Wadden Sea Cooperation make an application to IMO for designation of a Wadden Sea PSSA and associated protective measures. Any such application should:

- ◆ Make a clear case against all the criteria set out in MEPC 46/6;
- ◆ Consider nominating a core area, which comprehensively meets the IMO criteria, together with an offshore buffer zone, comprising an area contiguous to the core area, within which any risks from international maritime activities could significantly impact on the core area.
- ◆ Evaluate any additional associated protective measures, which would serve to reduce the environmental hazards associated with international shipping, particularly those relevant to any buffer zone, on the basis of a cost benefit risk assessment and in discussion with stakeholders (e.g. pilot organisations). Specifically this exercise might consider the merits of compulsory pilotage for certain vessels using deep water routes; mandatory reporting for certain vessels; and an appropriate area VTMS.
- ◆ Contain integrated measures and procedures for co-operation between the jurisdictions of the Wadden Sea states.

An application for Wadden Sea PSSA designation could go forward on the basis of no additional associated protective measures. However, as stated earlier, the preferred option suggested by this feasibility study includes additional associated protective measures. If an application is put forward on this basis, associated protective measures either need to be agreed in advance of an application (and thus the reasons why the proposed associated protective measures are the preferred method for providing protection for the area to be identified as a PSSA must be explained) or a proposal for at least one protective measure must be submitted within two years of the approval in principle of the PSSA.

9.2.2 It is also recommended that further research to quantify and attribute operational pollution is considered. A current EU project ‘*Assessing concepts, systems and tools for a Safer, Efficient and Environmentally Aware and Friendly Maritime Transport (SEAM)*’, within which Southampton Institute, Gemeentelijk Havenbedrijf Rotterdam and Senator Fuer Wirtschaft und Haefen der Freien Hansestadt Bremen are partners, is investigating the modelling of environmental effects of sea traffic, including a focus on the German Bight. Alternatively, this area of work might, for example, be the subject of a specific bid to the Fifth Framework call on ‘Sustainable Marine Ecosystems’ (deadline 16.10.01), under ‘understanding and reducing the anthropogenic impacts on the marine environment and the recovery of degraded systems’ involving the whole Wadden Sea Area. (see: <http://www.cordis.lu/fp5/src/programmes.htm>).

9.2.3 Finally it is recommended that any action taken to progress a PSSA application should take account of the need for wider understanding and acceptance of the concept. In particular this should be targeted at:

- ◆ A number of decision-makers who are yet to be convinced about the need for PSSA designation and any associated protective measures; and that a Wadden Sea PSSA would entail limited cost implications and would not adversely affect the competitiveness or future commercial aspirations of the Wadden Sea ports
- ◆ International shipping interests who have yet to appreciate the need to include the adjacent North Sea within any Wadden Sea PSSA delimitation, and thus do not currently perceive themselves as stakeholders
- ◆ Local people who need reassurance concerning the purpose of the designation; confirmation that it does not take powers away from existing agencies; that it does not affect recreational or small fishing vessels; and that it is in their interests.

It is suggested that the interests of decision-makers and the international shipping community could be served by appropriate circulation of this feasibility study, together with any evaluation of associated protective measures, and a subsequent consultation exercise. Local people would be better informed by a public information campaign, including perhaps a non-technical summary of this study.

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## **10.2 IMO Resolutions and MEPC Session Agenda Items**

### 10.2.1 Resolutions

Resolution A.720(17) adopted on 6.11.91 – Guidelines for the designation of Special Areas and the identification of Particularly Sensitive Sea Areas.

Resolution A.885(21) adopted on 25.11.99 – Procedures for the identification of Particularly Sensitive Sea Areas and the adoption of associated protective measures and amendments to the guidelines contained in Resolution A.720(17)

### 10.2.2 MEPC Session Agenda Items

MEPC 42/10 - Identification and protection of Special Areas and Particularly Sensitive Sea Areas: Report of the Correspondence Group.

MEPC 42/10/1- Identification and protection of Special Areas and Particularly Sensitive Sea Areas: Submitted by WWF.

MEPC 45/6 - Identification and protection of Special Areas and Particularly Sensitive Sea Areas: Report of the Correspondence Group on the revision of Resolution A.720(17)

MEPC 46/6/1 - Identification and protection of Special Areas and Particularly Sensitive Sea Areas: Areas to be avoided and precautionary measures in particularly sensitive sea areas in the region of the natural protected areas from Taba to Nuweiba Port, from Nuweiba Port to the Northern Limits of Abou Galum protected and Jazirat Tiran – note by the Government of Arab Republic of Egypt.

MEPC 46/6/3 – Identification and protection of Special Areas and Particularly Sensitive Sea Areas: Submitted by IUCN.

MEPC 43/6/7 – Identification and protection of Special Areas and Particularly Sensitive Sea Areas: Designation of Malpelo Island as a Particularly Sensitive Sea Area submitted by Columbia

MEPC 46/5 - Identification and protection of Special Areas and Particularly Sensitive Sea Areas: Designation of the Marine Area Around the Florida Keys as a Particularly Sensitive Sea Area – Submitted by United States.

MEPC 46/6 - Identification and protection of Special Areas and Particularly Sensitive Sea Areas: Report of the Drafting Group.